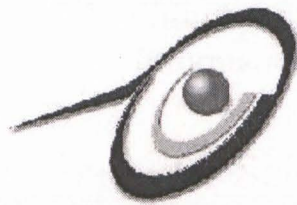


# Leave Management System (LMS)

## **Leave Management System (LMS)**

Submitted by  
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Submission Date  
25<sup>th</sup> January 2000



*Faculty of Computer Science and  
Information Technology,  
University of Malaya  
1999/2000*

# **Leave Management System (LMS)**

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Dissertation submitted in partial fulfillment of the requirements for the  
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## **Abstract**

This project is carried out based on the study of the Leave Management System (LMS) in Faculty of Science Computer and Information Technology (FSCIT). The study shows that the above system implemented in FSCIT is inefficient and most of the documents are not well organized. Therefore a further study has been done to determine the feasibility of the LMS in FSCIT. At the end of this report, it is clear that, by computerizing the existing leave application process through the business process reengineering, overall performance will be boosted and it will help to promote a paperless environment, revolutionizing the way of how the office operates.

Leave Management System proposed in this project is a Web based application. It is designed to suite the requirements of the current systems in FSCIT and is now being implemented in FCSIT.

Literature review has been carried out to select the most suitable tools for the proposed system. Besides, recommendations of changes, problems faced, the design and implementation of the system as well as the comparisons of the current with the proposed systems are discussed.

**Acknowledgement**

First and foremost, I would like to take this opportunity to express my gratitude and my warmest heartfelt appreciation to my supervisor, Mr Ling Teck Chaw. Without his support, guidance and advice, this project will not be successful. Next, I would like to offer my thanks to my moderator, Mr Chong Tse Wai for being most considerate and kind.

I would also like to extend my deepest appreciation to Dr. Sapiyan Baba, Ms Nyah Jali, Ms Azlin Mohd Ali and others concerned for their cooperation throughout the entire analysis of the current Leave Management System and Attendance Management System. Finally, I would like to thank my partner Mr Ang Tan Fong who has been very kind, helpful and has provided me with many valuable advice and assistance during the system analysis process for this project.



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### **1.0 Introduction**

#### **1.1 Evolution**

Since the invention of printing press in 1455 AD by Guntenburg, paper has become a means of communicating, storing and mass production of writing [1]. Paper can store massive amount of data, information and knowledge as well. However, paper is not an efficient media. In addition, in concern of cost, price of paper and cellulose is increasing dramatically. On the other hand, electronic publishing on computer floppy disk, compact disk or even hard disk itself has become cheaper and cheaper. Packaging, distribution, and marketing costs are much lower compare to paper based books. Therefore, the use of paper to carry the words is no longer economical method for distributing information or data.

Today, anyone who has a computer, modem and a telephone line will be able to go online at anytime for any information needed. Today's modern office environment requires the establishment of a technology infrastructure that provides connectivity and the necessary tools to get the jobs done. The Generic Office is just one of these evolving environment to take the advantages of new technologies to help in accessing information more efficiently and effectively.

#### **1.2 Generic Office**

The Generic Office is the architecture for management, organization, composition and retrieval of data, information and knowledge embodied in paper and electronic



documents [2]. Authoring, revision, distribution, storage, status, publishing tools and management processes can be used in adaptation and evolution of these documents and their components. In addition, it supports the ability to create, or recreate, a relevant and on-demand document assisted by integrated management system from a central enterprise-wide repository.

Moreover, the architecture of Generic Office is a step towards supporting the common and universal needs of any office and business environment. Yet, it can still be customized to suite any particular need. It is just like a generic toolkit that enable us to automate the existing working environment. In general, Generic Office is one of the solutions, which deal with document management, text retrieval, conferencing, communication and office process.

### **1.3 Problems**

The following are problems found in the current system in the Faculty of Science Computer and Information System that can be corrected by the Generic Office Environment:

- Staff often cannot retrieve the information **at the right time**, since currently most information is passing around manually in paper form.
- Staff cannot **share and re-use information** at anytime and at anyplace. They need to go to the office or particular places all the time just for the particular forms or documents.

- **Inefficient in collaborations and coordination** of the reviews cycles. For example, current leave application system is a time consuming process since lots of time taken just in handling the documents and retrieval of data.
- Difficulties in **tracking down the existing information** especially those that are not frequently requested. Since most of the systems are not or not fully computerized, searching for particular information may take lots of time.
- Lots of **unnecessary jobs are undertaking everyday**. Individuals are spending **unnecessary time gathering all related information** for analytical purposes
- Documents are **not properly backed up, archived or access controlled**. Critical information often exposes to the risk of being read by the unauthorized people. And, it is very hard to retrieve the backed up information after a few years.

### **1.4 Motivation**

The Gartner Group in USA estimates that number of electronic document will be doubled from 1992 to 1996. Also, the group estimates that business activities in USA create over one billion document a day and office worker spend over 40% of their time preparing, handling, filing, copying and faxing documents [2]. Hence, investment on efficient way in handling documents will surely improve the turn around time and reduce the costs.

Application form normally goes through several people for approval. They may then come back to the applicant with required or suggested changes especially on the date applied. Or, applicant may try to get back the application form to change some details. Ultimately, new release cycle starts all over again. This is typical linear cycle, but in



many cases, lots of applications may come concurrently. So, just in the handling of the documents, lots of time has been wasted.

Therefore, the Generic Office is needed to provide an organized structure that makes leave application processes easier and more effective. As any new leave application is submitted, everyone who is related will be informed, streamlining the overall cycle though ease of finding, access and retrieve the information such as the leave balance and the leave application records of the particular applicant. These will ensure that individual can access any related records and view it exactly as it appeared at that time. In short, it will provide knowledge worker with quick and easy way to retrieve appropriate information in order to process the applications, and the information found is always accurate, consistent and up-to-date.

In addition, Internet technology has become so common and this can be seen through the growth of the number of Internet users, electronic commerce transactions and the services that provided through Internet such as Internet mail and Internet phone. The multi-tier architecture implemented in the Internet-based or Intranet-based solution has been very helpful in reducing the cost of doing business while at the same time eases the process of communication.

Therefore, the implementation of web-based Leave Management System that completed with the proposed objectives and requirements will surely help to reduce the daily

workload. This will also ease the leave application process and at the same time promote a paperless environment as in the idea of Generic Office Environment.

### **1.5 Project Scope**

The project will consists of Leave Management System that is part of the Generic Office Environment. It is actually an enhancement from the last year project to suit the above systems to our faculty's existing system.

Below are the scopes for **Leave Management System**:

For the staff

- To apply for leave and get reply
- To configure or revoke the leave applied
- To generate reports on the leave applied
- To generate reports for the total days converted to cash and bring forward
- To made decision on the balance of the leave applicable at the end of the year
- To configure personal information

For the Dean and Head of Department

- To approve the application
- To view the summary of the staff under his/her department
- To activate another approver when he/she is on leave
- To approve the revocation of leave
- To approve the total days to be converted to cash and brought forward
- To change personal email address and password



For the clerk/administrator

- To generate various kind of reports
- To manage users and approvers of the system
- To administrate the whole system
- To configure (add, edit or delete ) the holidays of the current year
- To help applicants to apply for **emergency leave** (applicants can just apply the leave through phone)

For super administrator

- To add or delete system administrator (particular when the system first implemented)
- To add the total days converted to cash and brought forward since the past two years.

### **1.6 Project Objectives**

The objective of the project are listed as below:

- To test the feasibility of the implementation of GOE in the Faculty of Computer Science and Information Technology (FSCIT)
- To build and implement the concept of GOE in FSCIT
- To create, revise, distribute and protect faculty's most precious assets: data, information and knowledge.
- To provide search and retrieval system to support knowledge workers
- To continuing verify, normalize and optimize daily transactions

- To ease the process of leave application
- To help in analytical purposes
- To track down personal record, total leave taken and attendance easily

### **1.7 Benefits Gained**

- **Higher quality and faster time of revision**

Overall review and revision process can be shortened, by reducing the time spent looking for information and documents and ensuring the document drawn on the latest information always available

- **Ensure speed distribution and reduce paper used**

Assisting to be more productive in shorter period and at a lower cost while improving quality, eliminating non-valued-added steps, reduce the usage of paper, enabling quicker decisions making process, increasing the velocity of transactions, dissolving organizational boundaries, and communicating information promptly and accurately.

- **Centralized management of corporate resource holdings**

By centralizing the management and administration for shared resources, any information needed can be found easily and the integrity of information always being preserved. Besides, with the centralized information sharing, time needed for information would be sharply reduced.

- **High return on investment**

Return on investment will come from immediate cost saving in terms of paper, distribution, storage space and time. All needed information will be available immediately with minimum error. Besides, there will be an increase in return through more effective use of existing human and information resources.

### **1.7 Sytem Funtionality**

- To create a GOE environment that is stable, reliable and user-friendly
- The system should able to support the growth and future enhancement
- All applications must be server based
- The complexity of the system should be kept as low as possible while the quality is always assured

### **1.8 Expectation**

- The systems should be able to fulfill the proposed requirements
- The systems can perform the required functions efficiently and effectively
- The systems should be stable, reliable and user-friendly with a consistence interface

### **1.10 Project Timeline**

The project starts on Jun 1999 and ends on January 2000. Five main stages are involved.during the development of this project. The timeline for each stages is stated in the Gant chart in Figure 1.1 below.



Task Name	Duration	Start	Year 1999								2000
			Jun	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan	
Concept of Definition	5	15/6/1999	■								
Requirement Specification & Analysis	52	20/6/1999		■	■						
System & Program Design	20	11/8/1999				■					
System Development & Incremental Prototype	90	1/9/1999					■	■	■	■	
Integration & Testing	10	11/1/2000								■	■

Table 1.1 Project's Schedule



## **2.0 Literature Review**

### **2.1 System Consideration**

#### **2.1.1 Introduction**

Nowadays, the importance of effective attendance and leave management has become a hot issue in the new office environment. Recent statistics from the Conference Board of Canada estimates that absenteeism in the work place cost Canadian organizations \$10 - 15 billion per year. In North America, the loss of productivity due to sick leave and injury absences totals \$50 billion. Obviously it is worthwhile to acquaint a product that can assists in dealing with this important issue effectively, efficiently and at a reasonable cost.

#### **2.1.2 Overview**

Leave Management System (LMS) proposed for Faculty of Science Computer and Information Technology (FSCIT) is an Internet-based software system, designed as a comprehensive solution to an organization's leave management requirements. The system generates timely, accurate and relevant information necessary to effectively monitor and manage an organization's human capital. Besides, as a single specialized component that may be integrated into a complete human resource information system (HRIS), LMS actually is GOE application that planned to meet the leave management requirements of virtually any organization. Through various alerts, LMS allow FSCIT to take pro-active measures to improve the management of leave application in the organization.

**2.1.3 Overview of Viking Attendance and Leave Management System**

The Viking Attendance and Leave Management System (VAMS) is a system developed by Viking Solutions International Inc. in Canada. The Viking Attendance Management System is being used by a wide variety of organizations of all sizes in their country, ranging from manufacturing plants, financial service groups, hospitals, universities to municipalities of all sizes, including their Fire and Emergency Services.

