# ELECTRONIC LIBRARY INFORMATION SYSTEM
## (ELIS)

**WXES 3181**

**CHEAH SOOI PING**
**WEK 98039**

**SUPERVISOR: PUAN ABRIZAH ABDULLAH**
**MODERATOR: PUAN ZAINAB**
**DATE OF SUBMISSION: 11 SEPTEMBER 2000**

# Abstract

Electronic Library Information System (ELIS) is a computer-based (automation) library system for a secondary school. ELIS consists of a number of smaller systems called *subsystems.* The modules are acquisition, which enable the System Administrator and Librarians to do ordering and receiving operations: cataloging which enable the creation of a bibliographic database; online cataloging (OPAC) which enables information to be retrieved from the database; circulation which manages the borrowing, returning, renewing, reserving, fine for missing of items; bulletin & feedback which enable the patron to input the feedback regarding the service provided by ELIS and to view the most current bulletin and holiday calendar; and edit module which enable the System Administrator to edit the record in the database from the system interface. This system also provides some additional features such as maintenance on user, reporting, password changing, fine system and Online Help to guide the user while using ELIS. The graphical user interface (GUI) features incorporated into the system have made it more appealing and user friendly than other text-based library system.

The main development tool used for ELIS is PowerBuilder Ver 5.0. This software maintains the user interface, report and database of this program itself. Iterative Development Methodology is used as model as it allow the developer to move between phases easily and modify the application to evolve with the work environment. **ESF's Bar Code 3/9** is used to generate bar code for call number of an item. It is a set of TrueType fonts and a utility for implementing code 3 of 9 bar codes. It is easy to use, does not require a checksum, and lets the user code numbers, upper case letters, and some punctuation.

ELIS sure can achieve its objectives by fulfilled the functional and non-functional requirements.

# Acknowledgement

First and foremost, I would like to acknowledge Faculty of Computer Science & Information technology of University Malaya for a fulfilling and rewarding experience throughout this semester of doing thesis.

Secondly, I would like to express my gratitude to my supervisor, Puan Abrizah Abdullah for her constant guidance, suggestion, encouragement and precious advice. Her trust in me has motivated me to strive harder.

Thirdly, I would like to take this opportunity to thank my moderator, Puan Zainab for her guidance and suggestion that enable me to learn more and more.

Last but not least, a very big thank you to my friends and course mates especially Kuan Chen Wei for telling me how to find the information of bar code generator with internet.

Once again, it is a pleasure to convey my grateful thanks to many people involved, directly and indirectly throughout this period.

Thank You!

# Table of Contents

# Chapter 1    Electronic Library Information System (ELIS)

## 1.1    Background

The purpose of this introductory chapter is to provide some general background information for a project to develop a computer-based library system, ELIS. Specially, it includes overviews and descriptions of:

a)  The system approach.

b)  Element of ELIS (computer-based library system).

c)  Methods of developing computer-based library systems, ELIS .

d)  Objectives of ELIS.

e)  Benefit/Advantages of ELIS

## 1.2    The System Approach

ELIS comprises a number of separate but interrelated and interacting parts called system, arranged in a hierarchical network according to size and importance.

## 1.2.1    Definition of ELIS

ELIS is developed for the secondary school's library and Staff Center. ELIS is an acronym, which stand for *Electronic Library Information System*.

ELIS is an organized set of activities, tasks or operations performed on the information, library materials or other physical objects to achieve a specified end result or purpose using automation system (computer-based system). In such a system, humans and computer usually share responsibility for performing the work.

Due to this sharing of responsibilities, today's computer-based library systems actually should be referred to as "human-machine system", or literally "systems in which humans are assisted by a computer". The computer is merely a tool (albeit a marvelous one) enabling librarians to do something less expensively, more accurately, or more rapidly than by manual methods.

### 1.2.2   The Systems Hierarchy

ELIS consists of a number of smaller systems called *subsystems*. A circulation system, for example, might contain component borrower registration and overdues systems. The result of this division is another level of systems, some of which might be divided still further into even smaller subsystems. The process of dividing a large system into smaller and smaller subsystems can continue as long as is practical or possible. Figure 1.1 shows the hierarchical levels of ELIS.
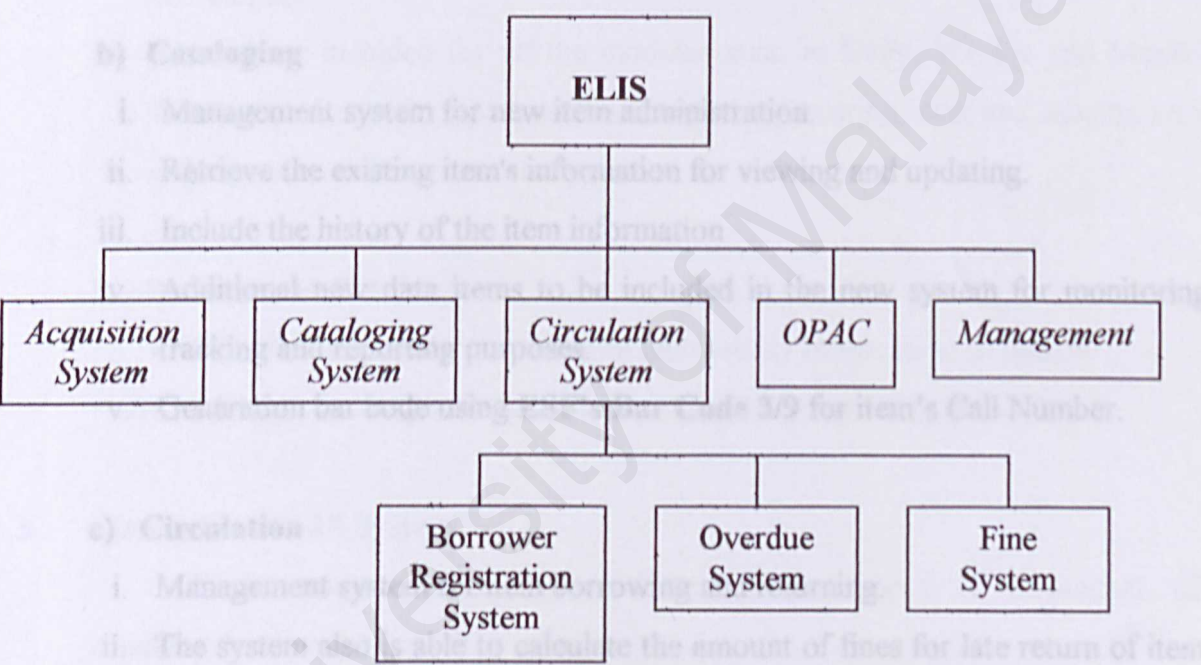


**Figure 1.1     The hierarchical levels of ELIS**

### 1.2.3   Scope of ELIS

Each module performs some specific function.

### a)  Acquisition

   i.   Controlling items received.

  ii.   Controlling overdue items from supplier.

 iii.   Generating selected input data to the cataloging department.

 iv.   Maintaining records of the number and type of acquisition activities.

### b)  Cataloging

   i.   Management system for new item administration.

  ii.   Retrieve the existing item's information for viewing and updating.

 iii.   Include the history of the item information

 iv.   Additional new data items to be included in the new system for monitoring, tracking and reporting purposes.

  v.   Generation bar code using **ESF's Bar Code 3/9** for item's Call Number.

### c)  Circulation

   i.   Management system for item borrowing and returning.

  ii.   The system also is able to calculate the amount of fines for late return of items automatically.

 iii.   Management system for fines for missing, fine for slight damage and fines for serious damage.

### d)  OPAC

   i.   Management system for retrieving information depends on the query.

  ii.   Query item based on search categories.

### e) Maintenance

#### I) Patron

i.   Management system for new patron administration.

ii.  Retrieve the existing patron's information for viewing and updating

iii. Include the history of the patron information

iv.  Additional new data patron to be included in the new system for monitoring, tracking and reporting purposes.

#### II) Report

Reports are included for all the modules such as Daily, Weekly and Monthly Transaction Reports, report on fines, report on existing, new and missing items and report on existing and new patrons.

### f) Bulletin and Feedback

i.   Provide the most current bulletin and holiday information to patron.

ii.  Manage the feedback that input by the patron regarding the ELIS.

## 1.3 Elements of ELIS System

Each computer-based library system is composed of a number of elements. Each system:

a) Has one or more goals or purposes.

b) Requires an input of information, materials, or other physical objects.

c) Performs specified processing operations on the input.

d) Produces end results called output.

e) Requires an environment in which to exist.

f) Requires computing, software, data communications, human, information, and other miscellaneous *resources* in order to operate.

A schematic model depicting these elements is shown in Figure 1-2.
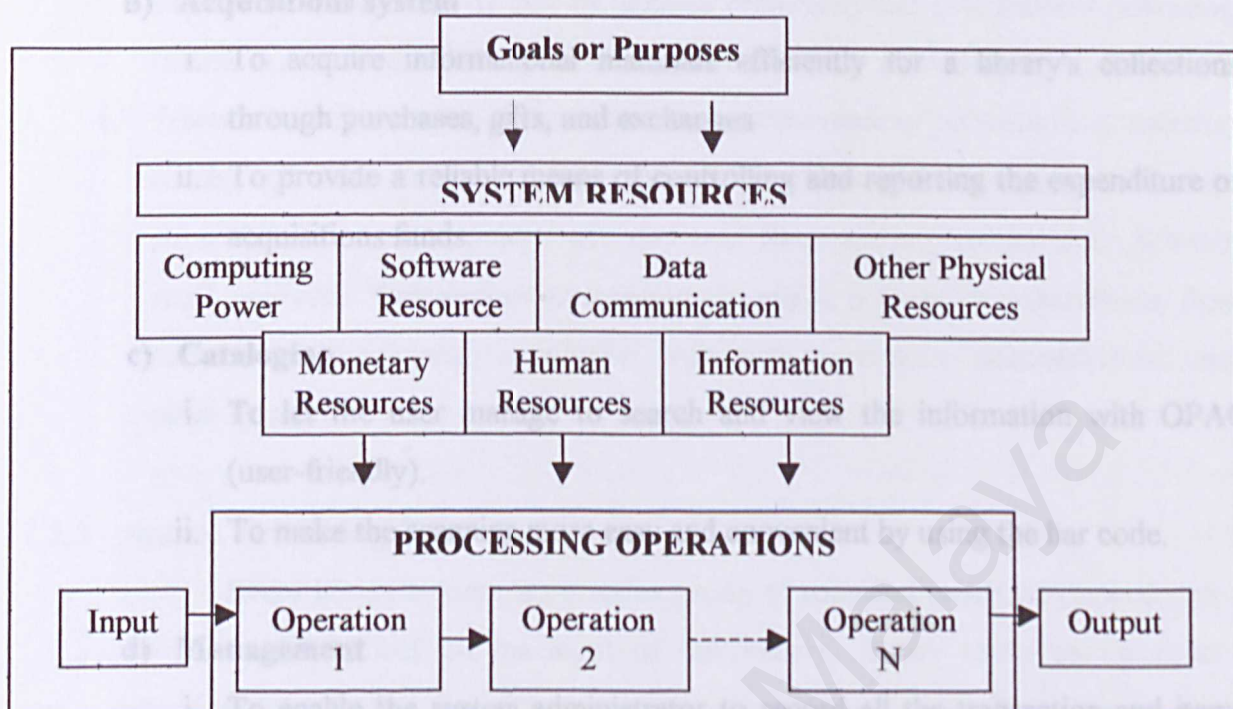
**Figure 1.2   A schematic model depicting the elements of an ELIS**

## 1.3.1   System Goals or Purposes

A library system has one or more goals or purposes, which state the mission or achievements toward which efforts in maintaining and operating the system are directed.

The purposes of developing the ELIS are:

**a)   Circulation system**

  i.  To loan informational materials to legitimate borrowers in good   standing

  ii.  To provide accountability for the successful return of the loans

**b)  Acquisitions system**

    i.  To acquire informational materials efficiently for a library's collections through purchases, gifts, and exchanges

    ii.  To provide a reliable means of controlling and reporting the expenditure of acquisitions funds.

**c)  Cataloging**

    i.  To let the user manage to search and view the information with OPAC (user-friendly).

    ii.  To make the scanning more easy and convenient by using the bar code.

**d)  Management**

    i.  To enable the system administrator to record all the transaction and items of the library system electronically and systematically. This can avoid errors compared to the manual system of recording.

    ii.  To let the user to view the reports at any time

System goals are long-range and usually not subject to change over the years.

**1.3.2  System Input**

    Each system requires an input of information, library materials, or other physical objects as raw material to be converted or processed into a desired output.

    Because library work is oriented around and dependent upon information, most library systems require either verbal or recorded information as the primary or only input. Information as system input for ELIS System includes the following:

a)  *Bibliographic and citation information describes materials for cataloging, indexing, and location purposes, and forms the basis of a library's catalogs and*

*indexes to its collections and of general bibliographies and indexes providing access to recorded knowledge both inside and outside the library.*

b) *Transaction information is contained in the thousands of circulation transaction cards, reference or information requests, interlibrary loan requests, selection slips, invoices and vouchers, overdue and fines notices, memoranda between staff, and other transactions that are generated in a library's acquisitions, fund accounting, cataloging, circulation, information services, administrative, and other systems.*

### 1.3.3   System Processing Operations

Every library system has a set or group of specified processing operations, which are performed on the input of information, library materials, or other physical objects. The system input is converted to output as these step-by-step tasks are performed. ELIS's common information processing operations include:

a) *Origination*-the capturing or recording of information through handwriting, keyboarding, as events or transactions occur.

b) *Verification-the checking* or validation of captured information to ensure that it is correct before processing continues.

c) *Classification*-the systematic grouping of information into classes such as type of transaction, material (item), or borrower (patron).

d) *Sorting*-arranging information into a predetermined order or sequence or selecting particular information from a larger mass.

e) *Calculation*-the arithmetic manipulation of information through addition, subtraction, multiplication, division, or logical comparisons required in such applications as funds accounting, purchase order preparation, fines calculation, and statistics compilation.

f) *Storage*-the placement of information into a file.

g) *Retrieval-the searching*, selection, and removal of specific information from a file.

h) *Summarization*-the reductions or compression of a mass of information into a more concise or meaningful form.

Information processing and physical operations are used repeatedly in a computer-based library system in selecting, acquiring, cataloging, classifying, processing, storing, locating, retrieving, and disseminating information and materials to users. In many library systems, the processing of information parallels that of processing materials and other physical objects. Each task or operation, performed in an orderly sequence, is necessary to convert the system input into the desired output. The movement of information and materials and other items from operation to operation through a system is referred to as *workflow*.

### 1.3.4  System Output

ELIS (computer-based library system) produces end results called *output*, which is processed input. Examples of system output include materials acquired and physically processed; records and reports prepared; lists and bibliographies produced; interlibrary loan transactions completed; and other products or results achieved by performing prescribed operations on input. Often, the output of one system later becomes the input to another system. For example, the output of an acquisitions system (materials acquired) becomes input (materials to be cataloged, classified, and otherwise processed) into a cataloging system. The output of a system also can be stated as a conditional change in information or materials. For example, output can be verified information (that is, unverified information is processed into verified information) and labeled materials (that is, unlabeled materials are processed into labeled materials).

### 1.3.5   Computer Hardware

An indispensable resource for a computer-based library system is computing power, furnished by a digital computer

**Hardware:**

a)  IBM compatible PC with an 80846 processor or higher.

b)  At least 80MB of Random Access Memory (RAM).

c)  A VGA or other compatible monitor display.

d)  $3^1/_2$ " floppy drive as drive A.

e)  Keyboard and mouse as input devices.

f)  Dot matrix or bubble jet printer.

### 1.3.6   Computer Software

Another important resource in an ELIS is computer software. Software refers to the collection of computer instructions or programs necessary to drive a computer system. Computer hardware cannot operate without software, which is of 2 basic types:

a)  *Application software* refers to the sets of computer instructions or programs required for specific applications such as library acquisitions, cataloging, circulation, or reference. A different set of instructions is required for each application or job the computer is to perform; in most complex systems, many sets might be necessary for a particular application.

b)  *System software*, which usually is supplied by the hardware manufacturer, is necessary to maintain and operate a computer system and to facilitate the programming, testing, debugging, and running of application software. Examples of system software include, among others, operating systems, programming language systems, utility programs, and database management systems.

**Software:**

| Development Tool | : | PowerBuilder Enterprise version 5.0 |
|---|---|---|
| Database | : | Sybase SQL Server Anywhere |
| Application Software | : | Forehelp 3.0 |

## 1.4 Method of Developing Computer-Based Library Systems

A library could have one or more of several types of computer-based systems operating simultaneously in its organization. These systems can best be characterized by the methods by which they were developed. There are 4 basic methods by which libraries develop computer-based systems:

a) Purchasing or leasing a turnkey system.

b) Sharing a system with other libraries through networking.

c) Adapting the system of another library for local use.

d) Developing a system locally from scratch.

## 1.41 Developing Systems In-house from Scratch for ELIS system

The last method of developing a computer-based library system is to design, program, and test it locally from scratch. The application software is locally designed, programmed, tested, installed, operated, and maintained on an in-house computer or on one located outside the library but in its host institution or in a service bureau. The primary advantages to this method of developing a system include:

a) The system can be designed to meet the exact needs of the library.

b) Greater success probably will be achieved in integrating several systems together in the library.

c) The library can maintain control over all aspects of the system's development, installation, and operation.

However, this is the most difficult and time-consuming method of developing a system, with some additional disadvantages:

a) The library must have access to computer and systems specialists to design, program, test, and install the system.

b) Several years might pass before the library would have an operational system.

c) The library itself must acquire and maintain a computer system and other essential hardware or use equipment already available locally.

d) There is a general feeling that a library should not design again a system, which many others already have developed and which could be obtained through other methods.

e) If all expenses are considered, the costs of developing, operating, and maintaining system locally probably are as expensive as, if not more than, a turnkey or shared system, with poorer results possible.

## 1.42  Problem Definition

A problem or problems facing the library usually underlie the need for developing a new or improved library system. These problems are identified through personal observations and knowledge of situations, results of studies of the library or suggestions and complaints from users.

Symptoms of problems may be more readily apparent at first than the problems themselves. Symptoms of problems:

a) Increased time required to process materials.

b) Long queues at service desks.

c) An increasing number of errors in a system or service.

d) A decline in the quality of a service.

e) A high number of complaints from users.

Problems that cause the library to seek better systems are:

a) Work in an existing system is increasing so rapidly that the increased volume cannot be handled effectively.

b) Costs in an existing system are increasing rapidly.

c) An existing system is not flexible enough to accommodate new functions, ideas, or services that must be incorporated into the library.

d) An existing systems needs improvement in general. The system might be operating satisfactorily but is limited in what it can do and unable to provide, for example, adequate administrator reports and statistic.

## 1.5    Project Objectives

While the purpose or purposes of a project might appear obvious, a written statement can assist in eliminating any ambiguity or uncertainty and provide a reference and focal point for the work to be undertaken. Like the problem statement, the statement of objectives should be clear, unambiguous, and specific. It outlines the end results towards which achievements should be directed or specifies what is expected to be accomplished or achieved in an endeavor to develop a new system. Quantification of the statement can be helpful in guiding development of a new system and evaluating it later to determine if the objective was met.

*Objectives for Administration:*

a) Upgrade and improve the effectiveness and efficiency of the present circulation system.

b) To ensure the accuracy in the process of issuing, returning, renewing and reserving of items.

c) To facilitates on-line library cataloguing thereby creating a bibliographic database.

    d)  Obtain a new or improved bibliographic control system, which will enable the staff to process 100 percent of the library's new acquisitions each year.

    e)  Upgrade the effectiveness of the present acquisitions system, with specific purposes to:

        i   Reduce the time and difficulty of acquiring new materials.

        ii  Improve and simplify procedures.

        iii Provide complete accountability for materials from selection through receipt and    processing

        iv Eliminate all manual files.

        v   Provide better control over materials being acquired.

        vi  Provide accurate statistics of materials being acquired and

        vii accurate accounting of materials funds.

        ELIS is designed to helps its users to better perform their responsibilities to enhance cooperation and coordination between functions. Besides, ELIS also provides information to help users in their operations and decision-making.

*Objectives for Patron:*

    a)  To enable easy and fast retrieval of the items from the bibliographic database.

    b)  To establish a consistent and user-friendly interface that uses GUI (Graphic User Interface).

    c)  To ensure authorized access to the function of the system.

    d)  To allow the maintenance of the items, library calendar and user information.

    e)  To establish a flexible fine system.

## 1.6     Benefits or Advantages of ELIS System

ELIS is anticipated to have the following advantages are:

a)  Reduced or at least stabilized operating costs of the system.

b)  Capability to expand existing services and/or provides new services without additional staff and to improve performance times of operations-in other words, to perform more work with fewer people.

c)  A shift of staff from performing undesirable tasks to performing more rewarding and stimulating duties.

d)  Improved accountability for and control over informational materials, records, and services.

e)  Accept information in a digital form, accurately perform long sequences of repetitive, time-consuming operations on the input over a long period of time, and present the results of its processing to a user.

f)  Store large amounts of information in mass storage devices and retrieve any or all of it on demand.

g)  Operate at high speeds. Its speeds are measured in terms of milliseconds (one-thousandths of a second), microseconds (onemillionths of a second), nanoseconds (one-billionths of a second), and pico seconds (one-trillionths of a second).

h)  Direct itself in a predetermined manner. The general-purpose digital computer has an internal storage unit or memory where information to be processed and interchangeable sets of processing instructions called programs are stored. Once it has been provided with information and instructions, there is no need for further human intervention and direction in the information processing cycle. The set of instructions can be removed or erased when others are required.

i) Choose among alternatives in processing information in a manner that is equivalent to, making decisions. The computer makes comparisons of information, and then follows paths dictated by the results.

j) Process one job at a time or several jobs almost simultaneously. By storing information and instructions for several jobs in different parts of its storage units and switching between them rapidly, the machine appears to be handling all jobs simultaneously.

k) Receive an input of information and instructions from users in remote locations via a data communications system, process the input, and transmit the results back to the user.

l) Easy and user-friendly usage of system.

m) Easier and faster retrieval of items

n) Accurate and secure processing of issue, return, renew and reserve transaction.

o) Accurate and up-to-date user information.

p) Accurate fine system that is updated in real system.

## 1.7    The Project Schedule

Either a simple Gantt chart or a network chart can be used as a means of scheduling and controlling the events in the project plan or outline.

The Gantt chart is one of the simplest and most effective scheduling tools. A disadvantage to this type of chart is that it does not effectively indicate relationship among the different events of a project. Each time the project outline is changed, the chart also must be revised to reflect the changes.

A system development schedule is planning at the system studies and planning phase to ensure that effort is distributed within the prescribed time frame to make the best of resource.

**Note:** Documentation will be doing along the system development life cycle from the literature review until the end.

| ID | Task Name | Start Date | End Date | 2000 | | | | | | | 2001 | |
|----|-----------|-----------|----------|------|------|------|------|------|------|------|------|------|
| | | | | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb |
| 1 | Literature Review | 6/5/00 | 6/22/00 | | | | | | | | | |
| 2 | Identifier user requirements | 6/14/00 | 7/3/00 | | | | | | | | | |
| 3 | System Design | 6/23/00 | 8/31/00 | | | | | | | | | |
| 4 | Development | 8/22/00 | 12/25/00 | | | | | | | | | |
| 5 | Testing | 12/26/00 | 1/23/01 | | | | | | | | | |
| 6 | Implementation | 1/24/01 | 2/1/01 | | | | | | | | | |
| 7 | Documentation | 2/2/01 | 3/2/01 | | | | | | | | | |
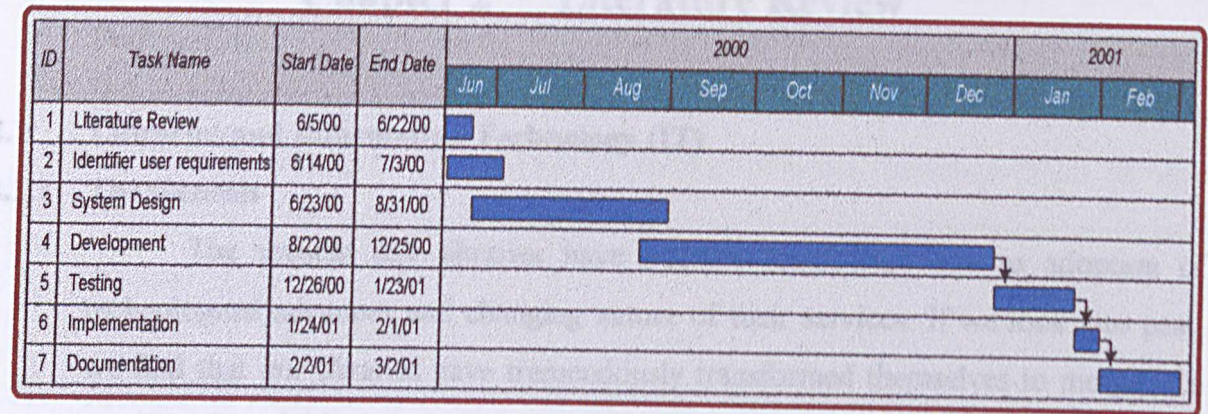
**Figure 1.2        Project Schedule**

**Summary**

ELIS is a computer-based library system that developed and integrated into the library organization in an effort referred to as a *system project*. And, the skills to plan, design, and implement systems are necessary. The next phase of system development life cycle is System Requirement and Need Analysis, which define the functional and non-functional requirement for ELIS. The system development methodology also identified in the next chapter.

# Chapter 2    Literature Review

## 2.1    Libraries and Information Technology (IT)

### 2.1.1    The Genesis

The present day libraries have become multimedia due to adoption of technological advances and changing nature of their services. If we look into past, we find that our libraries have tremendously transformed themselves to merge into present technological environment. It is a fact that almost all types o libraries are involved today in a period of revolutionary change. It seems that "computer age", which has already dawned, would show more transforming effect on the library that due to other two important revolutions i.e. invention to movable type by GutenBerg and subsequent developments of duplicating, techniques or "reprography".

Majority of libraries in developed countries and many in our own country have adopted such sophisticated devices/techniques for automation of their systems and services. In fact, it has become necessary and inevitable need to provide efficient and fast information service through automation, in the age of "information explosion".

### 2.1.2    Changing Concept of Library

The goal of the early library was to store and preserve the recorded knowledge in varies formats. The information contained in such documents was strictly for few privileged/exclusive users than for dissemination to all. Doors of the library were opened only to the will of owner of the collection. Learning was monopoly of philosophers, scholars patronized by religious institutions and monarchies, as number of manuscripts and other documents were very limited.

After the invention of movable type and printing press resulted in starting proliferation of literature and spreading of education, which have completely changed the concept of library. This was also because of the growth of documents and thus libraries grew in size and in number of users. Communication of right information to the right reader expeditious through various methods and media was the goal of library service.

### 2.1.3   Information Explosion and Its Effects on Library

*"information explosion"* relates to the considerable amount of recoded information and its exponential growth rate.  A study carried out in recent years by the Chemical Abstract Service and Organization of Economic Co-operation and Development (OECD) has concluded that volume of information is increasing by 13% per year that means the total amount of information in the world doubles in every 7-8 years. To cope up with this fantastic growth rate, the information centers and libraries should be capable and well equipped with efficient and fast information handling technique and tools. One has to take note of the fast generating information and its growth rate, which is running exponentially as well to avoid increasing risk of duplicating efforts in various fields including R & D activities. Proper bibliographical control and timely dissemination of information to concerned individuals/users benefit them from already acquired experience and knowledge and saves considerable time, money and manpower. The information explosion has created some problems, such as:

a)   It is impossible for any individual reader to comprehensively scan even a part of published information in his specific field.

b)   Consequent to the growth of literature there is parallel growth of secondary sources such as bibliographies, indexing, and abstracting journals and computer-based large retrieval systems.

c) Since any single library cannot afford to acquire each and every published document, readers have to depend upon the resources of other libraries.

d) Increase in acquisition of non-book i.e. non-conventional material by the libraries.

In order to cope up with these problems, libraries have to drastically modify their information handling techniques and their working methods. The information users also are required to change their approach for acquiring information. Some probably solutions are:

a) Adoption of more efficient techniques for recording, processing, retrieving and disseminating of information. Manual or semi-manual means and ways used in the past are no longer adequate to meet the quantum of information to be handled and hence need to be replaced by or complemented by computer based systems with use of telecommunication technologies. Reliable storage and dissemination of information requires increasingly sophisticated reprographic and micrographic devices.

b) Co-operative sharing of resources among libraries has become a vital necessity. No single library can fulfill demands of their clientele with their existing resources. Co-operative sharing can avoid unnecessary duplication of efforts by coordinating their systems and services.

c) Individuals who are involved in the information transfer process i.e. information specialists and users have to radically modify their behavior and habits. Today libraries and information officers have access to new sophisticated methods to enable them to co-operate even at international level and consequently need to be qualified persons in these specialized areas.

### 2.1.4    Application of Information Technology in Libraries

The information technology in libraries is applied in 4 ways:

a)  Library Automation

b)  Information storage and retrieval

c)  Office Automation

d)  Resource sharing, networks

## 2.2   Library Automation

### 2.2.1 Definition of Library Automation

The term *library automation* refers to the processing of certain routine clerical functions in the library functions in the library with the assistance of computers of other mechanized or semiautomatic equipment.

Automation can release the library staff from many routine, administrative, or clerical functions. A surprising number of functions are routine, administrative, or clerical. Automation cannot replace the librarians or make for the librarian any decision involving professional judgment. A conspicuous example is in the assignment of subject headings. Obviously, these must be assigned by a trained cataloger. Another example is public contacts; these also cannot be automated.

There are three main areas of library operations:

a)  administration of the library

b)  management of the library

c)  library science

Automation is of most value and is applied primarily to the first of these areas.

### 2.2.2   Library Administration

#### a)   Clerical Functions

Automation of these activities has several advantages. The amount of clerical work, which must be done by people, can be significantly reduced. The reduction in positions is offset to some extent by corresponding increases in computer costs. The professional librarians, by releasing these tasks to a computer is left with more time to spend on questions that are more in the librarian's interests. The jobs of both professional and nonprofessional personnel become more interesting, because a maximum of the repetitive, routine functions has been eliminated.

#### b)   Processing Speed

The use of automated methods almost invariably speeds up the flow of work in the library. New books, reports, and other material can therefore be released sooner to waiting readers. The catalog entries are usually made sooner, and catalogs are more often up-to-date. Circulation control cards can be prepared and in the books sooner than with manual methods.

#### c)   Work Control

Work-load, personnel, and transaction statistic and records can be automatically prepared. Automatic exception reports are now feasible. The work-load records are more accurate than under manual methods because they can be automatically kept or tallied at each step of the way.

Because improved statistics are available, improved cost control and improved planning are possible.

Inventory valuations can be automatic at any time and in a variety of breakdowns, e.g., by branch, by subject, etc.

### d) Protection of Records

Because of the ease and economy of producing and distributing multiple copies of the catalog files, automated systems provide greater protection against loss of the catalog by fire, earthquake, and natural disasters. The availability of machine-readable records would permit reproduction of the entire catalog file of holdings within days after an accidental destruction of the catalog. If a branch library were destroyed, orders for replacement copies could be prepared in a short time by automatic or semiautomatic means.

## 2.2.3  Library Management

### a) Financial

When properly planned, unit-operating costs are normally reduced when a function is automated. Expenditures saved from clerical effort may be transferred to book purchases or to providing new services to users. The larger the number of transactions, the lower the unit cost of automation in libraries.

### b) Increasing Work Load

Several factors have combined to cause permanently continuing increases in library workload. A higher percentage of the total population is being better educated than previously. Knowledge is being recorded at ever increasing rates. Population increases rapidly. The complexity of commercial, technical and scientific problems increases at an even higher rate. An increasing number of books is being published.

Retrieval of information from these growing collections for a growing number of users becomes increasingly difficult and complex. Subject cataloging must be in more detail in order to provide greater selectivity. Staff must be increased to handle increasing volume of service requests.

### c)   Staffing

Where possible, it is generally preferable to meet the needs for increasing service by increasing the use of equipment rather than increasing the number of personnel employed. Generally equipment is cheaper than personnel, it is more reliable (in the sense of breakdowns, vacations, etc.), more flexible, does not become bored. Computers are never on vacation or sick leave and rarely need repairs. They are thus more dependable and can work longer hours than people.

