ELECTRONIC LIBRARY SYSTEM (ELS)

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Abstract

Electronic Library System (ELS) is a web based automation system which digitized manual library. Internet plays a great role in determining the prospect of ELS. Web based system not only allow remote users to access the database of the library but also its enable the users to make use of the services provided by ELS. Therefore it is the perfect automation to convert a manual to a computerized library.

The main objective of this system is basically about transforming the current manual system to the digital library. Besides upgrading and improving the overall performance of the system, this system will enable easier retrieval of information from remote location using the Internet.

The functional requirements for this system are the Acquisition module, Cataloging module, Circulation module and the OPAC system. Besides, there are also several non-functional and general requirements.

There are a lots of tools available on the market today. After considering numerous reasons, Microsoft Interdev, Macromedia DreamWeaver as well as TextPad is chosen as the development tool, Microsoft SQL server as the database management system (DBMS), Internet Service Manager as the server management.

The methodology used to develop this system is the Model Driven Development Route which involved several systematic steps.

With all the careful planning and design, this system hope to be able to turn problem to solution and most importantly it can be used as a guide in the future.

Acknowledgement

I would like to deeply thank the various people who, during the several months in which this endeavor lasted, provided me with useful and helpful assistance.

First, I would like to express my gratitude to my personal supervisor, Puan Abrizah for her dedications and contributions in helping me to develop a better understand of ELS. To, my moderator, Puan Nor Edzan, I would like to say thank you for giving me a chance to demonstrate my ability to 'sell' my system through VIVA.

I would also like to convey my deepest gratitude to my senior, Mr. Lee Joo Hong for his advice and guidance. Without him, it is impossible for me to complete this project.

Many thanks also to my family and friends in university for their undying support and encouragement which give me the spirit to continuing doing what I am supposed to do.

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Chapter 1: Introduction

1.1 Background

The purpose of this introductory chapter is to provide some general Information and understanding about an automated library system. Basically this system is about transforming the whole library system from a manual to a computerized library. This is also known as digitizing the entire library system. We can see it as converting the catalog card of the library to an electronic database. The converted library is called Electronic Library System (ELS).

1.2 Why ELS (Web-Based)?

There are many reasons why a web based electronic library system is developed. We can see this as automated vs. manual system and web based vs. non-web based. At first glance, it seems that the obvious advantage of automation over traditional manual creation methods is greater efficiency, which, in turn, results in lower cost, and libraries that are available sooner. (www.cadabradesign.com)

The most substantial benefit is that more than one type of library can be created per process. The automation of library creation enables the development of more library solutions to meet the diverse needs of individual projects.

Internet plays a great role in determining the prospect of ELS. Web based system not only allow remote users to access the database of the library but also its enable the users to make use of the services provided such as reservation of books and searching for index. Beside this, developing a web based library system ensure

that users all over the world can share the information which is only available in that particular library.

1.3 Objectives/purposes of the system

An objective is a written statement that can assist in eliminating any ambiguity or uncertainty and provides a reference and focal point for the work to be undertaken. The statement of objectives should be clear, unambiguous and specific. It outlines the end results towards which achievement should be directly or specifies what is expected to be accomplished in an endeavor to develop the new system.

We can see the objective in 2 different angles; the administrator side and the patron/user side.

Objectives for the Administration:

a) Upgrade and improve the efficiency and effectiveness of the present circulation and acquiring system.
b) To ensure the accuracy in the process of reserving and updating of the reading materials.
c) To facilitates on-line library cataloguing thereby creating a bibliographic database.
d) Provide better control of the materials

Objectives for the Patron:

a) To enable fast and easy retrieval of the items from OPAC and bibliographic database.
b) To establish a consistent and user friendly GUI (Graphic User Interface)
c) To establish a flexible fine system

Hence, to achieve all the objectives above, the researchers need to develop the followings:

I. Develop a web-based system, which enable users to do searching and perform other services such as reserving books.
II. Develop a friendly user interface (GUI) for both users and administrators.
III. Develop a stable and reliable database for all information retrieval.
IV. Develop an accurate and effective system in order to maintain the efficiency of the system.
V. Develop a more robust system.
VI. Develop an easily accessible system so that accessing the OPAC will be hassle free.

1.4 Scope/limitation of the project

This is a small-scale project and the system is only suitable for public or special library's use. There will be only four modules involved in this project, which are the acquisition, cataloging, OPAC and the circulation of the reading materials.

In the acquisition module, the matter that is related to ordering, purchasing and invoice related will NOT be included in the system. Besides that, payment of the purchase books will NOT be included in the system as this system tend to focus on the library and users' part and not about determining how the library get their resources.

In the catalogue module, downloaded catalogue will not be included in the library as this is purely and independent system and not a shared one. The catalogue department will focus more on data entry and also categorizing of the reading materials.

There will be three main parts in the OPAC module: The administrators, the librarian and the users. Basically the administrators OPAC will include the acquisition window, the cataloging window, users' detail and etc. The librarian side will contain all the windows except the maintenance window. As for the users' OPAC, it is mainly the GUI on the browser when they log into the system.

As for circulation module, since users can only reserve books and not loaning them, therefore, the system only need to keep track of the reserve slots permitted for each user, check whether that particular material is in the library stock.

1.5 Advantages gained from the system

ELS is anticipated to have the following advantages are:

a. Reduced the operating cost of the current catalog card system.
b. Capability to expand existing services through Internet without additional staff and to improve performance times of operation.
c. Improved accountability for and control over information materials, records and services.
d. Accept information in digital form, accurately.

e. Operate in high speed measured in terms of milliseconds, microseconds and even nanoseconds.

f. A hassle free system for users and the administrators. Users benefits from the OPAC system, which make navigation easy and administrators, can easily update the reading material through acquisition and circulation function available in this system.

g. Easier and faster retrieval of items

h. Accurate and up-to date information on reading materials for both the users and administrators.

i. Searching and locating the reading materials is just within a click of a button.

1.6 Hardware and software

An indispensable resource to design and develop an electronic library system is computing power furnished by powerful software.

Hardware:

a. IBM computer PC with at least a Pentium II processor or higher with Window 2k or 9X preloaded.

b. At least 128MB of RAM.

c. 3 ½ floppy drive

d. 12X Cd-Rom drive or higher

e. At least 600MB of free hard disk space.

Software refers to a collection of computer instructions or program necessary to drive a computer system.

Software:

Development tool:	Microsoft Visual Interdev
	Microsoft Personal Web Server
Graphic:	Microsoft FrontPage/Macromedia Dreamweaver
	Adobe Photoshop
Database:	Microsoft SQL
Documentation tool:	Microsoft Words
	Microsoft Powerpoint

1.7 Project Schedule

A project schedule is a way of planning work in order to manage it more effectively. Figure 1.1 shows the project schedule for this project.

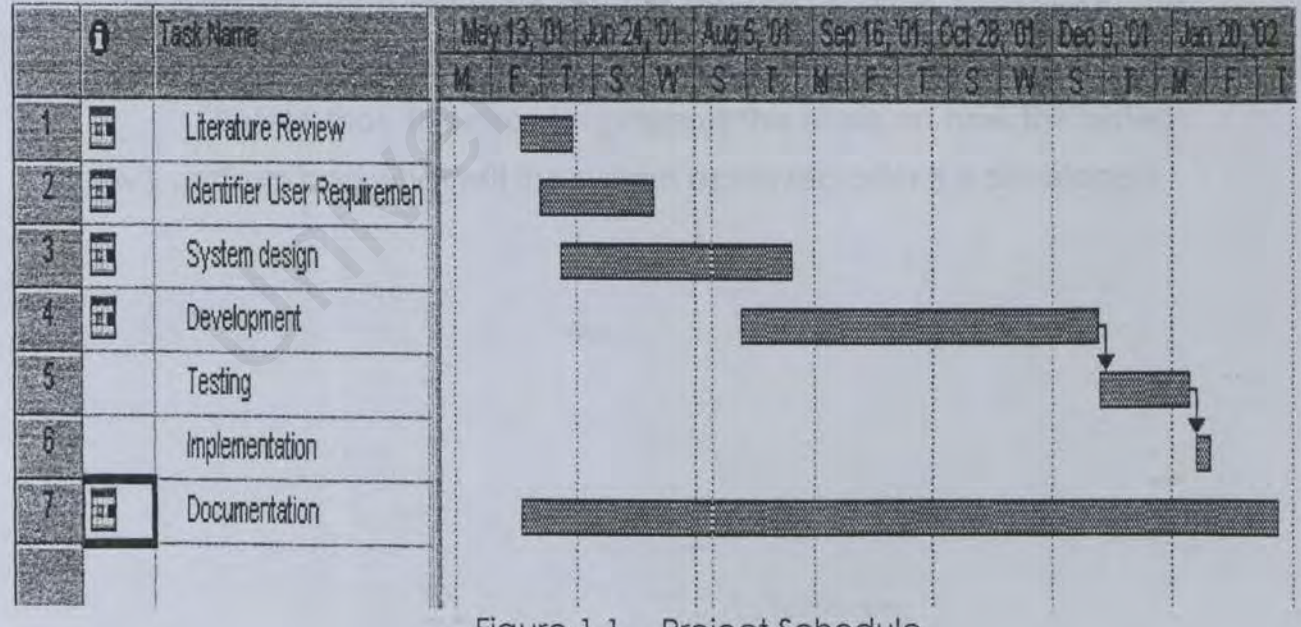


Figure 1.1 Project Schedule

1.8 Definition

ELS is developed for public library or other small-scale library system. ELS is an acronym, which stand for Electronic Library System.

ELS is and organized set of activities, tasks or operations preformed on the information, library materials or other reading materials to achieve a specific end result or objective to make searching, locating, reserving, circulation, acquisition and managing a library system more efficiency by digitizing it. In this system, human and computer share the responsibility for performing the work.

1.9 Summary

Chapter one presents the overview of ELS. It is an Internet cum computer based library system that developed and integrated into the library organization in an effort referred to as a system project.

From this chapter, the advantages, the scope, the objectives, the hardware and software that are required in order to develop the system is known.

Beside that, this chapter presents the hope on how the system will perform and what will the system achieved after it is developed.

Chapter 2: Literature Review

2.1 Introduction

The present day libraries are not only providing text related materials. It would not be over the line if we can catalogue libraries as multimedia provider due to adoption of technological advances and changing nature of their services. This is true based on the fact that libraries nowadays interact with other material such as graphic, video, animation and other non-text materials. If we look into past, we find our libraries have tremendously transformed themselves to merge into present technological environment. It is a fact that almost all types of 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, which is quite true.

Majority of libraries in developed countries as well as in this country have adopted the similar sophisticated techniques to automate their systems and services. In fast, it has become a trend or we can put it as necessary and inevitable need to provide efficient and fast information retrieval services through automation and "online" in this information era.

2.2 The library System Hierarchy

The hierarchy levels of ELS is shown in figure 2.1 below:

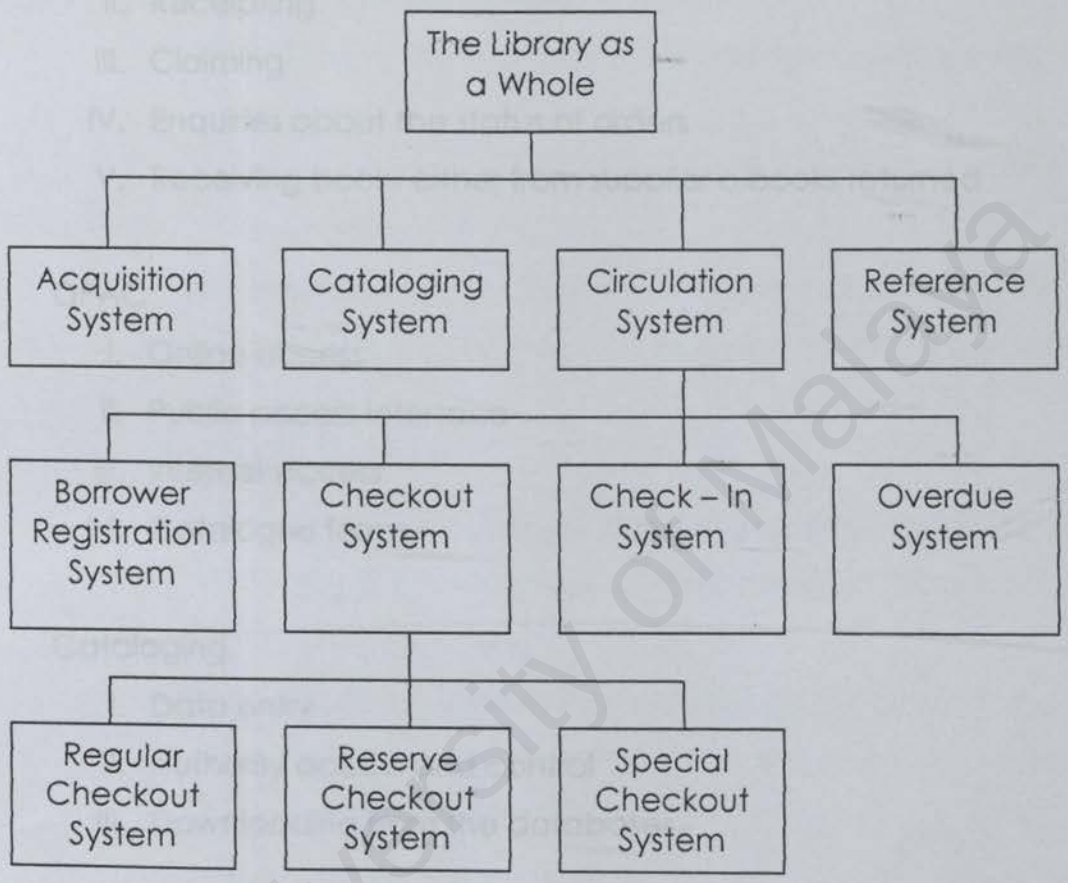


Figure 2.1 The Hierarchical levels of systems of a library

Basically, this soon to be developed system has 4 main modules:

a. Circulation
   I. Reservations
   II. Borrower file maintenance
   III. Enquiries on books

IV. Update of the book status whether it is available

b. Acquisition

I. Ordering
II. Receipting
III. Claiming
IV. Enquiries about the status of orders
V. Receiving books either from supplier o books returned

c. OPAC

I. Online access
II. Public access interface
III. Internet access
IV. Catalogue forms

d. Cataloging

I. Data entry
II. Authority access and control
III. Downloading from the databases

The basic function of each module is:

a. Acquisition

I. Controlling items received
II. Generating selected input data to the cataloging department
III. Maintaining records of the number and type of acquisition activities.

IV. To establish whether the items requested are already in stock or on order.

b. Cataloging

I. Management system for new items
II. Retrieving the existing item's information for viewing and updating
III. History of the item such as the properties/information of the books.
IV. Additional new data items to be included in the new system for monitoring, tracking and reporting purposes

c. Circulation

I. Management system for borrowing and returning
II. Recognize and possibly trap reserved books on their return from loans
III. Keep records of the number of books on reserved and bar that particular student from reserving unless he clears up his present one.

d. OPAC

I. Management system for retrieving information depends on queries
II. Query items based on search categories
III. Act as interface between the system and users.

Each module will be discussed in detail what each module has to perform in order for the system to work.

Acquisition

Acquisition functions which libraries automated include the following:

a. Ordering
    I. Generate order from content where possible
    II. Print purchase orders to suppliers
    III. Print bid lists or generate trial title lists for the library selection committee
b. Receiving
    I. Control item received
    II. Notify overdue items from suppliers
    III. 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 purchase order
d. Input the Cataloging
    I. Generate selected input data to the cataloging department

Computer processing for acquisition of books, technical reports and other reading materials is similar.

Cataloging

Cataloging is very closely related to Online Public Access Catalog (OPAC). Currently, most libraries still use OPAC for information retrieval purpose. OPAC allowed member of the library 's public to search the catalogue database in order to see if the library holds a particular items, to be informed of its location.

The objective of any computerized cataloguing system is to create appropriate catalogues. To this end, records my be drawn from any of the following sources:

I. Commercially available files of MARC records
II. A union file of stock of several libraries or another shared database.
III. Local cataloguing
IV. The library's ordering and acquisitions system

Key features in cataloguing module are:

I. Data entry
II. Downloading and
III. Authority control

Data entry for local creation of records is important. This is usually for a system to use the same record for the ordering and acquisitions function as I used in the cataloguing module.

Record from external databases may be added from tape, or by downloading direct from the files of the bibliographic utilities or from CD ROM.

Authority control is very important where the form of index terms or heading such as author heading, or subject index terms need to be controlled. Library maintains an authority file in order to improved consistency in indexing.

Circulation

The circulation department is the most important department in a library system. It is the one department that patrons usually come into contact with every visit. Therefore, the entire library rules, procedures and personnel should be directed towards making this contact a satisfying one.

Some of the functions preformed by circulation department are:

a. Identify the materials charged out
b. Identify borrower
c. Provide means of recalling the overdue materials
d. Provide and efficient reserve system
e. Identify delinquent borrowers
f. Provide an effective reserve system

The recent technology related to circulation department is the automation circulation. By using the computer's capabilities of adding and deleting data and storing information for future access, a library may be able to increase its efficiency as well as service.

The computer can manipulate the circulation information in any order so that circulation lists can be printed out. The computer can prepare overdue, fine (if the library have such rules) and reservation of reading material. All this capabilities help the library to serve its patron better.

Most automated circulation systems also provided features not available in other non-automated circulation system. Online system can often indicates that a borrower is eligible to reserve books. However this system is too costly for small-scale library to impose.

Besides that, data capture devices such as light pen or laser scanner using bar codes allowed documents and user number easily read so that loans and other transactions can be completed.

Online Public Access Catalog (OPAC)

The OPAC modules usually come with some default OPAC that can be used as a starter. Most libraries will prefer to take the opportunity to tailor the OPAC to their specific library and there is usually provision for individual library OPAC design.

The library can identified special menus for staff and users, dialogues as well as help menus. Often staff can bypass menus and to display information not available to public.

Most systems offer both phrase and keyword searching. With phrase searching there is usually implicit right hand truncation and for keyword searching, a truncation symbol is normally input if required. Keyword searching may be available across all fields or maybe limited to certain fields. Other search facilities offered are various and differ from system to system such as Boolean operators ('AND' and 'OR').

Once a record have been identified there are number of ways to display them. Some system display the index or a listing of brief records before showing the details or other, if there is only one match will show the details record directly.

A number of OPAC allowed and offer access to the Internet, through the same interface as is used for searching the library catalogue.

