e - Expense Claims System

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Abstract

This Project paper is prepared as to partially fulfill the requirement of the Bachelor of Computer Science. The development of e-Expense Claims System is highlighted in this document.

The e-Expense Claims System is to provide computerized and useful system for faculty administrators, lecturers and students in managing information more efficiently and effectively.

It has to point out that the e-Expense Claims System will not be developed specific for small and medium size commercial companies. This is to ensure that the system can easily adapt to changes and can be customized for other organization with similar needs.

The main purpose of the system is to computerize the manual system. This proposed electronic system enhances the expense claims application flows. The electronic Expense Claim application system to be located in company computer network center and accessible by all authorized users connected to the company office. The expense claim is then submitted electronically. The system will calculate the total value of the expense claim and check each expense against the approval rules and set each expense's approval status appropriately.

The decomposition of e-Expense Claims System into module and sub modules, function and features of each module are described in this document as well. The system analysis, system design, system development, and testing and maintenance are also focused.

Table of Contents

List of Figures

List of Tables

Chapter 1 : Introduction

1.1 Project Overview

Living in an information age, the rapid growth of the internet and intranet accelerated the ever-increasing demand for information resources will gain better knowledge and competitive advantages in this new era.

e-Expense Claims System is an online intranet based application aim of implementing the task of common functional component requirement. e-Expense Claims System is an electronic system that streamlines the process chargeable expenses application, approval and updates.

The main objective of this proposed system is to computerize the manual system. This proposed electronic system enhances the expense claims application flows.

1.2 Motivation for the project

Currently, most companies especially small and medium size commercial companies still manage their expense claims application manually. To apply claims, claimant is required to fill in and submit manual forms. Then, Finance staff will check on the details carefully esp. calculation, with triple independent confirmation. There are many finance staffs involved in the claims process. Their work are segregate independently among them. All the data is key into spreadsheet manually according to the claim forms. This method has not only inefficient but also very time consuming.

However, the emergence of the internet and intranet has changes the situation. In offers explosion of opportunities for solving the accessibility problem face by the employees. For example with this development, claimant can applies his/her claims through the network anytime without delay. The verifier can views and verifies the claims that request her checking on-line. Thus, e-Expense Claims System is proposed to focus into this problem with

intention of implementing an application type system through company internal web. The project if successfully developed and implemented would revolutionize the traditional process of doing work.

1.3 Project Objectives

e-Expense Claims System is an internal web site application with server sites and client site. As the on-line application, its objective are as below:

- Electronic Application and Approval – Claims applications & processing and reimbursement of claims are electronically done, hence manual forms will no longer be used because all applications and approvals are done electronically, reducing paper cost, printing cost and eliminating chance of lost forms.
- Efficiency & effectiveness - The proposed system automatically updates the chargeable claims information. Hence, eliminating human errors and time cost in keying each entry one by one.
- Reliability - All the details are based on the application entry and alteration. Hence, increase the reliability of the system generates reports.
- Ease of use - users may key-in the entries with up-to-date information provided by the system at their fingertips at all times.. Besides, there are selection lists, displayed fields and automatic calculation to ease staff's data entry.
- Decentralized data-entry - allows a more efficient way to utilize resources and accuracy of data can be ensured because data entry of expenses or disbursement are done by the staff themselves. Hence, this will bring to cost reduction of human resources.
- Streamline process - simplify the request, approval process by reduce resources required for process handling which shorten the processing cycle and eliminate possible human delay.
- Accuracy - The calculation is done automatically by the system.
- Security and Integrity - Applications accessibility are differentiate by different level of users. Besides, only claimant themselves can alter and update the application information when requested. Hence, increase the data's security and responsibility of claimant.

1.4 Project Scope

To propose an electronic application form system to be located in company computer network center and accessible by all authorized users connected to the company office. Custom Application (e.g. Leave Application, Room Booking System) has been chosen as the scope in the development of e-Expense Claims System. The project scope covers System Analysis, System Design, System Development, System Documentation, and Testing & Maintenance. The scope shall also covers activities, which most company is doing manually. The system comprises of the following modules:

- **Claims Application Module**

  - The claims application are divided in two different route i.e.

    1 General - Claimant → Department → Finance Dept

    2 HR - Claimant → Human Resources Dept → Finance Dept

- **Administrator Module**

  For Administrator to do maintenance of

  - Maintain Staff Information
  - Maintain Claims Type
  - Maintain Approver List
  - Maintain Cost Centre

  Various Reports Creation and Data Export

  ⇒ General list of claimants claim details

  ⇒ A summary list of Cheques

  ⇒ Summary list of claims ready to collect (includes claimant name and reference number)

  ⇒ Summary of Disbursement Claims reports

  ⇒ Type of claims payment summary list

- **Manager Module**

  For Manager in change to do:

  - Approved - A mail notification upon approval will be sent to claimant.
  - Disapproved -A mail notification upon disapproval will be sent to claimant.
  - Incomplete - A mail notification indicates that the application has Incomplete document or there is error on the expense claims application, will be sent to the claimant. Claimant can resubmit the application after updating the application.

The project will cover the areas as specified below:

- Implement network authentication user password is need to protect unauthorized access to the database.
- User and administrator are allowed changing the password.
- Claimant is required to specify an approvers' name upon application who has the rights to approve their subordinates leave or claim application in this system.
- Keep track the application.
- Administrators are allowed to generated the system report.
- Implement queries capabilities for employees, manager and administrative.

1.5 Relevance of Project

Undertaking this project requires the development of a large-scale system that draws on knowledge from various subjects relevant to the software engineering discipline. The activities involved in the system development would expect the application of various scientific methods to the realization of a software solution to solve the particular problem under analysis.

1.6 Project limitation

- For internal used only that is a user unable to access the database without using organization's Local Area Networking (LAN). The propose system to be located in the company's computer network center and accessible by all authorized users connected to the network of company office.
- Need to go through the process of technical testing by organization IT department before allocating the database into domino server.

1.7 Risk

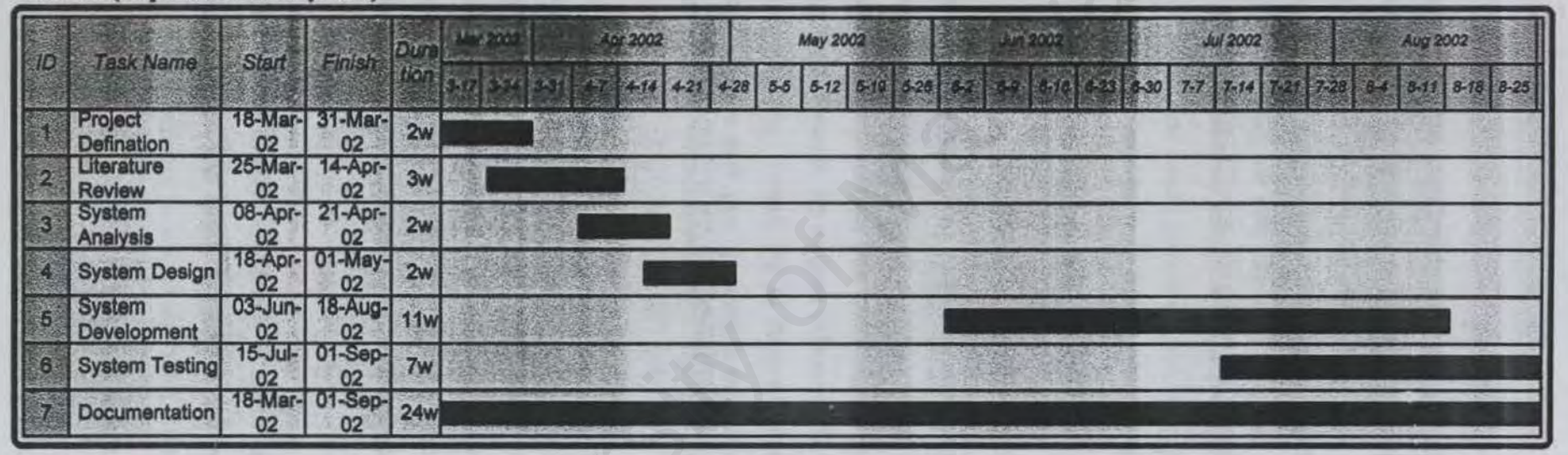
Should in any event the system fail, the availability of alternatives is described in the followings.

- Hard Copy Printout - the claimant may prints their application documents for record keeping purposes.
- System Backup - all data in the central computer network will be backed up daily. If the system fails, all data can be restored instantly.

1.8 Project Schedule

A few main activities, such as literature survey, preliminary investigation phrase, system analysis, system design, system development, system documentation and testing and maintenance are carried out for the e-Expense Claims System. A schedule for those activities is shown in a Gantt chart.

E-Office (Expense Claims system)



ID	Task Name	Start	Finish	Duration
1	Project Defination	18-Mar-02	31-Mar-02	2w
2	Literature Review	25-Mar-02	14-Apr-02	3w
3	System Analysis	08-Apr-02	21-Apr-02	2w
4	System Design	18-Apr-02	01-May-02	2w
5	System Development	03-Jun-02	18-Aug-02	11w
6	System Testing	15-Jul-02	01-Sep-02	7w
7	Documentation	18-Mar-02	01-Sep-02	24w

Figure 1-1 Gantt Chart for Project Schedule

Chapter 2: Literature Review

2.1 The Important Of Literature Review

Before proceeding into further topic, the review of literature works in various topics performed in the scope of the undertaken thesis project. It is essential to uncovering the knowledge in the range of this project before making any crucial decision in certain aspect.

Literature review is a careful inspection of a body of literature pointing toward the answers to the questions directly or indirectly imposed by the project title. The objective of literature review is to integrate the whole by planning steps and mechanism to approach the review in systematic way. Often, the result from literature review are thorough and reliable, and can be used in systems analysis, design, system implementation, testing, and maintenance phrase.

Literature review, a way of gathering related information, would focus on the latest developments in web information systems. It will give a better idea to the developer regarding the design and planning of the system. Researches had been done to discover and understand new concepts such as the advance of Internet tools, client-server computing, software development, and technologies. Comparison had also been made between existing online system to give a complete understanding and help to optimize the development of the upcoming e - Expense Claims System.

2.2 Exiting System Review

2.2.1 Manually System

Staffs are required to submit expense claims form together with the supporting documents for Manager/Head Of Department approval before submitting to Finance Dept for processing. When an approved expense claims document reached Finance Department, it will be handed to Clerk 1 to key into an Excel spreadsheet for recording and compilation purposes. At the same time, Clerk 2 will prepare the envelopes for individual claims with their name and amount of claims. Then, the Clerk 2 will hand over the envelopes to Clerk 3 to segregate the cash into envelope according to the amount written on it. Clerk 4's responsibility will be to get ready for

staff collection. Staff is required to sign on the claims form to acknowledge claims received.

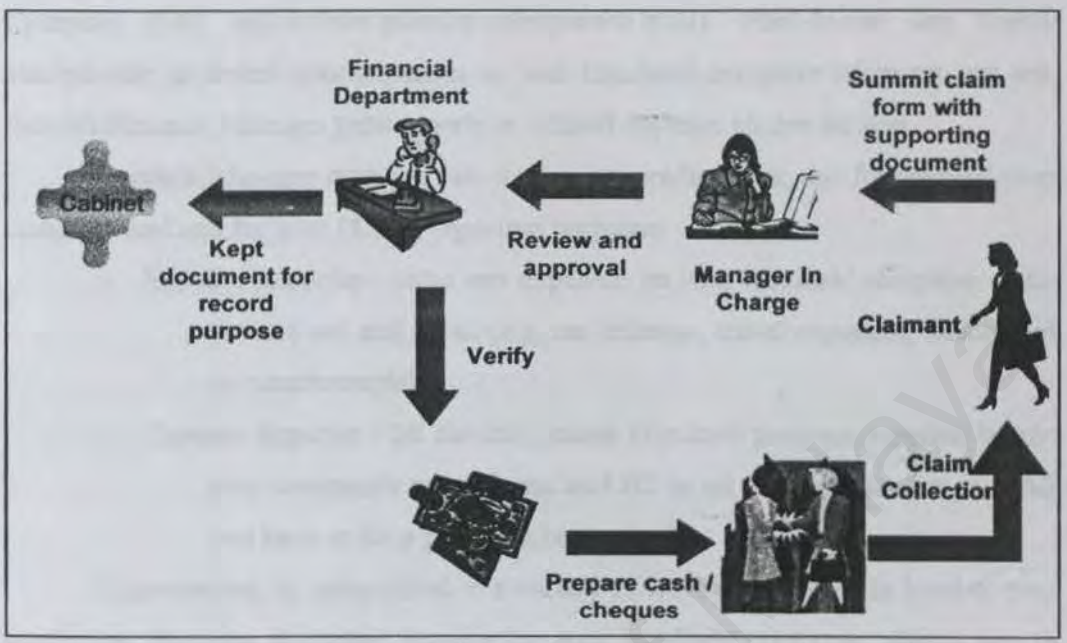


Figure 2-1 Process flow diagram for the manually system

Comparisons between the manually system and proposed systems:

Manually System	Proposed Systems
Centralized data entry - Labor intensive	Decentralized data entry
Piles of paperwork	Minimum paper-flow
No online access to information	Online access to information
Manual approval process	Electronic approval process
Hidden process flow and requisition status	Process flows and status are transparent to users.
No proper defined roles and responsibilities	"Unlimited" reporting function
-	Highly customizable system flow.

Table 2-1 Comparisons between the manually system and proposed systems

2.2.2 Expense Manager

The ideal tool for people who travel regularly and have to keep track of business expenses for reimbursement provided by Tomtom® Palmtop Software Company (Url: http://www.palmtop.nl/expenses.html). Easy-to-use and highly configurable to record your expenses on your handheld computer wherever you are, then let Expense Manager print reports or official expense claims for you.

Expense Manager contains two companion applications, one for your palmtop computer and one for your PC, for reporting purposes:

- Expense Recorder - enter any expenses on your handheld computer while you are out and about (e.g. car mileage, travel expenses, claims and reimbursements).
- Expense Reporter - let the companion Windows program supplied mimic your company's usual forms and fill in all the numbers for you! All you have to do is press the button.

Expenses can be categorized in a variety of ways and entered in local or own currencies. Expense Recorder, running on your handheld computer, allows you to create great reports and graphs as well. It also allows you to export expenses and reports to text files, spreadsheets or Quicken files.

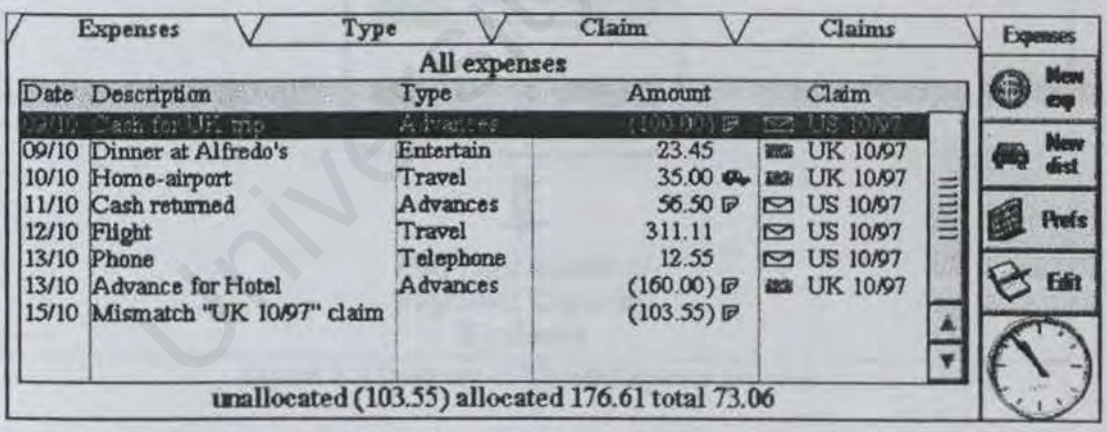


Figure 2-2 User Interface for Expanse Manager in palmtop

Advantages:

- Allows you to create great reports and graphs as well

Weakness:

- Support only for one user for recording claim or reimbursement.
- Non-ability to associate expenses to cost-centre and customers

2.2.3 UpsideExpense

UpsideExpense is a web-based expense claim entry and management system that provided by Upside Software Inc (Url: http://www.upsidesoft.com). UpsideExpense leverages the capabilities of Upside Software's business rules engine and approval workflow capabilities to help significantly reduce the time and effort associated with reviewing and approving expense claims.

In general, the UpsideExpense process is as follows:

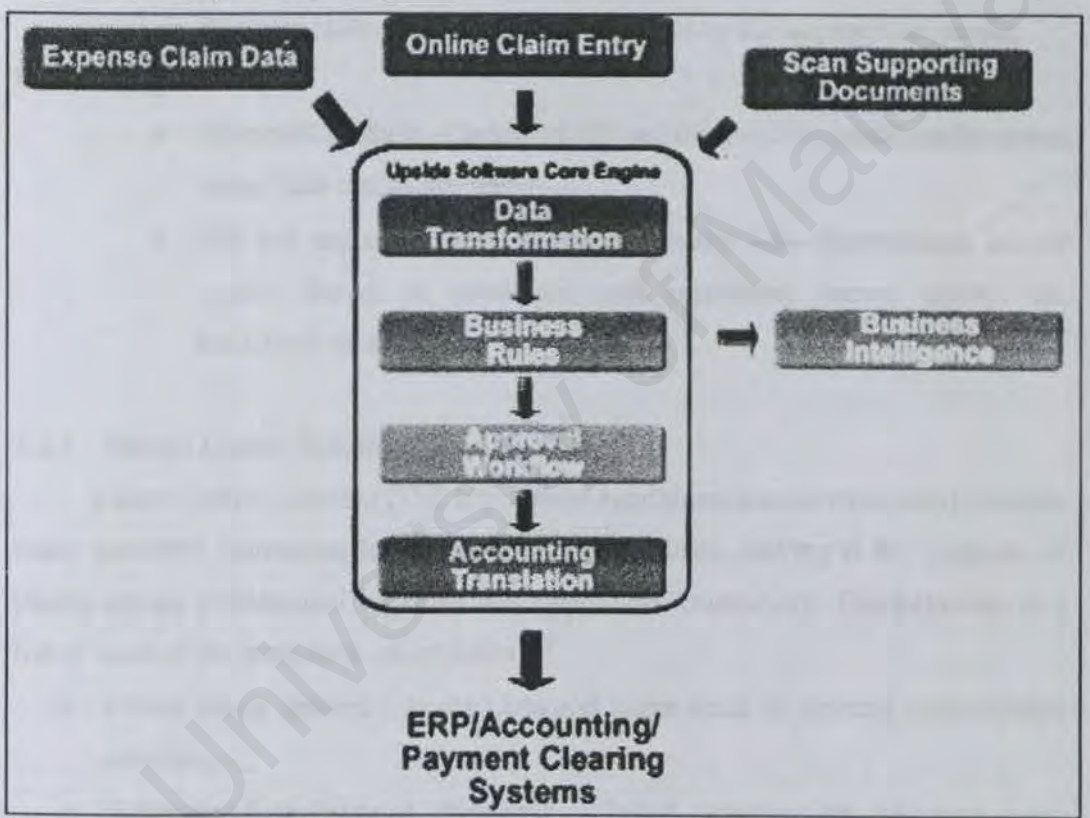


Figure 2-3 Diagram of UpsideExpense process

How it works:

- The expense claim is entered
- A process runs to determine which business rules are to be applied
- Business rules are then applied, flagging claims for review and approval by the appropriate people

- List of required approvals is passed to the workflow engine to manage the progression of the claim through the approval process
- If a claim does not require a manual approval because it has satisfied all the applicable business rules, or once the claim has received all required manual approvals, it is forwarded to the accounts payable system for payment processing.

Advantages:

- At anytime a claimant has the ability to make an inquiry through the web interface and review the disposition of their claim.
- Flagging claims for review and approval by the appropriate people.

Disadvantages:

- No e-mail module - Claimants did not received any email confirmation when their claims are ready.
- Did not enforcing well database security like discretionary access control based on privileges and mandatory access control for multilevel security.

2.2.4 **Means Claims Solution** (Version 1.0)

Means Claims Solution (Url: http://www.rsmininsuranceservices.com) contains many powerful estimating tools and adjusting features, making it the program of choice among professional adjusters and restoration contractors. The following is a list of some of the program's major features:

- **Claim Diary System** - To-do Lists and keeps track of pending claim-related activities.
- **Adjuster Appointment Manager** - helps organize an adjuster's busy schedule.
- **Management Report Generator** - instantly generates standard or ad-hoc reports from existing and warehoused claim files.
- **Import and Export Wizards** - creates file formats for the electronic uploading and downloading of claim information between Means Claims Solution and other computers, networks and mainframe systems.

The Claim Enclosures tree allows you instant access to any part of the active claim file. The name of the currently active file is displayed at the top of the enclosures tree. As you create estimates, reports, forms, diagrams and digital images, the tree will grow and expand to accommodate the claim file's enclosures.

To access any part of the existing claim file, you simply click on the correct listing and the Means Claims Solution will display that screen. To help you identify which activity is currently on display, the system will place a small pencil icon next to the selected listing, as seen below next to the "Claim Data" heading.

Figure 2-4 Graphical user interface for the Means Claims Solution

Advantages:

- Claim Diary System - To-do Lists and keeps track of pending claim-related activities.

Disadvantages:

- PC-based claims application system which did not offer online access to information database.

2.2.5 Halo eXpenZ

Halo eXpenZ provides an integrated end-to-end solution for expense claims supporting the creation, submission, approval, and repayment of expense claims. http://www.foundationindustries.com/galileo_expenz.html

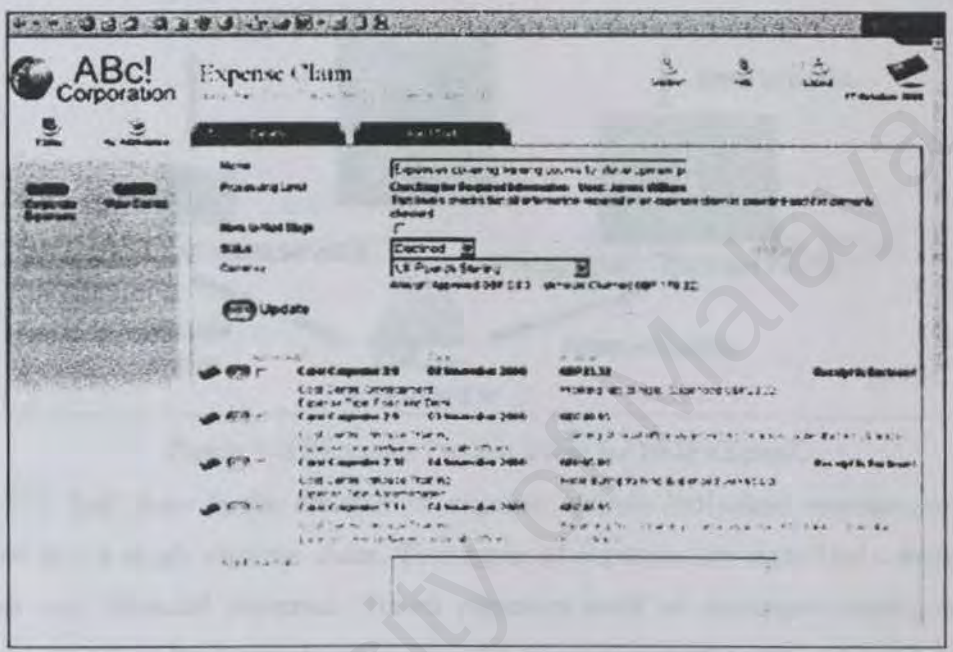


Figure 2-5 Graphical user interface for Halo eXpenZ

Halo eXpenZ delivers the following advantages:

- Efficient method of creating, submitting, and approving expense claims
- Expense Claims with automated currency conversions and calculations
- Special support for both purchase expenses and travel expenses, credit cards, floats, and per diems
- Customizable processing stages specific to teams or entire organizations that state the teams and/or individuals that will process an expense claim
- Ability to associate expenses to cost-centres and customers
- Automated travel reimbursement calculation based upon customizable rates

- Accountability for expense claims charged to cost-centres and customers
- Empowering management with information on demand

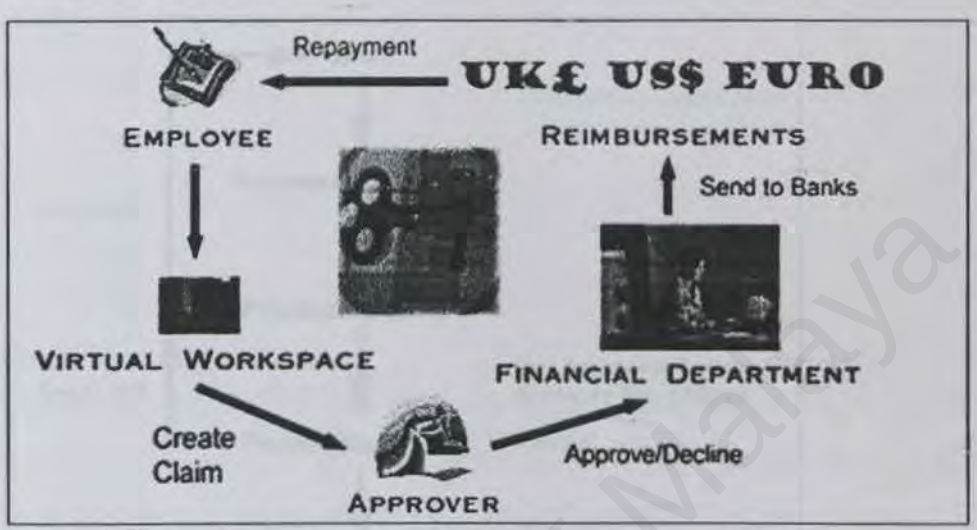


Figure 2-6 Expenses Process Flow for Halo eXpenZ

The first stage is the creation of expense claims. Individual expenses are packaged into a single expense claim. Two types of expenses are supported - travel expenses and financial expenses. Travel expenses refer to expenses relating to distance traveled whilst financial expenses refer to purchases of goods and services.

Once all the expenses have been added to an expense claim, Halo eXpenZ will calculate the value of travel expenses, perform any currency conversions, and calculate the total value of the expense claim. For organizations requiring original receipts, the expense claim can be printed and sent directly for filing whilst the electronic version is processed. In such cases, the printed version including the receipts is sent to the an individual within the processing hierarchy whom will manually verify all receipts are included before filing the expense claim. The expense claim is then submitted electronically. Halo eXpenZ will check each expense against the approval rules and set each expense's approval status appropriately.