### d)   Exception Reporting

Automated system can automatically provide overdue notices, follow up notices, location of orders, editing of cataloging activity, etc.

## 2.3     Online Information Retrieval System

Recent development in the fields of computer and telecommunication has provided a number of online information systems. A person sitting near computer terminal can have access to any database located anywhere on the earth in a matter of seconds through online system and can obtain hundreds of latest references on the given topic or topic of his interest. With the knowledge of fixed codes and command language one can easily operate these systems, which are widely used in USA, UK, France, Canada and other European countries.

*Advantages of using OPAC:*

*Tedd* has listed several advantages for using these online search services, as opposed to printed sources. These are:

a) Immediate access to a wide coverage: In 1980an estimated 40 million unique records were available on online searching systems.

b) Ability to access information not available in printed publication.

c) Greater currency since the online databases tend to be updated more quickly and more frequently than the printed version.

d) Less irksome clerical work, including automatic printing or retrieved references.

e) More effective searching due to larger number of access points in the record.

f) Faster searching: Various studies suggest that online searching takes 5-10% of the time taken to be a comparable printed index search.

## 2.4    The Library System Hierarchy

A network of "systems within systems" exists throughout the library, organized into hierarchical levels conforming usually but not always to traditional organization chart lines, and ranging from very large and general systems at the top of the hierarchy to very small and specific systems at the bottom. While each system or subsystems is functionally independent of all other, no system on any level can exist by itself or in isolation from other systems.
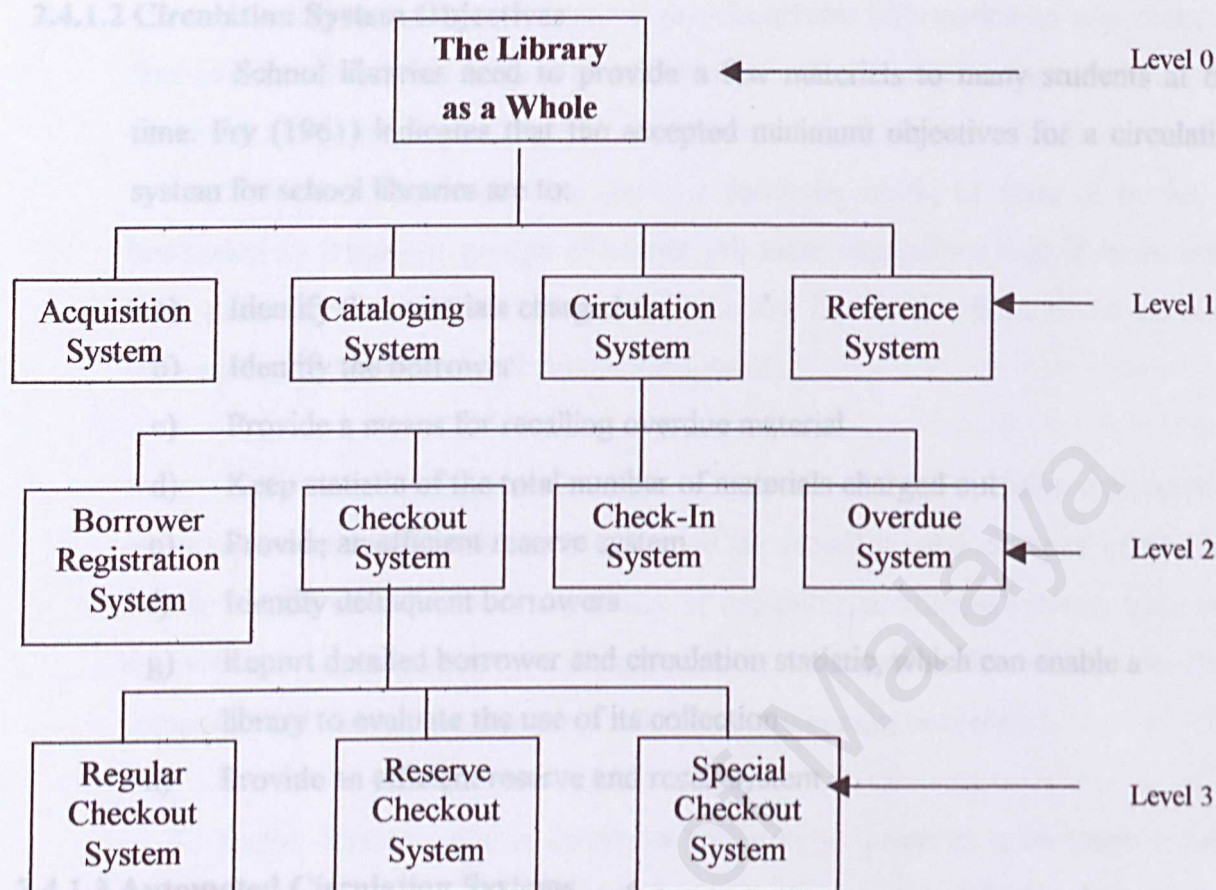Figure 2.1 shows the hierarchical levels of ELIS.

**Figure 2.2    The hierarchical levels of systems of a library**

## 2.4.1    Circulation

### 2.4.1.1 The Circulation Department

The circulation department is one of the most important areas in a library because it provides the patron's first contact with the library. It is the one department with which most patrons come into contact on every visit. Therefore, the entire library rules, procedures, and personnel should be directed toward making this contact a satisfying one.

This public-relations value of the circulation department cannot be overstressed and must be taken into consideration by every staff member.

### 2.4.1.2 Circulation System Objectives

School libraries need to provide a few materials to many students at one time. Fry (1961) indicates that the accepted minimum objectives for a circulation system for school libraries are to:

a)   Identify the materials charged out

b)   Identify the borrower

c)   Provide a means for recalling overdue material

d)   Keep statistic of the total number of materials charged out

e)   Provide an efficient reserve system

f)   Identify delinquent borrowers

g)   Report detailed borrower and circulation statistic, which can enable a library to evaluate the use of its collection

h)   Provide an efficient reserve and recall system

### 2.4.1.3 Automated Circulation Systems

A recent development in circulation systems has enabled libraries almost to "have their cakes and eat it too". Automated circulation systems have many libraries, not just the largest ones, to automate their circulation records and borrower's files so that the speed and accuracy of the computer can contribute to better library service.

By using the computer's capabilities of adding and deleting data, comparing and relating data, and storing information for future access, a library may be able both to increase its efficiency and to improve its service. Because the book charge does not have to be retrieved from complicated manual files, costly discharging routine are eliminated.

The computer can manipulate the circulation information in any order so that circulation lists can be printed out by due date, call number, or borrower. The computer can prepare overdue, fine, reserve, and recall notices. Circulation statistic can be compiled concerning the use of a particular book, or class of books, or borrowing by particular groups of clients. All these capabilities help libraries serve their patron's needs. However, there are other factors for libraries to consider before adopting an automated circulation system.

Besides evaluating the enormous cost involved in automating a circulation system, libraries must also study the rapid development and changes of the last decade. In the early 1970s, the majority of computer circulation systems were off-line systems—i.e., systems not directly link to a computer. Instead, keypunched computer cards had to be processed in batches at a computer center.

Rapid developments in computer technology, however, soon made it both feasible and profitable for commercial library vendors such as CLSI and Gaylord to develop and market packaged, or "turnkey" automated circulation systems that functioned on-line—that is, link directly to the computer. These on-line systems eliminated the time delays of the off-line systems and enabled libraries to tie their circulation systems into other areas of activity, such as acquisitions, cataloging, and resource sharing. Although many vendors have entered and left this market, libraries have been generally satisfied with the automated systems they have adopted.

Several types of automated circulation systems have emerged in recent years. Although they may be replaced tomorrow by new technology, most of them are designed along similar lines. They required book or item identification, borrower identification, a due date, and different codes to indicate whether an item

is being charged, discharged, reserved, or handled in some other way. Many on-line systems use identification bar codes, or "zebra labels", which are placed on every item, and on the borrower's cards. To charge an item, the "charge" code is selected, and a light pen or wand (similar to a small

pocket flashlight) or laser beam is passed over the bar codes of the item and borrower's card to optically "read" the number and enter them in the computer's data bank. To check in an item, the "discharge" code is chosen, and the light pen or laser is again passed over the item's bar code. Thus, all circulation information is recorded immediately in all library files.

Most automated circulation systems also provided features not available in other circulation systems. On-line systems can often indicate to the staff member that a borrower is ineligible to check out a book because of overdues or other problems. They also can indicate that a particular item has been reserved or need attention for some reason. Libraries that belong to library systems can communicate with other branches or library agencies by means of computer. And reserves may often be made instantly on any copy of an item anywhere in the library system. Some automated systems even enable patrons to perform self-service charging or to query the computer about the status of items in the collection. However, these automated circulation system features may be very costly.

Generally, libraries have considered the expense of a computer system to be justified when they have an annual circulation of over 250,000 and can recover the cost of the system in 5 to 7 years.

In spite of heavy costs, libraries have been satisfied with their automated systems and list the following principal benefits:

a) user satisfaction

b) improved patron services

c) faster charging and discharging

Contrary to most expectations, when automation is introduced into a system, the staff is generally not reduced. Instead, staff members have been released from circulation duties to spend more time in direct contact with library patrons. Thus, many libraries have finally found circulation systems that enable them to serve their patrons more fully and to provide good library service.

**2.4.2   Acquisitions**

Acquisition functions, which libraries have automated, include the following:

**a)  Ordering:**

i.   Generate order from content, where possible, e.g., if ordering additional copies of a previously ordered title.

ii.  Print purchase orders to suppliers

iii. Print bid lists or generate trial title lists for the library selection committee.

**b)  Receiving:**

i    Control items received.

ii   Notify requesters that their book has arrived.

iii  Control overdue items from suppliers.

iv   Generate automatic follow-up notices.

**c) Paying:**

   i    Print and control payment checks to suppliers.

   ii   Determine optimum date to pay supplier, in accordance with term of the purchase order.

**d) Input to Cataloging:**

    Generate selected input data to the cataloging department.

**e) Administration:**

   i    Maintain records of the number and type of acquisitions activities performed by the staff.

   ii   Maintain control of expenses for purchases within the budgets.

Computer processing for acquisition of books, technical reports, maps, phonograph records, and other material is similar.

### 2.4.3  Catalog Reference Service

     The term *catalog reference service* refers to identifying and/or notifying users of holding in the library's collection, which is accomplished by looking up references about the holdings in the catalog of library holdings. This includes activities such as:

a) Looking up particular books or holdings in the card or book catalog by author, title, subject, etc.

b) Literature searches, where a user submits key words or other search identifiers to the computer. The computer performs a search of its files and determines which items, if any, match the search identifiers.

c) Announcement or notification of selected new arrivals to borrowers.

### 2.4.4   How Computer Retrieval Operates

The effectiveness of any retrieval system is measured by the ratio of relevant and irrelevant information retrieved in response to an inquiry.

Experience has shown that two measures, number of items recalled (recall), and degree of relevance of the hit (precision), are inversely related. An inquiry and search, which produces few hits, may have a high degree of precision. As more hits are returned the precision of retrieval goes down, and documents with lesser relevance are selected by the computer as hits.

Following is a list of some types of descriptors often used to retrieve from the catalog file. Other types of descriptors are also used in systems operating today. Subject headings and/or key words are the most commonly used:

a) Subject headings

b) Title key words

c) Personal authors

d) Contract, project, or job numbers

e) Corporate authors

f) Abstract words

g) Publication dates, or range of dates

h) Geographical locations

i) Any combination of the above

### 2.4.5   Cataloging

Currently, most of the libraries still using the Online Public Access Catalog (OPAC) for information retrieval purpose. OPAC allows member of the library's public to search the catalogue database in order to se if the library holds a particular items, to be informed of its location and if the catalogue system is linked to the

Circulation system, to be told or the item is currently to loan. Apart from information retrieval, the OPAC system also allows users to perform functions such as renewing an item, checking for the user status, save previous searches, searching other remote database and perform reservation for an item.

### 2.4.5.1 The GUI OPAC

Meet the GUI (graphical user interface) OPAC, what Crawford has described as "the user friendly, bandwidth-intensive, hardware-dependent, slow for complex searches, GUI interface that is so much fun to use the first time around."

Williams et al. describe three types of user interfaces that have been developed to facilitate interaction between a user and an information system: command-driven, menu-driven, and GUI. They define a GUI as a: User interface that uses images to represent options. Some of these images take the form of icons, small pictorial figures that represent tasks, functions, or programs.

### 2.4.5.2 What Do GUIs Bring to OPACs?

Before GUIs we not only had inventive menu-driven interfaces, but some OPACs had rudimentary cursor-controlled "point-and-click" interfaces that permitted a degree of direct manipulation of data and functions highlighted on thedisplay screens. No doubt, GUIs are generally more attractive and colorful than character-based interfaces, and they hold the promise of making OPAC searching both easier and more richly interactive.

Some basic features of GUI interfaces are:

a)  Multi-windowed views of multiple kinds of data.

b)  Sizeable, moveable windows.

c)  Scroll bars to scan through data and lists.

d) Pull-down menus and pop-up dialogue boxes with preformatted data entry spaces.

e) Hot buttons for activating functions.

f) Point-and-click device-based interaction

### 2.4.5.3 Two Design Principles to Consider

Reflections on the online catalog user interface as a complex environment for supporting search, selection, review, and related decision making activities led this author to the articulation of principles and goals which should guide the design and development of the online catalog interface.

The first principle is that the online catalog system should never permit a user's search attempt to fail to retrieve one or more bibliographic records for review and action. Many searches in existing online catalogs fail to retrieve even a single record, and most online catalogs offer little or no assistance to the searcher when this result occurs. The assumption behind this principle (always retrieve something for display and review) is that something in a heterogeneous online catalog database might satisfy the request to some degree, or serve, even in its rejection by the user, to supply useful information that can be used to further the search.

A second principle is never assume the display of a bibliographic record is the end of a search, merely to be selected or rejected, then "set aside." *Bibliographic records are for use*, not just as location devices, but as information-laden devices for furthering the search. This action role of bibliographic displays is often overlooked in system design. Bibliographic records can be generative; they may have a springboard effect in the search process, or serve as information "seeds" to fertilize subsequent searching.

Searching and browsing are nondeterministic, dynamic processes; it may be best to think of even the most precisely formed queries in conventional query-oriented systems as dynamic queries, subject to change in the search process. The user may know precisely what he or she wants and uses the online catalog merely to locate that particular item and determine its availability. Yet, this single-minded user may choose from a variety of ways of searching for the item, may encounter other interesting items while searching for the desired item, or may even lose interest in the original item as alternatives are brought to his or her attention. For these reasons, found data--terms, titles, subject descriptors, and entire records-- should be able to serve as useful data for expanding a search or revising a search strategy. In short, it ought to be easy for *search output to serve as search input*. Display formats and prompts, point-and-click, and linked-record, hypertext navigation facilities should be employed in online catalogs to satisfy these principles and requirements.

## 2.5     PowerBuilder

### 2.5.1   The Development History of PowerBuilder

It has been over six years since *PowerBuilder version1.0* shipped in June 1991. PowerBuilder quickly became the market-leading client/server database application development tool. The initial release of PowerBuilder ran only on a 16-bit Windows 3.x platform, offered no object-oriented development features and supported only the Single-Document Interface (SDI) style.

Starting with *PowerBuilder 2*, developers could create Multiple Document Interface (MDI) application using window and menu inheritance.

*PowerBuilder 3* introduced user objects, MDI toolbars, and many enhancements to the DataWindow including crosstab reports, label and n-up reports, and many options for creating business charts and graphs.

*PowerBuilder 4* introduced improved performance, the data pipeline, composite and nested reports, the C++ class builder, enhanced OLE 2.0 support, and toolbar PowerTips (timed microhelp).

*PowerBuilder 5* was a major new release, introducing Distributed PowerBuilder, compiled machine code executables, drop-down toolbars, and true function overloading. It also introduced dot notation syntax for accessing DataWindow properties and data, event arguments, function posting, and new native Window 95 control including the Tab, TreeView, ListView, PictureListBox, and RichTextEdit controls. The Internet Developer's Toolkit and the PowerBuilder Foundation Class Libraries were also introduced with PowerBuilder 5.

### 2.5.2   Using PowerBuilder as an Object-Oriented Environment

PowerBuilder is an *object-oriented programming* (OOP), which means it implements all of the important features found in object-oriented environments. To put it simply, object-oriented languages consist of three ways of doing things. First, objects should not be allowed to directly manipulate the properties or know about the internal aspects of other objects--this is called **encapsulation.** Second, the language should help you to reuse much of your code in similar objects instead of having to use the old-style way of copying and pasting your old-code and making changes--this is called **inheritance**. Third, different objects should be allowed to respond in their own way to the same messages if necessary--this is called **polymorphism.**

This object-oriented ***paradigm*** (or way of doing things) is difficult for some to adjust to. PowerBuilder also greatly facilitates iterative development. *(See Chapter3)*

## 2.6    Existing System

an analysis of specific aspect of an existing system is important to identify problems with the current situation and understanding the existing system well enough to form the foundation for a better one. Figure 2.2 shows some existing library systems in Faculty of Computer Science & Information Technology in University Malaya.

| Year | Description |
|------|-------------|
| 1988 | ***An On-Line Information System for a Small Library*** (Lim, 1988) Dbase II, Basic, Wordstar and SIDEKICK used to develop this system. It applied the automation library system (acquisition, circulation and cataloging). |
| 1996 | ***Library Acquisition System*** (Zulkhairi, 1996) Software that used to develop this system are Windows 3.1 and Microsoft Access as database and Pascal as programming language. Only module acquisition is available. This system cannot be used in multi-user environment and are not reliable because are yet tested by any user. |
|      | ***School Library Online Catalogue (S.L.O.C)*** (Anis, 1996) This system is a catalog system based on PC and Window that was developed specially for secondary school's library. It has 2 module, OPAC system and records management system. OPAC system allow the user to search the information regarding the bibliography while the records management system can be accessed by the administrator to do |

| | | |
|---|---|---|
| | | the modification, deletion and adding record. Microsoft Access 2 used as database and Visual Basic version 3.0 as interface. |
| | 1999 | ***Simple Library Automation System (SLAS)*** (Goh, 1999)<br>SLAS used PowerBuilder5 to develop a library automation system. this system has 3 modules such as Cataloging Module, Circulation Module and OPAC Module. This system contains the features of GUI, maintenance, report and calendar. |
| | | ***Smart Library System*** (Jamie, 1999)<br>S.L.S is a library automation system for a special library with client-server based on PC and web. It contain 4 module, that are cataloging module, circulation module, acquisition module and bulletin& feedback module. Software that used to develop this system are Lotus Notes and Domino version 4.6.2. |

**Figure 2.2   Existing Library System**

**Summary**

With the literatures that are reviewed, it helps the planning and analysis phases in the system development life cycle. Throughout literature review, library history and library concepts give the system developer a clear picture to develop the system. Besides, knowledge related to IT fields can be gained too.

# Chapter 3   System Requirement & Needs Analysis

## 3.1    Introduction

A critical part of a project is the establishment of requirements for the new system to be developed for the library. A system requirement specifies what a system must do or how it must be designed in order to satisfy the needs of the library. It also may limit or restrict the system's design, operation or performance in some manner.

The purpose of establishing system requirements is to obtain a clear picture of the system wanted before the available alternatives are examined and one is selected for development. Without this effort, the project manager can only guess as to the needs and desires of the library management and staff for a new system.

Once established, a set of requirements are used:

a) To identify systems which possibly might meet the needs of the library.

b) To compare and evaluate the alternatives which are identified.

c) To communicate in later phases of the project with library management and staff, governing authorities, vendors, programmers, and other as to the exact needs and desires for a new system.

d) To guide the later preparation of more detailed specifications for the new system.

e) To evaluate the new system, once it has been developed and installed, to determine if it is operating as anticipated and meeting the needs established at the beginning of the project.

Specially, this chapter includes discussions of:

a) General requirements.

b) Functional requirements.

c) Non-function requirement.

d) Work and performance requirements.

## 3.2 General Requirements

General requirements define and establish broad guidelines for the new computer-based system, ELIS. Requirements of this type usually pertain to system flexibility, compatibility, control and cost.

### a) Flexibility Requirements

Flexibility requirements describe the extend to which the new system must be adaptable to meet the future conditions without complete redesign or noticeable disruption of its operations.

ELIS must be designed so that, after it is installed and operational, it can be modified without complete redesign or noticeable disruption of service when library policies must be changed, new hardware and techniques must be adopted, or unforeseen problems in system operation suddenly occur.

### b) Compatibility Requirements

Compatibility requirements define how the new system is to interface with other systems. Systems are compatibility if the output of one can be accepted as input by another and processed successfully to achieve a desired result. Also, the system with the new system must be compatible should be identified.

A) i. ELIS must be compatible with other automated and manual systems within the library.

ii. ELIS must be compatible with the policies and procedures of OPAC.

c) **Control Requirements**

Control requirements specify and define any regulations and constraints placed on the ELIS due to laws, regulations, recommendations, or policies of library management, governing authorities or others.

i. ELIS must provide an auditable hardcopy of all fines collected.

ii. ELIS must protect the privacy of all individuals.

iii. ELIS must provide for the date-dues provided for in the library's circulation policies.

iv. A system of passwords is provided to control and limit access to all files and functions.

d) **Cost Requirements**

Cost requirements specify any cost constraints on the ELIS.

i. The cost of operating the ELIS must not be more than the manual system it replaces.

ii. ELIS must reduce the operating costs after a specified length of time.

**3.3     Functional Requirements**

The bulk of the list of requirements for the new system will be of a functional nature, defining specifically what the new system must be able to do. To facilitate conceptualizations of these requirements, ELIS system are separated into subsystems and separate lists of functional requirements are established for each area.

There are:

## A)  Circulation System

### a)  Patron Control

i.  ELIS must provide for entry of data collected about patrons during their registration.

ii.  The patron file contain for each person registered:

- Patron identification number
- Patron name
- Address
- Telephone number
- Date of registration
- Date of last circulation
- Number of item charged

iii.  ELIS must accept changes, addition, and deleting to any data in records in the patron file from the terminals.

iv.  ELIS must accommodate up to 4 library-designated user types: System Administrator, teachers, librarians and students.

### b)  Charges

i.  ELIS must provide for rapid and accurate charging of materials to patrons, with response times of 3 seconds average per charge.

ii.  ELIS must permit patron identification numbers to be entered manually on the keyboard as a method of entering the numbers.

iii.  ELIS must check patrons' eligibility to use the library, their borrowing privileges and their status.

iv.  ELIS must check the loan period codes for items to be circulated and compute the dates due.

  v.  ELIS must permit the overriding of the standard loan periods and setting of different loan periods when necessary.

  vi.  ELIS must charge out additional items to the same patron without the operator having to key-in the identification number.

 vii.  ELIS must disregard holidays, which shall be specified in advance by the library periodically, in computing dates due.

### c)  Discharges

  i.  ELIS must provide for rapid and accurate discharging of materials returned by patron, with response times of 3 seconds average or less per discard.

  ii.  ELIS must sense and trap during the discharge process those items which are overdue or with holds or recalls placed against them.

 iii.  ELIS must compute and records fined owed if items are overdue and will notify the librarians with some prompts when such situations occurs.

  iv.  ELIS must use the library-specified assessment rates for the different types of patrons when computing fines.

  v.  ELIS must accept and record fines paid on the spot.

  vi.  ELIS must erase patron identification numbers from the bibliographic and/or circulation files when items have been discharged.

### d)  Renewals

  i.  ELIS must complete renewals with or without patron's identification numbers and with or without the physical items in hand.

  ii.  ELIS must check for reserve or holds on items and notify the librarians if any exist.

 iii.  ELIS must follow all other routines or requirements for charges when renewing loans of materials.

e) **Holds or personal reserves**

  i.  ELIS must accept holds or personal reserves on items in circulation.

  ii.  ELIS must allow holds to be changed or canceled upon request of patron.

B) **Cataloging System**

a) **Item Control**

b) **The bibliographic file**

  i.  ELIS has the ability to add, change, or delete bibliographic item records.

  ii.  ELIS must accept either full or partial records in MARC II format.

  iii.  The item record must contain:

  - Item identification number.
  - Item location.
  - Item cost.
  - Times the item/copy has circulated.

  iv.  ELIS must have the ability to update the bibliographic file automatically when new or updated main entries or subject headings are added to the authority files.

C) **Acquisition System**

a) **Ordering**

  i.  ELIS must be able to print and edit the purchase order

  ii.  ELIS must retain the most recent update or version of the purchase order until the receiving report is completely processed for all items on the purchase order.

b) **Receiving**

ELIS must be able to prints a receiving report for use in identifying the order when they are received from the supplier.

c) **Input to Cataloging**

ELIS must be able to generate selected input data to the cataloging department.

D) **OPAC System**

**Inquiries**

i. ELIS must allow the rapid determination of titles in the bibliographic file and their locations.

ii. ELIS must have a response time of 6 seconds or less for author, title or patron inquiries and 10 seconds or less for subject, call number.

iii. ELIS must enable searches by author, title, subject and call number.

iv. ELIS must display a "no posting" message if no matches are located during a file search.

v. ELIS must display a brief listing of all matches to a search arguments if more than one match is found, thus enabling the librarians to choose the correct one.

E) **Management System**

**Bulletin notices, feedback and reports**

i. ELIS must prepare and print the overdue notices upon demand.

ii. ELIS must prepare and print fine notices upon demand.

iii. ELIS must prepare and print available notices when necessary.

iv. ELIS must prepare and print a report of all items having exceeded a library-designated number of holds.

v. ELIS must prepare and print lists of borrowers by either name or others upon demand.

vi. ELIS must prepare and print a list of materials on loan by units to other units upon demand.

vii. ELIS must prepare and print a list of fines outstanding over library-specified number of days upon demand.

viii.  ELIS must prepare and prints lists of lost and missing materials upon demand.

ix.  ELIS must prepare and print or display upon demand statistics for circulation activity by borrower type.

## 3.4     Non-Functional Requirements

The non-functional requirement or constraints describes a restriction on the system that limits our choices for constructing a solution to the problem.

a) User friendliness

ELIS is designed in such a way that the users would not feel uneasy or frustrated in using the system.

b) Reliability

Reliability is the extent to which a program can be expected to perform its intended functions with required precision. Therefore, the system should be reliable in performing its functions and operations.

c) Robustness

The system should be robust enough to handle expected or unexpected system failure.

d) Flexibility

ELIS should exercise a high degree of flexibility.

## 3.5     Work and Performance Requirements

Work and performance requirements specify the expected amount of work to be accomplished by ELIS system during a period of time such as a day, week, month or year and the speed with which transactions or operations must be completed by the ELIS system.

Examples of timing requirements:

a) ELIS system must have an average response time of 5 seconds of less for inquiries.

b) ELIS system must have an average response time of 3 seconds or less for charge, discharge and renewals.

## 3.6    Needs Analysis

*There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new system. For the initiator has the enmity of all who would profit by the preservation of old system and merely lukewarm defenders in those who would gain by the new one.*

--

*Machiavelli*

The information management needs of a library can vary substantially depending both on the type of the library and the various policies that guide the library's planning and operation. In this chapter, the process of conducting a thorough needs analysis is examined and explained.

A need analysis does not necessary have to be conducted by a computer system analyst. In fact, a librarian could perform a competent job, provided there was a technical resource the librarian could tap on occasion for guidance and information. The need analysis is based on a comprehensive review of the existing system plus detailed interviews of personnel from all levels and functions in the library. This analysis seeks to determine and document the information flows among and between functional activities, that is, "what really happens," in the library. Much of the benefit of a needs analysis comes from understanding what is currently going on and making needed improvements. The benefits realized from the introduction of a computer system are often secondary.

**3.6.1    Method of Gathering Information**

To have a consistent set of information on which to make informed choices, data must be gathered about the library's current operations, good or bad. This is done by systematically gathering data about each functional area and breaking down each major areas of analysis. The idea is to break up a broad area into manageable pieces so that the various activities are understood and problem areas can be easily identified. Information about the various functional areas of ELIS system is gathered in a variety of ways.

These techniques includes:

a)  Document collection.

b)  Internet surfing

c)  Observation (include time and motion studies).

d)  Questionnaire.

**3.6.1.1 Document Collection**

A variety of documents that carry data and information about the functional area is gathered and organized. Examples of documents include reports on existing system, reference books and journals. The resources can be found in The Main Library of University Malaya and the Document Room in Faculty of Computer Science and Information Technology, UM. Information that found is generally about the process of developing computer-based library system.

**3.6.1.2 Internet Surfing**

Nowadays, Internet surfing is the most popular method of obtaining information through a lot of web sites which regarding the library systems around the world. Some interface design and screen features are interesting and can be the reference and guideline in developing ELIS system. The web pages of the UM library and the

libraries in foreign countries have been reviewed to have some ideas in designing ELIS interface.

### 3.6.1.3 Observation

Observation is a continuous process and is usually informal. By observing the current library system, the policies and procedures of operation and management can be clearly understood. The symptoms and problems that always occur also can be identified and defined by observing the actual library system. As a user, the need for better service when using the library also can be identified through personal observations. Observation has been made at the Main Library of University Malaya regarding the OPAC system for the purpose to understand more about the requirements of developing the ELIS system.

### 3.6.1.4 Questionnaire

Questionnaires are an information-gathering technique that can be used effectively to study attitudes, beliefs, behaviors and characteristics when trying to gather data about a particular topic from a large number of people. Attitudes are what people (System Administrator, teachers and students) say they want (in ELIS system); belief are what people think is actually true; behavior is what the people do; and characteristics are properties of people or things. Questionnaire should be brief and designed to elicit responses to specific questions. Possible uses of questionnaire include having people identify time spent on various activities, identify and prioritize problem areas, and indicates general and specific areas of satisfaction with services delivered. A questionnaire is prepared to collect information about the response of teachers and students regarding the library services. The questionnaire and the analysis of the questionnaire are prepared in Appendix A.

## 3.7    Software Development Process Models

A *development process* is a set of activities, together with an ordering relationship between activities, which if performed in a manner that satisfies the ordering relationship will produce the desired product.

A *process model* is an abstract representation of a development process. In software development effort the goal is to produce high quality software. The development process is, therefore, the sequence of activities that will produce such software. The basic phases such as requirements analysis, design, coding and testing, which are usually further broken down into distinct activities. A software development process model specifies how these activities are organized in the entire software development effort.

The purpose of specifying a development process is to suggest an overall process for development software. Existing development processes can also be modeled, and such an exercise is useful for determining the weaknesses in existing practices.

## 3.8    System Development Methodology: Iterative Enhancement Model

The waterfall model stipulates that requirement should be completely specified before the rest of the development can proceed. The iterative enhancement model counters this limitation of the waterfall model and tries to combine the benefits of both prototyping model and the waterfall model. The basic idea is that the software should be developed in increments, each increment adding some functional capabilities to the system, until the full system is implemented. At each step, extensions and design modifications can be made. An advantage of this approach is that it can result in better testing since testing each increment is likely to be easier the testing the entire system, as in the waterfall model. Furthermore, as in prototyping, the increments provide feedback

to the clients, which is useful for determining the final requirements of the system.

In the first step of this model, a single initial implementation is done for the subset of the overall problem. This subset is one that contains some of the key aspects of the problem which are easy to understand and implement, and which form a useful and usable system.

A *project control list* is created that contains, in order, the entire task that must be performed to obtain the final implementation. This project control list gives an idea of how far the project is at given step from the final system.

Each step consists of removing the next step from the list, designing the implementation for the selected task, coding and testing the implementation, and performing an analysis of the partial system obtained after this step and updating the list as a result of the analysis. These three phases are called the *design phase, implementation phase* and *analysis phase.* The process is iterated until the project control list is empty, at which time the final implementation of the system will be available. The iterative enhancement process model is shown in *Figure 3.1.*

The project control list guides the iteration steps and keeps track of all tasks that must be done. The tasks in the list can include redesign of detective components found during analysis. Each entry in the list is a task that should be performed in one step of the iterative enhancement process, and should be simple enough to be completely understood. Selecting tasks in this manner will minimize the changes of error and reduce the redesign work. The design and

implementation phases of each step can be performed in a top-down manner or by using some other technique.

