**Faculty of Science Computer and Information Technology**

**University of Malaya**

**Session 2001/2002**

Phone Directory Information System

PDIS

By

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## Abstract

This project can be define as a system, which attempts to communicate with the outside, and inside flow of information stored and provide the functions common for all applications. This information system allows users to perform their intended tasks such as information searching, sending email or messages and on the other hand, lets the authorized administrators to update the data stored. The rationale behind this development is to eliminate all the difficulties faced when trying to search through the conventional channel, i.e. flipping through paper documents or files.

A combination of waterfall model and prototyping model approach was selected for the development process because it supports for the rapid application development and reduces the risks. Software engineering principles based on this methodology were applied throughout the development phases. These include system analysis, system design, system implementation, system testing and evaluation phases.

The main development tools for this project is Visual Basic 6.0 programming language and the backend database used is Microsoft Access 2000 with Windows 98 as the operating system.

## Acknowledgement

I would like to take this opportunity to express my gratitude to all those who have helped and guided me during the development of this project.

First, I would like to thank my project supervisor, Ms Rafidah Mohd. Noor, for her invaluable guidance, reviews and advises throughout the project and my moderator, Mr. Woo Chaw Seng, for his suggestion, which really help in improving the performance of the project.

Second, I would like to express my thanks to my family, for their support and inspiration. They have always be with me whenever I am frustrated.

I would like to express my utmost gratitude to my friends, Loy Liang Liu, Kok Wai Ling, How Shih Wei, Looi Hsu Hsin, Chan Chee Yong, Lam Wei Li and Wang Chan Min. I thank for their help in advising me throughout the project.

Last but not least, sincere thanks to all lecturers in Faculty of Computer Science and Information Technology for sharing their time and knowledge with me.

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# Chapter 1

## 1.1 Project Overview

Phone directory information systems that contain information such as a person address, telephone number and etc have been built up. Traditionally, phone directories, just like the "Phone Book Guide" by Telekom, Malaysia, which is printed product, are operated manually to find information. With the existence of computer system it could curb this problem. Examples for the phone directory systems are small phone directory information system for personal use, phone directory information system for companies that stores information on business, for faculty, which stores students' information and etc. Apart from that, there are online phone directory information systems that stores information all over the country or even worldwide.

Such phone directory information systems are said can replace printed telephone directory books that take a quantity of times to do searching if it involving a long list.

Phone directories information system, which would be developed, is for company use. It enables the users to do searching more efficiency with the help of computer technologies.

This system enables the users to search information and also data

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manipulation such as data adding, data deleting and data updating. Besides, the system also provides the information sorting function and the e-mail and message facilities.

In the process of searching, system provides several optional search keys. A common interface will be designed that make the users to feel user friendly when using this system. So, the first task is to build and refine an interface that will not only increase the usability of the system and simplify the steps that users have to go through but also enhance the interface as well as provide sufficient information to users.

Besides, feature like Help will also provided in order to guide users in using this system when they face any problems. Also instructions on how to do a search will be given.

## 1.2 Objectives

The overall objective of this project is to build and implement a phone directory information system for companies' use.

The objectives of the project include:

- To offer a comprehensive and computerized phone directory information system in order to increase efficiency in information searching and retrieving.
- To take away manual works and will enable users to retrieve information via a click of a button.
- The information stored in a computerized system will be more manageable and reachable.

## 1.3 Scope

This system is designed for companies' use to store their employees and customers records.

The phone directory information system will include the following features:

i. Develop a database system to store and organize all records pertaining to the system.

ii. Only users with valid usernames and passwords are allowed to Add, Update and Delete data stored.

iii. Besides, for security purpose, only valid users will be able to access to the system.

## 1.4 Target Users

There are two categories of users that have authority to access the system. They are administrator and the end user.

***End user***

Those only have the authority to access certain modules and they are not allowed to do any updating of data that stored in database.

***Administrator***

Responsible on the database records maintenance such as adding, editing and deleting. Their roles include giving users an authority access right and in the same time control the accessibility level of the users.

## 1.5 Proposed Project Schedule

Chart 1 is the proposal schedule whereby a literature review was conducted, a user requirement study was carried out and an initial system design was proposed. The project started on 15 June 2001. With semester 1 coming to an end, chart 1 depicts the details.

| Task | Start | End | Jun '01 | | | | Jul '01 | | | | Aug '01 | | | | Sep '01 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Literature review | 25/6/01 | | | | | | | | | | | | | | | | | |
| User requirement study | 2/7/01 | | | | | | | | | | | | | | | | | |
| Initial system design | 16/7/01 | | | | | | | | | | | | | | | | | |
| Project proposal documentation | 11/6/01 | | | | | | | | | | | | | | | | | |

***Chart 1*** *Gantt chart for the project schedule*

Gantt chart 2 shows the proposed schedule for the project from November to February. The comprehensive development will start on early of November 2001. Changes on the interface design will be incorporated from time to time.

| Task | Start | End | Nov '01 | | | | Dec '01 | | | | Jan '01 | | | | Feb '01 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 |
| Comprehensive design and development | 03/11/01 | | | | | | | | | | | | | | | | |
| Implementation | 20/12/01 | | | | | | | | | | | | | | | | |
| Testing | 08/01/01 | | | | | | | | | | | | | | | | |
| User training | 19/01/01 | | | | | | | | | | | | | | | | |
| Project documentation | 04/11/01 | | | | | | | | | | | | | | | | |

***Chart 2*** *Gantt chart for the proposed project schedule*

## 1.6 Expected Outcome

The following will be expected from the project by the end of the project schedule:

i. System developed will fulfil user requirements.

ii. System can function well on different search key options. For example, if user using option code instead of name to do searching, the system still can provides appropriate information for user.

# Chapter 2

## 2.1 Introduction

Literature review is a research study about the knowledge and information needed to develop a project. Research is a systematic and goal-oriented investigation of facts that seeks to establish a relationship between two or more phenomenon. This is because most of the conclusions are based on systematic and goal-oriented research. The materials obtained can be in the form of journals, conference papers, proceeding, symposium technical reports or articles available from Internet.

Research and analysis have to be done before the development phase of the proposed system can be initiated. Background investigation on existing available system is crucial at project planning and determining scope of the system. Extensive research is conducted in several areas that include; the available programming technologies, programming languages and databases. The main objective is to acquire the essential knowledge in giving the correct techniques and methods in implementation and design stage.

## 2.2 Research and Finding Methods

An understanding of finding techniques or methods is essential to project success.

Finding techniques:

- Visiting to company (Review of the current situation)
- Reading and summarizing written material
- Information via Internet
- Interview
- Observation
- Brainstorming

## 2.3 Background Survey

It has always been a wise way to create a good solution by looking at existing one. Survey has been done based on information system that used by organization that I have visited and through foreign web sites.

### 2.3.1 University of Oregon Phone Directory

**URL http*: //duckweb.uoregon.edu/telecom/directory.html***

This web site is created for University of Oregon. It has a simple and user-friendly interface. It enables search for staff, student and department information.

Strength of the system:

- Provide help and example on how to do a search.
- Good design of user interface.
- Allow "middle initial" search option to narrow the search. (for staff and student search)
- There is not too much information placed in a single page, short download time is required.
- Uniform security and integrity controls.
- Allow updating or changing of information by authorized user only.
- A fast search result downloading despite the search result is a long list.
- Provide search for information of police or ambulance too.

Weakness of the system:

- Too few search options. Only by name (for staff and student) and by keyword (for department)
- The layout is too plain.

### 2.3.2 Customer Directory, Sentul Video Centre

The system used in Sentul Video Centre is a purchased software solution. The system runs on windows environment. This system is for internal use. The system used is categorized to several sections include customers section, the section that function like a phone directory information system that allowed search for information about a particular customer. Figure 2.1 shows the main screen of the system and figure 2.2 shows the customers' section screen.

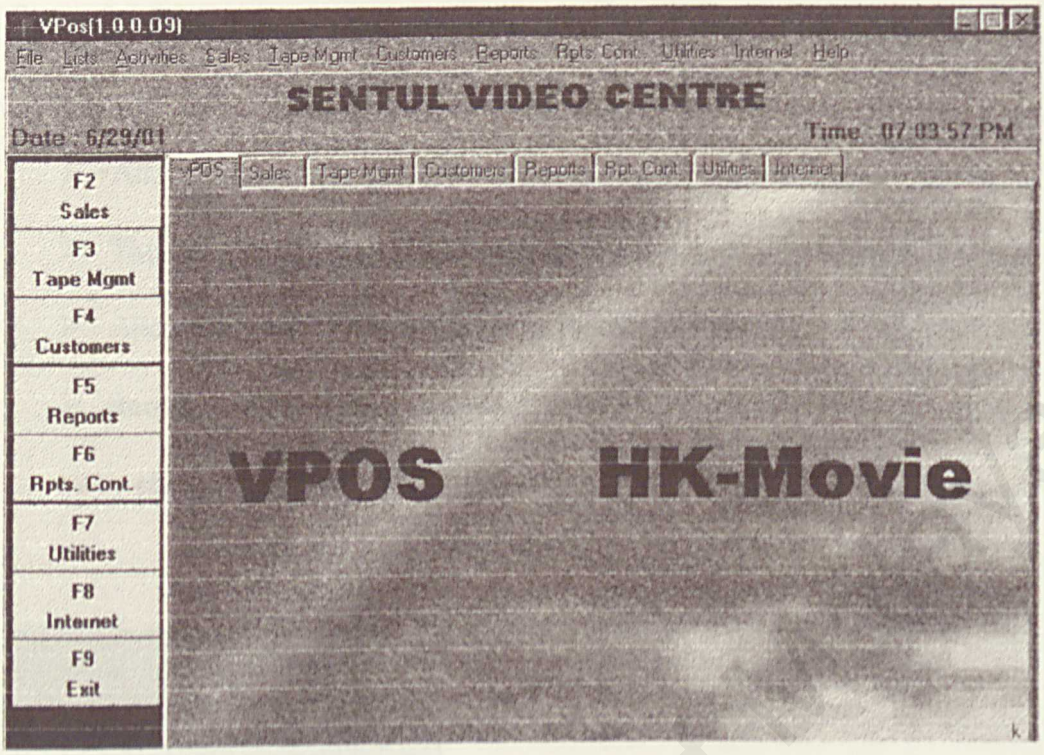



*Figure 2.1* *Main Menu Screen of The System*

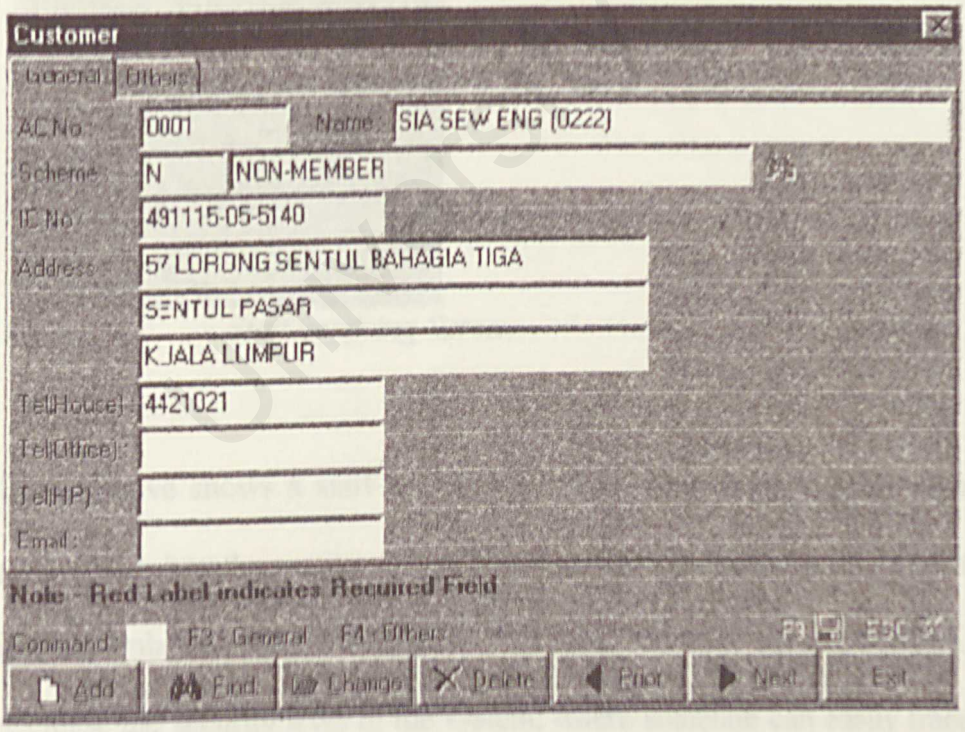



*Figure 2.2* *Customer Screen*

Strength of the system:

- Good design of graphical user interface (GUI).
- Allocated several search options, including by name and by ACNo.
- The layout is clean and simple. Easy to understand and use.
- Allow authorized users to gain access to the system.
- Require addition user name and password authentication before a user can make changes to the existing data.

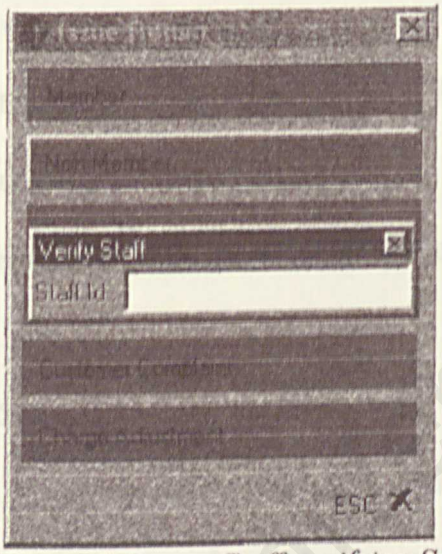



***Figure 2.3*** *Staff-verifying Screen*

Figure above shows a staff-verifying screen. An user has to enter id before can gain access into the system. There is a disadvantage of this kind of verifying, that is, the number of characters required for Staff Id can be as small as one. This will decrease the security level of the system, where someone can easily trace the Staff ID.

### 2.3.3 Student Directory & Teacher Directory, Sonata Music & Art Sdn. Bhd.

The software used in the company also a purchased software solution. The system is designed for all the branches of Yamaha Music Sdn. Bhd.. The system runs on Windows environment and Microsoft Access 97 as its database management system. The system is not designed for the purpose like what a phone directory information system do, but rather for store student information as well, including courses attended by a student. Although it was not designed for that purpose, it allowed search for particular information, just like what a phone directory information system do. Figure 2.4 shows a related student master record screen and figure 2.5 shows the teacher particulars screen.

Strength of the system:

- Required information is displayed on screen or is just a mouse click away.
- Only authorized user can access the system.
- Provides warning message for any abnormal action.
- Allows updating or modifying of data in the same module (teacher particulars sub-module)

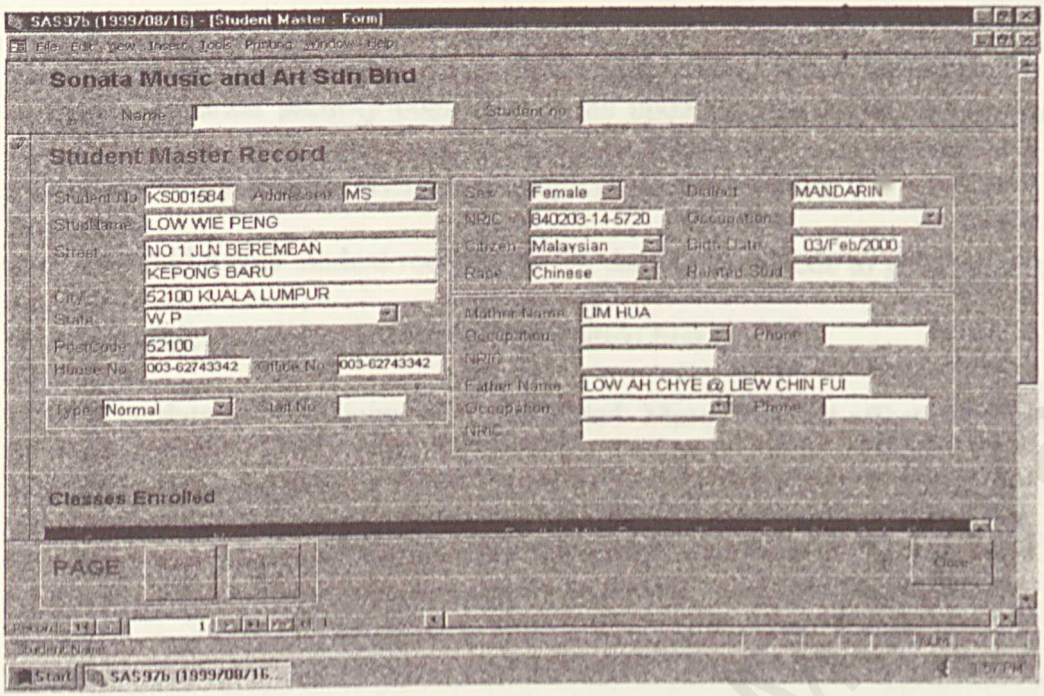



***Figure 2.4*** *Student Master Record Screen*

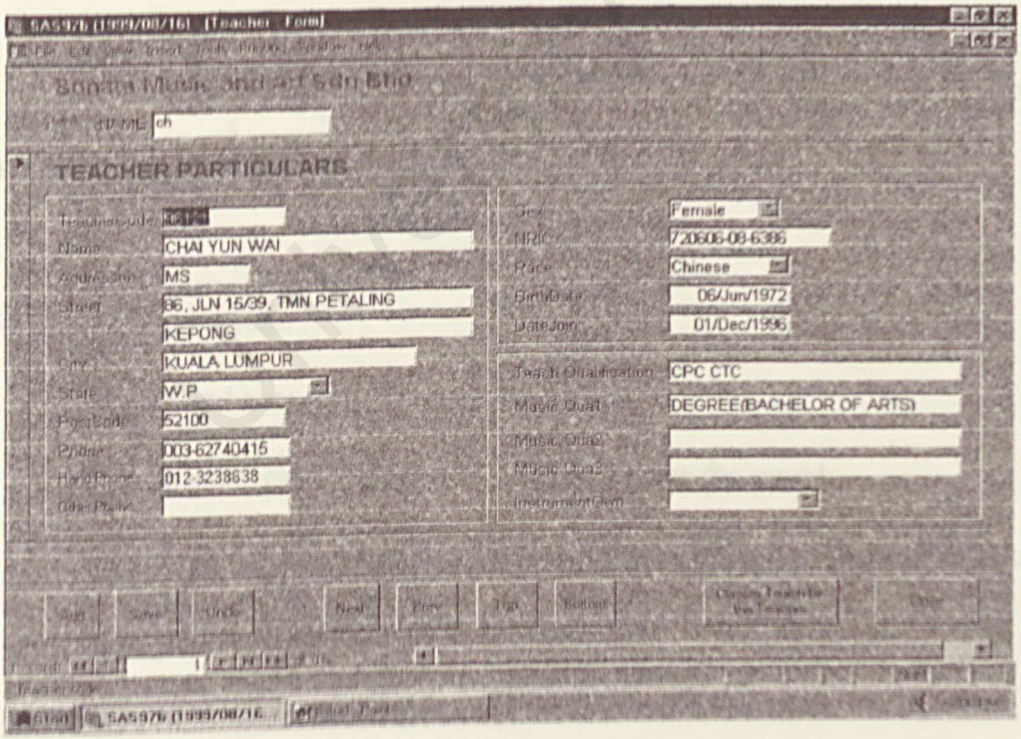



***Figure 2.5*** *Teacher Particular Screen*

Weakness of the system:

- No addition security control over the updating of the data. Once a user login to the system, the user has the right to modify the data.
- To add a new student record into the database, it needs to go to a separate sub-module in order to key in the information first.
- The data in the database are not sorted. More time and effort are required to get the desire result.

### 2.3.4 California State University Phone Directory

**URL :** http://info001.csusb.edu/phone_dir/sb_phone.htm

This web site is created for California State University, San Bernardino and it is using a simple interface and good background color.

Strength of the system:

- Simple and easy to use.
- Provides message if there are no data matches the search.
- There is a drop down list contains all of the department names. This makes the search more efficiency.
- Provides HELP and FAQs.

Weakness of the system:

- Only can search with one criterion among the three criteria i.e. Last Name, Department and Extension. Also, multiple criteria are not supported.

## 2.4 Client Server Computing

A client can be defined as single-user workstation that provides presentation services and the appropriate computing, connectivity, and database services and interfaces relevant to the business need. And a server is a one or more multi-user processor with shared memory providing computing, connectivity, and database services and interfaces relevant to the business need.

Client server computing is an environment that satisfies the business need by appropriately allocating the application processing between the client and the server processors. The client requests services from the server; the server processes the request and returns the result to the client. The communications mechanism is a message passing inter-process communication (IPC) that enables distributed placement of the client and server processes. Client server is a software model of computing, not a hardware definition.

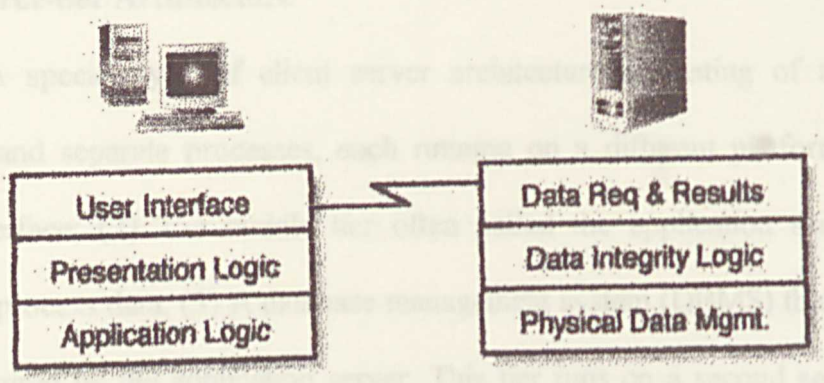



*Figure 2.6* *Client Server Computing*

### 2.4.1 Two-tier Architecture

Refers to client server architectures in which the user interface runs on the client and the database is stored on the server. The actual application logic can run on either the client or the server.

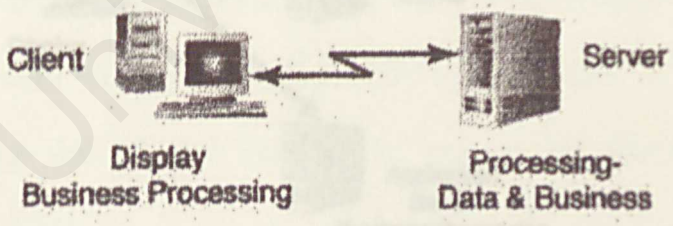



*Figure 2.7* *Two-tier client server architecture*

### 2.4.2 Three-tier Architecture

A special type of client server architecture consisting of three well-defined and separate processes, each running on a different platform: (1) The user interface; (2) The middle tier often called the application server which actually process data; (3) A database management system (DBMS) that stores the data required by the application server. This tier runs on a second server called database server.

The three-tier design has many advantages two-tier or single-tier design, due to the fact that the added modularity makes it easier to modify or replace one tier without affecting the other tiers. And separating the application functions from the database functions makes it easier to implement load balancing.