Next, the expense claim will enter a processing hierarchy that states the stages to be performed for approving the information. A processing hierarchy can be

created with multiple stages, called Processing Levels, specifically for your organization or for particular teams. The expense claim is sent to the first processing level. Within each processing level, the expense claim can be amended and sent to the next processing level. If the expense claim is rejected, the expense claim is returned to the submitting user whom can then make changes before resubmitting.

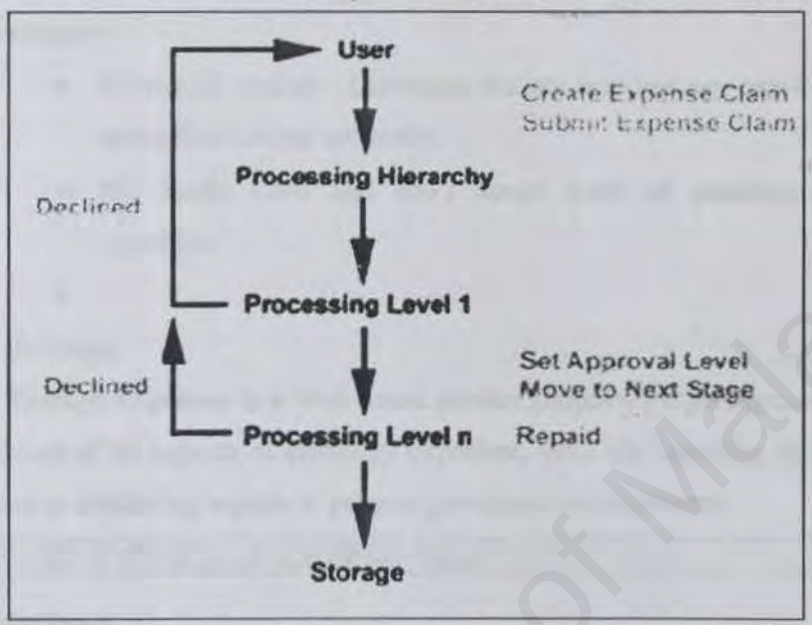


Figure 2-7 Diagram of Processing Level in Halo eXpenZ

If the expense claim is approved and passes through all processing levels, the expense claim can then be repaid, and finally stored.

The submitter is informed of any changes to their expense claim on their Outlook Today page. They are also able to view any expense claim at any stage of processing but not allowed to make changes.

Reports can be created on any expense claims that have been submitted. Within the reports, the statistics are subdivided by teams, cost-centres, and much more. Information is summarized for the amount claimed, amount reimbursed, and taxes paid.

Advantages:

- Halo eXpenZ is a business solution built upon 100% pure Java technology whish is Platform Independence. As a result, Halo eXpenZ

can be used on any operating system on any hardware platform provided a Java Virtual Machine is available.

- Halo eXpenZ will check each expense against the approval rules and set each expense's approval status appropriately.
- Ability to track for details of claim creator and approval.

Disadvantages:

- No e-mail module - Claimants did not received any email confirmation when their claims are ready.
- No To-do Lists and can't keeps track of pending claim-related activities.
-

2.2.6 Journyx

Journyx Expenses is a Web based service (http://www.journyx.com) designed to take care of all aspects of company expenses, from the inputting of data by each employee to producing reports to prepare governmental tax forms.

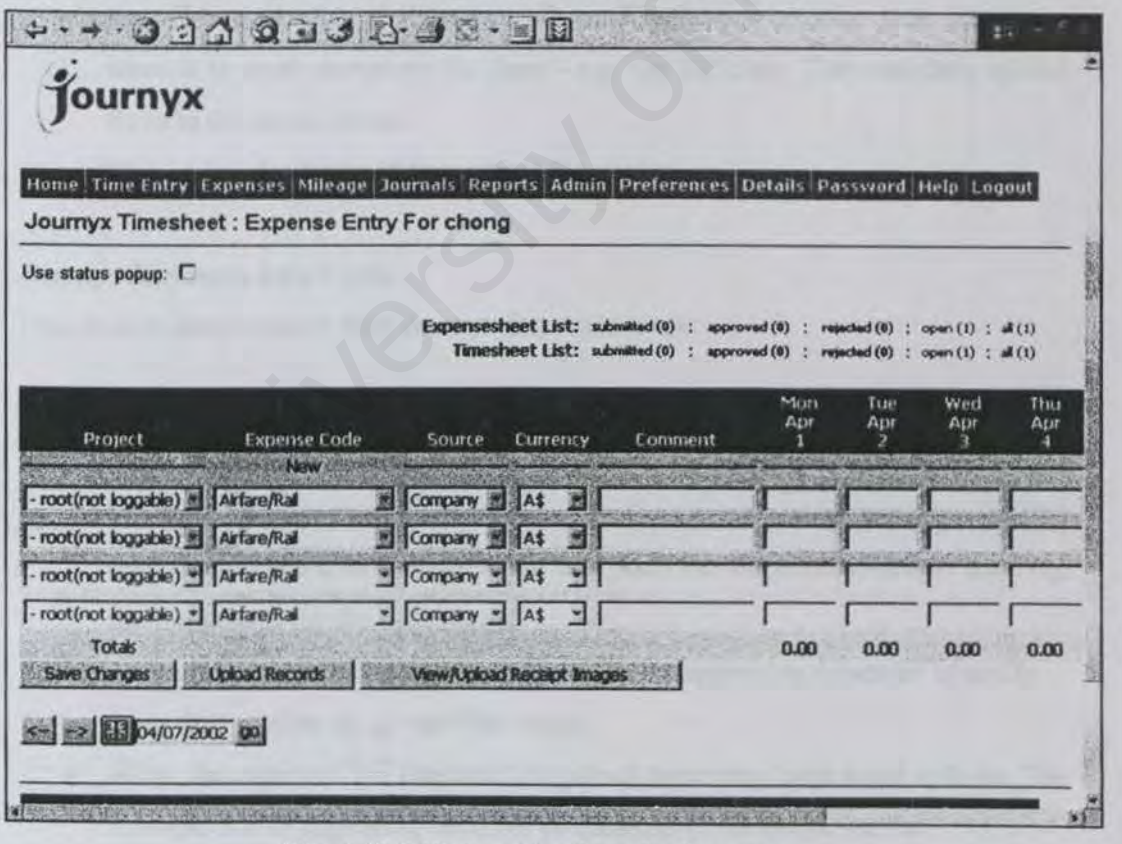


Figure 2-8 Claim entry from for Journyx

Features:

- Employees can enter all of the expenses on to the system
- Calculations are automatic, therefore employees claim the correct amount.
- Currency conversion allows expenses to be added from any currency
- Only the required fields that the employee needs to add each expense item are shown making it easier to use.
- VAT calculations are automatic
- Common expenses that employees have are stored as profiles so that they don't have to be manually entered each time.
- Expense categories are defined by your own company so they are entirely flexible.
- Mileage categories are set up so that each employee claims a correct amount for fuel etc.
- Advanced reporting facilities allows all data to be reviewed by management and accountants.
- An off-line version of Expenses allows Employees to enter their Expenses when it is most convenient for them - e.g. On the train. They can then upload them to the main service.
- Claims are standardized throughout the company

Journyx Expenses Life Cycle

This section aims to show how Journyx Expenses work:

1. Employees enter any Expenses they incur into the system. This can be done as soon as the expense is incurred or whenever it is convenient for the employee.
2. When an employee has no more expenses for a given period (usually a month) they are submitted to the system. At this point the employee can start entering their expenses for the next period.
3. An e-mail is sent to the person responsible for approving expenses to notify them that another claim has been made.
4. When the expenses are checked, the person approving them has 3 options: The expense can be approved, declined or returned to the employee for amendment.

5. If the expense is returned to the employee for amendment, an e-mail will be sent to him or her explaining that action needs to be taken.
6. When all expenses have been dealt with the cycle starts again.

Advantages:

- Handle all of your company expenses with one package.
- Save money by avoiding user error.
- Advanced reporting facilities to see who's spending what and where.
- Standardize your claims by setting up rules.

2.3 Analysis on Current Expense Claim System

	Expense Manager	Upside Expense	Means Claims Solution	Halo eXpenZ	Journyx
System Design	Palmtop-based	Web-based	Pc-based	Web-based	Wed-based
User Support	Mono-User	Multi-User	Mono-User	Multi-User	Multi-User
User Login	No	Yes	No	Yes	Yes
Graphical User Interface	Moderate	--	Moderate	Well	Lack
Supporting Document (Receipts)	No	Yes	No	Yes	Yes
E-mail Confirmation	No	No	Yes	No	Yes
Database Security	Low	Moderate	Low	Moderate	Moderate
Report Generator	Yes	Yes	Yes	Yes	Yes
Tracking Claimant and Approval Details	No	No	No	Yes	No

Table 2-1 Analysis on Current Expense Claim System

2.4 Definition of Intranet and Internet

2.4.1 Intranet

Intranet is a term used to refer to the implementation of Internet technologies within a corporation rather than for external connection to the global Internet [Ref. 1]. An Intranet is a network of networks that is contained within an enterprise or organization. It may consist of many interlined local area networks and also use leased lines in wide area network. Typically, an Intranet includes connections through one or more gateway computers to the outside Internet. Intranet serves the purpose of sharing company information and computing resources among employees. An Intranet can also be used to facilitate working in-groups and teleconferences. The Intranet has many benefits the enterprise can be obtained. These include [Ref. 2]:

- Increased, less-expensive, environmentally friendly internal communication
- Low acquisition and deployment costs
- Low maintenance costs
- Increased information accessibility
- Timely, current information availability
- Easy information publication, distribution, and training

A LAN, utilizes Intranet, is a network of interconnected workstations sharing the resources of single processor or server within a relatively small geographic area. To overcome the narrow area covered, Fiber Distributed Data Interface (FDDI) is used to extend a local area network over a much wider area. Usually, the server has applications and data storage that are shared in common by multiple workstation users. A local area network may server a few users or in the case of FDDI, may server several thousand.

The main LAN technologies and topologies included are Ethernet, Token Ring, ARCNET, and FDDI (Fiber Distributed Data Interface). Typically, a LAN server can keep a suite of application programs. Users who need an application frequently can always download it once and then run it from their local hard disk. User can order printing and other services as needed through applications run on the LAA server. A LAN server may also be used as a Web server if safeguards are taken to secure internal applications and data from outside access.

A WAN (Wide Area Network) covers a large geographical area, is a dispersed telecommunications network and term distinguishes a broader telecommunication structure from a local area network (LAN). A WAN may be privately owned or rented, but the term usually connotes the inclusion of public (shared user) networks.

An Intranet uses TCP/IP, HTTP and other Internet protocols and in general looks like a private version of the Internet. With tunneling, companies can send private messages through the public network, using the public network with special encryption/decryption and other security safeguards to connect one part of their Intranet to another.

Typically, larger enterprises allow users within their Intranet to access the public Internet through firewall servers that have the ability to screen messages in both directions so that company security in maintained and protected. When part of an Intranet is made accessible to customers, partners, suppliers, or others outside the company, that part is called an Extranet.

A firewall is a set of related programs, located at a network gateway server that protects the resources of a private network from users from other networks. (The term also implies the security policy that is used within the programs) Usually, an enterprise will install a firewall to prevent outsiders from accessing its own private data/information resources in its Intranet and for controlling what outside resources its own user have access to. This will prevent authorized access to places with is insecure or dangerous.

Basically, a firewall working closely with a router program, which filters all network packets to determine whether to forward them toward their destination. A firewall also includes or works with a proxy server that makes network requests on behalf of workstation users. A firewall is often installed in a specially designed computer separated from the rest of the network so that no incoming request can get directly at private network resources.

There is a number of firewall screening methods. A simple one is to screen request to make sure they come from acceptable (previously identified) domain names and IP addresses. For mobile users, firewalls allow remote access in to the private network by the use of secure logon procedures and authentication certificate.

2.4.2 Internet

The Internet is a large system of interconnected computer networks that span the globe. Using the Internet, people can communicate with others throughout the world. Users at any one computer can, if they have permission, to get information from any computer (and sometimes talk directly to users at other computers). It was conceive by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was firs7t known as the ARPANET. At first, the ARPANET is aim to create a network that would allow users of a research computer at one university to be able to "talk" to research computers at other universities.

Nowadays, the Internet is a public, cooperative, and self-sustaining facility accessible to hundreds of millions people around the world. Many of these businesses use the internet to market and sell their product and service the part of the internet known as the world wide web, is a subset of the computers on the internet that are connected to each other in a specific way that makes those computers and their contents easily accessible to each other. The set of protocols that underlie the basic operation of the Internet are Transmission Control Protocol and Internet Protocol (known as TCPIP). Intranet and Extranet also make use of TCP/IP protocol.

The functions and tasks of today's Internet are multipurpose. Below is a list of Internet function:

- The data transfer procedure uses a standard communication protocol (TCP/IP), therefore it does not matter which sort or size of the computer and which operating system is used.
- The Internet supports real time communication, in which users talk to one another online ("chatting") by typing or by audio- links. Another possibility of the real time communication is that users can play real time virtual reality games.

- The Internet provides a simple and standards way for users to log on into computers and transfer information around the world (i.e. FTP), which gives advantage. For example, user who working at home can connect to their office to download important files or information.
- Users around the world can exchange electronic mail (e-mail) with each other, which is nearly free of charge in which the delivery of the mail takes only few seconds or minutes to send to the receiver. But there is not only one-to-one communication in the Internet, it is also possible for groups of many individuals to communicate with each other, like to discuss with many other users.
- Available navigation tools, like Netscape or Mosaic, make it easy for users to "surf" through the Internet, searching and looking for information provided by universities, businesses, libraries, foundations, museums, other users and many more.
- All users around the world are able to get connected to the network
- The Internet helps to find and playback movies, sounds and other multimedia documents.
- Users around the world can publish visual or audio documents, which represent versatile topics.

2.5 Database Server

2.5.1 Introduction

A database is an integrated collection of data that is organized so that its contents can be easily accessed, managed and updates. A database management system (DBMS) involves the data itself and the software that controls the storage and retrieval of data. Database management systems provide mechanisms for storing and organizing data in a manner that facilitates satisfying sophisticated queries and manipulations of the data.

The most prevalent type of database is the relational database, a logical representation of the data that allows the relationships between the data to be considered without concerning oneself with the physical implementation of the data structures. An object-oriented database is one that is congruent with the data defined

in object classes and subclasses. A distributed database is one that can be dispersed or replicated among different points in a network.

Client-Server database computing can be defined as the logical partitioning of the user interface, database management, and business logic between the client computer and the server computer. The network links each of these processes.

2.5.2 Relational Database Management System (RDBMS)

RDBMS has become the standard for Client-Server database computing. It is based on the relational model that originated in papers published by DR.E.F.Codd in 1969 (Ref. 3). In an RDBMS, data is organized in a row/column manner and is stored in a table.

The number of RDBMS vendors has increased over the years as Client-Server has grown in popularity. Although each vendor's database products stems from the relational model, vendors take different approaches to implementing it. These differences combined with price, performance, operating systems supported and host of other items make choosing the right RDBMS become more difficult. Below is a brief summary of popular RDBMS vendors.

2.5.3 Microsoft SQL Server

Microsoft SOL Server is a scalable, high performance database management system designed specifically for distributed client-server computing. Microsoft SQL Server provides tight integration with windows and windows-based applications helping reduce the cost and complexity of deploying sophisticated applications. SQL Server is an ideal database engine for powering web sites. Through tight integration with Internet Information Server, SQL Server can be queried and updated via popular web browsers. SQL Server's native ODBC lets it inter-operate smoothly with the Internet Database Connector interface included with Internet Information Server. Ease of use is accomplished through SQL Server's graphical management tools.

Microsoft SQL Server allows two billion tables within each of 32,767 databases to be defined. The number of rows in a table is effectively unlimited for

SQL Server. It allows user to define up to 250 columns for each table. SQL Server allows user to combine columns from as many as 16 tables in a single query.

Structure Query Language (SQL), the query language which has been developed by IBM in the 1970s, became the standardize database query language for relational databases. The dialect of SQL that you use with SQL Server is Transact-SQL, which Microsoft implements as a core component of SQL Server. Support for multiple platforms is accomplished through Microsoft NT operating system, which runs on the Intel, RISC and other chip sets. However, the SQL Server database must be installed on the Windows NT platform.

2.5.4 IBM DB2

IBM's DB2 combines compelling database technology and market-leading scalability and performance with great standards and platform support and does so without being difficult to use (Ref. 4). DB2 which includes a new key technology - a SQL-based stored procedure language - that made it simple for us to write stored procedures to improve performance and add business logic code to the database.

DB2 also provides substantially improved data management and analysis features through new, built-in data warehousing, OLAP and XML (Extensible Markup Language) components that used to be separately purchased or downloaded items. In addition, a new in-memory text search engine will greatly speed text column searches, a task commonly performed in Web site searches.

2.5.5 Analysis and Synthesis

Most of the DBMS in the market offer great performance and high standard. They can handle many concurrent users and is design to handle large amount of data. Therefore, it is up to the developer to make the option to pick the best products that meet their needs. ODS stands for on-disk structure, the database architecture that is used in Lotus Notes and Domino. Domino Release 5.0 incorporates performance and scalability technology from IBM's high-performance database system, DB2. ODS is turned on by default. This means that any new databases created or compacted using Release 5.0 are created in the new ODS format. It is possible for older Notes clients to

access a database in the new format on Domino Release 5.0 servers. The only restriction is that a database in the new format cannot be physically copied onto a client or server running previous releases of Lotus Notes and Domino. Note that upgraded databases are still accessible to pre-release 5 clients, and can replicate with pre-release 5 servers.

2.6 Technology for Database Connection

2.6.1 Open Database Connectivity (ODBC)

In the beginning, Structured Query Language (SQL) was embedded within the application codes using traditional SQL data access methods. Later, the code was executed through RDBMS-specific pre-compiler where necessary database-specific code was inserted into the application. This has lead to a situation where connections with specific and different database require recompilation for every execution of the program. Therefore Open Database Connectivity was derived as a form of solution towards these problems.

ODBC is an open standard API, fully aligned with XOPWN & ISO standard organization that allow application to access different SQL data sources at run time without recompiling the application for each targeted database. ODBC is based on a concept of database drivers that perform conversion between ODBC, API and the version of SQL employed by relational database. During runtime, the ODBC driver manages the loads and communication with the drivers. The drivers communicate through standard interface called Service Provider Interface (SPI). ODBC is a network independent technology because it employs replaceable network library.

2.6.2 Data Access Object (DAO)

Data Access Object is a technology released in 1992 as part of Microsoft Access desktop database. It focuses on efficient management of desktop data and decision support level access to remote RDBMS data (Ref. 5). It is based on Microsoft Jet database engine. The Jet engine includes a full functional query processor data store. It is also equipped with local cursor engine that provides robust functionality for use with data sources. It includes distributed database query and update, local data management & access to a variety of data including all popular

Index Sequential Access Methods (ISAMs) and to all ODMC-based data. DAO's access to remoter data involved the use of Jet engine's entire set of extended functionality.

2.6.3 Remote Data Object (RDO)

Due to optimal speed and control, developer hopes to ignore the jet when creating transaction between centric application to a RDBMS. Therefore, Remote Data Object (RDO) was created. RDO is an object interface that directly calls ODBC for optimal speed, control and ease of programming. RDO provides access to server side cursor engine as to minimize network traffic.

2.6.4 Active Data Object (ADO)

It is a new technology for data access based on existing technology and it is even flexible. It is designed to provide a consistent way of accessing data regardless of how the data is structured. Its main concept is to fit into an environment whose base set of object interfaces is standardized and easily extensible as new application requirements arises. Therefore, it allows multiple implementation of ADO, each with specific usage such as desktop, client-server and distributed transactions.

The ADO is an evolution of both DAO and RDO into a single and simplified and extensible interface, which will later supersede all DB-Library, DAO & RDO functionality. Unlike RDO and DAO, which are designed only for accessing relational databases, ADO is more general and can be used to access all sorts of different types of data, including web pages, spreadsheets, and other types of documents. ADO version 1.0 release focuses primarily on Internet deployment as it has ability to maintain state in a connectionless environment. It includes implementation with full data manipulation capability and a downloadable, lightweight implementation available to Internet clients at runtime.

2.6.5 Java Database Connectivity (JDBC)

Java Database Connectivity (JDBC) is the industry standard for database independent connectivity between Java and a wide range of databases. JDBC provides a call-level API for SQL-based database access. JDBC allows Java developers to

explicit "Write Once, Run Anywhere" capabilities for applications that require access to enterprise data. JBDC makes it possible to do three things: It establisher a connection with a database, sends SQL statements and processes the results. With JDBC, business can continue to use their installed databases and access information easily even if it is stored on different database management systems. The combination of Java and JDBC makes application development easy and economical. JDBC is simple to learn, easy to deploy and inexpensive to maintain.

2.7 Server Architecture

2.7.1 Lotus Domino R5 Enterprise Server

Lotus defines an organization as a collection of Lotus Domino servers that are linked together to provide all the information, messaging, and connectivity needed by a workgroup. The organization is the largest administrative unit and encompasses all the Lotus Domino servers that provide the messaging infrastructure for your company. An organization is also the top level of the hierarchy and is required for all server and user ID files. An organization name generally corresponds to the company name.

Lotus Domino Enterprise Server provides value-added clustering services. Cluster Domino servers, for scalability and fault tolerance no single server can match. Workloads are dynamically balanced across the cluster, for optimal service even at times of peak usage.

Key Features and Benefits:

- **Failover for mail and applications** -Ensure continuous access to your Domino messaging system and applications. If a system fails, users can keep working with minimal disruption, from the point of their last replicated transaction.
- **Dynamic load balancing** -Automatically maximize performance and scalability, even at times of peak usage.
- **Server consolidation** -Consolidate servers enterprise-wide, while distributing ownership of server resources through unlimited

partitioning. Cluster any combination of Domino platforms, across any LAN or high-speed WAN. Use a built-in analysis tool to consolidate systems easily.

- **Billing services** -Track, report and analyze system usage for billing, chargeback and capacity planning purposes.

2.7.2 Microsoft Exchange 2000 Server

Microsoft Exchange 2000 Server unites users with knowledge anytime, anywhere. Exchange 2000 is designed to meet the messaging and collaboration needs of small organizations, large distributed enterprises, and everything in between. Exchange 2000 is seamlessly integrated with the Microsoft Windows® 2000 operating system and incorporates two years of customer feedback into its design.

Exchange 2000 offers superior support for Internet standards such as friendly URLs, WebDAV, and Extensible Markup Language (XML), resulting in increased flexibility and reduced developer training time. Exchange 2000 also uses Internet standards in its tools for developing corporate portals.

Web developers can take advantage of Exchange 2000 using standard Web development tools such as the Microsoft Visual Studio development system. Web developers working on Exchange 2000 can also take advantage of powerful workflow tools, easily accessible data, and Web standards such as XML, without using any additional tools.

Compare Lotus Domino and Microsoft Exchange

Lotus Domino Release 5.0	Microsoft Exchange Server Release 5.5
Organization is a collection of Domino servers. Lotus Domino provides the capability of multi-company/ multi-directory integration and messaging.	Organization is a collection of Exchange sites.
Domain is a collection of Domino servers sharing a common directory.	Site is a collection of Exchange servers, sharing a common directory.
Domino Named Network (DNN) is a	No equivalent function in Exchange.

group of one of more Lotus Domino servers sharing the same network connections and the same protocol.	
Domino uses up to 4 organizational units (OUs) to further distinguish a name.	Site is a group of one or more Microsoft Exchange Servers sharing the same directory information. Exchange uses only the first level organizational unit (also called site) to distinguish a name, which is effectively a flat naming scheme.
A hub server acts as the central point for replication of databases and mail routing between spoke servers.	A bridgehead server acts as the end-point of a messaging connection between two sites.
A spoke server depends on the hub server for replication and mail routing.	A site server belongs to a group of servers forming a site. A site server can also be a bridgehead server.
The Domino directory is the structure used to manage your Domino domain. It controls connections between servers, mail routing, and contains those names registered to Domino servers.	The Exchange directory (or Global Address List) stores all the information available about the Exchange organization. It defines folders, connections between sites, and the names registered on Exchange servers.
Domino's data respository is called a Notes database and has the file extension .NSF. There is a separate database file for each user's mail	The mail data repository provided by Exchange is called the Information Store. This is a single file holding all users' mail data. The public folder data repository provided by Exchange is called the Public Information Store. This is a single file holding all public folder data.

Table 2-2 Compare Lotus Domino and Microsoft Exchange

2.7.3 Apache

Apache 1.1.3, the most widely implemented Web server on the Internet, offers a powerful and customizable approach for any Unix-based server. But Apache's

greatest strength is also its biggest shortcoming. Experienced Unix users will enjoy the control they have over the Web server. Developer can download Apache and get all the Apache core and module source code, which can be modified to suit the developer needs.

Apache runs on most Unix-based machines. Apache can be managed either from a server console or a web browser. A server console is one that is in the same room as the server and that is directly attached to it. Wizards are available to create new sites and directories, and the server provides for multiple logs that can be automatically cycled or archived. (Cycling a log means replacing the oldest log with the newest, thus recycling the space they occupy. Archiving a log means saving it, perhaps on a large backup storage device.)

Apache's application development tools support CGI and several proprietary APIs. Once the API blocks are built, programmers can invoke the code blocks to perform their duties by using the common API interface. Apache supports Server Side Includes (SSI), a type of HTML comment that directs the web server to dynamically generate data for the web page when it is requested. Apache also supports Active Server Pages (ASP) and Java servlets. Similar to CGI, ASP generate dynamic content using either Jscript code or the Visual Basic programming language.

Both password authentication and digital certificate are found in Apache server. Access can be restricted by domain name, by IP address, or by user and group. Apache can prohibit access by directory or file, and support Secure Sockets Layer (SSL). The public-domain version of Apache provides nothing beyond this basic level of security

2.7.4 Microsoft Internet Information Server (IIS)

Microsoft Internet Information Server (IIS) is the core Windows NT services that provides Internet services. It is also the underpinning that provides information-publishing capabilities in the Internet. IIS comes bundled (free) with Microsoft' s Windows NT operating system. IIS serves equally well as an intranet web server or a public web server program. IIS uses Windows NT' s User Manager to maintain users

and groups, saving the trouble of maintaining multiple sets of network and Web site users.