Design $_0$    →    Design $_1$    →                  →    Design n

Implement $_0$           Implement $_1$       ··················        Implement n

Analysis $_0$          Analysis $_1$                      Analysis $_n$
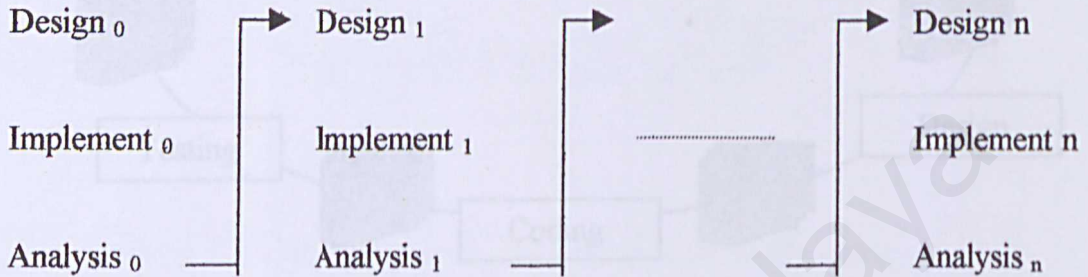
**Figure 3.1   The iterative enhancement model**

Iterative development is different from traditional development, which is sometimes called the waterfall approach. Using procedural languages, modifying existing code is difficult and error-prone. Previously, analysis, design, and development each were separated into sequential phases. Each phase had to be completed before the next phase began, as if each were separated by brick wall. See *Figure 3.2*.
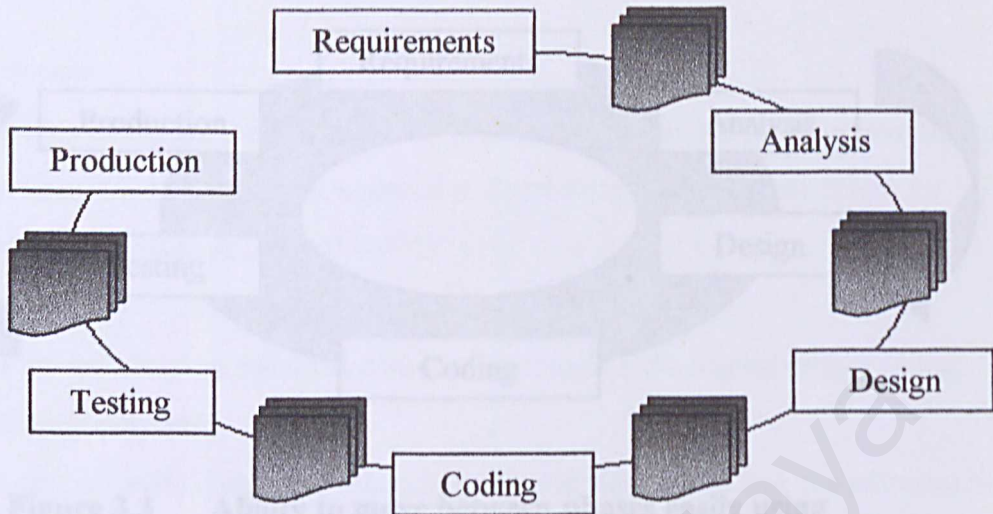
**Figure 3.2      Moving between phases of development was very   difficult -it was as though a wall existed between phases.**

It was expensive and difficult to go back to previous phase, and often the application suffered for it. Maintenance was a nightmare, and a program could not keep up with changes. Eventually, systems became so out-of-date that a whole new system needed to be written from scratch! Data processing departments fell years behind in development (literally) as a result. (Indeed, some are still years behind.)

Clearly, something had to be done. PowerBuilder and iterative development help solve this dilemma. Not only can you return to the analysis phase, but also you can easily modify the application to evolve with the work environment. In this project, you will see iterative development by developing a working application named *ELIS*. Iterative development allows the developer to move freely between development phases, as represented in *Figure 3.3*.
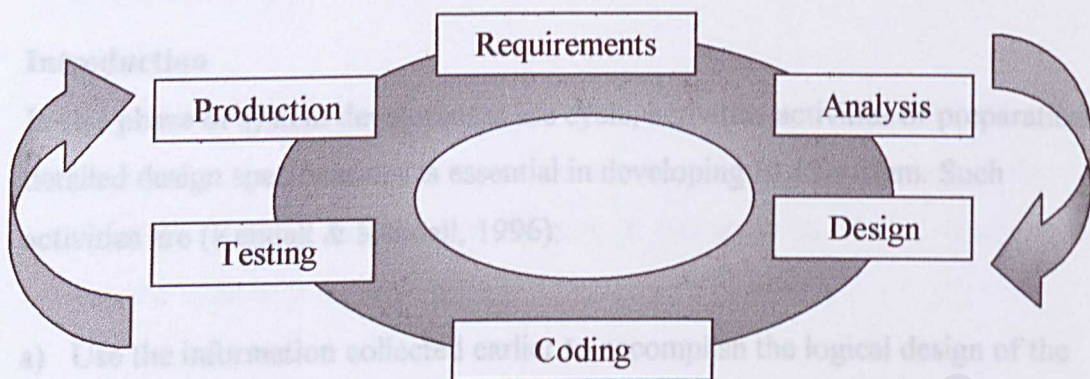
**Figure 3.3      Ability to move between phases easily using**
**Iterative development.**

**Summary**

System requirement and need analysis is important to identify the user's need, to evaluate
the system concept for feasibility, to perform technique analysis and to allocate functions
to hardware, software, people, database and other system elements. Building iterative
development model as system development methodology is a good choice for ELIS.
The next phase of system development life cycle is system design. During this phase,
quality is fostered. The system design will include screen, output, user interface and
database design.

# Chapter 4   System Design

## 4.1   Introduction

In this phase of system development life cycle, activities-activities or preparation of detailed design specifications is essential in developing ELIS system. Such activities are (Kendall & Kendall, 1996):

a)  Use the information collected earlier to accomplish the logical design of the information system.

b)  Designs accurate data-entry procedures so that data going into the information system are correct.

c)  Provides for effective input to the information system by using techniques of good form and screen design.

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

The design phase also includes *Designing files or databases*. A well-organized database is the basis for all information system. In this phase, programmer work with users to design output (either on-screen or printed) that meets their information needs.

Finally, the preparation of *designing controls and backup procedures* is needed. This effort is to protect the system and the data and to produce program specification packets. Each packet should contain input and output layouts, file

specifications and processing details; and it includes tables, data flow diagram and a system flowchart

The goal of system design is to translate the requirements defined during the system analysis phase into a model or representation of an entity that will be built later. To make ELIS more effective, it has to fulfill all the requirements and satisfy the need of the user.

## 4.2   Program Design

ELIS is divided to three types of access. There are:

a) *System Administrator*

System Administrator can access the entire system, which consists of all the acquisition module, cataloging module, circulation module, OPAC module, edit module, maintenance module, bulletin & feedback module and report module.

b) *Librarians*

Librarians can access the entire system accept the edit module, System Access sub module and System User sub module.

c) *Patron*

Patron only can only access the OPAC module, bulletin and feedback module.
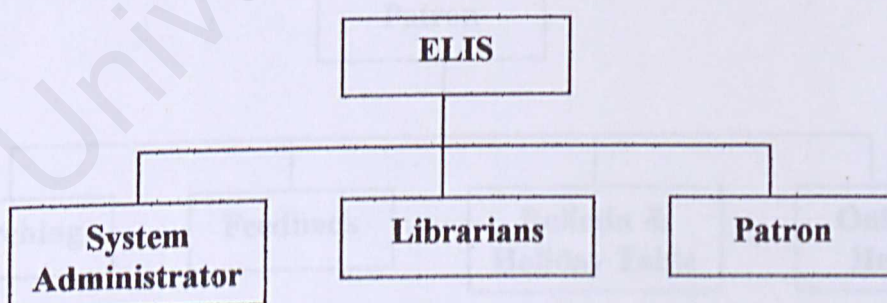
**Figure 4.1      System Access Categories**
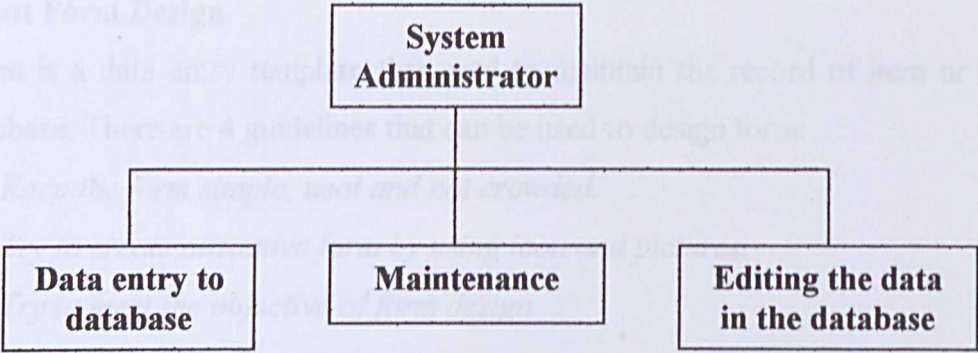
**Figure 4.2    The function of the System Administrator**
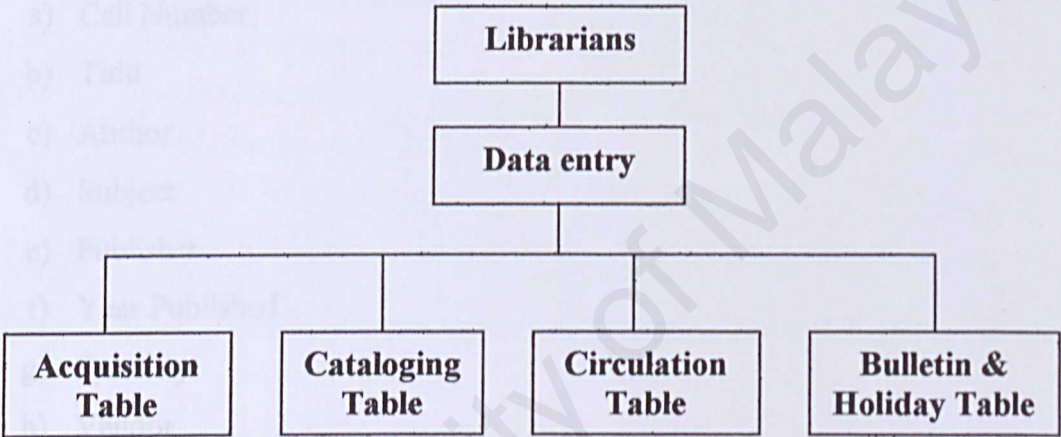


**Figure 4.3    The function of the librarians**
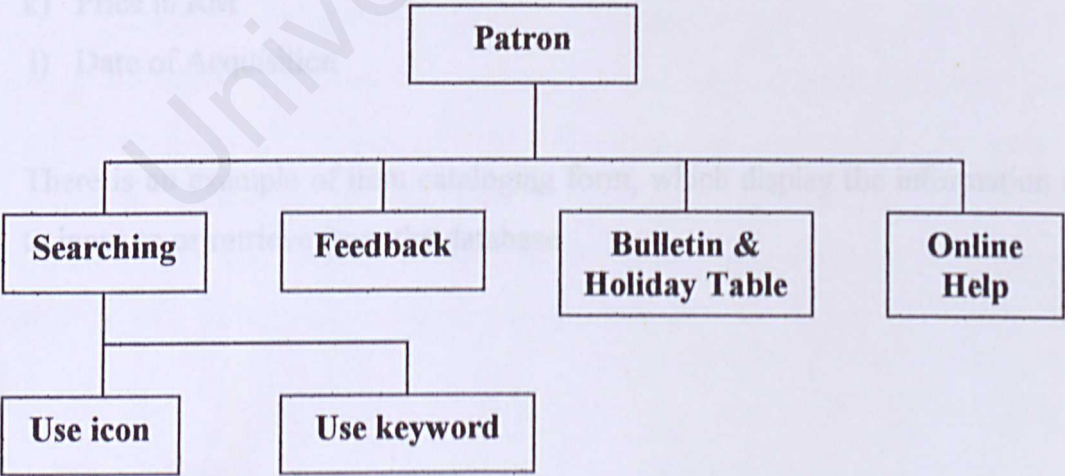


**Figure 4.4    The function of the Patron**

### 4.2.1   Input Form Design

Form is a data entry template that used to maintain the record of item or user in database. There are 4 guidelines that can be used to design form:

a) *Keep the form simple, neat and not crowded.*

b) *Try to create attractive form by using icon and pictures.*

c) *Try to meet the objective of form design*

d) *Try to ensure the form design is accurate*

Information that contain in item acquisition form are:

a) Call Number

b) Title

c) Author

d) Subject

e) Publisher

f) Year Published

g) Quantity

h) Vendor

i) Vendor Address

j) Price in Other Currency (if any)

k) Price in RM

l) Date of Acquisition

There is an example of item cataloging form, which display the information needed to input to or retrieve from the database.

**Figure 4.5    The Item Cataloging Form**

## 4.3    Data Flow Diagram (DFD)

Data flow diagram (DFD) is a graphical presentation, which characterize data processes and flows in a system. In the original state, data flow diagrams depict the broadest possible overview of system inputs, processes and output. The ability to understand the information requirements of the users is important to conceptualize how data moves through the library, the processes or transformation that the data undergoes, and what the outputs are.

Data flow diagrams are categorized to

a) Logical data flow diagram

A data flow diagram focuses on the system and how the system operates. It is not concerned with how the system will be constructed. Instead, it describes the system events that take place and the data required and produced by each event.

b) Physical data flow diagram

A physical data flow diagrams shows how the system will be implemented, including the hardware, software, files and people involved in the system.

The chart shown in **Figure 4.1** contrasts the features of logical and physical models.

| **Design Features** | **Logical** | **Physical** |
|---|---|---|
| *What the model depicts* | How the library operates | How the system will be implemented (or how the current system operates) |
| *What the processes represent* | Library activities | Programs, program modules, and manual procedures |
| *What the data stores represent* | Collection of data, regardless of how the data is stored. | Physical files and databases, manual files |
| *Type of data stores* | Show data stores representing permanent data collections | Master files, transaction files. Any processes that operates at two different times must be connected to by a data store |
| *System controls* | Show library controls | Show controls for validating input data, for obtaining a record (record found status), for ensuring successful completion of a process, and for system security |

**Figure 4.6     Comparison between logical and physical models**

### 4.3.1    Advantages of the Data Flow Diagrams

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

a)  Freedom from committing to the technical implementation of the system too early.

b)  Further understanding of the interrelatedness of systems and subsystems.

c)  Communicating current system knowledge to users through data flow diagrams.

d)  Analysis of a proposed system to determine if the necessary data and processes have been defined.

### 4.3.2    Developing Data Flow Diagram For ELIS

To begin a data flow diagram, ELIS is collapsed narrative into a list with the four categories of external entity (double square), data flow (arrow), process (rectangle with rounded corners) and data store (open-ended rectangle). This list in turn helps determine the boundaries of the ELIS. Data flow diagram of ELIS consists of

a)  Context Diagram

b)  Diagram 0 (The Next Level)

c)  Child Diagram (More Detailed Levels)

#### 4.3.2.1 Context Diagram

The context diagram is the highest level in a data flow diagram and contains only one process, representing the entire system. The process is given the number zero. All external entities (System Administrator, Librarian and Student & Teacher) are shown on the context diagram; as well as major data flow to and from them. The diagram does not contain any data stores.
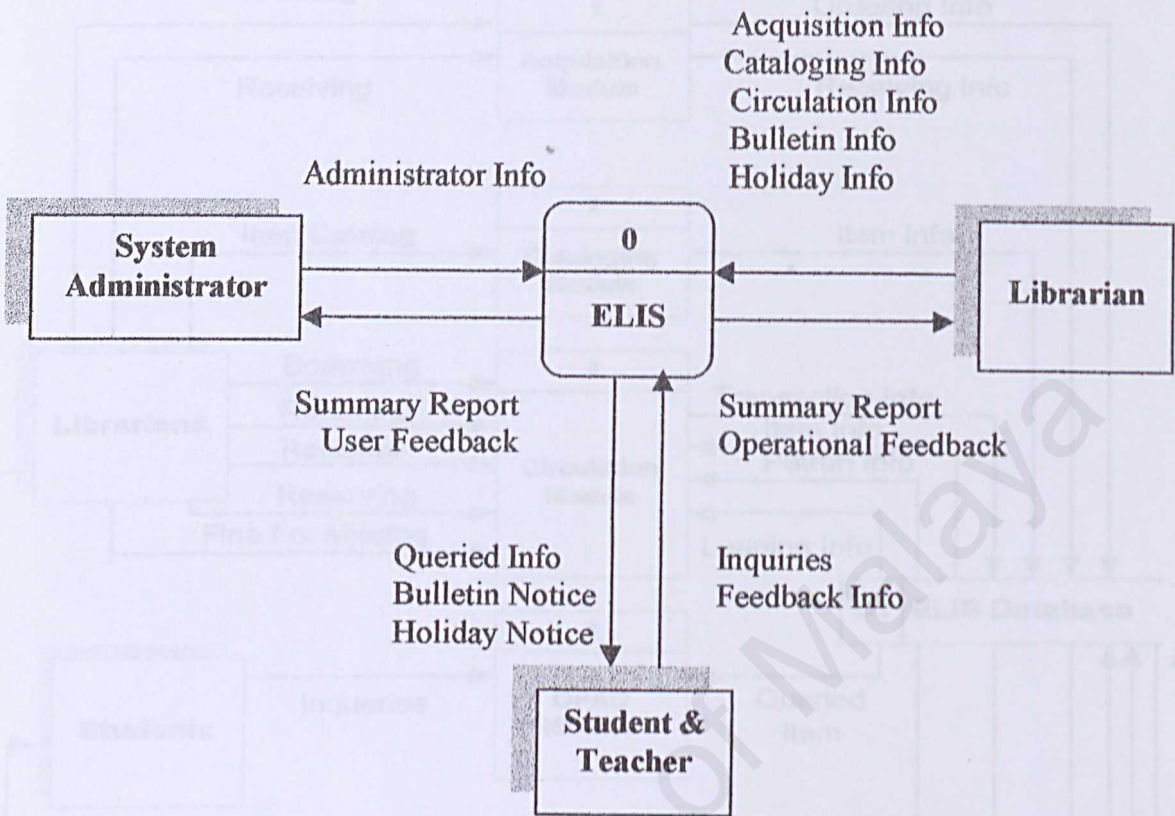
**Figure 4.7     Context Diagram for ELIS**

### 4.3.2.2 Diagram 0 (The Next Level)

Diagram 0 is the explosion of the context diagram and ELIS has included up to eight process. Each process is numbered with an integer, generally starting from the upper left – hand corner of the diagram and working toward the lower right-hand corner. The major data stores (ELIS Database representing master files) of the system and all external entities are included on Diagram 0
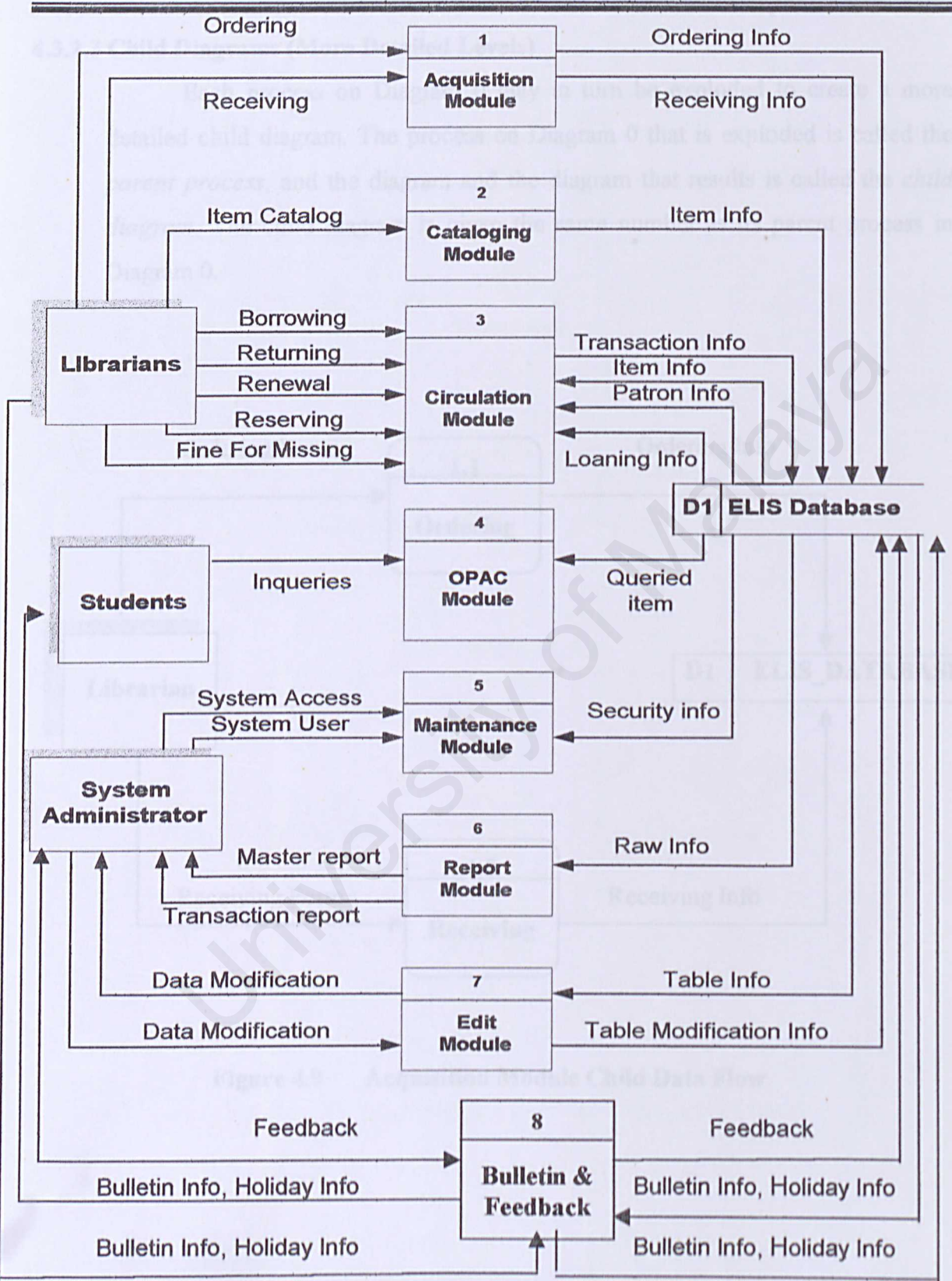
**Figure 4.8      The Diagram 0 of ELIS**

### 4.3.2.3 Child Diagrams (More Detailed Levels)

Each process on Diagram 0 may in turn be exploded to create a more detailed child diagram. The process on Diagram 0 that is exploded is called the *parent process*, and the diagram and the diagram that results is called the *child diagram*. The child diagram is given the same number as its parent process in Diagram 0.
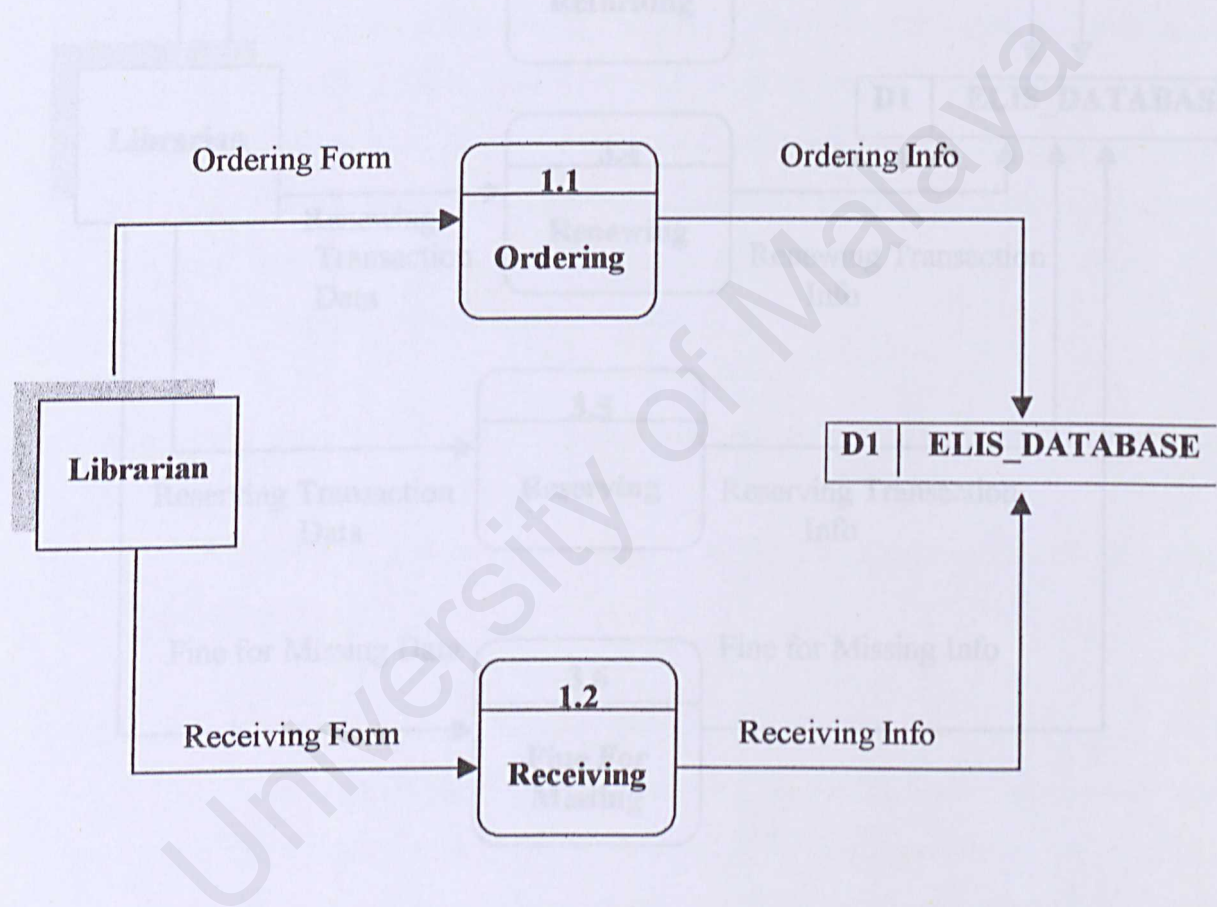


**Figure 4.9      Acquisition Module Child Data Flow**

Borrowing Transaction Data → **3.2 Borrowing** → Borrowing Transaction Info

Returning Transaction Data → **3.3 Returning** → Returning Transaction Info

**Librarian**

Renewing Transaction Data → **3.4 Renewing** → Renewing Transaction Info

Reserving Transaction Data → **3.5 Reserving** → Reserving Transaction Info

Fine for Missing Data → **3.6 Fine For Missing** → Fine for Missing Info

**D1   ELIS_DATABASE**

**Figure 4.10    Cataloging Module Child Data Flow**

## 4.4      Database Design

A database is a formally defined and centrally controlled store of data intended for use in ELIS. The heart of a database is the DBMS (database management system), which allows the creation, modification, and updating of database: the retrieval of data; and generation of reports. The person who ensures that the database meets its objectives is System Administrator.

### 4.4.1   Normalization

Normalization is the transformation of complex user views and data stores to a set of smaller, stable data structures. In addition to being simpler and more stable, normalized data structures are more easily maintained. Data normalization provides rules on how to break tables or fields into several tables that conveniently reference one other. The main purposes of normalization are to reduce data redundancy and eliminate data inconsistence.

The 3 steps below will describe the most basic normalization process.

a)  **Step 1: First Normal Form (1 NF)**

The first step involves removing all the repeating groups and identifying the primary key(s).

b)  **Step 2: Second Normal Form (2 NF)**

The second step involves removing all partial functional dependencies by splitting the original is said to be in the 2 NF is the relation is the relation is in 1 NF and every non-key attribute is fully functional dependent on the primary key(s).

c)  **Step 3: Third Normal Form (3 NF)**

The third step involves removing any transitive dependencies where non-key attributes are dependent on another non-key attributes. The relation is

said to be in the 3 NF if the relation is in 2 NF and there is no transitive dependency.

### 4.4.2    Data Dictionary

The data dictionary is a specialized application of the kind of dictionaries used as reference in everyday life. The data dictionary is a reference work of data about data, one that is compiled to guide them through analysis and design. The data dictionary is created by examining and describing the contents of the data flow, data stores and processes.