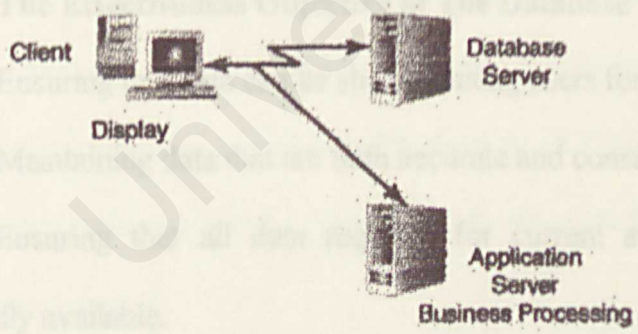



***Figure 2.8*** *Three-tier client server architecture*

## 2.7 Database

### 2.7.1 What is database?

A database is a shared collection of logically related data, designed to meet the information needs of multiple users in an organization. Database in most organizations has evolved over a period of time, often without a comprehensive plan to guide their development. The ease of use of contemporary database software has encouraged end users to develop their own database applications. According to Davydov (1993), "the current state of database applications is characterized by the fact that companies continue to deploy databases to meet isolated application needs. The end result is more redundant, incompatible data."

### 2.7.2 The Effectiveness Objective of The Database

- Ensuring that data can be shared among users for a variety of applications.
- Maintaining data that are both accurate and consistent.
- Ensuring that all data required for current and future application are readily available.
- Allowing the database to evolve and the needs of the users grow.
- Allowing the users to construct their personal view of the data without concern about how the data are physically stored.

### 2.7.3 Microsoft Access 2000

As for the relational database, Microsoft Access 2000 was studied and below is the information about Access 2000 package.

The concept behind a database is simple. A database is like a file cabinet. Just as a file cabinet stores information, so does a database. A database is a set of information related to specific application. In the context of Access, a database can be viewed as a large repository in which tables, reports, queries, and other objects are stored.

The Microsoft Access package is one of the best selling relational database packages for Windows in the market. Microsoft had estimates currently 10 million people using this database package. Access provides two different modes. The first is an easy to use menu driven interface that lets you issue commands without an in depth understanding of Access. Program mode lets the user to store instructions in a Visual Basic program file and execute all of them with one command.

Access allows the user to indicate how tables should be related to each other. A table can have a one-to-one, one-to-many or many-to-many relationship. A table that has referential integrity allows it to make changes to the structure of a

database table. User can add, delete and rearrange fields in the table structure. User can also control how data will be entered in a table using the Properties Sheet of a field.

***Benefits***

Feature such as the Help Wizard make it easy to find answers to questions about using the Access 2000 and helps users get the most their software tools.

***Standard Features***

- Database Wizard

It automatically builds tables, queries, forms and reports as needed.

***Simple Query Wizard***

This feature sorts through database information, including data from multiple tables, then determines how to bring it all together to answer your questions.

***Hyperlink Data Type***

It supports the storage of hyperlinks as a native data type.

***Image Control***

An image control provides a simple way to include graphical information on a form or report and improves the display performance of the image.

### 2.7.4 Microsoft SQL Server 7.0

SQL Server is Microsoft's leading Windows database and data-warehousing package. It is a highly scalable and high-performance relational database management system.

SQL Server can manage a large amount of data in a multi-user distributed client-server environment. It offers a high degree of data availability, concurrency, and integrity while delivering high performance. It is a fairly traditional relational database management system. In this model, a process on the user local PC communicates requests to, and receives responses from, a process, on the server. The server processes, then updates, the data files and takes care of other administrative tasks.

***Benefit of Standard Features***

- **Self-management**

SQL Server 7.0 can automatically configure its memory usage, grow and shrink disk space usage, and repair itself. You can let SQL Server control memory usage, locks, connections, open objects, and so forth, or configure them yourself.

- **Maintenance**

The SQL Server 7.0 DBCC command is dramatically faster, replaces the NEWALLOC option, and can actually repair data. In addition, SQL Server 7.0 incorporates a *fast failure* philosophy, where it's considered better to fail and repair as soon as an error occurs, rather than leave corruption in the database. Accordingly, SQL Server can automatically detect and repair some errors that would have crashed SQL Servers before.

- **Security and Backup**

SQL Server 7.0 security is much more integrated with Windows NT. Database roles replace groups, and fixed server roles can be used to delegate system administrator tasks. SQL Server 7.0 now uses the industry-standard *fuzzy backup* strategy, which makes backups much faster and makes possible a new differential database backup option.

- **The Storage Engine**

The larger page size of 8K seems to have had a ripple effect throughout SQL Server 7.0's storage structures. Extents are now 64K (eight pages), and a single row in a page can occupy 8,060 bytes, up from 1,962 bytes in prior releases. Character and binary columns can extend to 8,000 bytes, up from 255. Row locking is default in SQL Server, and SQL Server will automatically escalate to page or table locking depending on its analysis of the query.

- **Stored Procedures**

Compilation of stored procedures in SQL Server 7.0 delays resolving the names of objects in a stored procedure until runtime (called *delayed name resolution*), so you can compile stored procedures that reference objects such as tables and other stored procedures that don't yet exist.

## 2.8 Overview of DBMS

A database system provides a way of gathering together specific pieces or lists of information that are relevant to the users in their tasks or lives. A database system consists of two parts:

i. **Database Management System (DBMS)**

The program that organizes and maintains the list of information.

ii. **Database Application**

A program that allows users to enter, change, delete and generate report based on the data in the database.

It is common for both the DBMS and the Database Application to reside and execute on the same computer; in many cases the tow are combined in the same program.

### 2.8.1 Definition of DBMS

A DBMS provides the following services:

- **Data Definition**

Provides a method of defining and storing a data population

- **Data Maintenance**

Maintains the population using a record for each item in the population, with fields containing particular information that describes that item

- **Data Display**

Optionally provides some methods of displaying the data for the user

- **Data Integrity**

Provides one or more methods of ensuring that the data is accurate

### 2.8.2 DBMS Models

A database model describes the relationship between different items. The database management systems (DBMS) available today can be grouped into different types or models:

i. ***File Management System (FMS)***

Each field or data item is stored sequentially on disk in one master file.

ii. ***Hierarchical Database System (HDS)***

Data is organized in a tree structure that originates from a root. Each class of data is located at different levels along a particular branch that stems from the root.

iii. ***Network Database System (NDS)***

Conceptually describes databases in which many-to-many relationships exist. It relies on either straight line or cyclical pointers to map out the relationships between the different data items.

iv. ***Relational Database System (RDS)***

The data is organized in logical mathematical sets in a tabular structure. Each data field becomes a column and each record becomes a row in the table. The main advantage RDS has over Hierarchical and Network models is its complete flexibility in describing the relationships between the various data items. The primary goal of RDS is to preserve data integrity.

v. ***Object-oriented Database System (OODS)***

The document is stored as a single object, instead of several tables and would have properties whose state would be maintained. Often provided object-oriented concepts such as inheritance and encapsulation.

## 2.9 Software Development Tools

### 2.9.1 Microsoft Visual Basic 6.0

Microsoft Visual Basic development system is the one of the most productive tools for creating fast business solutions for Windows® and the web. A comprehensive, rapid application development environment helps developers quickly create and deploy client/server applications, plus easily program for the Internet using familiar Visual Basic programming tools and techniques.

Visual Basic enables the developers to create high-performance applications that take advantage of an integrated native code compiler. It helps the developers to perform the most common database activities without ever learning the Visual Basic development environment. Visual Basic supports the use of database language, Structured Query Language (SQL). Furthermore, the SQL queries can be visually created and tested using live data with drag-and-drop ease

from within the Visual Basic development environment. Data-centric applications can be developed easily by creating reusable data access components. Moreover, Visual Basic supports the development of broad-reach web applications that will run in any browser or any platform.

Visual Basic also helps in building applications and components quickly with more than 50 new and/or updated controls, or to create own custom components that can be shared by any VBA-enabled applications.

### 2.9.2 Microsoft Visual FoxPro®

Microsoft Visual FoxPro provides the tools you need to create and manage high-performance 32-bit database applications and components. Its robust tools and data-centric object-oriented language make it ideal for building modern, scalable, multi-ties applications that integrate client/server computing and Internet. Visual FoxPro uses the Foundation Classes and Applications Wizard to build applications quickly by using libraries of pre-built, reusable classes to easily add data manipulation, navigation, querying, conflict resolution, reporting, web enabling, and more. With Microsoft Transaction Server support, you can automatically manage and deploy COM components built with Visual FoxPro.

Visual FoxPro also helps to be more productive with the Coverage Profiler that identifies which lines of code are being run and how long it takes each to execute. A strict data format helps prevent ambiguous dates and ensure that new and existing Visual FoxPro-based applications are year 2000 compliant.

### 2.9.3 Visual C++

The Microsoft Visual C++ development system is the development tool used to build many of the most well known desktop software applications in the world, including Microsoft Word and Microsoft Excel. Many applications continue to require the language flexibility of C++ and the performance tuning options of a sophisticated C/C++ language compiler, which make Visual C++ the ideal tool for the most demanding performance requirement.

New features in Visual C++ include important compiler updates that reduce the size of an application by as much as ten percents. Using new language syntax extensions, developers who use Visual C++ can use Active Scripting components as easily as do Visual Basic developers.

## 2.10 User Interface

A user interface allows one or more individuals to have access to and command the computer systems. The first user interfaces for mainframe and personal computer systems were command-based. A Graphical User Interface (GUI) is an interface that uses pictures or icons on the screen, and menus to send commands to the computer system. Many people find that GUI's are easier to learn and use, because complicated commands are not usually required.

Advantages of using a GUI:

- Performing tasks in a GUI environment is intuitive.
- The applications are consistent.
- The applications are flexible.
- GUI supports multitasking.
- The applications can be easy to use.
- GUI allows a user to cancel or undo if mistakes are occurred.
- GUI often asks user to confirm important operations.
- Windows operating system, shell allows objects linking and embedding (OLE).

## 2.11 Data Access Model

Getting data from a database is not a direct way and it requires the use of a data access interface. Choosing the suitable data access interface as it can result in better performance, easier of programming steps and also programming flexibility.

### 2.11.1 Remote Data Object(RDO)

Remote data object is actually a very thin wrapper around ODBC. It was built specifically with VB in mind. Remote Data Object is easy to use in comparison to programming to the API directly. It is fast and very reliable due to the focus of legacy code placed in this technology.

RDO has evolved into ActiveX Data Objects, which is now the program interface Microsoft recommends for new programs.

### 2.11.2 ActiveX Data Object(ADO)

ActiveX data object is a set of objects that allow programmers to program their data access logic form languages like VB as well as scripting languages. ActiveX data object was first introduced as the data access interface in Microsoft Internet Information Server (IIS). ActiveX data object provides fast, easy and productive means for accessing all kinds of data sources.

ADO is designed for enterprise-class deployment. Applications built with ADO can use the transaction support in IIS 4.0 to enable interoperability and ensure a high degree of scalability and reliability.

### 2.11.3 Open Database Connectivity (ODBC)

ODBC is a standard for accessing data. it was designed to allow the programmer to use a common set of routines to access the data stored in databases, regardless of the type of database in which the data was stored.

ODBC provides an industry standard set of interfaces for communicating with over fifty five data stores. With ODBC, developers can write database applications without targeting a single database vendor. ODBC provides the

flexibility of creating powerful database applications and businesses the choice of database server.

Beside that, ODBC provides high-performance database connectivity and is the native drive to several server databases. These include Microsoft SQL server, IBM and Informix databases. Whether ODBC is the native driver for a database has very little effect on performance.

# Chapter 3

## 3.1 Objectives

The objectives of this analysis phase include:

- To acquire knowledge on how does the proposed system works.
- Research on how this proposed system can be developed using current or latest emerging technologies.
- To identify the software and hardware requirements for develop the proposed system.

## 3.2 System Methodology

### 3.2.1 Waterfall Model

The stages are depicted as cascading from one to another. Figure 3.1 shows the original model of the Waterfall Model.

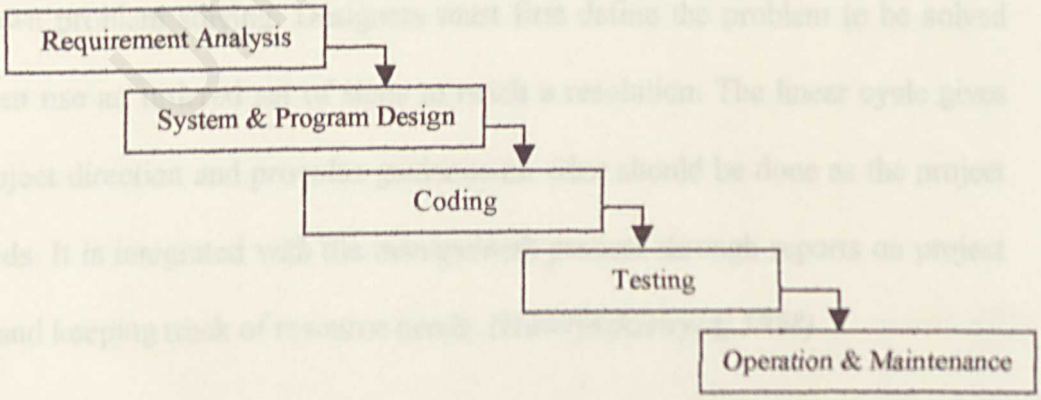



***Figure 3.1*** *Standard Waterfall Model*

One development stage will be completed before going down to the next stage. Thus, when all the requirements are elicited from the customer, analyzed for completeness and consistency, and documented in a requirement document, then the development team can go on to system design activities. The Waterfall Model presents a very high level view of what is going on during development, and it suggests to developers the sequence of events they should expected to encounter.

The Waterfall Model can be very useful in helping developers lay out what they need to do. Its simplicity makes it easy to explain to customers who are not familiar with software development; it makes explicit which intermediate products are necessary in order to begin the next stage of development. ***(Pfleeger, 1998)***

Linear cycle phases or Waterfall Model cycles are chosen to encourage top down problem solving. Designers must first define the problem to be solved and then use an ordered set of steps to reach a resolution. The linear cycle gives the project direction and provides guidance on what should be done as the project proceeds. It is integrated with the management process through reports on project status and keeping track of resource needs. ***(Hawryszkiewycz, 1998)***

A waterfall model approach has good visibility as each stage produces some deliverables that make it easier to keep track of the development process. By following the stages as stated, a systematic and clearly defined process can be produced.

### 3.2.2 Prototyping Model

Prototyping Model is chosen because there was a high degree of uncertainty in several areas in the system requirement. The emphasis is on trying out ideas and providing assumptions about the requirements, not on system completeness.

So, prototype actually refer to a partially developed product that enables customers and developers to examine some aspects of proposed system and decided if it is suitable or appropriate to continue with the next stage. In other words, prototyping means building a small version of a system (incomplete), usually with limited functionality that can be used to help the users or the customers to identify the requirements key of a system and demonstrate feasibility of a design.

Since the prototyping model allows all or part of a system to be constructed quickly to understand or clarify issues, it has the same objective as an engineering prototype, where requirements or design require repeated investigation to ensure that the developer, user and the customer have a common understanding both of what is needed and what is proposed. One or more of the loops for prototyping requirements, design or the system may be eliminated, depending on the goals of the prototyping. However, the overall goal remains the same: reducing risk and uncertainty in development. ***(Pleeger, 1998)***

This design model is very user-centered and involves the users as much as possible. It allows the system designers to gather feedback regarding the system and to use it for further improvements.

The reason for this approach is to refine the system with users' input to produce a system and interface design that satisfies them, after which the system may be delivered.

Prototyping is a very useful technique to incorporate into a design process because it helps both the users and the designers to developing a system that meets precisely user requirements. Its methodology anticipates that users tend to change their minds during the early stages of the development. Requirements can be determined dynamically as the prototype is constructed.

Below are the basic steps that will be used:

i. *User's requirements analysis*

The system developer works with the user to capture the user's basic information needs and analysis is done.

ii. *Design a prototype*

The system developer creates a working prototype quickly. The prototype may only perform the most important functions of the proposed system, or it may consist of the entire system with a restricted file.

iii. *Implement the prototype*

The user is encouraged to work with the system to determine how well the prototype meets his or her needs and to make suggestions for improving the prototype.

iv. *Revise and enhance the prototype*

The system builder notes all changes requested by the user and refines the prototype accordingly. After the prototype has been revised, the cycle returns to step iii. Step iii and step iv are repeated until the user is satisfied.

## 3.3 Facts Finding Techniques

There are a variety of techniques can be used to determine the requirements of the system.

Following are some of the techniques that have been used to gather information:

- Review of the current situation
- Interview
- Information via Internet
- Brainstorming

### 3.3.1 Review of The Current Situation

In order to get a full understanding of the current situation on how the system actually works, a review on current system and process of gathering into regarding phone directory information system have been done. This review helps to build a more user friendly system that will enables it to be used by the user more efficiency and effectively.

### 3.3.2 Interview

Several informal interviews and discussions with the people involved have been carried out. These people include the staffs working in that particular company and the owner of the company. By interviewing these people, information can be gathered on how actually the system in their company works and the purposes of developing such a system.

### 3.3.3 Information via Internet

Internet is used as one of the main resource. Through the Internet, some ideas from the similar systems have been collected and the user interface design of similar systems can be used as a guideline. The Internet also provides the techniques and information about the development tools in this project.

### 3.3.4 Brainstorming

During the requirement gathering, meeting the supervisor often is crucial to discuss the needs of system. Brainstorming has generated some ideas on how to proceed to the next every time one stage is accomplished.

## 3.4 Requirement Specification

### 3.4.1 Software Requirements

Selecting of suitable software to develop the proposed system is important because it will simplify the programmer tasks as well as reduce the time required to develop.

Below are the analysis of some of the programming tools and its features.

### 3.4.1.1 What Is Visual Basic and How Does It Work?

Visual Basic is a simple, easy to learn language and programming environment, which can used to build real applications for Windows. It is widely used in industry for developing rapid prototypes of new applications.

The features include:

***i. Event-driven programming***

An event is an action of some type. For example, moving the mouse, selecting an item from a list, or clicking a buttons are events. As a newer programming language, Visual Basic uses a different approach: object-oriented programming and event-driven programming. In event-driven programming, programs do not follow a sequential logic like what traditional programming do. In other words, programmers do not take control and determine the sequence of execution. Instead, the user can press any keys and click on various buttons and boxes in a window. Each of these actions will cause an event to occur, which triggers a block of code to be generated.

***ii. Visual Basic uses a graphical user interface***

Visual Basic is designed so that we can immediately see our creation. It uses two types of objects:

1. ***Forms*** are windows we create and customize
2. ***Controls*** are graphical objects appear on the forms, such as buttons, combo boxes, text boxes, etc.

***iii. End-to-end debugging***

It includes the standard debugging features.

***iv. Database Wizards***

It provides several database wizards that reduces time for developing database connections for the client-server forms. The wizards guide the user through the process of establishing connectivity with the database.

**v. *Files used by Visual Basic***

There are several types of files used by Visual Basic. Three most commons used are:

1. ***.mak*** Project File: contains a list of all the forms and codes in the particular project.

One project can have a lot of modules, forms and classes. Different activities of the program can store in different modules. Classes contain of predefine functions, it can be treated as an object.

2. ***.frm*** Form File: contains all of the objects and codes associated with the particular form. It allows communication between the system and users by using the objects in the form.
3. ***.exe*** Executable File: a project is compiled into .exe format before it can really applicable. In other words, it compiles the program into a readable machine language.

### 3.4.1.2 Why Visual Basic and not Other Programming Language

Visual Basic is chosen as the main programming tool in this project because of the following reasons:

1. Visual basic is one of the most popular programming language tools used in Windows environment due to its RAD (Rapid Application Development) capability.
2. Visual Basic embedded with search engine (JET engine 1.0) that comes from the family similar to the internal engine (JET 2.0) of the DBMS used. Eg. Microsoft Access. Both of them share the same database format and hence,

intermediate conversion such as Open Database Connectivity (ODBC) is not required.

3. Visual Basic using event-driven approach to program the system and not a procedural approach. An application developed using an event-driven model responds to event that occurs in computer environments.
4. Features of Visual Basic include multiple-document interface (MDI), object linking and embedding (OLE) and dynamic data exchange (DDED).

### 3.4.1.3 Why Microsoft Access?

Microsoft Access is a feature-rich, inexpensive database. Access is capable of excellent performance with small databases and is perhaps the best choice where rapid inexpensive development is essential and the database is not large. All accounting information and transactions entered by users need to be stored somewhere.

Microsoft Access 2000 is a database management system (DBMS) that can be used to create a relational database to store all this accounting information. A relational database has a number of tables that can be interrelated to each other by creating relationship between them. These tables can store records of the accounting transactions, suppliers and customers information and so forth.

Microsoft Access 2000 has a module called Query. Structured Query Language (SQL) can be used in this module to retrieve, insert, delete or modify data stored in an Access database. Besides that, the query module of Microsoft Access 2000 also provides some others ways to perform these kinds of tasks.

Another reason why Microsoft Access 2000 is chosen is Visual Basic (VB) can access a Microsoft Access database files. But before that, the path needs to be entered in the properties of the Data Control and Visual Basic should be informed about which table or query to access.

An Access database can have any or all of the parts stated below:

- ***Tables:*** the basic building blocks of database and the place where actual data resides
- ***Forms:*** for create a framework to present or enter data in one or more tables. In Access, forms have the abilities to manipulate and verify data that are not available at table level
- ***Queries:*** for the purpose of search and retrieve data from one or more tables based on the entered criteria
- ***Reports:*** a way to output data from tables or queries. It also used for data summarization.
- ***Macros:*** used to coordinate operations in Access

- ***Modules:*** refer to functions and procedures programmed through the Visual Basic language

Each development tool has its own strengths and weaknesses. Even Visual Basic has its own limitations such as security feature in Visual Basic not as strong as Visual C++ and other development tools. But in term of developing a system like PDIS, Visual Basic has its strengths over other development tools. Those advantages are stated in 3.4.1.2 above.

### 3.4.1.4 Conclusion On Development Tools Analysis

The two most popular programming languages to build windows based applications are Microsoft Visual Basic and Microsoft Visual C++. Microsoft Visual C++ is an object-oriented programming language while Microsoft Visual Basic is an event-driven programming language. Due to the system that will be developed involves interaction with user and event-driven, Microsoft Visual Basic is chosen. With the drag and drop feature provided by VB, a programmer can create a windows-based application easier. Besides that, there are many ActiveX (.ocx) controls that are available in the market that can be used in VB. (OCX is a third party control that can be used as a tool for developing an application).

Microsoft Visual Basic programming language can easily make use of Microsoft Access and Microsoft SQL server database programming. SQL server will be too expensive to use in this project. Furthermore, the database that is going to be used in this system does not need to be shared, therefore, Microsoft SQL server is not recommended.

Microsoft Access is the most appropriate database choice. This is because Microsoft Visual Basic is able to create Microsoft Access file using its JET Engine Database Driver. The JET Engine Database is fully compatible with the Microsoft Access ***mdb** files up to version 7.0. As RDBMS will be used extensively in this system, it is most suitable to use Microsoft Access database because it supports RDBMS feature.