In order to fully understand the standard and the system itself, several existing have been review in details:

1. NOTEbookS (http://www.rasco.com/prod1.html)

I. A state-of-the-art corporate library management system that runs on Domino and Lotus Notes.

II. Developed by Robert A. Schless & Co. Inc.
III. An easy, low risk path to integrate cataloging, research, serials management and acquisitions into LOTUS NOTES information infrastructure.
IV. It leverages Information Services' investment in technology and training
V. It leverages your patrons' familiarity with the Notes interface and features. In works for your Intranet users as well as your Notes users
VI. Written in LOTUS NOTES Version 4, is a full featured library automation and research system
VII. All NOTEbookS screens are designed to make researching easy for both patrons and for professional researchers. All databases take advantage of Notes' full text search engine for every word in every field in every document, including many attached documents. In addition NOTEbookS is fully integrated with the Internet, so links are as easy as including a URL within a document.
VIII. One main navigator is used throughout NOTEbookS. This provides an easy entry point for patrons, should they wish to browse existing research, catalogs, or serials documents

2. Surpass (www.surpasssoftware.com)

I. Surpass is a full-featured suite of applications that is smoothly automating all the day-to-day functions of hundreds of libraries and media centers.
II. Surpass is an effective automation solution for primary and secondary school districts as well as for public, college, corporate, and other specialty libraries

III. Developed by surpasssoftware

IV. It's a complete suite of applications ideal for automating for the first time or for upgrading to from other packages

V. Respected software reviewer ZDnet.com recently gave Surpass its highest rating and said, " This neatly integrated database application handles your materials list, patron register, and circulation ... [including] reserves, renewals, holds, and more with the fully customizable local policy options....

VI. Include:

Surpass Central - Circulation, administration and cataloging functions are quick and easy to learn in Central. Surpass Safari - Searching your Public Access Catalog is a pleasure for patrons when you have Safari. Surpass Shuttle - Portable scanners and Shuttle let you efficiently inventory your collection while items are still at home in the stacks. Surpass Web Safari - puts your collection on the Web InterCAT - Get free MARC records from the Internet by Z39.50 technology with InterCat. **Figure 2.2 shows one of the interface in surpass.**

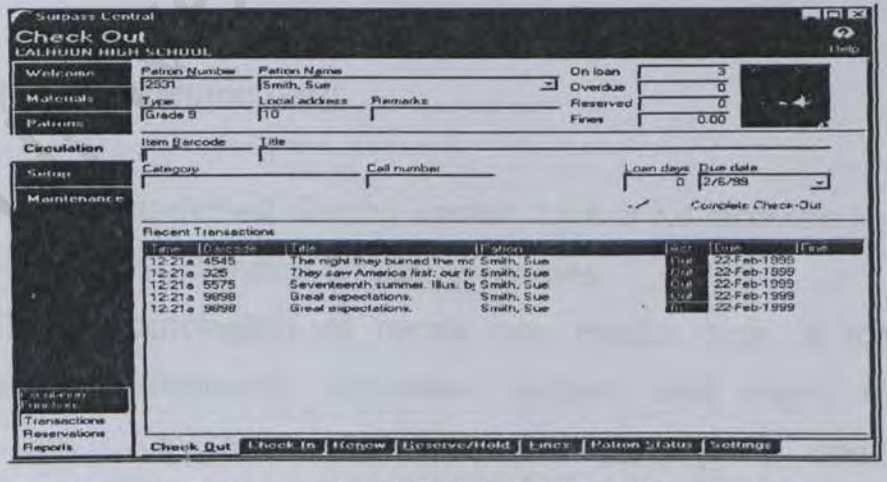


Figure 2.2 CheckOut Interface for surpass

3. Bookmaster (http://www.cadomel.com/)

I. BookMaster is an affordable, easy-to-use library system which is suitable for small general libraries of all kinds. It can handle up to 99,999 volumes and 999 users.
II. Available in 2 version: Bookmaster plus and Bookmaster
III. Stock searches can be by keyword, title, author, series and subject heading
IV. Can operate a loans service, and print overdue reminders by group or for individual students
V. Use barcodes to speed data entry and ensure accuracy.
VI. BookMaster Plus (catalogue, search and loans)
VII. BookMaster(catalogue and search only)
VIII. Fully featured with catalog, loans, reservation and reports
IX. Easy-to-use system of menus
X. Passwords protect your data and control access to different parts of the system
XI. Search by keyword, title, author, subject heading, class number and publisher's series

4. PAL v3.3 (http://www.neuton.net/)

I. PAL (Perfectly Automated Library) version 3.3 is a full-featured library automation system intended for school libraries.
II. It provides for cataloging of nearly any media type, a robust barcode-driven (optional) circulation system, and many more features, such as ready-reference, and periodicals check-in capability

III. PAL Library Automation Software is designed to accommodate the creation of hundreds of new database records on a daily basis

IV. Developed by neutron corporation

V. When databases get large (many thousands of records) indexes should be regenerated periodically (say, once a month or so) to improve performance

VI. Uses password as a form of security

VII. Figure 2.3 below shows the main menu for PAL v3.3

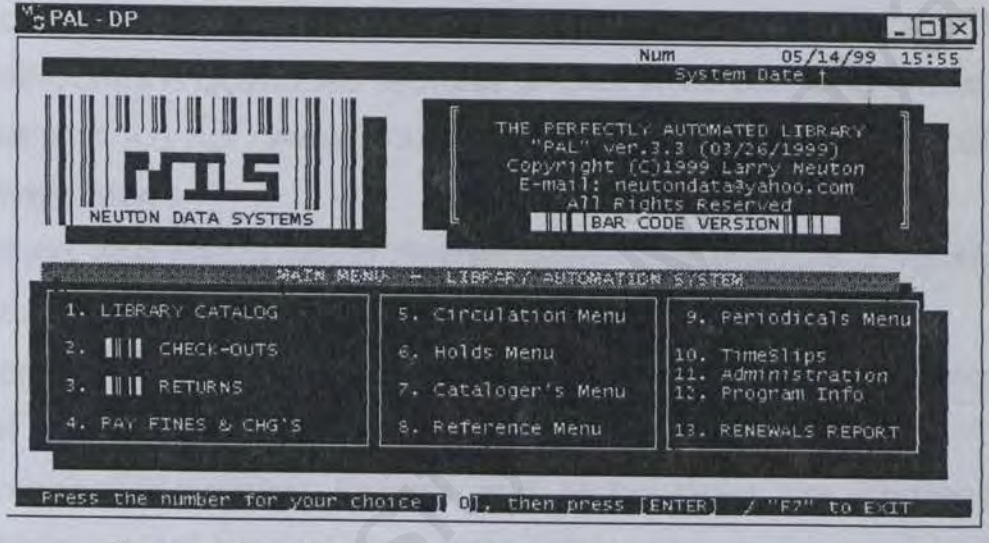


Figure 2.3 Interface for PAL v3.3 Main Menu

5. Virtua (www.vtls.com)

I. The Virtua ILS is a comprehensive client-server software solution that allows a developer to offer their patrons the latest technology for accessing information around the globe. Offering numerous advanced features in an integrated solution, Virtua ILS helps you manage your library's collections.

II. Improves workflow management for your library staff and provides powerful, flexible and convenient access to distributed multimedia information

III. Graphical user interface (GUI) client also furnishes an intuitive, familiar work environment with the use of tabs and floating menus and many additional access points, allowing quick travel through the database

IV. Virtua system design goes beyond the traditional two-tier client server architecture to a three-tier client server architecture. This architecture embraces the advanced features of UNIX while providing increased performance not always found in other two-tier, UNIX-based client server systems

V. Virtua's Acquisitions has a flexible design that supports a variety of repetitive, as well as integrated,

VI. Workflows is made easy through pull down menus and a right click of the mouse

VII. Emerging information formats and technologies are challenging catalogers to expand their talents into new areas, and Virtua's cataloging system has been specifically designed to help meet these challenges

VIII. Workflow flexibility and functionality are optimized in the Virtua Circulation system. Staff and Patron Views and patron circulation privileges are just a few of the customized options and features that give your library the flexibility to adapt circulation procedures to your operational environment

IX. Virtua's Online Public Access Catalog (OPAC) provides the end-user with an efficient, easy and quick way to access your library's catalog. Virtua's OPAC offers four types of searches: Browse, Keyword, Control

Number, and Expert. To further refine search results, users can employ the use of filters in Keyword searches.

6. DB/Text WebPublisher (http://www.inmagic.com/sol_libauto.htm)

I. The Interactive Web Library Solution provides information professionals not only a way to publish their Library Catalog on the Web but also enables end users to submit requests for internal information in one central area and rate or review journals, books, reports...all from a Web browser
II. The powerful combination of Interactive DB/Text *WebPublisher*, and DB/Text *for Libraries* provides information managers with ready-designed OPAC layout forms and screens - making it easy to mount your Catalog on your Intranet or the Web
III. Developed by Inmagic
IV. DB/Text *for Libraries* predefined textbases, query and edit screens (some with scripts), and display and report forms help you organize information about your library collection, library users and suppliers

7. iBistro (www.sirsi.com)

I. iBistro™ helps you "build" an e-Library □, accessible anywhere via the Internet, to deliver personalized, high quality knowledge and resources directly to library users.
II. Perform online all the functions of the traditional library, plus many more available in today's digital world
III. Information from any online source can be managed and shared by librarians with their users, making more useful knowledge available to users than ever before

IV. Cataloging

iBistro capitalizes on and adds value to the efforts that catalogers invest in cataloging materials by harnessing standard cataloging information, such as descriptive cataloging, subject cataloging, and classifications. With this information iBistro presents the results of a traditional broad Web-style search, but in context of all the access points the cataloger has entered, for more usable results. For example, a standard search on psychology might return 5,500 items. iBistro analyzes the cataloging of these returns and presents them in manageable, intuitive groupings so users can discover the knowledge they seek. This bonus for users is based entirely on the information catalogers' have already provided and serves novice and sophisticated users alike.

V. Acquisitions

iBistro offers opportunities for users to participate in and follow the acquisition process. Through options on the iBistro interface, users can request a particular title they would like the library to acquire. iBistro can manage the demand for these items and then signal the acquisitions group when copies need to be ordered. Users can request a notice when items of a particular subject, title, or author are acquired by the library. This entire process is automated, requiring no extra effort on the part of the library.

VI. Circulation

iBistro provides a whole suite of demand management functions that aid users with ease and speed to see the availability of items and provide accurate estimates of when checked-out materials will be available again. Users can take advantage of an iBistro option to request unavailable items. iBistro then manages these requests

automatically, notifying users of both the availability of the requested item and the number of people whose request for this item is ahead of theirs.

8. L4U 2000 (http://www.L4U.com)

I. Provides quick access to critical circulation data.
II. Immediately displays all items currently on loan to the active client: Overdue items are shown in red, and active items are shown in bold blue type
III. Speeds up circulation activities at a busy circulation counter
IV. Developed by Kelowna Software Ltd.
V. Provides an easy to read layout of information, and a variety of sounds that can be specified for incoming and outgoing items as well as for alert messages
VI. Both the layout and the functionality of the Preferences module have a simple user interface and contain many customizable features. The preference screens are easy to read and allow changes to settings and configurations to be made quickly and easily to tailor L4U 2000 to meet the specific needs
VII. Simplifies the management of data. To enter new records in L4U 2000, simply click the "Add Item" button
VIII. Acquisitions Screen has a layout that makes adding new items quick and easy. Smart Typing and subject authority records help maintain data integrity. Subjects can be added to new acquisitions by simply using a drag and drop feature. Acquisitions can be updated with speed and ease. Figure 2.4 shows one of the interface in L4U; the advanced booking interface.

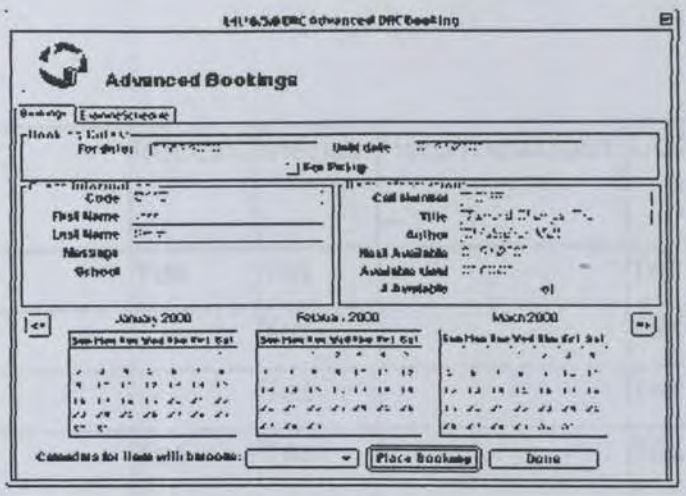


Figure 2.4 Advanced booking interface for L4U

The table (table 2.5(a) to table 2.5(e)) below shows the analysis and comparison of 8 systems that is being reviewed.

System	Web based	Catalog	Loans	Reservation
NOTEbookS	Yes	Yes	Yes	Yes
Surpass	Yes	Yes	Yes	Yes
Ibistro	Yes	Yes	Yes	Yes
L4U 2000	Yes	Yes	Yes	Yes
DB/TEXT Web Publisher	Yes	Yes	Yes	Yes
Virtua	Yes	Yes	Yes	Yes
PAL v3.3	Yes	Yes	Yes	Yes
Bookmaster	Yes	Yes	Yes	Yes

Table 2.5(a) Comparison between various systems

System	Reports	Menus	Help messages	Catalogue searches
NOTEbookS	Yes	Yes		Yes
Surpass		Yes		Yes
Ibistro		Yes		Yes
L4U 2000	Yes	Yes		Yes
DB/TEXT Web Publisher	Yes	Yes		Yes
Virtua	Yes	Yes	Yes	Yes
PAL v3.3		Yes		Yes
Bookmaster	Yes	Yes	Yes	Yes

Table 2.5(b) Comparison between various systems

System	Password	Keywords search	Acquisition	OPAC (online)
NOTEbookS	Yes	Yes	Yes	Yes
Surpass	Yes	Yes	Yes	Yes
Ibistro	Yes	Yes	Yes	Yes
L4U 2000	Yes	Yes	Yes	Yes
DB/TEXT Web Publisher	Yes	Yes	Yes	Yes
Virtua	Yes	Yes	Yes	Yes
PAL v3.3	Yes	Yes	Yes	Yes
Bookmaster	Yes	Yes	Yes	Yes

Table 2.5(c) Comparison between various systems

System	Circulation	Catalog forms	Purchasing forms
NOTEbookS	Yes	Yes	
Surpass	Yes	Yes	
Ibistro	Yes	Yes	
L4U 2000	Yes	Yes	
DB/TEXT Web Publisher	Yes	Yes	Yes
Virtua	Yes	Yes	
PAL v3.3	Yes	Yes	
Bookmaster	Yes	Yes	

Table 2.5(d) Comparison between various systems

System	Circulation forms	MARC import
NOTEbookS	Yes	Yes
Surpass	Yes	Yes
Ibistro	Yes	
L4U 2000	Yes	Yes
DB/TEXT Web Publisher	Yes	
Virtua	Yes	
PAL v3.3	Yes	Yes
Bookmaster	Yes	Yes

Yes=Applied to the system.

Table 2.5(e) Comparison between various systems

2.3 Summary

Chapters 2 present all the modules in details. Acquisition, cataloging, circulation and OPAC are the modules discussed in this chapter and each of the modules needs to be understand clearly before proceeding to the next chapter.

Besides that, chapter 2 also presents all other external requirement such as software and hardware needed for the development of the system.

A review on current and existing system has to be made to understand the current market standard and apply them to this system.

The following chapter will present the methodology and the system analysis used to develop the system.

Chapter 3: Methodology/System Analysis

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.

3.1 Methodology- Model Driven Development Route

One of the oldest and most commonly used approaches to analyzing and designing a system particular an information system is based on modeling.

Modeling is the act of drawing one or more graphical representation of a system (System Analysis and Design Method, Lonnie D.Bently). Modeling is a communication technique based on the old saying" a picture worth a thousand words" (Jeffrey L. Whitten, 1970)

Model driven development (MDD) technique (System Analysis and Design Method, Lonnie D.Bently) emphasizes the drawing of models to help visualize and analyze problems, define business requirements and design information systems.

There are 8 important phases in MDD namely

a. Preliminary investigation
b. Problem analysis
c. Requirement analysis
d. Decision analysis
e. Design

f. Construction
g. Implementation
h. Operation and support

1. Preliminary Investigation Phase

The purpose of this phase is twofold. First, it would answers the question," is this project worth looking at". Second assuming that the project is worth looking at, the preliminary investigation phase must also establish the project the project charter that establish scope, preliminary requirements and constraints, projects participant, budget and also schedule.

From preliminary investigation phase, one can determine the scope and outcome of the project. Scope defines how big is the project. Given the initial scope of the project, one can determine and estimate the budget and time for the system development and prepare a schedule for the remaining phases. (System Analysis and Design Method, Lonnie D.Bently)

2. Problem Analysis Phase

There is an old saying that suggests, "don't try to fix it unless you understand it". With those words of wisdom, the problem analysis phase provide for a study and analysis of the existing system. There is always an existing system, regardless of whether it currently uses a computer. The problem analysis phase provide me with a more thorough understanding of the standard and problem that might

occur during the designing of the system. (System Analysis and Design Method, Lonnie D.Bently)

Existing system is studied by collecting factual information from all kind of resources and also from the system user itself. From all this information, one can get a better understanding of the standard and problem of the existing system.

Every existing system has its own history, terminology, culture and nuances. Learning all those is the objective of this phase.

The primary deliverable of the problem analysis phase is system improvement objectives, these objectives do not define inputs, outputs or processes. Instead they define the business criteria on which any new system will be evaluated.

After reviewing all the current system and got a better understanding of each system, one can determine whether or not he/she can solve the problem that might occur during the development of the propose system. He/she can expand or reduce the scope depending on the requirement and standard and then approved to continue to the next phase.

3. Requirement Analysis Phase

Requirement analysis phase is an important phase because this phase is to define and prioritize the system requirement. This is perhaps the most important phase of the methodology. Errors and omissions in requirements analysis result in incomplete system and worth, the system couldn't be ready in time.

Essentially, the purpose of the requirements analysis is to identify the data, process and interface requirements for the new

system. Most importantly, the purpose is to specify this requirement without prematurely expressing computer alternatives and technology details.

From the data collected from various resources such as surfing from the Internet, users of existing system, questionnaires, interviews etc., one can collects and determine the requirement and prioritize. All these requirement need to be validated and the new system objectives from the problem analysis can provide it.

This phase should never be skipped because nowadays, one of the most common complaints about new systems and applications is that they don't satisfy the standard and user's need. (System Analysis and Design Method, Lonnie D.Bently)

4. Decision Analysis Phase

Normally, to design a system, there are numerous ways to do so. So many alternatives are available in the market today to fulfill those requirements.