Microsoft Internet Information Server runs only on the Windows NT operating system. IIS includes an integrated search engine that allows users to create custom search forms with a variety of tools, including ASP. ActiveX Data Objects, and SQL database queries. The IIS web server software also includes Microsoft Front Page HTML development tool. IIS supports FTP, allowing users to download files and data from the IIS server site with the FTP protocol.

Building on Windows NT' s security prowess, IIS provides additional levels of security. Thus, NT basic access control mechanisms (username/password) and Secure Sockets Layer (SSL) software encryption are also provided in IIS. IIS includes a built-in certificate server that allows organizations to issue and manage digital certificates verifying identities. Access control can limit use by groups or by individuals and can be applied to directories and files. Parts of documents can be hidden from users who do not have clearance to access them.

2.7.5 Netscape Enterprise Server

Building on Netscape FastTrack Server's strong foundation, Netscape Communications Corp. scores with Netscape Enterprise Server (NES). Enterprise adds site and content management tools and incorporates a robust Web development platform [Ref7]. NES provides a powerful development environment that supports development of web-based applications that can be run on the Internet, an intranet, or an extranet.

Netscape Enterprise Server comes with document conversion and indexing utility programs, and these programs bundle a Verity search engine. The Verity search engine is versatile because it can index documents in various formats, including Adobe PDF, Microsoft Word, and Microsoft PowerPoint. NES also provides a utility program to convert common document file formats to HTML. Besides, NES also supports dynamic application development, including CGI and Netscape's own

version of application program interface: Netscape Server API (NSAPI). NES supports the Java Servlet API for server side applications.

Netscape Enterprise Server's security is well through out, with support for password /challenge user authentication and digital certificate authentication. Netscape Directory Server (NDS), bundled into NES, provides basic security through user-name/password-based authentication mechanisms for discretionary access control. Netscape also works with SSL performance enhancement devices, which increase the efficiency of the server while it is performing SSL functions.

2.8 The Client/Server Architecture

A client/server computing defined as the logical extension of modular programming where modular programming has as its fundamental assumption that separation of a large piece of software into its constituent parts creates the possibility for easier development and better maintenance. Client/server computing takes this a step further by recognizing that modules need not all be executed within the same memory space [Ref.7].

Client/server architecture may be used in LANs, WANs, and on the web. The main characteristic that these three somewhat diverse uses share is a division of the workload between the client and the server. In each case, the client computers typically request services, including printing, information retrieval, and database access. The partner in these activities is the server, which is responsible for processing the clients' requests. Nearly always, the client does very little work.

While the client' s workload is light, the server' s workload is not. Besides receiving and interpreting requests from the client, the server must locate information, reprocess it, and request initialization of resources supplied by other applications running on dedicated computers under the server' s control. That workload-sharing arrangement is why servers generally must be beefy, expensive computers with lots of disk capacity, fault-tolerant processors, and ample memory.

In contrast to the server, clients require no more capability than is found on any ordinary personal computer. The term thin client is a popular description of a client's relative low workload, compared with that of a server. This will eventually result in putting the processing to the server and the data management as well as data storage.

2.8.1 Two-Tier Client/Server

A two-tier model involved only a client and server. All communication takes place between the client on the Internet and the target server at the other end. Of course, other computers are involved in the process of transporting packets of information across the Internet [Ref.7]. The conversation that occurs between a Web browser and a Web server is similar to any conversation between clients and servers generally.

This two-tier architecture is appropriate for simple, routine, relatively homogeneous applications that are not expected to grow. Two-tier applications are simpler, faster, and less expensive to build than their three-tier counterparts. Their need for middleware is minimal, if present at all.

A two-tier architecture is one in which only a client (tier 1) and a server (tier 2) are involved in the requests the responses that flow between them over the Internet. . It is typically used in small environments which less than 50 users. To properly scale to hundreds or thousands of users, it is usually necessary to move to a three-tier architecture.

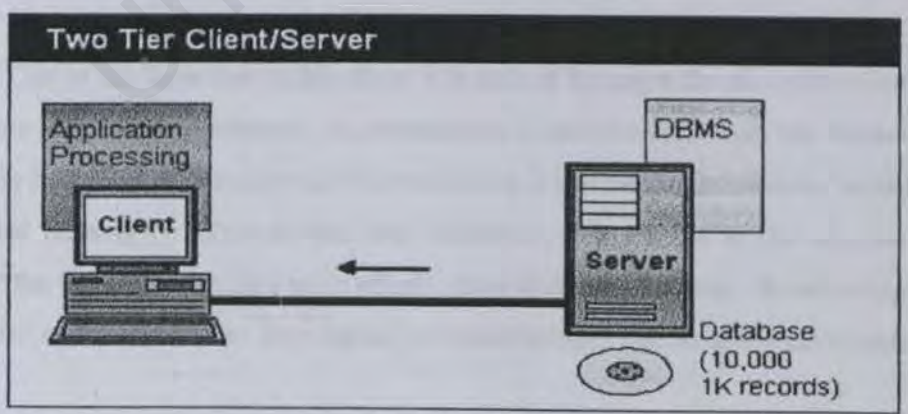


Figure 2-9 Two-Tier Client Server Architecture

2.8.2 Three-Tier Client/Server

A three-tier architecture builds on the traditional two-tier approach. The first tier as the client, the second tier is the Web server, and the third tier consists of applications and their associated databases that supply non-HTML information to the Web server on request. From a software perspective, the three-tier are client processes (tier 1), Web services (tier 2), and data services (tier 3) [Ref.7].

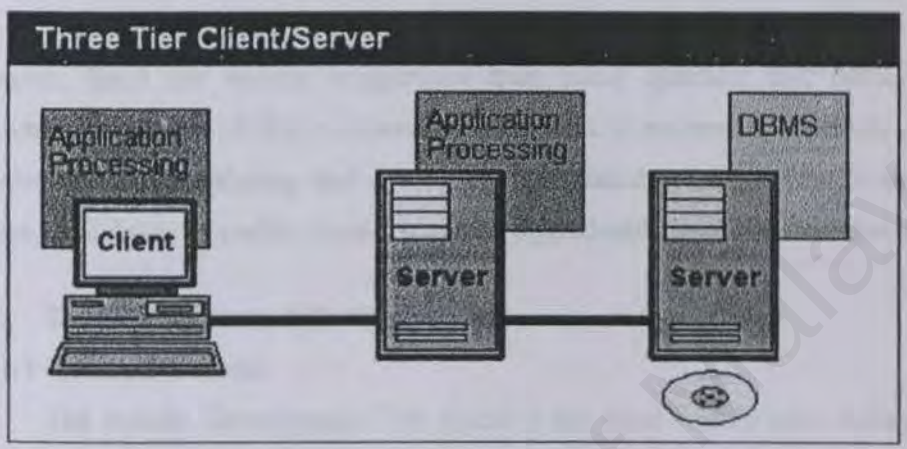


Figure 2-10 Three-Tier Client/Server Architecture

Interactions between client and server operate the same way as they do in a two-tier architecture. The third tier provides comprehensive data services, including database operations supported by database software, enterprise resource planning software services, and other services. A typical example of services supported by a database is a catalog with search, updated, and display functions. A client program can request the services of a backend processor connected to a server through a mechanism called the common gateway interface (CGI).

One of the three-tier architecture' s is each of its major functionality is isolated from one another. Furthermore, its presentation is independent from the behavior of business logic and processing rules where in turn is isolated from the data. Each piece may also running on different platform. However, when come to the analysis and design, the three-tier requires more efforts, costs and time. Anyway, the advantages of three-tier architecture have outweighed its disadvantages due to above circumstances

A CGI, which is a protocol, is a common way for web servers to interact dynamically with clients (users). CGI is a standard way of interfacing backend applications with web servers. The backend servers provide programs that dynamically transform data into HTML so that web browsers can display the results.

2.9 Software Development Models

There are no hard and fast rules for analyzing and designing this system. However, there are various suggestions from many quarters that proved to be noteworthy. In line with this explosive development, a systematic approach needs to be adopted when analyzing and developing web-based systems. This is needed to ensure availability of usable, stable, scalable, upgradeable, and maintainable systems.

2.9.1 Types of Software Life Cycle Model

2.9.1.1 Waterfall model

The System Development Life Cycle is the most widely used software life-cycle model is often referred as the Waterfall model, generally considered the conventional or "classical" software life cycle. [Ref. 8] B. Boehm developed this plan to enable a software project to be planned and conducted according to engineering standards. It was conceived as an ideal strategy for project management.

Waterfall model is a model, where the stages are depicted as cascading form one to another. As the Figure 2-11 implies, one development stage should be completed before the next begins. Thus, when all the requirements are elicited from the customer, analyzed and documented in a requirements specifications, then the development team can go on to system design activities.

Many problems with the waterfall model have discussed. The biggest problem with the waterfall model is that it does not reflect the way code is really developed [Ref. 9]. The first reservation and the greatest disadvantage of the waterfall model, is the product of the development process, 'the target system is not available for testing or trial by its intended users until the end of the project. Several studies have shown that errors in the requirement specifications are usually the last to be detected, often not until system or acceptance testing and are the most costly to correct. The second

reservation is that there is an implicit assumption in the model that all will go well throughout the project: the model suggests a unidirectional flow of activities through the project. Thus, a major design or performance problem may do undetected until the system is almost operational, at which time is usually too late to take effective action. There is another problem that the model starts at the project rather than at the strategy from which the project should have arisen.

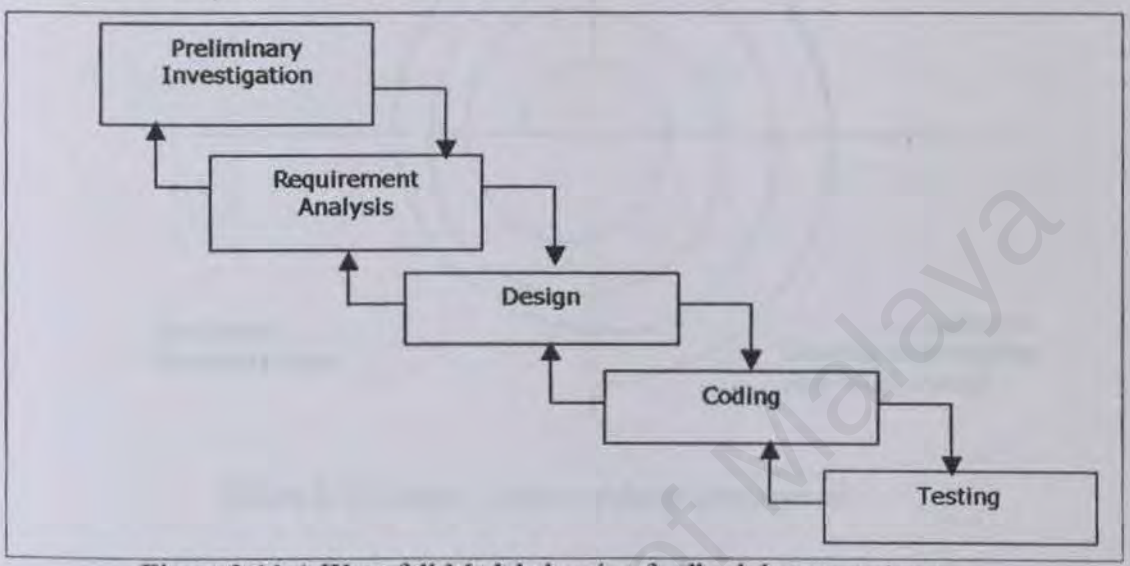


Figure 2-11 A Waterfall Model showing feedback between stages

2.9.1.2 Spiral Model

In 1988, Boehm viewed the software development process in the light of the risks involved, suggesting that a spiral model could combine development activities with risk management to minimize and control risk [Ref. 9]. This model is concerned with risk and is a risk- based model rather than being product- based.

The spiral model shown in Figure 2-12 with the project commencing at a point on the x axis to the left of the origin and proceeding clockwise around the origin. Progress is shown as an outward spiral, with every cycle going through the same sequence of activities and the result for each cycle is reviewed after the process has rotated through 360 degrees. Each quadrant in the figure depicts one or more activities. The first quadrant identifies the definition stage of the cycle while the second quadrant identifies the process of analysing the path ahead. The third quadrant depicts the carrying out of development and the fourth quadrant indicates the planning

of what is to be done in the next cycle of the process. Thus, the spiral model proceeds insteps, which pause and review at the end of each step.

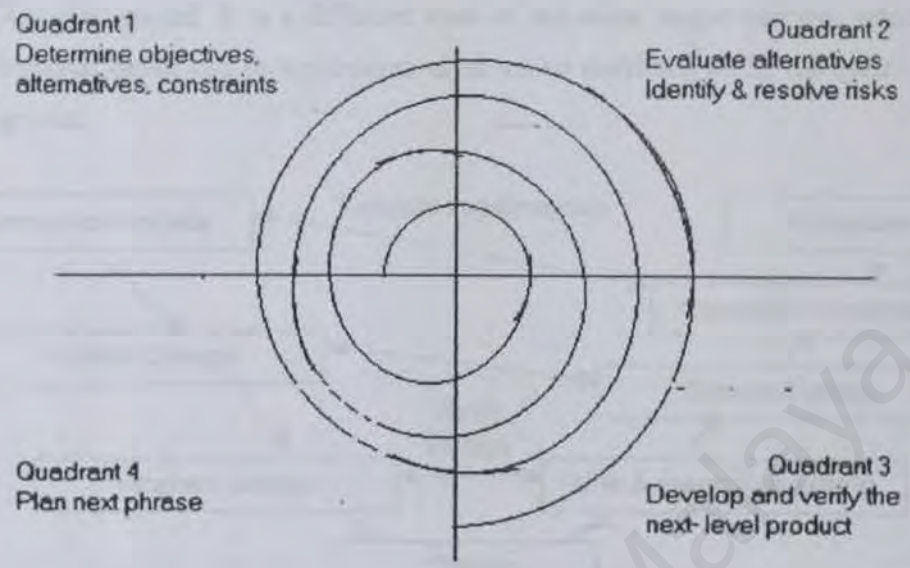


Figure 2-12 Boehm's Spiral model of development

2.9.1.3 V Model

The V model is variation of the waterfall model that demonstrates how the testing activities are related to analysis and design. [Ref. 9] As shown in the Figure 2-13, coding, programming of the smallest individual units of software, forms the point of the V, with analysis and design on the left, testing and maintenance on the right. The model suggests that unit and integration testing also use to verify the program design. That is the coders and test members should ensure that all aspects of the program design have been implemented correctly in the code. This is similar to system testing should verify the system design, making sure that all system design aspects are correctly implemented. Acceptance testing, which is conducted by the customer validates the requirements by associating a testing step with each element of the specification.

Consequently, each step on the right- hand side of the V is equivalent to the left- hand side, so that the system description on the left forms the basis of testing its equivalent level of system integration on the right. The V model makes more explicit

some of the iteration and rework that are hidden in the waterfall depiction. Whereas, the focus of the waterfall model is often documents and artifacts, the focus of the V model is activity and correctness [Ref. 9]. The V model is not different in principle from the waterfall model. It is a different view of the same staged process, which reveals additional detail and its application need not be restricted to the life cycle of an entire project.

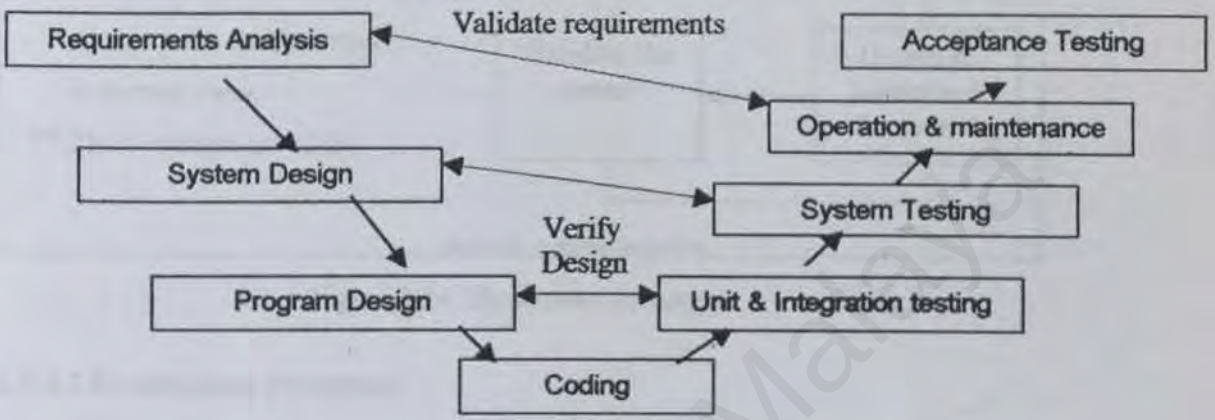


Figure 2-13 V model

2.9.2 Evolutionary Development Model

Evolutionary development model is based on the idea of developing an initial implementation, exposing it to users to gain their commands, and refining it through several versions until an adequate system has been developed. All the processes and phases involved in this model are carried out concurrently in sequence and feed back received across the activities [Ref. 12]. Unlike SDLC, there are no separate activities to be executed in sequence and refined through iterations. There are two types of prototyping involved in the Evolutionary Development which is exploratory prototyping and throwaway prototyping.

2.9.2.1 Throwaway Prototype

A throwaway prototype is a working system developed rapidly and at low cost, which is used to help clarify user requirements. Much valuable feedback can be obtained by giving users the capability of exercising the prototype. It can also use for experimental prototyping of the design, determining if certain algorithms are logically correct or if they meet their performance goals [Ref. 12].

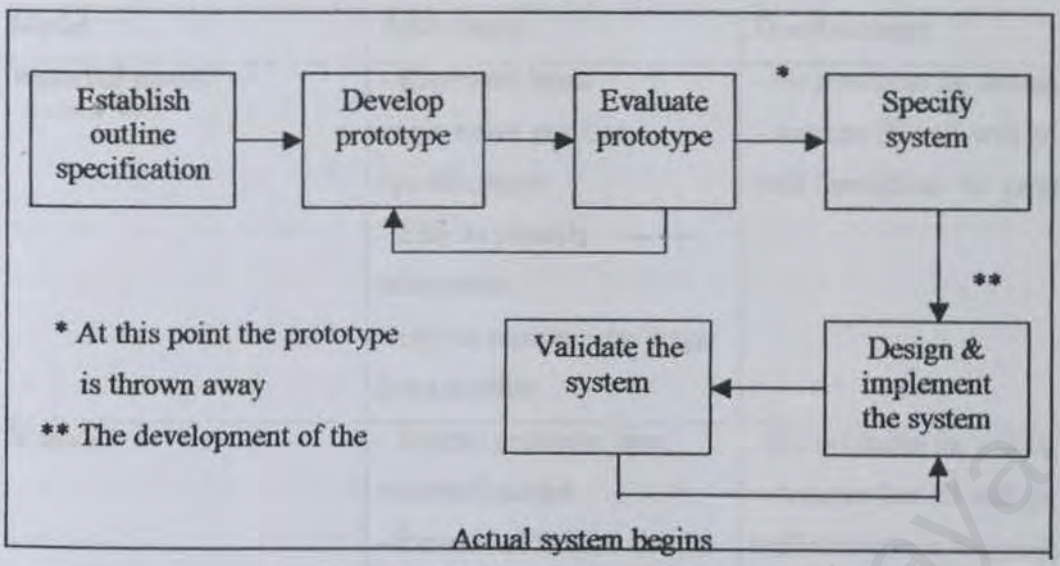


Figure 2-14 Throwaway Prototype

2.9.2.2 Evolutionary Prototype

The evolutionary prototyping approach is a form of incremental development, of which the prototype evolves through several intermediate operational systems into the delivered system [Ref. 12]. One of the objectives of this model is to have a subset of the system working early that is then gradually built upon. It is an advantage if the first incremental version of the system tests a complete path through the system from external input to external output.

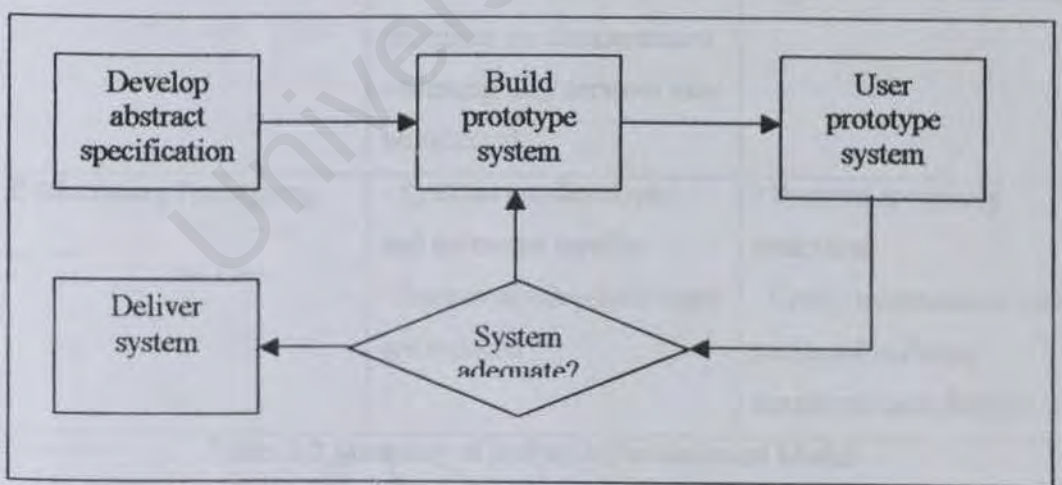


Figure 2-15 Evolutionary Prototype

2.9.2.3 Summary of Software Development Model

Model	Advantages	Disadvantages
Waterfall model	- Represent basic engineering practice specifications - Easy to identify milestones -Easy to separate one stage from another	- No available for testing - Assume that all will go well throughout the project
V model	- Similar principle from waterfall model - Reveals additional details	- No available for testing - Assume that all will go well throughout the project
Spiral model	- Risk based model	- Basically to identify and overcome risk that may found at each phase, does not follow the life cycle development exactly
Throwaway Prototyping	- Misunderstandings between software developers and users may be identified as the system functions are demonstrated - Missing user services may be detected	- Sometimes the cost of prototype development represents an unacceptably large fraction of total cost
Evolutionary Prototyping	- Systems are developed and delivered rapidly - System development costs are reduced	- Systems are poorly structured - Costly maintenance due to continual software structures modification

Table 2-2 Summary of Software Development Model

2.9.3 Analysis and Synthesis

The main advantage of the waterfall model is regular deliverables can be obtained at each phrase of development. Therefore, the progress of the projects is

gauge by these deliverables. When the analysis phrase end, major part of the system structure are not altered. The developers only refer to the planned system design and code systematically.

The problem with this model is its rigid partitioning. Whenever error encountered in certain stages, the development return to the previous stage and make amendment. Only then, the development could continue with the later stages. If many changes were to be made, the process would iterate and this could cost time. In addition, errors detected late are more difficult and expensive to correct.

Evolutionary development provides an alternative to the waterfall model because it provides solutions to the problem of long development times. However, a prototyped system tends to be corrupted structurally due to continual changes. Prototyping is invisible and system developed this way is not feasible to be documented and cost wise. There might not be tangible reports for evaluation purposes. The nature of prototyping might saves developer invaluable time, but some features may be omitted due to the rapid development.

As conclusion, every model has its pros and cons. It is up to the developer to choose the best model to use for system development. Developer also may use the combination of waterfall model and prototyping models to completely fulfill the requirements of the system to be built.

Chapter 3: System Analysis

3.1 Introduction

System Analysis is a problem-solving technique that decomposes a system into its component pieces for the purpose of studying how well those component parts work and interact to accomplish their purpose. Simply said, it is a phase to find out what a system does and to analyze the system needs. System analysis involves three basic phases, which are:

i) Feasibility assessment (Project Survey Phase)

ii) Organization problem statement (Project Study Phase)

iii) Organization requirements statement (Definition Phase)

Feasibility assessment involves four categories, which are interviews, project scope, problem statement and classification, and proposed project plan. On the other hand, organization problem statement includes project roles, learning current system (use repository), modeling the current system, analysis of problems and opportunities, new system's objectives, and new project scope and plan. Finally, organization requirements statement is formed by identifying requirements, modeling system requirements, discovering prototype, prioritization, and reviewing requirements.

The aim of system analysis is to analyze, specify and define the system, which is to be built. The models developed in this phase will describe what the new system will do. The benefits of system analysis are:

i) Provides an overview of the proposed system

ii) Defines the scope of the system

iii) Defines what the system will do

iv) Provides a solid understanding of the system

System analysis starts with data collection. Some techniques have been carried out in the information collecting process such as listed below:

3.1.1 Information collecting process

- **Feasibility study**

  Times have been given and efforts have been put to gather the information by reading references books, journals. Web sites and user guides that are relevant to the project as listed in Bibliography. The purpose is to find out the suitable programming environments and database that are going to be used for the system development.

- **Interview**

  This is a fact-finding technique whereby information is collected from individuals through face-to-face interaction. Interviewing can be used to achieve any or all of the following goals: find facts, verify facts, clarify facts, generate enthusiasm, get the end user involved, identify requirements and solicit ideas and opinions. There are two roles in conducting an interview where the system analyst is the interviewer (responsible for organizing and conducting the interview), and the system user or system owner is the interviewee (who is asked to respond to a series of questions).

- **Internet surfing**

  Internet surfing is considered as a good method and choice of fast finding for desired information. A lot of information can be obtained from Internet to fulfill the need in this project. Besides, online tutorials regarding programming languages can also be obtained through surfing the Internet. Analyzing the existing online system has made a big help in giving ideas on the features, functionalities as well as the design of the Expense Claim system.

3.2 Methodology

3.2.1 Waterfall model (with prototyping)

Waterfall model with prototyping will be use for the development of e – Expense Claims System.