### 3.4.2 Hardware Requirement

The hardware required for the development of the system:

i. At least 32MB RAM

ii. At least a Pentium 180MHz processor

iii. Other standard peripherals that include monitor, mouse and keyboard

## 3.5 Functional Requirement

### 3.5.1 Authentication and Authorization Module

Users with authorized id will be allowed to access the system. This is needed because different level of staffs has different level of access. Also, the authentication and authorization will always ensuring the integrity of the database and the accuracy of data.

| Sub-module | Login |
|---|---|
| Usage | For user to login the system by entering their ID and password. |

| Sub-module | Logout |
|---|---|
| Usage | Allows user to exit the system. |

| Sub-module | Change password |
|---|---|
| Usage | An input box will be displayed for user to input their login id and old password. If valid, the user can enter the new password. Successful changing password message will be displayed. |

### 3.5.2 User Module

User module consists of several sub-modules. There are staff search sub-module, company search sub-module, information sorting sub-module, instant message sub-module and the email & notice sub-module.

| Sub-module | Staff search |
|---|---|
| Usage | Allowing user to search for staff information based on the search key options: staff ID, staff name, staff position and department. |

| Sub-module | Company search |
|---|---|
| Usage | Allowing user to search for company information based on the search key options or criteria: company code, company name. |

| Sub-module | Information sorting |
|---|---|
| Usage | Providing another entry point for the user to acquire staff or company information. It provides two categories of information sorting:<br>i. Staff information sorting<br>Allows user to view the information sorted by staff ID, staff name in alphabetical order or department.<br>ii. Company information sorting<br>Allows user to view the information sorted by company code or company name in alphabetical order |

| Sub-module | Messenger |
|---|---|
| Usage | Messenger allows staff to quickly send a message to a staff. Unlike email, instant messages appear as soon as they are sent. |

| Sub-module | Email |
|---|---|
| Usage | It is used to send the email to staffs or customers. |

### 3.5.3 Administrator Module

This will allows the administrator to manipulate the records stored in database. The administrator will have the authority to access, add, delete or update the data in database. To avoid a large amount of data are editing at a time, one can edit based on the options provided while the other information fields remain unchanged.

| Sub-module | System user maintenance |
|---|---|
| Usage | Allows administrator to search, add, update and delete the records in database. The searching can be performed by input the system user ID and updating of records can then be done. |

| Sub-module | Staff record maintenance |
|---|---|
| Usage | For administrator to manipulate the records in database. These include updating an existing record, adding new records, or deleting of records. |

| Sub-module | Company record maintenance |
|---|---|
| Usage | Allows administrator to add new company records into database, update the existing records in database or delete the records. |

## 3.6 Non-functional Requirements

a) ***Reliability***

Reliability refer to the system can perform its intended function with required precision and accuracy. The system should be reliable in performing its operations and functions. For example, whenever a button is clicked, the system should be able to perform some functionality or generate message to inform the user for what is happening.

**b) *Usability and user-friendliness***

The system should be developed in such a way that it is easy to use. The usage and meaningful icons or buttons will enhance the understanding of users in using the system. Confirmation message and error messages for any non-trivial processes such as modifying or deleting any records should be displayed so that user can make up their decision.

**c) *Security***

The system should be equipped with sufficient security control. Each access by users should be authenticated and validated. The system should not allow any potential of leakage of information. Adding, modifying and deleting of data in the database only allowed by authorized users only, unauthorized access should be prevented.

**d) *Fast retrieving of information***

Users should be able to retrieve the information needed within a reasonable interval time.

**e) *Error detection***

Automatic prompt error message whenever error occurred.

# Chapter 4

## 4.1 Introduction

System design is one of the main parts in system development. It focuses on four major criteria of concern; there are architecture, data, interfaces and components. In this section, all the requirements analyzed in previous phase will be transformed into design specification or characteristics.

## 4.2 Architecture Design

Architecture design represents the structure of data and program components that are required to build a computer-based system. It will determine the architecture style that the system will implement; the structure and properties of the components that constitute the system; and the inter-relationships that appear among all architectural components of a system.

The architecture design will begin with a high level description of the functions that are to be implemented and will be used to build lower level descriptions of how each component will be organized and related to other components. Figure 4.1 shows the architecture of using this approach.

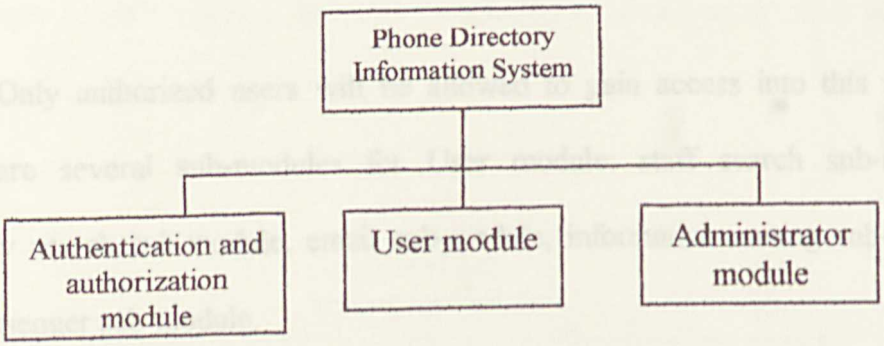



***Figure 4.1*** *The Main Structure Chart for the System*

### 4.2.1 Authentication and Authorization Module

This module allows a user to login to the phone directory information system. User is requested to input their userID and password. Then the userID and password will be searched and matched with the one existed in database. If matching, the menu screen will be displayed. User and administrator will have the different main menu screen displayed, as discuss in section 4.5 user interface design.

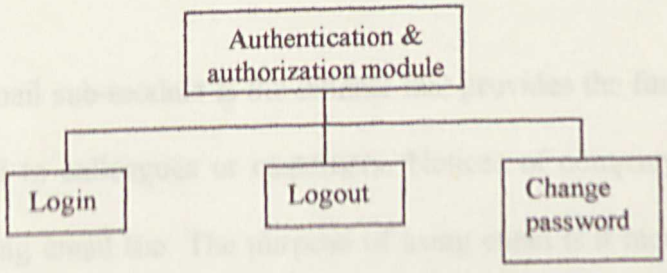



***Figure 4.2*** *Structure Chart for Authentication and Authorization Module*

### 4.2.2 User Module

Only authorized users will be allowed to gain access into this module. There are several sub-modules for User module: staff search sub-module, company search sub-module, email sub-module, information sorting sub-module and messenger sub-module.

The staff sub-module will let the users to look up one or more staff information using a keyword, either by Staff Name, Staff Position or Department options. The company search sub-module allows the users to search for company information by Company Name or by Company Code. If there is no matching record or records in the database that matched the user search criteria, the user will be informed in a user-friendly way.

The information sorting sub-module shows the listing of staff information sorted by Staff Name, Department and listing of company information sorted by Company Code or Company Name.

The email sub-module is the module that provides the functions for user to send the email to colleagues or customers. Notices of company's events can be distributed using email too. The purpose of using email is it more convenient and fast.

Messenger module enables staffs to communicate among each other instead of using email and phone.

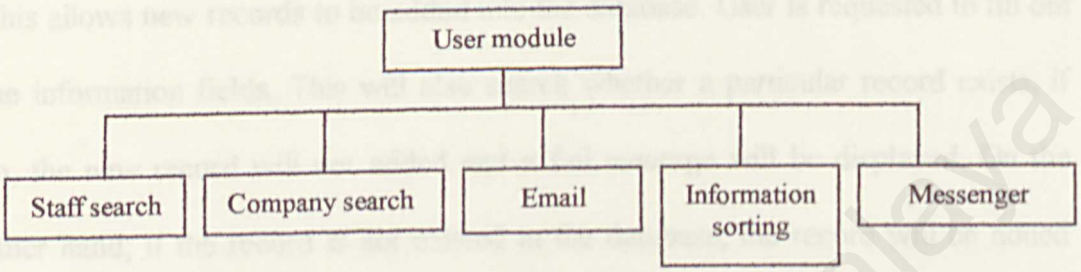



***Figure 4.3*** *Structure Chart for User Module*

### 4.2.3 Administrator Module

This module is a password-protected section, it meant only for authorized users only. All valid administrators are legitimate users for this module. There are three sub-modules, namely system user maintenance, staff maintenance, company maintenance, as shown in figure 4.4.

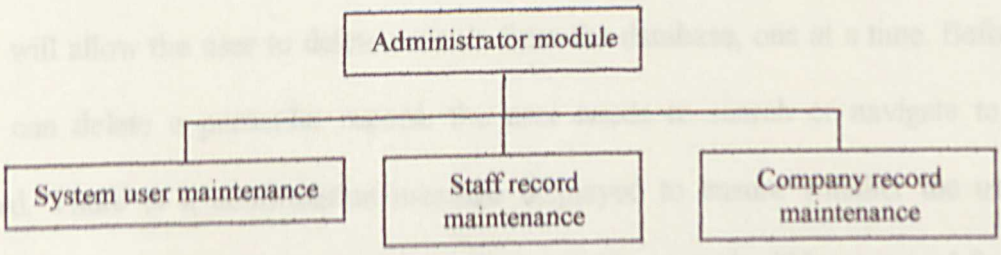



***Figure 4.4*** *Structure Chart for Administrator Module*

For each sub-module under administrator module, administrator can add, update and delete database records.

***Add record***

This allows new records to be added into the database. User is requested to fill out the information fields. This will also search whether a particular record exists, if so, the new record will not added and a fail message will be displayed. On the other hand, if the record is not existed in the database, the record will be added into the database and a success message will be prompted out.

***Update record***

This will allow the user to update certain fields in a particular record. A successful updating will prompt a success message. If the format (like format of date, format of currency, etc.) for certain fields is not followed, an error message will be displayed.

***Delete record***

This will allow the user to delete records from the database, one at a time. Before user can delete a particular record, the user needs to search or navigate to a record. There is a confirmation message displayed to ensure whether the user really wants to delete the record, if yes, then only the record will be removed from

the database. If user pressing the "delete" button without any record was displayed, an error message will be prompted.

## 4.3 Database Design

How to store data and the format of the data type is often a vital decision in the design of an information system. The structure of data has always an important issue of software application design, this is because the architectural of the data will have a profound influence on the architecture of the application that process it.

Thus, the design of a database is very important because it can affect greatly on the performance of data retrieval, adding, updating and deleting as well in the run-time period of the system.

### 4.3.1 Flow Chart

Flow charts are used to depict the workflow for a system. Figure 4.5 shows the flow chart for the authentication and authorization module. Figure 4.6

shows the overall logic flow for the user module and figure 4.7 shows the flow chart for the administrator section.

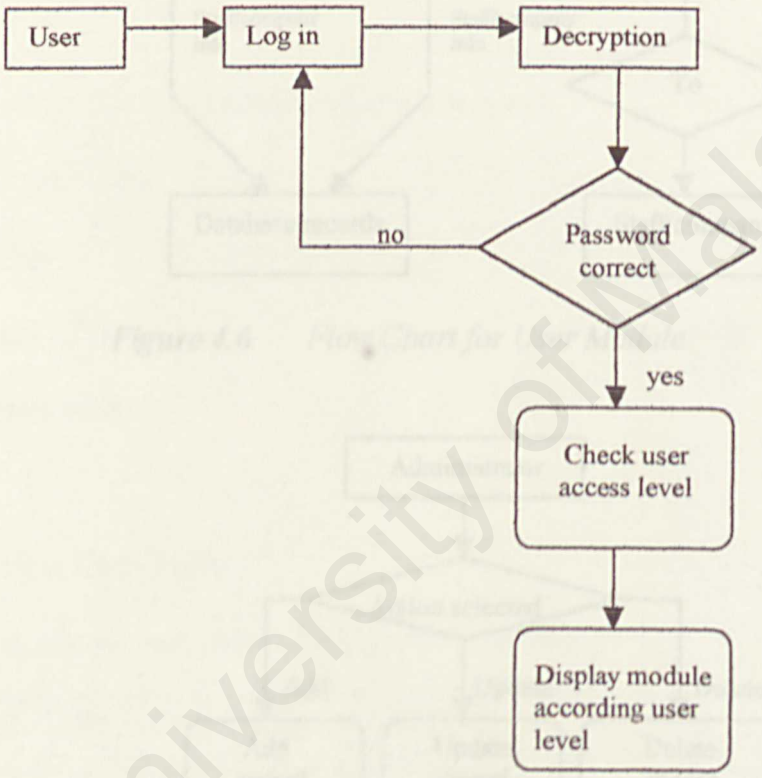



***Figure 4.5*** *Flow chart for authentication and authorization module*

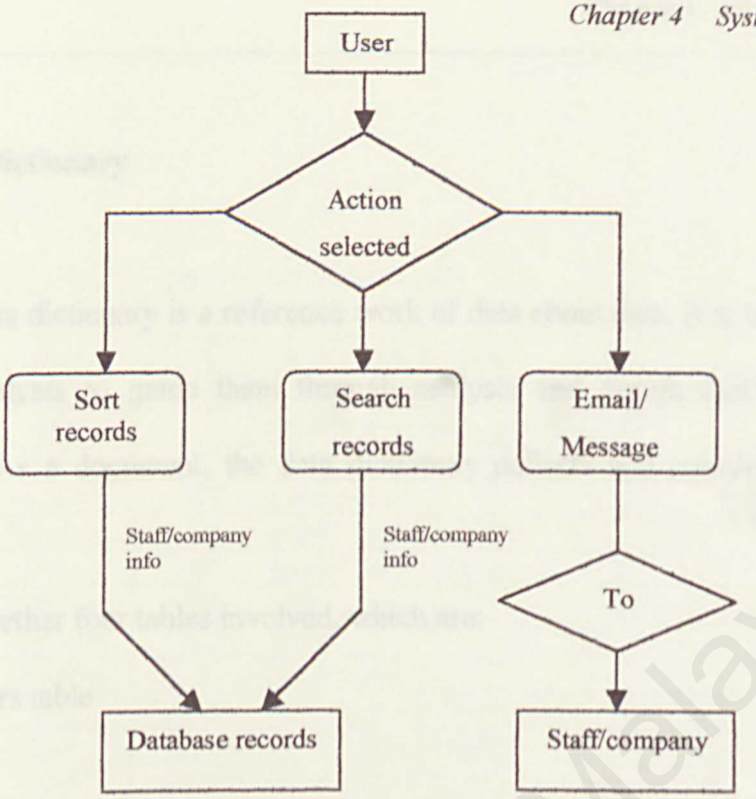



***Figure 4.6*** *Flow Chart for User Module*

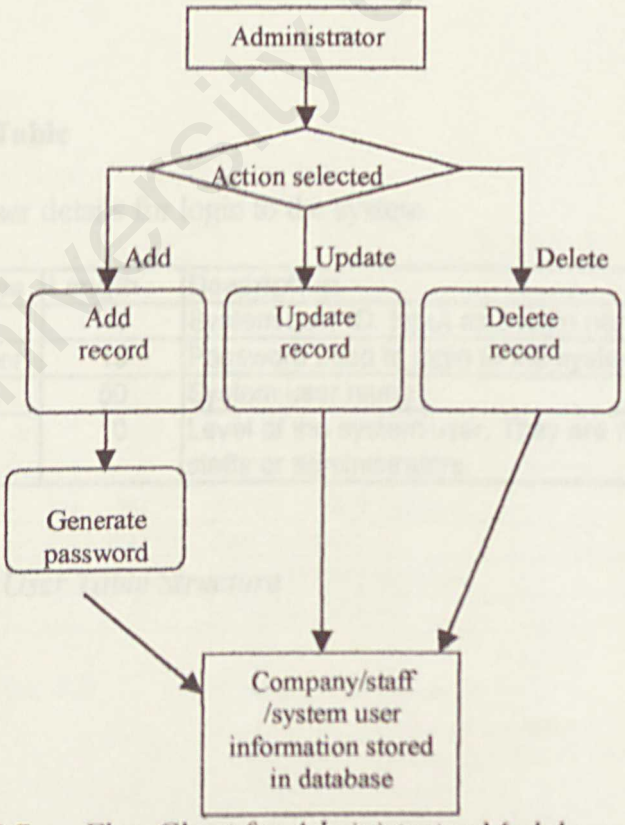



***Figure 4.7*** *Flow Chart for Administrator Module*

### 4.3.2 Data Dictionary

The data dictionary is a reference work of data about data. It is a task done by system analysts to guide them through analysis and design during system development. As a document, the data dictionary collects and coordinates data terms.

There are altogether four tables involved, which are:

1. System users table
2. Staff table
3. Company table
4. IP address table

#### 4.3.2.1 System User Table

This table stores the user details for login to the system.

| Field Name | Field Type | Length | Description |
|---|---|---|---|
| userID | Text | 15 | System user ID. Input as a login name |
| password | Character | 15 | Password used to login to the system |
| UserName | Text | 50 | System user name |
| UserLevel | Text | 10 | Level of the system user. They are normal staffs or administrators. |

***Table 4.1*** *System User Table Structure*

### 4.3.2.2 Staff Table

This table stores the staffs' general personal details.

| | | | |
|---|---|---|---|
| Addressee | char | 5 | addressee of staff |
| StaffName | Varchar | 50 | staff's name |
| Sex | char | 7 | staff's sex (male or female) |
| Position | Varchar | 20 | staff's position |
| Department | Varchar | 45 | Department |
| Address1 | Varchar | 60 | staff's home address |
| Address2 | Varchar | 60 | staff's home address |
| City | Varchar | 35 | city |
| State | Varchar | 20 | state |
| PostCode | numeric | 5 | post code |
| Home_phone | text | variant | home phone number |
| Office_phone | text | variant | office phone number |
| Hand_phone | text | variant | hand phone or mobile phone number |
| Email | Varchar | 50 | email address |

*Table 4.2 Staff Table Structure*

### 4.3.2.3 Company Table

This table stores the companies' general details.

| Field Name | Field Type | Length | Description |
|---|---|---|---|
| CompanyCode | char | 5 | unique primary key of company table |
| CompanyName | varchar | 30 | company name |
| Address1 | varchar | 60 | company address |
| Address2 | varchar | 60 | company address |
| Contact_person | varchar | 30 | person to contact |
| Addressee | char | 5 | addressee of the person to be contacted |
| Office_phone | text | variant | office phone number |
| Fax_no | text | variant | fax number |
| Hand_phone | text | variant | hand phone number |
| email | text | 50 | email address |

*Table 4.3 Company Table Structure*

#### 4.3.2.4 IP Address Table

This table stores the IP addresses of the staffs. This table is designed for use on the Messenger module, which enables the staff to send messages to each other.

| Field Name | Field Type | Length | Description |
|---|---|---|---|
| UserID | char | 5 | unique primary key for IP address table |
| UserName | varchar | 30 | store the user name |
| IPAddress | char | 15 | store the user IP address |

***Table 4.4*** *IP Address Table Structure*

## 4.4 Process Design

### 4.4.1 Data Flow Diagram (DFD)

Data flow diagram is a technique to show the graphical characterization of the data processes and flows in a system. The data flow diagram gives an overview of system inputs and outputs, processes and the flow of data through each process.

Table 4.5 shows the symbols for data flow diagram.

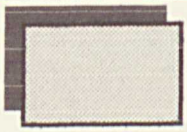
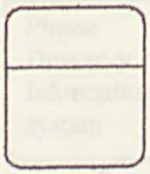
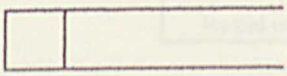
| Symbol name | Symbol | Description |
|---|---|---|
| Entity |  | Depict an external entity (another department, a business, a person, or a machine) that can send data to or receive data from the system. |
| Process |  | Show the occurrence of a transforming process. |
| Data store |  | Represent data in static storage |
| Flow of data |  | Show the movement of data |

***Table 4.5*** *Basic Symbols In Data Flow Diagram*

### 4.4.1.1 Context Diagram

Figure 4.8 is the context diagram for Phone Directory Information System.

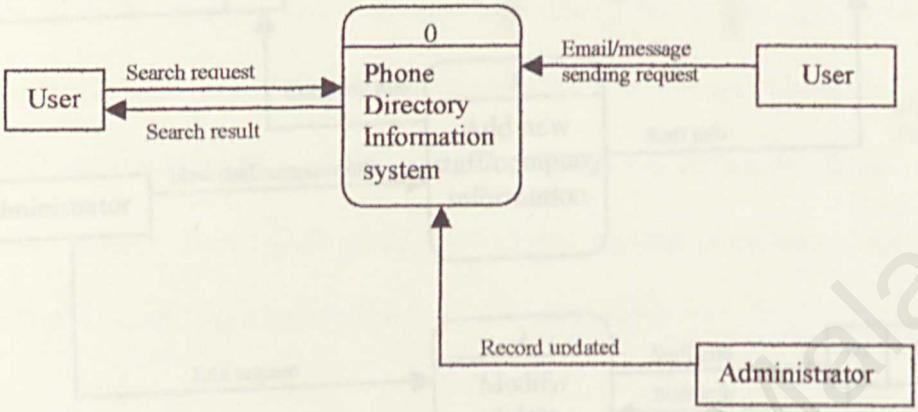



***Figure 4.8*** *Context Diagram for Phone Directory Information System*

### 4.4.1.2 Diagram 0

This is the diagram 0 for Phone Directory Information System.