### A.  Table: Acquisition

**1.  Table Name           : ELIS_ITEM_ORDERING**

**Purpose**           : Keep all the ITEM information regarding the ordering process

| **Primary Key** | : OrderNo | |
|---|---|---|
| **Foreign Key** | : AuthorCode1 | (ELIS_AUTHOR) |
| | AuthorCode2 | (ELIS_AUTHOR) |
| | AuthorCode3 | (ELIS_AUTHOR) |
| | AuthorCode4 | (ELIS_AUTHOR) |
| | PublisherCode | (ELIS_PUBLISHER) |
| | OrderNo | (ELIS_ORDERING) |

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| OrderNo | Char(10) | Purchase Order Number. |
| Title | Char | Item's title. |

| | | |
|---|---|---|
| AuthorCode1 | Char(4) | Codes for the first authors of items |
| AuthorCode2 | Char(4) | Codes for the second authors of items if exist. |
| AuthorCode3 | Char(4) | Codes for the third authors of items if exist. |
| AuthorCode4 | Char(4) | Codes for the forth authors of items if |
| PublisherCode | Char(4) | Codes for publishers of items. |
| YearPublished | Integer | The year when the item is published. |
| QtyOrder | Integer | Quantity ordered |
| OrderStatus | Char(2) | The status of the ordering ('A' – Active means the item ordered haven't receive, 'D'- Done means the ordered item has been received) |

2. **Table Name**        **: ELIS_ORDERING**
   **Purpose**          : Keep all the information regarding the ordering process

| | | |
|---|---|---|
| **Primary Key**         : OrderNo | | |
| **Foreign key**          : Requestor (ELIS_PATRON) | | |
|                           VendorID (ELIS_VENDOR) | | |
| OrderNo | Char(10) | Purchase Order Number. |
| DateOrder | Datetime | Date the acquisition is made |
| Requestor | Char(10) | Requestor user ID. |
| VendorID | Char(10) | Code that is unique for every vendor. |
| OrderStatus | Char(2) | The status of the ordering ('A' – Active means the item ordered haven't receive, 'D'- Done means the ordered item has been received) |

**3.  Table Name**        : **ELIS_VENDOR**

     **Purpose**           : Keep all the information of vendor.

| Primary Key | | : VendorID |
| --- | --- | --- |
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| VendorID | Char(10) | Code that is unique for every vendor. |
| Vendor | Char(30) | Name of the vendor. |
| VendorAddress | Char(50) | Vendor address. |
| VendorPhone | Integer | Vendor phone number. |
| VendorFax | Char(15) | Vendor fax number |
| VenEmailAdd | Char(30) | Vendor email address |

**4.  Table Name**        : **ELIS_RECEIVE**

     **Purpose**           : To keep all the information of receiving transaction

| Primary Key | : ReceiveNo | |
| --- | --- | --- |
| **Foreign Key** | : OrderNo | (ELIS_ORDERING) |
| | Receiver | (ELIS_PATRON) |

| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| --- | --- | --- |
| ReceiveNo | Char(10) | Number to represent the receiving transaction. |
| OrderNo | Char(10) | Purchase Acquisition Number. |
| DateReceived | Datetime | Date of receiving. |
| Receiver | Char(10) | The receiver ID. |
| InvoisNo | Char(10) | The invois number. |

**5.  Table Name** : **ELIS_ITEM_RECEIVE**

   **Purpose** : To keep all the information of item received.

| Primary Key | : OrderNo, Title | |
|---|---|---|
| Foreign Key | : OrderNo | (ELIS_ORDERING) |
| | Receiver | (ELIS_PATRON) |
| | CountryCode | (ELIS_CURRENCY) |

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| OrderNo | Char(10) | Purchase Acquisition Number. |
| Title | Char | Ordered item's title. |
| QtyReceived | Integer | The quantity being received. |
| CountryCode | Char(2) | The country that have the currency. |
| Currency | Decimal | The currency at that time. |
| CostPerUnit | Money | Actual cost per unit. |
| CostInRM | Money | Actual cost per unit in ringgit. |
| TotalCostInRM | Money | Total cost (RM) = Cost per unit x quantity received |
| ReceiveNo | Char(10) | Number to represent the receiving transaction. |

**6.  Table Name** : **ELIS_CURRENCY**

   **Purpose** : Keep the most recently currency.

| Primary Key | : CountryCode | |
|---|---|---|

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| CountryCode | Char(2) | Code that is unique for a particular country. |
| Country | Char(30) | Country that owns the currency. |
| Currency | Money | Value of currency. |

**B. Table: Item**

7.  **Tables Name**  : **ELIS_ITEM**
    **Purpose**  : Keep a list of all items' information.

| | | |
|---|---|---|
| **Primary Key** | : **CallNumber** | |
| **Foreign Key** | : PublisherCode | (ELIS_PUBLISHER), |
| | SubjectCode | (ELIS_SUBJECT), |
| | Category | (ELIS_CATEGORY), |
| | Language | (ELIS_LANGUAGE), |
| | LocationCode | (ELIS_LOCATION), |
| | StatusCode | (ELIS_STATUS). |
| | CountryCode | (ELIS_CURRENCY) |

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| ItemNo | Char(10) | Code that is unique for every item in system. |
| CallNumber | Char(10) | Code that is unique for every item. |
| Title | Char(50) | Title of the items. |
| AuthorCode1 | Char(4) | Codes for the first authors of items |
| AuthorCode2 | Char(4) | Codes for the second authors of items if exist. |
| AuthorCode3 | Char(4) | Codes for the third authors of items if exist. |
| PublisherCode | Char(4) | Codes for publishers of items. |
| SubjectCode1 | Char(5) | Codes for the subject of each book (**MGMT, FIN, etc.)** |
| SubjectCode2 | Char(5) | Codes for the subject of each book (**MGMT, FIN, etc.)** |

| | | |
|---|---|---|
| SubjectCode3 | Char(5) | Codes for the subject of each book **(MGMT, FIN, etc.)** |
| Category | Char(2) | Codes for the type of items **(BK, CD, MG, VD).** |
| Language | Char(1) | Codes for the languages of items (E, C, M and T). |
| LocationCode | Char(5) | Codes to represent the locations where items are keeping. |
| DateEntered | Datetime | Date where item information is created. |
| DateUpdated | Datetime | Date where item information is updated. |
| CountryCode | Char(2) | The country that have the currency. |
| Currency | Decimal | The currency at that time. |
| CostPerUnit | Money | Actual cost per unit. |
| CostInRM | Money | Actual cost per unit in ringgit. |
| FineRate | Money | Fines for items per day when the items are overdue. |
| StatusCode | Char(1) | Codes to represent the status of items **(B, L, M, D, R)** |

8.  **Table Name**                    **: ELIS_PUBLISHER**
    **Purpose**                          : Keep a list of the publishers.

| Primary Key | : PublisherCode | |
|---|---|---|
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| PublisherCode | Char(4) | Codes for publishers of items |
| PublisherName | Char(50) | The names of the publishers. |

9. **Table Name**          **: ELIS_ITEM_SUBJECT**

   **Purpose**             : Keep a list of all the items' subject.

| Primary Key | : Subject | |
|---|---|---|
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| Subject | Char(5) | Codes for subjects of the items (MGMT, FIN, GEN, SPRT, TVL, RLG, etc). |
| Description | Char(30) | Descriptions for the codes (management, finance, general, sport, travel, religion, etc.) |

10. **Table Name**          **: ELIS_ITEM_CATEGORIES**

    **Purpose**             : Keep a list of all the items' categories.

| Primary Key | : Category | |
|---|---|---|
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| Category | Char(5) | Codes for the type of items (BK, CD, MG, VD). |
| Description | Char(30) | Description for the codes (Books, Compact Disc, Magazine, Video) |
| Duration | Integer | The duration of borrowing |
| FineRate | Money | Fines for items per day when the items are overdue. |
| ReserveDuration | Integer | The duration of reserving an item according to it category. |
| FineInPercentage | Money | The percentage of fining if an item is missing according to it category. |

**11. Table Name**            : **ELIS_ITEM_LANGUAGE**

**Purpose**                    : Keep a list of all the items' languages.

| Primary Key | : Language | |
|---|---|---|

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| Language | Char(1) | Codes for languages of items (E, C, M, T). |
| Description | Char(20) | Descriptions for the codes (English, Chinese, Malay, Tamil). |

**12. Table Name**           : **ELIS_ITEM_LOCATION**

**Purpose**                    : This table contain the description of the item's location in the library.

| Primary Key | : LocationCode | |
|---|---|---|

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| LocationCode | Char(5) | Codes to represent the locations where items are keeping. |
| Location | Char(20) | The location of the items. |

**13. Table Name**           : **ELIS_ITEMSTATUS**

**Purpose**                    : This table contain the description of the item's status.

| Primary Key | : Status | |
|---|---|---|

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| Status | Char(1) | Codes to represent the status of items (B, L, M, D, R) |
| Description | Char(20) | Descriptions for the codes (Borrowed, Loaning, Missing, Damaged, Reference). |

## C. Table: Patron

**14. Table Name** : **ELIS_PATRON**

**Purpose** : Keep a list of patrons' information

| Primary Key | : Patron_ID | |
|---|---|---|
| Foreign Key | : RaceCode | (ELIS_RACE), |
| | PatronStatus | (ELIS_PATRONSTATUS) |
| | GendorCode | (ELIS_GENDER) |
| | StateCode | (ELIS_STATE) |
| | ClassCode | (ELIS_CLASS) |

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| Patron_ID | Char(10) | Code that is unique for every library's patron. |
| Patron_Name | Char(30) | Name of the patron. |
| ClassCode | Char(2) | Code that is unique for every class. |
| Gender | Char(10) | Sex of the patron. |
| RaceCode | Char(3) | Code that is unique for every race. |
| IC_No | Char(14) | The patron's IC (old/new) |
| DOB | Datetime | Date of birthday. |
| Hometown | Char(20) | The patron's hometown (contact information). |
| Street | Char(50) | Street where the patron's lives (contact information). |
| District | Char(40) | An area of the town. |
| Postcode | Char(5) | Post code of the area. |
| State | Char(20) | The state of the country where the patron stay at. |
| Phone | Char(12) | The patron's phone number (contact |

| DateEntered | Datetime | Date where patron information is created. |
|---|---|---|
| PatronStatus | Char(2) | The patron's status in the library. |

## 15. Table Name        : ELIS_RACE

**Purpose**        : This table contain the description of the patron's race in the library.

| Primary Key        : RaceCode | | |
|---|---|---|

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| RaceCode | Char(3) | Code that is unique for every race. |
| Race | Char(30) | Name of the race. |

## 16. Table Name        : ELIS_CLASS

**Purpose**        : This table contain the description of the patron's class in school.

| Primary Key        : ClassCode | | |
|---|---|---|

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| ClassCode | Char(2) | Code that is unique for every class. |
| Class | Char(30) | Name of the class. |

**17. Table Name** : ELIS_PATRONSTATUS

   **Purpose** : This table contain the description of the patron's status in the library.

| | |
|---|---|
| **Primary Key** | **: PatronStatus** |

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| PatronStatus | Char(2) | The patron's status in the library. |
| Description | Char(30) | Description of the status |

## D.  Table: Transaction

**18. Table Name** : ELIS_TRANSACTION

   `**Purpose** : Keep all the information of transaction.

| | | |
|---|---|---|
| **Primary Key** | **: ItemNo, PatronID, TranType, TranDate** | |
| **Foreign Key** | **: ItemNo** | **(ELIS_ITEM)** |
| | Patron_ID | (ELIS_PATRON) |
| | TranType | (ELIS_TRANSACTION_TYPE) |

| FIELDS | DATA TYPE | DESCRIPTION |
|---|---|---|
| ItemNo | Char(10) | Code that is unique for every item. |
| Patron_ID | Char(10) | Code that is unique for every library's patron. |
| TranType | Char(2) | Code for types of transactions (B, RT, R, RS, FM). |
| TranDateTime | Datetime | Date and times when the transactions take place. |

| | | |
|---|---|---|
| TranFine | Money | Fines for overdue or other types of fines. |
| TranStatus | Char(2) | A-active means the transaction still active<br>NA- not active means the transaction are not active |

**19. Table Name** : **ELIS_TRANSACTION_TYPE**

**Purpose** : Keep all the information of transaction type.

| **Primary Key** | : **TranType** | |
|---|---|---|

| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
|---|---|---|
| TranType | Char(2) | Code for types of transactions (B, RT, R, RS, FM). |
| Description | Char(30) | Descriptions for the codes (B for Borrowing, R for Renewing, RT for Returning, RS for Reserve, FM for Fine For Missing). |

**20. Table Name** : **ELIS_DUEDATE**

**Purpose** : Keep the due date for item borrowed by patron.

| **Primary Key** | : **ItemNo** | |
|---|---|---|
| **Foreign Key** | : ItemNo | (ELIS_ITEM) |

| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
|---|---|---|
| ItemNo | Char(10) | Code that is unique for every item. |
| DueDate | Datetime | Due dates for items borrowed by patrons. |

**E. Table: Maintenance**

**21. Table Name** : **ELIS_SYSTEM_ACCESS**

    **Purpose** : This table contains the description of the access code where it will make the system to open the appropriate menu for the user.

| Primary Key | : AccessCode | |
|---|---|---|
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| AccessCode | Char(1) | Code that is unique for every type of access (A, L, S, T). |
| Description | Char(50) | Description of the AccessCode (A for System Administrator, L for Librarian, S for Students, T for Teacher). |

**22. Table Name** : **ELIS_SYSTEM_USER**

    **Purpose** : Keep all the user information.

| Primary Key | : Patron_ID | |
|---|---|---|
| Foreign Key | : Patron_ID | (ELIS_PATRON) |
| | AccessCode | (ELIS_SYSTEM_ACCESS) |
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| Patron_ID | Char(10) | Code that is unique for every library's patron. |
| AccessCode | Char(1) | Code that is unique for every type of access (A, L, S, T). |
| Password | Char(10) | Password that used to access the system |

23. **Table Name**                 **: ERMS_BULETIN**
    **Purpose**                    : Keep all the information of bulletin in the library for the
                                    most recently.

| Primary Key | | : ActivitiesName, Date |
| --- | --- | --- |
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| ActivitiesName | Char(50) | The name of the activities. |
| Date | Datetime | The date and time of activities. |
| Venue | Char(50) | The location of the activities. |
| Explanation | Char(300) | The information of the activities. |
| Objective | Char(100) | The objectives of the activities. |
| PeopleInCharged | Char(50) | Name of the people in charged in the particular activity. |

24. **Table Name**                 **: ERMS_FEEDBACK**
    **Purpose**                    : Keep all the information regarding the feedback of the
                                    patron.

| Primary Key | | : Feedback, Date | |
| --- | --- | --- | --- |
| **Foreign Key** | | : FeedbackType | (ELIS_FEEDBACK_TYPE) |
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** | |
| Feedback | Char(50) | Title of feedback. | |
| FeedbackType | Char(50) | Type of the feedback (CP, Q, CI) | |
| Sender | Char(30) | Name of the sender. | |
| Date | Datetime | The date when the feedback is made. | |
| Content | Char(100) | The content of the feedback. | |

**25. Table Name        : ERMS_FEEDBACK_TYPE**

**Purpose**              : Keep the description of the feedback type.

| Primary Key | | : FeedbackType |
|---|---|---|
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| FeedbackType | Char(2) | Code that is unique for every type of feedback. |
| Description | Char(30) | Description for the codes( C for Complaints, Q for Question, CM for Comment for Improvement). |

**26. Table Name        : ERMS_HOLIDAYCALENDAR**

**Purpose**              : Store holidays for the library.

| Primary Key | | : HolidayDate |
|---|---|---|
| **FIELDS** | **DATA TYPE** | **DESCRIPTION** |
| HolidayDate | Datetime | The date of the holidays. |
| Occasion | Char(50) | Description for the declared holidays. |

### 4.4.3  Other Database Design Specifications

Other database design specifications may be necessary for ELIS, such as:

a)  Audit control specifications

b)  All outdated records must be retained for a period of 2 years after they been superceded or updated.

c)  Backup or recovery specifications

d)  Occasionally, records or entire files can be irretrievably lost through negligence, vandalism, sabotage, accident, or hardware or software failures.

Method of reconstructing lost data must be planned and provided for. A means of restoring files using a backup file supplied by a log file of all transactions completed since the last backup run must be provided.

## 4.5  User Interface

The interface is the system for most users. However well or poorly designed, it stands as the representation of the system. The goal of interface design is to help users to get the information they need in and out of the system by addressing the following objectives (Kendall &Kendall, 1996):

a) Effectiveness as achieved through the design of interface that allows users to access the system in a way that is congruent with their individual needs.

b) Efficiency as demonstrated through interfaces that both increase the speed of data entry and reduce errors.

c) User consideration as demonstrated in the design of suitable interfaces and by providing appropriate feedback to users from the system.

d) Productivity as measured by ergonomically sound principles of design user interfaces and workspaces.

The two categories of the user interface guidelines that can be followed are

a) General interaction

b) Information display

## 4.5.1  General Interaction

There are some general interactions associates with the user interface in ELIS. For example:

a)  **Consistency**

Consistency is important in designing user interface. A consistent format is used for menu selection, command input, data display and report. For example, in order to jump from a combo box to another combo box, user can press "ËNTER" key or "TAB" key. In ELIS, every screen is designed by dividing the screen into three main sections namely heading, body and instruction section.

i.  The ***heading section*** included the title form and the menu bar. The caption on the title form will show the purpose of each screen. The *MicroHelp* at the bottom of each screen will also show the title of the form.

ii. The ***body section*** is where the data entry operations such as adding a new item or user take place. It can also contain any information that is to be viewed or displayed. There are some buttons to execute a particular operation or transaction by clicking those button such as "OK", "CANCEL","ADD", "DELETE", "SORT", "FILTER", "PRINT", "SAVE" and so on.

iii. The ***instruction section*** is used to display the function of a specific object or control to let the user knows what is the purpose of the object and how the object can be used. *Online Help* is provided to guide the user while using the ELIS.

b)  **Meaningful feedback is offered**

ELIS provides the user with visual feedback to ensure that two-way communication (between the user and interface) is established. For example, the mouse pointer will change to hourglass shape to visually inform the user that the system is busy in process and be patient.

**c)  Ask for verification of any non-trivial destructive action**

A message box is always prompted to verify an action such as the deletion of a record before the action is being carried out. Before a record or data is added to or deleted from the ERMS Database, a message box will appear to the user for confirmation. Besides, a message box also will be shown if a particular transaction is not committed and the ELIS will automatically execute the rollback (Transaction Control) operation.

**d)  Forgive mistakes**

If the bar code is not the same with the call number of an item in the database, the system will not allowed the record to be saved.

**e)  Use simple action verbs or short verb phrases to name the command button**

For instance, the verb "OK", "CANCEL","ADD", "DELETE", "SORT", "FILTER", "PRINT", "SAVE", "SEARCH" and others are used to name the command buttons in screens.

**4.5.2  Information Display**

There are some ways of information display associates with the user interface in ELIS. For example:

**a)  Display information that is relevant to the current context**

User will get all the information relevant to a specific system function. For example, user will get the particular item's information in Cataloging Screen.

**b)  Use consistent labels, standard abbreviations and predictable colors.**

In ELIS, a standard and consistent headings, labels, buttons, fonts and color will be used in every screen.

**c) Provides meaningful error messages**

If the user ID or password is incorrect, a error message will pop up to inform the user to re-enter the user ID or password. The error message should be clear enough to tell the user what is wrong and what should be done regarding to the error.

**d) Deactivate command buttons that are inappropriate for a certain user to access**

By hiding or disabling a command button as the user does not have the authority to access it, will prevent the user from attempting some action that should be done by System Administrator.

| Module | Menu | Submenu | Description |
|---|---|---|---|
| **File** | Close | | Close the active screen. |
| | Save As | | Save a list of data to text file, Excel, Notepad or Word. |
| | Print | | Print master report, transaction report, bulletin or holidays notice. |
| | Exit | | Exit ELIS. |
| **Transaction** | Acquisition | Ordering | Allow user to input the ordering information and print the purchase order. |
| | | Receiving | Allow user to input in the information of item received. |
| | Cataloging | Item Cataloging | Allow user to input the information of item. |
| | Circulation | Borrowing | Allow patron to borrow an item from library. |

| | | Returning | Allow patron to return the borrowed items. |
|---|---|---|---|
| | | Renewing | Allow patron to renew their items. |
| | | Reserving | Allow patron to reserve any item. |
| | | Fine for Missing | Allow user to impose a fine on patron if their borrowed item is missing. |
| **OPAC** | Search Engine | | Allow a search up to 3 search fields. |
| **Bulletin & Feedback** | Bulletin | | Allow the patron to view and print the bulletin notice. |
| | Holiday | | Allow the patron to view and print the holiday notice. |
| | Feedback | | Allow the patron to input the complaint, questions or some comments to improve the library services. |
| **Edit** | Master Table | | Allow the System Administrator to edit the master data in the database. |
| | Transaction Table | | Allow the System Administrator to edit the transaction data in the database. |
| **Report** | Master Report | | Allow the user to view and print the master report. |
| | Transaction Report | | Allow the user to view the various type of transaction report periodically such as daily, weekly, monthly, or yearly. |

| Maintenance | Change Password | | Allow the user to change the password. |
|---|---|---|---|
| | System Access | | Allow the System Administrator to edit the access code for ELIS. |
| | System User | | Allow the System Administrator to edit the user that have the right to access a particular menu depend on the access code. |
| Help | Online Help | | To give the user an online help regarding the usage of each screen. |
| | About | | To display information about ELIS. |

**Figure 4.11    Module Description**

**Summary**

Design is the creative process or transforming the problem into a solution. So, the system design must be carefully handled so ELIS can fulfill the functional and non-functional requirements.

# Chapter 5    Systems Implementation

## 5.1    Introduction

System implementation is the physical realization of the database and application designs. Coding and debugging are the major tasks involved in the implementation phase.

## 5.2    System Coding

Coding is the process of translating the design specifications into source codes that the computer can process. The source codes may require an interpreter or compiler and linker to convert them into an executable program. Without proper programming standards and guidelines, the programmer or the coder will write the program in the format according to his likes or in the manner he deems fit. As a result, the program codes written might not conform to proper coding, naming convention, and lack appropriate comments, consistency and integrity of the terms used. This would make the codes very difficult to trace, debug, and maintain by another programmer. The use of standard programming guidelines that clearly spell out all the proper aspects of writing programs would certainly result in good and maintainable code design.

Purposes for coding include:

a) Keeping track of something

b) Classifying information

c) Concealing information

d) Revealing information

e) Requesting appropriate action

**5.2.1  Code Specification For ELIS**

| No. | Content |
| --- | --- |
| 1. | Define Code Specification |
| 2. | Define Code Standards <br> 2.1  Define Standard Naming Conversion <br> 2.2  Define Code Writing Standards |
| 3. | Write Module Codes <br> 3.1  Identity Module Code Priority <br> 3.2  Write Code to Perform One Function Per Module <br> 3.3  Inserting and Explaining Comments <br> 3.4  Define Initialization <br> 3.5  Define Loop Entry and Exit <br> 3.6  Each Loop Executes the Correct Number of Times <br> 3.7  Define Cleanup for Loop that Exited Prematurely <br> 3.8  Define Strings Type Manipulations <br> 3.9  Define Pointer Type Manipulations <br> 3.10 Define Interfaces Between Module Calls <br> 3.11 Define Files Used by the Module Codes |
| 4. | Identify Code Syntax |
| 5. | Identify Code Logic |

**5.2.2   Guidelines on the Writing of Code Specifications**

| No. | Content |
| --- | --- |
| 1. | **Define Code Specification**<br>The code specifications gathered are viewed from the following perspectives:<br>   a)  User Perspective<br>      • All module codes are present and correct<br>      • All module codes are prioritized correctly<br>   b)  System analyst perspective<br>      • All the module codes are correctly implemented<br>      • Each defined module implements a single function<br>   c)  Designer perspective<br>      • Module codes cover all the designs<br>      • All external interfaces are specified<br>      • Code constraints are realistic<br>      • The module codes support reuse<br>      • Module coded are consistent with system performance<br>   d)  Coder perspective<br>      • Module codes are consistent with all designs<br>      • Module codes match with test specifications<br>   e)  System Tester perspective<br>      • All module codes are testable<br>      • All module have validation/acceptance criteria<br>      • The explanations for each module codes are sufficient and correct<br>   f)  Maintainer perspective<br>      • The module codes allow for changes in the area most likely |

|     |                                                                                                                                |
| --- | ------------------------------------------------------------------------------------------------------------------------------ |
|     | to change                                                                                                                      |
|     | • The module codes support reuse                                                                                               |
|     | g) Quality perspective                                                                                                         |
|     |    • The module codes meet all specifications and development standards                                         |
|     |    • The module codes are traceable                                                                             |
|     |    • All module have validation/acceptance criteria                                                             |
|     | h) Database Administration perspective                                                                                         |
|     |    • The module codes for data security have been defined                                                       |
|     |    • The module codes support efficiency and performance and capacity                                           |
|     |    • The module codes are consistent with overall system design and architecture                               |
|     | i) Documentation perspective                                                                                                   |
|     |    • All documentation for implementation has been identified                                                   |
| 2.  | **Define Code Standards**                                                                                                      |
|     | Define code standards to endure consistency and integrity of terms used. This will avoid confusion and ensure ease of debugging and system maintenance. The code standards include standards naming conventions and code writing standards. |
|     | **2.3  Define Standard Naming Conversion**                                                                                     |
|     | Standard naming conventions should consider file, module, program, function, procedure, subroutine, data field, table and variable names. |
|     | **2.4  Define Code Writing Standards**                                                                                         |
|     | Code writing standards should consider consistent code indentation (e.g. conditional statements), appropriate locations of comments, etc. |

**3.  Write Module Codes**

This involves the writing of source codes. In order to ease debugging and future expansions and enhancements, the technique of modular programming is usually adopted. The codes that are written in module structures are easy to debug and maintain. Hence, it saves time in writing and debugging.

**3.1  Identity Module Code Priority**

Before writing of source codes, it is necessary to identify the priority of all the modules to be coded. This enables the coding and testing processes to be constructed according to the right sequence.

**3.2  Write Code to Perform One Function Per Module**

A module that is coded to perform one function is easy to trace and debug. It is also easy to maintain and define the interfaces between module calls.

**3.3  Inserting and Explaining Comments**

It is important for a programmer to insert comments at the appropriate locations and correctly explained. This allows other programmers to understand his codes and able to maintain the source codes without the assistance from the original code writer.

**3.4  Define Initialization**

All variables and parameters must be initialized before they are assigned any value. This is to avoid incorrect input or values to be stored in the variables or parameters, which would result in incorrect output results or calculation errors during program execution. Usually the variables and parameters are initialized at the following locations:

- Program initiation
- Start of every loop
- Function/procedure entry

### 3.5  Define Loop Entry and Exit

Ensures that each loop only has one entry and one exit. Also, all loop entry and exit conditions must be defined prior to the execution of any source codes. The loop entry can be zero, at least one, or a specific number of times depending on the entry conditions. Similarly, the exit conditions determine if the loop has executed a specific number of times or to terminate prematurely depending on the exit conditions. This is to ensure the correct number of execution/iteration of the program statements within the loop. The entry and exit conditions are also the test cases in which a tester must consider during program testing.

### 3.6  Each Loop Executes the Correct Number of Times

For each loop entry, the coder must ensure that it has executed the correct number of times by checking the loop exit conditions. A loop that did not execute the correct number of times usually produces incorrect results or logic error.

### 3.7  Define Cleanup for Loop that Exited Prematurely

If a loop is exited prematurely, the values of parameters or variables as well as the logic flow must be considered so that the program would not produce logic or run time error.

### 3.8  Define Strings Type Manipulations

When strings type is used in the program, the coder must ensure that strings are:

- Identified by pointers
- Terminated in null

### 3.9 Define Pointer Type Manipulations

When pointer type is used in the program, the coder must ensure that pointer is:

- Initialized to null
- Deleted after the procedure new
- Deleted after use (for new pointers)
- Terminated in null

### 3.10 Define Interfaces Between Module Calls

All interfaces between module calls must be defined correctly according to the type of passing. This is to avoid type mismatch in the passing of parameters between functions or procedures calls.

### 3.11 Define Files Used by the Module Codes

Files are often used as input, output or main data storage during the execution of a program. There are various types of files such data files, temporary files which are deleted after use and output files which are used to store results of executions or reports. Irrespective of the type of files, they must be property declared, opened before use and closed when they are no longer needed.

### 4. Identify Code Syntax

Syntax errors are not uncommon in program. This type of error is usually caused by typing mistake or the coder is not aware of the correct syntax. Such errors are detected easily during compilation and many of these errors can be avoided if the coder checks his codes properly to ensure that:

- Include files are complete
- Function call formats are correct
- Pointers are correct
- Parameters are correct
- Use of '&' is correct

| 5. | **Identify Code Logic** |
|---|---|
| | Coders always encounter logic errors in their programs. Such errors are not easily detected by the compiler during compilation and many of these errors can be avoided if the coder checks his codes properly to ensure that: |
| | • Each module codes perform correct functions |
| | • All calculations are correct |
| | • All illegal data entries are captured |
| | • Mismatched types are checked |
| | • Output format is correct (e.g. line stepping and spacing are proper) |

Brackets such as ( ) and { } pairs are correctly used and matched
No misspelling (e.g. misspell Mach for March) is present

## 5.2.3 Coding Approach

In ELIS, top-down design of systems as well as the modular approach to programming (coding) is defined.

### 5.2.3.1 Top-Down Approach

It is easy to visualize what the top-down approach refers to: it means looking at the large picture of the system and then exploding it into smaller parts or subsystems. This approach allows the higher-level modules to be coded first before the lower level modules. This approach will ensure that the most important modules will be developed and tested first. It also gives a preliminary version of the system sooner.

### 5.2.3.2 Modular Development

Once the top-down design approach is taken, the modular approach is programming. This approach is involves breaking the programming into logical, manageable portions, or modules. This kind of programming work well with top-down design because it emphasizes the interfaces between modules and does not

neglect them until later in systems development. Ideally, each individual modules should be functionally cohesive, so that it is charged with accomplishing only one function.

Modular program design has three main advantages. First, modules are easier to write and debug because they are virtually self-contained. Tracing an error in a module is lee complicated, since a problem in one module should not cause problems in others.

A second advantage of modular design is that modules are easier to maintain. Modifications usually will be limited to a few modules and will not spread over an entire program.

A third advantage of modular design is that modules are easier to grasp, since they are self-contained subsystems. This means that a reader can pick up a code listing of a module and understand its function.

Some guidelines for modular programming include:

a)  Keep each module to a manageable size (ideally including only one function).
b)  Pay particular attention to the critical interfaces (the data and control variables that are passed to other modules).
c)  Minimize the number of modules the user must modify when making changes.
d)  Maintain the hierarchical relationships set up in the top-down phases.

### 5.2.4  Coding Style

Documentations are an important attribute to determine the maintainability and readability of the program codes. Internal documentation is descriptive material written directly within the code; all other documentation is external documentation.

The coding style adopted in ELIS is:

i.   Header comment block

ii.  Use meaningful variable names and statement labels

iii. Write description or comments in the sources codes

iv.  Formatting and arranging the codes to enhance understanding

## 5.2.5   Scripting Language (PowerScript)

PowerBuilder 5 offers an icon-driven system for SQL database application generation, within a program-building format. Its PowerBar provide numerous tools building query forms and generating report. Event-driven applications respond to events. Such events can be actions that the user takes with the mouse or keyboard (user interface events) that may not follow a predefined, logical sequence, or events initiated within the application itself.

PowerBuilder coding involves writing scripts for event. For example, if a toolbar button is clicked, certain PowerScript code in an event is executed. If a window loses focus (a new window pop-up), other PowerScript in another event may be executed. Event-driven programming gives the programmer more control over the application flow. Event programming is one of PowerBuilder's many strengths

## Summary

On completion of the design stages, the database and application have to implement through coding. So, the coding approach, style and scripting language are the essential element in system coding. ELIS is using the hybrid of Bottom-up and Top-Down approach. Coding style includes the comments at the appropriate locations and correctly explained. PowerBuilder5 is a scripting language with object-oriented feature. So, the use of readily available software languages likes PowerBuilder to develop this system is an appropriate choice.

# Chapter 6    Testing

## 6.1    Introduction

After the coding phase has been completed, a software system is put through the testing phase before it can be released to the customer. Various test methods have been developed to detect any defects or errors that may arise to compromise the use of the completed system. Thus, software testing embraces a wide range of activities that not only support the assessment of quality but also help to achieve and preserve software quality.

## 6.2    Testing Objectives

In an excellent book on software testing, Glen Myers [MTE79] states a number of rules that can be serve well as testing objectives:

a)  Testing is a process of executing a program with the intent of finding an error.

b)  A good test case is one that has a high probability of finding an as-yet-undiscovered error.

c)  A successful test is one that uncovers an as-yet-undiscovered error.

## 6.3    Testing Principles

Before applying methods to design effective test cases, a system developer must understand the basic principles that guide system testing. There is a set of testing principles that have been adapted for use in ELIS:

a)  *All tests should be traceable to user requirements*

   As we have seen, the objective of software testing is to uncover errors. It follows that the most severe defects (from the user's point of view) are those that cause the program to fail to meet its requirements.

*b)  Tests should be planned long before testing begins*

Test planning can begins as soon as the requirements model is complete. Detailed definition of test cases can begin as soon as the design model has been solidified. Therefore, all tests can be planned and designed before any code has been designed.

*c)  Testing should begin "in the small" and progress toward testing "in the large"*

The first tests planned and executed generally focus on individual components. As testing progresses, focus shifts in an attempt to find errors in integrated clustered of components and ultimately in the entire system.

*d)  Exhaustive testing is not possible*

The number of path permutations for even a moderately sized program is exceptionally large. For this reason, it is impossible to execute every combination of paths during testing. It is possible, however, to adequately cover program logic and to ensure that all conditions in the component-level design have been exercised.

## 6.4  Testing Techniques

Testing is applied at different levels of software development in the life cycle, but the testing id done is different in nature and has different objectives at each level. The focus of all of development testing is to find errors, but different types of error are looked for at each level. The levels of testing in software development encompass unit, component integration testing, system testing and acceptance testing.

### 6.4.1  Unit Testing (Module Testing)

The purpose of unit testing is to find errors in the individual units, in either data or logic. This is where the most detailed investigation of the internal workings of the individual unit is carried out. Unit testing is often performed by the programmer who wrote the code, although this is not necessarily the most effective alternative. Tests can be derived from the detailed logic of the unit (the detailed design specification), with any additional structural tests derived from the physical design.

Some of the unit testing aspects taken into account is as follow:

a)  *Module interface*

Purpose is to ensure that information properly flows into and out if the program unit under test.

b)  *Local data structure*

Purpose is to ensure that data stored temporarily maintains its integrity during all steps in an algorithm's execution.

c)  *Boundary condition*

Purpose is to ensure that the module operates properly at boundaries established to limit or restrict processing.

d)  *Independent paths through the control structure*

Purpose is to ensure that all statements in a module have been executed at least once.

e)  *Error-handling paths*

Purpose is to ensure that error-handling routines can handle expected and unexpected errors.