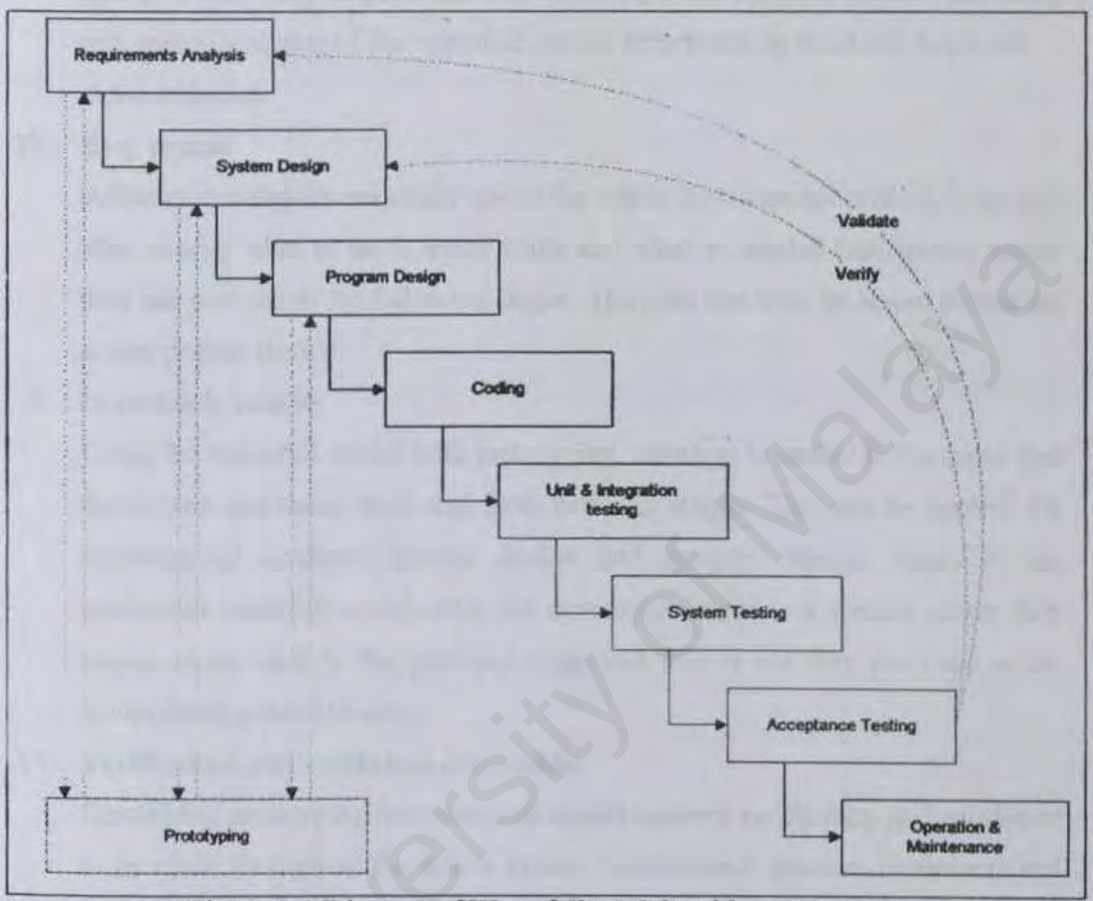


Figure 3-1 Diagram of Waterfall model (with prototyping)

This is because such model provides us with the advantages of both the waterfall and prototyping models as listed below:

I. **Easily explained**

The waterfall model can be easily explained to the customers even if they do not have any basics in software development.

II. **High level of view**

The waterfall model gives the system developer a high level of view about what is going on in every stage in the development process. It makes explicit which intermediate products are necessary in order to begin the next stage of

development. It also suggests to developers the sequence of events they should expect to encounter.

III. **The most basic model**

The waterfall model is the most basic model of software process model. This makes it very easy to learn and use. Besides, more complex models are really just embellishments of the waterfall model, incorporating feedback loops and extra activities.

IV. **Easy layout**

Software developers can easily layout the whole development process. They can plan exactly what to do in every stage and what is needed (milestone) before they can proceed to the following stages. The plan can even be layout before the actual project started.

V. **Iteration is enable**

Using the waterfall model with prototyping, iteration is enable in the sense that developers can move back and forth between stages. This can be applied for requirements analysis, system design and program design stage. In the traditional waterfall model, after the developers move to a specific stage, they cannot move back to the previous stage and this is not very practical in the actual development process.

VI. **Verification and validation are enable**

Combining prototyping into waterfall model enables verification and validation to be made throughout the whole system development process. Customers and developers can also examine some aspect of the proposed system and decide if it is suitable or appropriate for the finished product. Verification ensures that the system has implemented all of the requirements and validation ensures that each function works correctly.

3.3 Requirement Analysis

Requirement analysis is a structured document setting out detailed description of the system services. It should only specify the external behavior of the system and should not be concerned with system design characteristics. It is often written in natural language so that it is understandable by customers without knowledge of

specialized notations. There are two types of requirement analysis, which are functional requirements and nonfunctional requirements.

3.3.1 Functional requirements

Functional requirements are a description of activities and services a system must provide, how the system should react to particular inputs, and how the system should behave in particular situations. It is frequently identified in terms of inputs, outputs, processes and stored data that are needed to satisfy the system improvement objectives. In some cases, the functional requirements may also explicitly state what the system should not do.

I. System Functionality

- **Claimant is required to paste all the receipts or supporting document on a piece of A4 paper and record the system generated reference number from the system application form.**
- Claimant is required to specify an approvers' name upon application. For general staffs, the approver is MIC. DIC approvals is required only if the amount is greater than RM100.
- Only author of the claim is allowed to edit the application when notification of incompleteness or mistake has been made in the application or wrong approver list has been set.
- Claimant is not allowed to cancel his/her application after the following approval: -

Claim Amount	Claim Channel	Stage of claims Processing
<Rm100	General	After MIC's approval
≥Rm100	General	MIC's approval follow by DIC's approval
	HR	After HR's Manager approval

Table 3-1 Summary of Stage of claim processing

- MIC = Manager in Charge DIC = Director in Charge
- The system does not allow the claimant to apply claims that he/she is not applicable to. If the claimant trying to apply claims that are not eligible to

him, a message " You are ineligible to apply this type of claim! " will be prompted.

Flow	Type of Claims	Applicable to
HR	Parking	Manager and above
	Club Subscription	Manager and above
	Car Loan Monthly Subsidy (Monthly/Quarterly)	Manager and above
	Professional Subscriptions	Staff who has passed the paper
	Seminar / Conference	All Staff
	Medical Claims	All Staff
	Professional Exams Fees	All Staff
General	Advance The others.	All Staff

Table 3-2 Type of Claim are applicable to apply

- Claimant is allowed to make up to 10 claims in each application.
- Claimant can check on the status of their application through the system.
- System will send a reminder to approval and claimant when the claims are not process after 5 days.

II. Administrator module

Maintain and update function:

This module enables administrator to maintain certain information to be used within the system for amount computation, data control and user selection during data entry. Any changes made will be available or updated in the system automatically. This ensured data accuracy and consistency.

The administrator has the full rights to maintain the following information:

- Maintain Staff Information - Staff NO, Name, Department and Position are importance information of this system. Administrator has to key in each staff information before the user can use this system.
- Maintain Claims Type

- Maintain Approver List
- Maintain Cost Centre

Generate Report function:

Various Reports Creation and Data Export

⇒ General list of claimants claim details

⇒ A summary list of Cheques

⇒ Summary list of claims ready to collect (includes claimant name and reference number)

⇒ Summary of Disbursement Claims reports

⇒ Type of claims payment summary list

III. Normal Staff module

Create claims application function:

The claims application are divided in two different route i.e.

1 General - Claimant → Department → Finance Dept

Claim type: such as mileage, meals, transportation, Car Rental, Office Supplies, Phone / Fax and etc.

2 HR - Claimant → Human Resources Dept → Finance Dept

Claim type: such as Medical Claims, Overtime allowance, Seminar / Conference.

IV. Manager module

Approved / Disapproved / Incomplete function

- Approved - A mail notification upon approval will be sent to claimant.
- Disapproved -A mail notification upon disapproval will be sent to claimant.
- Incomplete - A mail notification indicates that the application has Incomplete document or there is error on the expense

claims application, will be sent to the claimant. Claimant can resubmit the application after updating the application.

Create claims application function:

The claims application are divided in two different route i.e.

1. General - Claimant → Department → Finance Dept

   Claim type: such as mileage, meals, transportation, Entertainment, Lodging / Room, Car Rental, Office Supplies and etc.

2. HR - Claimant → Human Resources Dept → Finance Dept

   Claim type: such as Medical Claims, Overtime allowance, Club's Monthly Membership Fees, Car Parking, Seminar / Conference and etc.

For e – Expense Claims System, the functional requirements can be categorized into 3 sections. These sections are normal staff module, administrator module and manager module. Below are the summary of the functional requirements:

Modules	Users	Functionalities
Normal User	Staffs with Lotus Notes access	• Create Claim Application • Review application • Cancel or Edit their own application document when approvals request alteration. • Setup approval list
Manager	Approver	• Create Claim Application • Review application • Setup approval list • Approve/Disapprove application • To access and review staff application that require their approval.
Administrator	Finance Department	• Monitor and review application • Accept/Approve or Reject/Disapprove application • To access and read all staff application. • Generate Report

Table 3-3 Summary of three modules functional requirements

3.3.2 Non-functional requirements

Non-functional requirements are a description of other features, characteristics, and constraints that define a satisfactory system. They include timing constraints, constraints on the development process, standards and so on. Although the non-functional requirements are quite subjective, they are as important as the functional requirements.

i. **Reliability**

It is reliability if the application system, software and hardware do not cause unnecessary failure and downtime when they are used in a reasonable manner.

ii. **Usability**

The application system shall be ease to use. They shall enhance and support rather than limit or restrict the processes. User interfaces shall be intuitive and consistent within themselves in purpose and use. Besides, the interfaces also shall be attractive and user friendly for user convenience.

iii. **Security**

The application system shall be able to prevent unauthorized users from accessing the system.

iv. **Maintainability and expandability**

The architecture and database design should be able to maintain and can be extend if necessary amendment in the future.

v. **Scalability**

The scalability is to promise the capability of the system to migrate as a client or server to machines of greater or power, depending upon requirements, with less or no changes to the underlying components. The solution can be using hardware or application configuration or a combination of both of them.

3.4 Technology Consideration

3.4.1 Lotus Domino R5 Family

After reviewing web-based application component and client-server concept, this is the time to find out a suitable environment to develop this e -Expense Claims System. Lotus® Domino™ R5™ Family has been chosen to be the development tools for this system.

3.4.1.1 Lotus Domino Server

The Domino R5 family of servers delivers messaging, applications and on-line collaboration fast and reliably for organizations from small businesses to the largest enterprises. Domino R5 helps organizations reduce costs by making the server easier to administer and the desktop much easier to manage. Domino R5 provides businesses with the flexibility and openness they need to harness the power of the Web, along with the security they need to keep systems running smoothly and to prevent unauthorized access. From industrial-strength messaging, to interactive applications with connectivity to back-office systems like supply chain management and sales force automation, thousands of e-business solutions run on Domino today, (http://www.lotus.com)

To meet organization's evolving business requirements. Domino provides an extensible foundation for messaging and collaboration featuring multiple server offerings:

a) **Domino Mail Server**

   E-mail, Web access, Calendaring and Scheduling, bulletin boards, newsgroups, mobile support Web standards.

b) **Domino Application Server**

   Collaborative Web applications with connectivity to back-end systems.

c) **Domino Enterprise Server & Domino Advanced Enterprise Server**

   Clustering and partitioning services, including dynamic load balancing and fail over for application for the ultimate in performance and reliability.

By the way, only Domino Application Server is chosen here to develop this Bus Ticket e-Reservation System for benchmark purposes. The advantages of Lotus Application Server are:

1. **The Domino Application Server is a world-class Web application server.**

    a. **CORBA/IIOP support.** Extends Domino application services to Web clients, for integration with existing applications architecture. Serve Lotus Notes clients and Web browsers with the same applications.

    b. **Flexible, pervasive security.** Personalize access to data and applications based on individual and group roles. Extend Domino security to HTML files and other data, for pervasive security no matter how or where Web content is stored.

    c. **Enhanced HTTP stack.** The Domino R5 HTTP engine delivers outstanding performance and Java servlet support.

    d. **Integration with Microsoft IIS.** Use US as the HTTP engine for Domino, to dramatically enhance US security and bring Domino's rich Web application services to NT-based Web environment.

2. **The Domino Application Server offers the industry's most comprehensive array of services.**

    a. **The most flexible security model.** Integrated X.509 support lets the developers register new users with Notes and/or X.509 certificates. S/MIME support ensures message integrity for all client types. SSL V3 for HOP and LDAP clients. Authentication via trusted third-party directories reduces complexity and duplication of information.

    b. **An enterprise-scale, LDAP directory.** Supports a multi-enterprise infrastructure of any size. Integrates with other directories via full support for LDAP V3, the open standard for directory access. Extensible schemas allow storing any information chosen. Synchronizes user accounts with the Windows NT directory.

c. **The world's best workflow.** Easily define processes to route and track documents, to coordinate activities both within and beyond organization.

d. **Enhanced search services.** Domain-wide searching across all Domino applications and the file system, built-in search security, universal filters and more.

e. **An integrated development environment.** Domino Designer is optimized to work with Domino, and features a complete set of visual tools for rapid development and deployment of secure, e-business solutions. It supports favourite tools for HTML authoring, Java development, and scripting.

3. **Domino Application Server includes Domino Enterprise Connection Services (DECS), for live access to enterprise systems.**

a. **Comprehensive connectivity.** DECS supports a wide range of enterprise systems, including DB2, Oracle, Sybase, ODBC, EDA/SQL, SAP, PeopleSoft, JD Edwards, Oracle Applications, MQSeries, CICS, and more. (Connectors for relational databases are included with Domino; connectors for ERP applications and transaction processing monitors are sold separately.)

b. **The most efficient integration available.** Access or update enterprise data from Web applications in real-time, via persistent, parallel, pooled connections.

c. **Choice of development options.** Connect to enterprise data non-programmatically via the easy-to-use DECS interface, or programmatically from Java or LotusScript.

4. **The Domino Application Server delivers unmatched reliability and manageability.**

a. **Transaction logging for Domino databases.** The industry standard for reliable data storage. Ensures complete data integrity for updates and

facilitates incremental database backup and fast restart after system failures.

b. **Remote server management options.** Improve convenience for administrators and provide consistent IT support for field offices with remote server management via the Domino Administrator, optimized administrative tools. Web-based administration, batch console commands and more.

c. **Centralized control of Notes desktops.** Organizations that use the powerful Lotus Notes client for mail and applications can centrally configure desktop settings like home server and UI preferences.

d. **Mail Server capabilities.** The Domino Application Server also delivers powerful administration and the unmatched Internet messaging

functionality found in the Domino Mail Server such as e-mail, calendaring and group scheduling, bulletin board and newsgroups.

Supported operating systems:

Microsoft Windows NT 4.0 (Intel, Alpha),

*Windows 2000,

IBM AIX 4.3.1,

HP-UX 11.0,

Sun Solaris 2.6 (SPARC and Intel),

Linux,

IBM OS/2 Warp Server 4,

IBM OS/400 V4R2 or later,

IBM OS/390 V2R6 or later.

*Windows 2000 is supported, but not certified.

Domino Application Server is licensed for deployment on systems with one to four CPUs.

3.4.1.2 Lotus Domino Designer

Domino Designer R5 is the next step towards a Web-friendly development environment. While Notes has always been a powerful tool for developing applications, R5 builds on this power by making it easier and faster for Web developers to create rich, robust, and secure applications with a new integrated development environment. For Web developers, it is now easier to use HTML and JavaScript to design because Designer supports them natively, meaning that a conversion process is no longer required. They can also use frames and Java applets, both supported by the Domino server, and available in Designer. If the developers are Notes developers familiar with application development in previous releases, they can now design more visually appealing applications that use the new features and still leverage the strengths of the Domino infrastructure that they know so well.

The goal of Domino Designer R5 is to support rapid development of applications for the Domino server. The themes driving the development team are:

1. **Usability** - Reducing the "time to Web", creating an intuitive set of design tools, providing more templates and examples (and documenting them), and incorporating additional Web design constructs.

2. **Openness to alternate tools** - Adding new tools to enable partners to extend the design environment themselves and providing integration with third-party tools (for instance, NetObjects' Fusion, IBM's VisualAge for Java, or any HTML created with any HTML authoring tool).

3. **Mixed client design** - Narrowing distinctions between the Notes client and Web browsers with a number of features, including native image support, the Web color palette, framesets, and pages, and establishing a common model for user interface (UI) events.

4. **Industry-standard programmability** - Leveraging existing and emerging languages, including Java, JavaScript, and HTML 4.0 and maintaining the existing investment in LotusScript.

5. **Global applications** - Integrating more closely with Domino Global WorkBench, which allows creating multilingual databases that, let users choose their preferred language from a list of available languages. In addition, users can tag Domino application design elements with a specific language attribute and automatically serve the application, in that language, to the client.

Designer R5 will change the way to develop applications. Developers won't develop just a Web application or just a Notes application. They can now move closer to ultimate goal of designing one application that runs both in the leading browsers and the Notes client.

3.4.2 Conclusion of Lotus Domino R5 Family

Domino R5 wears many different hats, and it wears them well. As an Internet messaging server. Domino integrates the features that need for providing full-fidelity messaging for users. In addition, it includes many exciting new directory features that can customize for organization. For Web applications, developers can use the best tools for designing the applications, and then use Domino Web application services to ensure that the application is always available and secure. Developers can even decide to combine Domino with Microsoft US. Database improvements in R5 mean that user can get greater reliability, availability, and scalability out of a single server. Finally, the day-to-day administration of the server is made easy with task-oriented, drag-and-drop administration. With all the enhancements large and small, the Domino R5 server is a good investment for any organization.

Lotus Domino R5 Family as an all-in one package for e-business system development tools has prompted me to choose it as my development tools for this e – Expense Claim System.

3.5 Summary of Chapter 3

In this chapter, the methodology used in developing the e – Expense Claim System, the waterfall model with prototyping is explained. The requirements of the analysis and the functional and non-functional requirements in this system are also clearly stated. Key features of Lotus Domino R5 Family are also discussed to meet the requirements of the system.

Chapter 4: System Design

4.1 System Design Overview

In this phase of the system development life cycle, the information collected earlier is used to accomplish the logical design of the information system. Accurate data-entry procedures are designed so that data going into the information system are correct. In addition, effective input is provided to the information system by using techniques of good form and screen design [Ref.11].

Part of the logical design of the information system is devising the user interface. The interface connects the user with the system and is thus extremely important. Examples of user interfaces includes a keyboard (to type in questions and answers), on-screen menus (to elicit user commands) and a variety of Graphical User Interfaces (GUIs), that use a mouse or touch screen [Ref.11].

The design phase also includes designing files or databases that will store much of the data needed by decision makers in the organization. A well-organized database is the basis for all information systems. In this phase, users cooperation is needed to design output (either on-screen or printed) that meets their information needs [Ref.11].

In another words, the results of the requirements analysis tell the problem that the system is to solve. Design is the creative process of transforming the problem into a solution; the description of a solution is also called design [Ref.12].

4.2 System Functionality Design

4.2.1 Program Design - Using Data Flow Diagram

The system analyst needs to make use of the conceptual freedom afforded by data flow diagrams (DFD), which graphically characterize data processes and flows in a business system. In their original state data flow diagrams depicts the broadest possible overview of system inputs, processes and outputs. A series of layered data flow diagrams may also be used to represent and analyze detailed procedures within the larger system [Ref.11].

The data flow approach has four chief advantages over narrative explanations of the way data moves through the system. The advantages are:

A. Freedom from committing to the technical implementation of the system too early.
B. Further understanding of the interrelatedness of system and subsystem.
C. Communicating current system knowledge to users through data flow diagrams.
D. Analysis of a proposed system to determine if the necessary data and processes have been defined.

Data flow diagrams can and should be drawn systematically. First, the system analyst needs to conceptualize data flow from a top-down perspective. The steps involved in successfully completing data flow diagrams are as follows:

1) Make a list of business activities and use it to determine various
   a. External Entities
   b. Data Flows
   c. Processes
   d. Data Stores
2) Create a context diagram, which shows external entities and data flows to and from the system. Do not show any detailed processes or data stores.
3) Draw Diagram 0, the next level. Show process, but keep them general. Show data stores at this level.
4. Create a child diagram for each of the processes in Diagram 0.
5. Check for errors and make sure the labels assign to each process and data flow are meaningful.
6. Develop a physical data flow diagram from the logical data flow diagram. Distinguish between manual and automated processes, describe actual files and reports by name, and add controls to indicate when processes are complete or errors occur.
7. Partition the physical data flow diagram by separating or grouping parts of the diagram in order to facilitate programming and implementation

The system design is based on data flow oriented or structured design. In the Data Flow Diagram (DFD), functional transformation changes a process to another

process, it is transformed as it moves. The symbols used in the DFD are shown as below:

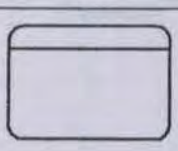
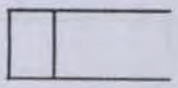
Name	Symbol	Description
Data Flow		Data transfer in the direction indicated by arrow. Each arrow should be labeled to indicate what data is being transferred.
Process		Manual or computer process that changes data.
External Entity		Source or destination of data that is external to the system.
Data Storage		Manual or computer storage of data.

Table 4-1 DFD Symbols

4.2.2 DFD of functionalities in the system

e – Expanses Claim system will have three modules in total and from them, we can get several different functionalities (Please refer to section 3.3.1 Functional requirements). The DFD for the system overview and its functionalities together with explanation is provided below:

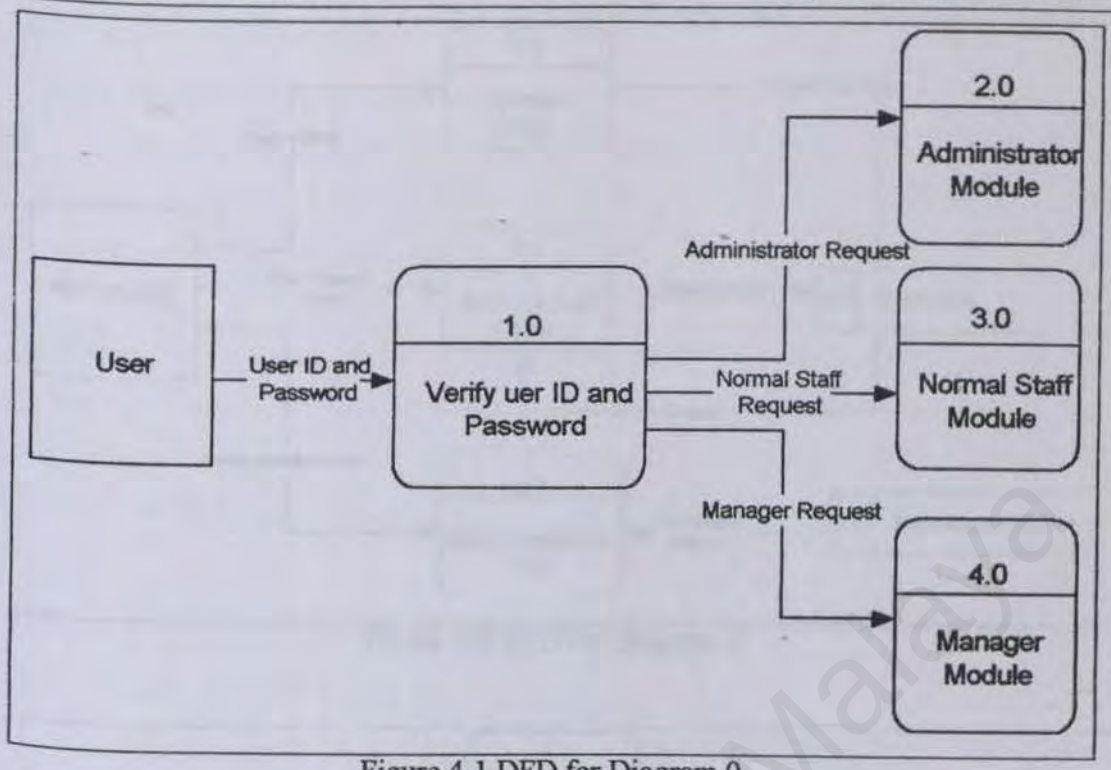


Figure 4-1 DFD for Diagram 0

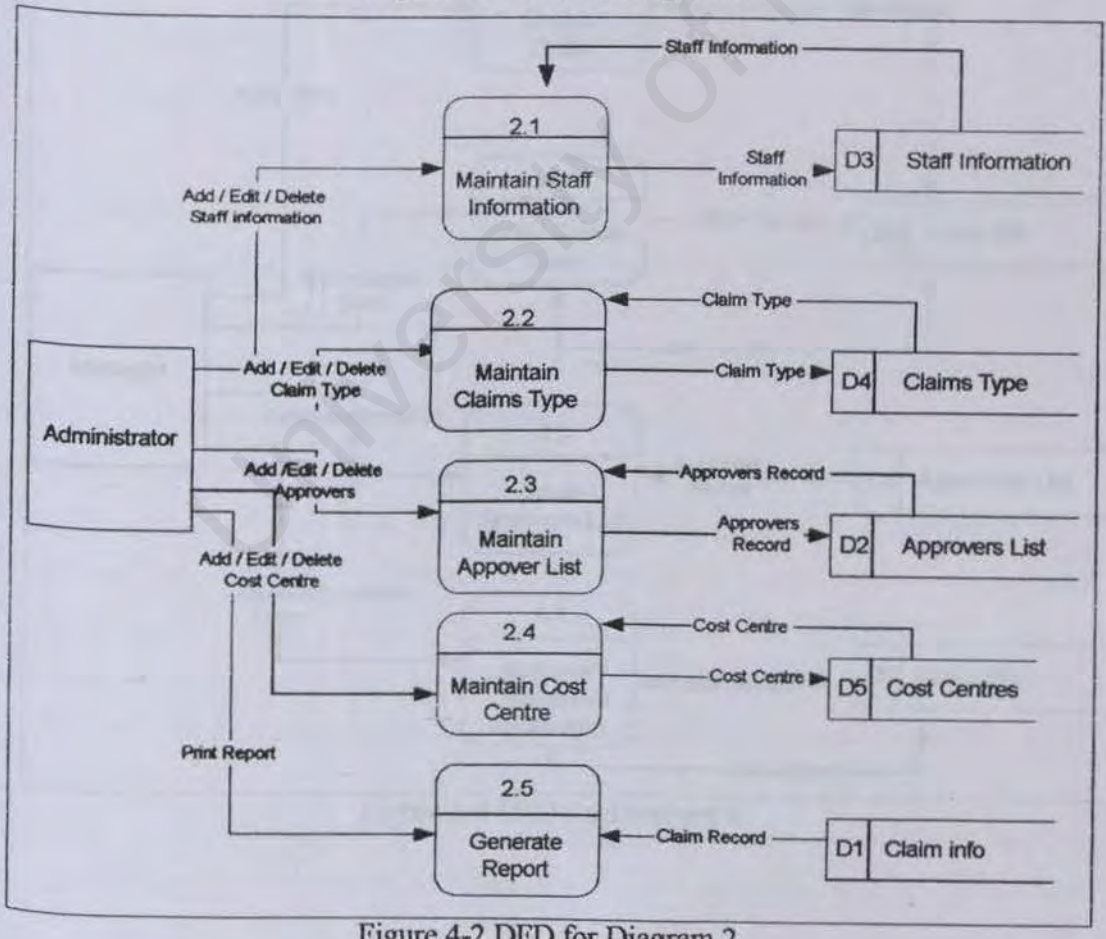


Figure 4-2 DFD for Diagram 2

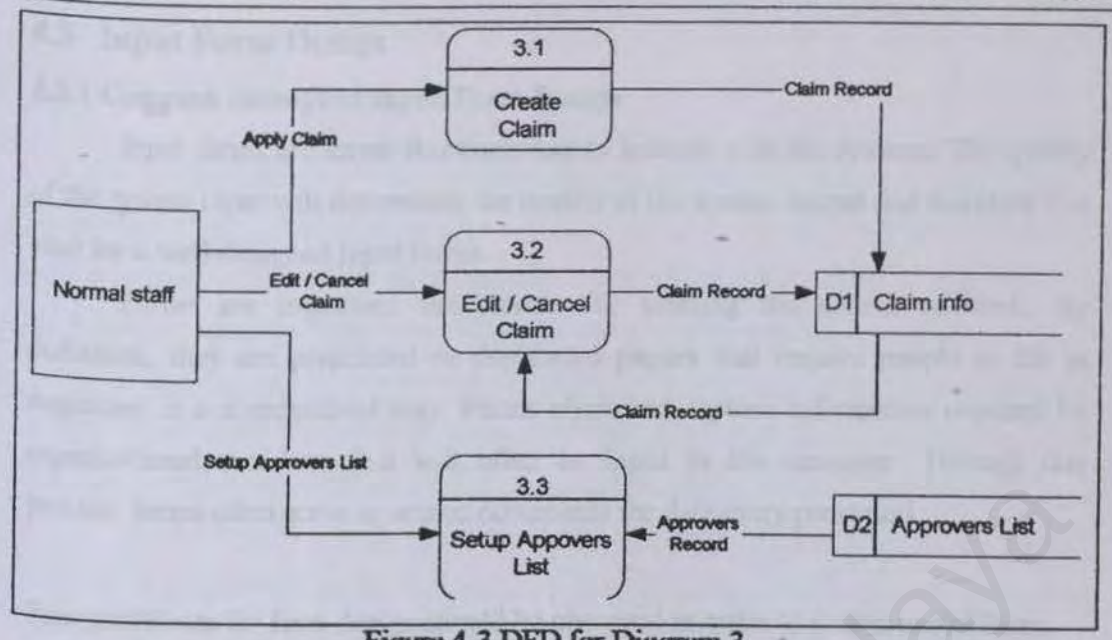


Figure 4-3 DFD for Diagram 3

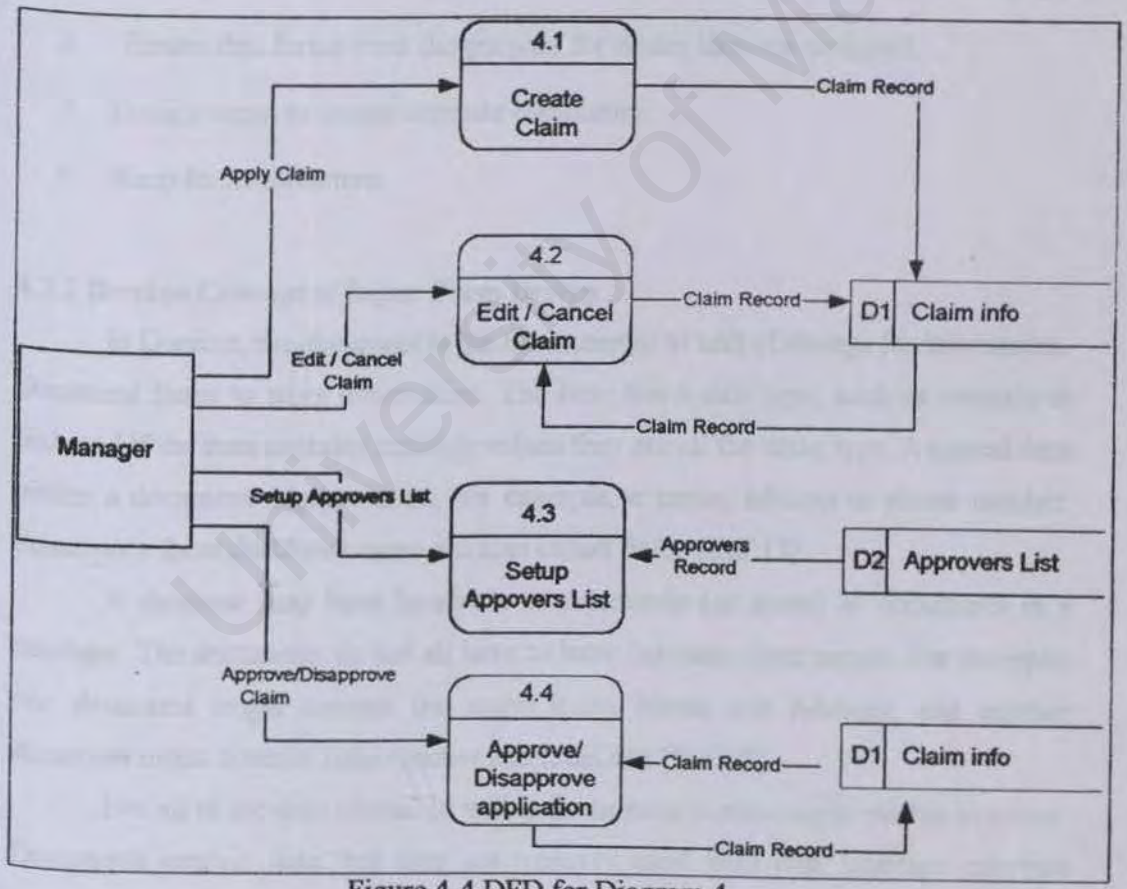


Figure 4-4 DFD for Diagram 4

4.3 Input Form Design

4.3.1 Common concept of Input Form Design

Input forms are forms that users use to interact with the systems. The quality of the system input will determines the quality of the system output and therefore it is vital for a well-designed input forms.

Forms are important instruments for steering the course of work. By definition, they are preprinted or duplicated papers that require people to fill in responses in a standardized way. Forms elicit and capture information required by organizational members that will often be input to the computer. Through this process, forms often serve as source documents for data entry personnel.

Four guidelines for form design should be observed in order to design useful form:

1. Make forms easy to fill out.
2. Ensure that forms meet the purpose for which they are designed.
3. Design forms to assure accurate completion.
4. Keep forms attractive.

4.3.2 Domino Concept of Input Form Design

In Domino, the *document* is the fundamental of unit of storage for information. Document items to store information. The item has a data type, such as numeric or text, and if the item contains multiple values they are all the same type. A typical item within a document might contain, for example, a name, address or phone number. Sometimes these document items are also called fields [Ref.13].

A database may have hundreds or thousands (or more) of documents in a database. The documents do not all have to have the same item names. For example, one document might contain the same items Name and Address, and another document might contain TotalAmount and DueDate [Ref.13].

Not all of the data contained within documents is necessarily visible to a user. Documents contain data, but they are typically used with user interface interface elements, such as forms and views. Forms and views are the mean to present information store within documents to the user. Views present summary information

from many document, and forms enable you to see detailed information from one document [Ref.13].

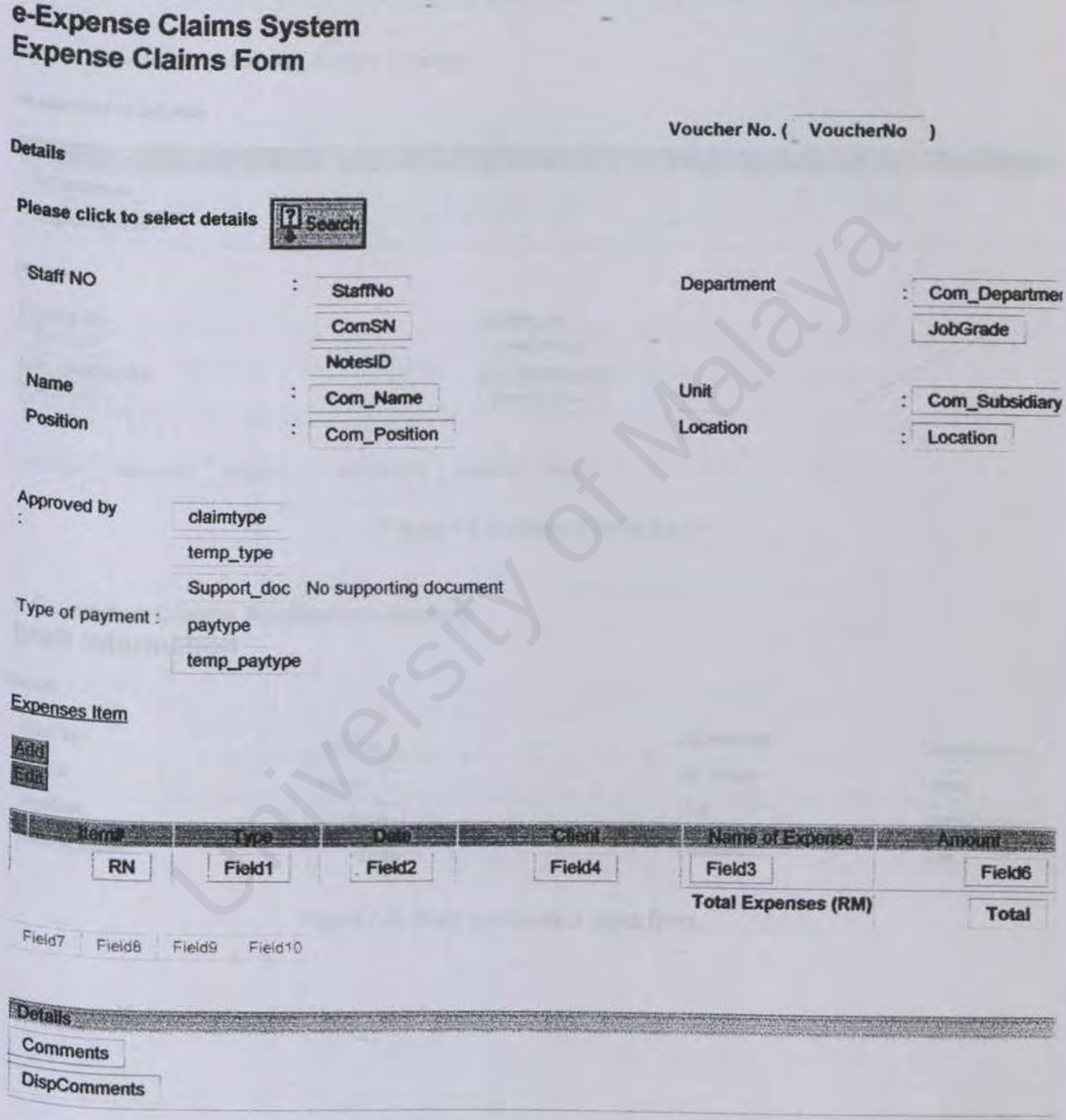
A form is like a visual template. By this, the form in Domino is much like a blank paper form. With domino forms, the blank areas are called fields. Each field within a form has a field name as reference and obtain information. A form contains both static information and field information. It is a visual object [Ref.13].

Suppose Domino is showing an empty form to a user. When the user fills the empty fields of the form, the information is stored in a document. Domino separates the user interface (form) from the field data stored within the document [Ref.13].

So to recap, forms are used for visual display to a user. And documents are used to store data within the database. The correspondences of names in forms and documents enables Domino to display fields filled in with the values from a document. For display to a web browser. Domino first merges the form definition with the document values and then converts the result to HTML, which is then sent to the browser [Ref.13].

Figure 4-5 to 4-7 presents the input forms of the system.

1. Expense Claims Form



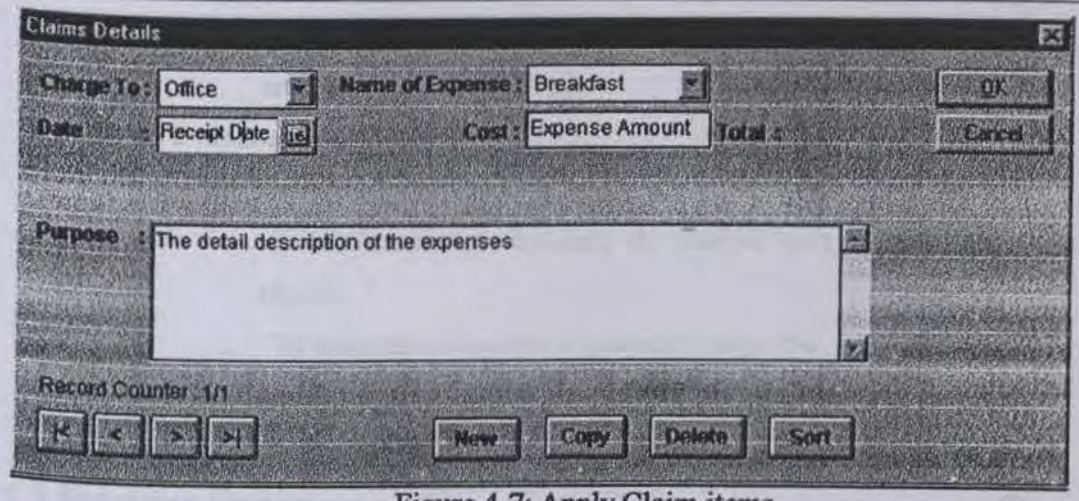


Figure 4-7: Apply Claim items

4.4 User Interface Design

The interface is the system for most users. User interface design establishes the layout and interaction mechanism for human-machine interaction and is one of the important aspects of this system development process. Objectives that are to be achieved in designing user interface are as follow [Ref.13].

1. Effectiveness as achieved through the design of interfaces that allow users to access the system in a way that is congruent with their individual needs.
2. Efficiency as demonstrated through interfaces that both increase the speed of data entry and reduce errors.
3. User consideration as demonstrated in the design of suitable interfaces and by providing appropriate feedback to users from the system.
4) Productivity as measured by ergonomically sound principles of design for user interfaces and workspaces.

It is built by taking into consideration the features for a user-friendly interface. They are:

- **Ease of use –**
  - Use different background ranging from GIFs to solid colors to make the pages more attractive.
  - Use bulleted items in place of long boring paragraphs as this will help the user find information quickly and easily.

- Breaking up long documents into small, modular sections that are easier to navigate through.

➢ **Consistency-**

- Consistency brings a sense of identity to pages. Users can find information faster when they are familiar with particular page layout.
- The page should reflect a consistent page font, color, image, background and page layout across the application.

4.5 Database Design

4.5.1 Common Concept of Database Design

A database is a collection of data stored in a standardized format, designed to be shared by multiple users. The system database must be carefully designed in order to fully exploit the advantages of database technology. The goals of database design are as follows:

1. Provide for the efficient storage, update and retrieval of data.
2. Be reliable where the stored data should have high integrity data.
3. Be adaptable and scalable to new and unforeseen requirements and applications.

All Domino applications begin with a Domino database. Domino databases are the containers for your application. Databases hold the data, logic, and design elements for your application. Your Domino application can be made up of one or more Domino databases [Ref.14].

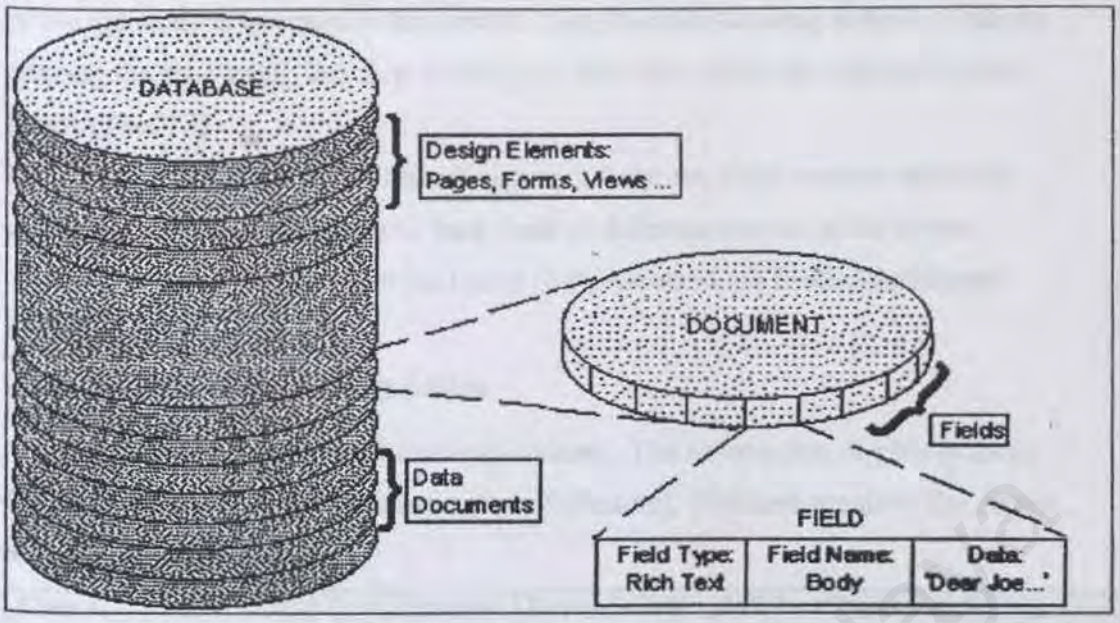


Figure 4-8: Domino database architecture

With Designer, you create one application to use on both your intranet and the Internet. The structure of a database is the same whether for the Notes client or a Web browser. What makes a database a Web database is the viewing mechanism: users view it through a Web browser instead of the Notes client. You do all design work in Designer and use the same design elements – forms, fields, views, outlines – to display and organize the content.

4.5.2 Domino Concept of Database Design

View is a fundamental part of Notes and Domino. They enable both the designer and user to organize document within a database. In essence, a view provides a tabular display of selected fields from documents contained in a Domino database [Ref.13].

Views use a formula, so the selection of document is automatic. The formula is typically written by a designer and is generally use to filter the documents. Designers frequently use several different views in a database, each with a different formula. This enables the user to see various collections of documents, grouped and sorted in meaningful ways [Ref.13].

View is a tabular display of data extracted from a set of documents. Each row of the table represents one document, and the values in each column can be field data or can be bases on a formula. Column formulas can combine data from multiple fields

or use @functions to compute their result. The process of creating a view is initially creating the view itself, and then defining the data that should be included in each column [Ref.13].

According to the input form designated, there are eight views to store and display document. Each view will keep track of different records in the system.

The followings describe the layout of the views in the Electronic Expense Claims System Database.

A. Normal Staff / For My Action

This view capture all claims applications. The information display includes Claim number, Department, Amount, Date Submitted, Claimant number. The details are sorted by Claim Number:

Claim #	Type	Amount	Date Submitted	Claimant Name

B. Normal Staff / By Claimant Name

This view capture all claims application. The information display includes Claimant name, Voucher number, Type (Route of claims), Status, Amount, Date Submitted. The details are sorted by Claimant Name.

Claimant Name	Claim #	Type	Status	Amount	Date Submitted

C. Normal Staff / By Employee Number

This view capture all claims application. The information display includes Employee number (Staff Number), Voucher #, Type (Route of claims), Status, Amount, Date Submitted. The details are sorted by Employee Number.

Employee #	Claim #	Type	Status	Amount	Date Submitted

D. HR / For Action

This view capture all claims application that route to HR. The information display includes Voucher number, Department, Status, Amount, Date Submitted, Claimant Name. The details are sorted by Voucher Number.

Voucher #	Dept	Status	Amount	Date Submitted	Claimant Name

E. HR / By Status

This view capture all claims application that route to HR. The information display includes Status, Voucher number, Department, Amount, Date Submitted, Claimant Name. The details are categorized by Status.

Status	Voucher #	Dept	Amount	Date Submitted	Claimant Name

F. HR / By Claimant Name

This view capture all claims application that route to HR. The information display includes Claimant name, Voucher number, Status, Amount, Date Submitted, Department. The details are categorized by Claimant Name.

Claimant Name	Voucher #	Status	Amount	Date Submitted	Department

G. HR / By Department

This view capture all claims application that route to HR. The information display includes Location, Department, Employee number, Claimant Name, Voucher number, Status, Amount, Date submitted. The details are categorized by Location, Department, Employee Number.

Dept	Employee #	Claimant Name	Voucher #	Status	Amount	Date Submitted

H. Finance / By Status

This view capture all claims application that route to HR. The information display includes Voucher number, Type, Department, Status, Finance Status, Amount, Date Submitted, Employee Number, Claimant Name. The details are sorted by Status.

Status	Type	Dept	Voucher #	Finance Status	Amount	Date Submitted	Employee number	Claimant Name

I. Finance / By Department

This view capture all claims application that route to HR. The information display includes Employee number, Claimant Name, Voucher number, Type, Status, Finance Status, Amount, Date submitted. The details are sorted by Department.

Employee #	Claimant Name	Voucher #	Type	Status	Financc Status	Amount	Date Submitted

J. By Finance / For Collection

This view capture all claims application that route to HR. The information display includes Claimant Name, Voucher number, Type (Route of claims), Amount, Date Submitted, Batch Number. The details are sorted by Claimant Name.

Claimant Name	Dept	Voucher #	Type	Amount	Date Submitted

4.6 Expected Outcome from e - Expense Claims System

e - Expense Claims System is expected to provide a general solution encompassing all the needs by the small and medium size commercial companies. It is an online, Intranet based, e - Expense Claims System that may be implemented into office environment to facilitate the Expense Claims application functional requirements.

e - Expense Claims System is presumed to provide a electronic system that streamlines the process chargeable expenses application, approval and updates. The system does not allow the claimant to apply claims that he/she is not applicable to. Claimant is required to paste all the receipts or supporting document on a piece of A4 paper and record the system generated reference number from the system application form. Claimant can check on the status of their application through the system. System will send a reminder to approval and claimant when the claims are not process after 5 days. When the expenses are checked, the person approving them has 3 options: The expense can be approved (A mail notification upon approval will be sent to claimant), declined (A mail notification upon disapproval will be sent to claimant) or returned to the employee for amendment (A mail notification indicates that the application has Incomplete document or there is error on the expense claims application, will be sent to the claimant).

For the manager end, they can also use the e- Expense Claims System as a source of gathering information of Claims application like total Claims and business

purpose. Beside that, manager could use the e- Expense Claims System for Review, Approve and Disapprove application.

On the administration end, applications would be available for database maintenance purposes. The administration is responsible for managing all information related and required for the system to run smoothly. The system would be enables administrator to maintain information to be used within the system for amount computation, data control and user selection during data entry. Any changes made will be available or updated in the system automatically. The administration will have the highest power and will be provided with most of the functions.

e - Expense Claims System would utilize simple but yet effective password security protection to ensure unauthorized access are prohibited. e - Expense Claims System strive to protect all user accounts and prevent others obtaining users sensitive information.

4.7 Summary of Chapter 4

This chapter focuses on the overall system design for the e- Expense Claims System. Program Design has been discussed using Data Flow Diagram (DFD) approach. Context diagram, diagram 0, child diagram of this system has been illustrated. Thus the data flow of the system has been clearly stated. Input forms are also designed. This give an idea on how the user key in data to the system. Then user interface is presented. Database design is very important to a system. So tables of database have been prepared in data dictionary approach. After researching on all design consideration, the expected outcomes are presented based on the objectives of developing this system.

Chapter 5 System Implementation

5.1 Introduction

System implementation is a process that converts the system requirements and designs into a workable system. The major sections of system implementation are coding and testing. The primary goals of this phase is the production of a simple, clear code that will ease the processes of verification, debugging the script, testing, modifications and further enhancements. In order to achieve that, appropriate tools and languages are needed to code the program.

5.2 Development Environment

The development environment has certain impact on the development of a system. Using suitable hardware and software will help to speed up the system development and it performance. The hardware and software tools used to develop and document the entire system are shown below.

5.2.1 Hardware Configurations

a) Pentium III Processor 450 MHz
b) 64 MB RAM
c) 48X CD-ROM Drive
d) 10 GB Hard Disk
e) 1.44 MB Floppy Drive A
f) 16" Monitor
g) Other standard desktop PC components

5.2.2 Software Tools Requirements

a) Operating System: Windows 2000
b) Database Development: Lotus Domino Designer
c) Program Coding: Lotus Scripts and Lotus Formula

d) Documentation and Presentation Tools: Microsoft Word 2000 and PowerPoint 2000

5.2.2.1 Operating System

Microsoft Window 2000 is used as the operating system in the development of this system.

5.2.2.2 Database Development

Lotus Domino Designer is used as the database development tool and one database known as Claims.nsf has been created.

5.2.2.3 Program Coding

Lotus Script and Lotus Formula are used in program coding as it commonly use standard language on the Lotus Notes application. Lotus Script is used in Form for document's operations such as setup approval list, some of the button as click event, and also at Querysave and Exiting event in Form. While Lotus Selection Formula is used in View to select the document following the different selection criteria. Lotus Formula in Form as Default Value, Input Translation, Input Validation, Window Title, Click action, etc can be inserted.

5.2.2.4 Documentation and Presentation Tools

Microsoft Word 2000 is used as a project documentation tool while Microsoft PowerPoint 2000 is used as Viva presentation tool.

5.3 Program Coding

Program development is the process of creating the program needed to satisfy an information system's processing requirements, which involves coding. Coding the program is the process of writing program instructions that will implement the program design specifications. The Lotus Designer is used in the coding process.

Coding is the process of writing program instructions that will implement the program design. Design specifications must be translated into a machine-readable format. The program must be written carefully to meet the specifications stated before.

5.3.1 Coding Methodology

The coding methodology of e - Expense Claims System uses the bottom-up approach. This approach starts coding at the lower modules before proceeding to higher level modules. The system is divided into different modules to ensure that every module is developed correctly and accurately. The completed modules will then be integrated into complete system.