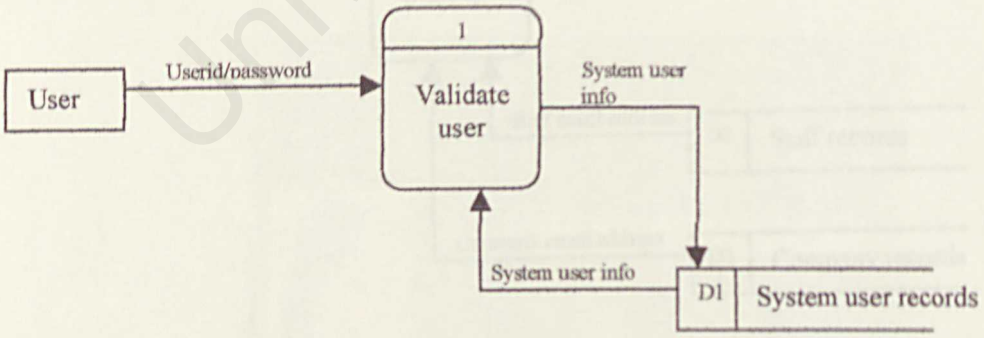



***Figure 4.9*** *Diagram 0 for Phone Directory Information System (part 1)*

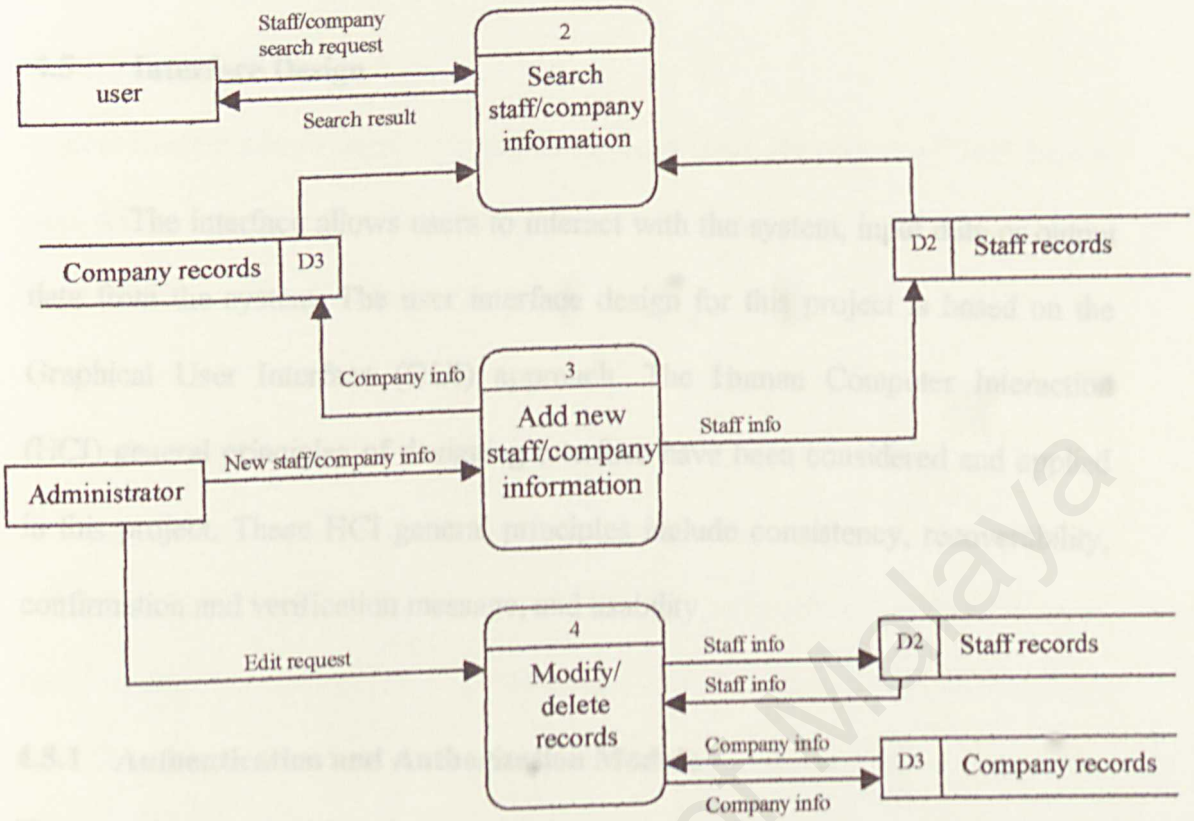



***Figure 4.10*** *Diagram 0 for Phone Directory Information System (part 2)*

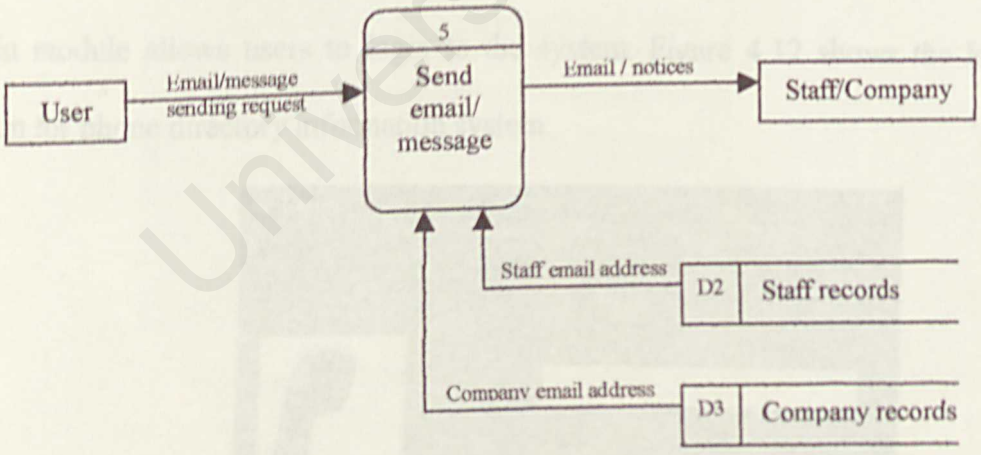



***Figure 4.11*** *Diagram 0 for Phone Directory Information System (part 3)*

## 4.5 Interface Design

The interface allows users to interact with the system, input data or output data from the system. The user interface design for this project is based on the Graphical User Interface (GUI) approach. The Human Computer Interaction (HCI) general principles of designing interface have been considered and applied in this project. These HCI general principles include consistency, recoverability, confirmation and verification message, and usability.

### 4.5.1 Authentication and Authorization Module

This module provides login, logout and change password functions.

#### 4.5.1.1 Login Module

Login module allows users to login to the system. Figure 4.12 shows the login screen for phone directory information system.

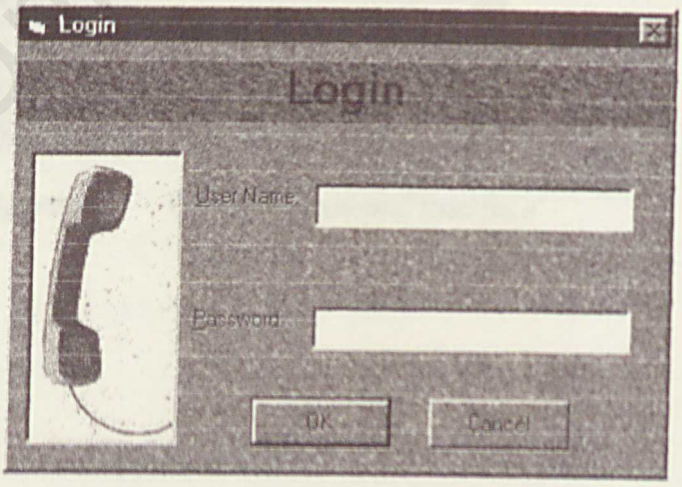



*Figure 4.12 Login Interface*

### 4.5.1.2 Logout Module

Logout module allows users to logout from the system. By pressing "Exit" button, user will exit from that particular interface. And clicking "Cancel" button on the login interface will logout from the system.

### 4.5.1.3 Change Password Module

Change password module allows users to change their password. An input box will be displayed for user to input their ID and password, if valid, the user is asked to enter their old password, again, and if the password is valid, the user can input the new password. If the password changing process is success, a message will be displayed.


***Figure 4.13*** *Change Password Interface*

### 4.5.2 User Module

#### 4.5.2.1 Search Module

There are two type of search: the staff search & the company search. The interface design for staff search and company search are similar, just the search key options and the field names are different. Figure 4.14 shows interface design for the search form.

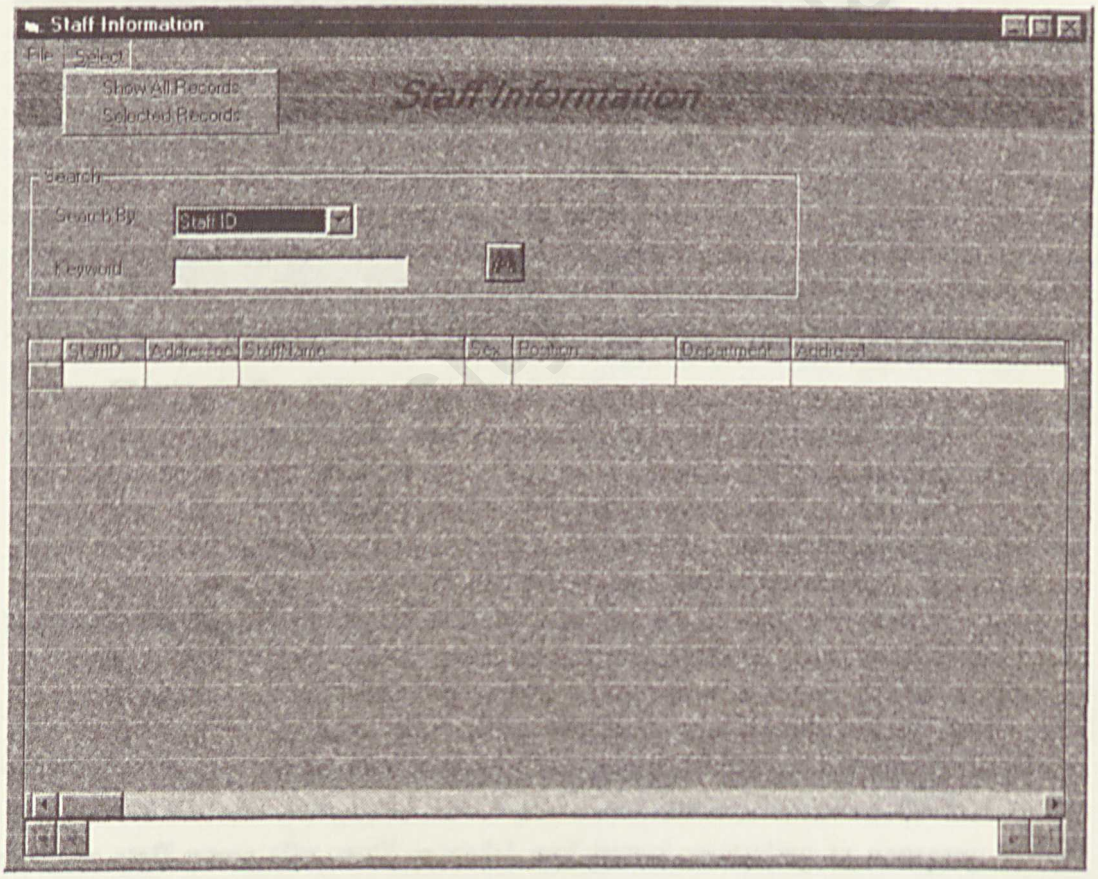



***Figure 4.14*** *Staff Search Interface*

For "Staff Search", user can search by staff ID, staff name, position and department. All these are search using one criterion, to search using two criteria, i.e. by "department" plus "position", user can click on the "Selected Record" and this will display another interface as shown in figure 4.15. The resulting record or records will be displayed in the staff information screen.

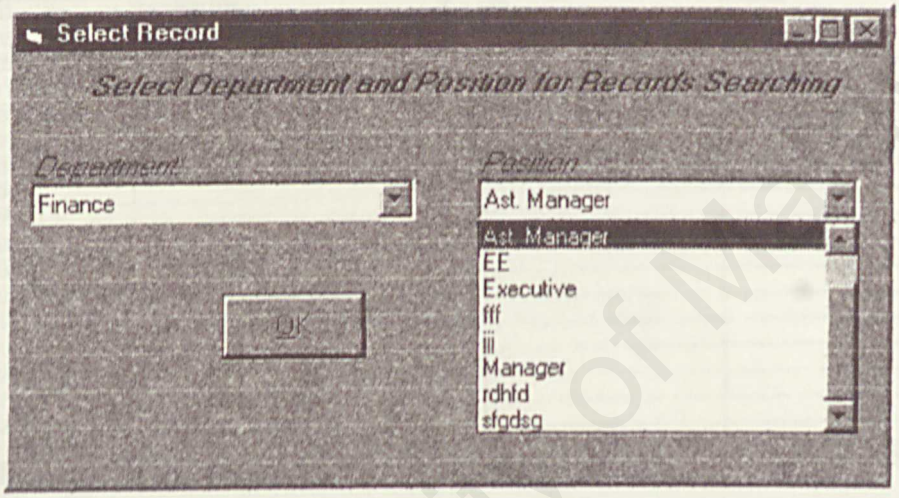



***Figure 4.15*** *Selected Record Interface*

### 4.5.2.2 Information Sorting Module

This will show a listing of available information sorted according to department, or staff name (for staff records) and sorted according to company code, company name (for company records). Figure 4.16 shows the sorting interface for staff records.

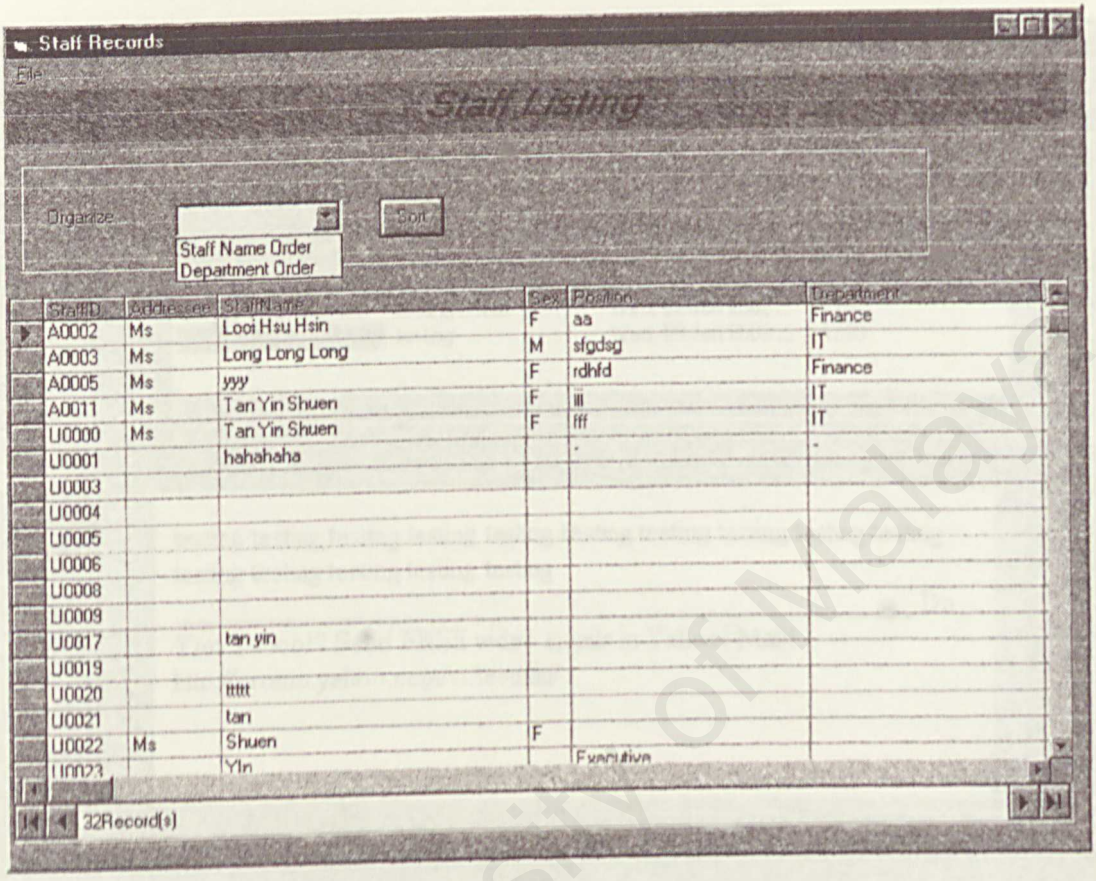



***Figure 4.16*** *Information Sorting Interface*



### 4.5.2.3 Email Module

This module allows user to check email, send email and search for the email addresses as well. User can send email to certain targeted customers based on the selection criteria provided by the form. User can find the company email address for they want to send on the "Contact" tab as shown in figure 4.17.

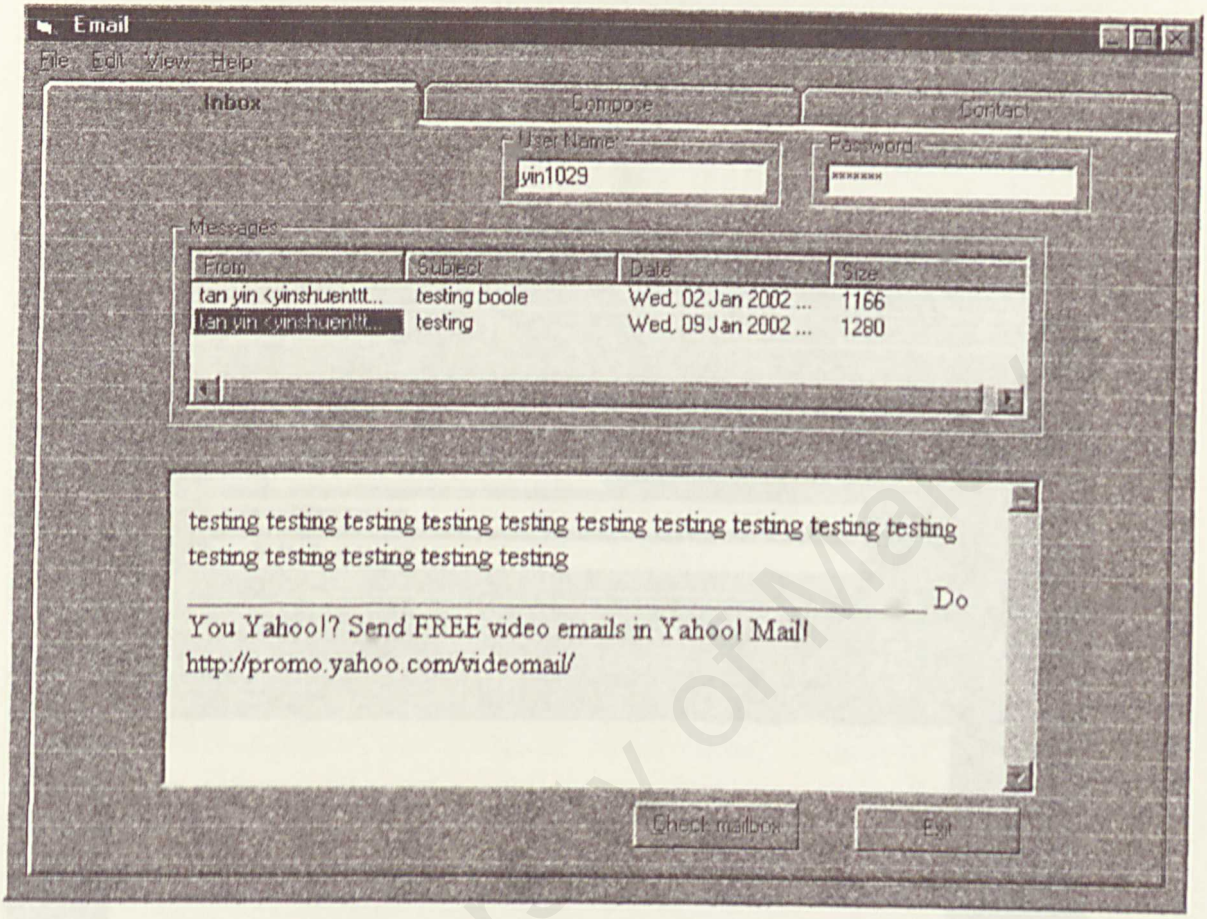



***Figure 4.17*** *Email Module Interface (Check Email Section)*

Figure 4.17 shows the "Check Email" section of the email module. By providing user name and password, user can check their mailbox by pressing the "Check mailbox" button. To view the content from a particular sender, click on the sender name will display the related content in the text box below.

Figure 4.18 is the Compose section of email module. This allows the user to send mail. Also, user can check for the email addresses by referring to the "Contact" section of the email module, as shown in figure 4.19.

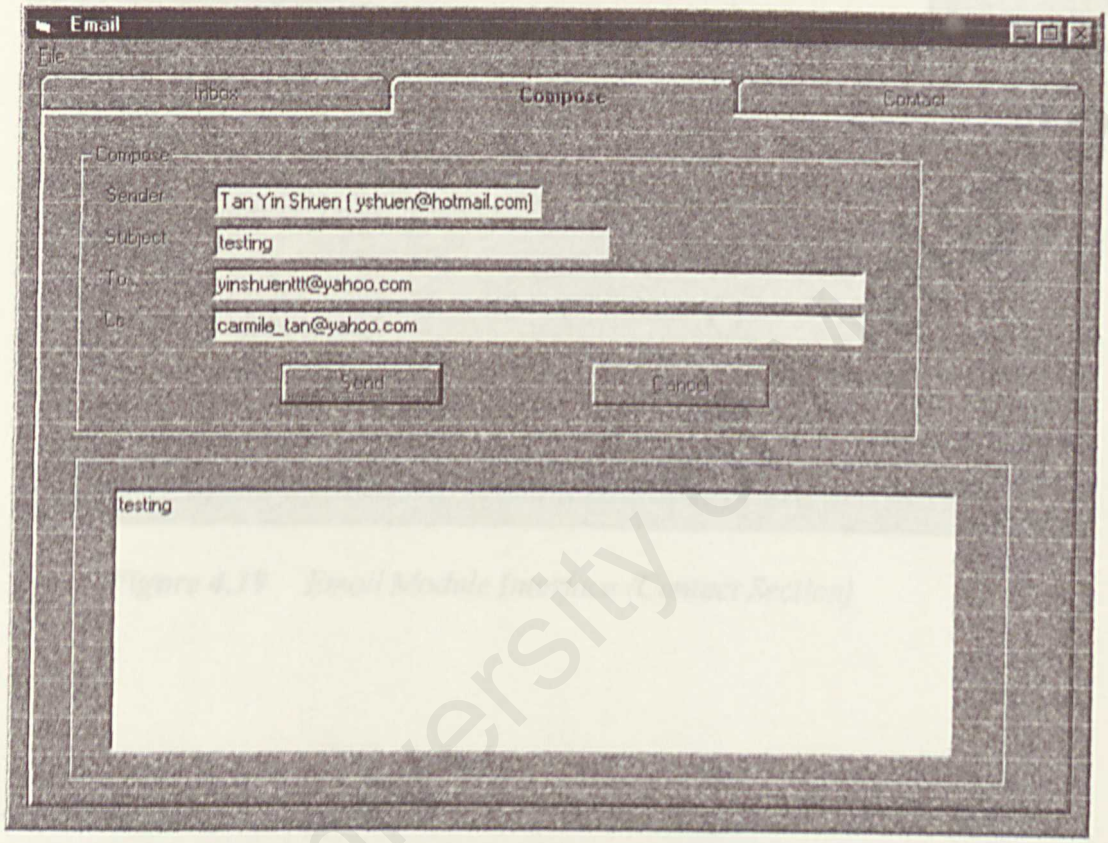



***Figure 4.18*** *Email Module Interface (Compose Section)*

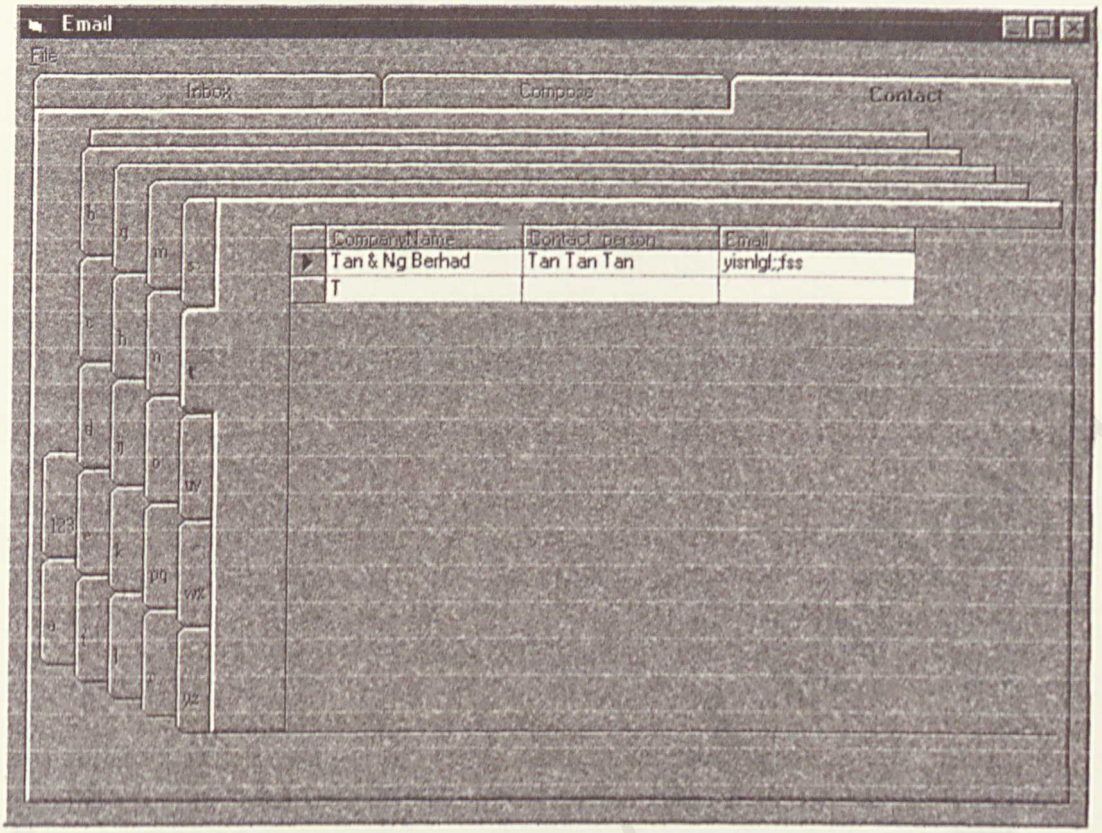



***Figure 4.19*** *Email Module Interface (Contact Section)*

### 4.5.2.4 Messenger Module

This allows communication among staffs in a particular company. Instead of using phone as a communication tool, staff can get contact with their colleagues using this method. By using the IP address, one user can send a message to another user.