**2.1.4 Comparison of LMS and VAMS**

Features	LMS	VAMS
Extensive client customization (absence codes, employee status, classification, security access, organizational structure, etc.)	Yes	Yes
Custom automatic leave accounting with on-line access for balance information by employees/supervisors	Yes	Yes
Automatic generation of mail notification for new application or any approval/disapproval	No	Yes
Automatic generation of forms for leave application	Yes	Yes
Effective leave management reporting	Yes	Yes
Full year-at-a-glance attendance/leave record on screen	Yes	Yes
System-generated prompts to supervisors to ensure action	Yes	Yes
Electronic leave requests by employees who can view their	Yes	Yes

leave bank balances on-screen		
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Table 2.1 Comparison of ALMS and VMAS

2.1.5 Overview of Current Leave Management System in FSCIT

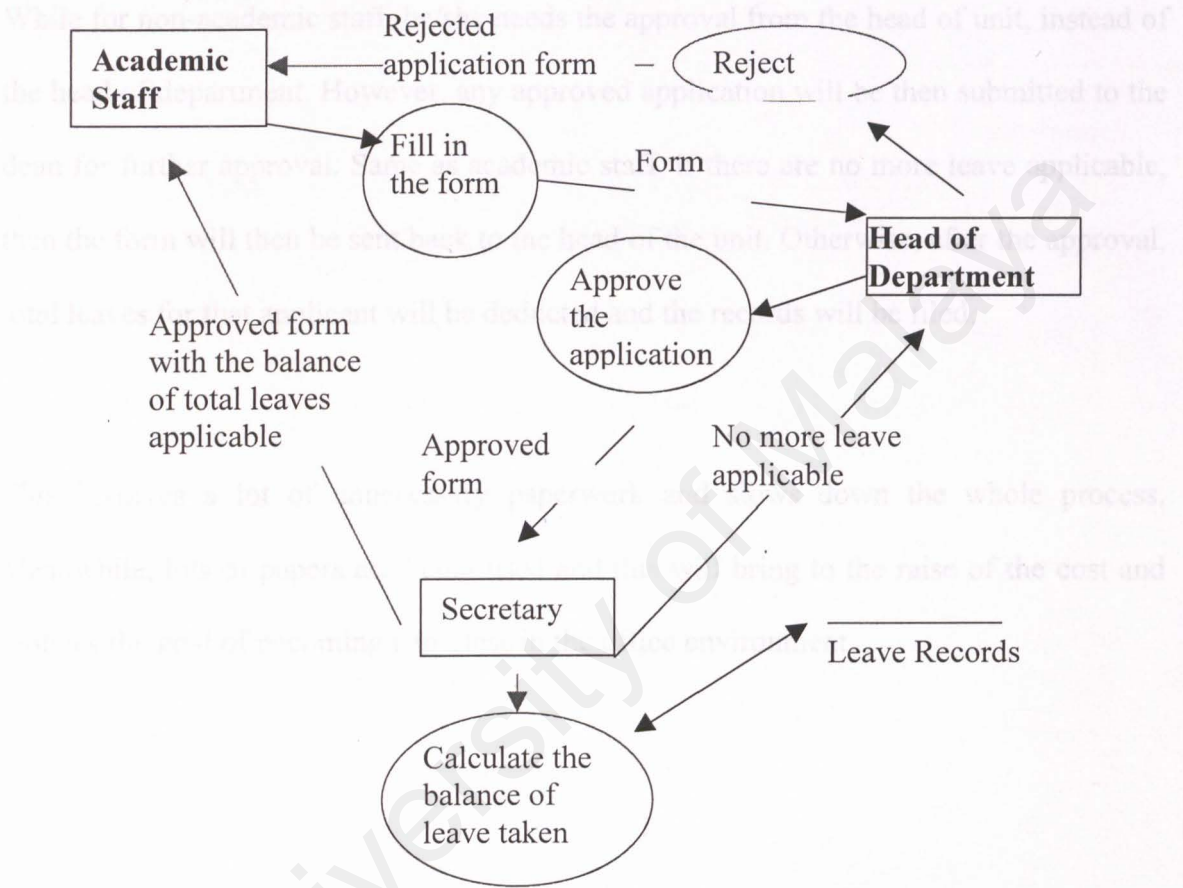


Figure 2.1 Current Leave Management System for Academic Staff

There are various kinds of activities for different kinds of leave and staff. For academic staff (or head of department), after filling up the form, he/she needs to submit it to the head of department (or dean). If the application is approved, then it will be sent to the secretary. The secretary will then calculate the balance of the leave applicable. If there are no more leave applicable or total leave applied has exceed the balance, then the



application form will be sent back to the head of department for rejection. Otherwise, the total leave available will be deducted.

While for non-academic staff, he/she needs the approval from the head of unit, instead of the head of department. However, any approved application will be then submitted to the dean for further approval. Same as academic staff, if there are no more leave applicable, then the form will then be sent back to the head of the unit. Otherwise, after the approval, total leaves for that applicant will be deducted and the records will be filed.

This involves a lot of unnecessary paperwork and slows down the whole process. Meanwhile, lots of papers are being used and this will bring to the raise of the cost and violates the goal of becoming paperless in the office environment.

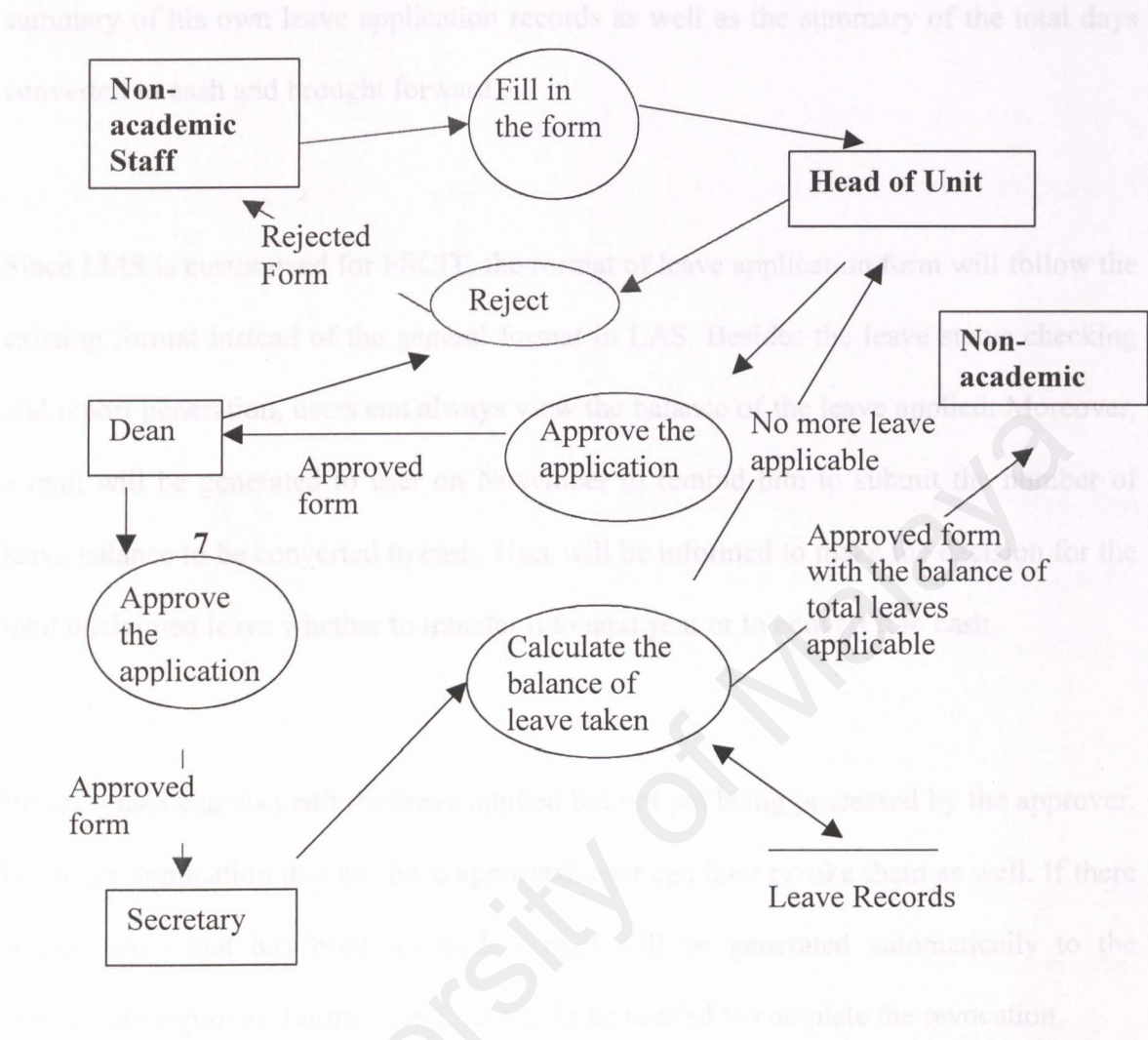


Figure 2. 2 Current Leave Management System for Non-Academic Staff

2.1.6 Comparison between Leave Approval System (LAS) and LMS

Module Applicant

LAS is a project done by last year senior. It enables user to apply for leave easily and effectively. Besides, the applicant can also check the status of his/her leave application and configure his/her own personal non-critical information. User can also generate the

summary of his own leave application records as well as the summary of the total days converted to cash and brought forward.

Since LMS is customized for FSCIT, the format of leave application form will follow the existing format instead of the general format in LAS. Besides the leave status checking and report generation, users can always view the balance of the leave applied. Moreover, a mail will be generated to user on November to remind him to submit the number of leave balance to be converted to cash. User will be informed to make the decision for the total unclaimed leave whether to transfer it to next year or to convert it to cash.

Besides, user can also edit the leave applied but not yet being processed by the approver. For leave application that has been approved, user can later revoke them as well. If there is any leave that has been revoked, a mail will be generated automatically to the appropriate approver. Further approval would be needed to complete the revocation.

Any leave applied that includes the current date would be considered as Emergency Leave and a mail will be generated instantly to the appropriate approver. Besides, system will also check for the existence of new applications, at 2:00pm and 12:00am everyday. If there is any new leave applied on that particular date, a mail will be generated to the head of that department. Applicant will then be notified through email on the decision made by the approver.



### **Module Approver**

Same as in LAS, there are module approver and administrator. However, for new system, there is a new module called super administrator. In LMS, approver would be the head of the department while administrator of this system would be the clerk of FSCIT, while super administrator would be trusted personnel that will assign the system administrator.

Besides, compare to LAS, LMS will not include the workflow configuration that integrate with Microsoft Exchange. This is because it will slow down the whole system and every staff in FCSIT has already got his/her own email account. Instead, workflow configuration will be replaced by the form format configuration.

Rather than using the approval code in LAS, LMS will assign the list of approvers according to the department. Approver will be identified through the login name and the password. Approver is responsible for the approval and rejection of the application of leave, revocation and the amount to be converted to cash. Application of leave balance to be converted to cash will only be enabled from November to December every year.

Approver would be treated as another entity of the system. For example A is a user of the LMS, meanwhile A is also the approver of Internet Department. If A logs in using approver's log in name, he cannot apply for leave, instead he will only act as an approver.

For every leave application that has been processed, a mail will be generated to inform the applicant about the decision made. The balance applicable for the particular applicant would be updated automatically.

Furthermore, when the approver is on leave, he/she can assign an assistant as temporary approver. Then, all mails generated to the approver would be routed to that assistant.

### **Module Administrator**

Generally, administrator can generate various kinds of reports and summaries. Administrator can add, edit or remove annual holidays, types of leave available, the list of department and also users' information.

Besides integrating this module with the other modules, there will be some new features added. For example, administrator should be able to apply for emergency leave on behalf of the applicant, applicants should be able to be grouped by working status, applicants should be able to be awarded with some additional leave, applicant's leave balance should be added after the promotion and so on. Some parts of interface will be changed to make it user friendlier.

### **Module Super Administrator**

This is totally a new module in LMS. The main task for super administrator would be to assign system administrator. Although super administrator has the right to dismiss system administrator, however, super administrator should not be able to change administrator's personal information later. Besides, super administrator is also responsible to fill in the leave balances that have already bought forward or converted to cash.



## **2.2 Tools Considered**

### **2.2.1 Development Platform**

#### **2.2.1.1 Window NT Server 4.0**

Window NT Server 4.0 is a network operating system that designed to help the developers to build and deploy business application faster and easier than before [3]. It provides the backbone for a complete, organic system, where all elements working together seamlessly. When joined with other Windows NT-related products, including the BackOffice® family of applications and Windows NT Workstation, Windows NT Server provides the foundation for a powerful and well-integrated environment. This integration means that administrators and developers can focus on their jobs, instead of spending time and money wrangling with disparate systems and applications. Besides, the option pack that designed for Window NT 4.0 makes it a complete platform for building and hosting web-based application. New management tools in Window NT with the option pack installed help to set up multiple web sites, manage contents, and analyze the usage pattern to improve the site as it evolves.

#### *Benefits:*

1. Ease of use- User interfaces for Window NT looks and feels like Window 95, the most popular operating system in the world.
2. Secure and reliable - Allocation of separate memory for 16-bit applications so that the failure of any 16-bit applications won't affects the other applications. Besides, it helps to protect critical operating system code, device drivers, and data from application.

3. Ease of management and control- this includes remote management and troubleshooting tools and allows administrators to implement standard and policies for system wide desktop configurations.

### **2.2.1.2 UNIX**

Another network operating system that proposed is UNIX operating system. A standard UNIX system includes a set of applications and its libraries. Figure 2.1 shows the components and layers of UNIX. On the top are the standard and client applications that installed to the system. Below it is the standard libraries. Standard libraries and standard applications are the main components that build the user interface. After this, it followed by file system and the process control that is in the same layer and finally hardware in the lowest layer.

#### *Benefits:*

The main strength of UNIX would be the consistent way for it to treat the files. There is no file extension or file type that distinguished as in Window, most UNIX files can be handled in the same way. This consistency makes it easier to work with files since users don't need to learn special commands for new tasks. Also, by the same command, the program can talk either to a terminal, a printer, or an ordinary file on a disk drive.



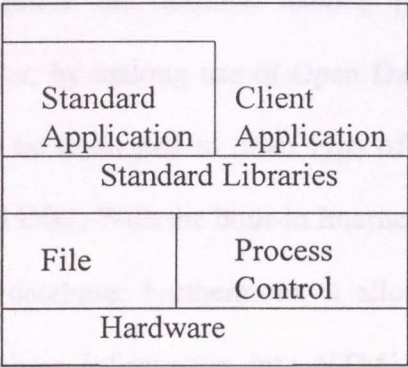


Figure 2.2 Layers of UNIX System

However, through the study, Window NT is more preferable for the following reasons:

- 1. Overall Window NT is easier to manage if compare to UNIX system
- 2. There are a lot of supporting software for Window NT especially the free downloadable option pack.
- 3. With the GUI that similar to Window 95 and Window 98, it is easier to learn and used by users.
- 4. It is cheaper and widely used.