### 6.4.2  Component Integration Testing

Component integration testing is the testing done to show the existence of integration bugs, i.e. the existence of inconsistencies between the sub-modules or sub-elements. This test is focused on the direct and indirect interfaces and the

consistency of the sub-modules/sub-elements to one another. Test cases are specially selected to test these interfaces. The integrated module/element is tested as an element from the point of view of structure and function, with test appropriate to that level. The process is iterated until the entire system has been tested and integrated. The test cases should consider:

a) Read/write access to the file, file creation

b) The system/program does not corrupt another system/program even though it does not fail itself

The common interface errors encountered are:

a) The parameter may not be in the correct order

b) The parameter may not be of the right data types, formats, or input-output modes

c) The parameter rules (e.g. call by value or call by reference) may not be obeyed

d) The domain of the actual and formal parameters do not match

There are a number of integration strategies. These strategies include:

a) *Bottom-Up Testing*

In bottom-up testing, the program is merged and tested from the bottom to the top of the call graph. All the terminal modules are unit tested in isolation, where a terminal module is a module that does not call another module. The next higher-level modules are then tested, one at a time, with these tested modules.

b) *Top-Down Testing*

Top-down testing starts with the top module in the call graph and add one module at a time to the set of merged modules. The top module is only one that is unit tested in isolation. There are two possible strategies in selecting the next module to be merged. The first strategy requires that the next module must have all its calling modules integrated. The second strategy relaxes the previous

requirement by selecting any module that has at least one of its calling modules tested previously. The first strategy is called strict top-down and the second, non-strict top-down testing.

c)  *Modified Top-Down Testing*

One problem with top-down testing is that it may be impossible to test certain logical conditions within the merged program such as error checks conducted in individual modules. This may prevent thorough testing of certain modules. The modified top-down testing is designed to overcome this problem. This strategy is similar to the top-down testing strategy except that is requires every module to be tested in isolation before it is integrated into the program. As in the case of top-down testing, there is strict and non-strict modified top-down testing, depending on the conditions for selecting the next module to be merged.

There is no one "best" test technique; rather the best testing makes use of as many technique as are relevant and useful. In other words, identify what are the test techniques that are most suitable and important for the testing process. The test techniques that are generally applicable for the various software include functional test (or black box testing) and structural test (or white box testing).

The test techniques applied should ensure that all requirements have been implemented correctly, appropriate levels of security have been implemented, maximum storage size has been tested, etc.

d)  *Sandwich Testing*

This strategy combines both the top-down and bottom-up testing. Top-down and bottom-up testing are applied simultaneously and the program is integrated from the both the top-and the bottom of the call graph. Eventually the integration meets somewhere in the middle of the call graph.

### e)  Modified Sandwich Testing

This strategy is a modified version of sandwich testing. All modules are unit tested before applying the sandwich testing strategy. This extra step overcomes the problem described earlier with top-down testing.

### f)  Big-Bang Testing

In big-bang testing, each module is first unit tested in isolation. All the modules are then merged together at once and tested.

## 6.4.3  System Testing

In system testing, the functional specification or requirements specifications is used to derive the test case selection at this level. System testing looks for errors in the end-to-end functionality of the system, and also for errors in nonfunctional quality attributes, such as performance, reliability, volume, stress tolerance, usability, maintainability, security, etc. in other words, a system test is a series of different tests designed to fully exercise the system to uncover its limitations and measure its capabilities. The objective is to test an integrated system and verify that it meets specified requirements. System testing can be carried out by independent testers.

## 6.4.4  Acceptance Testing

Acceptance testing marks the transition from ownership by the developers to ownership by the users. The purpose of acceptance testing is to give confidence that the system is working, rather than trying to find errors. Acceptance testing also includes the testing of the user organization's working practices, to ensure that the computer system will fit with clerical and administrative procedures. The acceptance test gives confidence to the users that the user is ready for operational use.

## Summary

In developing a large system like ELIS, testing usually involves several techniques such as unit testing (module testing), integration testing and system testing. ELIS is tested so the specification and performance requirements can be satisfied.

# Chapter 7   System Evaluation

## 7.1     Introduction

Throughout the systems development life cycle, the analyst, management and users have been evaluating the evolving information systems and networks in order to give feedback for their eventual improvement. Evaluation is also called for the following system implementation. [Kendall & Kendall, 1999]

## 7.2     Problem Encountered and Solution

Throughout the process of developing ELIS, some problems have been faced. The main problems and their solutions are listed below.

### 7.2.1   Lack of Ideas in Building the Search Engine (OPAC)

The criteria of searching are unsure because the search engine used in secondary school is different from the search engine used in university.

### Solution:

Valuable guidance, information and ideas obtained through discussion with the thesis supervisor, Pn. Abrizah, who is a very experienced librarian herself.

## 7.3     System Strengths

### 7.3.1   User Friendly Interface

ELIS is designed to have Graphical User Interface (GUIs) feature on the principal for ease to use. GUIs allow direct manipulation of the graphical representation on the screen, which can be accomplished with keyboard, or a mouse. The key to GUI is the constant feedback on task accomplishment that it provides. Continuous feedback on the manipulated object means that changes or reversals in operations can be made quickly, without incurring error manages. Users can easily understand

and captured the overview of the system, and hence, minimize the errors or irregularities made by the user and minimize the effort to train new user before he/she using the ELIS.

### 7.3.2    Security Features

ELIS users can be categorized into 3 types: System Administrator, Librarian and Student. Only System Administrator can access to the administration menu, which is allowed to create or edit other user's ID. Besides, Librarian can access to the appropriate menu where some function that are restricted will be hidden. By incorporating these security features into ELIS, the possibility of an unauthorized access will be greatly reduced.

### 7.3.3    Library Calendar

ELIS is a system that will not impose fines on days when the library is closed (Saturday, Sunday or school public holidays). This system attempts to do that by keeping a master calendar of events that the user can edit, edit or delete the dates when library is closed.

### 7.3.4    Context-sensitive Help

The Online context-sensitive help is provided in the ELIS. To invoke help, a user just needs to press the **F1** function key. This Online help makes ELIS easier to use for inexperience users.

### 7.4    System Limitation

Due to the time constraint, some of the system features could not be implemented. At the moment, the system has a number of limitations as outlined below:

### 7.4.1   Inability to Support Bar Code Scanner

The input devices used in ELIS are still the keyboard and mouse. Inputting data using the keyboard is much slower than using a bar code scanner and it also presents possible typing errors.

### 7.4.2   Required Large Storage for Database

The storage for database (Sybase SQL database) in PowerBuilder5 is far larger comparing to the storage of database that using Microsoft Access. Besides, the speed and time of retrieving the data from the database in PowerBuilder5 is far faster than the speed and time of retrieving data from the Microsoft Access database. But, as the amount of data for a library is growing now and then, so a larger storage for database is needed to support the system.

## 7.5   Future Enhancements

Although ELIS would able to run smoothly for the time being, but there are still much room for improvement on it. The possible future enhancement are listed below:

### 7.5.1   Support Bar Code Scanner

With the use of scanners, error rates due to typing error will be eliminated. Thus, the efficiency of service will be increased. The time taken for service also decreased.

### 7.5.2   Dual Lingual Support

Normally, the user has to translate the Mandarin's item into English in search string. Numbers of irrelevant items may increase due to the inaccurate searching string. So, if the system has the dual lingual (which is English and Mandarin) support, the user would be able to search for an item more accurately by using directly the Mandarin name.

### 7.5.3    Provide Interactive Help (in demo or video form)

If ELIS can provide a demo package or a short tutorial session, it definitely help the users to learn up the system in a shorter time period, especially for those who are inexperienced.

### 7.5.4    Convert the Shelf list to MARC Format

A MARC record is a MAchine-Readable Cataloging record. "Machine-readable" means that one particular type of machine, a computer, can read and interpret the data in the cataloging record. "Cataloging record" means a bibliographic record, or the information traditionally shown on a catalog card. The record includes (not necessarily in this order):

- a description of the item
- main entry and added entries
- subject headings, and
- the classification or call number. (MARC records often contain much additional information.)

With MARC, existing database is converted to a machine-readable format, which would be distributed or used by other libraries. By incorporating MARC format into ELIS, the importing or exporting of items with other libraries will be possible.

### 7.6    Knowledge and Experience Gained

Through this thesis, there is an opportunity to learn and gain a lot of knowledge related to IT. System development life cycle also can be experienced throughout ELIS. Besides, proper solutions or suggestions to the problems encountered are managed to propose with supervisor. Besides, positive attitude can be process through ELIS project.

### 7.6.1   Knowledge In IT

### 7.6.1.1 PowerBuilder5

The ELIS was developed using PowerBuilder 5.0. Object-Oriented concepts can be understand deeply through the using of PowerBuilder which is an object-oriented environment. Besides, event programming is an important aspect of developing applications with graphical user interface.

### 7.6.1.2 Sybase SQL Anywhere 5.0

ELIS uses Sybase SQL Anywhere 5.0 as the database tool. One nice thing about PowerBuilder is its database independence. By using the columns defined by user, the user can use any database the user want to implement (or usually with little effort) switch between them. Sybase SQL Anywhere 5.0 also can provide larger space and the time taken for retrieving the data from database is much faster than Microsoft Access.

### 7.6.1.3 ForeHelp 5

ForeHelp 5 is used to build the Help File in ELIS. ForeHelp is a flexible tool, providing easy ways to implement all of the features, simple or advanced, supported by the chosen Help format. ForeHelp includes a full-featured word processor for typing, editing, and formatting text and for inserting pictures or multimedia files.

### 7.6.2   Experiences

### 7.6.2.1 Opportunity to Express Self

With the opportunity to express myself, more new ideas and strategies were generated to tackle problems faced in developing the thesis. There was encouragement to think and speak up and this improved the understanding with the supervisor.

**Summary**

After implementation, ELIS and the approach taken should be evaluated. Problems that encountered were analyzed and the appropriate solutions were taken carefully. ELIS strengths fulfill the user' requirements and increase the effectiveness and efficiency of the library service. Although there are some constraints or limitation in ELIS, but there can be the future enhancement. Knowledge and experience gained through this project also being evaluated.

## 7.7    Conclusion

By doing this project, a lot of knowledge and experience have been gained. Besides, there was an opportunity to work independently as a programmer and apply the knowledge and skills in the real system development life cycle. By handling this big project, there is also an opportunity to learn to be more systematic in term of management and organization of work force.

This project has been so satisfied because the knowledge and theories gathered throughout the courses has been applied in real world, especially the whole system development life cycle.

At the completion of the system, ELIS can be said to have achieved its objectives as well as the functional and non-functional requirements as planned at the start of this project. Due to the time constraint, it is unable to apply the usage of bar code scanner. But, it will serve well as a computer-based library system for any secondary school. And sure, ELIS will become more powerful as new enhancements and features can be added in the near future.

# Table Of Contents

# Table Of Contents

# Introduction

ELIS is the short form for Electronic Library Information System. This is a system that incorporates many functions of a secondary library. ELIS comprises several module components such as acquisition module, cataloging module, circulation module, edit module, report module, bulletin & feedback module and maintenance module. New modules can be added to the system as time goes.

ELIS is designed to help its users to better perform their responsibilities, to enhance the library service and coordination between functions and also provide information to help users in the library operations and decision-making.

However it is you, the user who is going to really bring the system to life. The system is created to serve you. But in order for the system to serve you well, accurate and timely, input of data to ELIS is vital.

Having said all that, I wish you a good time using the system. Thank you.

# About User Manual

Before you install this system, please make sure that your computer is equipped with the following hardware and software requirements stated below. Before you can use this system, you also must first run the ELIS setup program. The setup program with install all the files needed from the installation disks to your hard disk.

## Hardware Requirement

- IBM compatible PC with an 80486 processor or higher
- At least 10 MB of hard disk space during
- At least 4 MB of RAM (Random Access Memory)
- A VGA or other compatible monitor display (with 800 x 600 display)
- 3 $\frac{1}{2}$ " floppy disk drive as drive A
- Keyboard and mouse as input device
- A dot matrix printer

## Software Requirements

- Microsoft Windows version 3.1 or higher (preferable Windows 95)

**Installing ELIS**

To stall ELIS from Windows, follow these steps:

a) Insert the **ELIS Setup disk 1** in drive A.

b) In the **Program Manager**, select **Run** from the **File** menu.

c) At the command prompt, type **A:\Setup** and press **<Enter>**. (If the disk is in drive b:, substitute b: for a).

d) Follow the instructions on the screen.

e) Please make sure that you don't change the default installation directory that is **C:\ELIS**.

After the installation is completed, setup will create a new program group called **ELIS** and a new program icon called **ELIS**. To start ELIS, simply click on the program item after which the startup menu will appear. The startup menu will be cover on the next chapter.

# CHAPTER 1    Getting Started

This chapter presents an overview of the ELIS (Electronic Library Information System) Environment and guide you step-by-step where and how to start the ELIS.

## 1.1    Login



**Figure 1.1    Initial login window for ELIS**
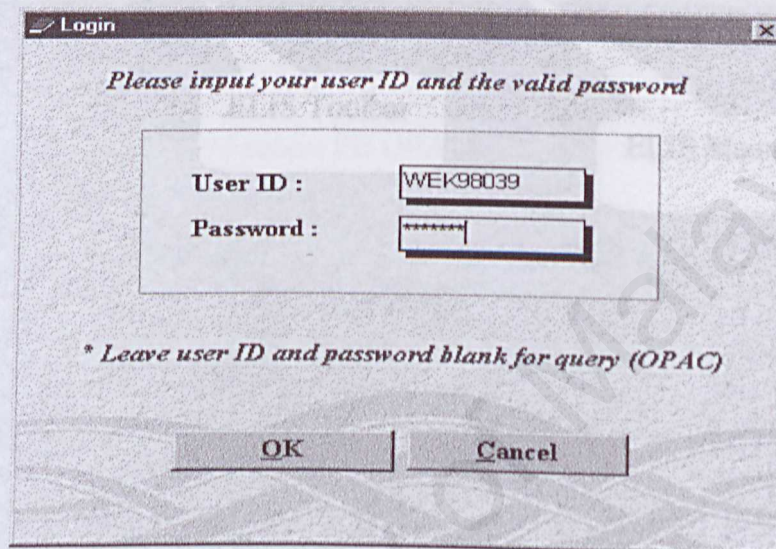
**Step by step:**

1.  Type in your user id and password in order to access the ELIS, then press **OK** button.

2.  Leave the user id and password blank for query (OPAC), then press **OK** button.

3.  If you forgot your password, please inform your System Administrator.

4.  Click **CANCEL** button to abort the system.

## 1.2     ELIS Menubar and ELIS Toolbar

On a successful login, the initial ELIS window will be shown. You can click on the ELIS Menu Bar icons to launch some options, each of which serves for different purposes.
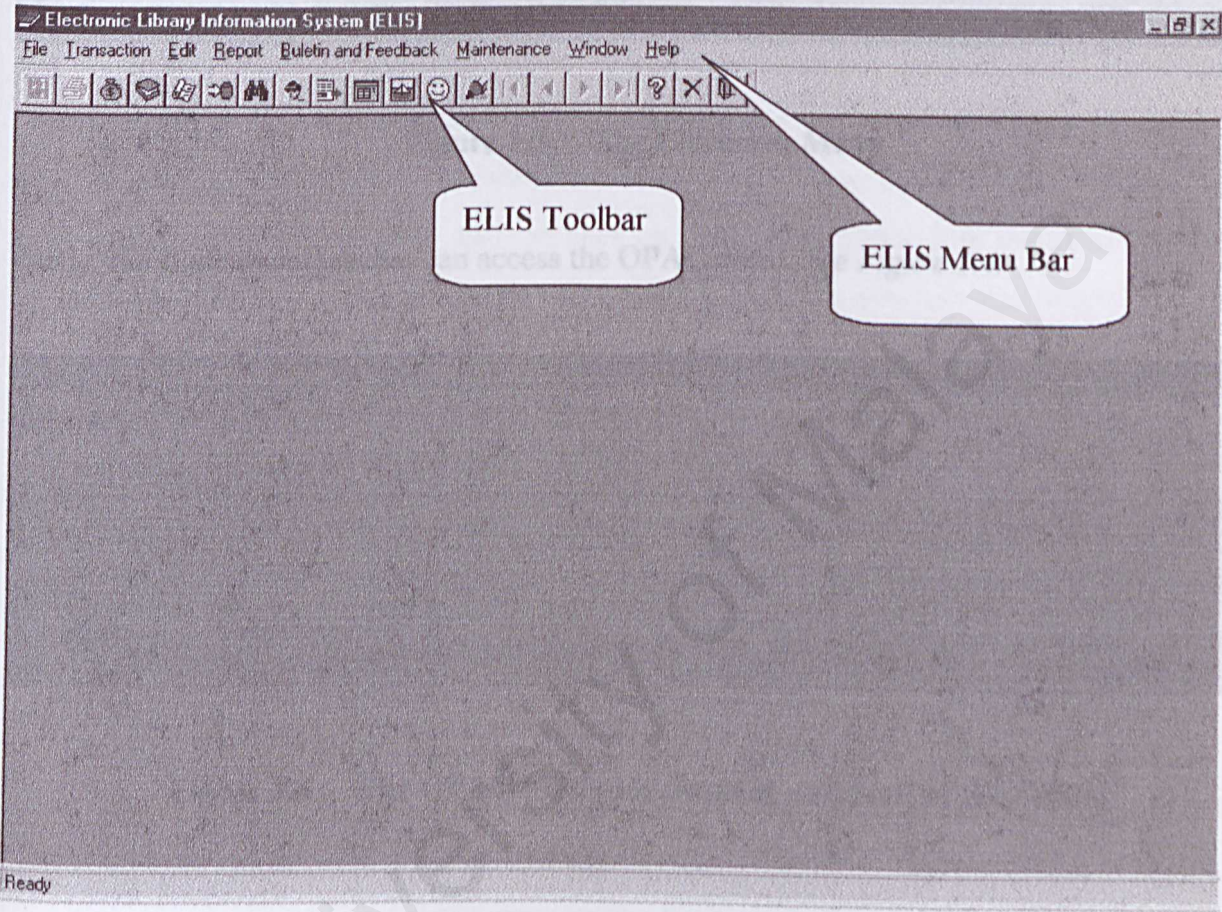


**Figure 1.2     The System Administrator Menu**

The System Administrator will access the window as above while the librarian will access the window as shown at the next page.
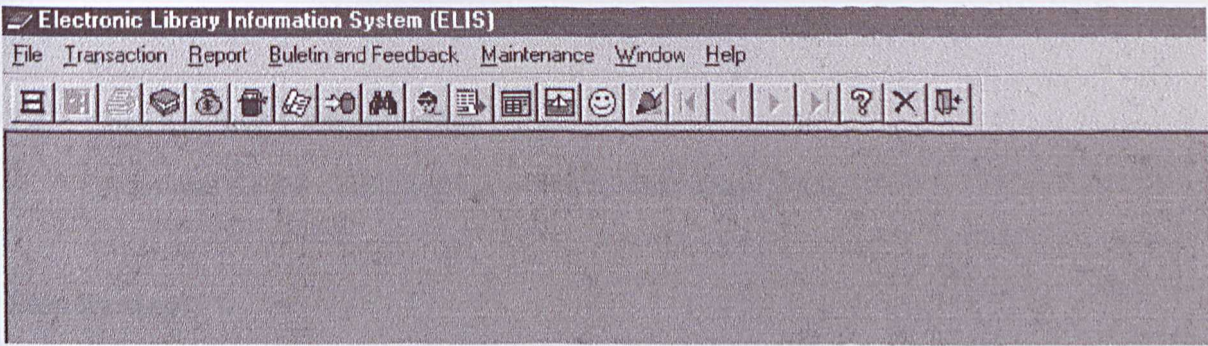
**Figure 1.3    The Librarian Menu**

Lastly, the student and teacher can access the OPAC menu. *See Figure 1.4.*
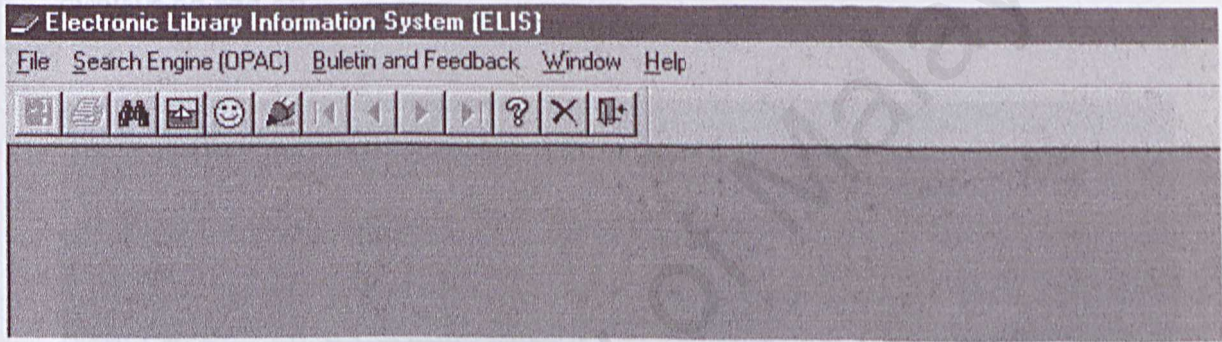


**Figure 1.4    The OPAC Menu for Student and Staff of the School**

## 1.3    Set Toolbar Configuration

You can set the configuration of the toolbar if you want.

**Step by step:**

a) To control the display toolbar, please select the **Window | Toolbar** menu option as shown in *figure 1.5*. This will open the Toolbars dialog box as shown in *figure 1.6*.

b) You can set the toolbar's position by clicking the **Top, Left, Right, Bottom** or **Floating** radio buttons. You also can click on the **Hide** button to hide the ELIS Toolbar or show the toolbar by clicking the **Show** button. Besides, you can also toggle the text displays on and off.
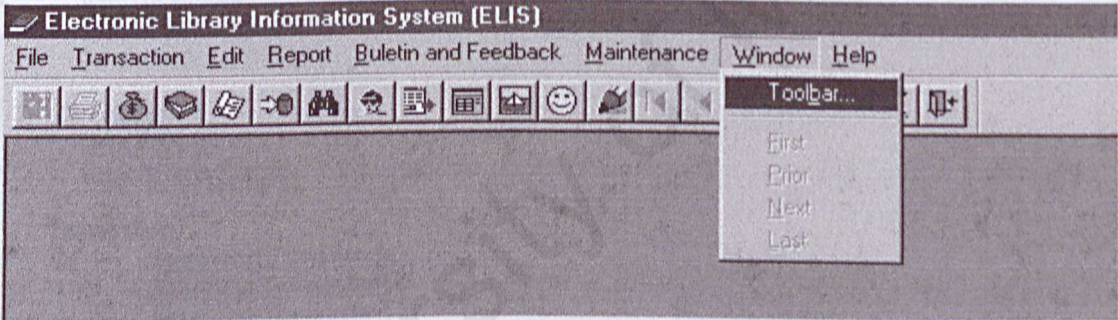


**Figure 1.5    The Window | Toolbar menu option**
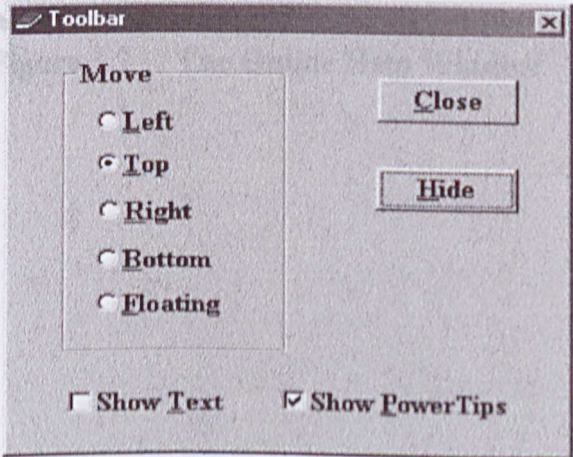
**Figure 1.6**     **The Toolbar Window**

## 1.4     Online Help

The help system in ELIS can access in two ways. One, you can select **Help |**

**Online Help**. Two, you can simply press **F1** to open the table of contents shown in

*figure 1.7.*
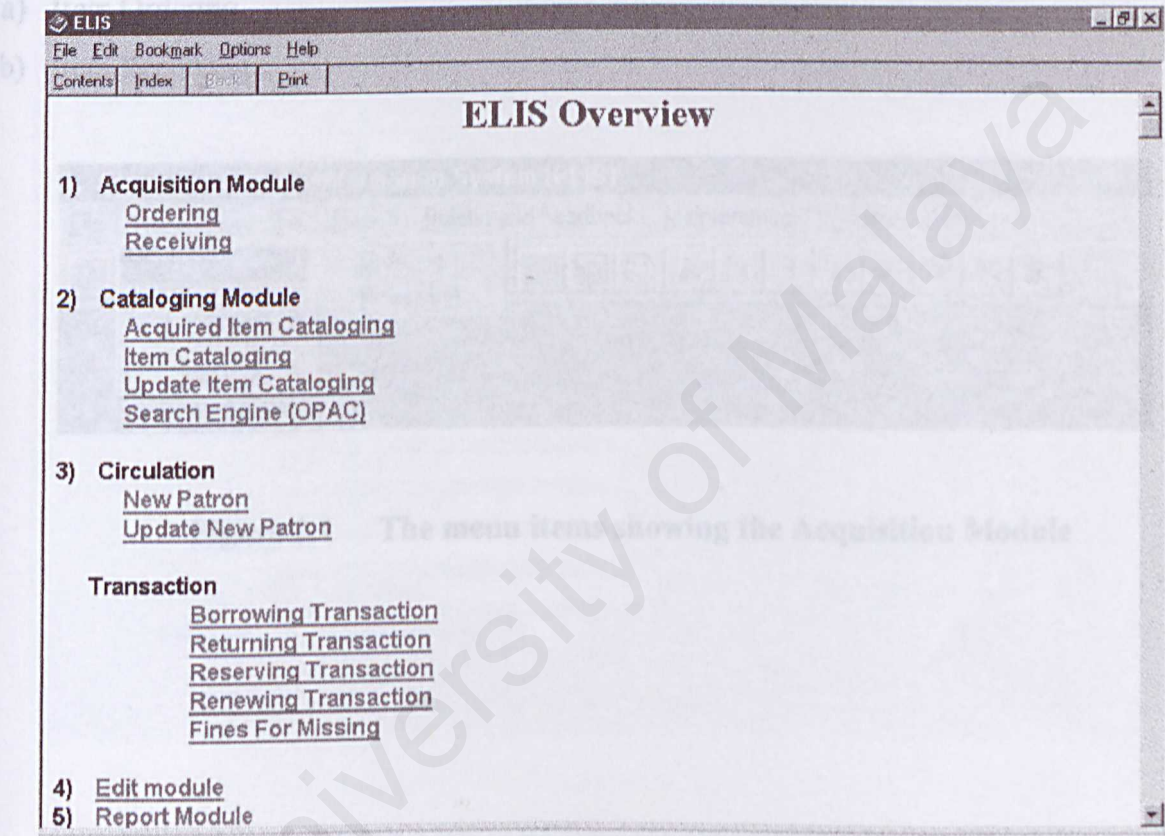


**Figure 1.7**     **The Online Help Window**

# CHAPTER 2    Acquisition Module

This part contains the important function of ELIS because it handles the item ordering and item receiving of a secondary library.

The following sub-modules are present:

a)  Item Ordering

b)  Item Receiving
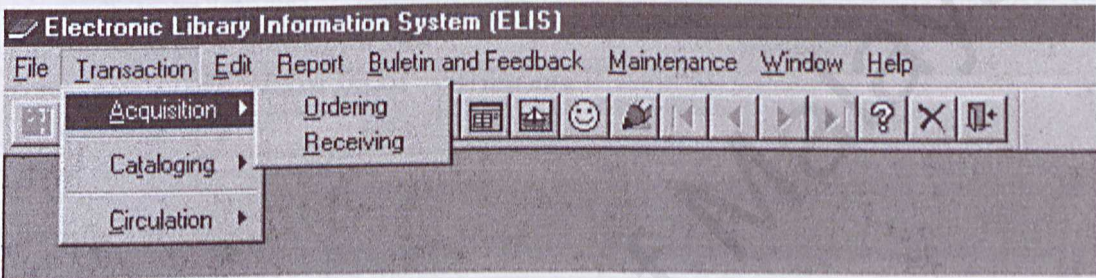


**Figure 2.1    The menu items showing the Acquisition Module**

## 2.1    Item Ordering

Access  :    System Administrator

Menu   :    Transaction | Acquisition | Ordering



**Figure 2.2    The Item Ordering Sub-Module**

**Step by step:**

a)      Key in your user id, then press the tab key or press enter key.

b)      Scroll and click the vendor list box. Then, the information of vendor will be retrieved automatically. If there is a new vendor, message box as below will be prompted. Click **Yes** button if you want to create this vendor. Then, key in the appropriate information of vendor.

New Vendor : Adding Confirmation

? CHEAH SOOI PING ADVANCED COMPUTER SHOP is a new vendor.
Are you sure you want to add this new vendor ?

Yes     No
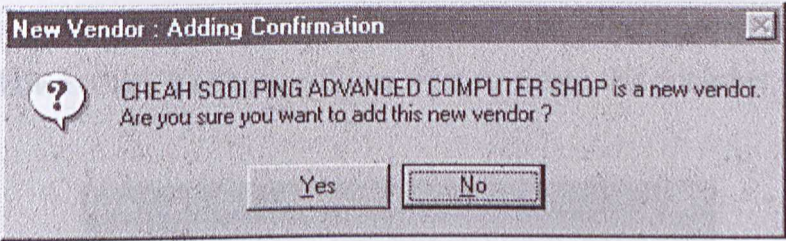
c)     Key in the first item's title.

d)     Key in the author(s) or scroll and click the author list box for the existing author.

| Author On the Item | Format Author In ELIS |
|---|---|
| Wayne M. Becker | Becker, Wayne M. |
| Charles Kittel | Kittel, Charles |
| Azhar Haji Huusin | Azhar Haji Hussin |
| Ong Kok Seng | Ong, Kok Seng |
| Susan Lim Lee Hong | Lim, Susan Lee Hong |
| Subramaniam a/l Mottain | Subramaniam Mottain |
| Dharam Singh Dhillon | Dhillon, Dharam Singh |
| Prof. Dato'Dr. Osman Bakar | Osman Bakar |

If the author is a new author in the database, message box as below will be shown.

Click **Yes** button if you want to create this author.

New Author : Adding Confirmation

? STEVENS, DAVE. L is a new author.
Are you sure you want to add this new author ?

Yes     No
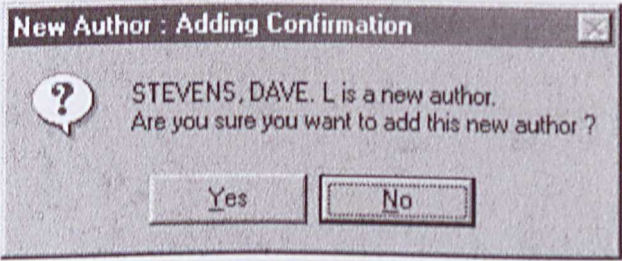
e)     Key in the publisher or scroll and click the publisher list box for the existing
       publisher. If the publisher is a new publisher in the database, message box as below
       will be shown. Click **Yes** button if you want to create this publisher.

**New Publisher : Adding Confirmation**

? DEITEL & DEITEL is a new publisher.
  Are you sure you want to add this new publisher ?

[ Yes ]          [ No ]
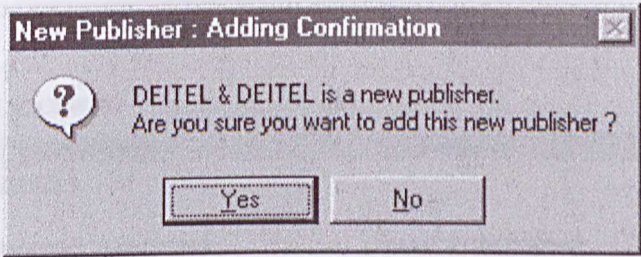
f)     Key in the relevant information of the first item

g)     When you are finished, click the **OK** button. If you want to order another item in
       the same order number (PONo), click **Yes** button.

**Ordering Info : Order Another Item**

? Do you want to order another item ?

[ Yes ]          [ No ]
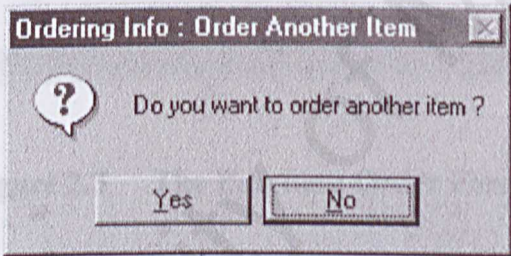
h)     Repeat (c) until (g) for the following items. If you click the **No** button, the Purchase
       Order will be shown in *figure 2.3*. You can print the PO by clicking the print icon.

**Figure 2.3**   **The Purchase Order Form**

i)     At ant time, you can click the **Cancel** button to abort the transaction.

Figure 2.4     The Malaysia Currency is used to Record the Unit Price for Item

Step by step:

a) Key in your user id, then press the tab key. If your user id is incorrect, the system will prompt you a message that you are not an authorized user. So, you are not allowed to do the transaction.

b) Scroll and click the OrderNo (active) that you have received the acquired items. Then, key in the relevant information.

c) Choose the currency that you want to record the unit price for the items.