Therefore decision analysis phase is the answer to the question. "Which method should I use to development the system". The purpose of this phase is to identify candidate solutions, analyze those candidate solutions for feasibility and choose one as the target solution. (System Analysis and Design Method, Lonnie D.Bently)

First and foremost, the designer solicits ideas and opinion from numerous resources such as from the Web pages on the Internet. After identifying the candidate solutions, each candidate is evaluated by the following criteria:

a. Technical feasibility - is the solution technically practical? Do the designer have the expertise to design and build this system?
b. Operation feasibility – will the solution fulfill the users' requirements?
c. Economic feasibility – is the solution cost-effective and within budget?
d. Schedule feasibility – can the system designed using this solution be implemented in an acceptable time period
e. Risk feasibility – what is the risk involved if the developer to choose this solution?

5. Design Phase

The purposely of design phase is to transform the system requirements statement from the requirement analysis phase into design specification for construction. In other words, the design phase addresses how technology will be used in the new system.

The design phase is concerned with technology-based views of the system's data, processes and interfaces. Design specifications take many forms including written documentation or working computer generated prototype of the new system.

A project is rarely cancelled during the design phase unless it is hopelessly out of the schedule or budget. As for the electronic library system, the developer should use the design phase to make sure that every module is put in to meet the requirement. (System Analysis and Design Method, Lonnie D.Bently)

6. Construction Phase

Given some level of design phase specifications, we can start constructing and test system components for that design. The purpose of construction is twofold: 1. to built and test a system that fulfills all the requirements and design specifications and 2. to implement the interfaces between the new system and the users.

As for the electronic library system, a database, some modules with needed to be applied and the user interfaces have to be constructed.

To do so, programs have to be written and it can be written in many ways and different languages and Microsoft Interdev is chosen to be the main development tool.

One important aspect of construction is conducting tests of both individual system components as well as overall system. Once tested, a system is ready for implementation. (System Analysis and Design Method, Lonnie D.Bently)

7. Implementation Phase

Implementation is all about bring the system to 'life'. It is the phase where the production system is delivered into operation. This is when users asked to test the system by doing what they do the best. The implementation phase usually includes an audit o gauge the success of the completed project. (System Analysis and Design Method, Lonnie D.Bently)

8. Troubleshooting, Operation and Support Stage/Phase

Once the system is operating, it will deliver what it is designed to do but it will still require ongoing system support for the remainder of its life. (System Analysis and Design Method, Lonnie D.Bently)

Before that, troubleshooting is needed to do the final touchup in order for the system to perform optimal.

Figure 3.1 on next page shows the model driven development route.

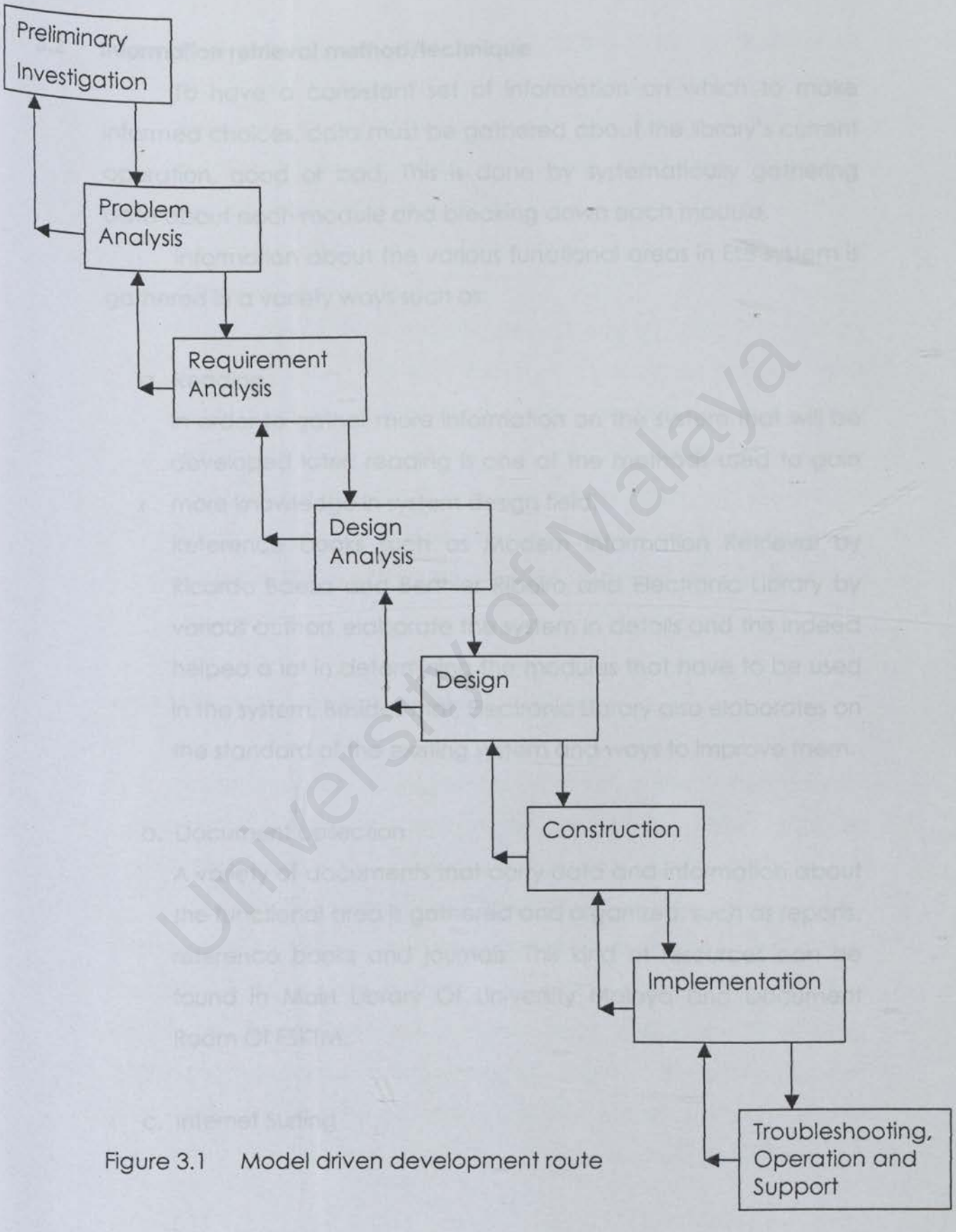


Figure 3.1 Model driven development route

3.2 Information retrieval method/technique

To have a consistent set of information on which to make informed choices, data must be gathered about the library's current operation, good or bad. This is done by systematically gathering data about each module and breaking down each module.

Information about the various functional areas in ELS system is gathered in a variety ways such as:

a. Reading

In order to gather more information on the system that will be developed later, reading is one of the methods used to gain more knowledge in system design field.

Reference books such as Modern Information Retrieval by Ricardo Baeza and Berthier Ribeiro and Electronic Library by various authors elaborate the system in details and this indeed helped a lot in determining the modules that have to be used in the system. Besides that, Electronic Library also elaborates on the standard of the existing system and ways to improve them.

b. Document collection

A variety of documents that carry data and information about the functional area is gathered and organized, such as reports, reference books and journals. This kind of resources can be found in Main Library Of University Malaya and Document Room Of FSKTM.

c. Internet Surfing

Internet surfing can be regarded as the most commonly used tools to gather information. LION (library automation for school library) is an example of a web sites listing all the library automation solution providers. Some interface and screen features are used in developing ELS.

d. Observations

Observation is a continuous process and is usually informal. By observing the current library system, the policies and procedures or 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 a better service when using the library system also can be identified through personal observations.

3.3 System Requirement Analysis/Need Analysis

The information management needs of a library can be very substantially depending both on the type of the library and the various policies that guide the library's planning and operation.

A need analysis does not necessary have to be conducted by a computer system analyst. In fact, the librarian could perform a competent job, provided there is 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 personal from all levels and functions in the library. The analysis seeks to determine and document the

information flows among and between functional activities. Much of the benefit of a needs analysis comes from understanding what is currently going on and making needed improvement. The benefits realized from the introduction of a computer system are often secondary.

General requirements define and establish broad guidelines for the new computer based systems, ELS. 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 adapted to meet the future conditions without complete redesign or noticeable disruption of its operations.

   ELS 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 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.

   I. ELS must be compatible with other automated and manual systems within the library.

II. ELS 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 ELS due to laws, regulations, recommendations or policies of library management, governing authorities or others.

d. Cost Requirements

Cost requirements specify any cost constraints on ELS.

I. The cost of operating the ELS must not be more than the manual system it replaces.

II. ELS must reduce the operating costs after a specified length of time.

3.3.1 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, ELS system are separated into subsystems or modules and separate lists of functional requirements are established for each area.

1. Acquisition System

a. Ordering

I. ELS must be able to print and edit the purchase order

II. ELS must be able to generate order from supplier

III. ELS must be able to retain 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

I. ELS must be able generate automatic follow-up notices

c. Input To Cataloging

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

2. Cataloging System

a. Item Control

I. ELS must be able to control the flow of the item

b. The Bibliographic file

I. ELS must have the ability to add, change or delete bibliographic items records.

II. ELS can have the ability to received the MARC records format

III. ELS 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.

IV. The item record must have-

1. Item location
2. Item cost

3. Item identification no

3. Circulation System

a. Patron Control

I. ELS must be able to provide entry of data collected about patrons during their registration

II. ELS must be able to accept changes, addition or deleting to any data in records in the patron file from the terminals

III. ELS must accommodate up to 2 library designated user types: Administrators and patrons

IV. The patron file contain for each person registered must have:

1. Patron identification no
2. Patron name
3. Address
4. Date of registration

b. Charges

I. ELS must provide for rapid and accurate charging of materials to patrons with a good response time.

II. ELS must permit patron identification no to be entered manually on the keyboard as a method of entering the numbers

III. ELS must check patrons' eligibility to use the library

IV. ELS must check the reserve period for items to be circulated and compute the dates due.

V. ELS must disregard holiday which shall be specified in advance by the library periodically in computing dates due.

c. Discharge

I. ELS must provide a rapid and accurate discharging of materials returned by patrons with a fast response time

II. ELS must be able to erase patron identification no from the bibliographic or circulation files when items have been discharged.

III. ELS must be ale to sense and trap during the discharge process those items which are overdue or with holds or recall placed against them

d. Renewals

I. ELS must complete renewals with or without patron's identification no and with or without the physical items in hand

II. ELS must be able to check for reserve and notify Admin (librarian)

III. ELS must follow all other routines or requirements for charges when renewing loans of materials.

e. Reserves

I. ELS must be able to accept reserves on items in circulation

II. ELS must allow hold/reserves to be changed or cancelled upon request of patron.

4. OPAC System

a. Inquiries

I. ELS must allow rapid determination of titles in the bibliographic file and their location

II. ELS must have a good response time (around 6 sec) for author, title or patron inquiries

III. ELS must enable searches by author, title, subject ad call no

IV. ELS must display "No Posting" message if no matches are located during a search

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

3.3.2 Non Functional Requirement

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

Some of the non-functional requirements are:

a. User friendliness

ELS is designed in such as way that 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 enough in performing its functions and operations

c. Robustness

The system should be robust enough to handle expected and unexpected system failure

d. Response time

The response time for all the searching and other application need to be as short as possible.

e. Flexibility

ELS should exercise a high degree of flexibility

3.4 Software/ Programming Language

1. Microsoft Visual Interdev 6.0

Microsoft Visual InterDev 6.0 provides a complete solution for building dynamic Web applications. Besides that, Microsoft Interdev 6.0 will be able to create Web projects and utilize databases. Microsoft Interdev 6.0 will be able to do the following:

a. Basics—Web, database, and editing basics; walkthroughs
b. Creating Web Projects—project concepts; working locally and with multiple developers; adding security; managing Web projects
c. Designing Sites—Web concepts; designing site navigation; managing a site diagram; viewing and maintaining links; customizing page appearance; adding multimedia

d. Integrating Databases—database concepts; viewing, modifying, and filtering data; working with stored procedures; managing database projects
e. Editing and Scripting—scripting concepts; editing scripts; adding objects; debugging pages; making HTML dynamic; Using ASP pages as objects; integration tasks and concepts; distributing Web applications

Microsoft Visual InterDev 6.0 is the leader in Web tools and technology, and by using it to generated ASP code and pages. It is the most suitable development tool to develop this web based electronic library system.

Dynamic Web sites and Web-based applications can also be developed using the Microsoft Visual InterDev® 6.0 Web development. (http://mspress.microsoft.com/prod/books/1607.htm)

2. Microsoft SQL Server

Microsoft SQL is used to manage the database for the ELS system.

Reasons why it is chosen because:

a. High level statistic
    I. Comparison between Microsoft SQL with Oracle:
    With 9*i*, Oracle has responded to the customer outrage over its megahertz-based pricing scheme. Nevertheless, Oracle9*i* Standard Edition is three times more expensive than SQL Server 2000 Standard Edition, and Oracle9*i* Enterprise Edition is twice as expensive SQL Server 2000 Enterprise Edition. Extensive integrated functionality, platform and tools integration, and ease-of-use

advantages that lead to significant time-to-market gains in application deployment are compelling differentiators in favor of SQL Server 2000. (http://www.microsoft.com/sql/evaluation/overview/2000/fastfacts.asp)

II. SQL Server version 7.0 pioneered the integration of Business Intelligence features (for online analytical processing, or OLAP, and data warehousing) with an enterprise database product. SQL Server 2000 extends these capabilities with integrated data mining. Microsoft is acknowledged by industry observers like The OLAP Report as the fastest growing provider of OLAP functionality

III. Oracle is late to the game in recognizing that customers want databases that are intelligent enough to manage critical resources and perform routine tuning automatically. For several releases, SQL Server had the ability to automatically tune itself based on run-time conditions. As a result, SQL Server requires little, if any, tuning by a database administrator; memory, file sizes, and the I/O subsystem are a few of the items SQL Server manages on behalf of the administrator. Indeed, respected independent groups like Aberdeen have already acknowledged that SQL Server delivers lower total cost of ownership than Oracle, largely because of these capabilities. (http://www.microsoft.com/sql/evaluation/overview/2000/fastfacts.asp)

b. Scalability benchmark

I. SQL Server 2000 delivers scalability for e-commerce, data warehousing, and line-of-business solutions. The table below summarizes a selection of SQL Server 2000 benchmark results for various applications and workloads. Of the 13 results listed, 10 are best on any platform, beating the results of Oracle, IBM, and other database vendors regardless of operating system or hardware.

II. SQL Server 2000 can handle 688,220 transactions per minute! SQL Server 2000 has further established its position as the fastest database in the world. With a performance rating of 688,220 transactions per minute (tpmC) and price/tpmC of $28.89, a 32-node IBM/eServer xSeries 370 systems exceeded the previous record, which was also held by SQL Server 2000.

III. On the Transaction Processing Performance Council (TPC) TPC-C performance list, SQL Server now holds both the number one position and five of the top six results. Microsoft Windows® 2000 holds the top six results

c. High reliability

d. High security

I. SAIC's Center for Information Security Technology, an authorized TTAP Evaluation Facility, has conducted the evaluation of Microsoft's claim that the security features and assurances provided by SQL Server 2000 Version 8.0 running on Windows NT 4.0 Service Pack 6a and C2 Upgrade meet the C2 requirements of the Department of Defense Trusted Computer System Evaluation Criteria

(TCSEC) dated December 1985, as interpreted by the Trusted Database System Interpretation of the Trusted Computer System Evaluation Criteria.

II. SQL Server enforces a DAC policy on its database objects through the standard SQL grant and revoke mechanism. The DAC protection is to the granularity of an individual user and is applied to all database objects including databases, tables, views, columns, and stored procedures.

III. SQL Server performs identification using an already established Windows NT logon. This creates a seamless login for the user and permits easier administration. Administration is accomplished via Enterprise Manager using the Microsoft Management Console (MMC). The MMC is the new user interface and framework for Microsoft BackOffice server management. This shared console provides a convenient and consistent environment for SQL Server and other console administration tools.

Each of the tools chosen to do this project has been reviewed and understands thoroughly. All the tools have been tested and it should be able to assist any developer to develop this system.

3.5 Client/ Server systems

The new system will make use of client server architecture.

A client/server system consists of two different types of computers — client computers and server computers — connected by a network. The client computers are where users do their work. The server computer

controls the data (information, files, or even computer programs) needed to do that work.

Users on client computers use *client software* to request the data they need from the server computer. *Server software* on the server computer receives the requests for data and responds to them. For example, a client application might send a message to the server application asking for all the documents that match a set of criteria; the server application would then respond by locating the appropriate documents and then transferring them to the client computer over the network.

Client/server computing is important because it centralizes the control of data. This is what library system is all about. All the data and bibliographic is centralized in the library main server. The library has a server computer, connected by a network to the Internet. A database on the server computer contains indexes about all the reading materials the library. The server software gives client applications access to this database.

A server's task can be very processor-intensive, especially when a large number of clients are involved. For this reason, the server software usually runs on a high-powered computer. Client computers (in this case, patron's computer) are generally less powerful than server computers, although they have far more memory, computing power, and storage space than the "dumb terminals" used by older networked computing systems. (http://www.quark.com/products/quarkdms/client_server.html)

3.6 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.

Model Driven Development route as the system development methodology is a good choice for ELS. All those phases in MDD is proven and tested and therefore the success of the system is quite high.

All the tools used in developing this system have been well tested to ensure the smoothness in completion of the project. Programs such as Microsoft InterDev and SQL Server can assist developer to design a complete and balanced system.

Chapter 4: System Design

4.1 Introduction

In this phase of the Model Driven Development Route (MMD), activities and preparation of detailed design specification is essential in developing the ELS 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 is correct and accurate.
c) Provides effective input form and screen design so that data can be inputted efficiency into the information system.
d) Designs a flexible and non redundant database for data storing
e) Designs a user friendly OPAC in order to maintain the simplicity uses for patrons and librarian.

Part of the logical design of the information system is devising the user interface. The interface resides between the user and system and therefore it is extremely important. Examples of user interface include output devices such as the screen of the monitor, input devices such as keyboard, mouse and a variety of Graphical User Interface (GUI).

The design phase includes the designing of databases and files. A well-organized database is essential for the accuracy of the data and is the basis for all information system. In this phase, the programmer transforms the information gathered earlier in the

Requirement Analysis Phase into tables in the databases. Besides that, the programmer also works with users to develop the design out (GUI).

Finally the preparation of designing controls and backup procedures is needed. This effort is to protect the system and data and to produce program specification packets. Each packets should contain the input and output layouts, files specifications and processing details such as tables, data flow diagram and system flowchart.

The goal of system design is to transform the requirement defined in the Requirement Analysis Phase into model or representation of all the entity that will be built later.