2.2.1.3 Comparison between Window NT 4.0 and Linux Red Hat 6.0

Please read appendix A for the comparison test carried by Mindcraft, an independent test lab. Mindcraft certifies that the benchmark results reported in this white paper accurately represent the performance of Windows NT Server 4.0, Linux, Apache, and Samba running on a Dell PowerEdge 6300/400 server [4].



This helps to improve the decision making processes and enhancing the business processes. Moreover, by making use of Open Database Connectivity (ODBC), it allows the information to be replicated to other type of database, including Microsoft Access, Oracle, Sybase and DB2. With the built-in Internet integration, it helps to publish the data from the existing database. Furthermore, it allows web administrator to automate the publishing of database information into HTML document. The combination of SQL Server and Internet Information Server (IIS) provides the user complete database publishing capabilities.

### **2.2.2.2 Microsoft Internet Information Server (IIS)**

Microsoft Internet Information Server (IIS) is an Internet file and application server included with the Microsoft Windows NT Server operating system. IIS can be used alone as a Web server, or in conjunction with compatible technologies to set up Internet commerce, to access and manipulate data from a variety of data sources, and to build Web applications that take advantage of server script and component code to deliver client-server functionality. The latest information is available on the IIS Web site .

Because of its tight integration with Windows NT Server, IIS guarantees the network administrator and application developer the same security, networking, and administration functionality as Windows NT Server. Above and beyond its use of familiar Windows NT Server tools and functionality, IIS also has built-in capabilities to help administer secure Web sites, and to develop and deploy server-intensive Web applications.

Appendix B shows the comparison between Windows NT Server 4.0 with its integrated Web services (Internet Information Server 4.0, IIS) on a Compaq ProLiant 3000 and Solaris 2.6 with Sun WebServer 1.0 (SWS) on a Sun Ultra Enterprise 450 that carried by Mindcraft [5].

#### **2.2.2.3 Microsoft Exchange Server 5.5**

Microsoft Exchange Server is a robust messaging and group scheduling system with Internet mail capability for Exchange users to reach just about everyone on the Internet [6]. It can integrate with the existing mail system by providing the connectors, gateways, and migration/extraction tools. Meanwhile, it is also one of the messaging backbone and a versatile GroupWare product available in the market.

#### **2.2.2.4 Lotus Note & Domino 4.6**

Lotus Note & Domino is another GroupWare application to support communication and collaboration of process, which flows within a company. It is a distributed client server database application that enables groups of people to organize, track, access and share information over a network. Just like Microsoft Exchange Server, it supports various kinds of Internet and messaging features.

#### **2.2.2.5 Comparison between MS Exchange Server and Lotus Note & Domino**

For enterprise application, Lotus Note only allows its own scripting (Lotus Script) and object models. It works well with data stored in Lotus Note database and other databases



remain second priority in its deployment. Besides, to integrate in Window NT, some basic functions like directory, security and administration have been duplicated.

### ***Microsoft Exchange Server***

- Size of single information can be up to 16 gigabytes
- It logs all steps during messaging and collaboration transactions. This will help to roll back the incomplete transaction due to power failure, abnormal shutting down and so on. This helps to maintain the integrity of valuable data.
- Every time it restarted after abnormal shut down, transaction log will be scanned. If any incomplete transaction found, the whole transaction will be rolled back.
- User can be granted access to recover items that were deleted accidentally from client desktop.
- It provides the administrator end-to-end message tracking with a graphical display that maps every server, MTA, and the connectors that ever received the message.
- Microsoft outlooks (client in Windows platforms) can straight away use Windows NT challenge/response authentication to validate the user's identity, resulting in a true single logon experience for all users.
- Strongly integrate with Microsoft Office document which it allows the documents to be sent to an Exchange public folder easily

### ***Lotus Note & Domino***

- Size of single information can be up to 4 gigabytes only



- It does not use transaction log to reduce the overhead that can slow down the whole system.
- The whole database must be rebuild if the data integrity is violated.
- User cannot be granted access for recovering data that accidentally deleted.
- Limited facilities to set up manual message tracking.
- When Notes running on Window 95 as client, it requires user to type in his password at least twice; one for Window NT and another for Notes.
- Notes does not understand Office document properties and instead applies its own set of meta-data tags via a Notes document "wrapper" around every Office document stored in Notes database.

### **2.2.3 Development Software**

#### **2.2.3.1 Active Server Pages (ASP) Technology**

Active Server Pages is a programming environment that provides the ability to combine HTML, scripting, and components to create powerful Internet applications that run on Window NT server [8]. After creating Web sites that combine HTML, scripting, and some reusable Active-X components, ASP can be used to glue these items together. Then, these components can be called from script or other components. For example, a ".asp" file is a special HTML file containing hypertext, client side script and Active Server Page script for a web page. In other words, it is a standard HTML document interlaced with Active-X script code that call specified Active Server components. Besides, it can be used to create dynamic and interactive web pages that able to include

Active-X component and Java Applet as well. By the way, ASP script is decoded and run on Microsoft Internet Information Server (IIS) which is a web server that can be free downloaded from the Internet.

In other words, when incorporate ASP into the Web site,

1. The user brings up a Web site (like MSDN Online Web Workshop) where the default page has the extension .asp.
2. The browser requests the ASP file from the Web server.
3. The server-side script begins to run with ASP.
4. ASP processes the requested file sequentially (top-down), executes any script commands contained in the file, and produces an HTML Web page.
5. The Web page is sent to the browser.

Because ASP script runs on the server, the Web server does all of the processing and standard HTML pages can be generated and sent to the browser. Another benefit of having script reside on the server is that the user cannot "view source" on the original script and code. Instead, the user sees only the generated HTML as well as non-HTML contents, such as XML, on the pages that are being viewed.

### **2.2.3.2 Comparison between ASP and CGI**

#### **ASP**

- ASP language is six times faster to write than other conventional Web page design methods



- ASP takes less time to write and debug (no compilation), thus less "down" time for Web sites
- ASP outperforms (by 5-to-1 ratio) other conventional Web page design methods (CGI, etc.)
- ASP allows for multiple browsers, doesn't restrict a user to any "one" particular browser type
- ASP Web design is "dynamic", continuous changes can be made "on the fly" effortlessly
- ASP is inherently multi-threaded (CGI isn't) allowing a greater number of concurrent users
- Asp's memory resident engine uses minimal server resources, thus greater performance
- ASP allows amazing design power in developing database applications and e-commerce

### ***Common Gateway Interface (CGI) Applications***

The Common Gateway Interface (CGI) allows Web servers to execute other programs and incorporate their output into the text, graphics, and audio sent to a Web browser [9].

CGI programmers use tools that provide for forms processing, looking up records in a database, or sending e-mail. In other words, CGI applications are more like a system utility than full-blown applications; scripts are task-oriented rather than process-oriented.

A CGI script has a single job: it initializes, does its job, and then terminates. It's easy to chart data flow and program logic, but CGI has its limitations:



- CGI programs take more time to write and debug; thus having frequent 'down' time for Web sites
- CGI programming is consistently outperformed by ASP and is five times slower
- CGI Web pages are "non-dynamic"; thus continuous changes cannot be made "on the fly."
- CGI is not inherently multi-threaded (ASP is), which limits the number of concurrent users
- CGI uses a greater amount of server resources degrading performance of servers and sites.

### **2.2.3.3 Active-X**

ActiveX includes technologies that programmers can use to build Internet-enabled applications, products that end users can use to access the Internet, and technologies that content developers can use to build terrific Web sites [10]. It is neither a language nor a software package; rather it is a technology framework. This component framework comprises of five services that must be provided by a component model. These services include:

- Interface publishing and discovery: As components are assembled at the run-time, it needs to register or publish its interfaces so that other components can discover their existence and know how to interact with them.
- Event Handling: When an object broadcasts an event and the framework delivers it to the appropriate object.
- Persistence: Mechanisms that allow components to store information.

- Layout control: Mechanisms and services that determine the layout of components.
- Application builder support: Enables components to expose their properties and behaviors to development tools

### **2.2.3.4 Comparison between Active-X Controls and Java Applets**

#### **Active-X Controls**

Among the most exciting ActiveX technologies are *ActiveX controls*. These controls can help to diverse functionality to the Web site just by inserting a control right in the Web page. ActiveX controls that used throughout Windows are called OCX files. An example of OCX file is a drop down list when the command named File on menu bar is clicked. Besides, ActiveX is language independent, therefore, it can be written in Java, C, C++, Visual Basic and also Delphi [11].

- It can be written using various type of programming languages, such as Visual Basic and C++.
- It can be compiled within Web browser as well as within other applications
- It is compatible with the platforms supporting Win32 interface, generally Window 95, 98 and Window NT
- It allows complete local system access

#### **Java Applets**

Java Applets is the technology developed by Sun Microsystems in building the applications with reusable parts. It is a program that will be downloaded before the



execution and it is supported on the Web browser with embedded Virtual Machine (Microsoft Internet Explorer and Netscape Navigator).

- It is written using JAVA programming language
- It is usually interpreted within a Web browser
- It is a platform independent code that typically requires an interpreter and usually supplied as a part of Web browser
- It did not allow complete local system access

### **2.3 System Architecture**

Client/server computing is the logical extension of modular programming. Modular programming has its fundamental assumption that separate a large piece of software into its constituent parts ("modules"), creating the possibility for easier development and better maintainability. Client/server computing takes a step further by recognizing that those modules need not be executed entirely within the same memory space. With this architecture, the calling module becomes the "client" (that which requests a service), and the called module becomes the "server" (that which provides the service). The logical extension of this is to have clients and servers running on the appropriate hardware and software.

For example, a client-server system is a network of computers in which some of the computers (called clients) process applications while other computers (the servers) provide services to the clients. Classical client-server application architecture is based on



client computer where services and queries are constructed and a connection is directly made to the server computer. The query results will then be passed back as data stored in the local cache of client computer. A visual display will be connected to this cache to display the query's results. Normally, most of APIs, database drivers, and business logic resides within the client's computer. High-performance data retrieval technologies become an important consideration when constructing the entire architecture.

### ***Two -Tier Client / Server Architecture***

Two-tier architecture is where a client talks directly to a server, with no intervening server. It is typically used in small working environments (normally less than 50 users). A common error in client/server development is to prototype an application in a small, two-tier environment and then scale up by simply adding more users to the server. This approach will usually result in an ineffective system, as the server becomes overwhelmed. To properly scale to hundreds or thousands of users, it is usually necessary to move to a three-tier architecture

### ***Three-tier Architecture***

A three-tier architecture introduces a server (or an "agent") between the client and the server, normally to separate the application codes from client's computer and also from the database server. The role of the agent is many folds. The middle tier will be the one to process most of the application instead of client computer as in the two-tier design. It provides translation services (as in adapting a legacy application on a mainframe to a client/server environment), metering services (as in acting as a transaction monitor to

limit the number of simultaneous requests to a given server), and intelligent agent services (as in mapping a request to a number of different servers, collating the results, and returning a single response to the client).

## 2.4 Conclusion

In conclusion, this project will be implemented with Window NT Server 4.0 as the development platform with Microsoft Internet Information Server as web server, Microsoft SQL Server as database server and Exchange Server as mail server. All this servers would be setting up with three-tier architecture; web and mail server would be the middle tier while the database server would be the third tier. Active server pages will be used as the main programming language, with the help of Active-X control, Java scripts [12] and VB scripts.



### **3.0 System Requirement**

#### **3.1 Introduction**

System requirement will define what the system should do and determine the nature of the requirements and problems.

#### **3.2 Method Used to Collect Information**

##### **3.2.1 Interview**

Interviewing is the main sources for the reference of any ambiguities that arise during the system definition. Interviews have been carried out in order to understand the problems, weaknesses and the actual requirements needed. The clerk in the office of FSCIT, Ms Nyah Jali, had been interviewed to figure out how each process related to the leave application is being done in the actual office environment.

##### **3.2.2 Prototype**

The main role of prototyping is to improve requirement definition by involving potential users. This is because users normally are uncertain of exactly what is required or needed. Through requirement analysis such as interview and research, may yields a "wish" list of what they want to see, though it is not clear whether the list is complete. Besides since the time given is so short, evolutionary prototype [13] approach is being used instead of throwaway method [14].



A few staff, lecturers and also the Dean of FSCIT had been invited to evaluate, to give their valuable advice as well as to correct the wrong perception of the developed prototype in the real office situation.

### **3.2.3 Internet Research**

Internet is used as a main reference about the functionality and the feasibility study of the system. It helps to determine the possible solutions of the problems faced and the most appropriate tools available to meet the potential and existing requirements.