Below are some examples of coding in the Lotus Designer:

5.3.1.1 Lotus Script

a) Below is part of Lotus Script in e - Expense Claims System for setup approval list. The script will automatically verify all the field in the from had their relevant information and prompt the error message when the claimant selected the wrong approval.

```
Sub Click(Source As Button)
    Dim tmpApprList() As Variant
    Dim tmpDateList() As Variant
    Dim tmpStatusList() As Variant
    Dim tmpWorkList() As Variant
    Dim tmpNumAppr As Integer

    Dim t1 As Variant

    Set uidoc = ws.CurrentDocument
    Set doc = uidoc.document

    If doc.staffno(0) = "" Then
        reply =Messagebox("Staff information is empty" &_
        Chr(13) & "Please enter the staff details", 64+0, "Error")
        Exit Sub
    End If

    If doc.field1(0) = "" Then
        reply =Messagebox("Expenses item is empty." &_
        Chr(13) & "Please enter the expense first.", 64+0, "Error")
```

```
            Exit Sub
        End If

'   If (doc.hasitem("GenHrAdm") = False) Then
'       Set item1 = New NotesItem(doc,"GenHrAdm",doc.temp_type(0))
'   End If
'   doc.GenHrAdm = doc.temp_type(0)

'   If (doc.hasitem("mjobgrade") = False) Then
'       Set item1 = New NotesItem(doc,"mjobgrade",doc.jobgrade(0))
'   End If
'   doc.mjobgrade = doc.jobgrade(0)

        If doc.temp_type(0) = "General" And doc.jobgrade(0) > "4" And doc.total(0) >
exceedamt Then
            exceed$ = "1"
        Elseif doc.temp_type(0) = "HR" And doc.jobgrade(0) > "0" And doc.total(0) >
exceedamt Then
            exceed$ = "1"
        Else
            exceed$ = ""
        End If
        If (doc.hasitem("exceed") = False) Then
            Set item1 = New NotesItem(doc,"exceed",exceed$)
        End If
        doc.exceed = exceed$

        If doc.temp_type(0)="General" Then
            If doc.jobgrade(0) >"4" Or Len(Trim(doc.jobgrade(0))) > 1 Then
                doc.Applist1 ="Manager "
            Elseif doc.jobgrade(0) ="0" Then
                doc.Applist1 ="Finance Manager "
            Else
                doc.Applist1 ="Director "
            End If
            doc.Applist2 ="Director "
        Else
            If doc.temp_type(0)="HR" Then
                doc.Applist1 ="HR Manager "
                If exceed$ = "1" Then
                    doc.Applist2 ="HR Director "
                End If

            End If
        End If
```

```
    For k = 1 To 3
  'check whether Approver1 to 3 exists
        FieldName$ = "Approver" & Cstr(k)
        If Ubound(doc.com_Approver) >= k-1 Then
            If doc.advance(0) = "" And doc.com_Approver(k-1) = "Not
required" Then
                FieldValue$ = ""
            Else
                FieldValue$ = doc.com_Approver(k-1)
            End If
        Else
            FieldValue$ = ""
        End If
        If (doc.HasItem(FieldName$) = False) Then
            Set item1 = New NotesItem(doc,FieldName$,FieldValue$)
        Else
            doc.ReplaceItemValue "Approver"+Trim$(Cstr(k)), FieldValue$
        End If
    Next
    Select Case doc.temp_type(0)
    Case "HR"
        If exceed$ = "1" Then
            doc.Approver3 = "HR"
        End If
    Case Else
        If doc.jobgrade(0) <> "0" Then
            doc.Approver2 = "Finance"
            doc.Approver3 = ""
        End If
    End Select
    If doc.advance(0) = "Advance claim" Then
        doc.Approver1 = "Not required"
    End If

    Redim tmpStatusList(Ubound(doc.com_Approver))
    For j = 0 To Ubound(doc.com_Approver)
        If doc.advance(0) = "" And j = 0 Then
            If doc.com_Approver(j) = "" Then
                tmpStatusList(j) = ""
            Else
                tmpStatusList(j) = "None"
            End If
        Else
            tmpStatusList(j) = doc.ApprStatus(j)
        End If
    Next
```

```
        doc.ApprStatus = tmpStatusList

        uidoc.Reload
        uidoc.Refresh

        okcancel = ws.DialogBox("ApprSetup", True, True,"Setup Approver List")
        If okcancel Then
                If (doc.HasItem("tmpAction") = False) Then
                        Set item1 = New NotesItem(doc, "tmpAction","")
                End If
                doc.tmpAction = "SetupList"

                NumApprover% = 1
                If exceed$ = "1" Then
                        NumApprover% = 2
                End If

                Redim tmpworkList(NumApprover%)
                For j = 0 To NumApprover%
                        t1 = doc.GetItemValue("Approver" & Cstr(j+1))
                        tmpworkList(j) = t1(0)
                Next

    'all names are filled up  in the list. e.g if # of approver is 3, all 3 names are filled up
                If (EmptyElement(tmpWorkList) ) Then
                        reply = Messagebox("Approver list is not complete." &_
                        Chr(13) & "Please Setup the Approver List again", 64+0, "Error")
                        Exit Sub

                End If

    ' ensure all elements in list is unique
                If Not ( ListUnique(tmpWorkList) ) Then
                        reply = Messagebox("Approver List is not unique." &_
                        Chr(13) & "Please setup the Approver List again", 64 +0, "Error")
                        Exit Sub
                End If

    ' Validation - Checks whether the requester name is in the Approver List
                If IsRequesterAnApprover(tmpWorkList) Then
                        reply = Messagebox("You cannot nominate yourself as an
Approver !" &_
                        Chr(13) & "Please setup the Approver List again", 64+ 0, "Error")
                        Exit Sub
                End If
```

```
'check whether last approver is authorised approver
        Dim IsMgr As Integer
        Dim ReqCheck As Variant
        For j = 1 To NumApprover%
            ReqCheck = True
            If j = 1 Then
                If Trim(doc.Applist1(0)) = "Manager" Then
                    IsMgr = 1
                Elseif Trim(doc.Applist1(0)) = "Director" Then
                    IsMgr = 0
                Else
                    ReqCheck = False
                End If
            Else
                If Trim(doc.Applist2(0)) = "Director" Then
                    IsMgr = 0
                Else
                    ReqCheck = False
                End If
            End If
            If ReqCheck Then
                If Not AuthorisedLastApprover(j+1,IsMgr) Then
                    If IsMgr = 1 Then
                        replymsg = "The approver is not a
manager." &_
                            Chr(13) + "Please setup the Approver List
again."
                    Else
                        replymsg = "The approver is not a director"
&_
                            Chr(13) + "Please setup the Approver List
again."
                    End If
                    reply = Messagebox(replymsg, 64 + 0, "Error")
                    Exit Sub
                End If
            End If
        Next

    'redim here
        Redim tmpApprList(NumApprover% )
        Redim tmpApprType(NumApprover% )
        Redim tmpdateList(NumApprover% )
        Redim tmpStatusList(NumApprover% )

    'built the new list
```

```
        For j = 0 To NumApprover%
            t1 = doc.GetItemValue("Approver" & Cstr(j+1))
            tmpApprList(j) = t1(0)
            tmpStatusList(j) = "None"
            Select Case j
            Case 0
                tmpApprType(j) = "Verifier"
                If doc.advance(0) = "Advance claim" Then
                    tmpStatusList(j) = "Verified"
                End If
            Case 1
                If t1(0) = "Admin" Then
                    tmpApprList(j) = getPIC("AdMGR")
                    tmpApprType(j) = "Admin Manager"
                Elseif t1(0) = "Finance" Then
                    tmpApprList(j) = getPIC("FinMGR")
                    tmpApprType(j) = "Finance Manager"
                Else
                    tmpApprType(j) = doc.Applist1(0)
                End If
            Case Else
                If t1(0) = "HR" Then
                    tmpApprList(j) = getPIC("HrDirector")
                    tmpApprType(j) = "HR Director"
                    tmpStatusList(j) = "None"
                Else
                    tmpApprType(j) = doc.Applist2(0)
                End If
            End Select
        Next

    'set field values here

        doc.com_Approver = tmpApprList
        doc.Apprstatus = tmpStatusList
        doc.ApprType = tmpApprType
        Call uidoc.Refresh
    End If
End Sub
```

5.3.1.2 Lotus Formula

Lotus Notes Formula is used in several different contents within the Notes client and Domino Designer. They can be used to view selection, input translation and

validation, default value, etc. Basically, a formula is an expression that is evaluated and results in a value. The usage of the resultant value depends on the formula context. In view selection, the selection formula will apply to all documents in the database and if the value is true for the document, the document will be selected in the view. Otherwise it skips to the next document. The formula at the form's field can be used as input validation to test the data user input that has pass the formula given.

Formulas are attached to objects and depend on the context of the objects. The formula can be used to specify:

a) Value or action to take when triggered
b) Titles for windows and column contents
c) Access and hiding of information
d) Selection of forms, subforms and document

The formula can be used on objects and contents as shown in Table 5.1.

Object	Purpose
	Values and Actions
Field	Default value Input translation Input validation Keyword field for choices
Window Title	Field Value
Button	Button action to take
Column Formula	Keyword field for choices
Agent	Select documents to be processed and actions to take on them
Action	Formula evaluated for action to be taken
Hotspot	Hotspot action to take
SmartIcon	Actions to take if smart icon invoked
	Access and Hiding
Hide Paragraph	Hide the paragraph if Formula True

Hide Action	Hide the action if Formula True
	Selection
Form Formula	Determine which form design to use in view.
Insert Subform	Evaluates to determine subform to insert
Agent	Select documents to be processed and actions to take on them

Table 5.1 Formula Usages

Special formulas are some specific locations in Notes where formulas can be used. Most of the formulas used are clear and calculate simple results, but some formulas have specific conventions. Some of the special formulas are:

a) Form Formula

These formulas are used to determine which form will be used for composing and are displayed under different condition. This type of formula must result in the name of a form. Form formulas are optional, and if present, are associated with a view, not a form. The formula below will describe the situation in which a button to Brings up a dialog box that displays the current document using a form you specify. The user interacts with the form and document as usual, selecting OK or Cancel when finished

@If(claimtype="Department";@DialogBox("dlgExpItem" ; [AutoHorzFit] : [AutoVertFit] : [NoCancel] : [NoNewFields]; "Claims Details");@If(claimtype="HR";@DialogBox("dlgExpHRItem" ; [AutoHorzFit] : [AutoVertFit] : [NoCancel] : [NoNewFields]; "Claims Details");@DialogBox("dlgExpAdmItem" ; [AutoHorzFit] : [AutoVertFit] : [NoCancel] : [NoNewFields]; "Claims Details")));

@Command([ViewRefreshFields])

b) Input validation formula

An input validation formula can be associated with each field in the form. It is invoked for a document whenever it is saved, recalculated or refreshed. The purpose is to determine whether a field has a valid value which follows the

formula provided. The system will return a result of either @Failure or @Success, and the system will display the error message to the user if the return is @Failure result. The validation formula below is to prompt the user to input data in the StaffNo field.

@If(@Trim(StaffNo)= ""; @Failure("Staff Number is required."); @Success)

c) Input translation formulas

An input translation formula can be associated with each editable field in a form. It is invoked for a document whenever it is saved, recalculated or refreshed. The purpose of the input translation formula is to convert the data input by the user to the format in which the formula applies. For example, the formula below will convert all the data input at Staff Name field to appear as upper case of alphabets.

@UpperCase(Staff Name)

d) Window title formula

This formula will be used to determine what is displayed on title line of the window that shown the document. This formula can vary the title to correspond to data that is within the document. Below is an example of formula which displays New - Expense Claims Form Details for newly created documents.

@If (@IsNewDoc ; "New - Expense Claims Form" ; "Expense Claims Form")

e) Default value formula

This formula will convert the date of creation of the document and adjust it by adding 20 days to the string format. Example: the creation date of the document is 22/07/2002, the formula will convert to 11 August 2002.

Month := @Text(@Month(@Date(@Adjust(@Created;0;0;20;0;0;0)))) ;
@Text(@Day(@Date(@Adjust(@Created;0;0;20;0;0;0))))+" " +@If(Month = "1" ; "January" ; Month = "2" ; "Febuary" ; Month = "3" ; "March" ; Month = "4" ; "April" ; Month = "5" ; "May" ; Month = "6" ;"Jun" ; Month = "7" ;"July" ; Month = "8" ; "August" ; Month = "9" ; "September" ; Month = "10" ; "October" ;

Month = "11" ; "November" ; Month = "12" ;"December" ; "") +" "+@Text(@Year(@Date(@Adjust(@Created;0;0;20;0;0;0))))

a) @Function is used to help the users to automate the processing of documents. There are nearly 200 functions in Lotus Notes and they include mathematical functions, string handling functions, date-time manipulation, list handling, database, security, etc. We can also combine @Function by using in a nested fashion. For example below, system will convert the date of last modified document to the test string and only extract the month which have been adjusted by adding 20 more days to the date last modified.
@Text(@Month(@Date(@Adjust(@Modified;0;0;20;0;0;0)))) ;

5.4 Summary

This chapter focuses on the system implementation of the e - Expense Claims System. Lotus Notes as platform of this system has a lot of useful tools for the system developer and the programming tools available provided alternative to the programmer to choose the most suitable language to manipulate the system's data and export data to the report format. Designer is an integrated application development environment which lets developers and designers create, manage, and deploy secure, interactive applications for the Domino Server.

Chapter 6 System Testing

6.1 Introduction

Software testing is a critical clement of software quality assurance and represents the ultimate review of specification, design, and code generation. Testing can uncover different classes of errors in a minimum amount of time and with a minimum amount of effort. For the development of e - Expense Claims System , various testing techniques were employed and various testing strategies implemented. The strategies used for testing are unit testing, integration testing and system testing.

The objectives of testing are:

a) To executing a program with the intend of finding an undiscovered error.

b) To ensure system reliability and quality.

6.2 Testing Technique

Choosing an appropriate testing technique is important before testing is done. Each technique provides a mechanism that can help to ensure the completeness of testing and provides the highest likelihood of uncovering errors in software. Two type of testing techniques used are White Box Testing and Black Box Testing.

6.2.1 White Box Testing

White Box Testing also known as glass-box testing, is a testing technique which uses the control structure of the procedural design to derive test cases. By using this technique, the developer can ensure:

a) All independent paths within a module have been exercised at least once.

b) Exercise all logical decisions on their true and false sides.

c) Execute all loops at their boundaries within their operations bounds.

d) Exercise internal data structures to ensure their validity.

The main purpose of this technique is to ensure that all details and unnoticed errors are taken care off. Furthermore, it also helps to ensure the developed system is operating according to the specifications stated earlier.

6.2.2 Black Box Testing

Black Box Testing focuses on the functional requirements of the system. This testing technique enables the software engineer to derive sets of input conditions that will fully exercise all functional requirements of the system. It is used to show that the software functions are operating concisely.

The objectives of Black Box Testing is to uncover:

a) Incorrect or missing function
b) Interface error
c) Error in data structures of external database access
d) Performance error
e) Initialization and termination errors

Black Box Testing is not an alternative to White Box Testing. It complements White Box Testing and is likely to uncover a different class of errors. Black Box Testing is usually applied during the later stages of testing which is different from White Box Testing which is performed early in the testing process.

6.3 Types of Testing

The testing process is performed throughout the development of e - Expense Claims System. Testing strategies conducted are unit testing, integration testing and system testing. Unit testing is implemented by testing each program as its own. Different modules are then integrated together and tested in integration testing. Lastly, the system test is conducted and this is a testing of the entire system in an attempt to exercise all processing situations.

6.3.1 Unit Testing

Unit testing is the earliest stage of the testing and focuses on the smallest unit of software design - the software component or module. The component of e - Expense Claims System is the individual form or a collection of document that makes up a function provided by the system.

Unit testing is employed using the White-Box Technique. The module interface is tested to ensure proper information flow in and out of the program unit under test. The objectives of unit testing are to identify and eliminate execution errors and logic errors.

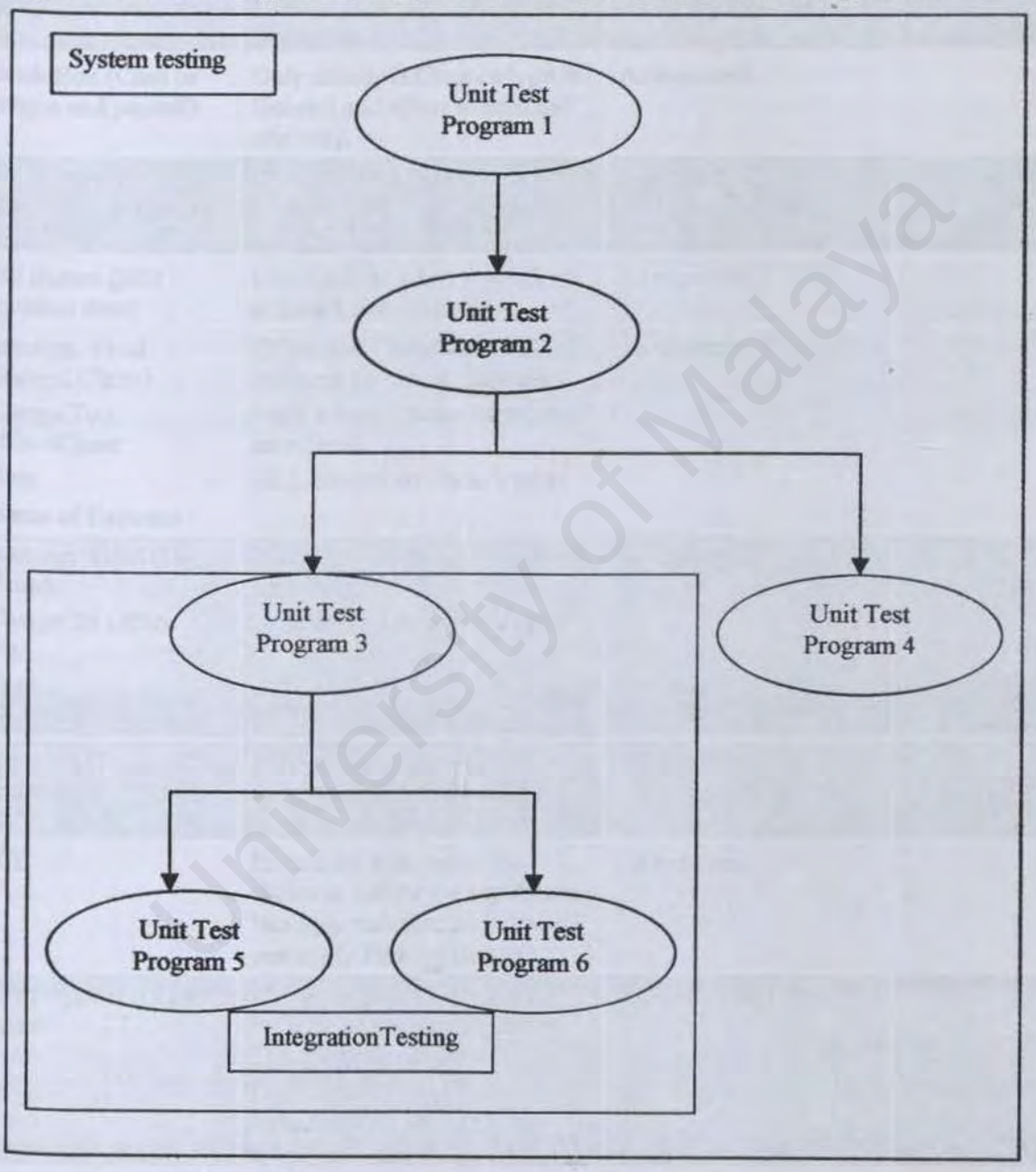


Figure 6.1 Types of Testing

		StaffNo field is input. (Claimant, can pick up from selection list)		
2	Type of claims	Only can select one from General or HR	As expected	
3	Check Box (Cash or Cheque and payroll)	Only unhide if Claim's type is General and allow to selected one only.	As expected	
4	Add Button	Only unhide after user input the staff# field and will pop up Enter Expense form after click.	As expected	
5	Edit Button (Edit expenses item)	Only Unhide when user added at least 1 item expense.	As expected	
6	Selection Field (General Claim) -Charge To Office/Client -Date -Name of Expense	Office and Client field have different names of Expense. Each selected name of expense set a limit ACL control on claim's type.	As expected	
7	Selection Field (HR Claim) -Charge To Office only -Date -Name of Expense	Each selected name of expense set a limit. ACL control on claim's type.	As expected	
8	Approval Detail and History	Display status of the claim, and also the Creator and Last Modified of this claim's form.	As expected	
9	ACL	Ensure the user apply the claims is follow the regulation like only manager and above can apply Parking claims.	As expected	
12	Setup Approval List Button	Follow ACL for Approval must be Manager and above. For verifier must be AO. Base on amount (Claim amount >100 need DIC to approve)	AO can be any one.	
13	Submit Button	Ensure the Setup Approval List detail is filled and save the claims.	As expected	

14	Voucher number	Voucher number is increase by 1 after every application is submitted for each type of claims.	As expected	

2. Edit Document, Canceling request

Item	Test Conditions	Expected Output	Actual Output	Criticality
1	Status of claim is Pending	Can edit all the detail include Approval List.	As expected	
2	Status of claim is Verified	Not allow to edit anything include cancel request.	As expected	
3	Status of claims is Incomplete	Only allow edit expense item and not allow edit approval list and staff #. Resubmit button.	As expected	
4	Status of claims is I am Not Authorise	Only allow edit approval list and resubmit.	As expected	
5	Edit Button (Edit document)	Only unhide to applicant and status of claim before verify or incomplete.	As expected	
6	Edit Approval List button	Only unhide to applicant and status of claim is Not authorize. Only edit approval list.	As expected	
7	Resubmit button	Unhide to applicant only and status is incomplete or before verify. Only work when after edit approval list, mail notification will send to new verifier and also Mail notification will send to existing verifier to inform not longer require verify for the claim.	As expected When edit expense item and click this button will prompt message to Click Save & Exit button to exit.	

8	Cancel Request button	Only unhide to applicant and status of claim before verify or incomplete.	As expected	
9	Close button	Quit the form without save anything and no mail notification.	As expected	

3. Approval Cycle

Item	Test Conditions	Expected Output	Actual Output	Criticality
1	Verify button	Unhide to Verifier and selected Finance personel only. For Verified Change the claims status to verified and mail notification with the appropriate link is sent to approval to inform the claims form is verified. For Finance Personel Change the claim's Finance status to verified no mail notification.	As expected	
2	Incomplete button	Unhide to Verifier and approval (include Finance personel). Change the claims status to incomplete and mail notification with the appropriate link is sent to applicant to inform incomplete of the claim form with status the reason.	As expected	
3	I am Not Authorise button	Unhide to approval only. Change the claims status to unauthorized and mail notification with the appropriate link is sent to applicant to inform the approval is not authorize people.	As expected	

4	Approve button	Unhide to approval only. Change the claims status to approved and mail notification with the appropriate link is sent to applicant to inform the claims were approved.	As expected	
5	Disapprove button	Unhide to approval only. Change the claims status to disapproved and mail notification with the appropriate link is sent to applicant to inform the claims were disapproved.	As expected	
6	Close button	Quit the form without save anything and no mail notification.	As expected	
7	Ready button	Unhide to Finance selected personel. Change the claims status to ready and mail notification with the appropriate link is sent to applicant to inform the claims were ready for collect.	As expected	
8	Collected button	Unhide to Finance selected personel. Change the claims status to collected and no mail notification.	As expected	

4. Other

Item	Test Conditions	Expected Output	Actual Output	Criticality
1	All claims type.	Message pop up to tell user if claims amount above the limit.	As expected	
2	Calculation on claims amount	The claims amount follow the systems profile	As expected	
3	Weekly Update Button	Unhide to Finance role people.	As expected	

	-Staff First Update -Staff Second Update -Manager Update	Collect all claims which Finance Status is Verified, and assign a unique Batch Number.	
4	Generating Report Button	Unhide to Finance role people. Generate a report by select the Batch Number and export the data to Excel (Detail, Payroll and other) and Notepad file.	As expected

Table 6.1 Unit Testing for e - Expense Claims System

Once the unit testing is done, testing can proceed to the next stage, which is the integration testing.

6.4 Integration Testing

When the individual components are working correctly and meet the objectives, these components are combined into a working system. In other words, integration testing is the process of verifying that the system components work together as describe in the system and program design specification.

The Domino Designer Integrated Development Environment (IDE) has successfully overcome the constraints in integration testing. Figure 6.2 shows the IDE environment of Domino Designer.

The interface modules are created at the main portion of the environment. The "Work Pane" on the right is the area of the screen where you actually develop design elements like insert the field, text, button, etc to the form. We can also input the programming code into front-end modules such as fields in the form at the bottom part of "Work Pane" which is "Programmer Pane". The "Programmer Pane" is where the associate programming code to an object within the design pane and its support Notes Formula, Lotus Script, Java and JavaScript. The "Design Pane" on the left consists of a list of design elements and shared resources can be developed to the domino database like form, sub-form, view, navigator, agent, icon file, about database documentation, etc.