4.2 Program design

ELS is divided into 3 types of access:

a) System administrators

System administrators have full access to the entire system. This system consists of all the acquisition modules, cataloging modules, circulation modules, OPAC modules, edit modules, maintenance modules and bulletin & feedback modules as well as report module.

b) Librarians

Librarians can access the entire system as well except the edit modules, System Access sub modules and System User sub module.

c) Patrons

Patrons only can access the OPAC modules, bulletin and feedback modules.

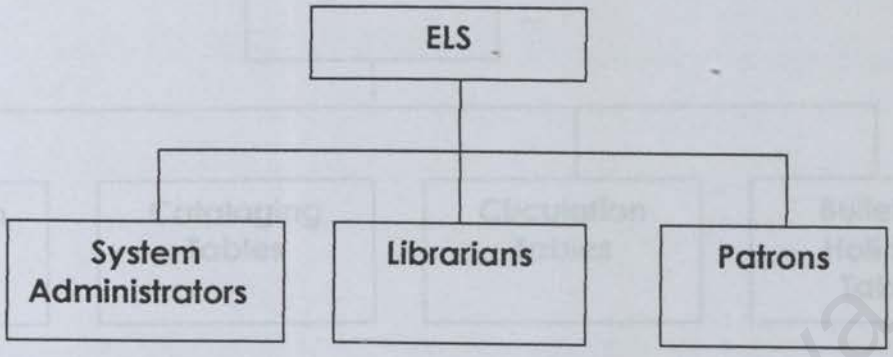


Figure 4.1 System Access Categories

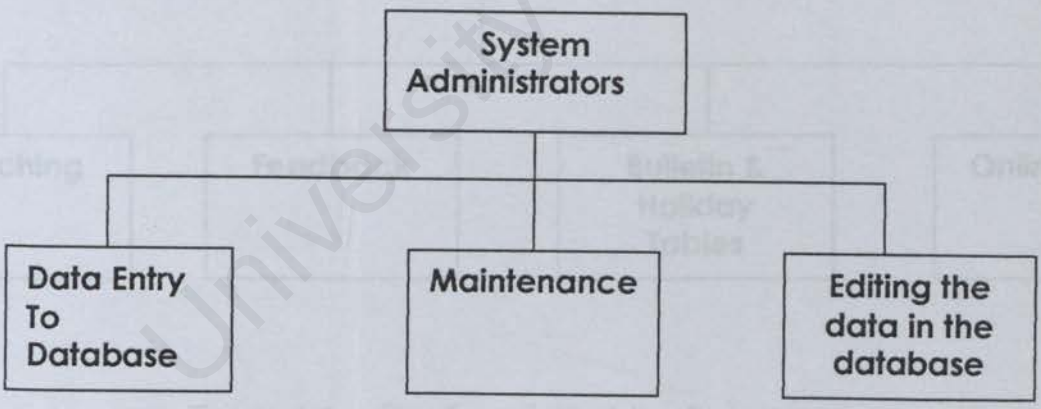


Figure 4.2 The function of System Administrators

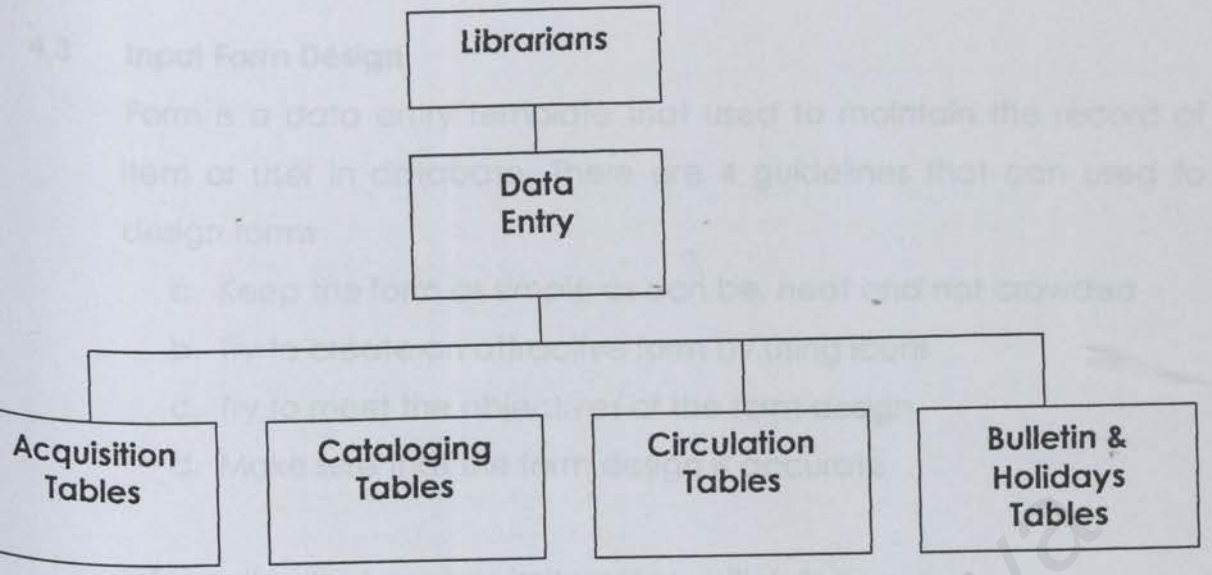


Figure 4.3 The Function of the Librarians.

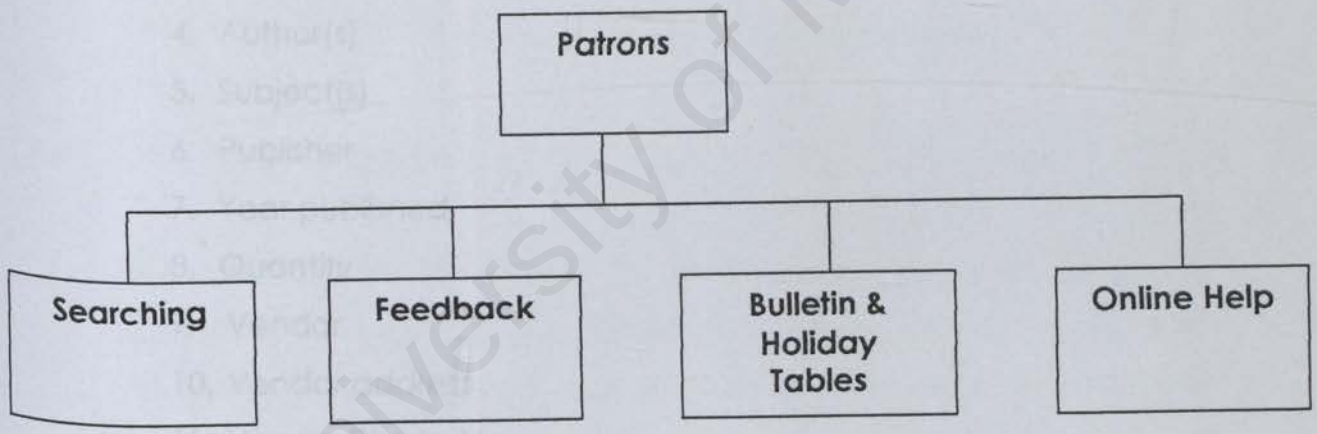


Figure 4.4 The Function of the Patrons

4.3 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 used to design forms

a. Keep the form as simple as can be, neat and not crowded
b. Try to create an attractive form by using icons
c. Try to meet the objectives of the form design
d. Make sure that the form design is accurate

Information that contain in item acquisition form are:

1. Call number
2. Title
3. Series
4. Author(s)
5. Subject(s)
6. Publisher
7. Year published
8. Quantity
9. Vendor
10. Vendor address
11. Vendor Phone No
12. Price (RM)
13. Date of acquisition
14. No of copies

Example of an Interface as in the cataloging module is presented in figure 4.5:

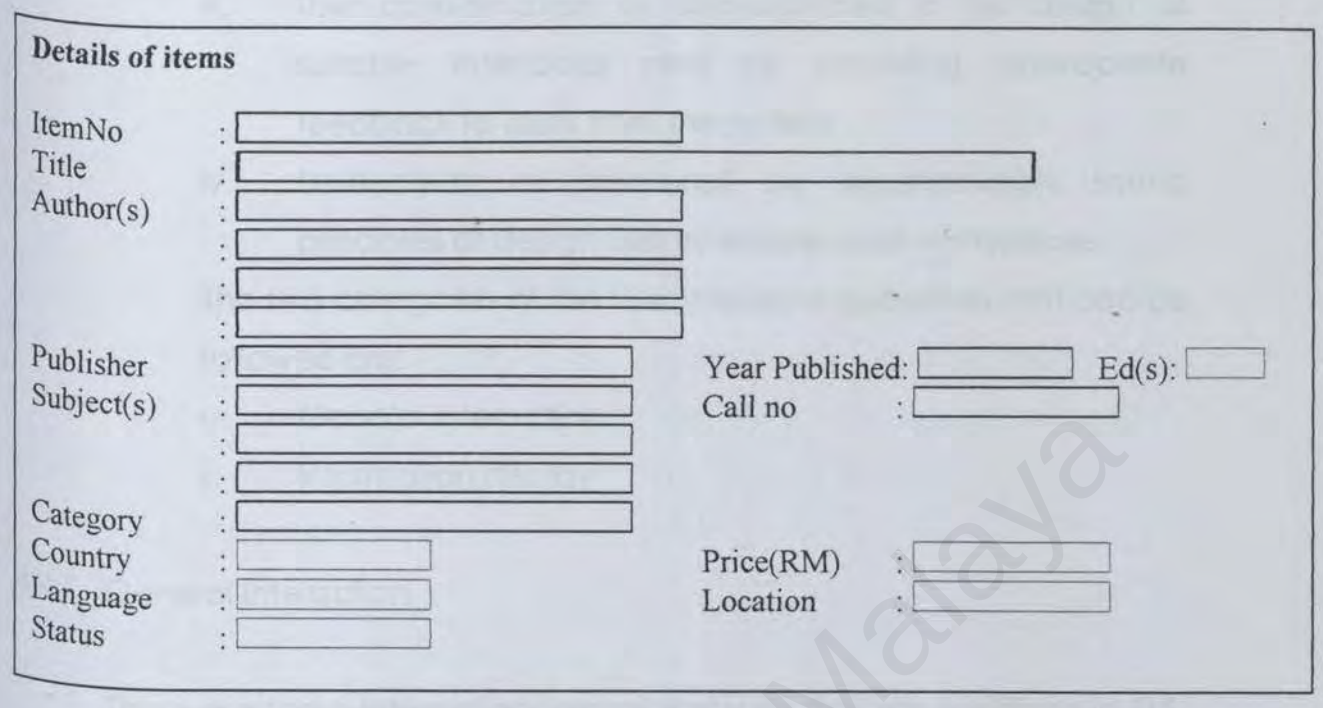


Figure 4.5 Example of cataloging module form

4.4 User Interface Design

The interface is the system for most users. How 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):

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

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

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

iv. 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:

i. General interaction

ii. Information display

4.4.1 General Interaction

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

a. Consistency

Consistency is important in designing user interface. A consistent format I used for menu selection, command input and data display.

In ELS, every screen is designed by dividing the screen into three main sections namely heading, body and instruction section

ii. The heading section includes the title form and menu bar. The caption on the title form will show the purpose f each screen.

iii. The body section is where the data entry operations such as adding a new item or user take place. It also contains any information that is to be viewed or displayed.

iv. 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.

b. Meaningful feedback is offered

ELS provide the user with visual feedback to ensure that two-way communication (patrons 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

A message box is always prompted to verify an action such as the deletion of a record before the action I being carried out. Before a record or data is added or deleted from the database that will be discussed later, a message box will appear to the user for confirmation.

d. Forgive mistake

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. Simple action verbs

Examples such as "OK", "SEARCH","ADD","ENTER" and etc. are used to name the command buttons in screens

4.4.2 Information display

There are some ways to display information in the ELS's user interface. For examples:

a. Display information that is relevant to the current context
User will get the relevant information on the screen. For example, user will get the particular item' information in Cataloging Screen

b. Use consistent labels, standard abbreviations and colour
In ELS, buttons, labels, fonts, colour and standard are consistent.

c. Provides meaningful error messages
The error message that pops up should be enough to inform user what is the problem and what should be done regarding the error.

d. Used meaningful command buttons and simple action verbs
This is to make the entire page simpler and easier for the user to understand.

e. 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.

4.5 Database design

4.5.1 Data Flow Diagram

Data flow diagram is a graphical presentation, which characterize data processes and flows in a system. In the original state, data flow diagram depicts the broadest possible overview of system inputs, processes or transformation that the data undergoes and what the output are.

Data flow diagrams are categorized into

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 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 hardware, software, files and people involved in the system.

The chart shown in figure 4.6 contrast the features of logical and physical model

Design Features	Logical	Physical
What the model depicts?	How the library operates	How the system will be implemented
What the processes	Library activities	Programs, program modules and manual procedures

represent?		
What the data stores represent?	Collection of data, regardless of how the data is stored	Physical files and databases, manual files
Type of data stored	Show data stored 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	How library controls	Show controls for validating input data, for obtaining a record, for ensuring successful completion of a process and for system security

Figure 4.6 Comparison between logical and physical model

4.5.2 Advantages of the Data Flow Diagrams

The data flow approach ha four main advantages over narrative explanations of the way data moves through the system. There are:

a. Freedom from committing to the technical implementations of the system too early
b. Further understanding of the interrelatedness of the system 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

4.5.3 Developing Data Flow Diagram for ELS

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

a. Context Diagram
b. Diagram 0
c. Child Diagram

4.5.4 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, teachers, student and librarian) are shown on the context diagram, as well as some of the major data flow to and from them. The diagram doesn't contain any data store. Figure 4.7 shows the context diagram of ELS.

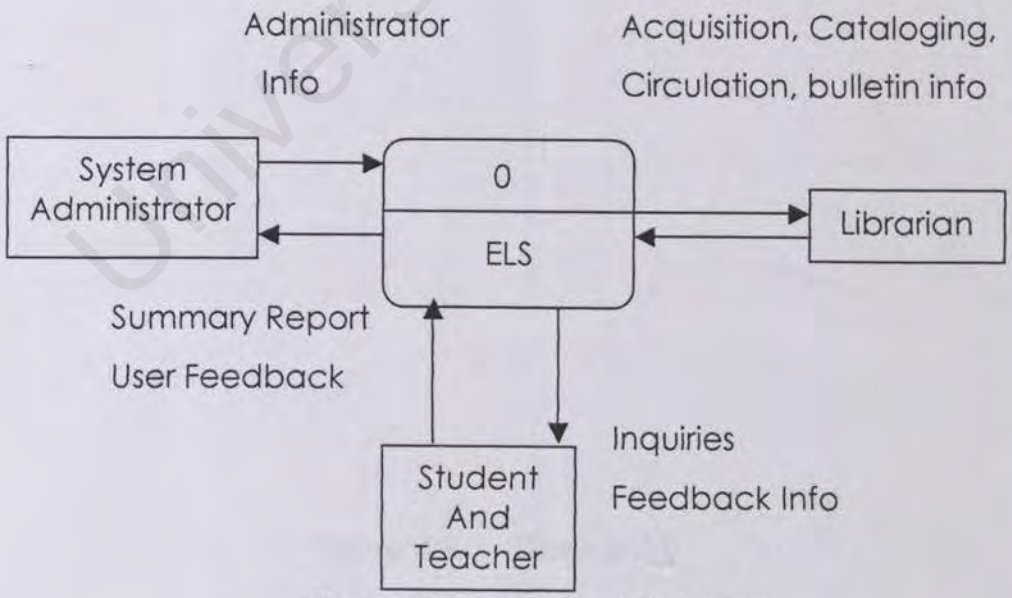


Figure 4.7 Context Diagram

4.5.5 Diagram 0

Diagram 0 is the explosion of the content diagram and ELS has included up to 8 processes. 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 (ELS Database) of the system and all external entities are included on Diagram 0.