For example, some problems on coding such as Transact-SQL and the problems on the configuration of SQL and IIS server can be found in <http://msdn.microsoft.com>.

### **3.2.4 Analyze existing document**

Analyzing the existing documents will help to understand the input and output of the system. It helps in preparing the system output and developing the database.

For example, information that is needed in order to apply for leave can be extracted from the existing application form. Besides, types of reports needed and the frequent used information can also be figured out from the existing documents.

### **3.3 Functional Requirement**

The following are the functional requirements of the Leave Management System (LMS).

#### **3.3.1 Applicant Module**

Applicant should be able to apply for leave, generate summaries and submit their total remaining balance either to be converted to cash or to be brought forward.

- **Apply for Leave** - Applicant should be provided with a complete and easy to use interface. Some personal information as in the existing form must be included in the electronic form. Some information like contact number during leave must be specified in every application. However, some personal information such as applicant's name should be filled in automatically in every application form.

The system shall be able to calculate total days applied accurately and each application must be validated before the acceptance. Applicant should not be able to apply for leave if there is no more remaining balance.

- **Conversion of the Leave Balance** - Applicant should be able to submit the number of days desired to be converted to cash. This option should only be appeared on November and December.

Total days that can be converted to cash cannot exceed 90 days. The maximum number of days that can be converted into cash per year cannot exceed half of the



- 1.3 applicant's annual leave or maximum 15 days per year, depending which is lower.
- App Besides, only the leave balance from the previous two years can be brought forward.
- Any unclaimed leave balances that earlier than the previous two years would be automatically expired. For example, if now is year 2000, any remaining leave balance on year 1997 would be expired on 1 Jan 2000.
  - Status Checking - Applicant should be able to check for the current status of their applications anytime from anywhere. All leave applications can be edited after the submission as long as they are not yet processed. Revocation of application should be allowed and each revocation is considered complete only after the approval from the head of department. Applicant should not be able to delete their leave records except the leave applications that are rejected.
  - Configure Information - Applicant should be able to change his/her personal information such as address during leaves, contact number, email address and password any time from anywhere.
  - Generate Summary - Applicant should be able to generate summaries on their leave applications records, on the total days converted to cash and the total days brought forward from the previous years. Data like leave balance, leave start date, leave end date and total days applied should be included in the generated report.



### 3.3.2 Approver Module

Approver should be able to approve the leave applications under his/her own department.

- **Process Application** - The system should display a use-friendly interface for approver to process the leave applications and the revocation of leave. Only important information such as leave period, applicant's name, total days applied, type of leave, leave reason and the leave balance should be displayed. Approver should also be able to approve or reject the application for the conversion of the leave balances to cash.
- **Generate Summary** - List of leave applications under his/her department should always be available. Approver should be able to add or remove any information needed in the summary. There should be a list of fields for the approver to choose whether to display them on the report or not.
- **Configure Information** - Approver should only be allowed to change his/her own email address and password. This is because there may be a promotion or retirement on the current approver. To make it maintainable and ensure the integrity of the system, approver should not be able to change his/her own name nor his/her log in name. However, administrator can change all personal information about approver, even approver's name, log in name and also the password.
- **Assign Assistant** - If the approver is on leave, an assistant can be appointed to help him/her to process the applications. All mails would then route to this assistant,

instead of the actual approver. However, approver should be able to disable the assistant easily too.

### **3.3.3 Administrator Module**

Administrator should be the only one who is able to configure and monitor the whole system.

- Annual Holiday List- Administrator should be able to create, edit or delete the list of annual holiday. Any holiday added or deleted will automatically change the total leave applied by the applicant, if effected. Applicant's leave balance should be recalculated whenever there is any changes on the list of holidays.
- System Configuration - Administrator should be able to add new applicants, departments, working status, positions, and types of leave. The existing information can be edited or deleted without affecting the integrity of the database. Any department, working status, position or type of leave that is being used cannot be deleted from the database. This option should also allow the administrator to apply emergency leave for the applicant. This is because applicants may have the problems of getting online on that particular time. Therefore, they have to contact the administrator to apply leave for them.
- Generate Summary - Administrator should be able to generate the summary of approved leave applications easily. Administrator shall be able to view the summary based on the selected applicant's name within the selected date range.



### **3.4 Non Functional Requirement**

#### **3.4.1 Security**

The system should not show any potential leakage of information. It should be equipped with sufficient security:

- Each access by user should be authenticated and validated
- Each user has his/her own unique login name
- Password should be encrypted before sending online
- Password in the database should be encrypted

#### **3.4.2 Database Backup**

The system should be able to:

- Automatically launch the daily backup
- Restore easily from any potential disaster
- Automatically delete the leave applications records that have been stored for three years after backing up the records.

#### **3.4.3 Reliability**

The system is expected to perform its intended functions with high accuracy. Thus the system should be reliable to perform its daily operation with required consistency. For example after any changes made on the list of holidays, the remaining balance of the leave balance should be recalculated to ensure its accuracy. LMS should be able to operate 24 hours per day and 7 days per week.



3.4.4 Users and Human Factors

The system must be user-friendly with easy to use interface, and the skill level needed shall be as low as possible. It should be easy to understand and can automatically react to the misuse of users. For example,

- Appropriate error message should be prompted for the errors made
- Data entered should not be truncated
- Date format should be specified properly to avoid confusion

Third-tier

## **4.0 System Design**

The third tier consists of the Microsoft SQL Server 7.0 and will be the database server

### **4.1 Introduction**

Every query requested from the web server will be

During the system design, the requirements will be transform into a working system. This will help to understand clearly how the system is to work. It is needed as a guide to complete the system.

4.3 Detail Design

### **4.2 Broad Design**

#### **4.2.1 LMS Three-tier Client Server Architecture**

data model. data is stored in

##### ***Client-tier***

relationships between rows are represented by data values. Database design

For LMS, client tier is constituted of computers with Internet Explorer (4.0 or above). It will provide the interface for clients to process their application and maintain their data.

Microsoft / MS's database. It is designed to protect the security and integrity

##### ***Middle-tier***

Middle-tier consists of Microsoft Exchange Server 5.5 and Internet Information Server

4.0. All application programs or files will be resided in the middle-tier. The web server

processes the request from the client and then returns required result in HTML format.

Microsoft Exchange Server will be the mail server that generating mails to the users.

Middle-tier will always link to database server to assists in authenticating and validating

the user that log in to the system. Most of the processing role would be resided in the web

server.

Third-tier

The third tier consists of the Microsoft SQL Server 7.0 and will be the database server that maintains the data records. Every query requested from the web server will be authenticated first and the results will then pass back to the web server, before to the clients.

4.3 Detail Design

4.3.1 Database Design

The database design in LMS is based on the relational data model, which data is stored in relations and relationships between rows are represented by data values. Database design in LMS involves the activities of modeling the structure of the database so that the data or records in the database can be created, updated, deleted or displayed at the direction of the users. Meanwhile LMS's database is also designed to protect the security and integrity of the database.

The following are some tables in the database.

Field Name	Data Type	Description
ApplicantID	Int	Key of the table
AddressDuring Leave	Varchar(150)	Default value of the address during leave
PhoneNumber	Varchar(15)	Default value of the contact number during leave period
DepartmentCode	Varchar(15)	Code of department; to determine who is the



Field Name	Data Type	approver
Email	Varchar(30)	Applicant's email address
AccessRight	Varchar(10)	Can be user or administrator
ApplyLeave	Bit	True if the applicant is able to apply for leave; mainly for Attendance Management System
Applied	Bit	To check whether the applicant had submitted his/her remaining balance to be converted to cash
BalanceToDate	Int	Current leave balance
TempBalance	Int	Remaining leave balance applicable on the current date
TempDefault Balance	Int	Default value of annual leave balance, based on the position held; mainly for the calculation of leave balance
BalanceAdded	Int	Balance added because of promotion or seniority; at the end of the year, it will be transferred to become permanent leave balance.
PermanentAddOn	Int	Annual leave balance added permanently to the total leave balance because of the promotion or seniority.

**Table 4.1      Fields in the *ApplicantInfo* table**

Field Name	Data Type	Description
ApplicantID	Int	Key used to link to the <i>Applicantinfo</i> table
ApplicationID	Int	Key of the table
LeaveStartDate	Datetime	Start date of the leave application
LeaveEndDate	Datetime	End date of the leave application
ReasonForLeave	Varchar(150)	Reason for the leave application
NoDaysTaken	Int	Number of days taken for the application
Status	Varchar(20)	To determine the current status of the application, whether approved, rejected or in progress.
ActionBy	Varchar(30)	Approver's Name
Processed	Int	0 - Not yet processed 1 - Processed by the first approver 2 - Processed by the second/last approver
Revoking	Bit	True if the leave has been revoked
Rstatus	Varchar(20)	Revoking status
PhoneNumber	Varchar(20)	Contact number during leave; this is needed because it may not same as the default value

Table 4.2 Fields in the *Application* table

Field Name	Data Type	Description
DepartmentCode	Varchar(20)	Key of the table
DepartmentName	Varchar(50)	Name of the department
Fname	Varchar(50)	First approver's name
FloginName	Varchar(30)	First approver's log in name



Fpassword	Varchar(20)	First approver's password
Femail	Varchar(30)	First approver's email address
FRoute	Bit	True if there is an assistant
Sname	Varchar(50)	Second approver's name
SloginName	Varchar(30)	Second approver's log in name
Spassword	Varchar(20)	Second approver's password
Semail	Varchar(30)	Second approver's email address
SRoute	Bit	True if there is an appointed assistant
RFname	Varchar(50)	First assistant 's name
RFloginName	Varchar(30)	First assistant 's log in name
RFpassword	Varchar(20)	First assistant 's password
RFemail	Varchar(30)	First assistant 's email address
RSname	Varchar(50)	Second assistant 's name
RSloginName	Varchar(30)	Second assistant 's log in name
RSpassword	Varchar(20)	Second assistant 's password
RSemail	Varchar(30)	Second assistant's email address

Table 4. 3 Fields in DepartmentCode table

4.3.2 Entity-relationship Model

Entity-relationship model is used to describe the structure of a database and the relationship among entities in the system. The things in the user's world are represented by entities, and associations among those things are represented by relationship [15]. The E-R model assists in defining the connection between data and entities within the system.



It helps to analyze the relationship and requirement constraints that lie ahead. Generally, one of the LMS's E-R diagrams is as below:

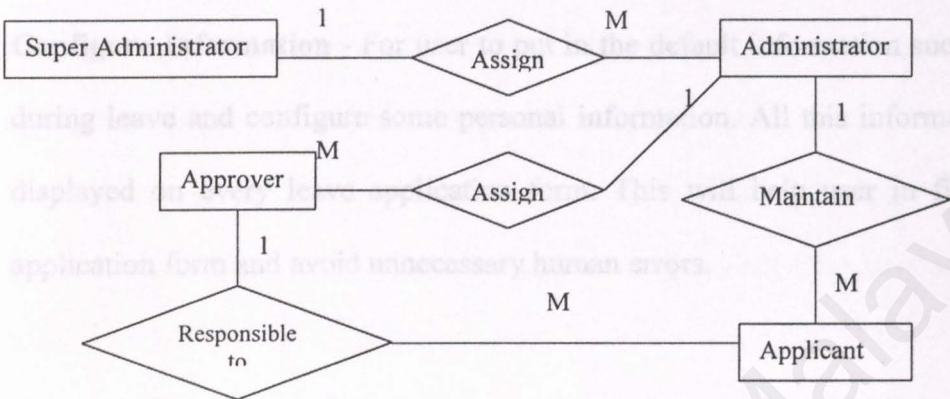


Figure 4. 1 E-R Diagram

4.3.3 Graphical User Interface Design

The main purpose of user interface design is to make it as user friendly as possible. There would be four kinds of interfaces provided, including interface for user, administrator, super administrator and also approver.

The navigation bar provided will include:

User

- **Leave application** - For user to apply leave and submit the amount of balance to be converted into cash.

- **Check Application** - For user to check for the leave that applied according to the current status, including the leave that had been revoked by the user. User can process the revocation through this option too.
- **Configure Information** - For user to put in the default information such as address during leave and configure some personal information. All this information will be displayed on every leave application form. This will help user in filling up the application form and avoid unnecessary human errors.
- **Generate Summary** - For user to generate summary of leave taken and the total balance brought forward.

### *Approver*

- **Process Application** - For approver to process the application of leave, revocation and the total balance to be converted into cash.
- **Configure Information** - For approver to change his/her own password and email address as well as assign another approver as assistant.
- **Generate Summary** - For approver to generate the summaries of leave application records of the staff under his/her own department.

Administrator

- **Configure Calendar** - For administrator to add, edit and delete the list of holidays.  
There would be two kinds of holiday, organizational or public holiday.

- **Configure Choices** - For system administrator to configure applicants' detail, types of leave available, the list of departments, working status and the list of positions.  
Besides, this option allows administrator to apply emergency leave on behalf of applicants and also to award some additional leave to a specific user as an incentive of hard work.