Below shows the screen design for this module, changes may be made in the development stage later, whether on the screen design or the implementation of this module.

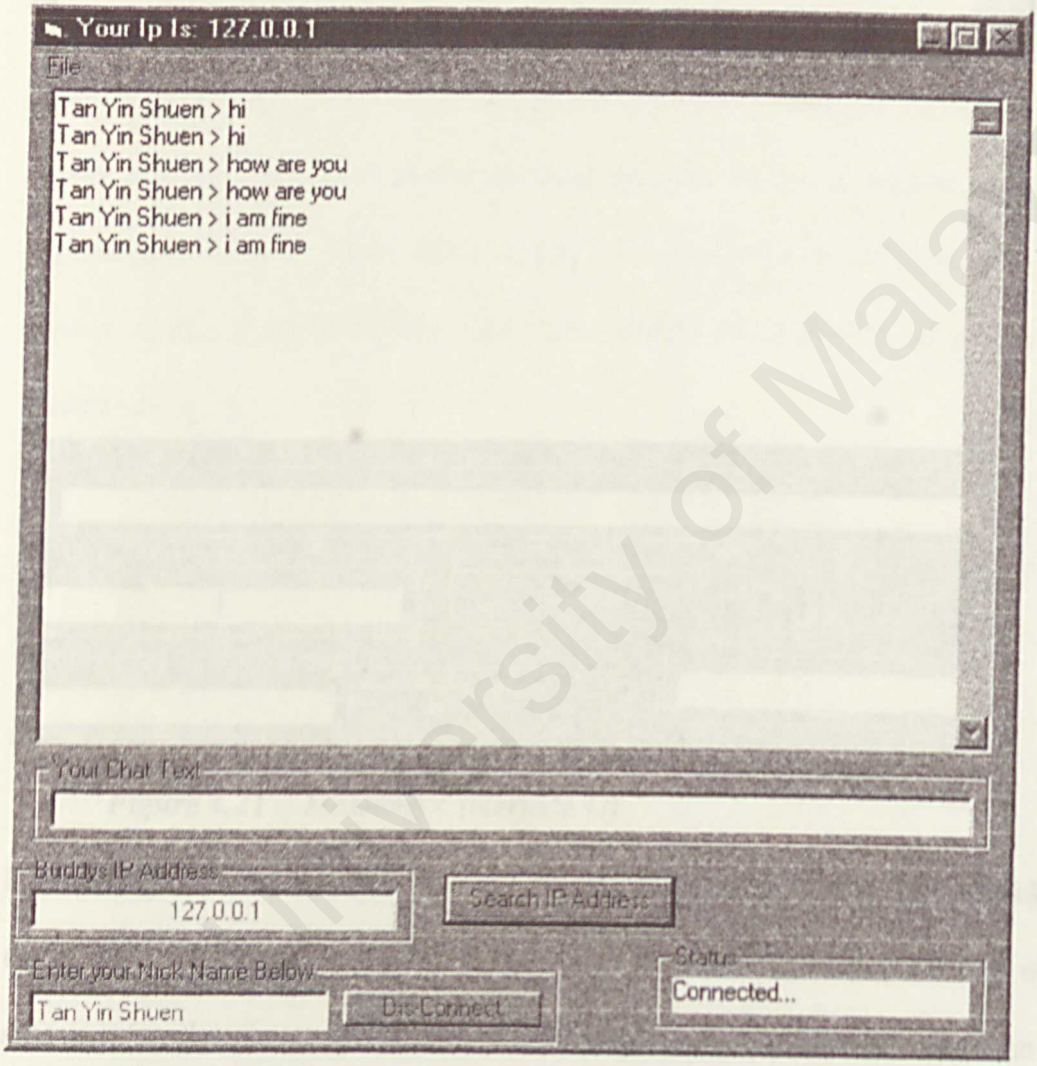



***Figure 4.20*** *Messenger Interface (1)*

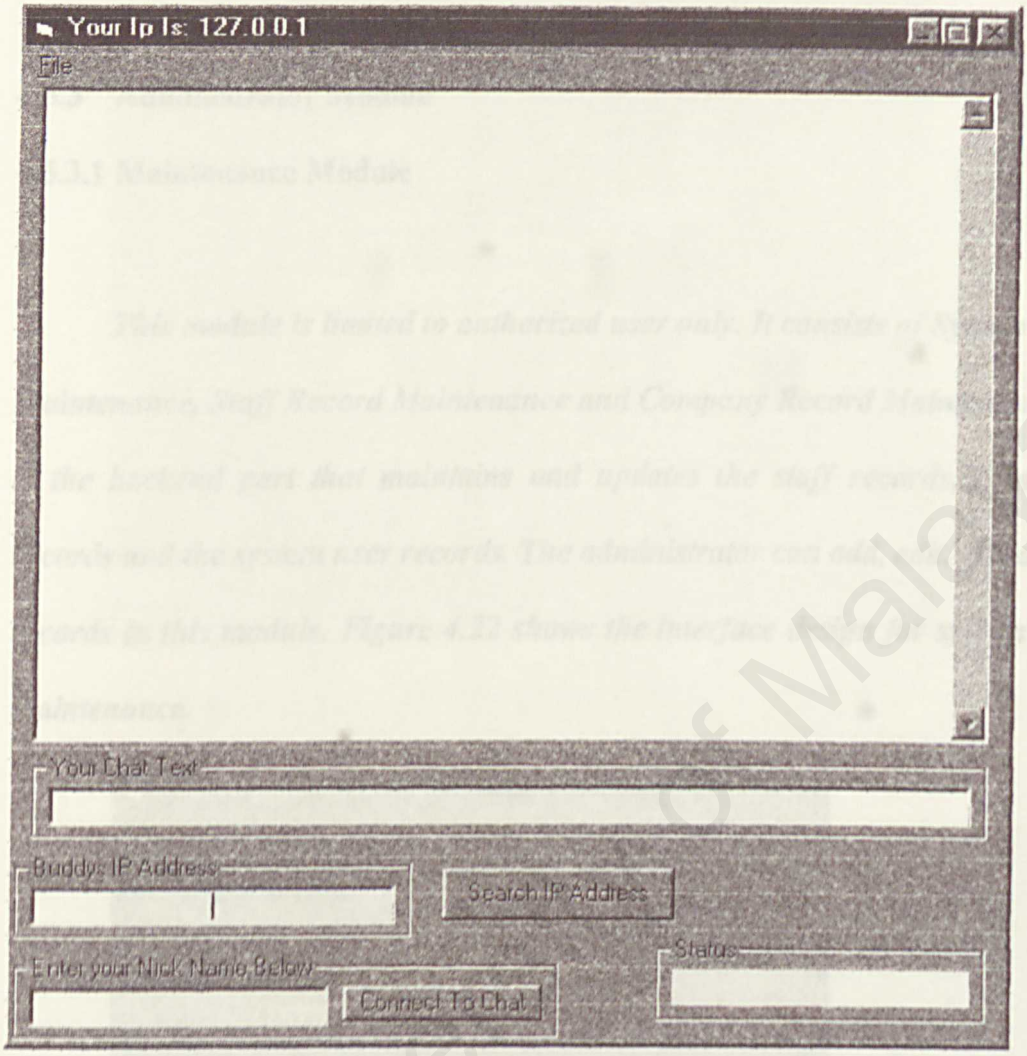



***Figure 4.21*** *Messenger Interface (2)*

By entering a valid IP address into the "Buddy IP Address" text box and click on the "Connect To Chat" button, user can send instant messages to other if the other side running the program too at the same time. To disconnect, just click on the "Dis-Connect" button (figure 4.20)

### 4.5.3 Administrator Module

#### 4.5.3.1 Maintenance Module

***This module is limited to authorized user only. It consists of System User Maintenance, Staff Record Maintenance and Company Record Maintenance. It is the backend part that maintains and updates the staff records, company records and the system user records. The administrator can add, edit, and delete records in this module. Figure 4.22 shows the interface design for system user maintenance.***

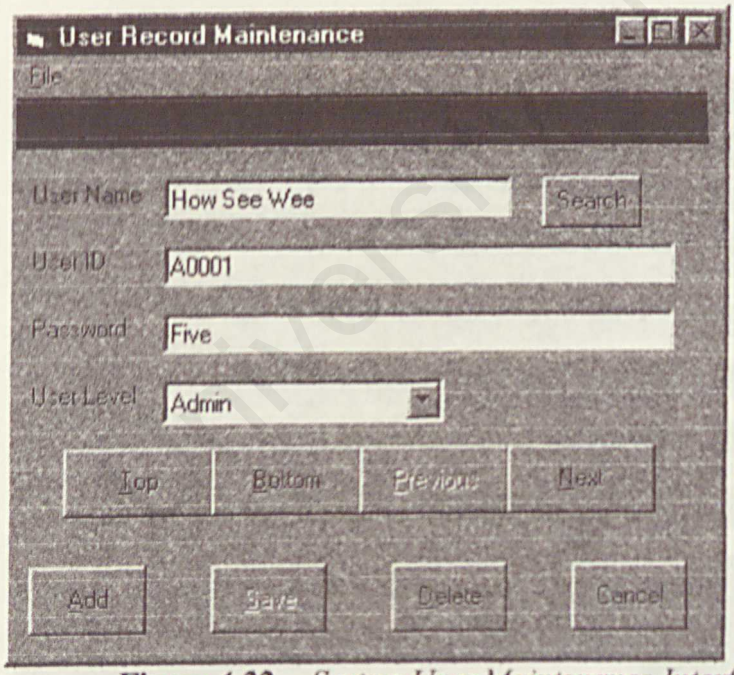



***Figure 4.22*** *System User Maintenance Interface*

The staff record maintenance and company maintenance interface are shown is figure 4.23 and 4.24.

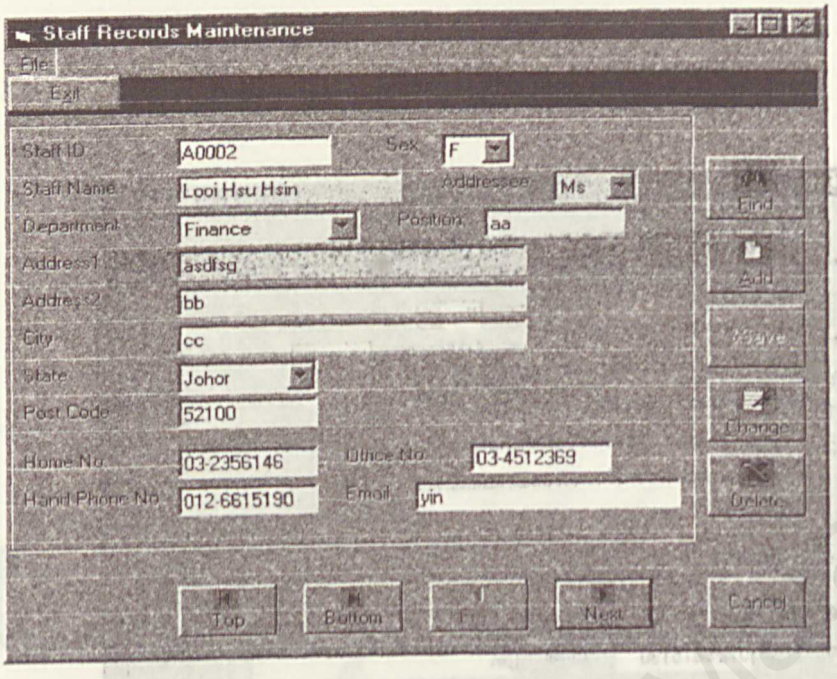



***Figure 4.23*** *Staff Record Maintenance Interface*

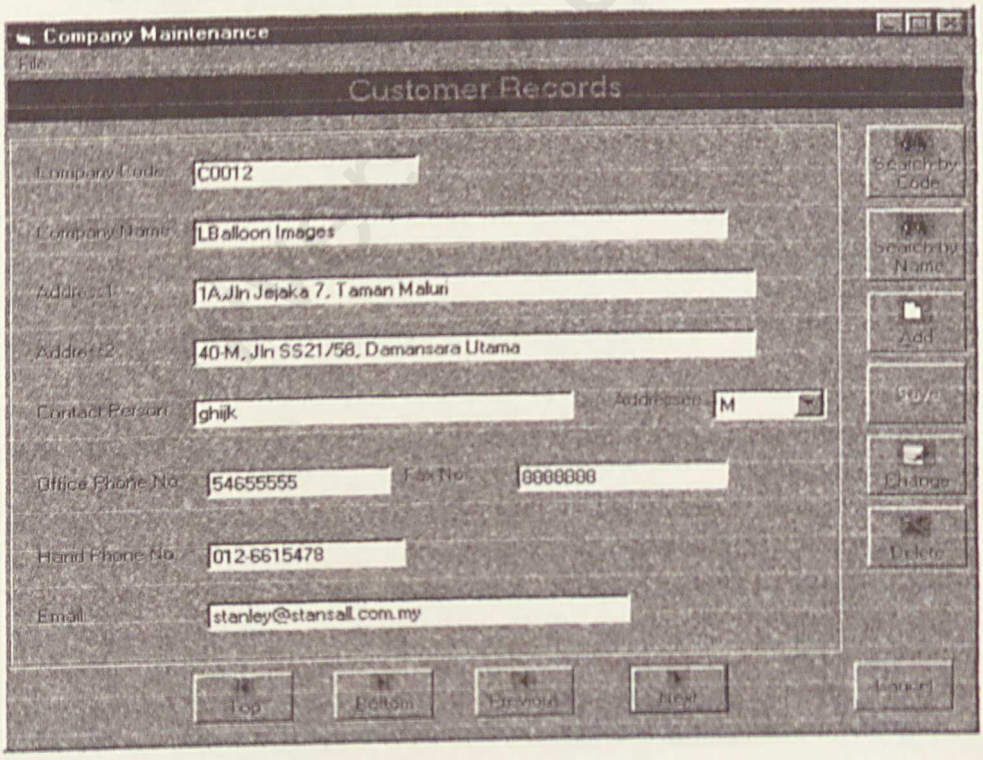



***Figure 4.24*** *Company Record Maintenance Interface*

# Chapter 5

## 5.1 Introduction

System implementation is a phase integrating the designed modules or functions to develop a system based on the given requirements by using appropriate tools and languages.

In the system implementation phase, the major works include coding and debugging which needed to solve the problems and errors faced during coding stage. Programming characteristics and coding style can profoundly affect the system performance.

## 5.2 Development Environment

There are two essential configurations in the development process. These include hardware configuration and software configuration.

### 5.2.1 Hardware Used

The related tools used to develop include:

- Pentium IV 1.4GHZ
- 32 RAM

- 1.44MB Floppy Disk
- 17'' SVGA Monitor
- Mouse
- Canon Printer

### 5.2.2 Software Used

The related tools used to develop the system include:

- Operating system: Microsoft Windows 98
- Development tool: Microsoft Visual Basic 6.0
- Database: Microsoft Access 2000
- Documentation: Microsoft Word 2000

## 5.3 Coding

Coding translates a detail design representation of software into a program language realization.

### 5.3.1 Coding Style

PDIS is developed using architecture approach. It consists of three parts: User Interface layer, Data Layer and Transaction Layer. A layered paradigm has many benefits that help meet the objectives in developing the system. These benefits include:

- Maintainability

  Code is organized in a recognized format where task-oriented code is centrally located.

- Reusability

  Task-oriented code is easily developed for reusing purpose, specifically for tasks that are performed across application boundaries.

- Testability

  Modules can be tested more efficiently. Modularization breaks the code coverage task into smaller, manageable sections.

- Speed

  Modular code can sagely be optimized without affecting the whole procedure.

## 5.4 System Development

PDIS is developed by divide it into modules, which is more manageable. The system is built up by combining a set of modules and by synchronizing the communication between each module.

This approach makes both the design and implementation more efficient. In general, there are eight steps in building the system using Visual Basic 6.0:

i. Create a project to store all the functions, classes (if any) and global variables.

ii. Create the user interfaces, which used the built in resources (components in the toolbox dialog) in the Visual Basic software.

iii. Integrate the database to the project.

iv. Add the functionality required to each individual module. Define the contents.

v. Test and evaluate the results to ensure that each module is performing the correct tasks.

vi. Perform error handling and checking in each module.

vii. Compile and run each module using the debugger integrated.

viii. Integrate the modules to create a complete system.

# Chapter 6

## 6.1 Introduction

Testing is carried out to discover different classes of errors in system development. It demonstrates that each function appear to be working according to the specifications and performance requirements. However, testing cannot show the absence of defects, it can only show that system defects are present.

Software testing is often referred to as verification and validation. Verification refers to the set of activities that ensure the software correctly implements a specific function. Validation refers to a different set of activities that ensure the software fulfill the predefined requirements.

Three type of testing strategy as described in section 6.2, 6.3 and 6.4 have been conducted to test the project.

## 6.2 Unit Testing

PDIS is divided into modules and each module contains a number of functions. For example, Staff Maintenance module consists of functions such as Add, Change and Delete staff record. Unit testing involves testing of each function in a module like whether the specific functions do what it supposed to

do. Finally, proceed to the testing for overall module. The unit testing of PDIS covered the following aspects as listed below:

i. Test on module interface

   To ensure that information flows in and out properly

ii. Test on data structure

   Ensure that data stored temporarily maintains its integrity during an algorithm execution

iii. Test on boundaries condition

   Ensure that modules operate properly in boundaries established of processing limitation and restriction

iv. Error handling

   Ensure that error handling procedures able to handle the expected or unexpected errors by giving error messages to users.

Example unit testing 1: add new user

Test case: a unique user id and a duplicate user id.

Example unit testing 2: update an existing record

Test case: test validation for each field

Unit testing is performed to ensure that a specific module had operated correctly as define in the system requirements.

## 6.3 Integration Testing

Integration testing is a systematic technique for constructing program structure while conducting test to discover errors associated with the interface. The objective of this test is to take the tested unit module and build a program structure by combining them. Integration testing ensures that the sequence of each unit module is arranged correctly. There are a few aspects covered in integration testing:

i. Ensure that data is not lost across interfaces.

ii. Ensure that each function, when combined, produces the desired performance.

iii. Ensure that global data structures do not present unacceptable results.

In PDIS, integration testing includes testing of the top most level, which is the main module. Then followed by all components called by the tested module. This is continuing until all modules have been tested.

## 6.4 System Testing

System testing consists of a series of different tests, which verify that all system elements like the hardware, software, modules and data have been properly integrated and perform the desired functions. In system testing, the flow of data through the entire system is also tested to make sure it follows the sequence accurately.

System testing is performed to make certain that the whole system works according to users' specifications. Developers will join the users to perform this stage of testing where the system is checked against the users' requirements description. If there is a need for change, system modification will then be carried out if the users' requirements were not met as described in the specifications. If the users are satisfied with the system's characteristics, the system is ready to be deployed for use. The testing result will show whether or not the entire system specifications and objectives are achieved. The testing steps are shown as figure 6.1 below. There are 3 main steps taken in the Phone Directory IS testing process:

- Function testing
- Performance testing
- Acceptance testing

### 6.4.1 Function Testing

A function test checks that the integrated system performs its function as specified in the requirements.

### 6.4.2 Performance Testing

Once the system functions are convinced to work as specified, the performance test is conducted. It compares the integrated components with the non-functional system requirements. These requirements, including security, accuracy, speed and reliability, constrain the way in which the system functions are performed. Performance tests taken are to evaluates the followings:

- Speed of data retrieval.
- Security precautions required.
- Consistency in data's availability.
- Precision accuracy in data, function and process.
- Response time to user inquiry and errors detection.
- System's reliability and robustness.