Figure 4.8 on next page shows the Diagram 0 of ELS

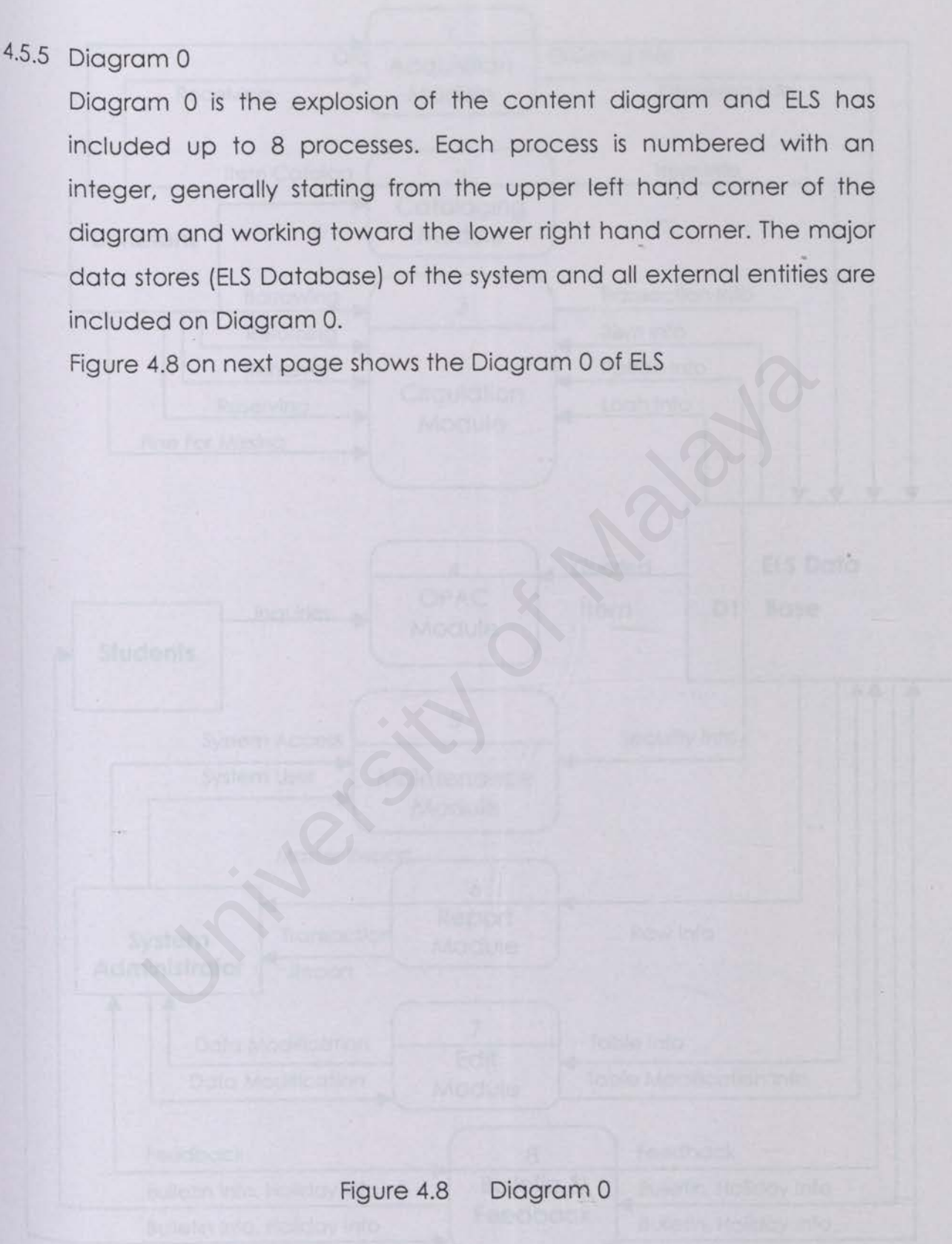
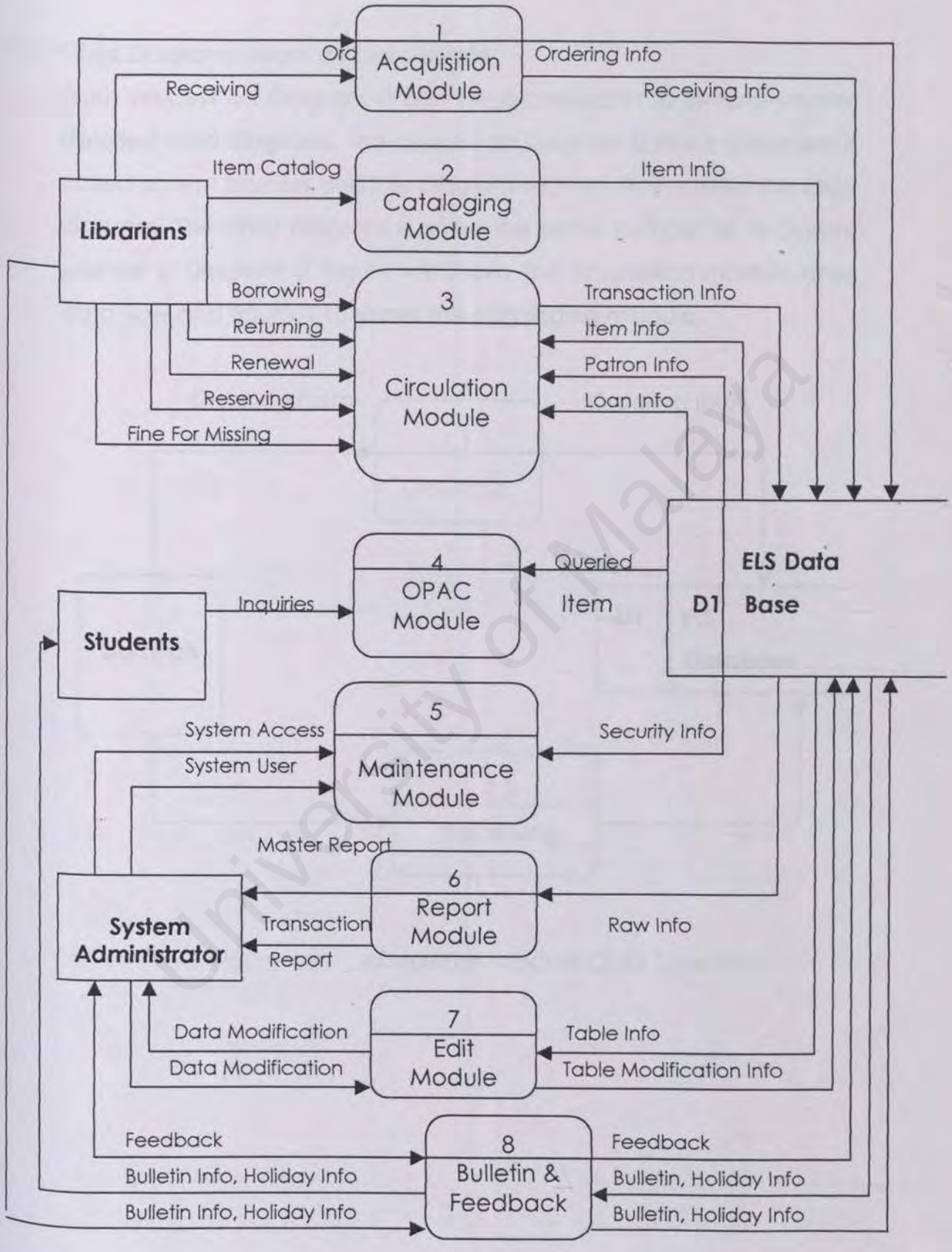


Figure 4.8 Diagram 0



4.5.6 Child Diagrams (More detailed levels)

Each process on Diagram 0 can be exploded in to several smaller detailed child diagrams. The process on Diagram 0 that is exploded is called parent process and the diagram that results in called the child diagram. The child diagram is given the same number as its parent process in Diagram 0. Figure 4.9 shows the acquisition module child data flow and figure 4.10 shows the cataloging module.

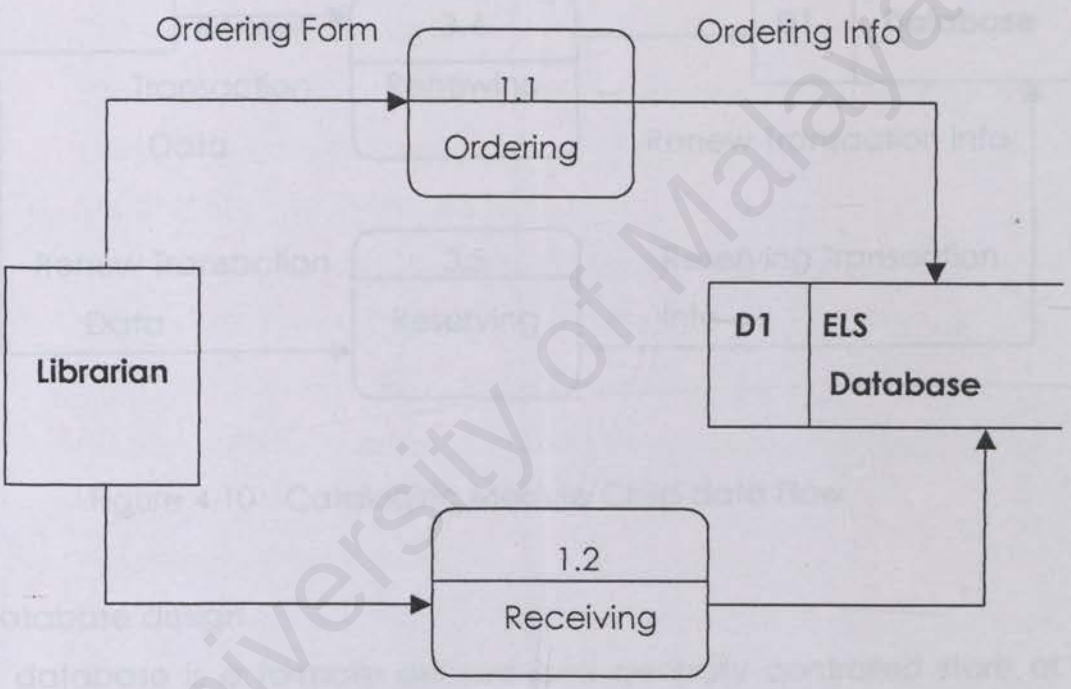


Figure 4.9 Acquisition Module Child Data Flow

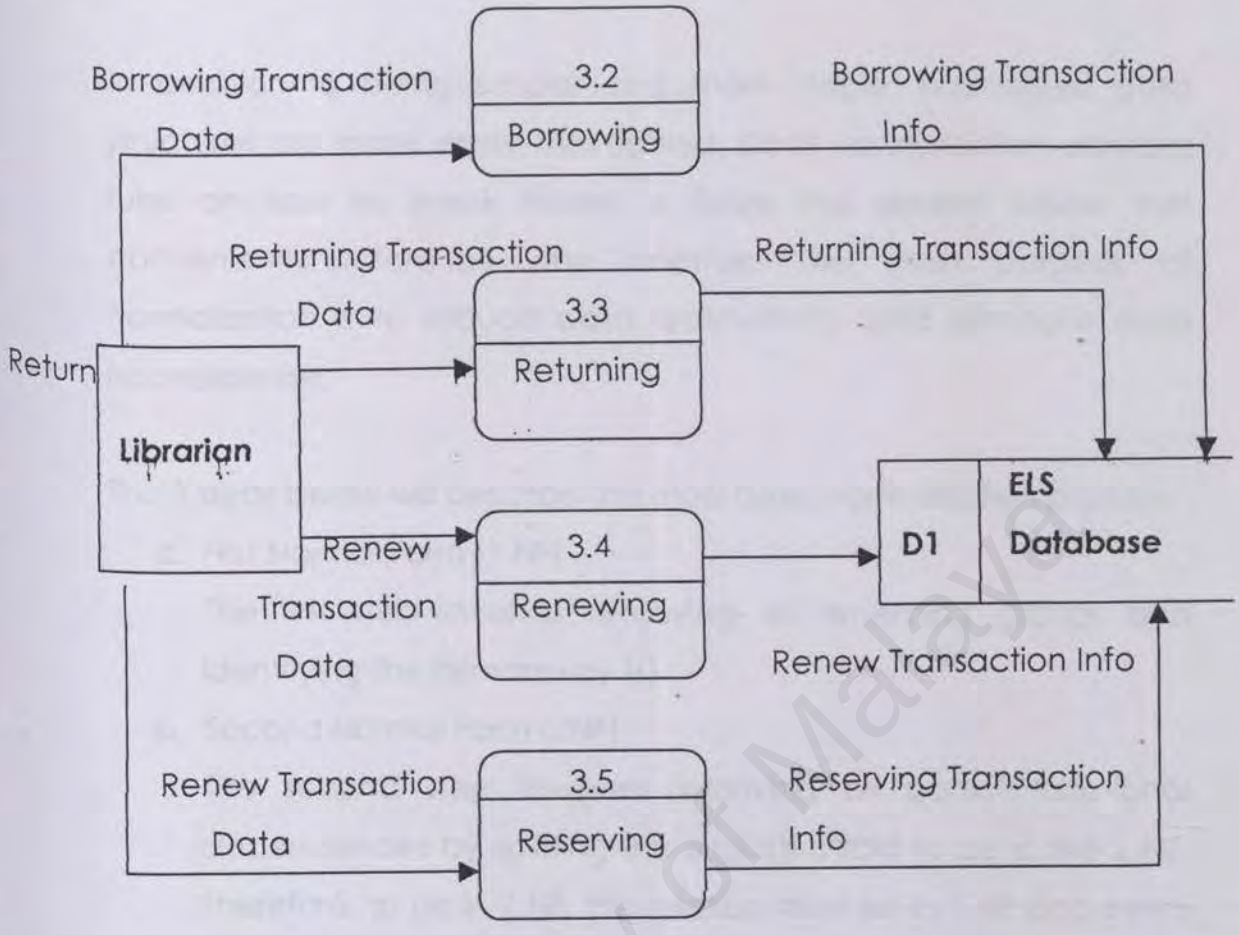


Figure 4.10 Cataloging Module Child data Flow

4.5.7 Database design

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

4.5.8 Normalization

Normalization is the transformation of complex user views and data stores to a set of smaller, stable and non-redundant 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 another. The main purpose of normalization is to reduce data redundancy and eliminate data inconsistence.

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

a. First Normal Form (1 NF)

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

b. Second Normal Form (2NF)

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

c. Third Normal Form (3NF)

   The third step involves removing and transitive dependencies where non-key attributes are dependent on anther non-key attributes. The relation is said to be in 3 NF if the relation is in 2 NF and there is no transitive dependency.

4.5.9 Tables

1. Table: Acquisition

a. Table Name : ELS_ITEM_ORDERING

Purpose : Keep all the ITEM information regarding the ordering process

Primary Key:OrderNo

Foreign Key: AuthorCode1 (ELS_AUTHOR)
AuthorCode2 (ELS_AUTHOR)
AuthorCode3 (ELS_AUTHOR)
AuthorCode4 (ELS_AUTHOR)
PublisherCode (ELS_PUBLISHER)
OrderNo (ELS_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
AuthorCode	Char(4)	Codes for the third authors of items if exist
AuthorCode	Char(4)	Codes for the four authors of items if exist
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

Table 4.1 ELS_ITEM_ORDERING

b. Table Name : ELS_ORDERING
Purpose : Keep all the information regarding the ordering process

Primary Key	**:OrderNo**
Foreign key	:Requester (ELS_PATRON) Vendor (ELS_VENDOR)

FIELDS	DATA TYPE	DESCRIPTION
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

Table 4.2 ELS_ORDERING

c. Table Name : ELS_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	Integer	Vendor fax number
VenEmail	Char (30)	Vendor email address

Table 4.3 ELS_VENDOR

d. Table Name : ELS_RECEIVE
Purpose :Keep all the information of receiving transaction

Primary Key : **ReceiveNo** **Foreign Key** :OrderNo (ELS_ORDERING) Receiver (ELS_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
InvoiceNO	Char (10)	The Invoice number

Table 4.4 ELS_RECEIVE

e. Table Name : ELS_ITEM_RECEIVE
Purpose : To keep all the information of item received.

Primary Key	**: OrderNo, Title**
Foreign Key	: OrderNo (ELS_ORDERING) Receiver (ELS_PATRON) CountryCode (ELS_CURRENCY)

FIELDS	**DATA TYPE**	**DESCRIPTION**
OrderNo	Char (10)	Purchase Acquisition Number
Title	Char	Ordered Item'stitle
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

Table 4.5 ELS_ITEM_RECEIVE

f. Table Name : ELS_CURRENCY
Purpose : Keep 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 own the currency
Currency	Money	Value of the currency

Table 4.6 ELS_CURRENCY

2. Table: Item

g. Table Name : ELS_ITEM
Purpose : Keep a list of all items' information

Primary Key	**: CallNumber**	
Foreign Key :	PublisherCode	(ELS_PUBLISHER)
	SubjectCode	(ELS_SUBJECT)
	Category	(ELS_CATEGORY)
	Language	(ELS_LANGUAGE)
	LocationCode	(ELS_LOCATION)
	StatusCode	(ELS_STATUS)

CountryCode (ELS_CURRENCY)		
FIELDS	**DATA TYPE**	**DESCRIPTION**
ItemNo	Char (10)	Code that is unique for each item in the 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
SubjectCode2	Char (5)	Codes for the subject of each book
SubjectCode3	Char (5)	Codes for the subject of each book
Category	Char (2)	Codes for the type of item
Language	Char (1)	Codes for the languages of the items
LocationCode	Char (5)	Codes to represent the location where items are kept

DateEntered	Datetime	Date when item information is created
DateUpdated	Datetime	Date when 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 overdue per day
StatusCode	Char (1)	Codes to represent the status of items.

Table 4.7 ELS_ITEM

h. Table Name : ELS_PUBLISHER
Purpose : Keep a list of the publisher

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

Table 4.8 ELS_PUBLISHER

i. Table Name : ELS_ITEM_SUBJECT
Purpose : Keep a list of all the item' subject

Primary Key :Subject		
FIELDS	**DATA TYPE**	**DESCRIPTION**
Subject	Char (5)	Codes for subjects of the items
Description	Char (30)	Descriptions for the codes

Table 4.9 ELS_ITEM_SUBJECT

j. Table Name : ELS_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
Description	Char (30)	Description for the codes
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
FineInPercentge	Money	The percentage of fining if an Item is missing according to its category

Table 4.10 ELS_ITEM_CATAGORIES

k. Table Name : ELS_ITEM_LANGUAGE
Purpose : Keep a list of all items' languages

Primary Key : Language		
FIELDS	**DATA TYPE**	**DESCRIPTION**
Language	Char (1)	Codes for languages of items
Description	Char (20)	Descriptions for the codes

Table 4.11 ELS_ITEM_LANGUAGE

l. Table Name : ELS_ITEM_LOCATION
Purpose : this table contains the description of the items' location in the library

Primary Key : LocationCode		
FIELDS	**DATA TYPE**	**DESCRIPTION**
LocationCode	Char (5)	Codes to represent the Locations where items are kept
Location	Char (20)	The location of the items

Table 4.12 ELS_ITEM_LOCATION

m. Table Name : ELS_ITEMSTATUS
Purpose : This table contain the description of the items' status

Primary Key : **Status**		
FIELDS	**DATA TYPE**	**DESCRIPTION**
Status	Char (1)	Codes to represent the status of items
Description	Char (20)	Descriptions for the codes

Table 4.13 ELS_ITEMSTATUS

3. Table: Patron

n. Table Name : ELS_PATRON

Purpose : Keep a list of patrons' information

Primary Key	: **Patron_ID**	
Foreign Key	: RaceCode	(ELS_RACE)
	PatronStatus	(ELS_PATRONSTATUS)
	GenderCode	(ELS_GENDER)
	StateCode	(ELS_STATE)
	ClassCode	(ELS_CLASS)

FIELDS	**DATA TYPE**	**DESCRIPTION**
Patron_ID	Char (10)	Code that is unique for every visitor
Patron_Name	Char (30)	Name of the patron
ClassCode	Char (2)	Code that is unique for each class
Gender	Char (10)	Sex of the patron
RaceCode	Char (3)	Code that is unique for each race

IC_No	Char (14)	The patron's IC
DOB	Datetime	Date of birth
Hometown	Char (20)	The patron's hometown (Tel no)
Street	Char (50)	Street where the patron lives.
District	Char (40)	An area of the town
Postcode	Char (5)	Post code of the area
State	Char (20)	The state where the patron stay
Phone DateEntered	Char (12) Datetime	The patron's phone number Date when patron information is created
PatronStatus	Char (2)	The patron's status in the library

Table 4.14 ELS_PATRON

o. Table Name : ELS_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 each race
Race	Char (30)	Name of the race

Table 4.15 ELS_RACE

p. Table Name : ELS_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 each class
Class	Char (30)	Name of the class

Table 4.16 ELS_CLASS

q. Table Name : ELS_PATRONSTATUS
Purpose : This table contains 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

Table 4.17 ELS_PATRONSTATUS

4. Table: Transaction

r. Table Name : ELS_TRANSACTION
Purpose : Keep all the information of the transaction

Primary Key	**: ItemNo, PatronID, TranType, TranDate**	
Foreign Key	: ItemNo	(ELS_ITEM)
	Patron_ID	(ELS_PATRON)
	TranType	(ELS_TRANSACTION_TYPE)

FIELDS	**DATA TYPE**	**DESCRIPTION**
ItemNo	Char (10)	Code that is unique for each item
Patron_ID	Char (10)	Code that is unique for each library's patron
TranType	Char (2)	Code for types of transactions
TranDateTime	Datetime	Date and times when the transactions take place.
TranFine	Money	Fines for overdue or other
TranStatus	Char (2)	A- active, NA-not Active

Table 4.18 ELS_TRANSACTION

s. Table Name : ELS_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
Description	Char (30)	Description for the codes

Table 4.19 ELS_TRANSACTION TYPE

t. Table Name : ELS_DUEDATE
Purpose : Keep the due date for item borrowed by patron

Primary Key : **ItemNo**		
Foreign Key : ItemNo (ELS_ITEM)		
FIELDS	**DATA TYPE**	**DESCRIPTION**
ItemNo	Char (10)	Code that is unique for every item
DueDate	Datetime	Due dates for items borrowed by patrons

Table 4.20 ELS_DUEDATE

5. Table: Maintenance

u. Table Name : ELS_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
Description	Char (50)	Description of the AccessCode

Table 4.21 ELS_SYSTEM_ACCESS

v. Table Name : ELS_SYSTEM_USER
Purpose : Keep all the user information

Primary Key : **Patron_ID** **Foreign Key** : Patron_ID (ELS_PATRON) AccessCode (ELS_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
Password	Char (10)	Password that used to access the system

Table 4.22 ELS_SYSTEM_USER

w. Table Name : ELS_BULETIN
Purpose : Keep all the information about the library in a bulletin

Primary Key : **ActivitiesName, Date**		
FIELDS	**DATATYPE**	**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 regarding the activities
Objectives	Char (100)	The objectives of the activities
PeopleInCharged	Char (50)	Name of people in charged of the activities

Table 4.23 ELS_BULETIN

x. Table Name : ELS_FEEDBACK
Purpose : Keep all the information regarding the feedback of the patron

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

Table 4.24 ELS_FEEDBACK

y. Table Name : ELS_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

Table 4.25 ELS_FEEDBACK_TYPE

z. Table Name : ELS_HOLIDAYCALENDER
Purpose : Store holidays for the library

Primary Key : HolidayDate		
FIELDS	**DATATYPE**	**DESCRIPTION**
HolidayDate	Datetime	The date of the holidays
Occasion	Char (50)	Description for the declared holidays

Table 4.26 ELS_HOLIDAYCALENDER

4.5.10 Other Database Design Specification

Other database design specification necessary for ELS is:

I. Audit control specifications

II. All outdated records must be retained for a period of 2 years after they have been superceded or updated
III. Backup or recovery specifications
IV. Occasionally, records or entire files can be irretrievably lost through negligence or other such ways. Therefore method to reconstruct the lost data must be planned and provided for.