- **Generate Summary** - For administrator to generate reports about the list of working status, departments, types of leave and positions available.

Super Administrator

- **Assign Administrator** - For super administrator to add or delete system administrator. However, to maintain the integrity of the database, super administrator cannot edit administrator's personal information.
- **Configure Conversion** - For super administrator to add the number of days brought forward and converted to cash for the last two years. This is only needed when the system is newly implemented.



4.4.4 Security Design

Every user will be verified through log in name and password. A few session variables will be created to determine the access right of the user. There are:

Session Variable	Description
Session("Authenticate")	True if the user is authorized
Session("ApplyLeave")	True if the user is allowed to apply for leave
Session("AccessRight")	To determine the access right of the user; whether is the first approver, second approver, administrator or super administrator

Table 4. 4 Session Variables

These sessions will be used to verify the access right of the logged in user. This can avoid unauthorized user to break into the system by just typing the URL addresses.

To ensure every user has a unique login name, whenever a new user is added to the database, tables such as *ApplicantInfo*, *SuperAdmin* and *DepartmentCode* will be queried to check for any duplication. If there is any duplicated log in name, then the user will be prompted with an error message.

Password that sent through the network will be encrypted to ensure the security and the confidentiality of the system's information. Passwords in the *ApplicantInfo*, *SuperAdmin*, *DepartmentCode* tables are encrypted to avoid the possible exposure of applicant's password to any malicious user.

**4.4.5 Database Backup**

With the job scheduling function provided in Microsoft SQL 7.0, any job can be scheduled to execute on any time.

- Automatically launch the daily backup

The whole database will be backup on 12:00 am everyday to the web server (middle tier).

The T-SQL coding would be as below:

```
USE Goelas
GO
BACKUP DATABASE Goelas
TO DISK= '\\LMS\lms\lmsbackup.bak'
WITH FORMAT,
NAME = 'Full Backup of LMS Database.'
GO
```

Execution time can be scheduled by adding a new job in the SQL Server Agent Service.

- Restore easily from any potential disaster

User can restore the database using T-SQL code as below:

```
RESTORE DATABASE Goelas
FROM DISK = '\\LMS\lms\lmsbackup.bak'
GO
```

- Automatically delete the leave applications records that have been stored for three years after backing up the records. Data transformation service will be used to copy



the related records to another database named BACKUP. Then with T-SQL, those records would be then deleted from the database.

### **4.4.6 User and Human Factors**

- Appropriate error messages should be prompted for the errors made

Each error will be identified and different error messages will be prompted for different kinds of error. For example, if an applicant is applying leave but forget to state his contact number during leave period, then an error message will be prompted for the applicant to fill in the contact number.

- Data entered should not be truncated

The maximum length of the fields for user to key in will be limited according the setting in the database.

- Date format should be specified properly to avoid confusion

The use of Microsoft Active-X Calendar Control helps to avoid this kind of confusion.

The date format appeared in the control would follow the configuration in the regional setting on each computer. While, the date format in the generated summary will be displayed in dd/mm/yyyy format.



## **5.0 System Development and Implementation**

### **5.1 System Development**

#### **5.1.1 Coding**

The methodology used in the development of Leave Management System is the incremental prototyping methodology. The coding is begun with design, followed by the implementation of a preliminary prototype. On completion of the preliminary prototype, additional functions are added. This phase is highly iterative and always required to trace back the previous stages if any error found. It ends with a complete workable module.

#### **5.1.2 Interface**

There would be altogether four main interfaces developed for user, approver, administrator and super administrator. Tool tips are prepared on every icon to help user to be more alert of the functionality of the icon.

Client side input checking is performed to validate the correctness of the input as well as to improve the performance of the system. Besides, a Microsoft calendar Active-X control is used as to avoid user from entering invalid date format and to make the system user friendlier.

#### **5.1.3 Database**

Database is initialized with some actual data. This is to ensure the length of the data is correct so that the data entered would not be truncated. The interface, for example input

box, is being designed with the limited length. Besides, with some actual data, it helps to test the accuracy and reliability of the system in the actual office environment.

## **5.2 System Implementation**

### **5.2.1 Implementation Environment**

#### **5.2.1.1 Window NT Server**

For multi-tier architecture in LMS, there would be two servers needed, one as web server (Microsoft Internet Information Server) and mail server (Microsoft Exchange Server 5.5), while another one as database server (SQL 7.0). The web server will be the Primary Domain Controller (PDC) and the database server as Backup Domain Controller (BDC). BDC can be setup during the installation of Window NT or by using Window NT Server Manager in the PDC.

#### **5.2.1.2 Internet Information Server**

The minimum requirement for the web server to host the LMS is WinNT with Service Pack 4.0. However, for the installation, WinNT Service Pack 3.0 that contains the hot fixes for WinNT 4.0 must be the first to install. Next, Internet Information Server (IIS) has to be installed prior to the Service Pack 4.0. Both the Service Pack and IIS can be found from WinNT Option Pack 4.0, which is available free from the Microsoft web site.

### ***Creation of Virtual Directory***

To enable users to access the system from the Internet, a virtual directory has to be created in the web server. The virtual directory corresponds to the actual directory where



all system files are found. The default document is *iframe.html* and in the IIS security setting, this directory should be granted "allow anonymous access".

**5.2.1.3 Microsoft SQL Server 7.0**

***SQL Server Agent***

SQL Server Agent runs on the server running Microsoft SQL Server. It is responsible for:

- Running SQL Server tasks that scheduled to occur at specific times or intervals.
- Detecting specific conditions for which administrators have defined an action, such as alerting someone through pages or e-mail, or a task that will address the conditions.

SQL Server Agent is like an auxiliary operator that is responsible for handling the repetitive tasks and exception handling conditions.

For LMS, an operator is needed to act as the system administrator. He is the one to inform if any scheduled job failed (or succeed, depend on the setting).

A few scheduled jobs are created to maintain the system. There are

- Database Backup - The database is backed up everyday at 12:00am from the database server to the web server.
- Daily Checking - If any new leave application found, the particular head of department would be informed. This job is scheduled at 2:00 pm and 12:00 am everyday.
- Unprocessed Checking - If there is any leave application that unprocessed for more than 3 days, a mail would be generated to the related approver.



- November Mail- On 1 November, SQL Agent will send mails to every applicant, reminding them to submit their desired days to be converted to cash.
- January Update - On 1 Jan, the leave applications that are occurred 3 years ago would be automatically archived. All related records will be copied to another database named '**Backup**'. After the backup process is completed, all related records will be deleted form the existing database. Besides, all balance added based on promotion or seniority on the previous year will be converted to become permanent add on to their annual balance. The list of holidays on the previous year would then be deleted automatically.
- December Reminding Message - If there is any unprocessed application of the total days to be converted to cash, then SQL Server Agent will generate reminding mail to the approver. This job is scheduled to be executed everyday on 12:00 pm. start from 1 December.

SQL Mail

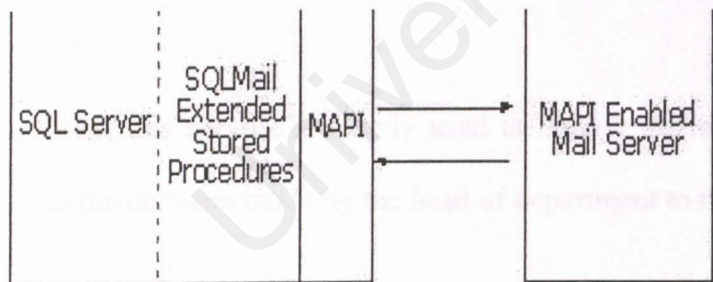


Figure 5. 1 Architecture between SQL Mail and Mail Server

SQL Server 7.0 provides a set of extended stored procedures that allow SQL Server to operate as a workgroup post office for MAPI-enabled mail system.

The computer running SQL Server must be set up as e-mail client. This can be done through the installation of Microsoft Outlook or Microsoft Messaging. After the installation, an e-mail profile must be specified in SQL Mail service.

The mail component of SQL Server can be started automatically when the SQL Server Agent service is started. Alternatively, the mail component can be started and stopped at will, using either SQL Server Enterprise Manager or the **xp\_startmail / xp\_stopmail** stored procedures.

### **5.2.1.4 Microsoft Exchange Server 5.5**

#### ***SMTP Service***

SMTP Service uses the standard Internet protocol Simple Mail Transfer Protocol (SMTP) to transport and deliver messages based on specifications in Request for Comments (RFC) 821 and RFC 822. It also includes enhancements that build upon the basic delivery functions of the protocol.

In LMS, this service is mainly used to deliver mails to the applicants to inform them about the decision made by the head of department to their applications.

#### ***Installation of Internet Mail Connector***

Internet Mail Service routes messages between Microsoft Exchange Server and Simple Mail Transfer Protocol (SMTP)-based systems, including Internet mail servers and Post



Office Protocol version 3 (POP3) and Internet Message Access Protocol, Version 4rev1 (IMAP4rev1) clients.

To setup the Internet Mail Service for the minimum configuration requirements, use the following list of procedures in the order in which they appear.

Task	Description
Installing and configuring Transport Control Protocol/Internet Protocol (TCP/IP).	Install Windows NT TCP/IP, and specify the host and domain name. If DNS will be used, enter the IP address of the DNS servers.
Adding the Internet Mail Service computer to DNS.	If using DNS, add the host name, domain name and IP address of the computer that serving the Internet Mail Service to the DNS.
Updating the Hosts file when not using DNS.	If not using DNS, use the Hosts file to specify the host name and IP address of the hosts to which the Internet Mail Service will forward mail.
Verifying the site address.	From the <b>Configuration</b> container in the Administrator window, select <b>Site Addressing</b> .
Running the Internet Mail wizard to install the Internet Mail Service.	From the <b>Connections</b> container in the Administrator program, choose <b>File, New Other, and Internet Mail Service</b> .
Testing the connection.	Test the connection to ensure that the Internet Mail Service



	is configured correctly.
--	--------------------------

Table 5.1      Installation Procedures for Internet Mail Service

**Note** When changes are made to the Internet Mail Service, the Internet Mail Service must be stopped and then restart again for the changes to take effect.

*Setting Up Window Messaging*

After the installation of Internet Mail Service, with Windows Messaging, electronic mail can then be sent and received through the mail server. To start Windows Messaging, double-click the Inbox icon on window's desktop. If the Inbox icon is not on the desktop, then Windows Messaging is not installed. Then, it can be installed through the add/remove programs in Control Panel.

MAPI profile is a set of configuration options used by Microsoft Exchange and other MAPI compliance messaging applications that contains essential information. This information includes the location of Inbox, Outbox, and address lists, and the personal folder files available to the account for storing and retrieving messages and files. It is needed for SQL Mail Service to send and receive electronic mail. Every mail sent or received by SQL Mail will go through the MAPI profile created with Window Messaging.

In LMS, an Administrator account has been created in Exchange Mail Server. During the setting up of Window Messaging, the user profile name would be Administrator while the

IP address of the mail server would be 202.185.107.20. Default port number is used for

POP3 and SMTP protocols.

System testing is important to ensure the correctness, accuracy, completeness and reliability of the system. Therefore, all testing are proceeded in parallel with system development. First, individual modules are tested. Once module and interface testing is completed, the next step is to test whether they can be combined properly. During integration testing, modules are integrated with the interface built, and tested together. This is to determine whether the interfaces between modules work. Then the entire system is tested. After this, some staff will be invited to give their comments on the system. The list of requirements will be revised and changes needed would be made.

### Unit Testing

Unit testing consists of Black box and white box approach. It is done during the development phase.

White box testing is the approach that deals directly to the structure of the codes within a module or segment. For example,

Segment code coverage testing

Statement coverage testing is a type of white box testing where all of the statements in a program are executed at least once.

Branch coverage testing is a type of white box testing

where all the possible paths through a program are tested. Every loop, decision, and conditional statement is tested. This is done by testing the true and false conditions of the statements.

## **6.0 System Testing**

System testing is important to ensure the correctness, accuracy, completeness and reliability of the system. Therefore, all testing are proceeded in parallel with system development. First, individual modules are tested. Once module and interface testing is completed, the next step is to test whether they can be combined properly. During integration testing, modules are integrated with the interface built, and tested together. This is to determine whether the interfaces between modules work. Then the entire system is tested. After this, some staff will be invited to give their comments on the system. The list of requirements will be revised and changes needed would be made.

### **6.1 Unit Testing**

Unit testing consists of black box and white box approached. It is done during the development phase.

**White box** testing is the testing that deals directly to the structure of the codes within a module or segment. For example:

- Segment coverage testing

Every function created in LMS is rechecked to ensure that all of them are supposed to be executed at least once.

- Compound condition coverage testing

Different kinds of input are provided to test the compound statement. Every stated condition must be able to be executed. Unnecessary codes are eliminated.



### 6.2 Interface Testing

- Data flow testing

For example, after an application is submitted, it is supposed to reach the appropriate approver instantly. If the application has been processed, a mail should be correctly sent to the original applicant.