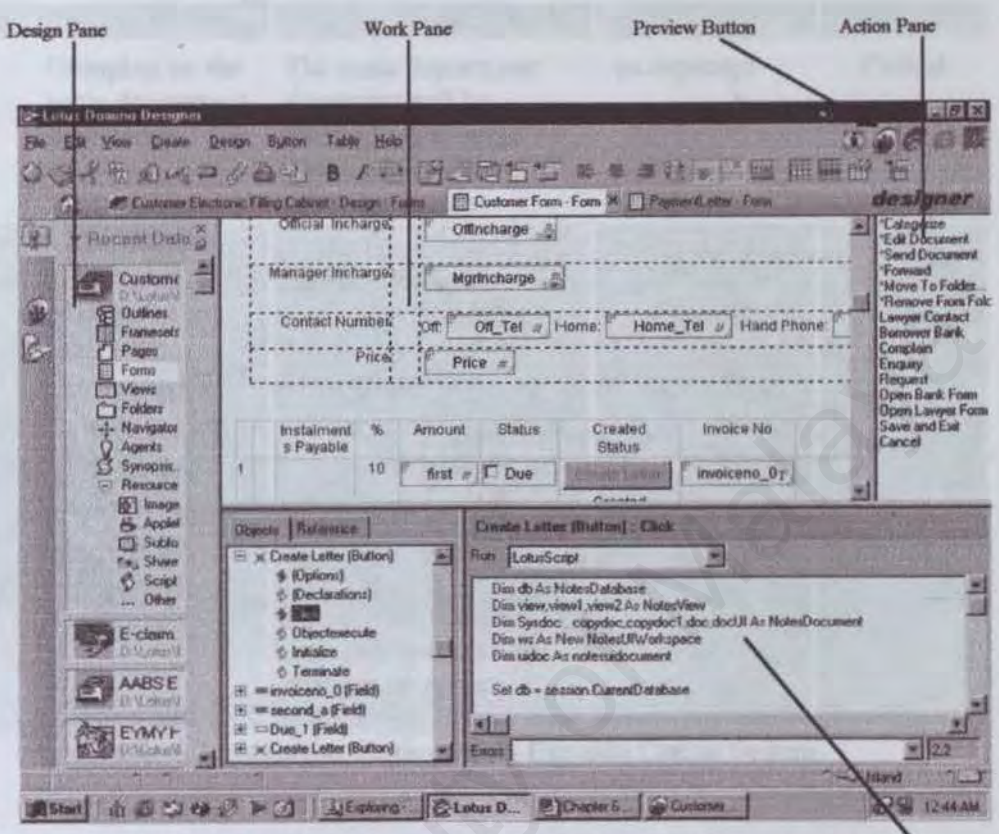


Figure 6.2 Domino Designer Integrated Development Environment (IDE)

The "Action Pane" on the right is to code action in the form. The "Domino Designer Preview" button is used to preview the design on Notes client.

Table 6.2 is an example of integration testing.

Item	Test Conditions	Expected Output	Actual Output	Criticality
1	Navigator for different user role	Each user role can only access their Navigator with their own view.	-as expected-	Critical
2	Display the right information and icon on different view's column based on the	Each column in a view will display different information and icon based on the document type and data.	-as expected-	Critical

	formula provided			
3	Grouping on the same department documents	The same department document will be categorized to same group and separated by other department.	-as expected-	Critical
4	System Profile data extract by other function.	System profile store data needed by other functions like Club selection list and Professional bodies subscription selection/Professional examination list. The profile's data successfully extracted by the respective function to produce their data and save the changes on system profile.	-as expected-	Critical

Table 6.2 Integration Testing for e - Expense Claims System

6.5 System Testing

The final testing procedure is system testing, which is very different from unit and integration testing. The objective of unit and integration testing is to ensure that the codes implement the design properly. In other words, the code is written to do what the design specifications are intended. After all the modules have satisfied the requirement, the system is finally tested as a whole to ensure that it runs smoothly without any interruptions. System testing is designed to reveal bugs that cannot be attributed to individual components, or to the interaction among components and other objects.

The aims of system testing are to perform a final test of all programs against the design specification and to ensure that the end users can interact with the system easily. In addition, the testing process is to verify that all predicted requirements of information system components are fulfilled.

6.6 Summary

System testing is very important to the developed system for it ensures that executes accurately to the specifications and fulfills the user's requirement. The main objective of software testing is to uncover errors and it is considered a critical element of software quality assurance. Approaches taken to achieves the objective are unit, integrate and system testing. Each testing approach plays an important role in ensuring that the system works accurately, is complete and reliable. Almost all the problems encountered have been solved except those involving Lotus Domino limitations.

Chapter 7 System Evaluation

7.1 Introduction

System evaluation is a process of evaluating the developed system to identify the system strengths and limitations. A few suggestions will made as enhance of the system in the future. It enables the developer to evaluate the knowledge gained, problems encountered and solution to problems encountered during development of the system.

During the development process, several problems were encountered in hardware, software interfaces and logic errors in programming the required functions of the system. Most of the problems are solved after doing some additional findings, reading and helps from the online forum like http://www.notes.net and http://www.martinscott.com, Lotus Designer Help files and some other reference books. Improving of the present system and potential enhancements are based on suggestions and evaluations.

7.2 Problems Encountered and Solutions

A lot of system analyses need to be done on technologies and programming concepts before starting to develop e - Expense Claims System. The basic knowledge needed as a foundation in building an application. The following are some of the major problems encountered and the approached taken to solve the problems from the beginning through the end of the system development process.

7.2.1 Lack of Knowledge In Programming Language and Tools

As Lotus Script is the default language of my system's functional requirement and also most of the coding in my system was done using Lotus Script. Learning and developing process were done concurrently to save the development time. Without a strong knowledge based of the Lotus Script, a lot of time has been spent in looking for solutions at Help file to solve the problem that were occurred during the development of the system. Some more not other course mate or senior know this programming or use Lotus Designer as development software cause me solve the problem by myself.

To overcome this problem, much of time spent through the tutorial note and help file example from the Lotus Designer to learning and grasping the new language. And also refer to my friends whose was working in Lotus Designer environment.

7.2.2 Lack of Resources

As Lotus Designer is a very powerful groupware, it is only practiced in big corporate like PriceWaterHouseCoopers Consulting, Petronas Bhd and IBM. It is not common as other programming language like Active Server Pages (ASP) and Java Server Pages (JSP), HTML editing tools like Microsoft FrontPage and Macromedia DreamWeaver, as well as web server like Personal Web Server (PWS). It is not easy to solve the technical or programming problems and not easy to get the resources or reference. And also lack of reference books on Lotus Designer R5 in the University Library, or even in the Market.

This problem was solve by refer to my friend, Mr. Yoh whose working at PriceWaterHouseCoopers Consulting as senior programmer. He borrows the Lotus Designer reference book, some example code and database to me.

7.2.3 Lack of Hardware

Lotus product is a groupware with using network, document database and communication to improve the productivity of the companies. Due to not enough facilities and server in the lab, the early stage of my development of my system is done using my personal computer without network supported. After the system is completed, it needs to transfer into the Domino server at FSKTM and a lot of work to be done to transfer the system. Configuring a Domino server for an intranet required network management technical knowledge, especially this is an organization-based server.

I have to refer to Lotus Domino server user manual and seeking help from my friend, Mr. Yoh to solve this problem.

7.2.4 Lack of Mastery

Because of not much exposure to Lotus Notes environment for those who do not work in big corporate, it has slow down the progress of developing in the early stage of development. But I have getting more familiar to the Integrated Development Environment (IDE) of Lotus Designer after few weeks of development.

7.2.5 Software Limitation

Lotus Notes is a groupware and the client PC must have Lotus Notes client software to access the system. e - Expense Claims System is not similar to web-based system with just required Internet Explorer or Netscape Navigator browser (Free ware) at client PC. Because of the require functions at e - Expense Claims System only can coding by Lotus Script at Lotus Notes which is not supported by Internet Explorer or Netscape Navigator browser. e - Expense Claims System will not be accessible by Internet Explorer or Netscape Navigator browser, and only access by Lotus Notes client software.

7.2.6 Inexperience in Choosing a Development Technology, Programming Language and Tools

Choosing a suitable technology and tool to develop e - Expense Claims System in obvious difficult because there are many software tools available in the market as each of them has its advantages and disadvantages. As for the programming languages, the Lotus Script, VB Script, Active Server Page, CGI, and PHP are the likely candidates to implement e - Expense Claims System. This would further complicate matters. Therefore, seeking advises and views from project supervisor, course mates and even seniors engaging in similar project were carried out to solve this problem.

7.3 System Strength

The e - Expense Claims System has some strong points. The system strengths are:

7.3.1 User-Friendly Interface

The e - Expense Claims System user-friendly interface enables the user and the system administrator interacts with the system easily. GUI component like button, action button, check box, combo box and navigator button are used to minimize the user action while perform certain task. The combo box is used to list all the payment type and bank for the user to choose. The navigator button on the left frame of the main page enables users to navigator and uses the features within the system easily and fast. The instructions to use the system are also very simple and clear.

7.3.2 Validation on Input Data

e - Expense Claims System performs validation on user input and this feature enhances the system reliability and error handling. Certain characters that are not accepted in certain cases are blocked to avoid errors from happening. Like input field for staff number will not accept if user key in any one alphabet, or user forgot to fill up the compulsory field will be prompt with help message by the system.

7.3.3 Access Control List

Access Control List (ACL) is a key security feature of the system. It has Manager, Designer, Author, Reader and each have different access right on their job function. Like who can create document or delete document, who only allow to read the document and not allow writing the document. This will prevent the company's staff change the finance data like payment amount without permission and cause the company loss the money. And also the ACL will add User Role security feature for access the different view for different department. e - Expense Claims System will have Finance, HR role for the respective department staff.

7.3.4 Computed Data Field

e - Expense Claims System applies a lot of computed data, especially at payment and reminder letter's form, invoice form and etc. These computed fields will assign by a default value follow the system coding, and it is depend on the system need or sometime it is data input by the user before to prevent user to re-input. It also prevents unauthorized change on data.

7.3.5 Authorization and Authentication

For ensure the system security, every user will give a user id file with password. Every user must login with the user id file and password before access to the system. Only administrator allows to create the id file for the user.

7.3.6 Systematic Procedure

e - Expense Claims System has a systematic procedure to conduct the data entry task for the staff to input the data. They will request fill in data steps by steps so that they would not got missing in the process of data entering. The error message will prompt the user when user skip the compulsory field or user want to save the document when they still not fill up all compulsory field.

7.3.7 Customized View

The e - Expense Claims System will customize the view for different user roles like finance department view only allow view by finance roles staffs.

7.3.8 Informative Message

The e - Expense Claims System able to alert to user when the system profile is empty, some more the alert message will inform user which filed is empty at the system profile. When the Claimant save a new claim document to the system, the system will generate a unique reference number to each document. If the document cannot get the reference number, the system will prompt an alert message to user about wrong reference number and the save operation will stop. When an agent is successful run or not, an

informative message will be prompt to user and inform the user the Excel file created at which location.

7.4 Current Enhancements

During the process of development, some enhancements are done to the approval cycles that add a verifier. In general, the verifier is the AO/Secretary of claimant's respective department. For claims that route to HR or Admin, the verifier is HR staff in-charge or Admin staff in-charge. Verifier is required to check on the claim application on-line, only when the supporting documents is received.

Application's Receipts/Supporting Doc	Action Taken	System Function
Support & Complete	Click 'Verified' button	The claim status will change to 'verified'. Manager will only review on the claims with 'verified' status.
Not Support or Incomplete	Click 'Incomplete' button and type in reasons	A mail notification will be sent to the claimant. Claimant can resubmit the application after updating the application.

Table 7-1 Verifier job function

7.5 System Constraints

Besides all the positive points of e - Expense Claims System, it also has some limitation and constraints due to time constraints and other factor. The system can be further improved and enhanced to increase the features and functions. The system constraints are:

7.5.1 No Web-Based

The e - Expense Claims System still not ready for web-based system because of the current culture and situation at Malaysia. And also the function of Lotus Script will not support the web browser.

7.5.2 No Search Engine

The e - Expense Claims System does not provide search engine for search documents. If the documents become plenty, users may get lightly difficult to look for the document they needed. Thus, it has customized view for different document to solve the problem and also using search bar functions provided by the Lotus Notes software.

7.6 Future Enhancements

There are some suggestions for the future enhancements:

7.6.1 Search Engine

Create a dynamic search engine specific for e - Expense Claims System and not use the default search functions provided by the Lotus Notes software. This is to prevent time consumed in searching document on a huge documents sea. The requirement of the database usage nowadays and in the future is efficiency. Thus, providing powerful search engine in a database is very important. The capabilities of search engine should be support different query like Boolean operator with not limit the keyword can input by user. Besides that, the system can provided normal and advance search engine, advance search engine able to narrow down the queries according the certain criteria for advance users.

7.6.2 Web-Based System

The system provides a web-based system to allow developer company's customers change their information like mailing address, contact number and other through the internet with any browser. This can reduced the workflow of developer company's staff and developer company's customer can change their information any time at anywhere. This changing function must come with unique user name and password to prevent unauthorized access.

7.7 Knowledge and Experience Gained

A wealth of knowledge and experience was obtained in the development of the e - Expense Claims System. It was very much a learning and application of knowledge learned throughout the development effort. And also the clearer picture of the requirements of an analyst programmer was gained.

To develop a project, time management is very important. A development phrase and milestone must define very clear. After complete this project, knowledge of programming like Lotus Script, design pattern and unit testing and database concept has be learned form this project.

Through the development of the e - Expense Claims System, I have learn how to deploy an organization-based platform tools, including server installation and configurations, security control, access control list and so on. And also experience the process of planning, designing, developing and testing a system.

7.8 Summary

At this stage, e - Expense Claims System has been completed successfully, and the entire functional and non-functional requirements are fulfilled, and also met the objectives as determined during system analysis phase. However, it has its own strengths ability as well as its own limitation as documented.

The improvement made will certainly propel the system to be more versatile and robust. More features will be added into the system in the future enhancements to increase the system effectiveness.

7.9 Conclusion

Overall, the e - Expense Claims System has achieved and fulfilled the system objective as stated in the project scope and specifications. The system able to simplify the filing process to developer's staff, and also to the director to make decisions. Staffs are more time spends on one customer because they would have done their daily work with just simply click on button provided and got the entire necessary document from the e - Expense Claims System. On the other hand, developer's staff workload will be lightening because the e - Expense Claims System has replaced the daily paper work and calculation.

e - Expense Claims System able to save the most valuable asset of the users, which is their time. With the system, the objective of less paperwork can be achieved and more timely information can be made available to customers.

Throughout this project, there was a lot of valuable knowledge and experience gained. As the project progressed, I have learnt to plan time so that the project will be finished on time and within the budget. I also learnt how to analyze and plan before designing a system. All these knowledge and experience will be valuable assets in a distant future and career. Subjects learn in FSKTM such as Programming
Object Oriental, C, C++, System Analysis and Design, Software Engineering was applied in the developing process.

Lastly, the e - Expense Claims System is still expandable in terms of functionality. It is hoped that this system will serve as foundation for more effective and comprehensive system may be built to perform multiple tasks and fulfills various user requirements.

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Table of Contents

List of Figures

List of Tables

Appendix

Part 1 Server Setup Guide

For many installations, especially for workgroup application and mail servers, the Quick and Easy configuration is a good beginning. The wizard fills in default values based on your system settings, but allows you to edit them if necessary. Click Next to go to step three, Server Audience, where you will tell the wizard what services your users will need.

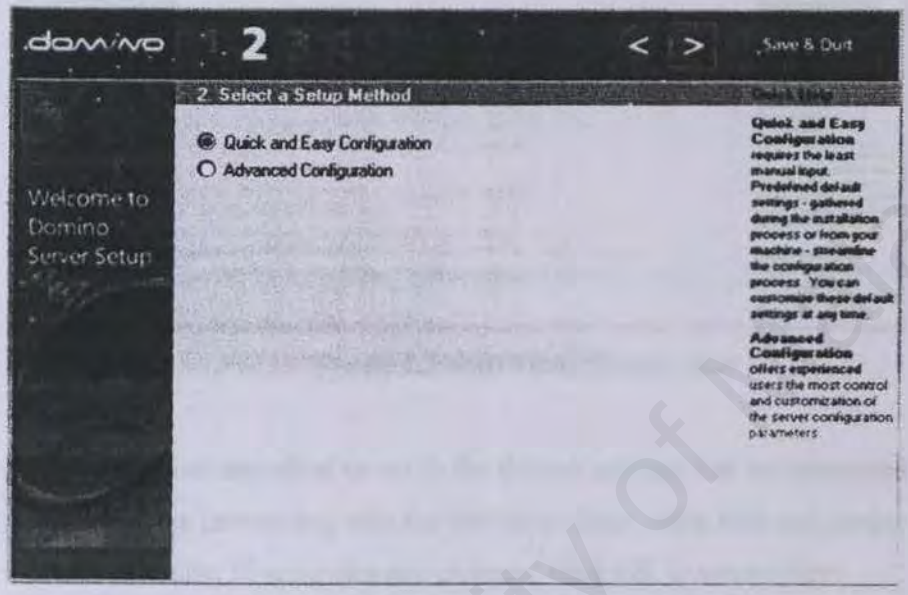


Figure 1.1 Step two screen shot

Step three of the Quick and Easy Configuration allows you to choose what services you would like to make available to users. If you select Web Browsers (for example: Netscape Navigator or MS Explorer), the Domino server will start the http Web server when the server is running. The four options are simple and explained fully in the wizard.

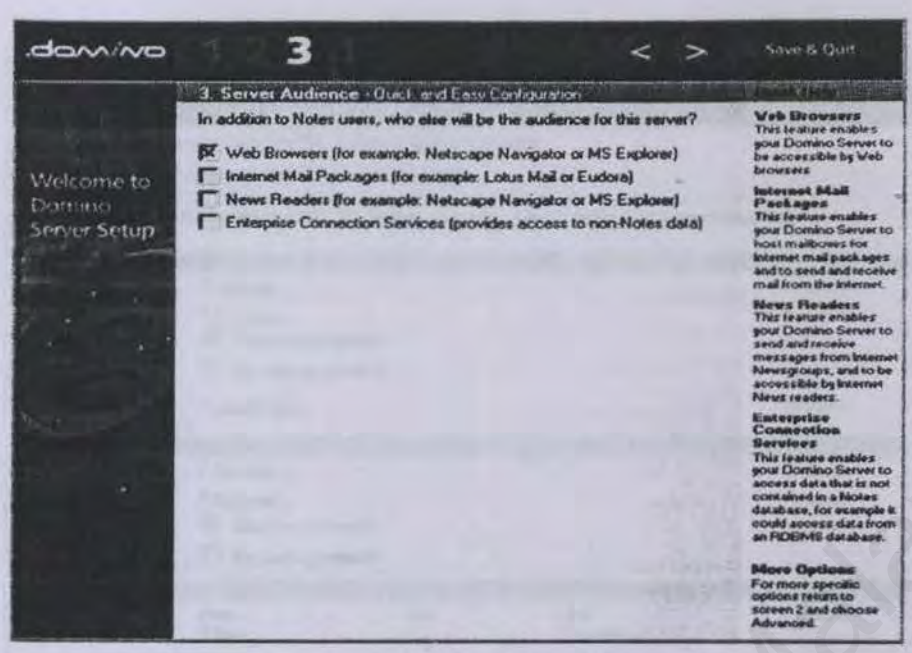


Figure 1.2 Step Three Screen Shot

In step four, you are asked to verify the default settings that are presented by the wizard. Before proceeding with the default settings, click Edit and review all of the options carefully. If you make any changes, click OK to accept them.

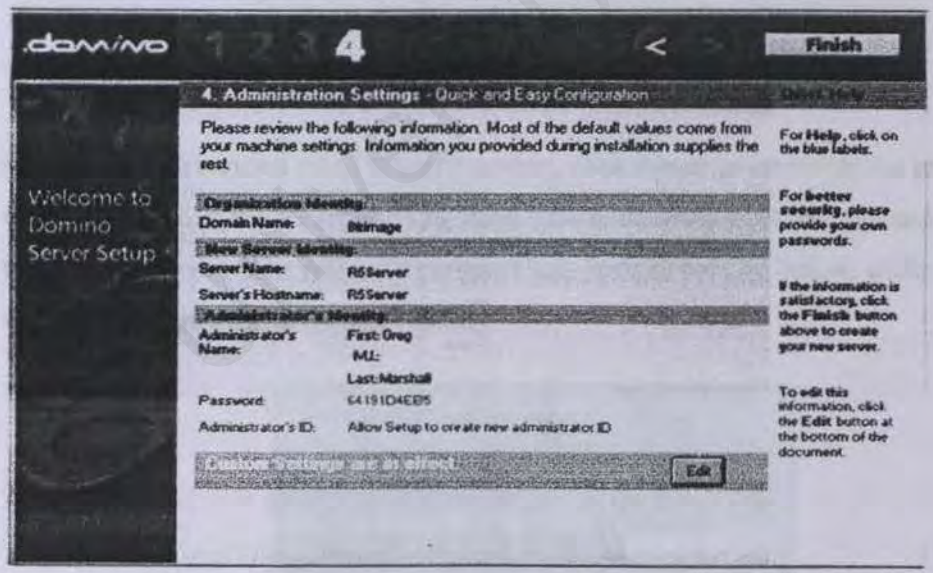


Figure 1.3 Step Four Screen Shots

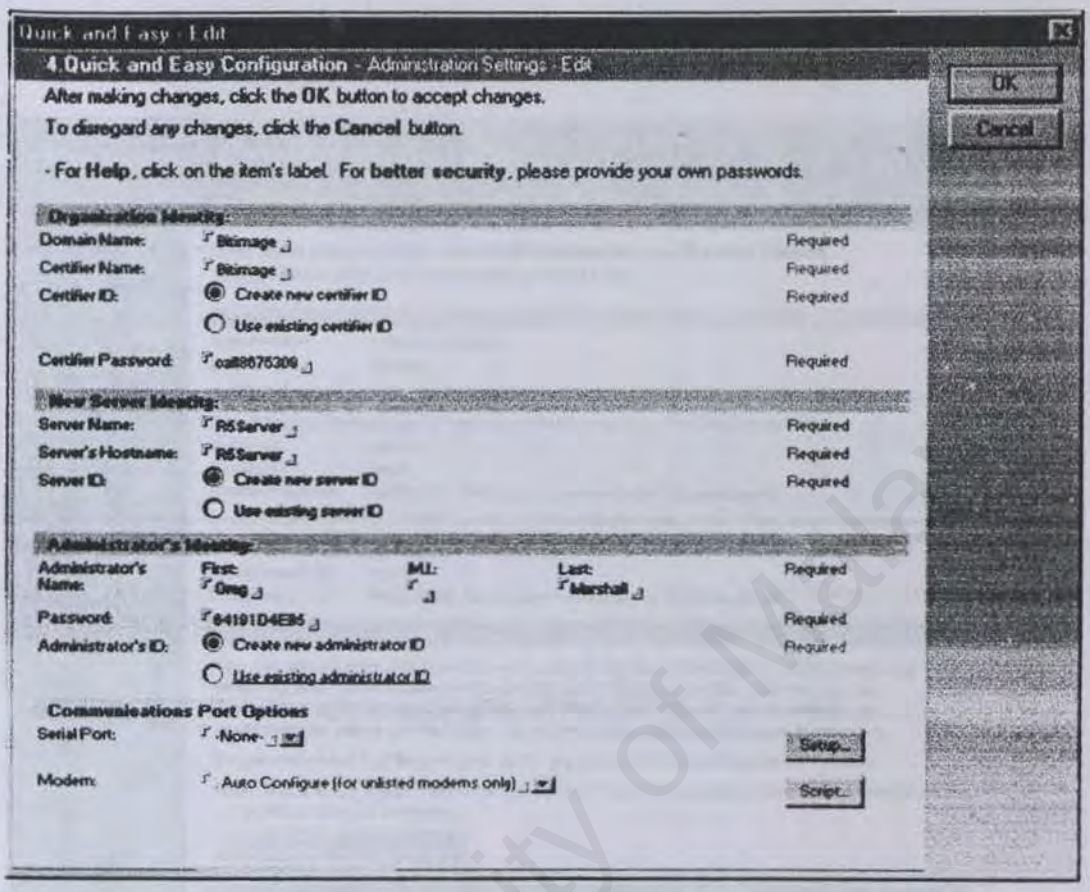


Figure 1.4 Administration setting

Once you have verified all of the information, click Finish to complete the process. Clicking Finish in the server configuration wizard finalizes your settings and applies them to the server. You will see a progress bar, such as the one below, while the configuration settings are being written.

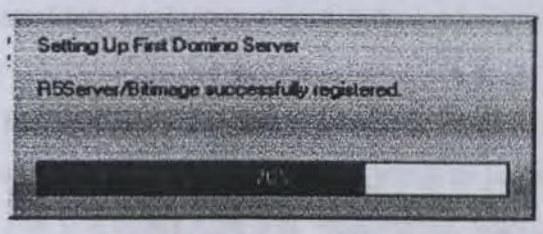


Figure 1.5 Server registered

Once the wizard has finished applying your configuration to the server, you will be given a summary of your configuration of the new server. It is a good idea to record

this information and keep it in a safe place. An example summary is shown below. Note that you are given the option to Set Access Control List Entry by a button in the the summary screen.

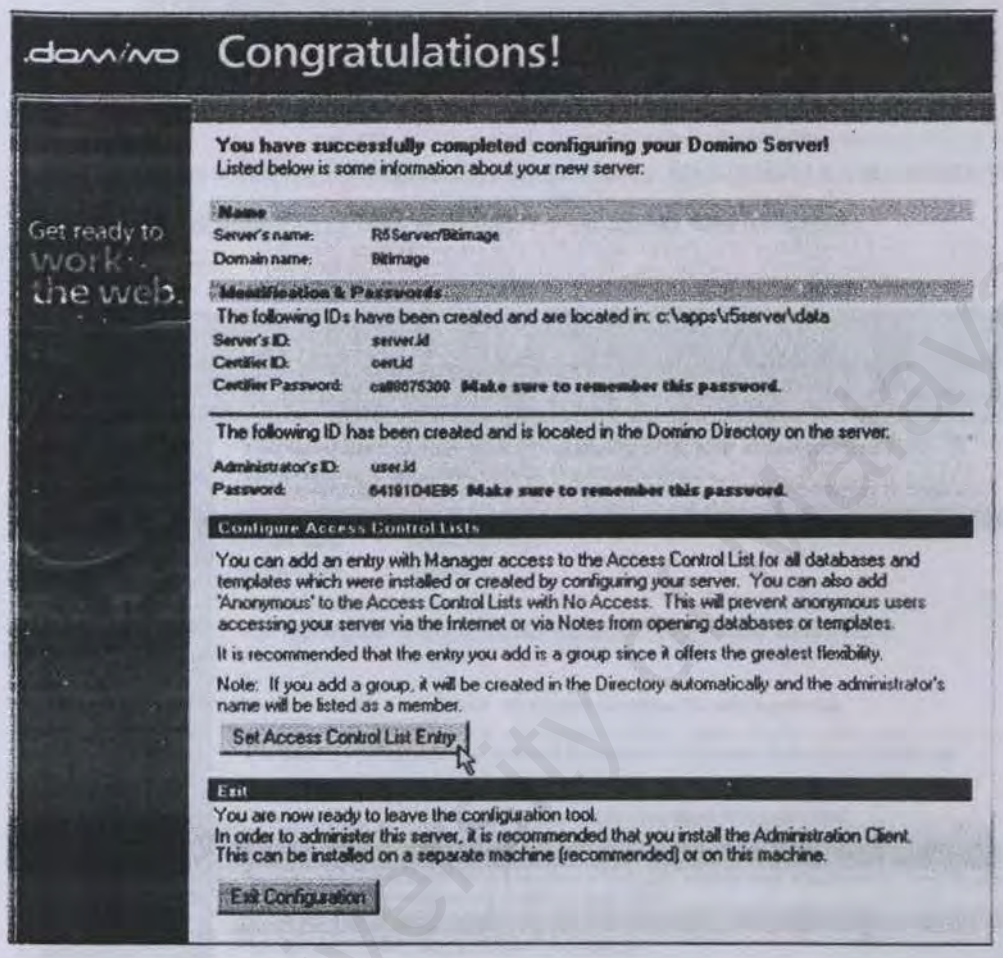


Figure 1.6 Configuration Summary Screen Shot

If you are setting up the first server in your domain, it is recommended that you modify the access control lists of all system databases and templates to include the Administrator. To do this, click the Set Access Control List Entry button shown in the picture above. When the Set Default Database Access dialog box appears, select Add a group or Add a person, and enter the name of the group or person in the text field. It is also recommended that you select Also add 'Anonymous' with No Access. This ensures the greatest security and can be modified later if anonymous users need to access a database application or your directory.