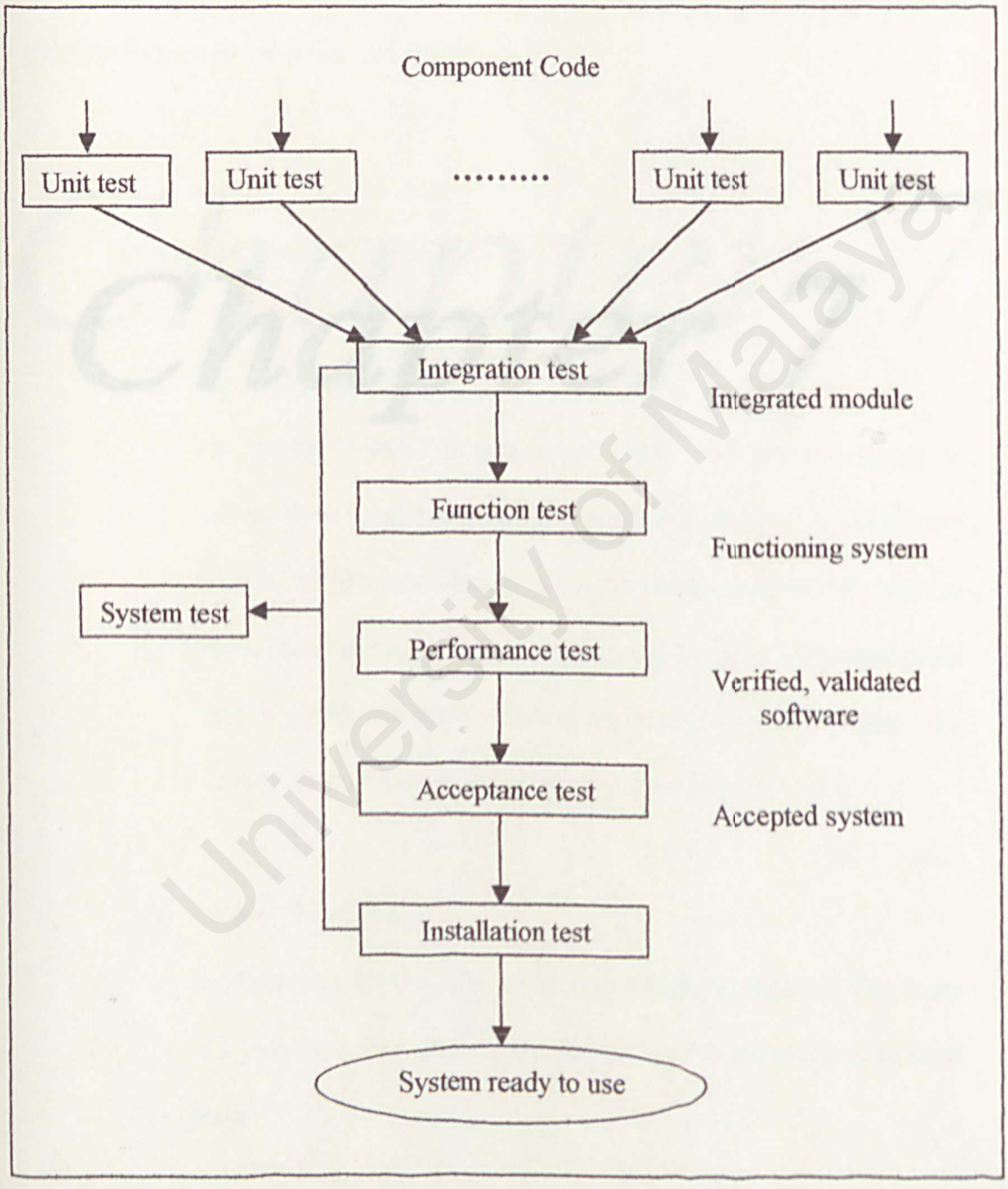
At this point, after the performance tests, the system is considered to have operated the way it is intended to be. This verified system is then compared with

the end-users expectations by reviewing the requirements definition in the documentation. Upon satisfaction of the comparison, the system is called a validated system, which means that the requirements have been met.

### 6.4.3 Acceptance Testing

Function and performance testing is done by the system developer. Before the system is fully ready to roll out, it is a best thing if the system is also tested by the end-user. This test, called an acceptance test, assures the end-users that the system they requested is built for them. The end-user testers are selected specially to test out the application.

***Figure 6.1*** *Testing Steps*



# Chapter 7

## 7.1 Introduction

In system evaluation, the system strengths and limitations as well as possible future enhancements are discussed.

## 7.2 System Strengths

a) User friendliness

The design of PDIS is simple and clean. The interface design as well as some icons provides the easiest way for users to access the system. PDIS uses window style interfaces that contain buttons, scroll bars, combo boxes and other window standard components. This is similar to other window applications in functioning. The window environment made it easy for users to learn.

b) Less keyboard usage

In PDIS, less keyboard skills or knowledge are required. The users just have to "point and click" the buttons to perform their desired tasks.

c) Searching capabilities

PDIS provides searching capability that enables the users to search for the database records.

d) User ID and password

Only authorized users can gain access into the system. Different status of users will gain access to different level of the system. For example, only users with administrator level are allowed to update the database records while normal users can only view and perform some tasks on it.

e) Informative messages

The system provides error messages whenever a user attempts to perform some illegal operations. These messages in turn tell the user what had happened and user can react on it. Beside, there are also messages prompt out whenever certain tasks are successfully completed.

f) System transparency

It refers to the condition where the system users do not need to know the following issues:

- The database management system

- The database structure
- The system architecture
- Anything related to the underlying system built

## 7.3 System Limitations and Constraints

Due to the limited time for development, some of the system features have not been well implemented. These include:

a) A limited number of search options

Only a limited number of search option are provided for users to search for certain records from database. Users only can search by company code and company name for customers records. This restricts users from searching efficiently if they have others search option like the company location or other means.

b) No online help

There are no online help is provided for PDIS users.

c) IP addresses

Users need to know their buddies' IP addresses in order to send a message to them. If they do not have the IP address, they cannot do so.

## 7.4 Future Enhancements

With reference to the limitations and constraints of the system discussed above. It is hoped that the following can be performed in the future to make the system more useful:

a) Provides the greater number of search options i.e. users can search for the records based on their search option choice.

b) Provides the buddies' name instead of using the buddies' IP address. This is said to be more user friendliness.

c) Provides online help

## 7.5 Conclusion

Phone Directory Information System could be said to have achieved the objectives that were defined in the system requirements. It enables the users to perform their tasks such as searching for staff and company records, sorting the records, sending email as well as gain access to their personal inbox. Beside that, users can also send an instant message to their buddies' using the messenger provided.

The user friendliness interface design made it easy to use and learned by people with no technical experience.

Although for the time being, PDIS has a few limitations or constraints that made it not that perfect in some aspects, it is expected able to be enhanced in the future.

Throughout the whole project development, I have gained some experiences and knowledge. The months of intense works, in turn, presented me with an opportunity to learn new things from learning a new programming language to how to handle and solve problems. Beside, throughout the development process, my writing skills and communication skills have improved. Also, experiences are gained through project management, scheduling and planning.

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http://cuinl.tripod.com

Visual Basic 6.0 Tutorial & Source Code. Available HTTP:

www.coderoom.com

Visual Basic 6.0 Tutorial & Source Code. Available HTTP:

http://bestoftulsa.com/computers/visual_basic.shtml

Visual Basic 6.0 Tutorial & Source Code. Available HTTP:

www.programmersheaven.com

Visual Basic 6.0 Tutorial & Source Code. Available HTTP:

www.marshallsoft.com

Visual Basic 6.0 Tutorial & Source Code. Available HTTP:

www.vbsquare.com

Visual Basic 6.0 Tutorial & Source Code. Available HTTP:

http://members.aol.com/danp600/vbtutorial.html

Microsoft Visual FoxPro® Available HTTP:

http://www.vbresourceguide.com/display.asp?cat=mt&ID=12

Microsoft Windows 2000 Server. Available HTTP:

http://www.microsoft.com/catalog/display.asp?subid=22&site=656&x=31&y=16

SQL Server 7.0 Database. Available HTTP:

http://www.microsoft.com/sql/evaluation/features/70/default.asp

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# User Manual

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**Chapter 1**

# Chapter 1 System Requirement

## 1.1 Hardware Requirement

The hardware requirements for installing PDIS are summarized in Table 1-1.

| Component Description | Comments |
|---|---|
| Microprocessor | 486DX/66MHz or higher processor PC (Pentium or higher processor recommended). |
| RAM | At least 32MB RAM for Windows 95/98 or at least 16MB for Windows NT Workstation 4.0. |
| Storage | 30MB minimum hard disk space. |
| Video monitor | VGA or higher resolution monitor. |
| Input Device | Keyboard and Mouse. |
| Printer | Bubble Jet or Laser Jet printer. |

*Table 1-1 Hardware requirements for PDIS*

## 1.2 Software Requirement

The software requirements for installing PDIS are summarized in Table 1-2.

| Component Description | Comments |
|---|---|
| Operating System | Microsoft Windows 95/98 or Windows NT Workstation 4.0. |

| System Development Tools | Microsoft Visual Basic 6.0 |
|---|---|
| Database Management System | Microsoft Access 2000 |

***Table 1-2*** *Software Requirements for PDIS*

## Chapter 2 Installing PDIS

Steps:

1. To install *PDIS*, insert the PDIS CD into the CD-ROM.
2. Starting the setup with 2 different ways:
   i) Through *Windows Explorer*
      - Open the *Windows Explorer* and go to the *CD-ROM* drive. To install, double click on the the *setup.exe* file in the folder.

   ii) Through the *Run* function
      - From the *Start* Menu, choose *Run* and click the *Browse* button to search the *setup.exe* file from the *CD-ROM* drive. Click Open to return to the *Run* window. Click *OK* to continue.
3. Now the installation process will continue. Follow the instructions given.
4. By default, *PDIS* will be install to *C:\Program Files\PDIS*. To change directory, please click *Change Directory*.

# Chapter 3 Setting Up ODBC

After you have successfully install PDIS into your Personal Computer, you have to setup the ODBC Data Source before you can start using PDIS.

Steps:

1. Click the *Start* Menu and choose *Setting*, then *Control Panel*.
2. On *Control Panel*, choose *ODBC Data Sources* icon (see Figure 3-1) and double click on it.

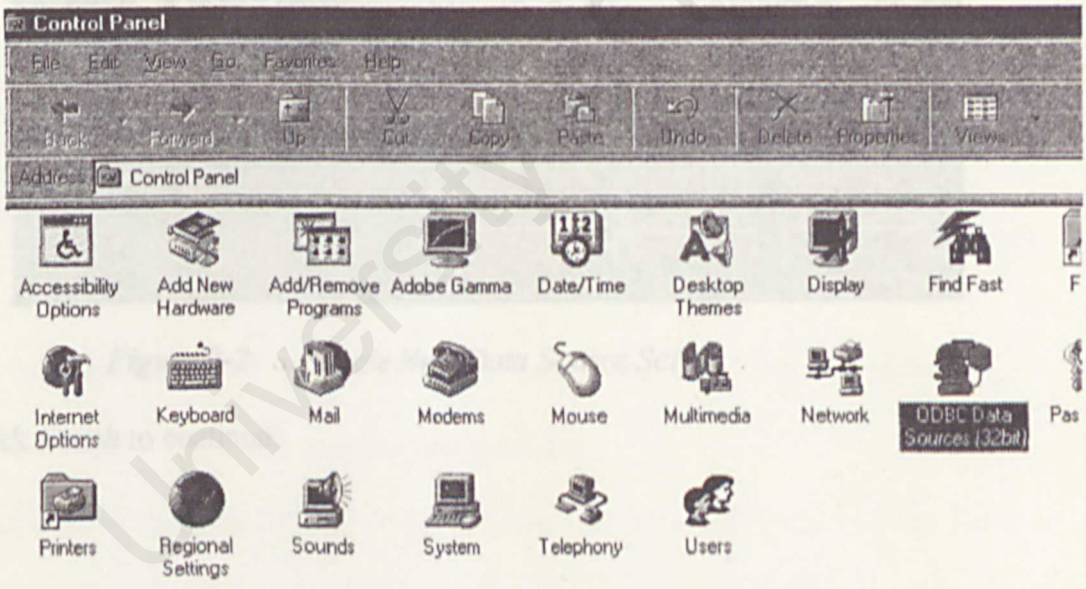


***Figure 3-1*** *Control Panel Screen*

3. Once the *ODBC Administrator* window appears, choose the system's *Data Source Name* tab and click *Add*.

4. A window to enable you create a new Data Source will appear as in figure 3-2. Choose *Microsoft Access Driver (*.mdb)*.

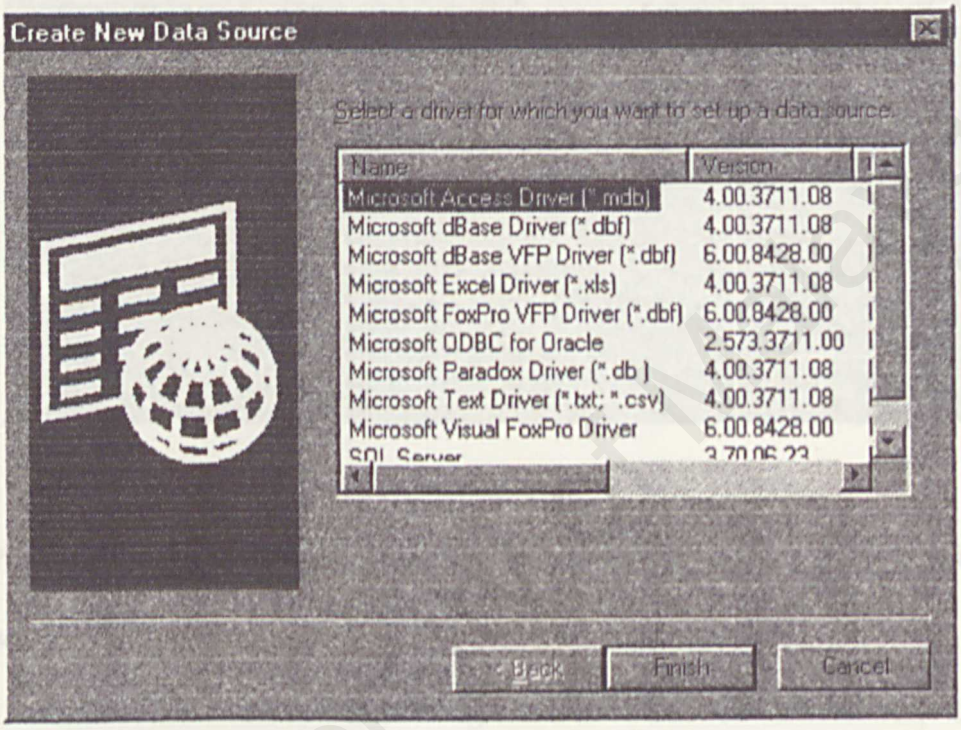


***Figure 3-2*** *Create New Data Source Screen*

5. Click *Finish* to continue.

6. In the *ODBC Microsoft Access Setup* window screen as shown in figure 3-3,

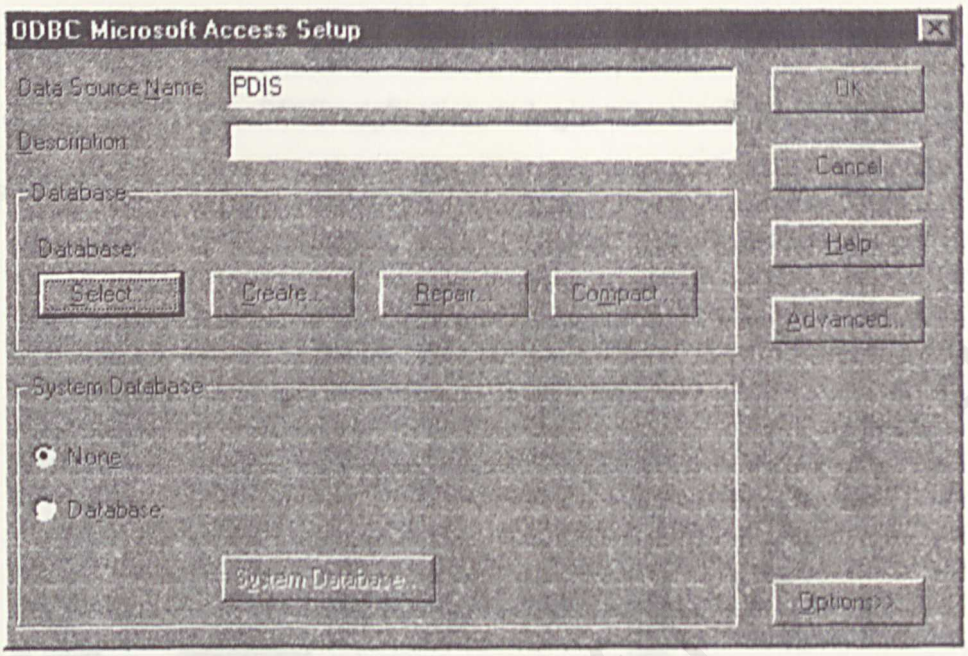


***Figure 3.3*** *ODBC Microsoft Access Setup Screen*

Type *PDIS* in the *Data Source Name* and click select to select the *PDIS.mdb* database:

Select *C:* for Drives and *C:\Program Files\PDIS* for Directories, the database name will appear in the list box. Select the *PDIS.mdb* database and click *OK* to finish selecting the database.

7. Click *OK* to close the *ODBC Setup* window and click *OK* again to close the *ODBC Data Source Administrator* window.
8. Congratulations, you have successfully setting up the ODBC Data Source for *PDIS*.
9. Now, you can start using *PDIS*. To start the *PDIS* application, from the *Start* Menu, select *Program* and then *PDIS*.

# Chapter 4 PDIS

## 4.1 Login Screen

once you start the PDIS application, a login screen will be prompted out. As shows in figure 4-1.

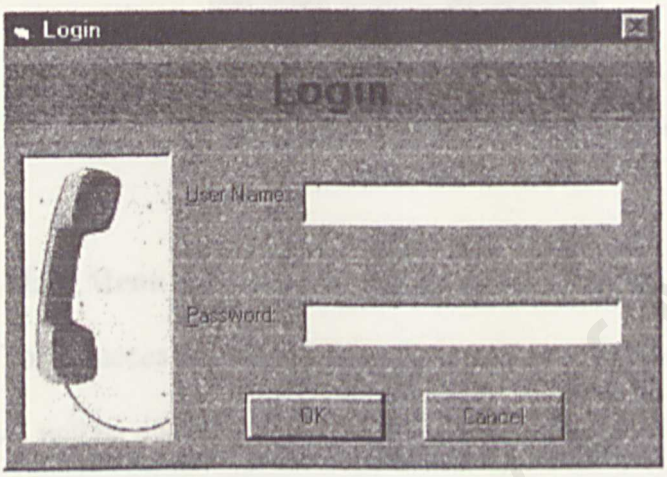


***Figure 4-1*** *Login Screen*

User needs to enter their user name and password in order to gain access into the PDIS. Based on the type of user name input, i.e. normal user (user ID starts with 'U' and followed by four digits number) or administrator (user ID starts with 'A' and followed by four digits number), different access levels will be provided. There are some errors checking such as if user press OK button without entering any data in the text boxes or the password entered not matching the user ID. When these happened, message box with related information will prompt out

and telling the user what had happened. Figure 4-2 shows an example of the message box.


***Figure 4-2*** *Error Prompt Out Message Box*

## 4.2 Main Menu Screen

For a successful login, if the user name starts with 'U' the menu shown in figure 4-3 will be displayed.

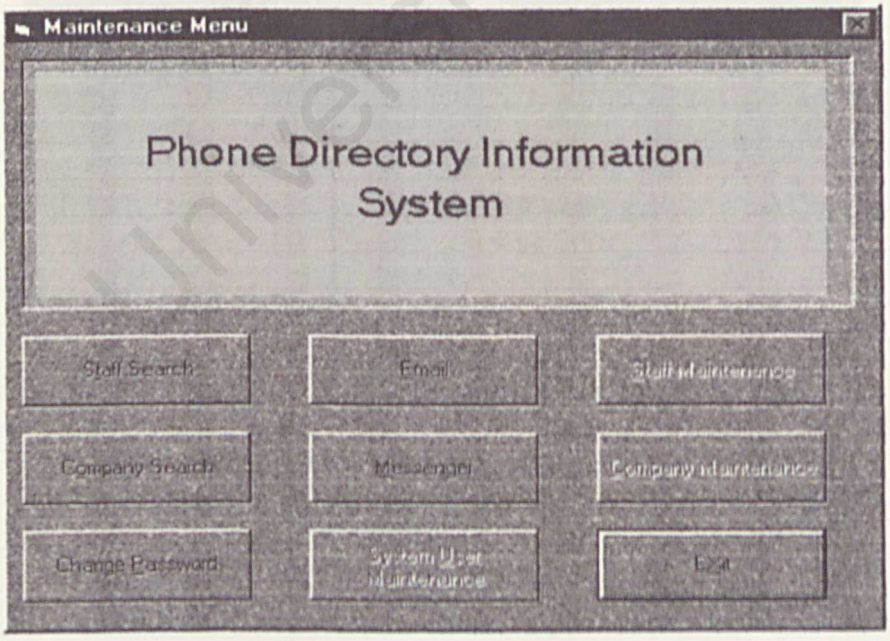


***Figure 4-3*** *Normal User Main Menu*

Else, if the user name starts with 'A', the menu shown in figure 4-4 will be displayed. There is only one administrator can access the System User Maintenance i.e. user with login id 'A0001'. Other users with user name start with 'A' will not be allow to access the System User Maintenance.

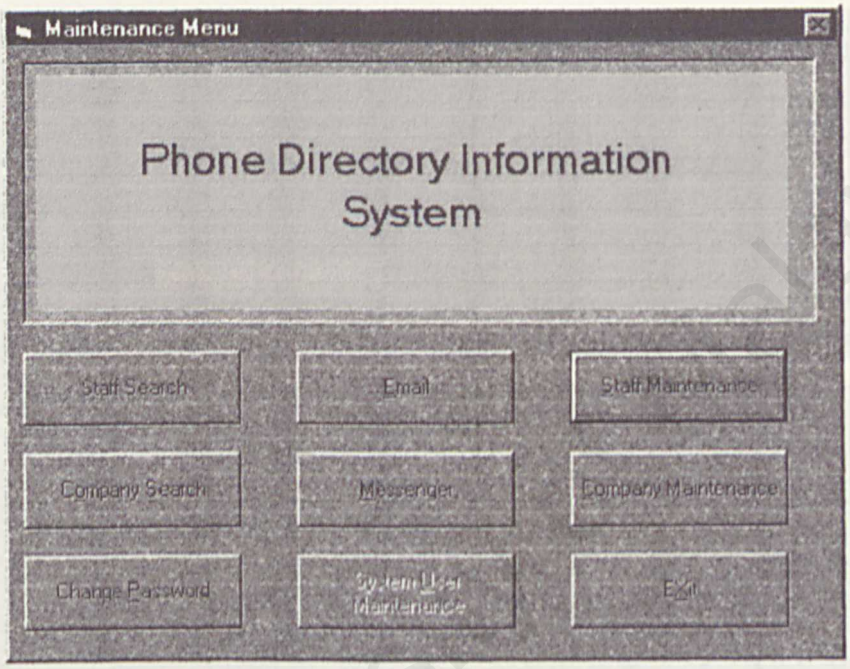


***Figure 4-4*** *Administrator Main Menu*

## 4.3 Normal User Main Menu

As shown in figure 4-3, it has four functions, i.e.