## 2.2     Item Receiving

Access  :   System Administrator

Menu   :   Transaction | Acquisition | Receiving
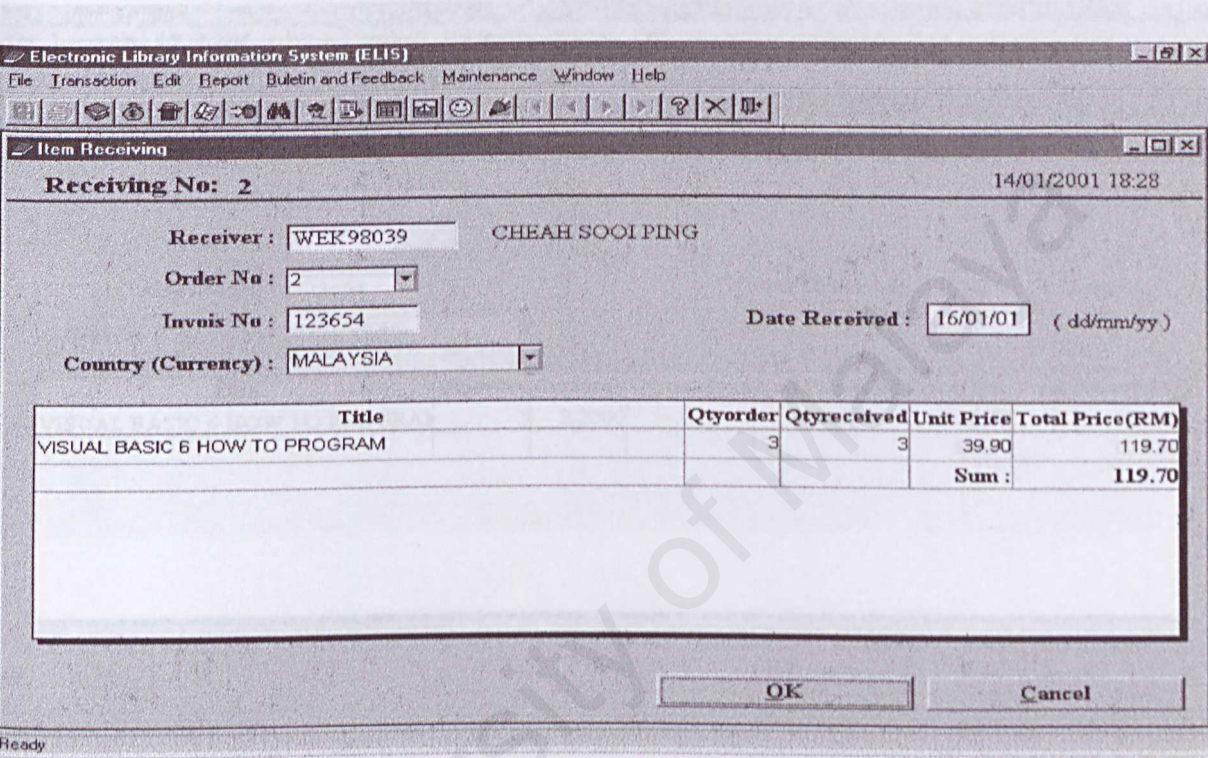


**Figure 2.4    The Malaysia Currency is used to Record the Unit Price for Item**

**Step by step**:

a) Key in your user id, then press the tab key. If your user id is incorrect, the system will prompt you a message that you are not an authorized user. So, you are not allowed to do the transaction.

b) Scroll and click the OrderNo (active) that you have received the acquired items. Then, key in the relevant information.

c) Choose the currency that you want to record the unit price for the items.

d)  If the quantity received is more than the quantity order, a message will be prompted to
    alert the user. So, you can change it.

e)  Click **OK** button to save the data to the database.

f)  Click **Cancel** button to cancel the operation.



**Figure 2.5    The Singapore Currency is used to Record the Unit Price for Item**

# CHAPTER 3    Cataloging Module

The following sub-modules are present:

a)  Acquired Item Cataloging

b)  Item Cataloging

c)  Update Item Cataloging

d)  Search Engine (OPAC)
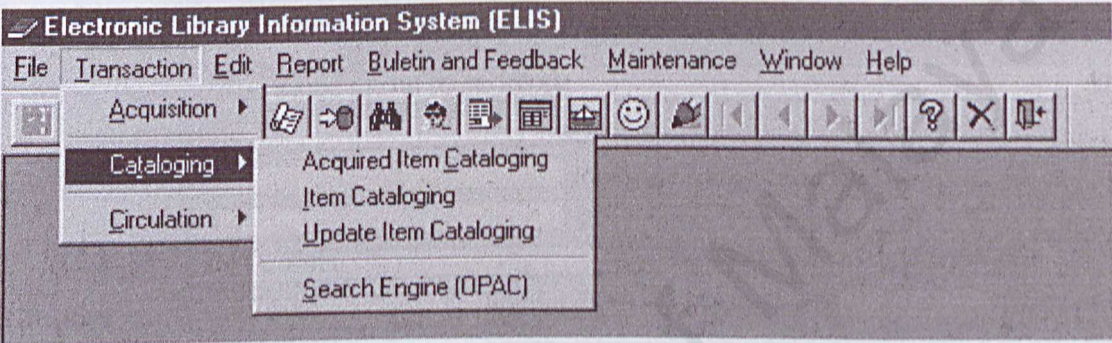


**Figure 3.1    The menu items showing the Cataloging Module**

## 3.1    Acquired Item Cataloging

Access   :   System Administrator, Librarians

Menu    :   Transaction | Cataloging | Acquired Item Cataloging



**Figure 3.2    The Acquired Item Cataloging Window**

**Step by step:**

a)  Please key in the ItemNo (must be unique), which the system will automatically varify the validity of the ItemNo. If the ItemNo is already existed, then the system will prompt a message box to alert the user.

b)  Key in the acquired item's title. If the title is valid, then the information of this item will be retrieved automatically.

c) Then, what you just have to do is key in all the information that required.

d) Click **OK** button to save the record.

e) At any point, you can click **CANCEL** to abort the operation.

Menu : Transaction | Cataloging | Item Cataloging
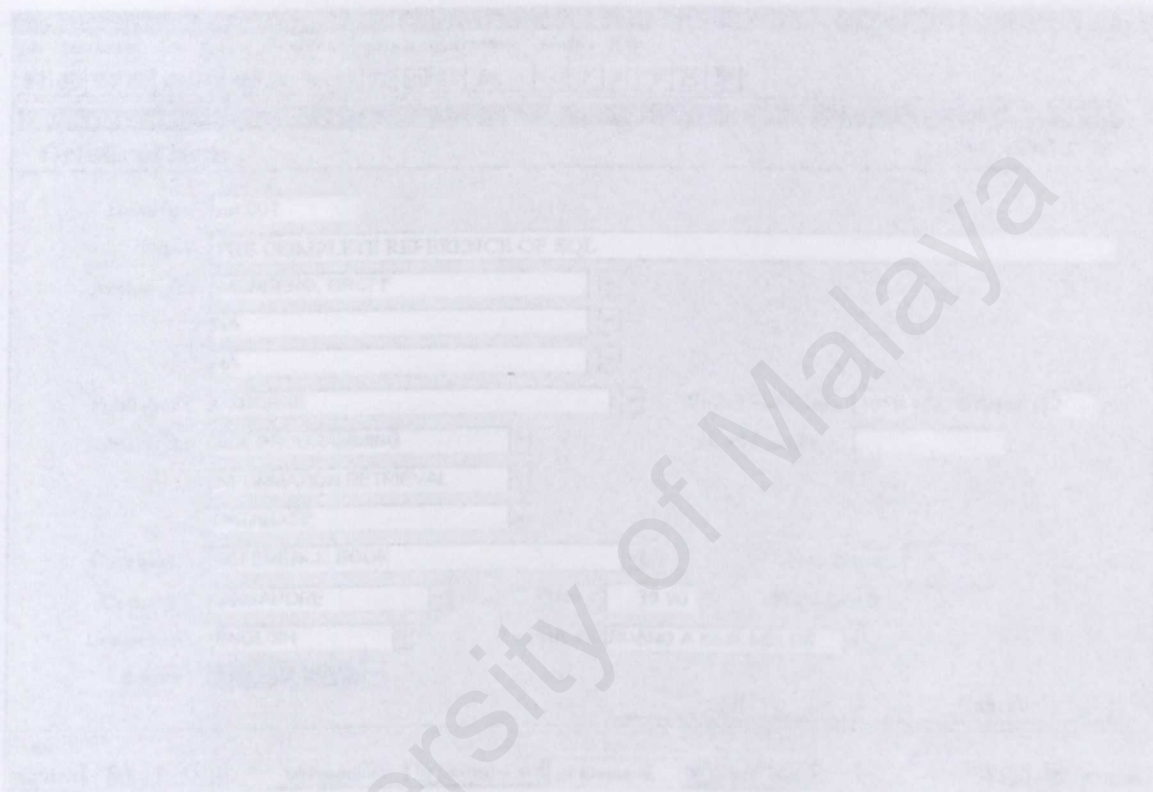


Figure 2.3 The Item Cataloging Window

**Step by step:**

a) Please key in the ItemNo (must be unique), which the system will automatically verify the validity of the ItemNo. If the ItemNo is already existed, then the system will prompt a message box to alert the user.

b) Key in the item's title.

c) Then, what you just have to do is key in all the information that required.

d) Click OK button to save the record.

e) At any point, you can click CANCEL to abort the operation.

## 3.2    Item Cataloging

Access  :    System Administrator, Librarians

Menu   :    Transaction | Cataloging | Item Cataloging



**Figure 3.3    The Item Cataloging Window**

**Step by step:**

a)  Please key in the ItemNo (must be unique), which the system will automatically varify the validity of the ItemNo. If the ItemNo is already existed, then the system will prompt a message box to alert the user.

b)  Key in the item's title.

c)  Then, what you just have to do is key in all the information that required.

d)  Click **OK** button to save the record.

e)  At any point, you can click **CANCEL** to abort the operation.

## 3.3    Update Item Cataloging

Access  :   System Administrator, Librarians

Menu   :   Transaction | Cataloging | Update Item Cataloging



**Figure 3.4    The Update Item Cataloging Window**

**Step by step:**

a)  Please key in the ItemNo (must be unique), which the system will automatically varify
    the validity of the ItemNo. If the ItemNo is already existed, then the system will
    prompt a message box to alert the user.

b)  Key in the item's title.

c)  Then, what you just have to do is key in all the information that required.

d)  Click **OK** button to save the record.

e)  At any point, you can click **CANCEL** to abort the operation.

## 3.4   Search Engine (OPAC)

Access   :   System Administrator, Librarians, Students

Menu     :   Transaction | Cataloging | Search Engine (OPAC)
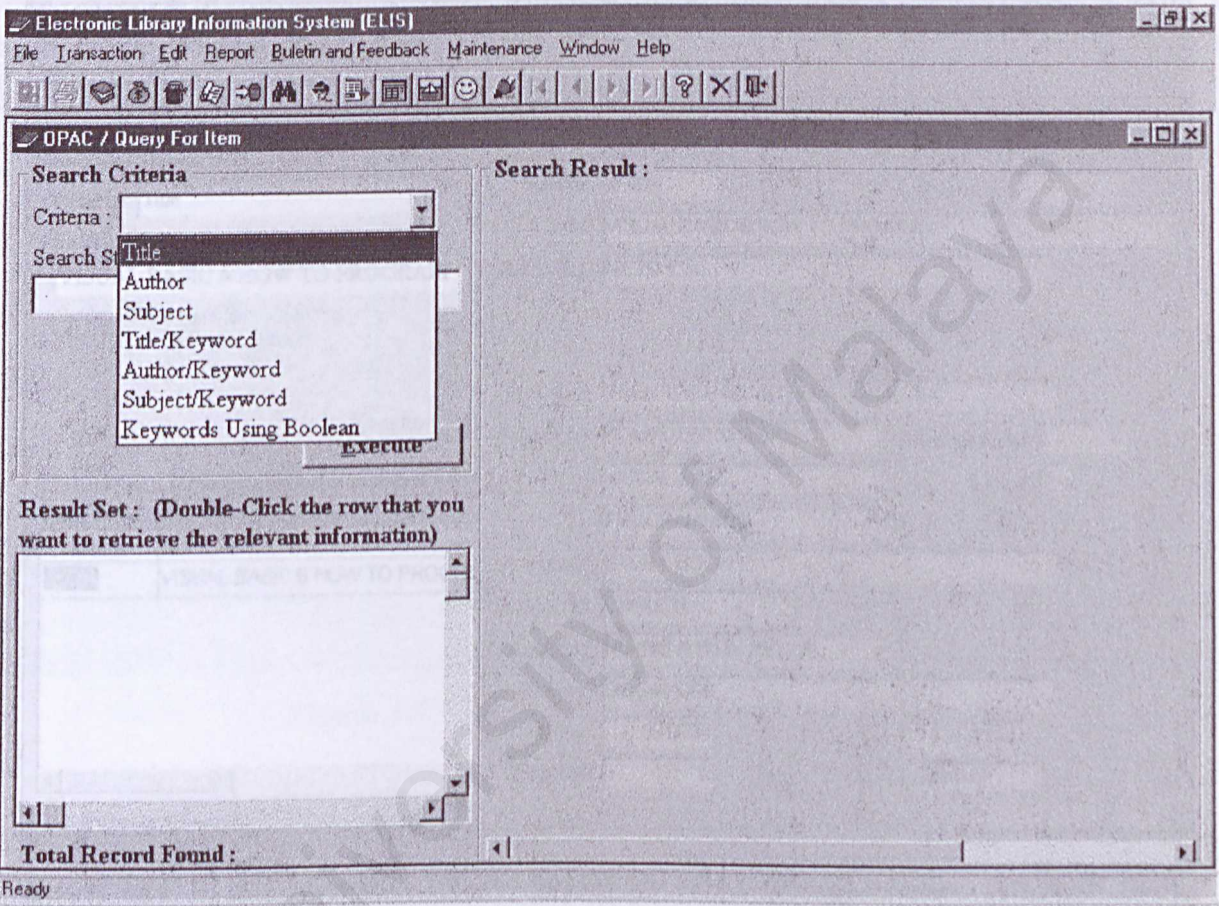


**Figure 3.5    The Search Engine (OPAC) Window**

**Step by step:**

a)   Click-Select the search criteria.

b)   Key in the search string according to the search criteria.

Guide: Please type the *actual title* of an item if the search criteria is **Title**.

c)   Then, you will get a list of the item(s) that contain that search string (title).

d) To view a specific item in the **Result Set**, please double-click the row that contains the record. *See Figure 3.6.*

e) At any point, you can click-select the search criteria and/or input the appropriate search string.



**Figure 3.6     The Information of Search Result**

### 3.4.1 Boolean Search



**Figure 3.7    The Search Result of Boolean Search**

**Step by step:**

a) Click the search criteria list box and select the "Keywords Using Boolean ".

b) Key in the search string and click-select the Boolean list box between the 2 search string.

   *\* The search string can be the combination keywords of title, author or subject.*

c) Then, you will get a list of the item(s) that fulfill the search condition.

d) To view a specific item in the **Result Set**, please double-click the row that contains the record.

e) At any point, you can click-select the search criteria and/or input the appropriate search string.

# CHAPTER 4   Circulation

This module lets you, the user keep record of every active patron and also the historical patron that are not active (who are left the school). Besides, this module keeps track of items loaned to patrons.

It contains 3 separate sub-modules:

a)  New Patron

b)  Update Patron

c)  Transaction
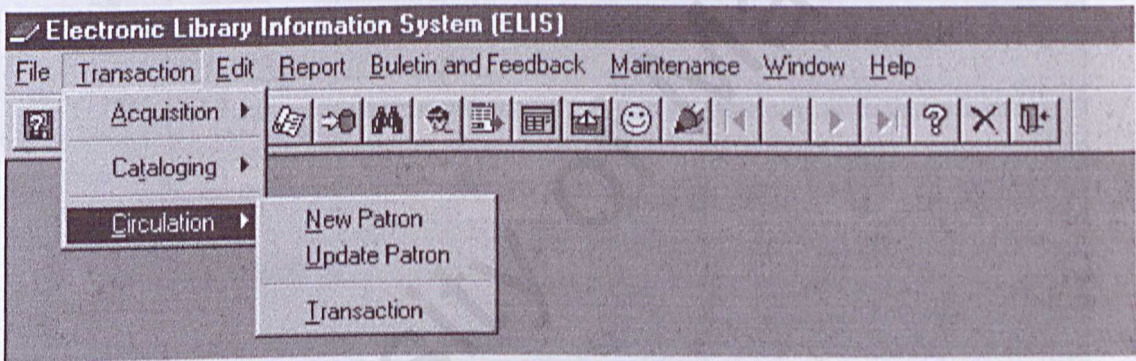


**Figure 4.1   The menu items showing the Circulation Module**

**4.1    New Patron**

c) When you finished, click OK button to save the data into the database.

Access  :   System Administrator, Librarian

Menu    :   Transaction | Circulation | New Patron
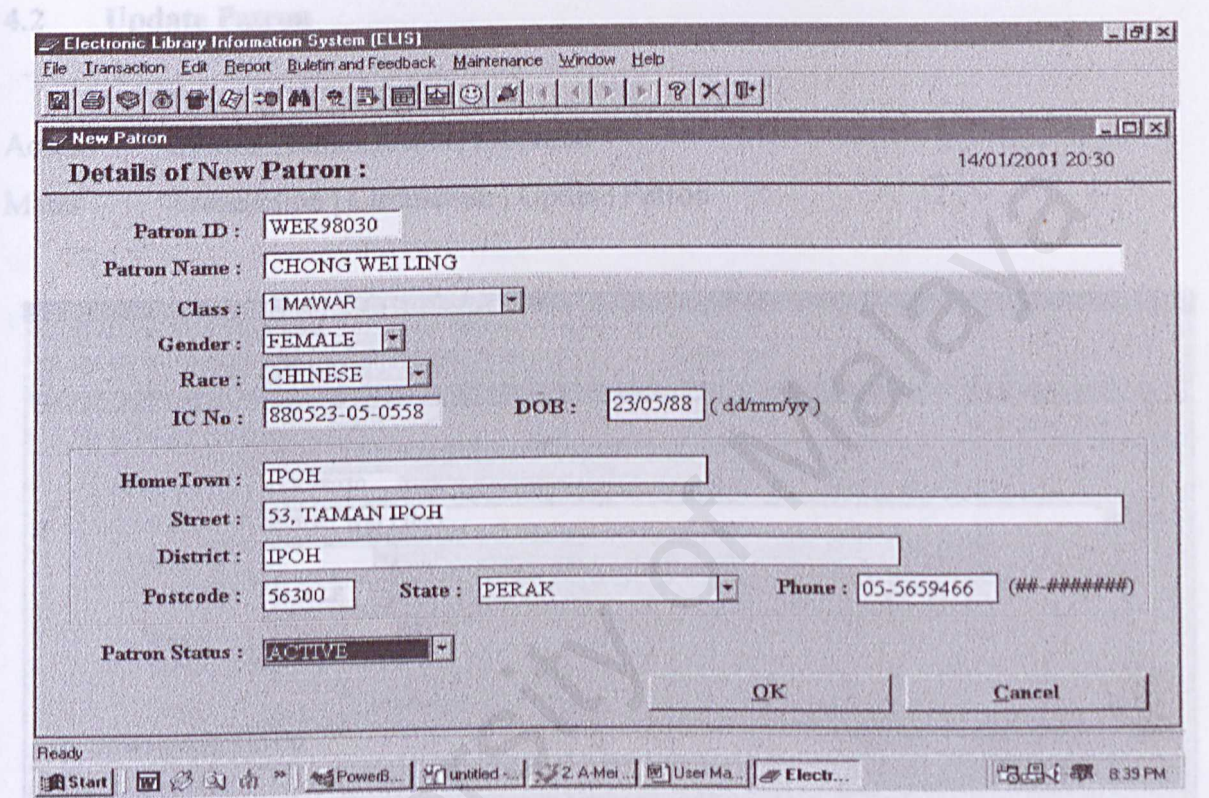


**Figure 4.2    The New Patron Window**

**Step by step:**

a)  Key in the patron id, which is unique. A message box will be prompted if another
     patron already uses the patron id. Retype again the patron id.
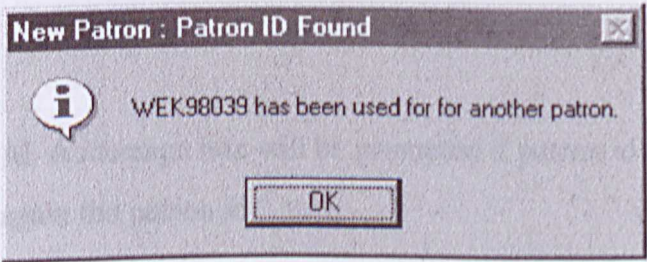
b)  Then, you can key in the relevant information of the new patron.

c)  When you finished, click **OK** button to save the data into the database.

d)  Click **Cancel** to abort the operation.

## 4.2    Update Patron

Access   :   System Administrator, Librarian

Menu    :   Transaction | Circulation | Update Patron



**Figure 4.3    The Update Patron Window**

**Step by step:**

a)  Key in the patron id. A message box will be prompted if patron id does not exist in the
database. Retype again the patron id.

4.3    Transaction



Update Patron Info : Patron ID Not Found

WEK98038 is not found in database.

OK

Access :    System Administrator

Menu :    Transaction

b) If the patron id is found, then all the relevant information of the patron will be retrieved.

c) Change the desired information.

d) Click **OK** button to update the data.

e) Click **Cancel** button to cancel the operation.

Figure 4.4    The Transaction Type in Transaction Window

## 4.3    Transaction

Access  :   System Administrator, Librarian

Menu   :   Transaction | Circulation | Transaction

**Figure 4.4    The Transaction Type in Transaction Window**

### 4.3.1   Borrowing Transaction



**Figure 4.5    The Borrowing Transaction Window**

**Step by step:**

a) Key in the patron id. A message box will be prompted if patron id does not exist in the database. Retype again the patron id.

b) If the patron id is correct, then key in the item's itemno. If the itemno is not found in database, then a message box as below will be shown. So, please retype the actual itemno.

**ItemNo Not Found**

(i) ItemNo: vbs.001 does not exists for any item.

OK
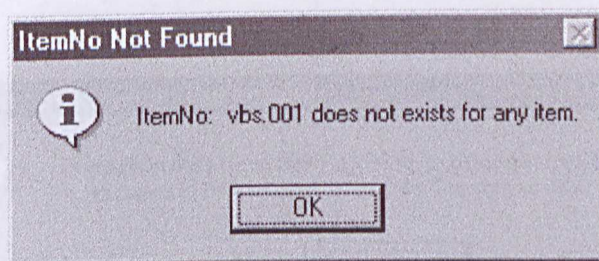
c) The relevant information of the item is retrieved.

d) The status of item is checked. If the item's status id "B" (borrowed) or "M" (missing), then a message box will be prompted to verify that the borrowed or missing cannot be borrowed again.

**Transaction**

⚠ Borrowed, missing item cannot be borrowed

OK
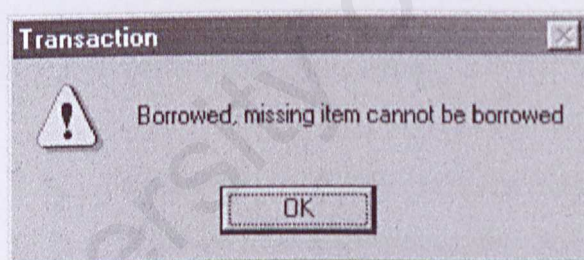
e) If the status of item is "R" (Reserved), the system will check whether is item is reserved for the patron. If the item is reserved to another patron, a message box will be displayed as below.

**Cannot be Borrowed**

⚠ This item is reserved to another patron. Reserved item cannot be borrowed

OK
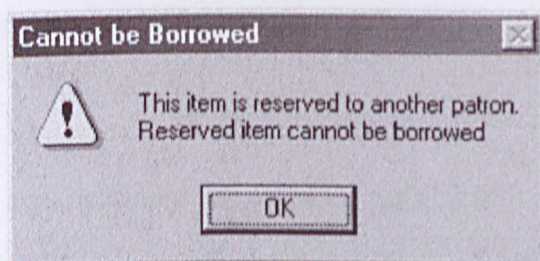
f) Click **OK** button to update the data. If the system manages to save the transaction, a message box will be shown to verify that the update is successful.

You can do another borrowing transaction for the same patron by clicking the **Yes** button. Else, the screen will be cleared if you click the **NO** button.
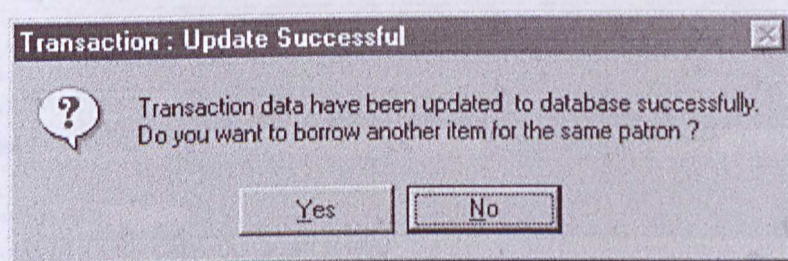


g) If the system failed to save the record, then a message box will be shown to verify that the update is failed. So, I suggest that you try it another time.

h) Click **Cancel** button to cancel the operation.

## 4.3.2   Returning Transaction



**Figure 4.6     The Returning Transaction Window when the library is operating as normal**

**Step by step:**

a) Key in the ItemNo of the item that want to return.

b) If the ItemNo is correct, the system will check whether the borrowed item is overdue. If overdue happens, then the system will automatically count the number of days that overdue. The fines for overdue will be the total of multiplying the fine per day and number of days.

*\* ELIS is not impose fines on days when library is closed.*

If the library closed on the date between the due date and the day when the returning transaction is take placed, the system will check the number of days when library is closed, *d_close,* for certain reason (Sunday or school holidays). The number of days late for returning will be subtracted from the *d_close.*



**Figure 4.7    The Returning Transaction Window when the library is closed for one day between the due date and the transaction date**

c)  Click **OK** button to update the data. If the system manages to save the transaction, a message box will be shown to verify that the update is successful.

You can do another borrowing transaction for the same patron by clicking the **Yes** button. Else, the screen will be cleared if you click the **NO** button.

4.3.2   Reserving Transaction

**Transaction : Update Successful**

? Transaction data have been updated to database successfully. Do you want to borrow another item for the same patron ?

Yes        No
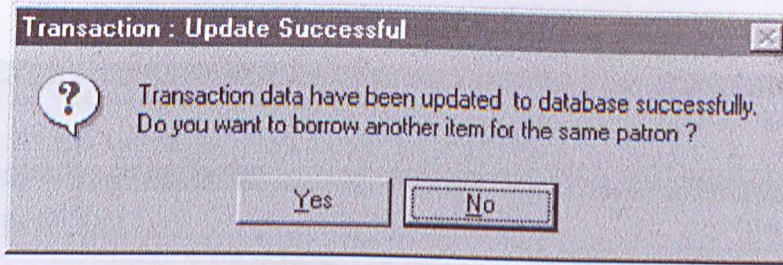
d)  If the system failed to save the record, then a message box will be shown to verify that the update is failed. So, I suggest that you try it another time.

e)  Click **Cancel** button to cancel the operation.

Figure 4.5   The Reserving Transaction Window

Step by step:

* Same with steps (a) - (c) in borrowing transaction

d)  If the status of item is "B" (Borrowed) or "M" (Missing) then, a message box will be prompted to verify that only borrowed item can be reserved.
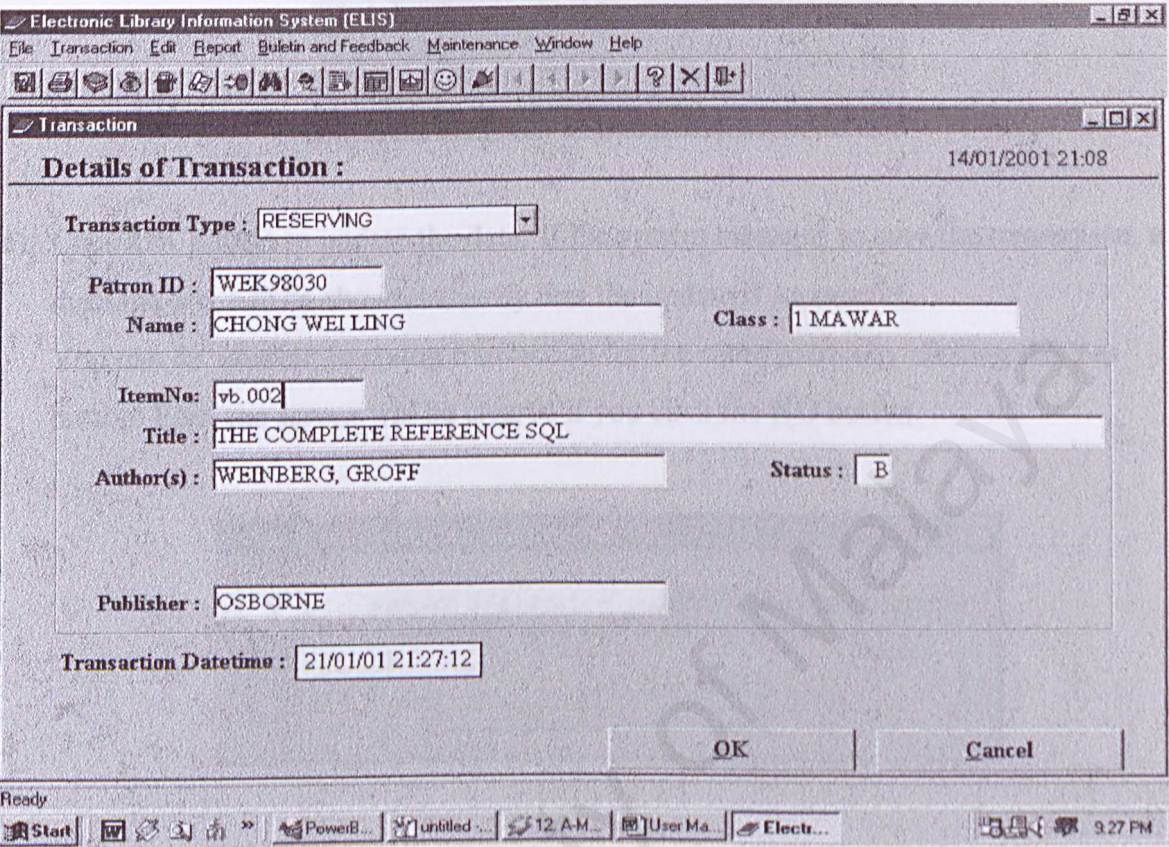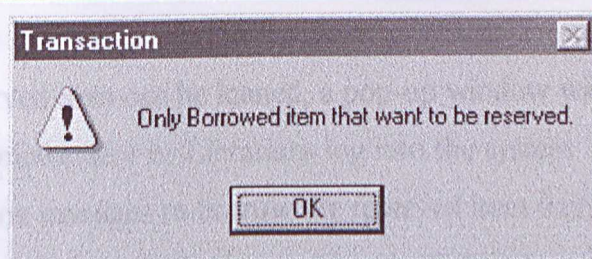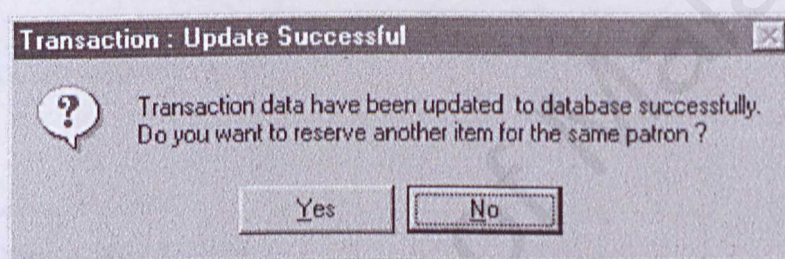
## 4.3.2   Reserving Transaction



**Figure 4.8    The Reserving Transaction Window**

**Step by step:**

\* *Same with steps (a) – (c) in borrowing transaction*

d)  If the status of item is "B" (Borrowed) or "M" (Missing) then, a message box will be
    prompted to verify that only borrowed item can be reserved.