4.6 Expected Outcome

With all the careful planning and design, this system hope to be able to turn problem to solution. Some of the results desired from this system are:

I. Upgrade and improve the efficiency and effectiveness of the present circulation and acquiring system.
II. To ensure the accuracy in the process of reserving and updating of the reading materials.
III. To facilitates on-line library cataloguing thereby creating a bibliographic database.
IV. Provide better control of the materials
V. To enable fast and easy retrieval of the items from OPAC and bibliographic database.
VI. To establish a consistent and user friendly GUI (Graphic User Interface)
VII. To establish a flexible fine system

4.7 Summary

Design is the creative process of the Model Driven Development route. It is the transformation of problem into solution. System designs

have to be handled carefully so that ELS can fulfill both the functional and non-functional requirements.

Chapter 5 System Implementation

5.1 Introduction

System Implementation is the physical approach or realization of the database and application designs. Coding and debugging are the major and common tasks involved in the implementation phase. Besides that, the implementation of the system is also known as translating the user requirement to designs, source code and the system itself.

5.2 System Coding

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

The purposes for coding would include the following:

a) Keeping track of something
b) Classifying information
c) Concealing information
d) Revealing information
e) Requesting appropriate action
f) As a platform

5.2.1 Code Specification For ELS

No	Content
1.	Define Code Specification
2.	Define Code Standards 2.1 Define Standard Naming Conversion 2.2 Define Code Writing Standards 2.3 Standard Guidelines
3.	Write Modules Codes 3.1 Identity Modules Code Priority 3.2 Write Code To Perform One Function Per Module 3.3 Inserting and Explaining Comments 3.4 Define Initialization 3.5 Define Loops Entry and Exit 3.6 Each Loop Executes the Correct Number of Times 3.7 Define Cleanup for Loop that Exited Prematurely 3.8 Define Strings Type Manipulations 3.9 Define Pointer Type Manipulation 3.10 Defines Interface Between Module Calls 3.11 Define Files Used by the Module codes
4.	Identity Code Syntax

5.	Identity Code Logic

Table 5.1 Code Specifications For ELS

5.2.2 Guidelines on the Writing of Code Specifications

No	Content
1.	**Define Code Specification** The code specifications gathered are viewed from the following perspectives: a) User Perspective I. All module codes are assumed present and correct II. All module codes are prioritized correctly b) System Analyst Perspective I. All the module codes are correctly implemented II. Each defined module implementation a single function c) System Designer Perspective I. Module codes cover all the designs II. All external interfaces are specified III. Code constraints are in the realistic range IV. The module codes support reuse V. Module coded are consistent with system performance VI. All internal interfaces such as those for system administrator are coded accordingly d) System Programmer/Coder Perspective

	I. Module codes are consistent with all designs II. Module codes always matches with the test specification e) System Tester Perspective I. All module codes are testable II. All module have appropriate validation/acceptance criteria III. The explanation for each error is sufficient and easier understandable IV. The explanation for each module codes are sufficient and correct f) System Maintainer/Tester Perspective I. The module codes allow for changes in the area most likely to change II. The module code support reuse III. Any changes to the user requirement are easily maintained using the existing codes. g) Quality Perspective I. The module codes must meet all specification and development standards as well as user requirements II. The module codes are traceable III. All module should have validation as well as acceptance criteria as well as suitable error messages h) Database Administrators Perspective I. The module codes for data security have been defined

	II. The module codes support efficiency and performance and capacity III. The module codes are consistent with overall system design and architecture. IV. The communication between module codes and database are well preserved i) Documentation Perspective I. All documentation for implementation has been identified
2.	**Define Code Standards** Define code standard ensure consistency and integrity of the terms used. This will avoid confusion as well as make the process of debugging and system maintenance easier. The code standards include standards naming conventions and code writing standards. **2.1 Define Standard Naming Conversion** Standard naming conversion should consider file, module, program, subprogram, function, procedure, subroutine, data field, table and variable names as well as others **2.2 Define Code Writing Standards** Code writing standards should consider consistent code indentation (e.g. conditional statements), appropriate locations of comment such as after a statement execute, etc. **2.3 Standard Guidelines**

	I. Keeping the program simple Keeping the program simple is basic steps in good programming. By keeping the program simple, the understanding of the code is made much easier and therefore maintaining the code is easier II. Localizing Input and Output Those programs that read input or generate output are highly specialized. Because of this dependence, the program sections normally performing the input and output function e sometimes difficult to test. Therefore it is more desirable to localize these sections in components separate from the rest of the code III. Include pseudocode Pseudocode is used to adapt the design to the chosen language. In this way, code can be rearranged and restructured with minimum of rewriting IV. Reuse Components that are originally developed by other programmer can be used if that particular component matches what we want.

3.	**Write Module Codes** This involved 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 identity 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** 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 also important for a programmer to insert comments tothe appropriate locations and correctly explained the statement of code. This will allow other programmers to understand his/her code and be able to maintain the source code without assistance from the original code writer. **3.4 Define Initialization** All variables and parameters must be initialized before they are assigned to any value. This is to avoid incorrect input or values to be stored in the variables or

parameters which will result in incorrect output as well as affect the whole system performance. Besides that, incorrect will result in calculation errors during program, execution. Normally, initialization will happen at the following locations:

I. Program initialization
II. Start of every loop
III. Function/procedure entry
IV. End of each control statement
V. Include file

3.5 Define Loop Entry And Exit

This will ensure that each loop has only one entry and only on 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 if the loop has executed a specific number of times or to terminated 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 errors.

3.7 Define Cleanup for Loop that exited Prematurely

If a loop that exited prematurely, the value of the parameters or variables as well as the logic flow have to be considered so that the program would not produce any logic error or run time error

3.8 Define Strings Type Manipulations

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

I. Identified by pointers
II. Terminated in null

3.9 Define Pointer Type Manipulation

When a pointer is used in the program, the programmer must ensure that the pointer is:

I. Initialized to null
II. Deleted after the new procedure new
III. Deleted after user (for new pointer)
IV. 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 which is a common error in passing of parameters between functions or procedures calls.

3.11 Define Files Used by the Module Codes

We need files as storage for common functions, graphics as well as other important sub program. There are often used as input, output or main data storage during the execution of a program. There are various

	types of files such as data files, temporary files which is deleted after the content of the files is used and output files which are used to store result of executions or reports. Besides that, file that are called during the execution of the program normally contain important functions which can be used by my application. Irrespective of the type of the files, they must be properly declared, opened before used and closed when they re no longer needed.
4.	**Identify Code Syntax** Syntax error is a common thing in programming. Typing in mistake usually causes this type of error or coder is not aware of the correct syntax. Such errors are detected easily during the compilation and execution of the program. This errors can be avoided if the coder checks his codes properly to ensure that: I. Include files are complete and included II. Function call formats are correct III. Pointers are correct

	IV. Parameters passing is in correct order V. Use of "&" and other common syntax such as "If", "Else If" and "Then" are correct VI. Brackets such as"[]" or "()" are correctly used and each opening matches each closing of brackets. VII. No spelling mistakes are present.
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: I. Each module codes perform correct functions II. All calculations are correct III. All illegal data entries are captured IV. Mismatched types are checked V. Output format is correct

Table 5.2 Guidelines on the Writing of Code Specifications

5.2.3 Coding approach

In ELS, top-down design of systems as well as the modular approach to programming is defined.

5.2.3.1Top Down Approach

It is easy to visualize what the top-down approach refers to:

Top down approach means that looking at the large picture of the system and then exploring it into smaller parts or subsystems. This approach allows higher-level modules to be developed and coded first before the lower level modules. This can ensure that the most

important modules will be developed and tested first. It also gives preliminary version of the system sooner. . *(Software Engineering Theory and Practice, Shari Lawrence Pfleeger)*

5.2.3.2Modular Development

Once the top-down design approach is taken, the modular approach is programming. This approach is involved breaking the programming into logical, manageable portion 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 module should be functionally cohesive, so that it is charged with accomplishing only one function.

Basically, modular program design has three main advantages.

The first advantage is, modules are easier to write and debug because they are virtually self-contained. Tracing an error in a module is less complicated since a problem in one module should not cause any problems to others

A second advantage is, modular design is create an easier and more maintainable modules. Modification usually will be limited to a few modules and will not spread over an entire program

The third advantage is, since each module is developed respectively and is self contained, the modules are easier to grasp. This means that reader can pick up a code listing of a module and understand its function.

Some of the guidelines for modular programming include the following:

a) Keep each module to a manageable size and for one function (recommended)
b) Pay particular attention to the critical interface
c) Minimize the number of modules the user mist modify when making changes or when testing the system
d) Maintain the hierarchical relationship set up in the top-down development phases

5.2.4 Coding Style

Documentation is 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. *(Software Engineering Theory and Practice, Shari Lawrence Pfleeger)*

The internal documentation for ELS uses coding style such as:

I. Header Comment Block
II. Meaningful Variable Names and Statement Labels
III. Formatting to Enhance Understanding
IV. Documenting Data

As for external documentation, ELS uses coding style such as:

I. Describing the Problem
II. Describing the Algorithms
III. Describing the Data

5.2.5 Scripting Language

In the process of developing codes for ELS, 3 kinds of scripting codes are used namely, Active Server Page (ASP), JavaScript and Hypertext Markup Language (HTML).

5.2.5.1 Active Server Page (ASP)

ASP is a coding language to link the hypertext web pages to the databases as well as the Internet. An ASP page (*.asp) is any file located on the web server that has the extension .asp. When someone visits pages with .asp, the web pages play a more active role. The web server will need to interpret and executes any scripts in an ASP page before sending it to the user's browser.

Active Server Page included a server side scripting. It can also contain other scripting language such as VB script and Java script. The advantages of using the ASP scripting language as well as other scripting language is that it makes modification of the Web site easier even after the site was launched. ASP scripting language runs in the same process as Web server and they re multithreaded. This will allow and support large number of concurrent users. *(E-Commence Programming with ASP in 21 Days, Stephen Walther, Jonathan Levine)*

5.2.5.2 JavaScript

Java script, like other scripting language is easily maintained and modifies even though the web pages has been launched. Normally, java script is used to code validation/acceptance code and other window prompt messages.

Java script can be included in ASP for error checking as well as other function. Java script files normally end with the extension *.jsp.

5.2.5.3Hypertext Markup Language (HTML)

Hypertext Markup Language or HTML is any web pages that have an extension *. html or *. htm. Normally, HTML pages only display static component such as icon, text and other graphic. HTML is the basic language in designing web pages since it can be pick up easily by amateur web programmer. Nowadays, there are a lots of program that design pages in HTML format without needing the user to have knowledge on HTML such as Macromedia Dream weaver as well as Microsoft FrontPage.

Summary

On the completion of the design stages, the database and application have to implement through coding. Therefore, in the coding approach, style and scripting language are essential element in system coding. Basically, ELS is not only using the top-down approach but a hybrid of top-down and bottom-up approach. This type of coding ensures that all the view includes general and specific views are not neglected. Coding style includes the comments at the end of appropriate locations and correctly explained the codes. ASP scripting language as well as JavaScript is the chosen language used to develop the code. Combination of all the coding feature such as coding style as well as scripting language ensure that ELS can be developed in time.

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 market and 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 ranger of activities that not only support the assessment of quality but also help to achieve and preserve the software quality

Software testing is essential for new software because by using all those techniques, we can ensure that the system/software that have been developed satisfied the user requirement.

6.2 Testing Objectives

Glen Myers [MTE 79] stated in his book that a number of rules have been created that can serve well as a testing objectives. This objectives are:

a) Testing is the process of finding error by executing the system/program/software.

b) A good test case is a case where the probability of finding an as yet known error is high

c) A successful test is one that uncovers an as yet known error

6.3 Testing Principles

There are many testing principles available in the market. Therefore, before applying methods to design an effective system, a system

developer must understand the basic principles that guide system testing. For ELS, a set of principles has been adapted. They are:

a) All test should be traceable to user requirements

Since the objectives of system testing is to uncover errors, testing needed to be done that so that it follows the most deter or severe defects are those that cause the program/system to fails in meeting its user requirements.

b) Tests should be planned

Test planning can begins as soon as the user requirement model is completed. Detail of the test definition can begin as soon as the design model has been solidified. Therefore, all tests can and must be planned and designed before any codes have been written. At this stage, the system developer will have sufficient knowledge in coding as well as testing.

c) Exhaustive Testing is Impossible

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 the testing. It is possible however, to adequately cover program logic and ensure that all conditions in the component-level design have been exercised.

d) Testing should be start with 'small testing' and progress towards 'larger testing'

The first test normally is planned and executed on individual components. As the testing progress, focus will shifts in an attempt to find errors from general component to integrated clustered of components and finally the entire system.

6.4 Technique (Testing)

Different type of testing is needed for different type of level. Each type of testing is applied at different levels of software development in the software development life cycle. Each testing has its own testing id that is different in nature and objectives. The main objectives are still looking for errors but different types of errors are looked for at each level. The levels of testing in software development encompass unit, component integration testing, system testing, acceptance testing as well as installation testing *(Software Engineering Theory and Practice (Chapter 8), Shari Lawrence Pfleeger)*

6.4.1 Unit/Module Testing

Unit testing is a type of testing that finds errors in individual units in either the data or the logical part of the system. This is where the most detailed investigation of the internal workings of the individual units is carried out. Normally, the system programmer whom wrote the code earlier will test the code himself although this is not necessary the most effective alternative. Tests can be derived from the detailed logic of the unit, with any additional structural tests derived from the physical design. Each module such as acquisition is tested in unit/module testing. This can ensure that each module goes through a number of different test and all modules are tested.

During unit testing, the system programmer needs to review the code that he/she wrote earlier. There are two type of code review:

a) Code walkthrough

In walkthrough, the code accompanied by documentation is presented to the review team and the team will comments on their correctness. This is an informal process and the focus is on the code not coder.

b) Code inspection

In code inspection (Fagan (1976), IBM), it is quite similar to walkthrough but more formal. The review team will check the code and documentation against prepared concerns. For example, in ELS, checking might be done on the definition and use of data types and structure to see if their use is consistent with the design and system standard and procedures.

Besides, some of the unit that is tested during unit/module testing is:

a) Local data structure

The purpose is to ensure that data stored temporarily will maintains its integrity during all steps in an algorithm's execution. For example,

b) Error handling path

The purpose is to ensure that the system can handles expected and unexpected error by applying error-handling

routines. In ELS, error-handling event is the validation of information inputted by system user such as date, etc.

c) Module interface

The purpose is to ensure that the information property flows into and out if the program unit is under testing. For example, the checking of each icon and button to see whether there is a link to each of the button to avoid dead link or orphan link.

d) Condition (boundary)

The purpose is to ensure that the module operates properly at boundaries established to limit or restrict processing. For example, the loop IF THEN checking the condition of a function.

e) Independent path through control structure

The purpose is to ensure that all statements in the particular module have been executed at least once.

6.4.2 Component Integration Testing

This type of testing is used to determine the existence of integration bugs. For example, the inconsistencies between sub modules or between sub elements. This test is only focused on the direct and indirect interfaces and the consistency between the sub modules as well as the sub elements.

Test cases are specially selected for this kind of interfaces testing. The integrated modules/elements 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 criteria that the test case has to considered are:

a) Read/Write access to a particular file, file creation
b) The system does not corrupt so easily or does not corrupt other system even though it does not fail itself.

Some of the more common interface errors encountered are:

a) The parameters may not be in correct order
b) The parameters may not be of the right data types, formats, or input-output modes.
c) The parameter rules maybe not be obeyed such as all by value or call by reference
d) The domains of the actual and formal parameters do not match.
e) No such parameter
f) Type mismatch where the data types is incorrect
g) Exception error such as error happens when the requested information is not in the database.

There is a number of integration testing strategies. Some of these strategies are:

a) Top Down Testing

Top Down testing is type of testing that starts with the top module in the call graph and add one module at time to the set of merged modules. The top module is the only one that is

unit tested in isolation. There are two possible strategies in selecting the next module to be merged.

I. Strict Top Down Testing

The first strategy requires that the next module must have all its calling modules integrated.