4.3.1 Staff search

4.3.2 Company search

4.3.3 Email

4.3.4 Messenger

4.3.5 Change password

### 4.3.1 Staff Search Screen

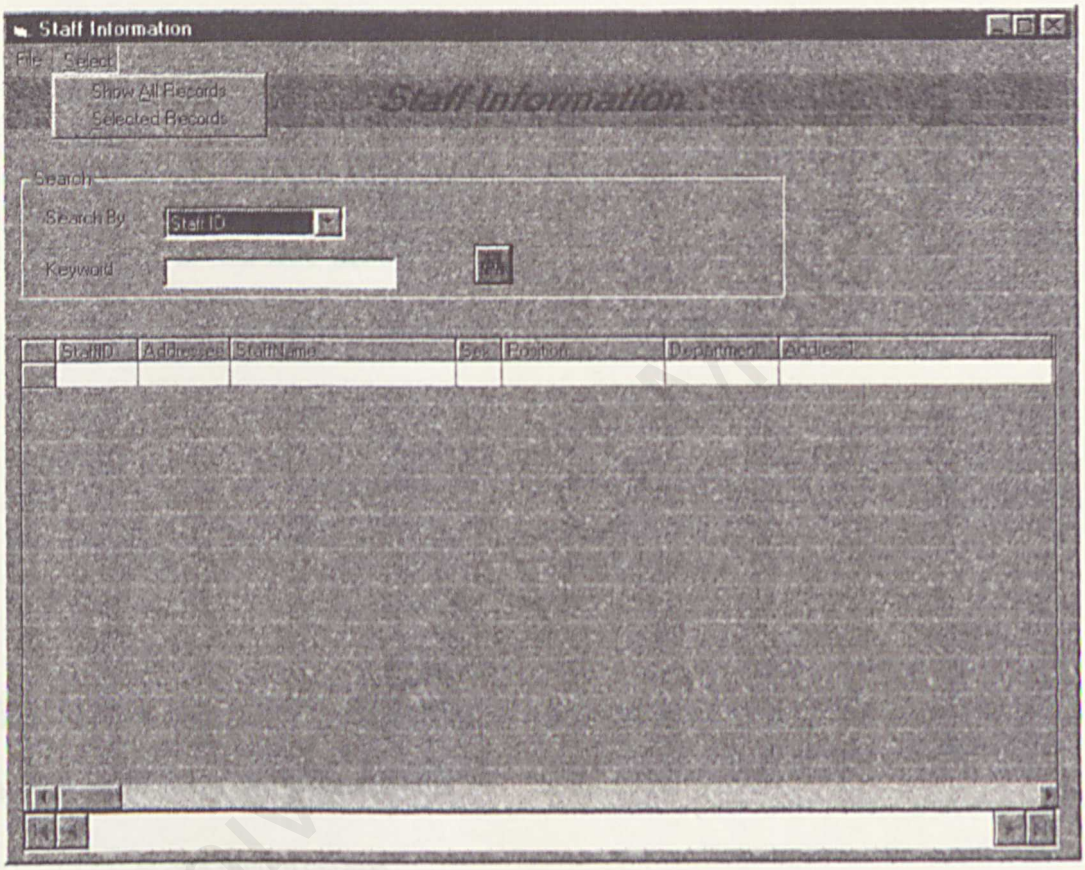


***Figure 4-5*** *Staff Search Screen*

Figure 4-5 shows the Staff Search Screen. In order to do a search, user need to:

Step 1: Choose one search option from the combo box. The search options provided include search by Staff ID, Staff Name, Department and Position.

Step 2: Type in the keyword.

For staff ID search option, type in 'U0001' will display the record of staff ID = 'U0001'. Type in 'U01' will display all records with staff ID start with 'U01', which include 'U0199' and 'U0189' and vice versa.

For staff name search option, type in 'Tan' will display records with staff name = 'Tan Carmile' or 'tan danielle' but not 'Carmile Tan' or 'danielle tan'.

For department search option, type in 'fi' will display records with department = 'Finance' but not 'unfit'

For position search option, type in 'manager' or just 'ma' will display records with position = 'Manager'

From figure 4-5, if user clicks the *select* menu on the upper left of the form, there are two options: 1. Show All Records and

2. Selected Records

where user can choose.

1. Show All Records

Click on this will display the following screen. As shown in figure 4-6.

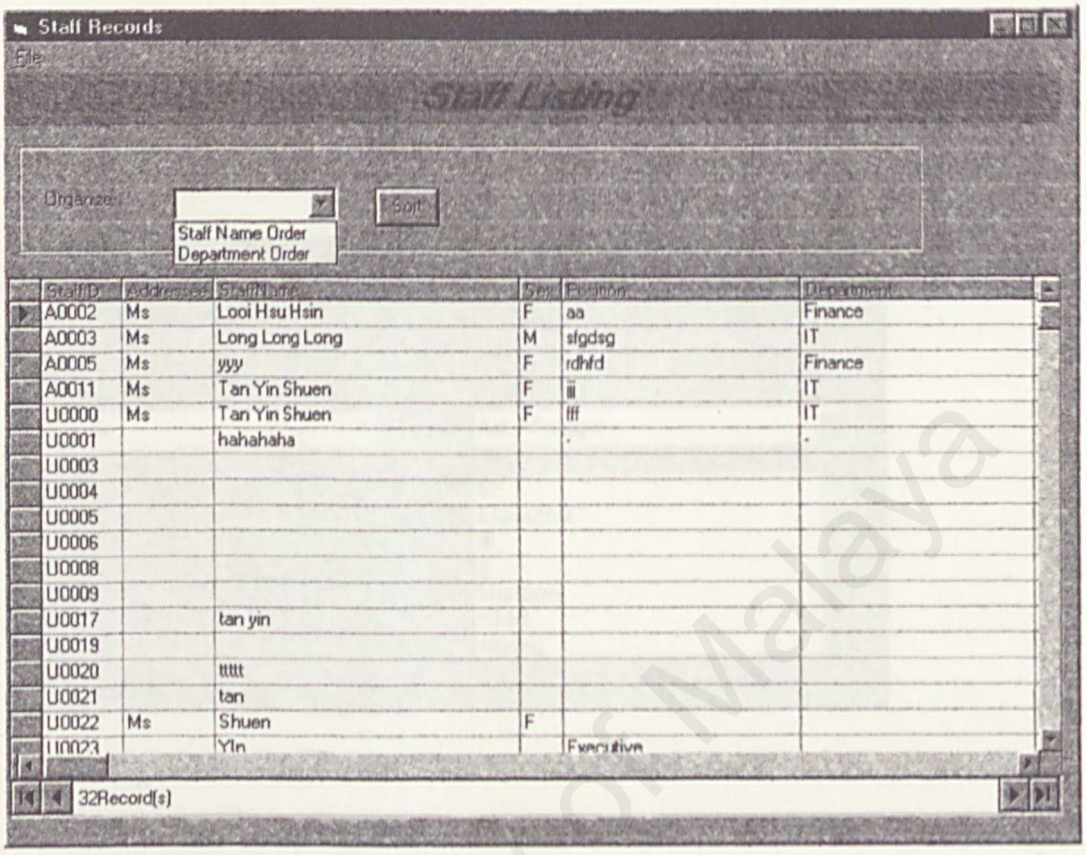


***Figure 4-6*** *Staff Listing Screen*

This option displays the staff listing. User can view on the staff listing in Staff Name Order or Department Order by choosing the kind from the combo box and click on the sort button.

2. Selected Records

Choosing this option will display the screen as shown in figure 4-7.

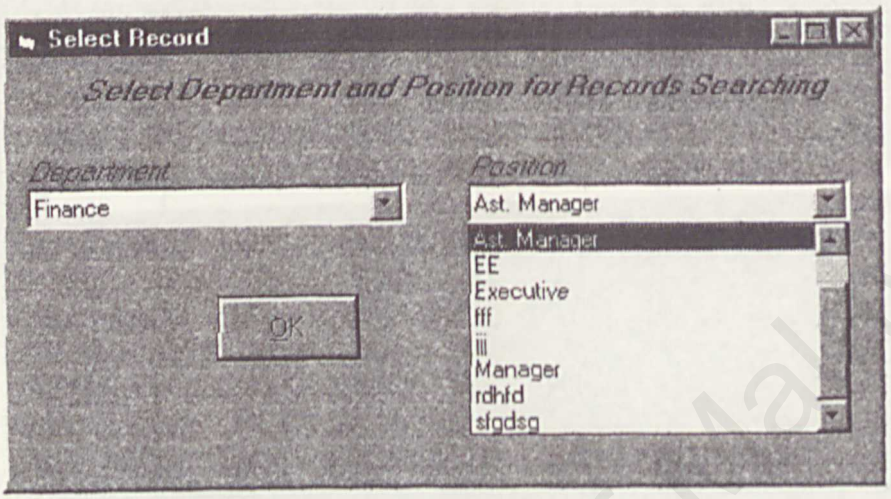


***Figure 4-7*** *Selected Records Screen*

This screen allows user to search for the record(s) based on two criteria i.e. Department and Position. The result will be displayed back in figure 4-5.

### 4.3.2 Company Search Screen

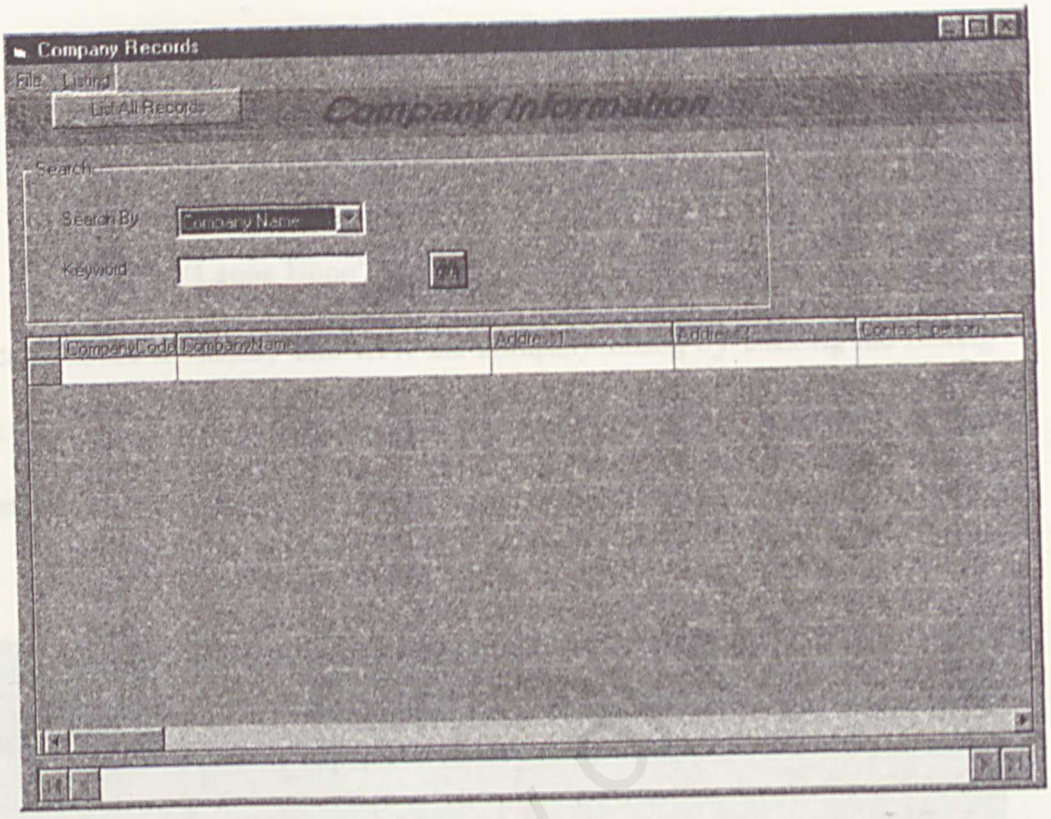


***Figure 4-8*** *Company Search Screen*

Figure 4-8 shows the Company Search Screen. In order to search for company record(s), user need to:

1. Choose a search option from the combo box. Either Company Code or Company Name.
2. Type in the keyword.

   For Company Code search option, type in 'C0003' will display record with company code = 'C0003'. Type in 'C' will display all records

with company code start with 'C'. Type in 'C02' will display all records with company code start with 'C02' and vice versa.

For Company Name search option, type in 'Hong' will display records with Company Name = 'hong Leong' or 'Hong Leong' or 'leong hong' or 'Leong Hong'.

User can choose to display and view the company listing by clicking the *Listing* on the upper left corner of the form and choose *List All Records.* This will display a screen like figure 4-9.

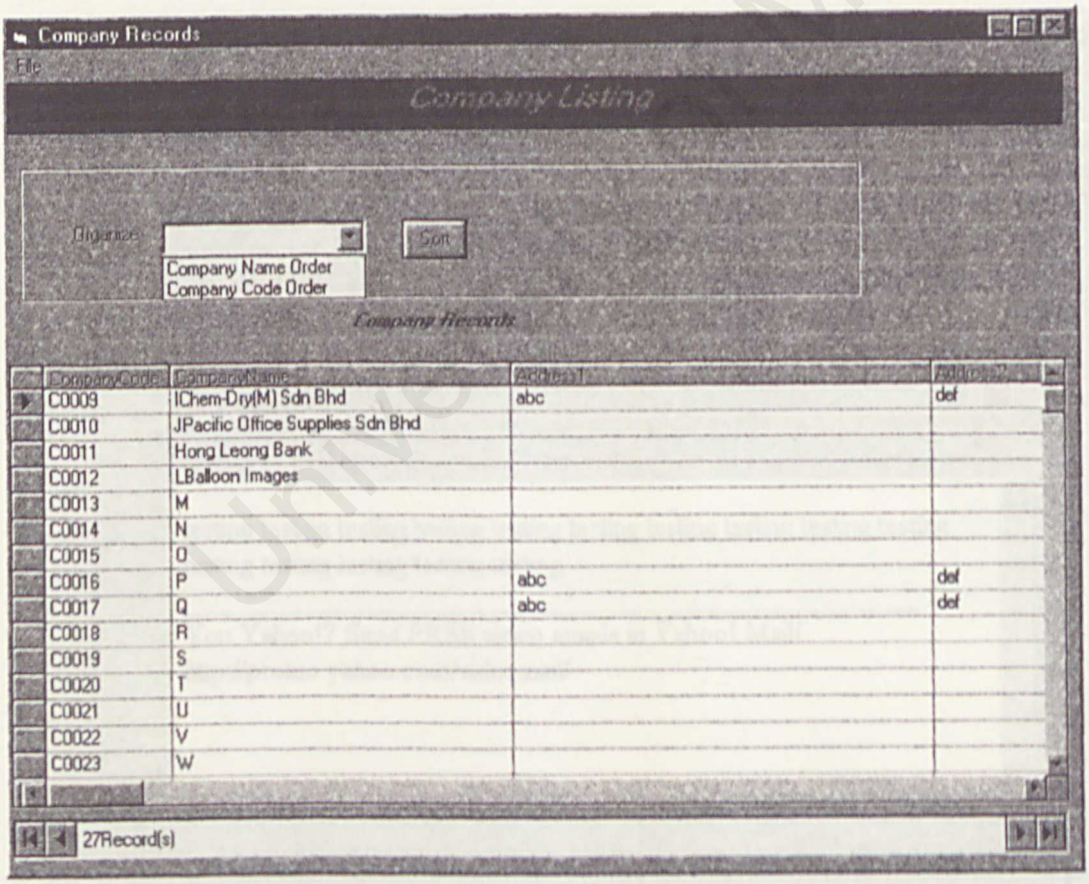


***Figure 4-9*** *Company Listing Screen*

User can choose to view the company listing in Company Code order or Company Name order by choosing the option from the combo box and press the sort button.

### 4.3.3 Email Screen

There are three sections in the email part: the inbox, compose and contact sections. Figure 4-10 shows the inbox section of the email screen. To check email, user needs to type in the user name and password first, and follow by a clicking on the check mail button.

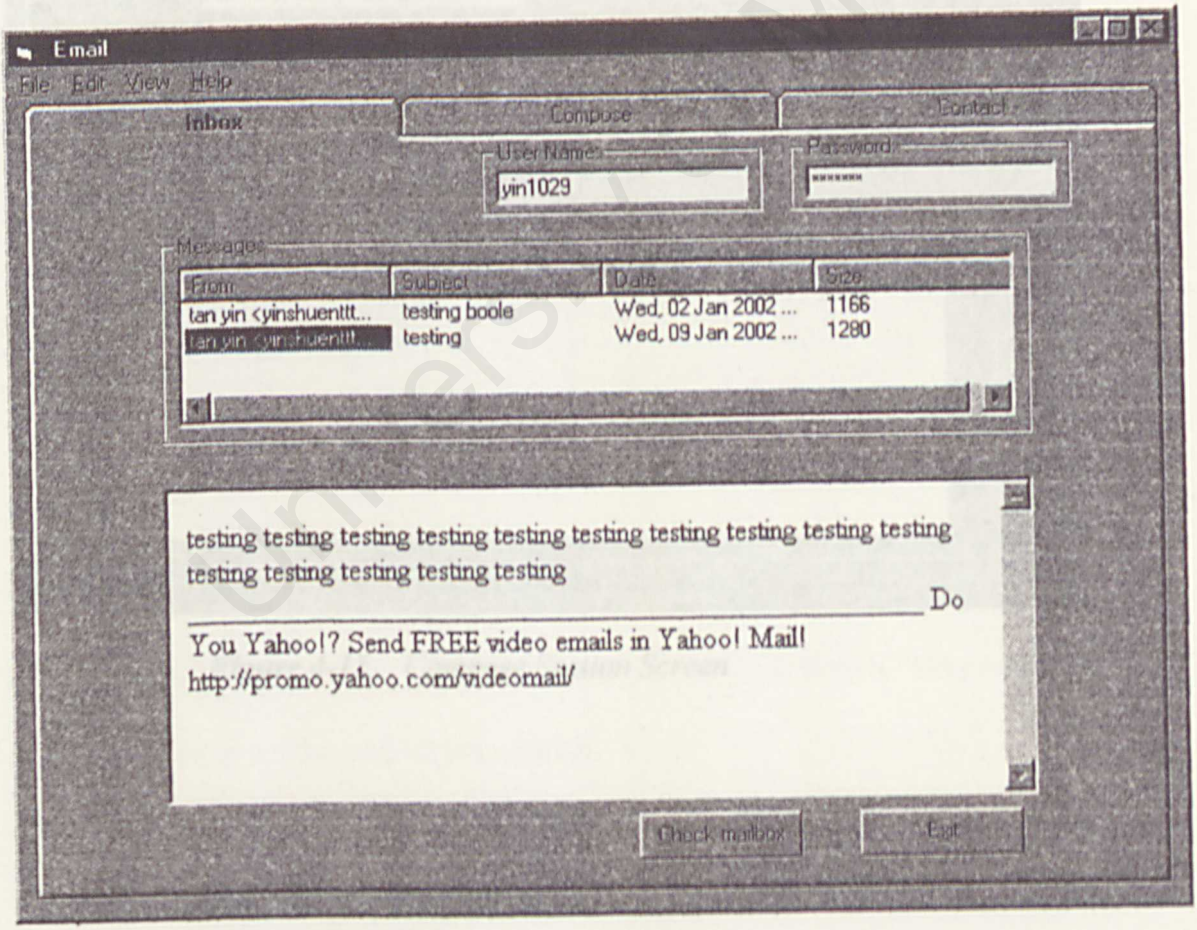


***Figure 4-10*** *Inbox Section Screen*

To check for the content of a message, user just has to click on that sender and the related message will be displayed in the space above the check mailbox button.

The second section of the email part is the Compose section. The screen is shown in figure 4-11 below.

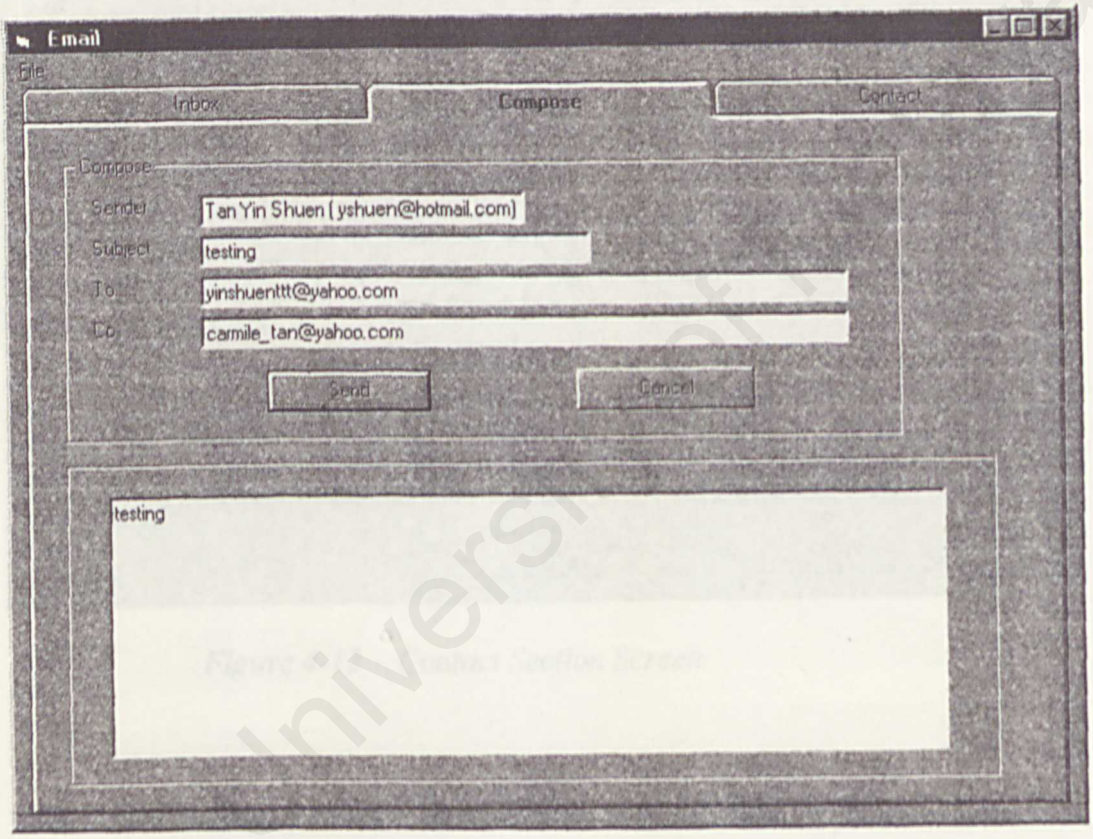


***Figure 4-11*** *Compose Section Screen*

User needs to type in the recipient name(s) or else error message box will be prompt out stating that the mail cannot be sent. A success mail sending will be informed by a prompt out message box.

The third section of the email part is the Contact section as shown in figure 4-12 below.