Besides, the interface design should not lead the user to key in invalid entries. Data type

**Black box** testing is to test the functionality of the system in an ad hoc basis without knowing the logic structure of the code. Input is provided and output is verified manually to check for accuracy. For example, output like leave balance would be manually calculated and then compared with the generated result. Any error found must be corrected.

### 6.3 Integration Testing

- Input analysis

Tester deliberately does some mistakes or key in the value that is out of acceptable range. This is to see how the system will react, and to determine whether the system will prompt the tester with appropriate error message. For example, applicant is asked to:

- a) Put in the leave start date that has occurred in the past.
- b) Put in the leave periods those are overlapped with the existing leave periods.
- c) Put in the incorrect date sequence so that leave end date is earlier than leave start date

## **6.2 Interface Testing**

The interface should be user friendly and not misleading. It is crucial to ensure the user understands what he is doing, and what is the expected outcome. Instructions must be given in appropriate manner and the error message must be clear and straight to point.

Besides, the interface design should not lead the user to key in invalid entries. Data type like date format and the data length will be controlled to avoid unnecessary havoc. For example, the use of Microsoft Calendar Active-X will help to eliminate the problems of date format and for the every input text, the maximum length must be set according to the setting in the database.

## **6.3 Integration Testing**

In the final stage of development, all modules that are developed separately will be combined to form a complete system. This testing is to ensure that all modules that integrated together are able to interact and work seamlessly together. Approach that applied in integration testing is Top-Down Integration approach, where the highest level main module is tested first and sub modules are then added gradually.

Every link to all modules is tested and all components must be tested again after the integration. Black and white box testing is repeated and every output is verified again. The flow of information between modules is validated for accuracy and completeness.



## **6.4 System Testing**

Finally, overall system testing is carried out. This test covers the performance, reliability, accuracy and other criteria. System testing is carried out with some testers who are not the system developers. They will access the system to determine its ability to suit the current office environment. Each user is assigned some modules to be tested. Errors are jotted down for further correction.

### **Test 1**

An applicant is created and the current leave balance is recorded. He is then awarded with some additional leaves, and total bring forward is added later. Total balance to date is checked after the changes. Compute the leave balance manually and compare with the output result.

### **Test 2**

Applicant tries to apply for leave. After some approval and rejection of the leave application, the total balance to date must be compare with the manually calculated value.

### **Test 3**

Super administrator adds an administrator. Then, the created account is used to log in to the system. The system should route the user to administrator page.



## **6.5 Revision of the Requirement List**

After the system testing, the requirement of LMS will then be revised and new functions are added. For this purpose, Dr. Sapiyan Baba, Mr Ling Teck Chaw, Ms Azlin Mohd Ali, Ms Nyah Jali and some others staff had been invited to use the system. Every suggestion or problem faced is recorded to determine the level of user friendliness and also for enhancement. Below are the summaries of their suggestion:

### **Module Applicant**

- Total days applied for each application should be displayed on the application form.
- Most of the user would like to generate their report on yearly basis, so there should also be a check box for annual report.
- The system is expected to support both dd/mm/yyyy and mm/dd/yyyy format. User should not be required to change their computer setting in order to use the system.

### **Module Approver**

- When approver is on leave, he should be able to assign an assistant to help him. The assistant can be then activated or deactivated as wish.
- To process the application, only some important information is needed. Therefore, some fields such as address during leave and contact number had been taken away in the application processing form.
- Before that, the approval and rejection of the application had to be done separately. Approver has to submit once for approval, once for rejection. However, changes have been made so that the approver needs to submit the decision once only.

- Application of emergency leave must be highlighted, and approver should be informed to process the leave only after receiving the medical certificate or related documents.

### **Module Administrator**

- Ability of the administrator to add the rewarded leave and to apply for emergency leaves on behalf of applicant are two new functions that added after the evaluation.
- Some fields are added to the database. For example, date appoint is the field that added after some comments form the clerk.
- Some information such as users' name and log in name can only be changed by administrator

### **Module Super Administrator**

- The whole module is added later to make the system complete and workable.

## **7.0 Finding**

### **7.1 Evaluation**

Implementing the Leave Management System is similar to designing a database application. This initially involves building a data flow diagram and a data model of the working environment. First, existing documents, data and processes are evaluated: how documents are handled, how they progress through the organization, how different kinds of work gets done and who plays what role in getting things done.

During the survey and information gathering, any changes or tunings needed to the current system (through the activity of Business Process Engineering/Re-Engineering) is reviewed. Bringing in the Generic Office often highlights an organization's inefficiencies or duplicated efforts in current processes. Correcting such problems in the leave application process is not just automating the existing manual steps, but are enhancing them.

Then, with the system requirement, a model is built to describe data, documents, workflow processes, people in the organization and the relationships among people, processes, and documents.

Once the design is confirmed, implementation strategy is planned. This depends largely on how LMS is going to be used in the future. For those organizations that have significant investment in hardware and software, existing hardware, software and networks should be allowed to leverage easily. For example in LMS, to provide high



scalability, three-tier client server architecture is used. By distribution of the job load, the system would be more efficient, and easier to maintain.

## **7.2 Strength**

### **7.2.1 Wide-accessibility**

Since LMS is deployable on the Internet, users can always access the system virtually from anywhere in the world. What is needed in the client-side PC is just an Internet Explorer 4.0 or above, which is already preinstalled with Window 98, the most popular operating system in the world.

### **7.2.2 Interoperability**

The distributed nature of server-side application has contributed to the interoperability of LMS. The application files are located in the web server while the database server is located in another machine. Communication through machines from different domain is possible through the establishment of trust relationship. This also means that LMS is highly portable and the implementation of distributed server can be established easily, either to a new machine or the existing server.

### **7.2.3 Coding Reusability**

The simplicity and modularity of the functions make them reusable. Almost all functions are located in “\*.inc” (include) files, therefore enable developers to trace the them easily. With remarks and high modularity of the functions, they are easy to understand and

reuse. For example, some functions like *countdays* and *checkholidays* can just be used without any modification.

### 7.2.4 Confidentiality and Integrity of Information

Password and login name are needed for user to log in to the system. There would be a header in every file to check for the user authentication. This is to protect the confidential and integrity of information so that only information which the user has access right can be published. Besides, password encryption has fully enhanced the security of the system.

In addition, SQL server will validate the user account written in "*global.asa*" file before returning any result to the client. For Internet Information Server, "*global.asa*" is a file with global variable and is protected by the web server from remote access. Besides, directory browsing is disabled and the access right of anonymous user that set to log in to the web server is also controlled.

Furthermore, the database will be backup every day at 12:00 am automatically. This is the precaution for problems such as power break down.

### 7.2.5 Scalability

LMS is highly scalable. For example, it is possible to add another machine dedicated as the mail server in the future. The only changes needed are the inbox setting for Window Messaging in Control Panel and the DNS setting to "recognize" the mail server. For sure a trusted relationship is a must for the machines in different domain.

### **7.2.6 Reliability and Accuracy**

The interface design is consistent throughout the whole system. There will always be a navigation bar on the top and brief instructions are given to every process. Besides, the current leave balance will be calculated again after some changes such as adding or deleting a holiday. With automated calculation, the accuracy of the leave balance is guaranteed.

At the same time, LMS is reliable because of the error tolerance provided by the system. For any error made by user such as duplication of login name, deleting empty records and submitting changes twice, an error message will be prompted stating the particular mistake. Besides, LMS is now working online 24 hours per day 7 days per week without any downtime.

## **7.3 Limitation**

### **7.3.1 Browser and Platform**

LMS is limited to certain platforms in term of openness. It can only run in Windows 95, Windows 98 and Windows NT with Internet Explorer 4.0 or above. This limitation is due to the usage of Microsoft Calendar Active-X control. Active-X control can only work properly in Netscape's browser with the Active-X plugs in installed. Besides, VB Script that used in LMS can only supported in Internet Explorer.



### 7.3.2 Language Support

There would be two versions of LMS, which are English and Malay. However, for the current system, although the text in the interface can be set as to Malay but the data or records in the database has to be keyed in to two different databases in order to make it fully displayed in either language.

## 7.4 Problems Encountered

### 7.4.1 Setting up mail server

A mail account has been created in Outlook Express. Although mails can be sent out through Internet Mail Service in Exchange Server, but any mail replied to that account couldn't receive by the server.

#### *Solution*

If there is a DNS server, then some setting are needed as below. This is for the Internet Mail Service (IMS) to resolve the domain name of the outbound mail and also for other Internet mail servers to resolve IMS's domain name.

**A (address) records** - Contain the IP address and the fully qualified domain name (FQDN) of a computer. It is necessary for other mail server to resolve the address of LMS's mail server. For example, if the host name in the TCP/IP configuration is *lms*, the domain in the TCP/IP configuration is *fsktm.um.edu.my*, and the IP address is 202.185.107.20 (Web and Mail Server), the A record in DNS would be:

`lms.fsktm.um.edu.my. IN A 202.185.107.20`

**MX (mail exchanger) records** - If Microsoft Exchange Server SMTP site address is different from the host and domain name configured in TCP/IP, an MX record should be used to associate the address with an A record.

However, for LMS, because Microsoft Exchange Server site address is `lms.fsktm.um.edu.my`, and the TCP/IP configuration specifies a host name of `lms` and a domain name of `fsktm.um.edu.my`, then the MX record would be:

`lms.fsktm.um.edu.my. IN MX 0 lms.fsktm.um.edu.my.`

`lms.fsktm.um.edu.my. IN MX 5 fsktm.um.edu.my.`

Mails will be routed to the first MX record which is `lms.fsktm.um.edu.my` with the 0 weight, the main mail server. If this server is down, then the incoming mails will be routed to the second mail server according to the hierarchy in MX records. The lower the weight, the higher the priority of the mail server.

**Note** Using both an A record and an MX record can result in faster name resolution. This is because the server will first do a DNS query for the MX records. If this fails, then attempt will be taken towards trying A records before reverting to other methods such as host files.

### 7.4.2 Setting up SQL Mail Services

Initially, SQL Mail Services cannot be started. An error message is prompted, asking for a valid MAPI profile.

#### **Solution**

SQL Mail must have a mail profile created in the same user domain account that is used to start SQL Server. That profile is activated when a user logs on to Windows NT successfully. When a mail's stored procedure, such as *xp\_sendmail* is executed, SQL Mail will look for the defined mail profile in the domain account to send out the mail.

To create a mail profile, Windows Messaging Service or Microsoft outlook is needed.

### 7.4.3 Active-X control

Some machines will act differently to the Active-X control that used in LMS. For some machines, error messages will be prompted if it cannot support the Active-X control. This is especially for the machines with Internet Explorer 4.0. For the machines that are using Windows 95 or Windows 98, which never install Visual Basic, Visual Interdev, or Microsoft Office 2000 before, Microsoft Calendar Active-X controls used in LMS must be downloaded to the client's computer. Problems encountered to make it downloadable automatically. Besides, the date format in the Microsoft Calendar Active-X cannot be changed, and by default, there are only two digits for year, which is not appropriate.



### Solution

Because of the different in default security setting between IE 4 and IE 5 or some users may have already changed their IE's security setting, therefore, some features like "running active-X controls", "initializing Active-X controls not mark as safe" and others as such must be set to enable or prompt. For the first time user, the security setting, "download Active-X control" must be set to prompt or enable in order to make it downloadable automatically.

For the date format, it can be changed in the Regional Setting in Control Panel. However, LMS has been configured to support either dd/mm/yyyy or mm/dd/yyyy date format.

#### 7.4.4 Lack of time

Due to lack of time, complete testing could not be carried out. A thorough testing is required to test for the functionality of the scheduled jobs, database integrity and the correctness of the leave balance for each user.

### 7.5 Future Enhancement

#### 7.5.1 More powerful access control features

The security setting for Internet Information Server can be set to become **Basic Authentication**, which a message box will prompt the user for password and username. This verification is based on the NT user list and based on this feature users can be

disabled easily even without deleting them. There would be more controls over users' accessibility to the system.

### **Recommendation**

With data transformation services in SQL 7.0, Win-32 executable file can be scheduled to be executed at the specific time or it can be triggered when there is new user added to the database. Developer may use this feature to add new user into Windows NT user list.

### **7.5.2 Language Support**

There should be only one LMS's database in the database server, instead of two databases with different language. Otherwise, the integrity of the information in the database must be configured properly.

### **7.5.3 Database Integrity**

The database should be able to restore automatically after the disasters like power break down. Any transaction that stopped because of the unexpected broken down of database connection must be rolled back automatically.

## **7.6 Knowledge Gained**

### **7.6.1 A Better Understanding of Network Systems**

Sufficient knowledge on network system is needed in developing Leave Management System. Issues such as shared resources, distributed system, three-tier architecture and

network bandwidth have to be understood completely. Possible network and system security flaw is also the major concerns in a network system.