Transaction

⚠ Only Borrowed item that want to be reserved.

OK

e) Click **OK** button to update the data. If the system manages to save the transaction, a message box will be shown to verify that the update is successful.

You can do another reserving transaction for the same patron by clicking the **Yes** button. Else, the screen will be cleared if you click the **NO** button.

Transaction : Update Successful

❓ Transaction data have been updated to database successfully. Do you want to reserve another item for the same patron ?

Yes          No

f) If the system failed to save the record, then a message box will be shown to verify that the update is failed. So, I suggest that you try it another time.
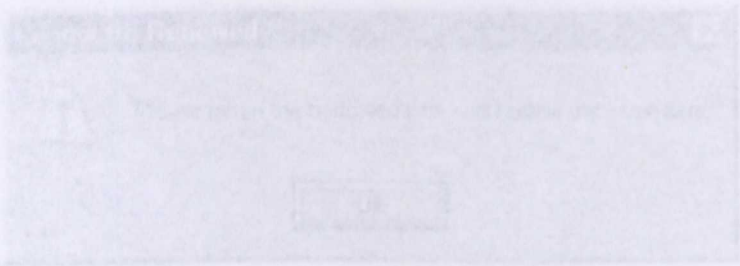
g) Click **Cancel** button to cancel the operation.

\*    When the reserved item can be loaned, a pop-up window will be display every time
the System Administrator or Librarians log into the system. This alert will only
disabled if patron manages to borrow the reserved item within 7 days or the patron
does not manage to borrow the item within the 7 days.
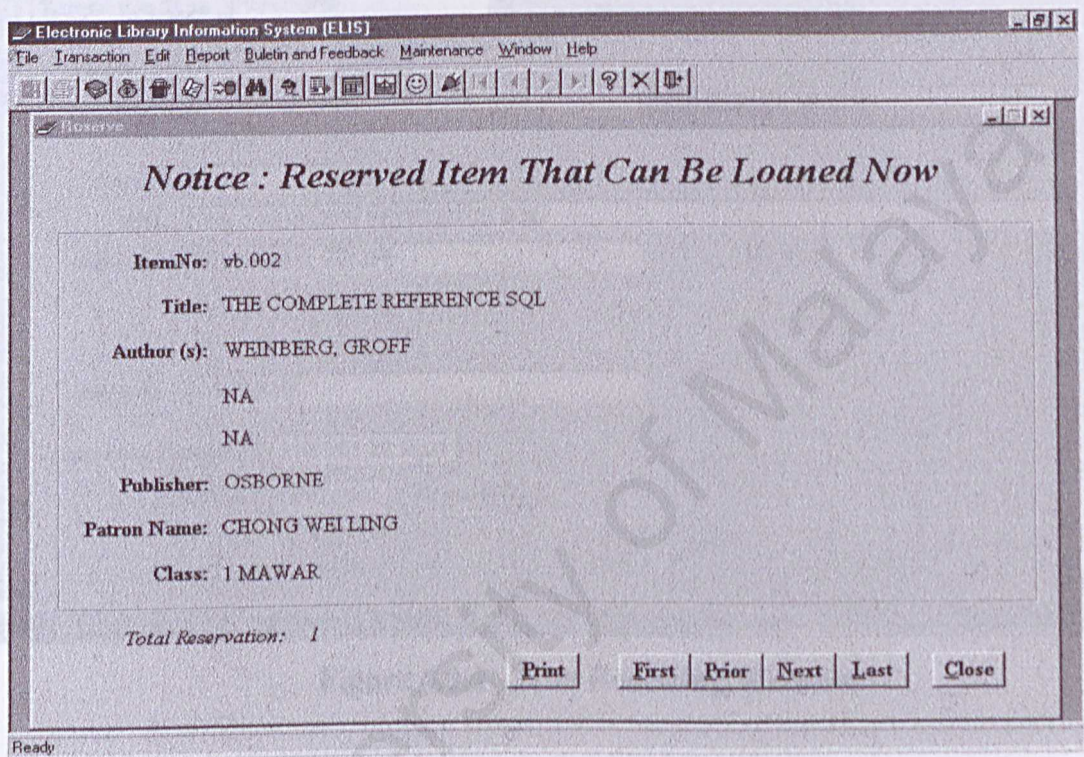


**Figure 4.9    The Pop-Up Window For Reserved Item that can be Loaned**
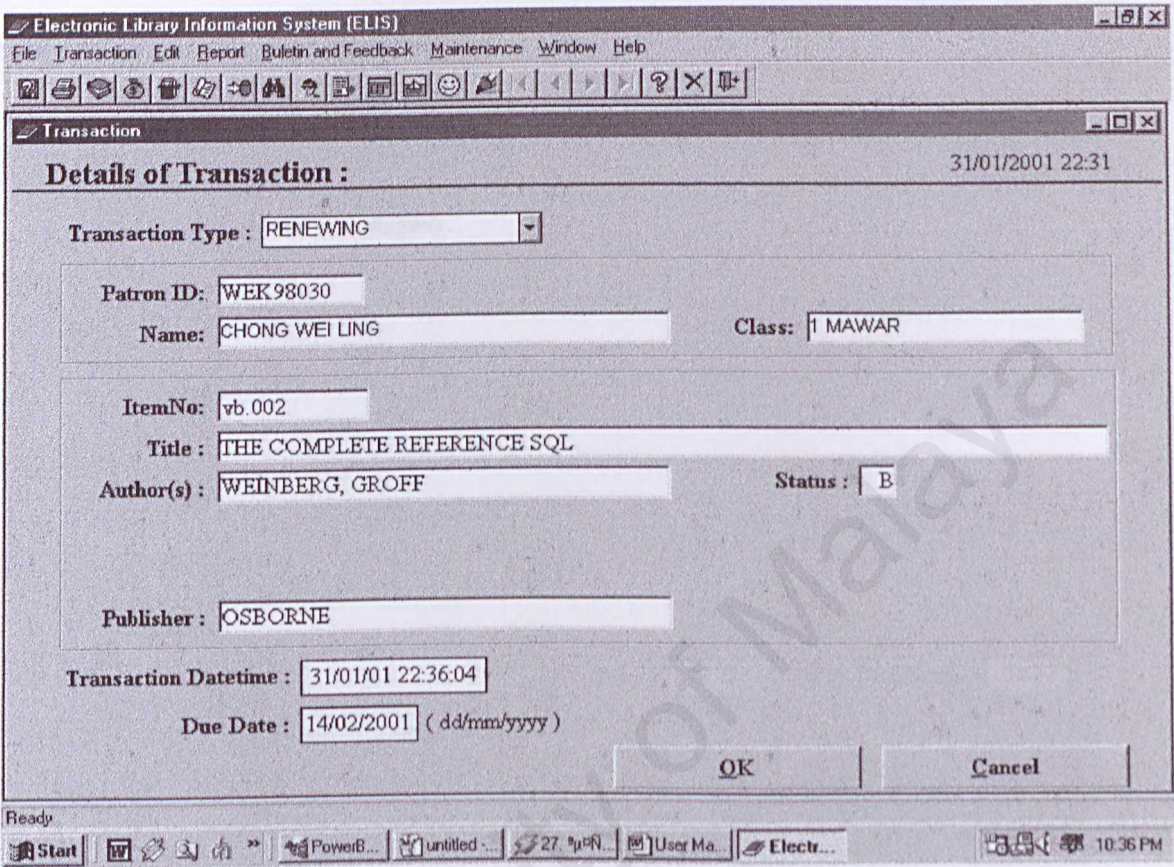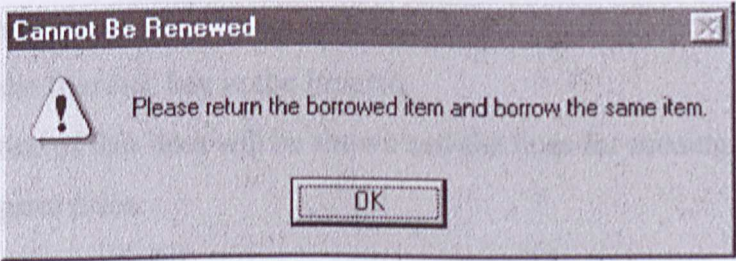
### 4.3.3   Renewing Transaction



**Figure 4.9.1   The Renewing Window**

**Step by step:**

a) Key in the ItemNo of the item that want to return.

b) If the ItemNo is correct, the system will check whether the borrowed item is overdue.
   If overdue happens, a message box will be displayed as below.

c) If no overdue happens, you can proceed the transaction by clicking the **OK** button.
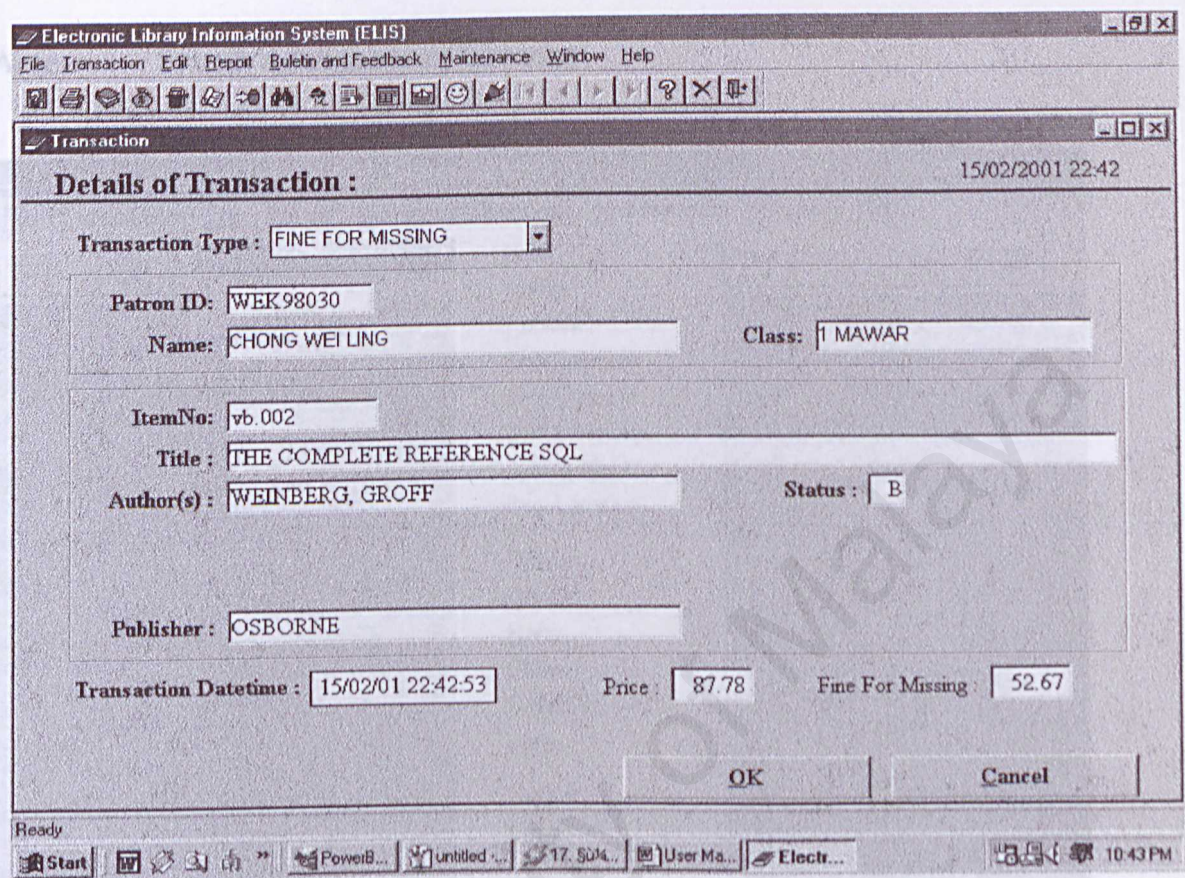
### 4.3.4   Fine for Missing Transaction



**Figure 4.9.2   The Fines For Missing Window**

**Step by step:**

a) As the borrowed item is missing, so the user have to find out the ItemNo.

   Going to the menu **Edit | Transaction Table | Transaction** can lets the user search for the itemno that borrowed by that patron id where the status of the transaction is active (not yet returned).

b) After finding, the ItemNo, key in the ItemNo.

c) The original price of that item will be shown and the fines for missing is depend on the percent of original price.

d) Click **OK** button to proceed.

# CHAPTER 5   Edit Module

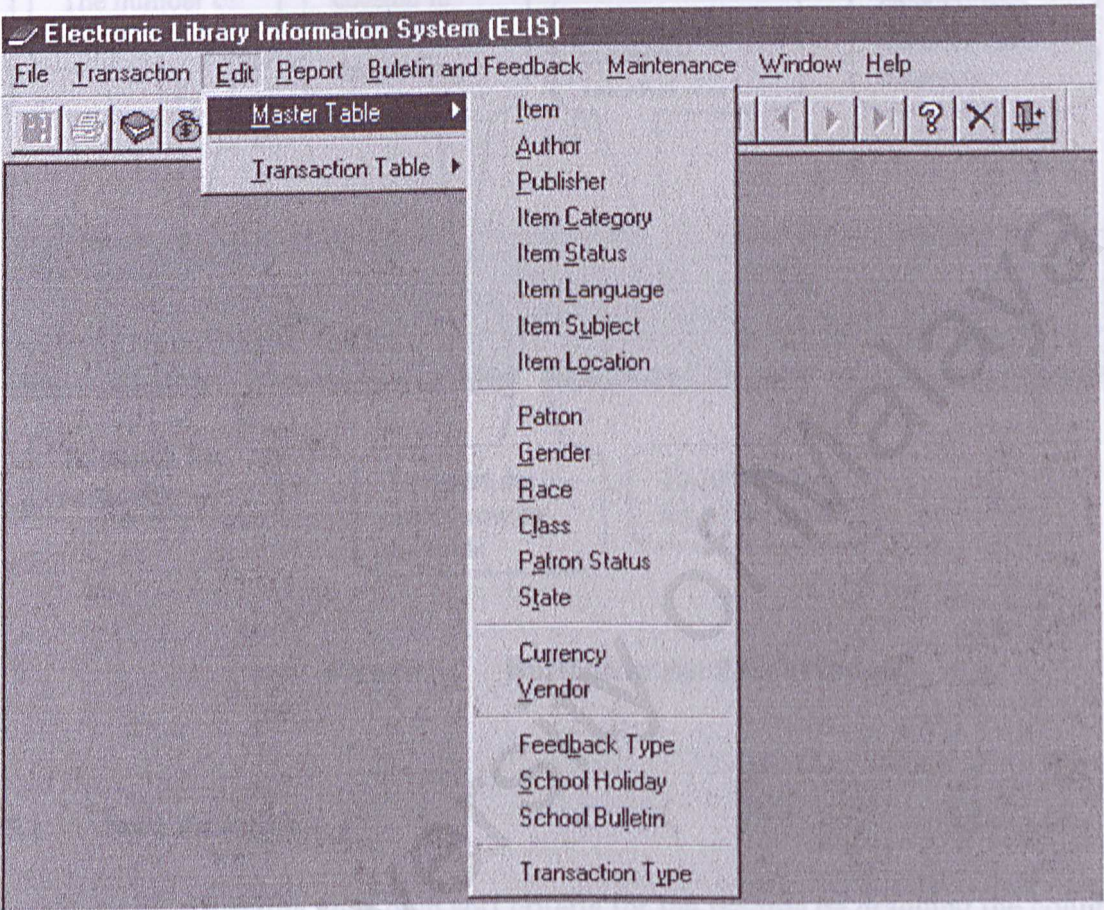Access  :   System Administrator, Librarian



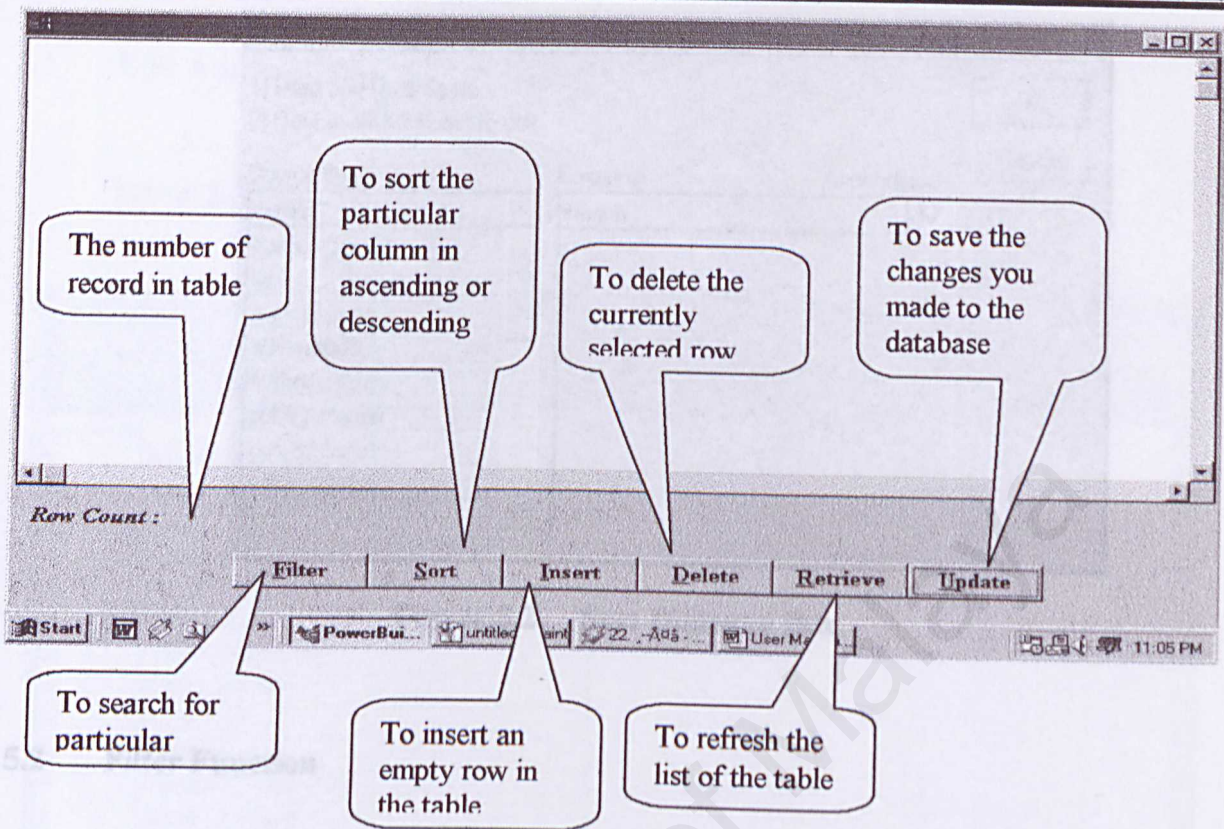**Figure 5.1   The options of the Editing Module**

The number of record in table

To sort the particular column in ascending or descending

To delete the currently selected row

To save the changes you made to the database

To search for particular

To insert an empty row in the table

To refresh the list of the table

Enter your filter criteria into the Expression box. You can paste or type functions, fields (column) and operators in the Expression box.
* *Remember that quantity must be decimal, others must be except for quantity.*

**Figure 5.2   Buttons in the Edit Window**

## 5.1    Sort Function

You can define your own sort criteria for the records by dragging the columns that you want sort from the **Source Data Box** to the **Column box**. A checkbox with a check in it displays under the **Ascending** heading to indicate that the values will be sorted in ascending order. To sort in descending order, clear the checkbox.
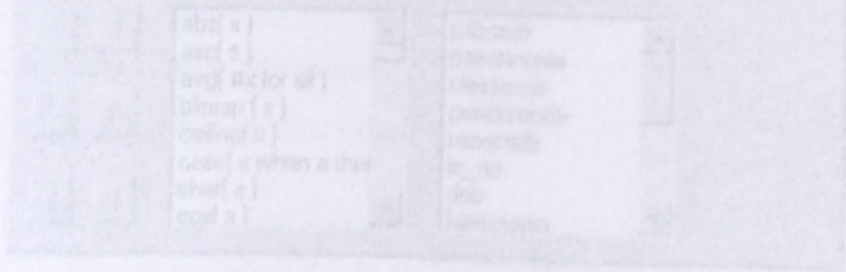
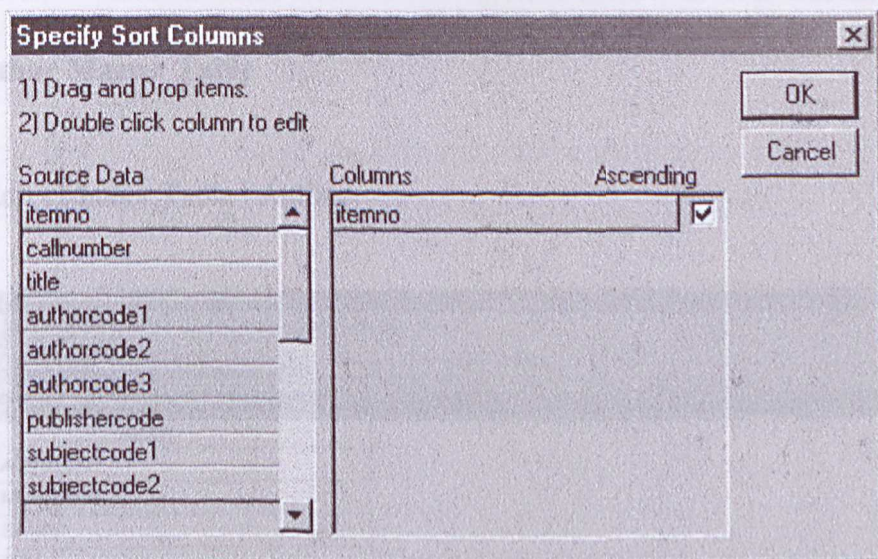**Figure 5.3    The Specify Filter Dialogue Box**

**Figure 5.2    Sort Dialogue Box**

## 5.2    Filter Function

Enter your filter criteria into the Expression Box. You can paste or type functions, fields (column), and operators in the Expression Box.

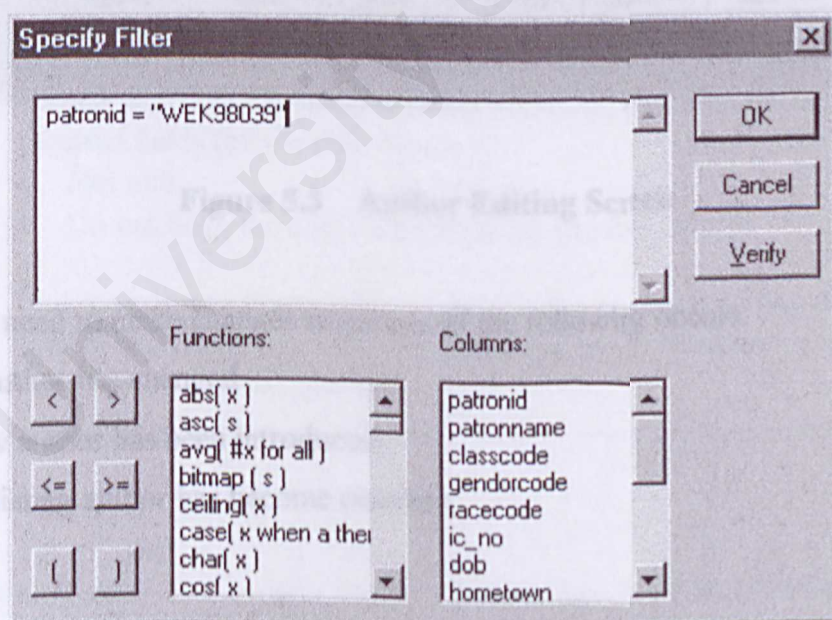*\* Remember that you have to enclose all values in quotes except for quantity.*



**Figure 5.3    The Specify Filter Dialogue Box**

## 5.1    Edit Author Master Table

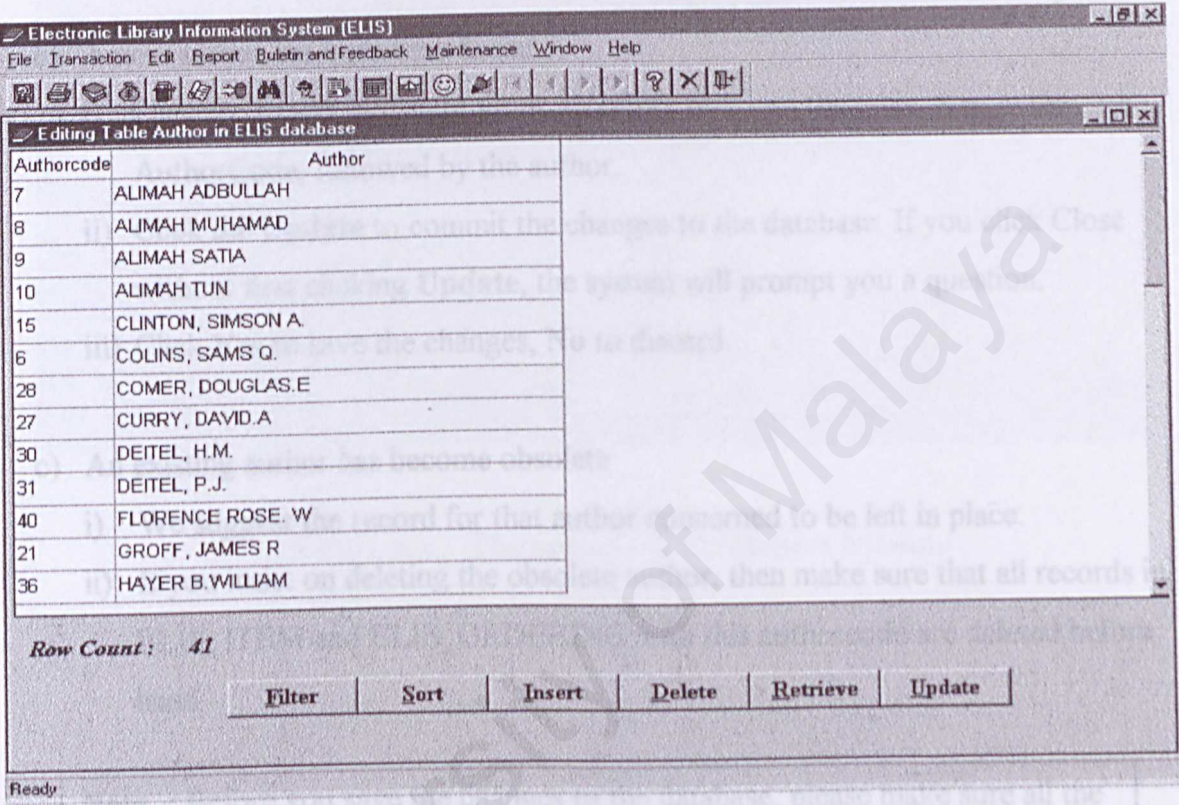Menu: Edit | Master Table | Author



**Figure 5.3   Author Editing Screen**

We may only need to make changes when one of the following occurs:

    a)  The author has changed

    b)  A new author has been introduced

    c)  An existing author has become obsolete

* Other Master Tables, Transaction Tables, System User Table and System Access Table*

*have the similar edit procedures as above.*

**Step by step:**

a) The author has changed

   i) We suggest that you change the author concerned only and leave the AuthorCode intact if the essence of the author is unchanged.

b) A new author has been introduced

   i) Click the **Insert** button to insert an empty row into the table. Key in the AuthorCode, followed by the author.

   ii) Click the **Update** to commit the changes to the database. If you click Close without first clicking **Update**, the system will prompt you a question.

   iii) Click **Yes** to save the changes, **No** to discard.

c) An existing author has become obsolete

   i) We suggest the record for that author concerned to be left in place.

   ii) If you insist on deleting the obsolete author, then make sure that all records in ELIS_ITEM and ELIS_ORDERING with this authorcode are deleted before hand.

---

**Note** : Before you save the changes to the database, please make sure all the required fields (all the columns) are

- Not null
- Do not have the duplicate values for the first column

This is to ensure that you have typed in the correct data and the system will allow you to save the changes to the database before giving you any error message.