II. Non-Strict Top Down Testing

The second strategy unlike the first one, relaxes the previous requirement by selecting any module that has at least one of its calling modules tested previously.

b) Bottom Up Testing

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

c) Modified Top Down Testing

Top Down testing has one major problem, that is, it may be impossible to test certain logical condition within the merged program such as error checks conducted in individual modules. This will prevent thorough testing of a certain modules. The solution to this problem is the Modified Top Down testing. This strategy is similar to the Top Down testing except that it requires every module to be tested in isolation first 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

Generally, there are not best test techniques; rather the best testing makes use of as many techniques as are relevant and useful. In other words, identify what is the best technique that is most suitable testing of the system. The test techniques that are generally applicable for various software include functional test or 'black box testing' and structural test or 'white box testing'.

The main thing is that, whatever test technique that has been chosen, it should ensure that all requirements have been implemented correctly, appropriate levels of security, maximum storage size and etc. etc.

d) Sandwich Testing

This strategy combines both the Top Down and the Bottom Up testing. Top Down and Bottom Up testing are applied simultaneously and the program is integrated from the both the top as well as the bottom of a call graph. Eventually, integration meets somewhere in the middle of the call graph

e) Modified Sandwich Testing

This is the modified version of the Sandwich testing. All modules are unit tested before applying the sandwich testing strategy. This extra step overcomes the problem described earlier with the Top Down testing.

f) Big Bang Testing

In this kind of testing, each module is first unit tested in isolation and then merged together and being tested.

6.4.3 System Testing

In system testing, the functional requirement and specification 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 non functional quality attributes such as performance, reliability, max volume, stress tolerance, usability, maintainability, security and more. Therefore, we can said that system testing is a series of different tests designed to fully exercised the system to uncover its limitations and measure its capabilities. The objective is to test an integrated system and verify that it meets all the user requirements. System testing can also be carried by independent testers to get a better result.

6.4.4 Acceptance Testing

Acceptance testing is a kind of testing that shows the transition from the ownership by the developers to the ownership of the users. The purpose of this test is to give confidence that the system is working, rather than trying to find errors.

Acceptance testing also includes testing of the user organization's working place and practices, to ensure that the computer system will fit with clerical and administrative procedures. The acceptance test gives confidence to the user that the user is ready for operational use.

6.4.5 Installation Testing

The final round of testing involves installing the system at the user's site. In ELS, the user's site is in University Malaya's Lab. If acceptance test has been performed on site, then installation testing may not be needed.

To being installing testing, the system is configures to the user environment. Installation testing requires that the system developer working hand in hand with the end users.

The test will focus on two important objectives:

a) Completeness of the installed system
b) Verification of any functional or non functional characteristic that might be affected by the site environment

Summary

Testing is part of software engineering and in developing a system like Electronic Library System (ELS), testing usually involves several techniques and methods such as unit/module testing, integration testing as well as system testing.

Chapter 7 System Evaluation

7.1 Introduction

System evaluation is one the process that we did on the system development life cycle. The analyst, management and users have been constantly evaluating the evolving system in order to provide feedback to the system developer for eventually improvement. Evaluation is also called for the following system implementation. [Kendall & Kendall. 1999]

7.2 Problem Encountered and solutions

Throughout the process in developing ELS, numerous problems occurred. Some of the main problems with their solutions is listed below:

7.2.1 Lack of Knowledge in Using The Scripting Language

Problem:

ELS uses at least 2 different scripting language namely, ASP (VB script) and java script. The combination of both the scripts gave a lots of problem since my knowledge in both the scripts is limited. During industrial training, I didn't get to learn any of them because the company that I trained with is more into using a customize software.

Solution:

Basically, all the scripts that are needed to build ELS are available on the Internet as well as reference books. Since

time is main problem here, I opted for building the system as well as learning the scripts at the same time.

7.2.2 Lack of Ideas in Building the Search Engine (OPAC)

Problem:

The criteria for the search engine is blur because the knowledge I have on library system is limited. Besides, what module is involved in the OPAC is anonymous to me.

Solution:

I managed to get valuable information from then Internet as well as from Puan Abrizah. With this, I have a slight idea of what is the criteria a search engine must have especially for an online library system. I also managed to get useful information about library system through literature review where I can review other already developed system.

7.2.3 Lack of resources

Problem:

Resources are in terms of computers. There are only 4-5 computers in the Information System Lab. Therefore, the students need to wait for their turn installing the system as well as testing the acceptance and installation.

Solution:

No solution has yet managed to improve the situation. In the future, hope that, the management of the faculty can

increase the availability of PCs to students especially the final year students.

7.2.4 Interface Management

Problem:

The combination of button, colour as well as layout of the interface is not appealing.

Solution:

Modification has been done to the interface by adding rollover images, tool tips as well as some other more vibrant layout and colour to enhance it.

7.3 Evaluation By End Users

End user testing and evaluation is essential for the success of the system. I have enquired one of my friends, a programmer to evaluate ELS. From his advice and guidance, I managed to revert all the mistakes and errors as well as some incompleteness

7.4 System Strength

7.4.1 User Friendly Interface

ELS is designed to have Graphical User Interface (GUIs) feature on the principal for ease of use. Direct manipulation is allowed using the GUIs on the screen which can accomplish by using the keyboard and mouse. The main 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 messages. By using the

GUIs, the user can easily understand and captured the overview of the system, and hence, minimize the errors or irregularities made by user and minimize the effort to rain new user.

Beside that, each icon and button on the GUIs come with tool tips which show what the button does or means.

7.4.2 Completeness of Functional Requirement

ELS provides all functional modules which make it a complete library system. All the common modules as well as some complicated one had been developed in ELS. One can expect that ELS will be able to perform up to par with the normal non-online library system.

7.4.3 Security Features

ELS is divided into 2 important categories namely System Administrator/Librarian and Library's User. Only system administrator or librarian can access the maintenance menu. The web pages in ELS is divided into 2, the Administrator/Librarian and Library's User. To enter the administrator/librarian site, a password as well as patron id is needed. This can ensure that unauthorized user will not be able to break into the administrator site. By using ASP, a normal user can only view pages that are for them. They are blocked from entering internal site. By adding security features, the possibility of unauthorized access is greatly reduced.

7.4.4 Local Time and Date

ELS has been built in with a local server time that manages all the transaction. This local server time is taken into account whenever a transaction happen so that all transaction such as loaning or

returning a book is calculated correctly. Based on the local time, user can decide when they want to borrow the books and when must they return it.

7.4.5 Confirmation Page

Each page which required user inputting information to the system will automatically have a confirmation page. This confirmation page will ensure that the user will be able to view what the data that they had keyed in before acknowledging it. This will prevent user from entering invalid information and give them another chance to change the data.

7.4.6 Error Messages Pop Up and Error Message Pages

Each textbox is coded so that whenever a user make a mistake such as keying in alphabet instead of number for phone number, a pop up window will appear with the appropriate error messages.

Error message pages are also included in ELS such as when in a case where there are no such particular items in the library.

7.4.7 Help

A help page is available for users. The online help makes ELS easier to use for inexperience users.

7.5 System Constraints/Limitations

Due to time constraints, some of the system features could not be implemented. A list of the limitations is as below:

a) Inability to support Bar Code Reader

The input devices used in ELS are still the keyboard and mouse. This is far less realistic compare to the real world where a bar code reader is used to input data information. Besides, inputting data through keyboard and mouse is much slower and tedious as well as error prone compare to bar code scanner.

b) Large Storage Required

Compare to Microsoft Access, ELS which uses Microsoft SQL required a larger and more complicated database. This can create a problem for slow or low performance computer.

c) Graphical User Interface

Due to limited time, the interface of the system is some how not as appealing as it should be. Colour is quite dull and not very attractive. Nevertheless, in future time, the "make up" of ELS will be modified and enhance.

7.6 Future Enhancement

Even though ELS is a complete system by itself, there are still a lot or room to make some improvement. Only the system alone won't be able to replace the existing conventional library system. Some of the enhancement that would probably take place in the future is:

a) Integration with Bar Code Reader

With the use of scanners, error rates due to typing and clicking of mouse will be minimized. Thus, the efficiency of the services will increase. Not only that, the prospect of the whole system is bright with the inclusion of the scanner.

b) Attractive Interface

A modification is surely will take place in the near future on the interface. The interface is the first thing the user will bump into. Therefore, a friendly interface can make the system more appealing as well as accepted.

c) MARC format

A library system isn't a complete system unless its integrate with MARC format. MARC is an international acclaim format for cataloging. By integrating ELS with MARC, ELS will be a really complete system. MARC or "Machine Readable Cataloging Record" means that one particular type of machine; a computer can read and interpret the data in the cataloging record.

With MARC, the database in ELS can be converted to a machine-readable format which can be used by other library system as well. Therefore, exporting and importing of items with other library is possible.

d) Interactive Online Help

In the near future, ELS should have an online tutor. Library whose uses ELS need not spend on training as training will be provided online. This not only helps the new user to understand the system in a shorter time but also can save money.

e) Integrated with Other Library

Integration with other library is seen as a future enhancement for ELS. By using MARC, ELS can 'communicate' with other libraries. User looking for books or other materials can have more choice while searching for their items

7.7 Knowledge and Experience Gained

Needless to say, a lot have been gained through out the process of completing ELS. Knowledge related to Information Technology as well as Computer Science is learnt and gained. ELS provides me with the opportunity to endure the real life of s system developer. System development life cycle provide step-by-step information in developing a complete system. From analyzing user requirement until the testing of the final system, I had managed to learn what I couldn't imagine before this. Proper solution methods or suggestion to problems encountered are managed to propose with supervisor.

ELS provided a platform where one can gain the real working life experience.

Some of the knowledge gained in developing ELS is:

a) Active Server Page (ASP)

Needless to say, the engine of ELS is ASP. ASP provides the essential coding mechanism and functions. ASP helps programmer in understanding the concept of programming. ASP helps programmers to express themselves to code which can be executed.

b) Java Script (JSP)

Same as ASP, JSP is the engine of ELS. Even though JSP is not used as frequent as ASP but the contribution of JSP is visible. As a programmer, I've learnt that JSP is very useful in the checking of error and the validation of information. JSP uses preloaded WINDOWS 2000 built in function to pop up error message boxes.

c) Macromedia Dream weaver

Macromedia Dream Weaver is used to design the interface. Macromedia Dream Weaver uses HTML to code the design and translate the code to what we are saw in ELS. Macromedia Dream Weaver is very user-friendly. I managed to learn how to use Dream Weaver and applied the user what in my head and changed it into a design.

d) Microsoft SQL Server

ELS uses Microsoft SQL Server as the database tool. SQL is an independent database which means that the database is moveable. By using the fields that are defined by the user, he/she can insert, delete, update as well as other more complicated function. Besides that, Microsoft SQL Server can handle a lots of transaction at one given time and is very suitable for a data heavy system like the ELS.

e) Internet Information System (IIS)

ELS is a web based system. Therefore, Internet Information System is needed to publish the system online.

Besides knowledge, I am able to get a feel of how system developing is all about. I am able to generate more ideas as well as strategies in developing ELS. I get to feel what working environment is all about. And lastly, after completing ELS, I felt that I have the potential to developing a more complicated system in the future. I hope that ELS is the stepping-stone for me in the field in developing system.

Summary

After implementation, ELS and the approach as well as the method should be evaluated. Problems that encountered were analyzed and the appropriate solutions were taken carefully. ELS strengths are the fulfillment of the user's requirements and increase the effectiveness and efficiency of the library service. Although there are some minor constraints in ELS, but based on the future enhancement mentioned earlier, these constraints should be able to solved.

Conclusion

Much has been gained throughout this project. ELS or Electronic Library System is a web-based system that allows users search as well as do some transactions.

A lots of knowledge and experience have been gained throughout the duration of developing ELS.

I got to work independently as a programmer and apply the theory learnt in lecture and skills to the real system. There is also an opportunity to gain management and organization skill in the handling of ELS.

ELS is not a big project that cost million of millions of Ringgit, nevertheless, ELS is of one of a kind. All the knowledge and theories learnt in lecture classes have been successfully applied to the real world.

It is proud to say that ELS has managed to achieve its objectives, functional and non-functional requirements that were planned earlier in Thesis 1. Even though there are still some rooms for improvement, it can assure that with the future enhancement, ELS can surely be a powerful system in the near future.

APPENDIX

Table Of Content

Introduction

ELS or Electronic Library System is a web based system library system. This is a system that incorporates many features and functions of any library in the world be it a public library or a special library.

ELS is consists of several modules or components such as acquisition module, cataloging module, circulation module, maintenance module, bulletin & feedback module as well as OPAC module. Each of the module works to perform their functional needs and integrated to perform as a general library system.

ELS is designed to helps its user to better perform their responsibilities, to enhance the existing library services, to make the library service available even to the user in remote area and also provide helps to the users of the library in library operation and decision making.

I believe that ELS will serve all kinds of library well. You just need to customize what you need from ELS to serve your own library.

Having said that, I hope that whoever that might use ELS will find it convenience and useful.

Thanks

About The User Manual

This user manual contained all the information and guide that is needed to help new user get used of the system.

Before you install this system, please make sure that your own computer comes with the following hardware and software:

Hardware Requirement

a) IBM compatible PC with an 80586 processor or higher. A Pentium PC is recommended.
b) At least 10 MB of hard disk is required.
c) At least 4MB of RAM
d) A VGA or other compatible monitor display
e) A minimum of 2X CD ROM Drive
f) Keyboard and mouse

Software Requirement

a) A Microsoft Window version 3.1 or higher. Recommended, Windows 2000
b) A Microsoft SQL Server preinstalled

This user manual consists of 11 chapters. Each chapter will guide you in understanding the system.

Installing ELS

To install ELS, you need to do the following:

a) Put the ELS CD ROM in the CD ROM drive.
b) Copy the ELS folder to and place it in under your C:/ directory
c) Open a browser and type in the URL: http://proserver2/ELS/first page. Asp
d) If a window pops up asking for connection, click Connect.

Chapter 1 Getting Started

This chapter presents an overview of the ELS (Electronic Library System) environment and guide you step-by-step where and how to start ELS

1.1 Main Page

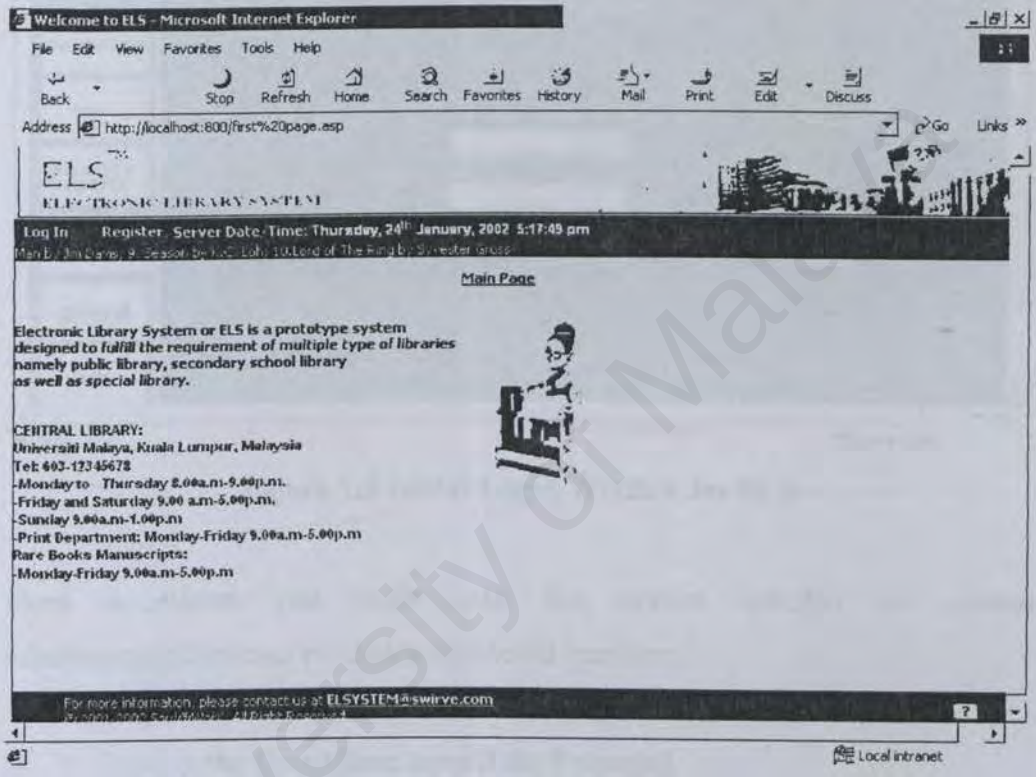


Figure 1.1 Main Page for ELS

This is the main page where you will be able to log in as a user or as a librarian.

1. Click on the Log In button to log on into the system or
2. Click the Register button to register as a member or
3. Click on the ? icon on the bottom of the screen to read help file or
4. Click on **ELSYSTEM@swirve.com** to contact the administrator

1.2 Login

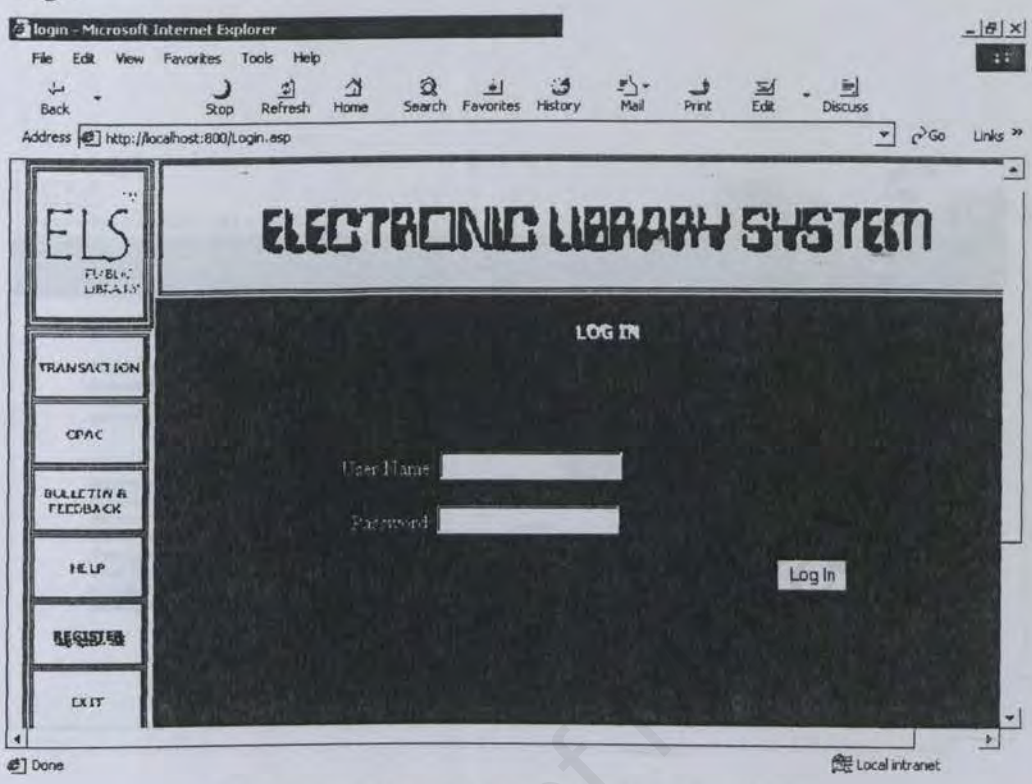


Figure 1.2 Initial Login Window for ELS

Here is where you login into the system whether as system administrator/librarian or library registered members.