### **7.6.2 Ability to Set Up NT Servers and NT Workstations**

For a distributed system, knowledge of setting up a new domain, including server and workstations is required. This has provided the project team members with the opportunity of learning how to set up a network of NT domain. Some important knowledge would be the setting up of trust relationship, configuring domain user, and the server manager in NT.

### **7.6.3 Understanding Active-X technology**

Active-X technology has brought to a higher level of the object-oriented technology. Active-X technology stresses on maintainability and reusability. Usage of Active-X has resulted in shorter development time. This is one of the major factors, which has encouraged the growth of Active-X technology.

### **7.6.4 Active Server Pages**

ASP though new, has captured the attentions of many software and web developers. It provides very powerful features enabling one to create highly interactive and dynamic web pages. Knowledge of ASP has propelled one in the forefront of multimedia technology. With its highly integration with Internet Information Server and Active-X technology, ASP has become one of the most prominent web developing programming language.



#### **7.6.5 Using SQL Server**

SQL server 7.0 is the best database for the Microsoft Windows platform. It provides a comprehensive platform that makes it easy to design, build, manage and use data warehouse solutions, enabling any organization to make effective business decisions based on timely and accurate information. Therefore, the knowledge of SQL server is of great value.

#### **7.6.6 Transact SQL**

Transact SQL is the standard language for communicating between applications and SQL Server. The Transact-SQL language is an enhancement to Structured Query Language (SQL), the ANSI-standard relational database language. It provides a comprehensive language for defining tables; inserting, updating, or deleting information stored in tables; and for controlling access to data in those tables. Extensions such as stored procedures make Transact-SQL a full programming language.

#### **7.6.7 Improve Debugging Skill**

The debugging feature provided with ASP is poor. Without the reliance on automated debugging tools, other debugging methods have to be used. For example, printing out the parameters and values passed among the files as well as displaying message boxes for some semantic checking. All this will finally improve one's debugging skill.

#### **7.6.8 Requirement Capturing**

The development process of LMS has helped one to be able to capture the requirements of an actual office application. Through interviews, prototyping and discussions, one has been trained to analyze and evaluate the basic requirement of the system. Besides, one has learnt the ways to identify system deficiencies, generates alternative solutions and also evaluating the feasibility of the system. All of this would be a great experience for the future development process.

## **8.0 Conclusion**

At the completion of the system, the project has successfully met its main objective of developing a workable web-based leave management system that based on the requirements of the Faculty of Computer Science and Information Technology (FCSIT). LMS has enabled system users to process and manage every application process that related to leave. Besides, it has also projected the main idea of GOE as to promote a paperless environment with the implementation of the GOE concept in LMS.

In addition, this project has provided the golden opportunity to learn the fundamental of web-based programming language as well as to gain knowledge of the technology of Microsoft products like Window NT Server, Internet Information server, SQL Server and Microsoft Exchange Server.

LMS is designed properly so that it can be adopted at any time for any organization with only minor changes. The important point here is not to recognize "how" but rather "when" you need to move towards the implementation of Generic Office Environment. The implementation of LMS in FCSIT has once again proved the feasibility of GOE in an actual office environment.



## Appendix A

### Summary

- Windows NT Server 4.0 is 2.7 times faster than Linux/Samba on a four-processor file server for Windows 95 clients and 1.9 times faster for Windows NT clients.
- Windows NT Server 4.0 is 2.2 times faster than Linux/Apache as a Web server on a four-processor system and 1.4 times faster on a one-processor system.
- Linux performance does not scale well between one- and four-processor systems for file or Web servers.

### File-Server Performance

Amount of Processors	Client Type	Windows NT Is Faster Than Linux By
1	Windows 95	1.5 times
4	Windows NT	1.9 times
4	Windows 95	2.7 times

Table A.1 File Server Speed Advantage of Windows NT Server over Linux

### Web-Server Performance

The performance scaling differences between Linux and Windows NT Server are even more pronounced for Web servers. The Web-server tests show that Windows NT Server is 2.2 times faster than Linux 2.2.10/Apache 1.3.6 on a four-processor server and 1.4 times faster on a one-processor server. Linux increases four-processor system

performance by 42% over single processor system compare to the 124% performance scaling improvement in Windows NT Server[5].

Microsoft tested two Web servers to determine the maximum performance possible from each.

- Windows NT Server 4.0 with an integrated Web services (Internet Information Server 4.0, IIS) on a Compaq ProLiant 3000.
- Solaris 2.6 with Sun WebServer 3.2 (NFS) on a Sun Ultra Enterprise 450.

Table B.1 shows the peak performance they measured for each Web server in HTTP requests per second (RPS), the peak throughput in megabytes per second, the price of each system, and the performance per dollar per RPS. (Higher numbers are better for RPS, and lower numbers are better for price and price per RPS.)

Web Server	System	Price		Price/Performance
		(\$)		
IIS 4.0	Compaq ProLiant 3000	412,250	52.17/RPS	(ISAP)
Solaris 2.6	Sun Ultra Enterprise 450	544,750	517.85/RPS	(ASP)

Appendix B

Mindcraft tested two Web servers to determine the maximum performance possible from each:

- Windows NT Server 4.0 with its integrated Web services (Internet Information Server 4.0, IIS) on a Compaq ProLiant 3000.
- Solaris 2.6 with Sun WebServer 1.0 (SWS) on a Sun Ultra Enterprise 450.

Table B.1 shows the peak performance they measured for each Web server in HTTP requests per second (RPS), the peak throughput in megabytes per second, the price of each system, and the price/performance in dollars per RPS. (Smaller numbers are better for System Price and Price/Performance, larger numbers are better for the others)

Web Server	Peak RPS	Peak Throughput	System Price	Price/Performance
IIS 4.0/Compaq ProLiant 3000 (2 x 333MHz Pentium II, 512 MB)	1337 (ISAPI) 694 (ASP)	17.1 MB/S 8.8 MB/S	\$12,250	\$9.17/RPS (ISAPI) \$17.65/RPS (ASP)
SWS 1.0/Sun Ultra Enterprise 450 (2 x 296 MHz Ultra SPARC, 512 MB)	336	4.5 MB/S	\$31,828	\$94.75/RPS



Table B.1 Performance Summary

References

They tested these systems with Ziff-Davis Benchmark Operation's WebBench 2.0 and a workload is created to model published research on Web usage patterns. The workload also includes a significant amount of dynamically generated Web pages. The benchmark results clearly show that a Windows NT Server 4.0-ProLiant 3000 platform is a more cost-effective, higher performance Web server solution than a Solaris 2.6-SWS 1.0-Ultra Enterprise 450 platform. Besides, the Windows NT Server platform using ISAPI to respond to dynamic Web requests is four times faster than the Solaris-SWS platform and has 10.3 times better price/performance. Furthermore, the Windows NT Server platform using ASPs is 2.1 times faster and has 5.4 times better price/performance than the Solaris-SWS platform.

## References

- [1], [2] Educom Training System Inc., "The Generic Office Environment: A guide to understand the architecture", white paper, V4.05, August 1994
- [http://www.educom.on.ca/gen\\_off/cover.htm](http://www.educom.on.ca/gen_off/cover.htm)
- [http://www.educom.on.ca/gen\\_off/introduc.htm](http://www.educom.on.ca/gen_off/introduc.htm)
- [http://www.educom.on.ca/gen\\_off/solution.htm](http://www.educom.on.ca/gen_off/solution.htm)
- [3]"Windows NT Server: A Platform for Every Computing Task", Microsoft Cooperation, October 21, 1998
- <http://www.microsoft.com/ntserver/nts/techdetails/overview/ntplatform.asp>
- [4]Bruce Weiner, "Open Benchmark: Windows NT Server 4.0 and Linux" Mindcraft Inc., June 30,1999,
- <http://www.mindcraft.com/whitepapers/openbench.html>
- [5] "Web Server Comparison: Executive Summary " Mindcraft, Inc., between April 14 and May 20, 1998,
- <http://www.mindcraft.com/whitepapers/nts4sol26web.html>
- [6] Software Spectrum with Kent Joshi, Tracy Bradley, Tito Del Prado, Neil Neimida, Richard Romo, Inetekhab "Inti" Shaikh, Robert Short, Valeno Valentino, Sal Collora, Mark Kapczynski, Ruben Perez and Ed Roberts, " Special Edition Using Microsoft Exchange Server 5.5" Que Cooperation, 1997

- [7] Kenyon Brown, Kyle Brown, Francois Koutchouk, Kevin Brown, "Mastering Lotus Notes 4.5 and Domino", Second edition, Sybex Inc., 1996
- Ken McCrery , "Dynamic Web Design Using Active Server Pages", University of North Carolina, Wilmington, February 1999
- [8] <http://www.surfonline.com/ken/independentstudy/whatisasp.htm>
- [9] <http://www.surfonline.com/ken/independentstudy/aspcgi.htm>
- [10], [11] Rob Thayer, "Visual Basic 6.0 Unleashed" SAMS Publishing, 1998
- [12] Bill Anderson, "Netscape Developer's Guide to Java Script 1.2", Prentice Hall PTR, 1998
- [13], [14] Shari Lawrence Pfleeger, "Software Engineering, Theory and Practice", Prentice Hall International Inc., 1998
- [15] David M. Kroenke, "Database Processing Fundamentals, Design, and Implementation", Prentice Hall International, 1998



## **Bibliography**

Homer, Alex et al, "Active Server Pages", Birmingham, Wrox Press Limited, 1997

---

Wynkoop, Stephen, "Special Edition Using Microsoft SQL Server 6.5 Second Edition",

Indianapolis, Macmillan Computer Publishing

## Table of Contents

University of Malaya

LEAVE MANAGEMENT SYSTEM

# Leave Management System

User Manual

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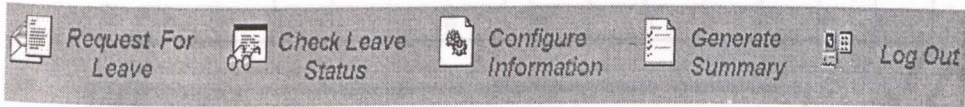
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# Leave Management System

## 1.0 LAS Applicant

Leave Management system enables applicant to apply for leave easily and effectively. Besides that, applicant can check the current status of his leave application and configure his personal information. He may also generate the summary of his own leave application records. The menu of LMS for the applicants as below:



### 1.1 Request for Leave

To apply for leave, click on the menu labeled as 'Request For Leave'. A form will be displayed.

#### Step 1 of 5

The following is the information provided automatically by the system in the application form.

#### Step 1 of 5 : Confirm Your Information

To :	Approver
Name :	Lee Chun Hoo
Contact Number	7544802
Email Address	lchosl@rocketmail.com
Position	Pembantu Am Rendah
Balance To Date	104
Balance Applicable	100

#### Step 2 of 5

Choose the date range for the leave period. You may select the start date and the end date from the calendar.

### Step 2 of 5 : Provide Your Leave Duration

Starts From

Ends On

January 2000

January 2000

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

January 2000

January 2000

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

Contact Number

Address During Leave Period

An error message will be prompted if the selected period conflict with ant other existing leave applications.

Your start date has conflict with another existing leave application record that you have applied

Existing Record Start Date Wednesday, January 19 2000

Existing Record End Date Thursday, January 20 2000

Press BACK to reconfirm your application date

### Step 3 of 5

Applicant must specific the type of leave for each application. If the leave start date is the current date, then only emergency leave can be selected.

### Step 3 of 5 : Select The Type Of Leave

Type Of Leave

Balance Left

Days Applied

Apply On

1.3 Query Results

Step 4 of 5

The default reason would be to "Rest". If applicant choose "Other", the reason of the application must be specified.

Step 4 of 5 : Select Reason Of Leave

☒ Rest

☐ Other

Step 5 of 5

When done, click the button "Apply Now" to submit the application.

1.2 Check Leave Status

Applicant may check the status of their application by clicking "Check Leave Status" from the menu bar.

Check Leave Application Status

Check Leave Application Status that is

In Progress submit

Applicant can either check the leave status that is 'In Progress', 'Rejected' or 'Approved'

Delete

Application Date	Reason For Leave	Type Of Leave	Start Date	End Date	Days Applied
<input type="checkbox"/> 18/01/2000	Rest	Annual Leave	23/02/2000	25/02/2000	3
<input type="checkbox"/> 17/01/2000	Rest	Annual Leave	18/01/2000	18/01/2000	1
<input type="checkbox"/> 17/01/2000	Rest	Annual Leave	09/02/2000	11/02/2000	3

DeleteReset



### 1.3 Query Results

Applicant may delete any application that is in progress. He may also edit any application by clicking the application date.

### 1.4 Revocation of Leave

The approved leave applications can be revoked. Below is a list of revoked leave.

Cancel Revocation

Application Date	Type Of Leave	Start Date	End Date	Reason For Leave	Days Applied	Revoking Status
<input type="checkbox"/> 12/01/2000	Annual Leave	19/01/2000	20/01/2000	Rest	2	In Progress

Revocation Date	Reason	Status
14/01/2000	Attend meeting	Approved
Cancel Revocation	Reset	

Applicant can always cancel the revocation as long as the revocation is not yet approved. However, once the revocation is approved, it can not be canceled already.