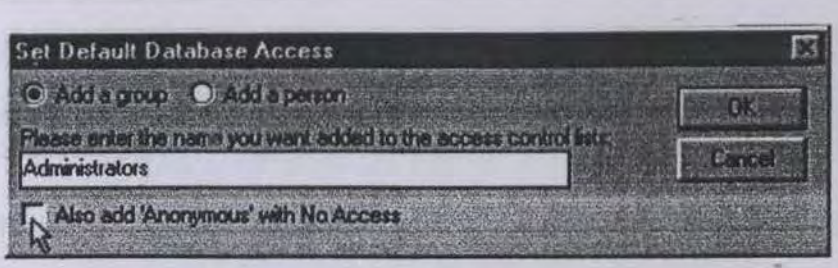


Figure 1.7 Set default database access

Click OK. You will then be returned to the summary information screen where you can see that Administrators was added to 74 databases and templates.

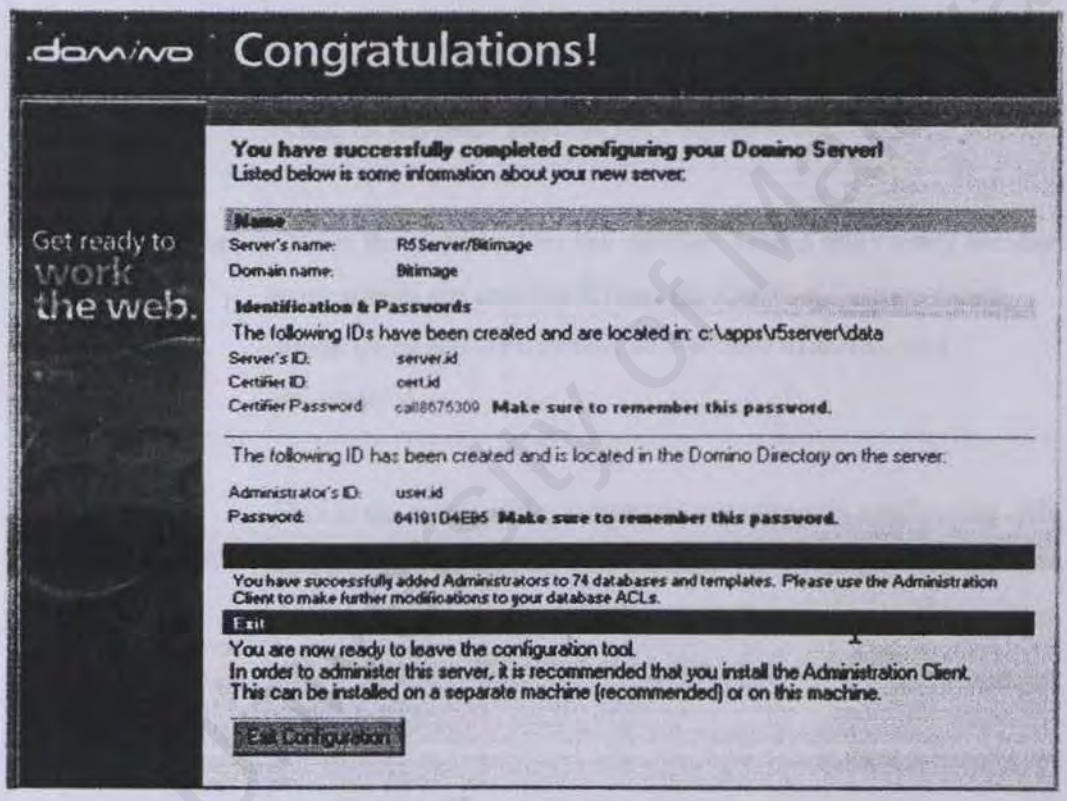


Figure 1.8 Configuration Summary Screen Shot 2

Congratulations! You have completed setting up and configuring your server.

Setting	Explanation
Domain Name	This is the name of your domain. Domain names usually affect messaging and the naming of users and servers in your organization. Most of the time it is best to use your company name as the Domain Name. Avoid using spaces in the name.
Certifier Name	This will be the file name for your domain certifier ID. If you enter "Acme" here, the ID file for the Acme domain will be acme.id. To avoid confusion, it may be best to have the Certifier Name be the same name as the Domain Name.
Certifier Password	This is the password for the certifier. Guard this closely because anyone with the certifier ID and the Certifier Password can create users and servers that will be able to access your information.
Server Name	This is the name of the server you are currently configuring. All servers must be named. The Certifier Name will be appended to the name of the server. It is best to make the Server Name short and descriptive, but avoid using spaces. (i.e. Sales1 or NYCMail1)
Server's Host Name	If you plan to have this server be part of an intranet which Web browsers, POP3 mail clients, and USENET newsgroup readers will be allowed access, you may wish to register this server with the DNS server for your organization. For example, when a user tries to access the server sales1/acme with a Web browser, the DNS server will know to find it at IP address 108.3.92.20. You may enter the server name here, or use a more typical "internet-like" name such as "intranet.acme.com"

Server ID	If this is a new server (you are not upgrading or replacing a server) you will need to have the setup process create an ID file for your server. Select Create new Server ID if you do not have one already. The setup wizard will put a file named "server.id" in the server data directory. Typically, server ID files do not have passwords, but one can be assigned later for additional security.
Administrator's Name	This is the name of the user who will be set as the administrator by default. If this is an additional server in your domain, make sure you use the exact name of your current administrator as it appears in the Domino directory.
Administrator's Password	This password gives access to the administrator ID. Since the administrator has a variety of privileges by default, it is wise to guard this information closely.
Administrator's ID	If you are setting up the first server in your domain, select Create New Administrator ID.
Serial Port	If users will have access to the server via modem, choose the serial port where the modem is connected. Please note that this is for a direct dial-in connection to the server, not to your company network.
Modem	Choose the type of modem that you have connected to your server. If the modem is not listed, you can choose one of the generic modem profiles. It is recommended, however, that you contact the modem manufacturer and obtain a Domino modem driver (which is actually a text file with the .mdm extension).

Table 1-1 Setting Explanation

User Guide Part 2

1.0 INTRODUCTION

1.1 Overview

Electronic Expense Claims System is an electronic system that streamlines the process of claims application, verification, approvals, reports preparation, updating requested payment. This user manual will guide you through on how to use all of the functions available.

1.2 Views

All the information has been arranged according to the views specified below. The view are cateogorize into 3 major groups i.e.

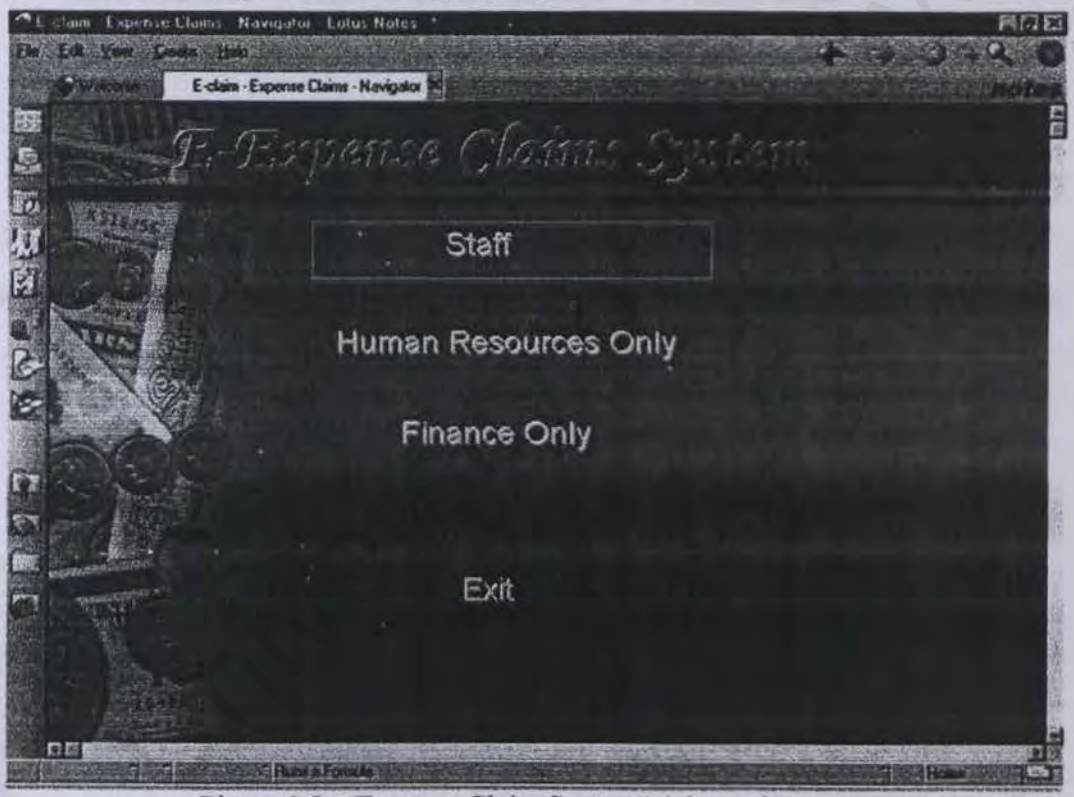


Figure 1.9 e-Expense Claim System Main navigator

- **STAFF VIEW** - View that can be accessed by all staff.
- **HR VIEW** - View that can be accessed by Human Resources Staff in-charge.
- **FINANCE VIEW** - View that can be accessed by Finance Staff in-charge.

2.0 FOR ALL STAFF

2.1 Claims Application Module - The claims application are divided into 2 different route i.e.

1. **Department** : ***Claimant Department → Finance Dept***
Department route expense claims are claims that required claimant's respective department's verifier and approvals verification and approvals.

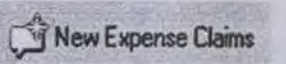
The department route expense claims application that can be done within this module are claims **charge to office** i.e. Meal allowance, mileage, transport(includes OTA, Office travelling), toll, outstation, accommodation, Canteen, Postage, Repair\Maintenance, Upkeep Motor, Periodicals\Books, P\Stationery, Photocopy, Conference, Filing, Computer, Telephone, Staff Welfare, Training, canteen, contra, entertainment and others; **claims charge to client** i.e. Mileage, Transport, Parking, Lunch, Dinner, Outstation(includes Daily allowance, selective allowance), Entertainment, Filing, P/Stationery, Photocopy, Courier, Postage and Others. Entertainment expenses is only applicable to Manager and above.

2. **HR** : ***Claimant → Human Resources Dept → Finance Dept***
HR route expense claims are claims that required HR department's verifier and approvals verification and approvals.

The HR route expense claims application that can be done within this module are claims charge to office i.e. Professional Subscription Fee, Charge Card, Club, Car loan Interest, Medical claims, Student Claims - Registration, Subscription, Exam Fee, Exemption, Tutorial Reimbursement, Others.

2.1.1 To compose a claims requisition

1. From main view, select Staff.

2. Click on **New Expense Claims** button 

. A blank electronic claims application form is launched.
3. Claimant search for his/her information from the box by clicking on button .

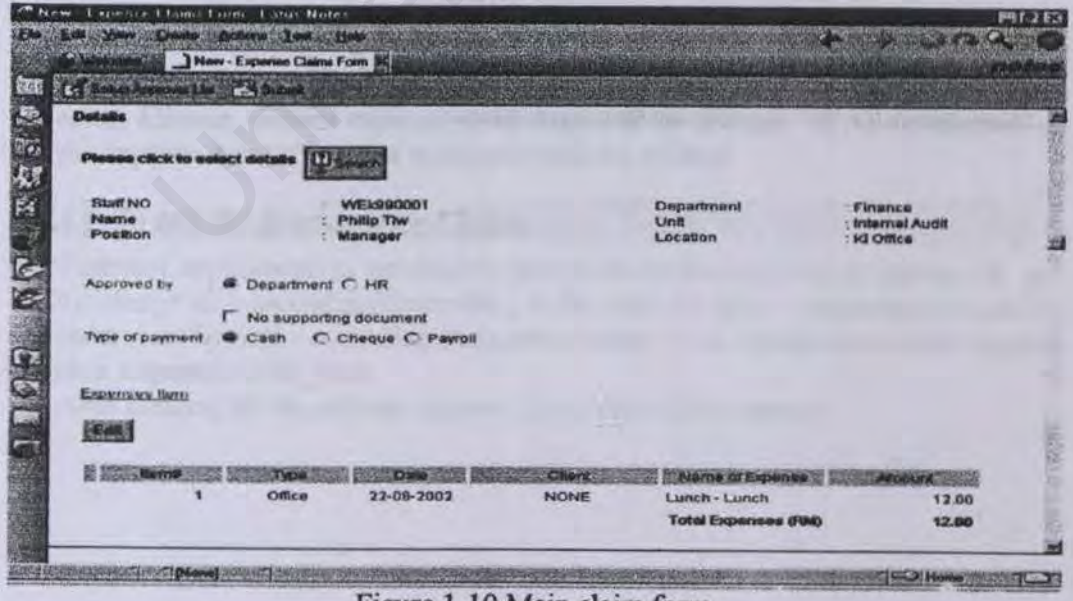


Figure 1-10 Main claim form

4. Select **Approved by** - There are three option to select i.e. Department or HR.
1. If there is no supporting documents attached, check on
   ☒ No supporting document
2. Click on **Add** button. An 'Claims Details' dialog box will prompted.

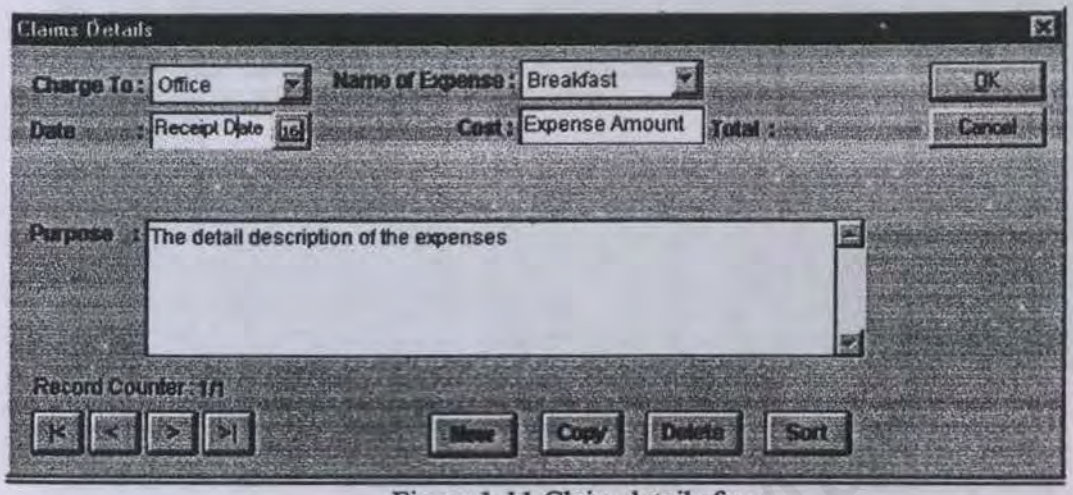


Figure 1-11 Claim details form

2.1.2 To create a New expense claims items

Steps :

1. Click on **New** button - to create an environment to fill in expense claims.
2. Select **Charge to** and **Name of Expense** - Claimant can click on the arrow button ▼ beside individual field to select appropriate claims details.

2.1.3 Common Function in Claims Details window

2.1.3.2 To delete all or certain current expense claims items

Click on delete button - there will be two selection :- 1. Current 2. All. If one select Current, current expense claim item will be deleted. If All is selected, all the expense items of current application will be deleted.

2.1.3.3 To sort the expense claims items

Claimant are allowed to sort their expense claims items as below options i.e. sort by charge to - ascending/descending order, sort by date - ascending/descending order, sort by cost - ascending/descending order, or to change the current expense item sequence to the front.
After creating all the relevant expense items click OK to accept.

2.1.3.4 To look at each claims items within 'Claims Detail' window

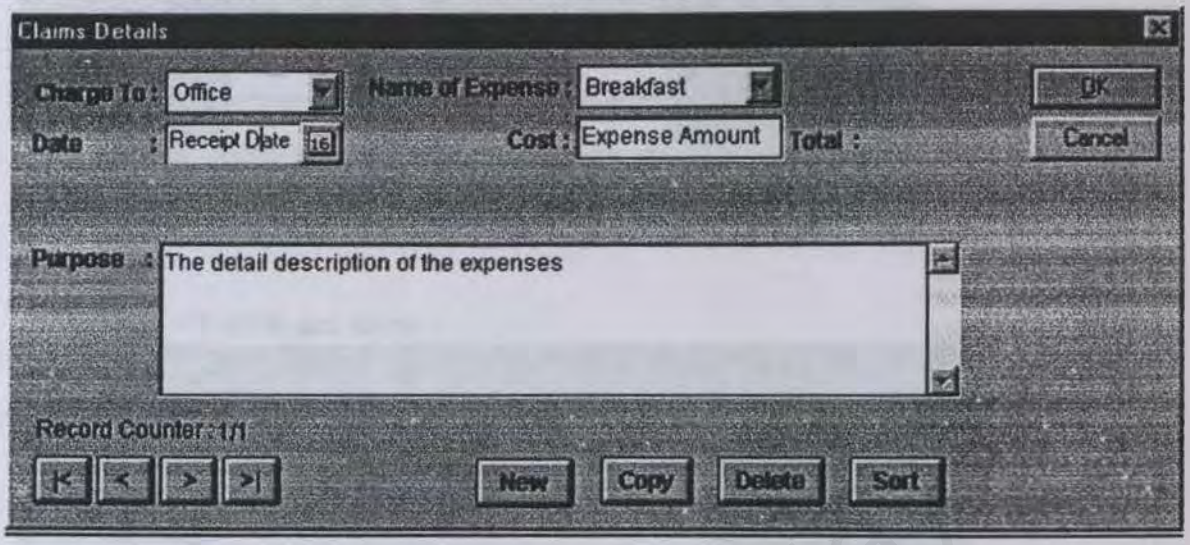


Figure 1-12 Claim details form 2

Claimants are allowed to scroll between claim items if the application has more than one claim items. Click an arrow for the direction you want to scroll.

 - To the 1st claims item's details.

 - To the claims item's details prior current's claims item.

 - To the claims item's details after current's claims item.

 - To the last claims item's details.

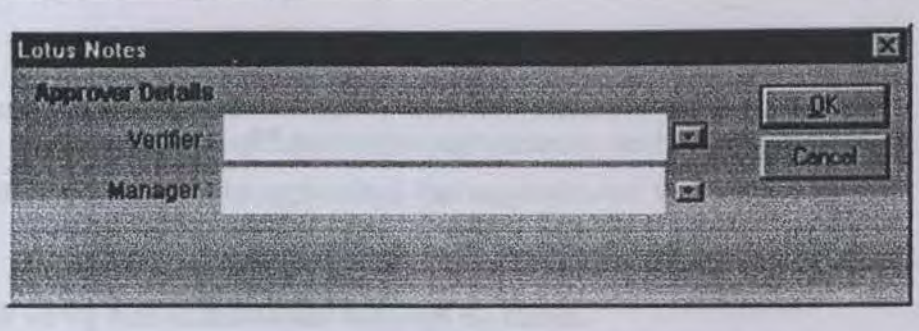
2.1.4 To setup approval list

1. Click on the Setup Approval List 

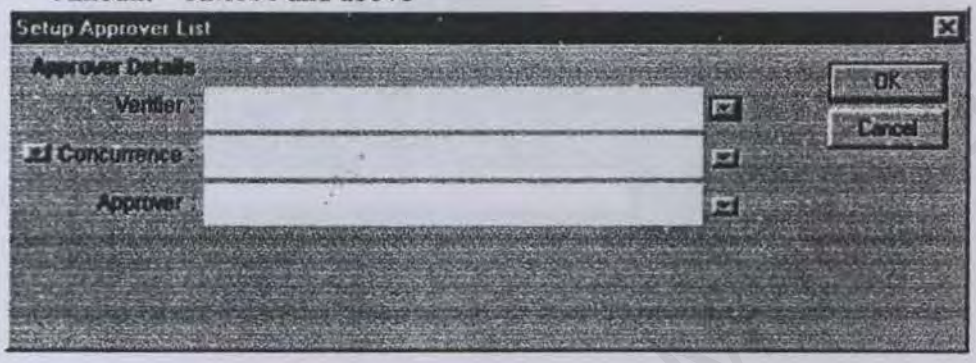
to specify the verifier and approver you need to go through. Setup box as below will prompt :

2.1.4.1 Normal Staff

I. Amount < RM100



II. Amount = RM100 and above



2.1.5 Edit a document

Claimant is allowed to edit the document for all type of transaction before verifier has verified the claims application or the application has been rejected by the verifier or approver. To edit document:

1. Select the document from the view, double click on that document to enter the document. Click on Edit button 

2. If required to modify the expense items, click on the Edit button.

3. After edit, click resubmit button 

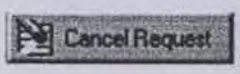
to resubmit the claims.

2.1.6 Application Cancellation

Claimant are allowed to cancel their claims application.

To do cancellation:

1. Open the document that you want to cancel by double clicking on the document.

2. Click on the Cancel Request button 

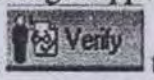
the application will be cancelled.

3.0 For verification

Once the supporting documents or mail notifications are sent to the verifier, he/she can accesses the correspondent claims application to verify the application.

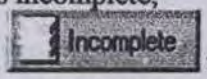
Verifier can view all the applications that require his/her verification only.

If there is enough supporting document and the details are correct,

click **verify** button 

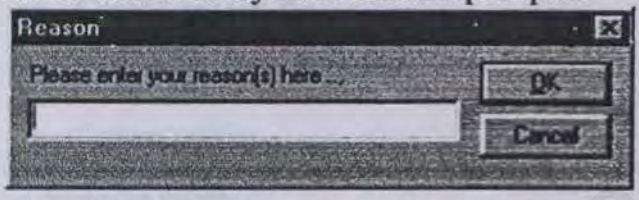
to accept the claims.

If there the application is incomplete,

click **incomplete** button 

to reject the application.

A dialog box for verifier to key in the reason is prompted.

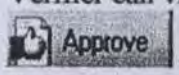


III. Click OK. A mail notification upon rejection sent to the claimant.

4.0 For Approval

Once the supporting documents or mail notifications are sent to the approver, he/she can accesses the correspondent claims application to approve the application.

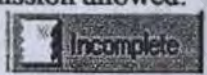
1. Verifier can view all the applications that require his/her approval only.

□ 

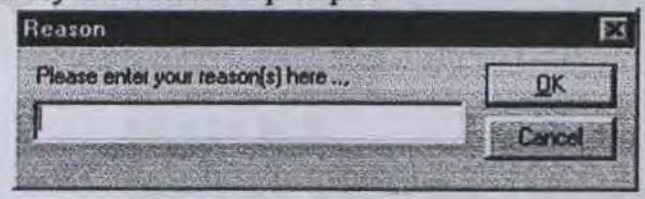
- Click Approve button to approve the application. A mail notification upon approval is sent to the claimant.

□ 

- Click Disapprove button to disapprove the application. Once it is disapprove, a mail notification upon disapproval is sent and no editing or resubmission allowed.

□ 

- Click Incomplete button to reject the application. A dialog box for verifier to key in the reason is prompted.



Click OK. A mail notification upon rejection is sent to the claimant. Claimant is allowed to edit the document and resubmit.

- Click I am not authorised button if you have not the appropriate person to approve the application. Once this button is click a mail

notification is sent to the claimant. Claimant is required to click on edit button to edit the setup approval list.

5.0 For Human Resource Representative

5.1 System Maintenance

HR Department is responsible in maintaining below list for application purpose which are as follows :

- Club Selection List
- Credit Card Profile
- Professional Body
- System Profile

To update the profile by,

1. Click on **New Entry** Button to compose a blank maintenance form.

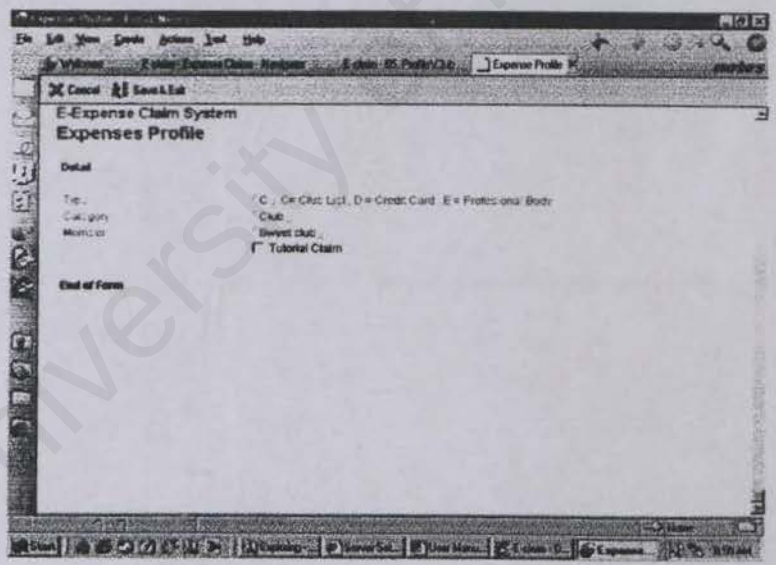


Figure 1-13 ExpensesProfile

2. Fill in the fields.
3. Click on **Save & Exit** button to save the record, or click on **Cancel** button to abort.