---

\* *Other Master Tables, Transaction Tables, System User Table and System Access Table have the similar edit procedures as above.*

# CHAPTER 6    Report

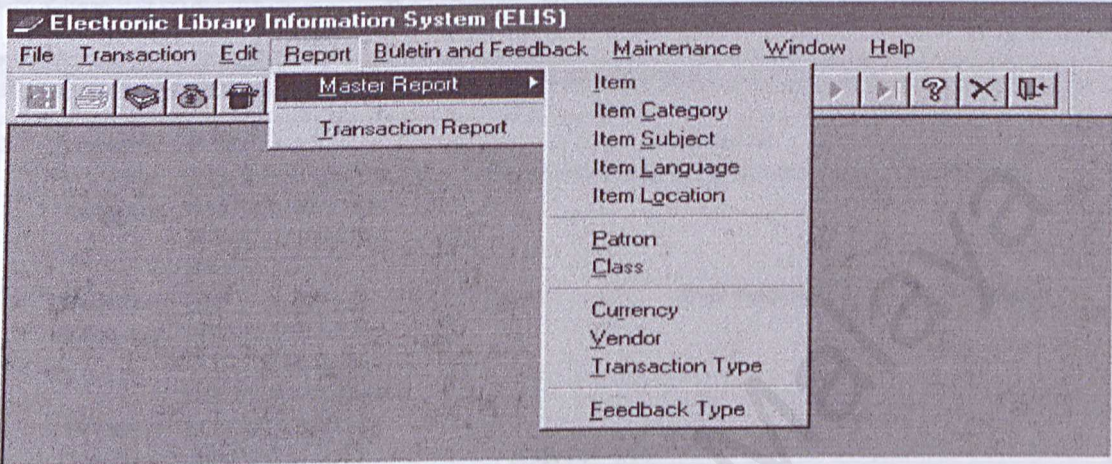Access   :    System Administrator, Librarian



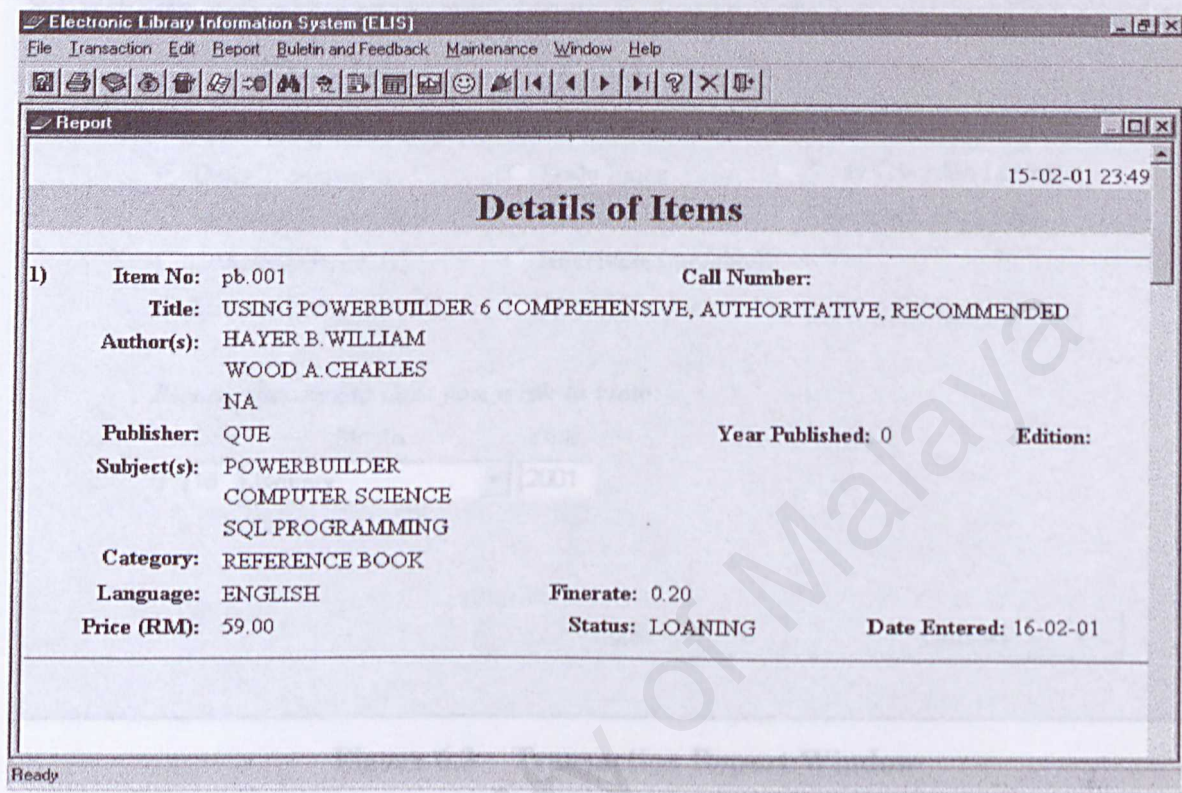**Figure 6.1    The options of the Report Module**

## 6.1    Master Report



**Figure 6.2    An example of a Master Report**

**Step by step:**

a) Check the radio button that represent the desired transaction report.

b) If it is a monthly report, click-select the month and key in the year for viewing the report at the month.

c) If it is a daily report, key in the day, year and click-select the month for viewing the report at that date.

d) If you check the graph (Transaction Versus Item Category), input the year for viewing the graph at that year.
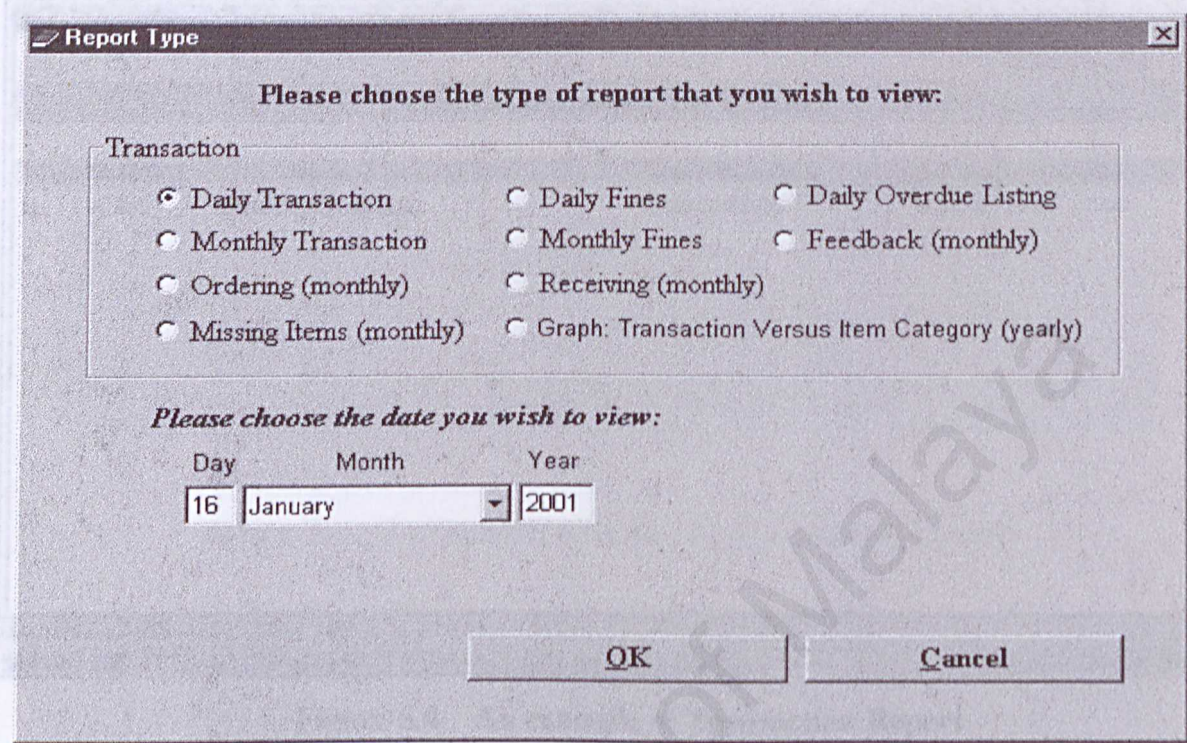
## 6.2    The Transaction Report



**Figure 6.3    Transaction Report Window**

**Step by step:**

a)  Check the radio button which represent the desired transaction report

b)  If it is a monthly report, click-select the month and key in the year for viewing the report at the duration.

c)  If it is a daily report, key in the day, year and click-select the month for viewing the report at that date.

d)  If you check the graph (Transaction Versus Item Category), input the year for viewing the graph at that year.
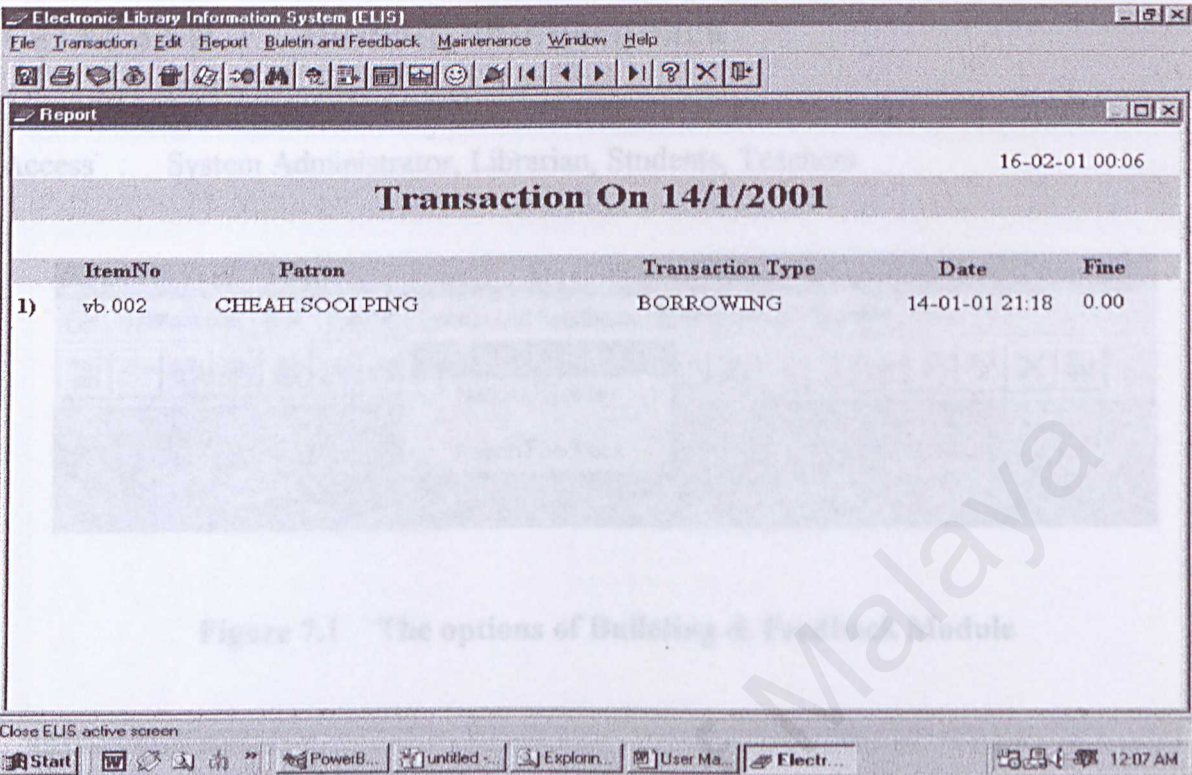
**Figure 6.4    An example of Transaction Report**
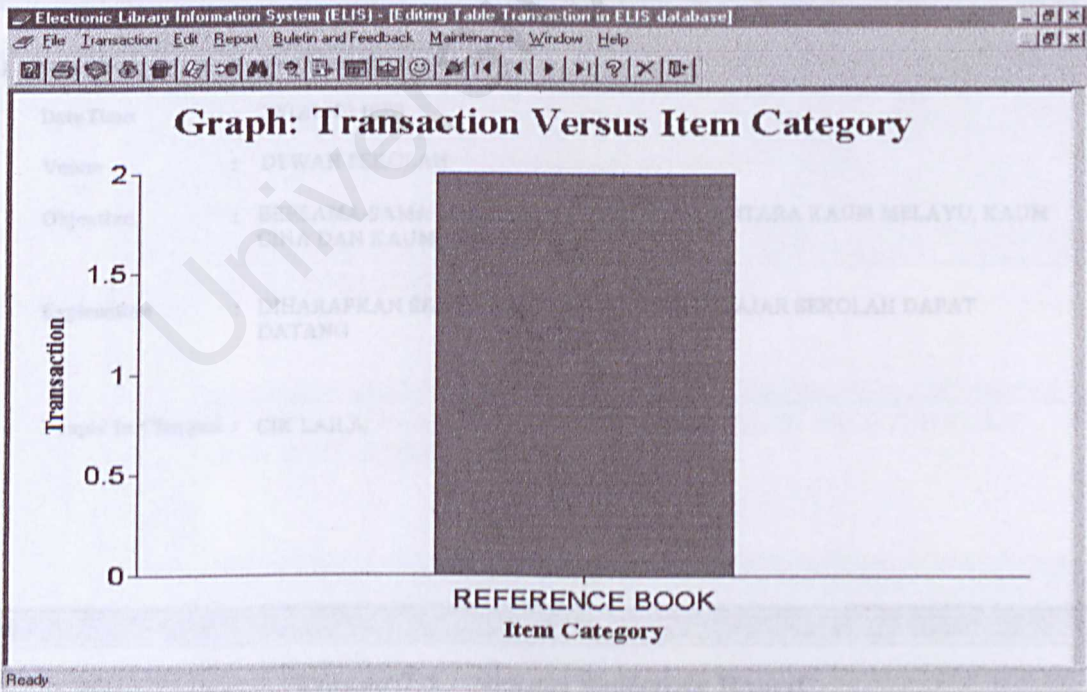


**Figure 6.5    An example of Graph (Transaction Versus Item Category)**

# CHAPTER 7    Bulletin and Feedback

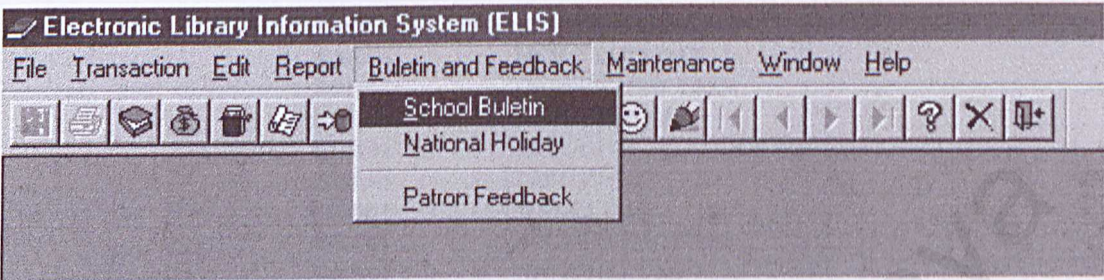Access  :  System Administrator, Librarian, Students, Teachers


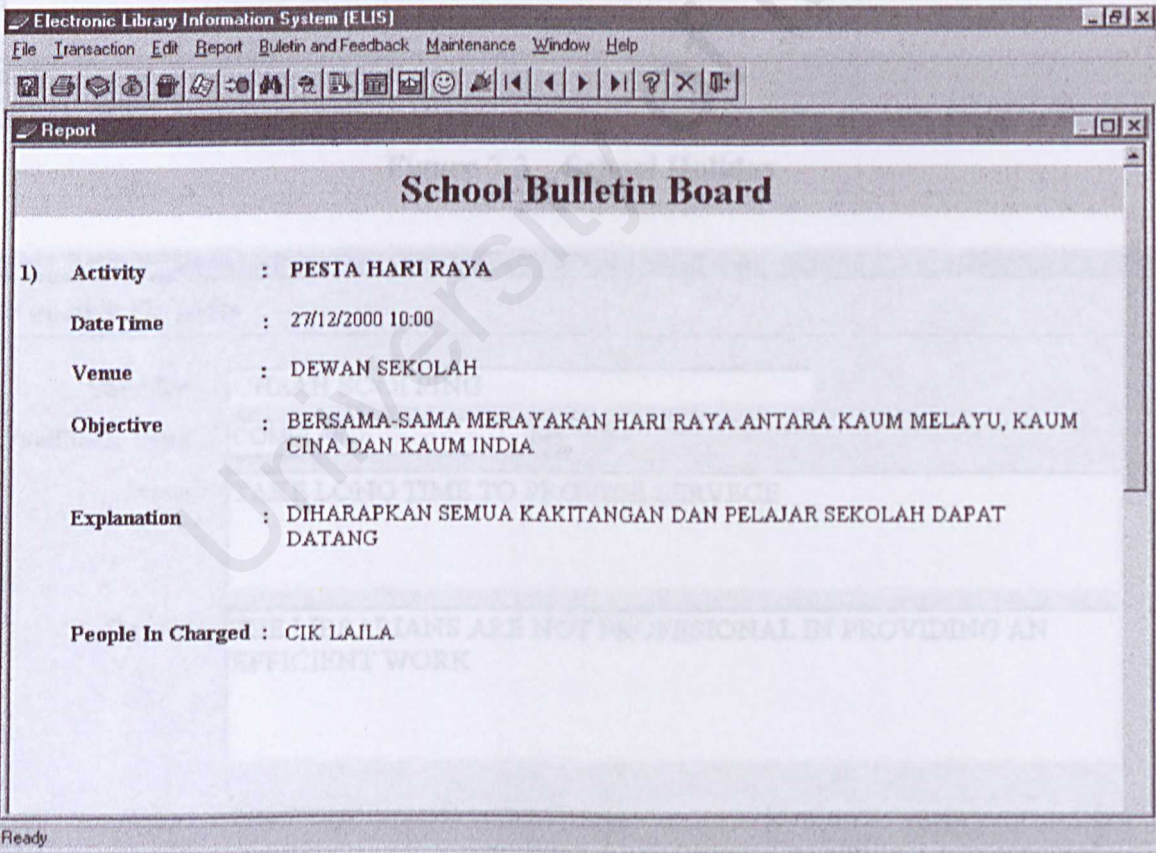
**Figure 7.1    The options of Bulleting & Feedback Module**



**Figure 7.2    School Bulleting Board**

Electronic Library Information System [ELIS]

File  Transaction  Edit  Report  Buletin and Feedback  Maintenance  Window  Help

Report

16-02-01 00:31

## National Holiday

| Date | Occasion |
|------|----------|
| 01/01/01 | NEW YEAR'S DAY |
| 24/01/01 | CHINESE NEW YEAR |
| 06/03/01 | HARI RAYA HAJI |
| 10/03/01 | SULTAN OF SELANGOR BIRTHDAY |
| 01/05/01 | LABOUR DAY |
| 07/05/01 | WESAK DAY |
| 02/06/01 | AGONG'S BIRTHDAY |
| 31/08/01 | NATIONAL DAY |
| 14/11/01 | DEEPAVALI |
| 16/12/01 | HARI RAYA PUASA |
| 25/12/01 | CHRISTMAS |

Ready

Start | PowerB... | untitled -... | Explorin... | User Ma... | Electr... | 12:31 AM

**Figure 7.3    School Holiday**

---

Feedback Form

## Feedback Info

Sender :  CHEAH SOOI PING

Feedback Type :  COMPLAINT

Issue :  TAKE LONG TIME TO PROVIDE SERVECE

Details :  THE LIBRARIANS ARE NOT PROFESIONAL IN PROVIDING AN EFFICIENT WORK

OK          Cancel

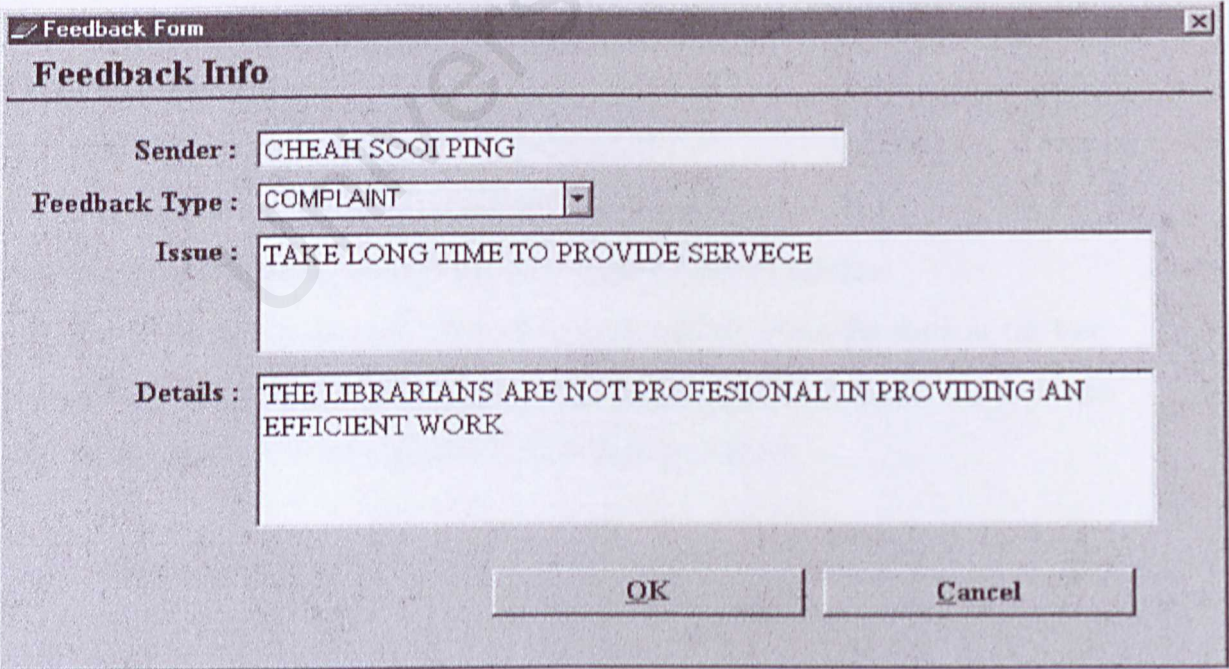**Figure 7.4    Feedback Window**

# CHAPTER 8    Maintenance Module

It contains 3 separate sub-modules:

a) Change Password

b) System Access Maintenance

c) System User Maintenance



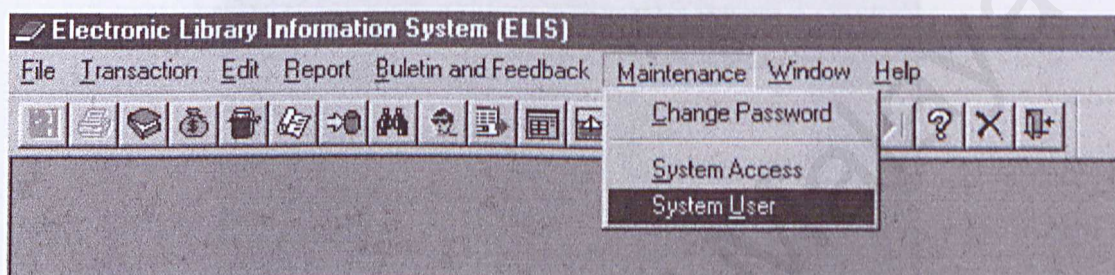**Figure 8.1    The options of Maintenance Module**

## 8.1    Change Password

Access    :    System Administrator, Librarian, Students, Teachers



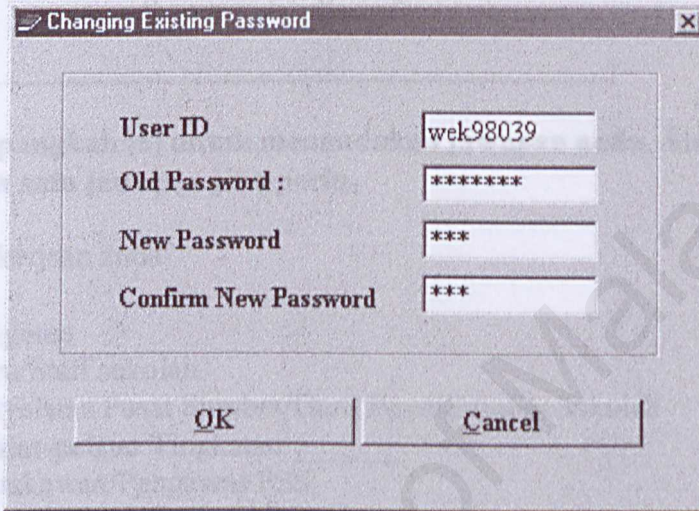**Figure 8.2   The Change Password Window**

**Step by step:**

a)  Key in your user id. Press the enter or tab key.

b)  Key in your old password. Press the enter or tab key.

c)  Key in your desired new password. Press the enter or tab key.

d)  Key in the new password a second time to confirm. Press the enter or tab key.

e)  When you are finished, click **OK** button to commit the change to the database.

f)  At any point, you can click the **Cancel** button to abort.

*Remember: the old and new password only can contain 8 characters maximum.*

*System Access Table and System User Table: See Chapter 5  (Edit Module)*

# Borang SoalSelidik

*Borang soal selidik ini bertujuan untuk mendapat maklumat tentang kecendurangan responden ke atas sistem perpustakaan sama ada sistem manual atau sistem automasi. Selain itu, tinjauan soal selidik ini tumpu kepada keupayaan responden dalam menggunakan kad katalog atau katalog komputer.*

**Sekolah   :** _____

**Sila gunakan pangkah (x) untuk menandakan jawapan anda. Anda boleh beri lebih daripada satu jawapan jika perlu.**

1. Apakah pekerjaan anda?

   - ❑ Pengetua
   - ❑ Guru/Staff sekolah
   - ❑ Penyelaras Pusat Sumber/Guru Pusat Sumber Sekolah
   - ❑ Pelajar-pelajar Tingkatan _____
   - ❑ Pustakawan/Pengawas PSS
   - ❑ Lain-lain      Sila nyatakan: _____

2. Berapa kerap anda pergi ke perpustakaan sekolah anda?

   - ❑ Tidak pernah
   - ❑ Sekali setahun
   - ❑ Lebih daripada 1 kali setahun
   - ❑ Lebih daripada 1 kali sebulan
   - ❑ Lebih daripada 1 kali seminggu

3. Apakah *tujuan utama* anda pergi ke perpustakaan sekolah anda?

   - ❑ Mencari buku untuk membuat rujukan
   - ❑ Membaca buku cerita
   - ❑ Membaca buku pelajaran
   - ❑ Buat kerja sekolah (sebab suasana perpustakaan sunyi)
   - ❑ Mengikut rakan-rakan
   - ❑ Lain-lain      Sila nyatakan: _____

4. Adakah perpustakaan anda memenuhi kehendak (keperluan maklumat) anda?

   - ❑ Ya
   - ❑ Tidak

5. Adakah perpustakaan sekolah anda menggunakan sistem automasi (fungsi-fungsi perpustakaan diproses dan dibantu oleh penggunaan komputer and peralatan lain.) untuk menjalankan semua aktiviti perpustakaan?

   □ Ya
   □ Tidak

6. Adakah anda berpendapat bahawa sistem automasi perpustakaan lebih berkesan daripada sistem manual perpustakaan?

| Jarang berguna | | kadang-kala berguna | | | Selalu berguna |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |

7. Adakah perpustakaan sekolah anda dilengkapi dengan sistem katalog komputer?

   □ Ya
   □ Tidak

   Jika jawapan anda ialah *Ya*, sila jawap soalan di bahagian A.
   Jika jawapan anda ialah *Tidak*, sila jawap soalan di bahagian B.

**Bahagian A**

8. Pernahkah anda menggunakan katalog perpustakaan yang telah dikomputerkan?

   □ Ya
   □ Tidak

9. Bagaimanakah anda dapat tahu cara menggunakan katalog komputer?

   □ Daripada ajaran rakan-rakan
   □ Daripada ajaran pustakawan/kakitangan perpustakaan
   □ Daripada panduan (online help) di skrin terminal
   □ Daripada panduan bertulis/manual pengguna (user manual)
   □ Daripada sesi pengajaran dan latihan penggunaan sistem
   □ Lain-lain      Sila nyatakan: _____

10. Pada pendapat anda, adakah menaip arahan semasa pencarian adalah sukar?

| Sangat Sukar | | Agak susah | | Agak senang | | Sangat senang |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

11. Tentukan tahap kecendurangan anda menggunakan perkara-perkara di bawah bagi kaedah pencarian maklumat menggunakan komputer.
(kecendurangan paling tinggi (1) ⟶ kecendurangan paling rendah (4))

Perkara (Subject)     ____
Pengarang (Author)    ____
Judul (Title)         ____
Kata kunci (keyword)  ____
Lain-lain   Nyatakan : _____

12. Berdasarkan pengalaman anda, apakah pendapat anda mengenai pencarian buku melalui komputer?

- ❏ Tiada apa yang dapat dicari
- ❏ Hanya sebahagian sahaja yang dapat dicari
- ❏ Semua yang dikehendaki dapat dicari
- ❏ Lebih daripada apa yang dikehendaki

13. Apakah ciri yang anda ingin dalam katalog komputer (selain keupayaan memberi lokasi buku, keupayaan untuk memberi maklumat tentang nombor pangggilan dan status semasa sesebuah buku)?

- ❏ Keupayaan mencetak hasil pencarian
- ❏ Keupayaan menghantar emel
- ❏ Maklumat tentang buletin dan berita perpustakaan
- ❏ Lain-lain   Nyatakan:_____

14. Semasa anda menggunakan perkhidmatan perpustakaan sekolah, adakah anda berhadapan dengan masalah komputer atau "system down".

| Tidak | Jarang | Kadang-kala | | Selalu | Kerap |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | |

15. Berdasarkan pengalaman anda, apakah pendapat anda mengenai pencarian buku melalui komputer?

| Sangat tidak memuaskan | | Memuaskan | | Sangat memuaskan |
|:---:|:---:|:---:|:---:|:---:|
| 1 | 2 | 3 | 4 | 5 |

16. Pada pendapat anda, adakah antaramuka pengguna (user interface)  untuk sistem katalog perpustakaan anda ramah pengguna (user-friendly)?
*(antaramuka pengguna menggunakan images untuk mewakili options. Sebahagian daripada images adalah dalam bentuk ikon, gambar kecil yang mewakili tugas, fungsi atau program.*

    ❑ Ya
    ❑ Tidak

17. Kalau anda diberi pilihan, apakah ciri-ciri antaramuka GUI (*graphical user interface*) yang anda rasa perlu bagi kemudahan dan keselesaan pengguna di sekolah?

    ❑ Pelbagai pandangan tetingkap untuk pelbagai bentuk data
    ❑ Tetingkap yang boleh diubah saiznya, dan boleh digerakkan
    ❑ Bar Bergerak untuk melihat data and kumpulan data.
    ❑ Menu yang dapat ditolak ke bawah *(pull-down menus)*
    ❑ Butang-butang untuk mengaktifkan fungsi.

**Bahagian B**

18. Tahukah anda apa itu kad katalog?

    ❑ Ya
    ❑ Tidak

*Perpustakaan menggunakan kad katalog untuk merekod semua maklumat untuk satu bahan dalam perpustakaan. Maklumat itu ditulis dalam keadaan teratur and terasing seperti berikut: Tajuk, subtajuk, nama pengarang, editor, illustrator, translator, place of publication, penerbit and tarikh penerbitan.*

19. Pernahkah anda menggunakan kad katalog di perpustakaan untuk mancari buku?

    ❑ Ya
    ❑ Tidak

Jika *Tidak*, terus ke soalan 23.

20. Apakah pendapat anda berkenaan dengan kad katalog?

| Tidak berguna | | Sedikit berguna | | Sangat berguna |
|:---:|:---:|:---:|:---:|:---:|
| 1 | 2 | 3 | 4 | 5 |

21. Berapakah kerapkah anda menggunakan kad katalog?

| Tidak pernah | Jarang | Kadang-kala | Selalu | Kerap |
|:---:|:---:|:---:|:---:|:---:|
| 1 | 2 | 3 | 4 | 5 |

22. Adakah anda selalu berjaya dalam mancari buku menggunakan kad katalog?

| Tidak pernah | Jarang | Kadang-kala | Selalu | Kerap |
|:---:|:---:|:---:|:---:|:---:|
| 1 | 2 | 3 | 4 | 5 |

23. Jika dipilih pilihan, anda lebih suka menggunakan kad katalog atau katalog komputer?

- ☐ Kad katalog
- ☐ Katalog komputer

Sebab: _____

_____

24. Di antara dua bahasa berikut, bahasa manakah yang akan anda pilih sebagai bahasa (tidak kira kad katalog atau katalog komputer)?

- ☐ Bahasa Melayu
- ☐ Bahasa Inggeris

Sebab: _____

_____

# Analysis of Questionnaire

There are 40 respondents, which consists of 2 teacher/staff, 2 system administrator of school Resource Center and 36 of students from Form 1 to Form 6. 40% (16 people) of respondents go to school library more than 1 time every week. 50% (20 people) of respondents go to school library more than 1 time every month. And the rest, 10% (4 people) of respondents, the frequency of visiting the library is more than 1 time per year.

65% of respondents go to the library with the main purpose of finding the reference books. 15% of respondents with the purpose of doing homework in library, 10% prefer reading story books, 5% because they have their duty in library and the rest of 5% just follow their friends to the library.

More than 75% of the respondents found that the library is not fulfilling the requirement and need of the user.

Sekolah Menengah Agama Persekutuan, Kajang (SMAP) is using the automated library system. So, the school (18 respondents) is using the cataloging system. 22 respondents from Sekolah Menengah Seksyen 9, Shah Alam argued that they have not used the cataloging system before, as their school doesn't have the automated library system.

## Part A *(18 respondents answered this part)*

From the 18 respondents who have used the cataloging system, 16 of the respondents know the way of using the cataloging system through the learning lesson and practice session. While the rest, get the lesson from their friends. Almost all the respondents found the searching by typing the search string are not difficult. 16 respondents would prefer finding the subject, following by the using of keyword, title and author. While 2 respondents would search the title, following by the author, subject and keywords.

8 respondents got everything they want from the searching through computer. And the rest got everything more than they wish to have. More than 80% of 18 respondents wish

the system would have the mailing and printing capabilities. While the rest, would like to see the school bulletin through the cataloging system. All the respondents found satisfied in using cataloging system, as they never faced the problem like 'system down'.

**Part B** *(22 respondents answered this part)*

All the respondents know about the catalog card. 16 respondents have used the catalog card before in library to search an item. They found quite useful using the catalog card. The frequency of using catalog card in library is quite low, that is 80% of the respondents are not using the catalog card frequently. They found the searching is successful sometimes. If they are given two choices (catalog card and cataloging system), 100% of the respondents are preferred using the cataloging system. Between English and Malay, 70% of the respondents wish to choose Malay as the catalog language as they can understand better than English. 30% of respondents wish to have both languages as the catalog language with the reason they want to learn the English besides Malay.

# References

1. Official PowerBuilder 6 Advanced Tools for the Enterprise, Second Edition, Derek C.R. Ball, International Thomson Publishing Company, 1997

2. Advances in Library & Information Science Volume 1, Computer Application, 2nd Edition, D.C.OJHA, Scientific Publishers, Jodhpur/India, 1995.

3. Modern Library Practice, Sheita Ritchie, ELM Publication, 1982.

4. An Integrated Approach to Software Engineering, Pankaj Jalote, Springer-Verlag, 1991.

5. Choosing an Automated Library System, Joseph R. Matthews, American Library Association, 1982.

6. Procedures for Library Media Technical Assistants, Barbara E. Chernik, American Library Association, 1983.

7. Computer Systems in the Library, Stanley J. Swihart, Beryl F. Hefley, Melville Publishing Company, Los Angeles, California.

8. Using PowerBuilder 6, William B. Hayes with Charles A.Wood, Que Corporation, 1998, United State of America.

9. System Analysis And Design, Kenneth E. Kendall, Jualie E. Kendall, 4th Edition, Prentice Hall International, Inc, USA.

10. Simple Library Automation System(SLAS), Goh Wei Siong , Degree of Computer Science, University of Malaya, 1998/1999.

11. Smart Library System (S.L.S), Jamie Azma bt Jamaluddin, Degree of Bachelor of Computer Science, University of Malaya, 1998/1999.

12. Malacca.National Semiconductor Resource Center, Ong Tek Imm, Degree of Bachelor of Computer Science, *Universiti Kebangsaan Malaysia*, 1998/1999.

13. www.softseek.com

***************** *Terima kasih atas kerjasama anda* ******************