### 1.5 Configure Information

Applicant can edit and provide some frequent used information in this form. The information provided would be the default value in the leave application form.

Name	Lee Chun Hoo
Phone Number	7544802
Address During Leave	
E-mail	lchosl@rocketmail.com
Login Name	lch
Password	*****
Retype Password	*****

## 1.6 Generate Summary

Two options are provided: Applicant can either query for the summary of leave applied or the summary of total days converted to cash.

### a) Summary of Leave Applied

#### Step 1 of 4

Applicant can either query the records that are in the current year by clicking the selected option box or choose the date range himself.

Step 1 of 4

Click Here For Current Year ☐

Or Select Your Summary Date Range

Starts From

Ends On

January 2000							January 2000						
Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	1	26	27	28	29	30	31	1
2	3	4	5	6	7	8	2	3	4	5	6	7	8
9	10	11	12	13	14	15	9	10	11	12	13	14	15
16	17	18	19	20	21	22	16	17	18	19	20	21	22
23	24	25	26	27	28	29	23	24	25	26	27	28	29
30	31	1	2	3	4	5	30	31	1	2	3	4	5

#### Step 2 of 4

Four fields would be selected by default since these are the most frequently needed.

Step 2 of 4

Select The Field To Be Listed

- ☒ Include Leave Start Date
- ☒ Include Leave End Date
- ☒ Number Of Days Taken
- ☒ Balance To Date
- ☐ Application Date
- ☐ Type Of Leave Taken
- ☐ Leave Application Status
- ☐ Reason For Leave
- ☐ Results Comment
- ☐ Action By

### Step 3 of 4

The summary result can be sorted by "Type of Leave", "Leave Application Status" or "Leave Application Date".

### Step 3 of 4

Sort The Leave Application Records By

### Step 4 of 4

Click "generate Summary" to generate the report.

#### b) Summary of Conversion

Applicant can type in the year range for the summary.

From Year	<input type="text" value="1950"/>
To Year	<input type="text" value="2000"/>
<input type="button" value="Submit"/>	

Generated summary would be like below:

Year	Amount Bring Forward	Amount Converted	Status
2000	20	0	In Progress
Total days converted to Cash		0	
Total days Bring Forward		0	

Total days bring forward are the total numbers of balance that has brought forward from the previous two years.

## 1.7 Application for Conversion to Cash

This option is only displayed every year on November. This is for the applicants to submit their desired balance to be converted to cash.



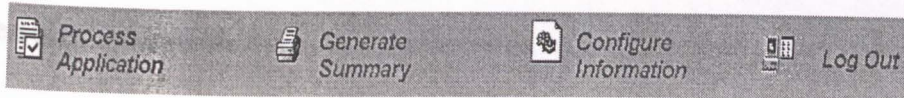
**Total Converted To Cash : 0**

Balance For Year 1999	
Amount Bring Forward *	
Amount To Cash	
Annual Leave For Year 2000	18
Amount To Cash **	<input type="text"/>
Amount Bring Forward ***	

Total converted to cash is the total days that have already converted to cash (Maximum is 90 days). Applicant needs to submit the number of days to be converted to cash while the amount bring forward will be automatically filled in at the end of the year. It would be the remaining leave balance on that particular year.

## 2.0 LAS Approver

Leave Management System allows approver to process each application of leave, revocation and conversion to cash.



### 2.1 Process Application

Approver will be displayed with a list of new, unprocessed applications. Approver can choose any application from the list, whether to approve or reject. By clicking the applicant's name, approver can add comments to that application. Or, approver can just

Approve	Reject	FullName	Leave Type	Reason	Start Date	End Date	Days Applied	Balance
<input type="checkbox"/>	<input type="checkbox"/>	Lee Chun Hoo	Annual Leave	Rest	09/02/2000	11/02/2000	3	104

Submit

Reset

\*Emergency Leave : Please process the application only after receive the related document

### Leave Revocation

Approve	Reject	FullName	Leave Type	Start Date	End Date	Days Applied	Balance
<input type="checkbox"/>	<input type="checkbox"/>	Lee Chun Hoo	Annual Leave	19/01/2000	20/01/2000	2	104

Submit

Reset

select whether to approve or reject the application by clicking on the appropriate check boxes next to the records.

### 2.2 Generate Summary

This option enables approver to generate a leave record summary of the applicants under his own department. To generate the summary, please refer to the interface in the applicant's user manual.



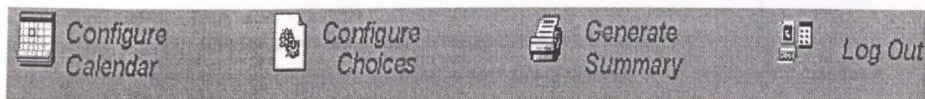




### 3.0 LAS Administrator

#### Configure Choices And System Setting

Administrator can maintain the running of the entire system can its workflow.



### 3.1 Configure Calendar

Administrator can add, edit or delete annual holidays from the list.

Date	Holiday Description
<input type="checkbox"/> <u>1/1/2000</u>	New Year's Day
<input type="checkbox"/> <u>8/1/2000</u>	Hari Raya Puasa
<input type="checkbox"/> <u>10/1/2000</u>	Hari Raya Puasa
<input type="checkbox"/> <u>15/1/2000</u>	Replacement for Fisrt Saturday of the Month
<input type="checkbox"/> <u>1/2/2000</u>	Federal Territory Day
<input type="checkbox"/> <u>5/2/2000</u>	Chinese New Year

The type of holiday are coloured as followed:

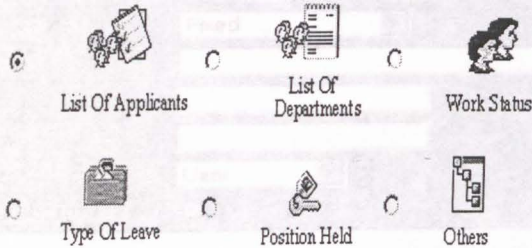
☐ Public Holiday ☐ Organisation Holiday

### 3.2 Configure Choices

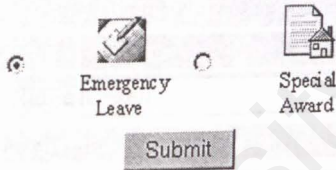
Administrator can configure the whole system through this option. He can add, delete or edit the list of applicants, the list of departments, work status, type of leaves and the list of positions. However, for any department, leave, position and work status that is currently used, it can not be deleted from the database.

## Configure Choices And System Setting

Please choose one of the following option to be configured.  
You may add , delete or configure choices available to user and information about approvers & applicant.



Besides, administrator can also help applicant to apply for emergency leave and add some additional leaves as an award of good performance for that particular year.



### a) List of Applicants

To add a new applicant, administrator needs to fill up the form below. Login Name, Access Right and Date Appointed will be fixed and cannot be changed later.

**Step 1 of 1** You may add a new applicant by providing the following information

Applicant Full Name	<input type="text"/>
Email Address	<input type="text"/>
Department	Dean <input type="text"/>
Position Held	Pembantu Am Rendah <input type="text"/>
Phone Number	<input type="text"/>
Date Appointed	Day: <input type="text"/> Month: <input type="text"/> Year: <input type="text"/>
Status	Fixed <input type="text"/>
Login Name	<input type="text"/>
Password	<input type="text"/>
Retype Password	<input type="text"/>
Access Right	User <input type="text"/>
Can he/she apply for leave?	<input checked="" type="radio"/> Yes <input type="radio"/> No

b) List of Departments

**Step 1 of 1** You may edit the current approver record by providing the following information.

Department Code	Dekan
Department Name	Dekan

**First Approver's Data**

Name	Dekan (Pemangku)
Email	sapiyan@fsktm.um.edu.my
Login Name	apsapiyan
Password	skakakakakak
Retype Password	skakakakakak

**Second Approver's Data**

Name	<input type="text"/>
Email	<input type="text"/>
Login Name	<input type="text"/>

Administrator can add one or two approvers for each department. Department Code would be fixed after being added to the database.



c) Work Status : cannot be deleted from the database. It must always exist in the database.

*Work Status Configuration*

Work Status Code	Work Status Name
<input type="checkbox"/> <u>C</u> ontract	Contract
<input type="checkbox"/> <u>F</u> ix	Fixed
<input type="checkbox"/> <u>T</u> emp	Temporary Worker


Add New Work Status

Delete Work Status

Clear Selection

Administrator can edit the particular record by clicking the code that is in blue color. He can also add new work status or delete the existing records using this option.

d) Type of Leaves

  
Type Of Leave

Leave Code	Leave Description
<input type="checkbox"/> <u>A</u> NUAL	Anual Leave
<input type="checkbox"/> <u>E</u> MG	Emergency Leave
<input type="checkbox"/> <u>N</u> oPay	No pay Leave
<input type="checkbox"/> <u>R</u> AD	Cuti Radiasi
<input type="checkbox"/> <u>S</u> TU	Study Leave
<input type="checkbox"/> <u>S</u> uk	Cuti Sukan

Add New Leave

Delete Leave

Clear Selection

Emergency leave cannot be deleted from the database. It must always exist in the database.

#### e) Positions Held

<input type="checkbox"/>	Position Code	Position Description	Annual Leave Applicable
<input type="checkbox"/>	Dekan	Dekan	30
<input type="checkbox"/>	KJ	Ketua Jabatan	30
<input type="checkbox"/>	PAR	Pembantu Am Rendah	18
<input type="checkbox"/>	Pensy	Pensyarah	30
<input type="checkbox"/>	PM	Pembantu Makmal	20
<input type="checkbox"/>	PP	Penolong Pendaftar	30
<input type="checkbox"/>	PPSM	Penolong Pegawai Sistem Maklumat	25
<input type="checkbox"/>	PPT	Penolong Pegawai Tadbir	25
<input type="checkbox"/>	PSM	Pegawai Sistem Maklumat	30
<input type="checkbox"/>	PT	Pembantu Teknik	25
<input type="checkbox"/>	PTK	Pembantu Tadbir Kesetiausahaan	20
<input type="checkbox"/>	PTP	Pembantu Tadbir Perkeranian	20
<input type="checkbox"/>	PTPK	Pembantu Tadbir Perkeranian Kanan	20
<input type="checkbox"/>	PTR	Pembantu Tadbir Rendah	18
<input type="checkbox"/>	TTA	Timbalan Dekan Akademik	20

Annual Leave Applicable is the default value of annual leave balance for that particular position. For every new applicant, the annual leave is based on his position. Administrator can later add his annual leave through "List of Applicant".

#### f) Emergency Leave

Administrator can apply for emergency leave on behalf of applicant. This option is to help the applicant that is away but do not has the Internet access on that time.

Select the date range:

Starts From

Ends On

January 2000

January

2000

January 2000

January

2000

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

Fill in applicant's information

Name	clerk
Address During Leave	
Period	
Contact Number	
Type Of Leave	Emergency Leave
Reason	
<div>Submit Changes    Reset</div>	

g) Special Award

Special award is the option for administrator to add some additional leave to a particular applicant as an award. This value will be expired on the end of that year.





Special Award

Balance To be Added :	0
Description/Reason :	0
<div>Submit Changes    Reset</div>	

3.3 Generate Summary

This option enables the administrator to generate summaries of applicants, departments, holidays, types of leave and positions.

You may generate any report summary by choosing the following options.

- ☒  List Of Holidays
- ☐  List Of Department
- ☐  List Of Choices
- ☐  Leave Application



4.2 Configure Conversion

4.0 LAS Super Administrator

Super administrator can add or delete administrator and also key in the total leave has been brought forward or converted into cash for the last two year.



Conversion Of Balance Applicable

4.1 Configure Admin

For a new system, super administrator would be the first one to log into the system to add at least one system administrator. Super administrator can add a new administrator or delete any existing administrator. However, he can not later re-edit administrator's personal information.

Applicant Information Configuration

	Applicant's Name	Position Held	Department
<input type="checkbox"/>	clerk	Pembantu Am Rendah	Dean
<input type="checkbox"/>	ohoh	Ketua Jabatan	Dean

Add New Administrator

Delete Administrator

Clear Selection

4.2    **Configure Conversion**

For a new system, super administrator would be the one to key in the leave balance that has been converted to cash or brought forward form the previous two year. Super administrator can only configure applicant's conversion of leave balance if there are 2 continuous year that the applicant does not submit his application of conversion.

*Conversion Of Balance Applicable*

<b>Balance For Year 1998</b>	
Amount Bring Forward	<input type="text" value="0"/>
Amount To Cash	<input type="text" value="0"/>
<b>Balance For Year 1999</b>	
Amount Bring Forward	<input type="text" value="0"/>
Amount To Cash	<input type="text" value="0"/>
<input type="button" value="Submit"/>	<input type="button" value="Reset"/>