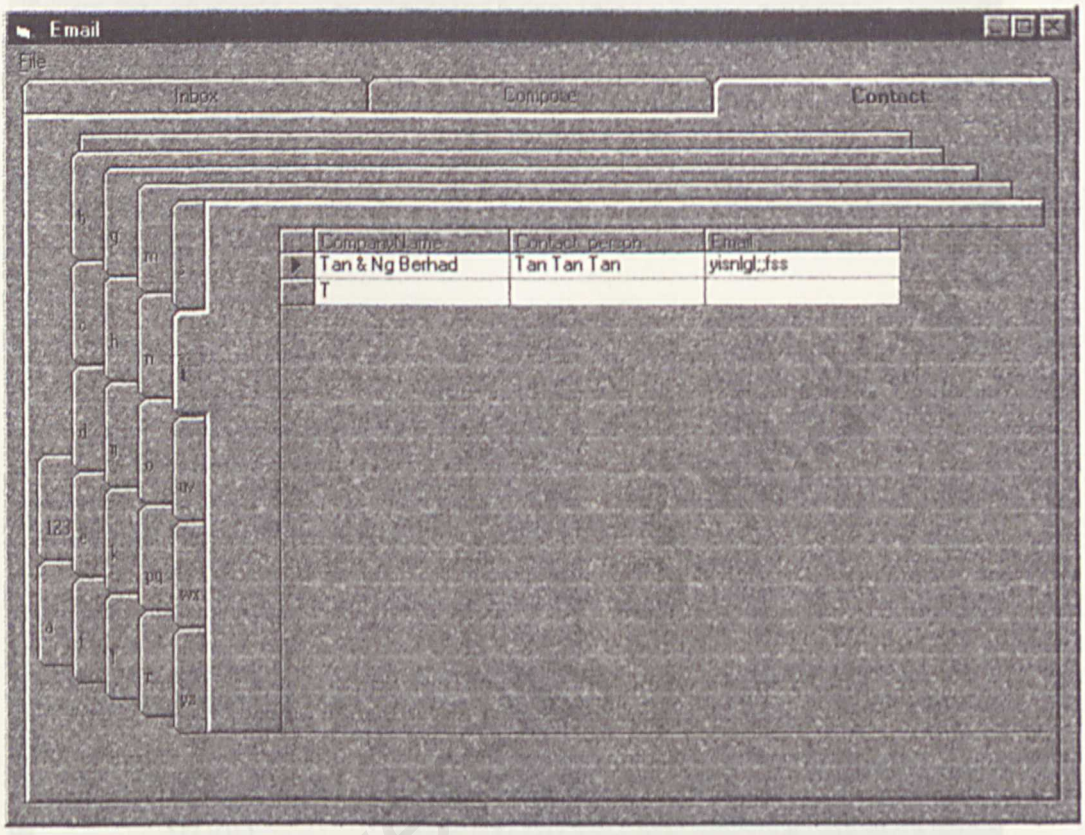


***Figure 4-12*** *Contact Section Screen*

This section enables the users to search for the company email addresses. They don't need to go back to the search company part to do a search. They can just refer from here to get the contact information.

### 4.3.4 Messenger Screen

Figure 4-13 shows the Messenger screen.

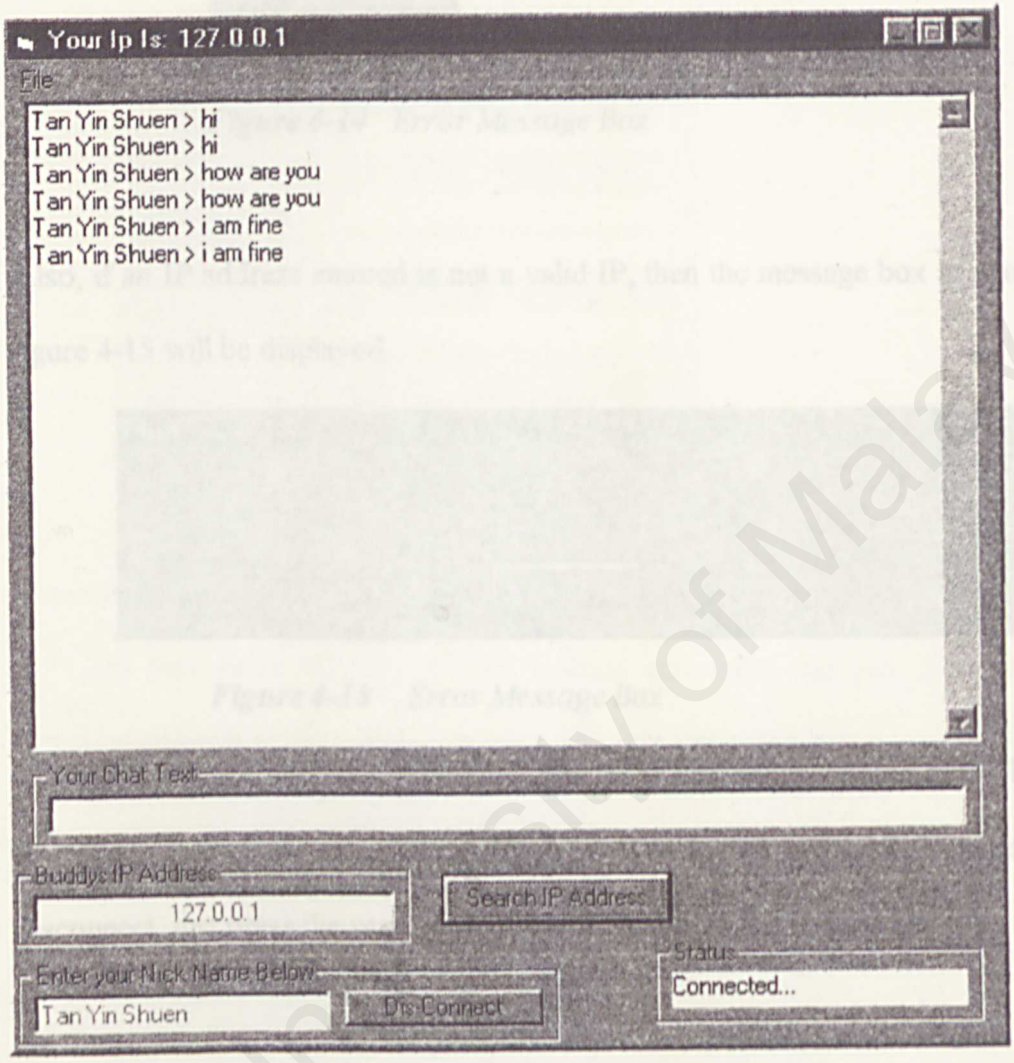


***Figure 4-13*** *Messenger Screen*

In order to chat with someone, user needs to enter the Buddy IP Address. If user failed to do this, a message box as shown in figure 4-14 will be displayed.

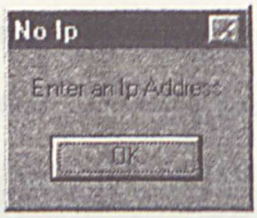


***Figure 4-14*** *Error Message Box*

Also, if an IP address entered is not a valid IP, then the message box as shown in figure 4-15 will be displayed.


***Figure 4-15*** *Error Message Box*

If there is no any message prompt out and an IP address is entered in the Buddy IP Address, user may press the Connect To Chat button to start the chatting. To disconnect, just press the same button and the connection will be terminated.

### 4.3.5 Change Password Screen

Figure 4-16 shows the Change Password screen.

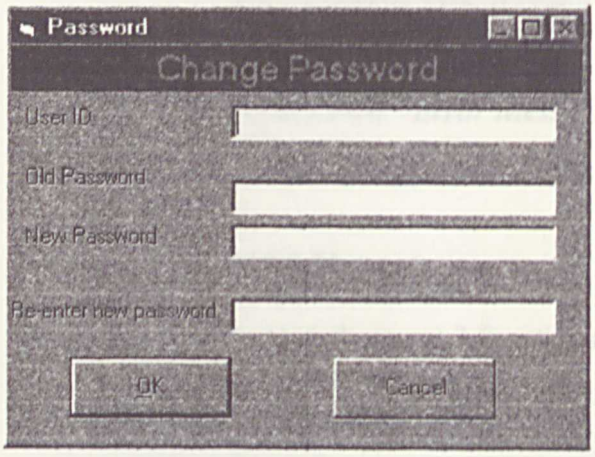


***Figure 4-16*** *Change Password Screen*

There are several error handlings provided.

1. If user press OK button with nothing entered in the user ID text box, message box as shown in figure 4-17 will be displayed.


***Figure 4-17*** *Error Message Screen*

2. If there are no input in the Old Password, New Password and Re-enter New Password text boxes, the message box as shown in figure 4-18 will be displayed.


*Figure 4-18 Error Message Screen*

## 4.4 Administrator Main Menu

As shown in figure 4-4, there are 3 functions, which are:

4.4.1 System User Maintenance

4.4.2 Staff Record Maintenance

4.4.3 Company Record Maintenance

### 4.4.1 System User Maintenance

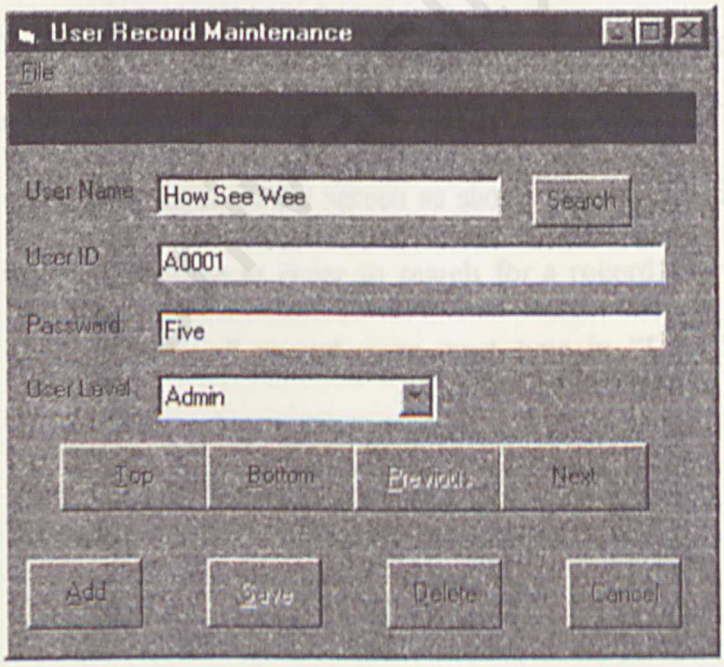


*Figure 4-19 System User Maintenance Screen*

Figure 4-19 shows the System User Maintenance screen. There are several operations user can perform, i.e. Search, Add and Delete.

1. Search

   In order to search for a record, there are two alternatives: press the Search button or navigate through the records by clicking on the previous and next buttons. By pressing the Search button, an input box as shown in figure 4-20 will be displayed.

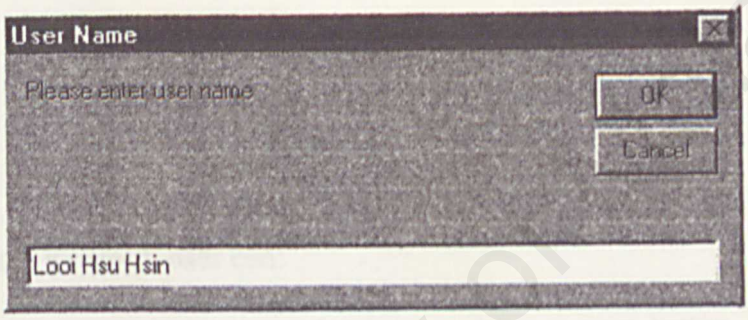


***Figure 4-20*** *Input Box Screen for System User Maintenance*

By clicking OK, an information message box will be prompted out telling the user whether the record existed or not existed. If existed, the record will be displayed in the screen as shown in figure 4-19. User must type in the exactly name in order to search for a record. For example, to search "Looi Hsu Hsin" record, user must type in "Looi Hsu Hsin" and not "Looi" or any other means.

2. Add

To add a new system user, all the text boxes should be enter a value, or else, error message will be prompted out. This will also check for any duplicate user ID. A duplicate ID record will not be successfully saved.

Two steps in adding a new user:

i. Click the add button

ii. Enter related values in each field. Enter "-" for any N/A fields

iii. Press the save button

3. Delete

To delete a record, user can:

i. Navigate to that record using previous or next button, or click on the search button to search for the record.

ii. Press the delete button.

iii. A confirmation of deleting will be prompted out, answer yes will delete the current record, and answer no will keep that record without deleting.

### 4.4.2 Staff Record Maintenance

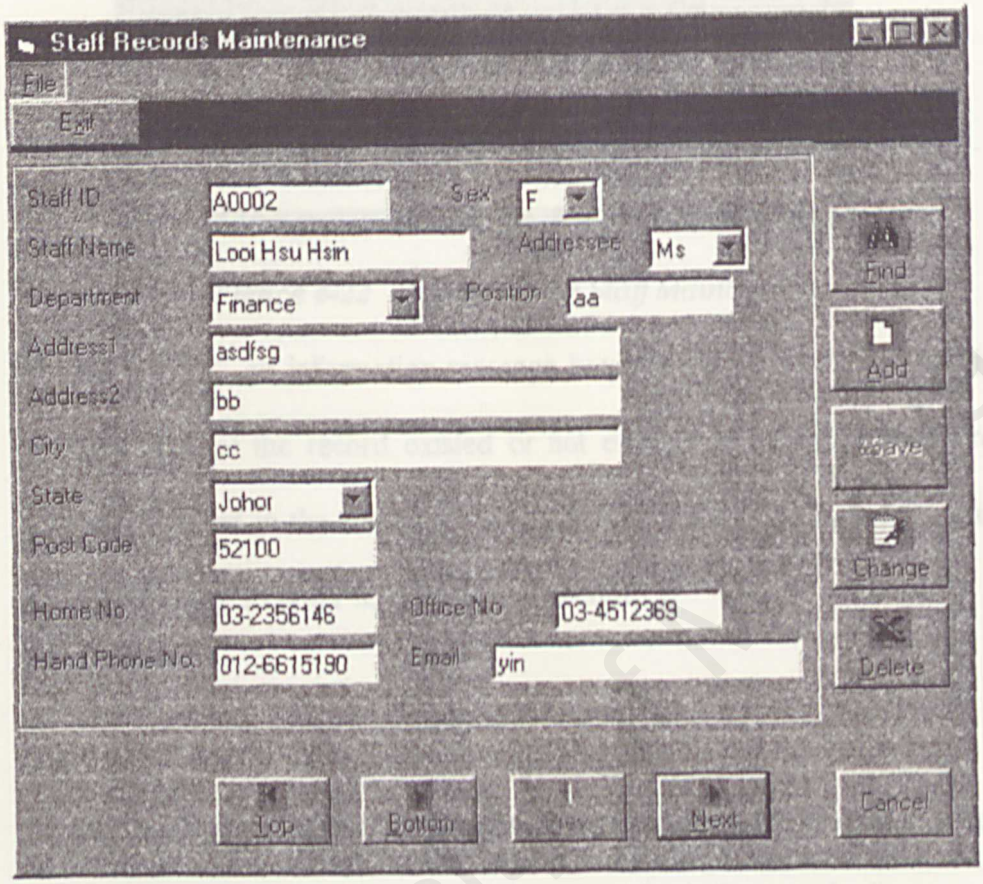


***Figure 4-21*** *Staff Maintenance Screen*

Figure 4-21 shows the Staff Maintenance screen. There are several operations that a user can perform, i.e. Search, Add, Change and Delete.

1. Search

   In order to search for a record, there are two alternatives: press the Find button or navigate through the records by clicking on the previous and next buttons. By pressing the Find button, an input box as shown in figure 4-22 will be displayed.

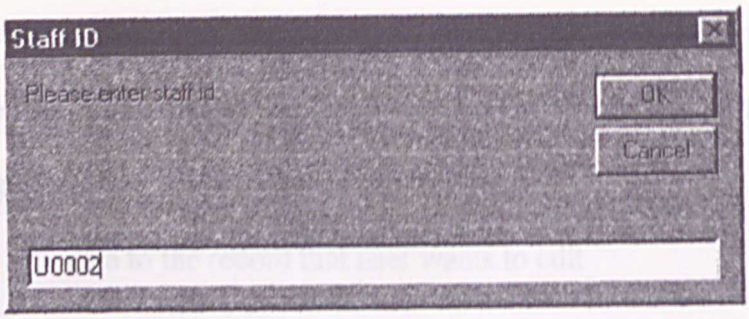


***Figure 4-22*** *Input Box for Staff Maintenance*

By clicking OK, an information message box will be prompted out telling the user whether the record existed or not existed. If existed, the record will be displayed in the screen as shown in figure 4-21. User must type in the exactly name in order to search for a record.

2. Add

To add a new staff, all the text boxes should be enter a value, or else, error message will be prompted out. This will also check for any duplicate user ID. A duplicate ID record will not be successfully saved. Also, the valid format for Home No, Office No and Hand Phone No. will be checked, any invalid format for these fields will be informed.

Two steps in adding a new user:

i. Click the add button

ii. Enter related values in each field. Enter "-" for any N/A fields

iii. Press the save button

3. Change

Change operation allows existing records to be edited. The steps required in doing the editing:

i. Navigate to the record that user wants to edit

ii. Edit the field or fields (field validation will be performed and editing the Staff ID field is not allowed)

iii. Press the Change button when done

4. Delete

To delete a record, user can:

i. Navigate to that record using previous or next button, or click on the search button to search for the record.

ii. Press the delete button.

iii. A confirmation of deleting will be prompted out, answer yes will delete the current record, and answer no will keep that record without deleting.

### 4.4.3 Company Record Maintenance

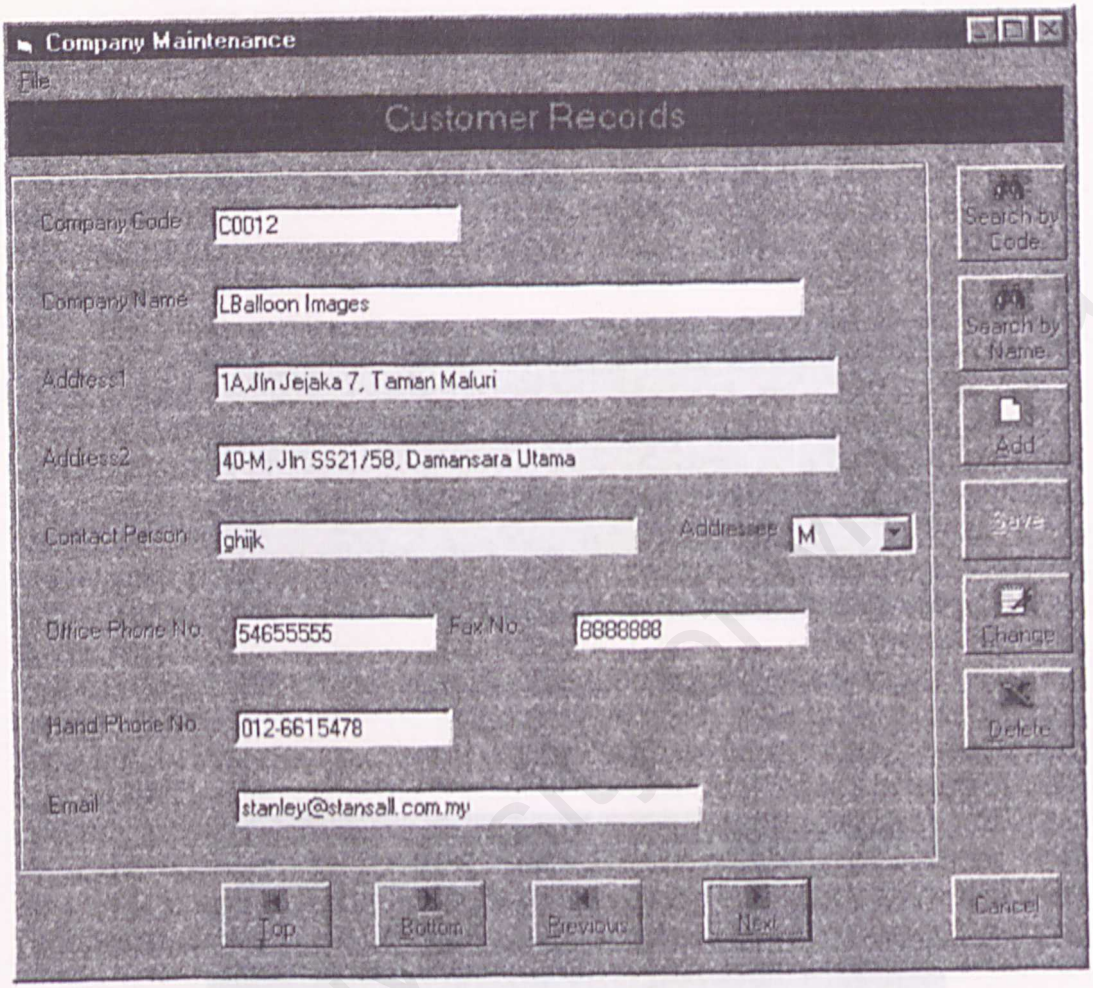


***Figure 4-23*** *Company Maintenance Screen*

Figure 4-23 shows the Company Maintenance screen. There are several operations that a user can perform, i.e. Search, Add, Change and Delete.

1. Search

   In order to search for a record, there are two alternatives: press the Search By Code button (to search using company code) or Search By Name button (to search by company name) or navigate through the records by

clicking on the previous and next buttons. When Search By Code button or Search By Name button was clicked, an input box will be displayed for user to enter Company Code or Company Name. Figure 4-24 shows the input box screen for Company Code input and figure 4-25 shows the input box screen for Company Name input.

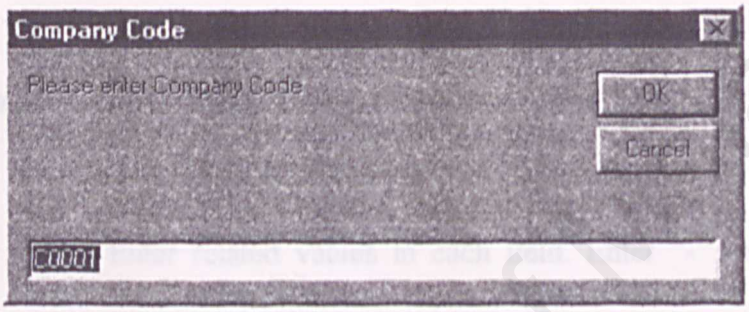


***Figure 4-24*** *Input Box for Company Maintenance*

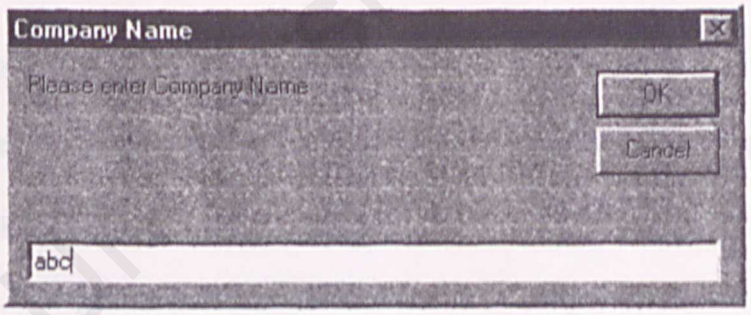


***Figure 4-25*** *Input Box for Company Maintenance*

By clicking OK, an information message box will be prompted out telling the user whether the record existed or not existed. If existed, the record will be displayed in the screen as shown in figure 4-23. User must type in the exactly code or name in order to search for a record.

2. Add

To add a new company record, all the text boxes should be enter a value, or else, error message will be prompted out. This will also check for any duplicate company code. A duplicate company code record will not be successfully saved. Also, the valid format for Fax No, Office Phone No and Hand Phone No will be checked, any invalid format for these fields will be informed.

Two steps in adding a new company record:

i. Click the add button

ii. Enter related values in each field. Enter "-" for any N/A fields

iii. Press the save button

3. Change

Change operation allows existing records to be edited. The steps required in doing the editing:

i. Navigate to the record that user wants to edit

ii. Edit the field or fields (field validation will be performed and editing the Company Code field is not allowed)

iii. Press the Change button when done

4. Delete

To delete a record, user can:

iv. Navigate to that record using previous or next button, or click on the search company code button or search company name to search for the record.

v. Press the delete button.

vi. A confirmation of deleting will be prompted out, answer yes will delete the current record, and answer no will keep that record without deleting.

## List of Tables

**Chapter 1**