Step by step:

1. Type in the User Name as well the Password
2. Click Log In or
3. Click on the left hand side icon to go to their respective pages.
4. Click on the ELS Public Library Logo will send you to the user main page or
5. Click on OPAC icon will send you to the search engine or OPAC or
6. Click on BULLETIN & FEEDBACK Icon will send you to the bulletin and feedback as well as holiday pages or
7. Click on HELP icon to read help file or
8. Click on REGISTER to register s a member of the library system or
9. Click on EXIT to log out

1.3 Administrator/Librarian

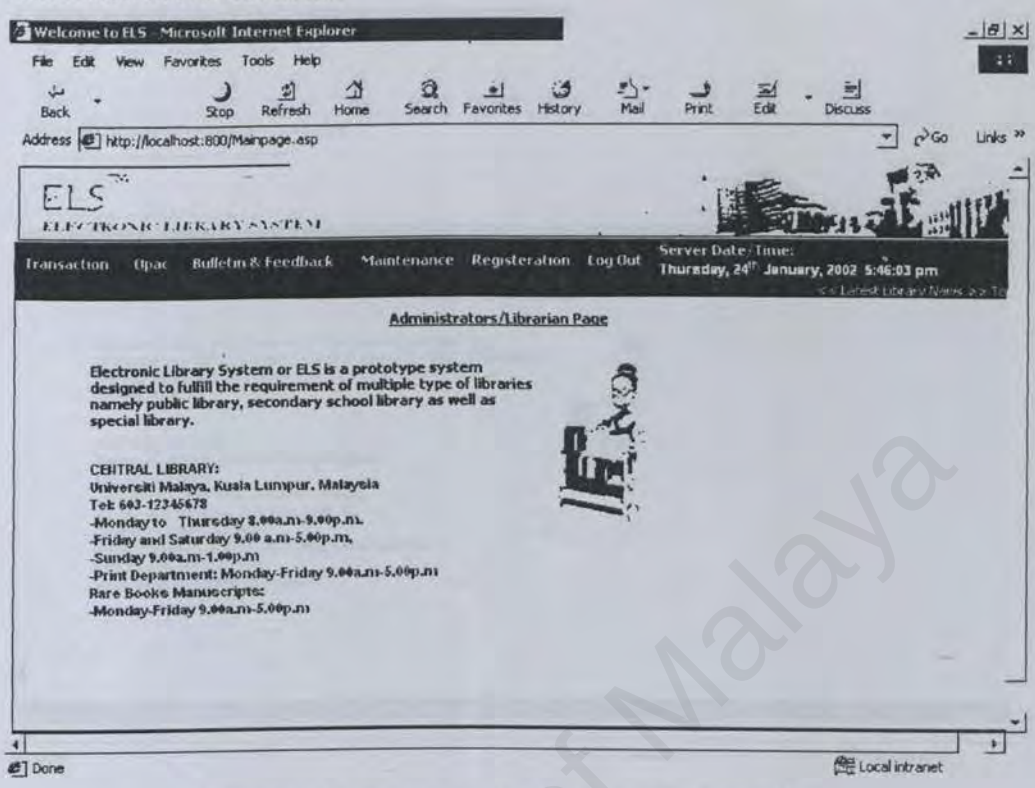


Figure 1.3 Administrator/Librarian Main Page

This is the administrator and librarian menu.

1. Put the mouse cursor Transaction on the top bar will bring down drop a down menu. Click the Transaction to go to transaction page.
2. Put the mouse cursor Opac on the top bar will bring down drop a down menu. Click the Opac to go to Opac page.
3. Put the mouse cursor Bulletin & Feedback on the top bar will bring down drop a down menu. Click the Bulletin & Feedback to go to Bulletin & Feedback page.
4. Put the mouse cursor Maintenance on the top bar will bring down drop a down menu. Click the Maintenance to go to Maintenance page.
5. Put the mouse cursor Registration on the top bar will bring down drop a down menu. Click the Registration to go to Registration page.
6. Click the Log Out to log out from the system.

1.4 Visitor

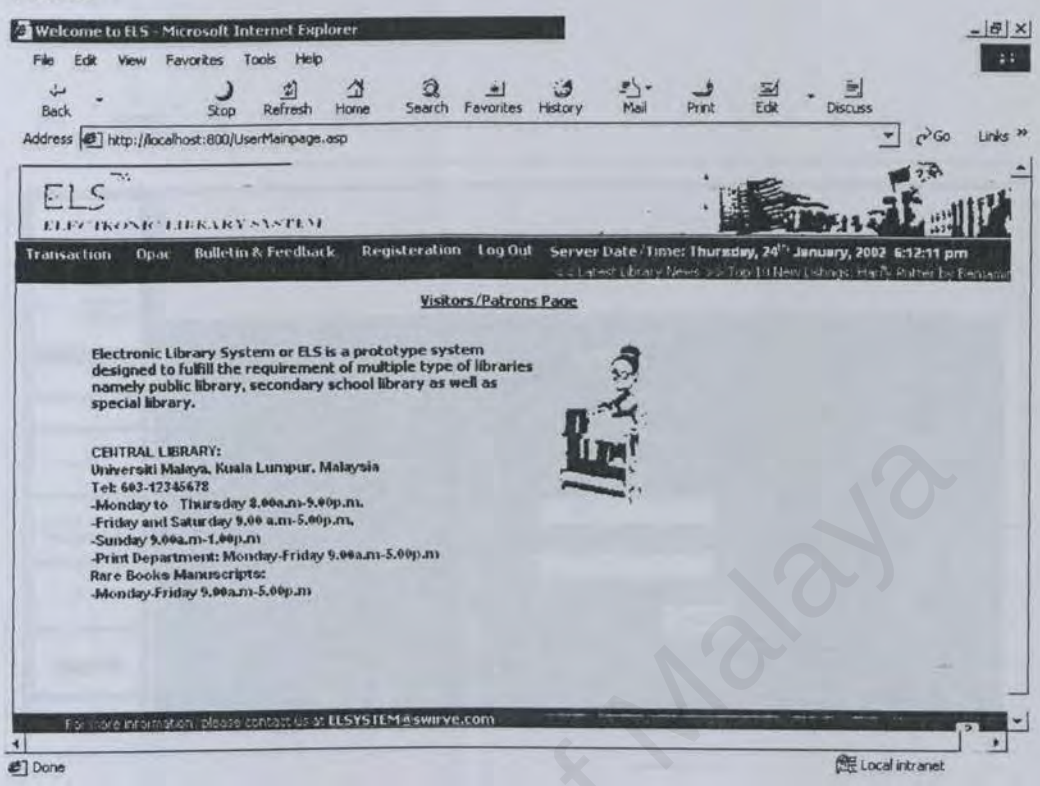


Figure 1.4 Visitor Main Page

This is the visitor menu.

1. Put the mouse cursor Transaction on the top bar will bring down drop a down menu. Click the Transaction to go to transaction page.
2. Put the mouse cursor Opac on the top bar will bring down drop a down menu. Click the Opac to go to Opac page.
3. Put the mouse cursor Bulletin & Feedback on the top bar will bring down drop a down menu. Click the Bulletin & Feedback to go to Bulletin & Feedback page.
4. Put the mouse cursor Registration on the top bar will bring down drop a down menu. Click the Registration to go to Registration page.
5. Click the Log Out to log out from the system.

1.5 Re Login

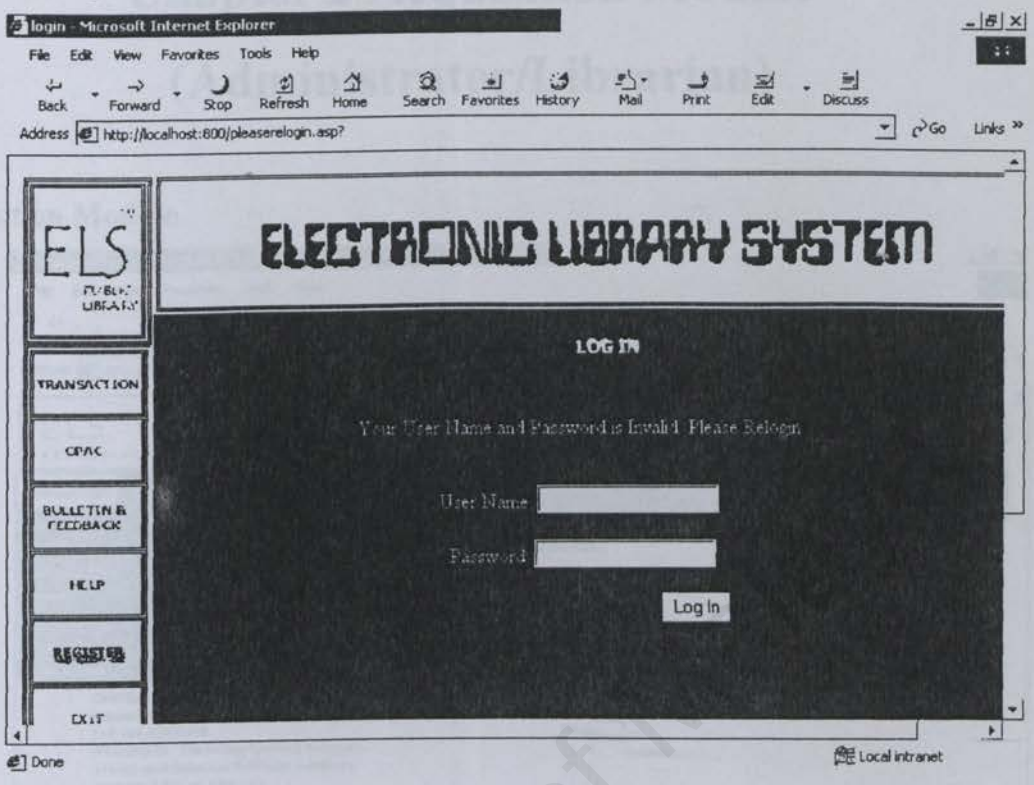


Figure 1.5 Re Login

If the User Name or the Password is invalid, please re login.

If you forgot the password, please contact your system administrator.

Chapter 2 Acquisition Module

(Administrator/Librarian)

Acquisition Module

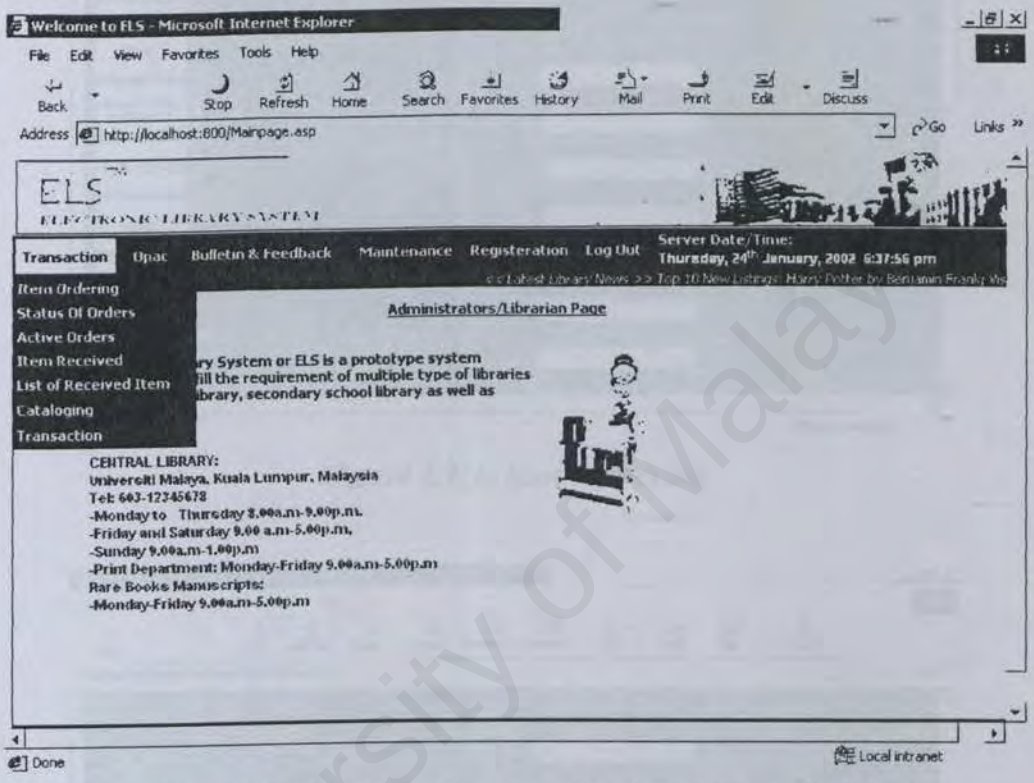


Figure 2.1 The Menu Showing The Acquisition Module

The following sub-modules are:

1. Click on Item Ordering to go to Item Ordering menu
2. Click on Status Of Order to go to Item Order Status menu
3. Click on Active Order to go to Active Order menu
4. Click on Item Received to go to Item Received menu
5. Click on List Of Received Item to go to List Of Received Item menu
6. Click on Cataloging to go to Cataloging menu
7. Click on Transaction to go to Transaction menu

2.1 Item Ordering

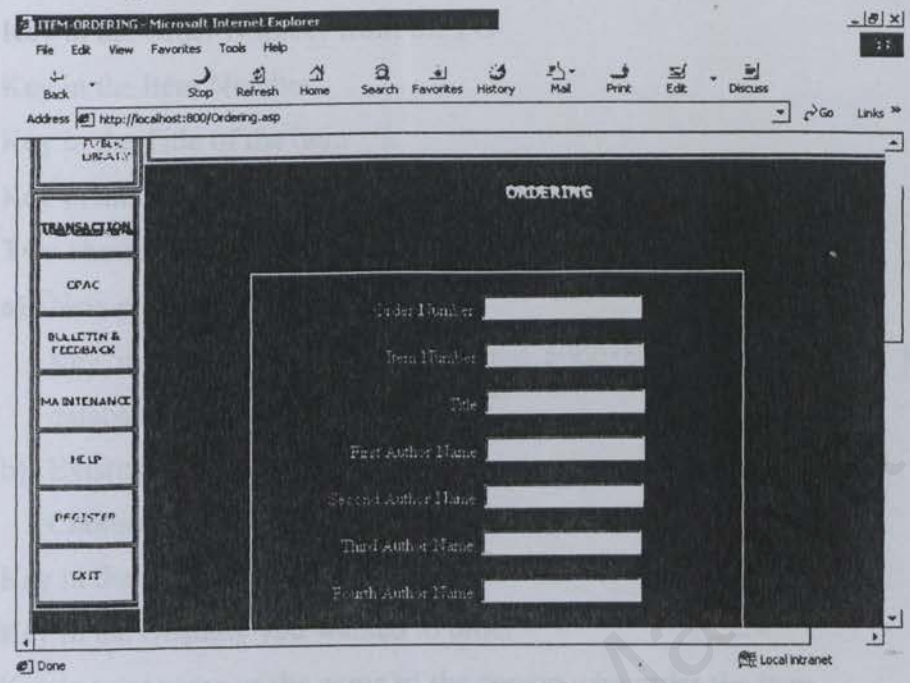


Figure 2.2(a) Item Ordering

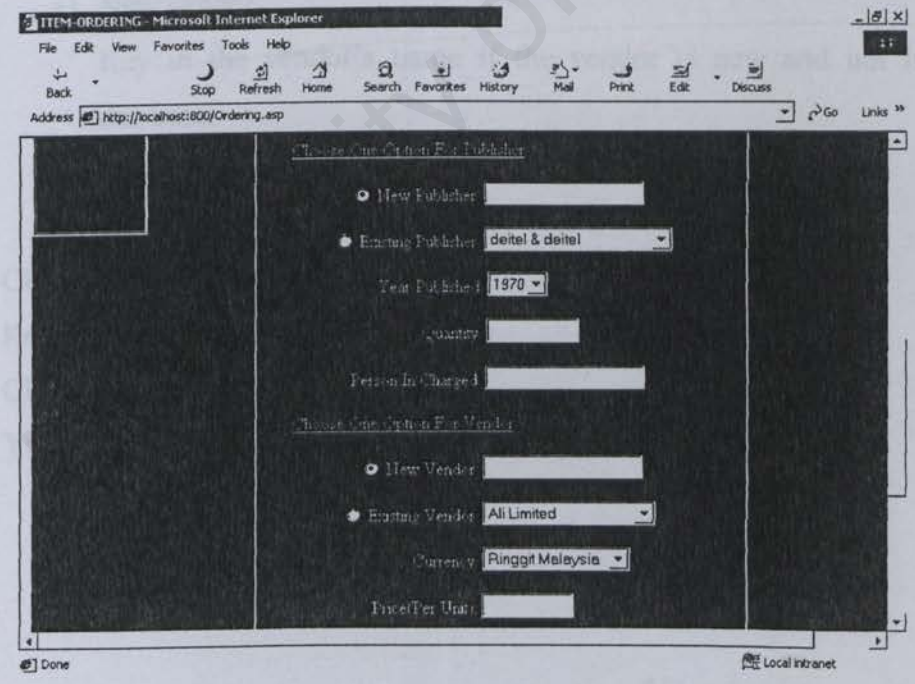


Figure 2.2(b) Item Ordering

Step by step:

1. Key in the Order Number from the PO
2. Key in the Item Number
3. Key in the Title of the item
4. Key in the Author's name. At least one author needed to be keyed in.
5. Two choices for the publisher:
   a) New publisher
      Key in the publisher's name if the publisher is new and not in the database
   b) Existing publisher
      Choose from the list of publishers
6. Key in the Publication Year
7. Key in the Quantity you wanted to order
8. Key in your name or the name of the person who order the item
9. Two choices for the vendor:
   a) New vendor
      Key in the vendor's name if the vendor is new and not in the database
   b) Existing vendor
      Choose from the list of vendors
10. Choose the currency of the item
11. Key in the price of the item (one unit)
12. Click Submit
13. You will reach a page called Confirmation Page (figure 2.3)

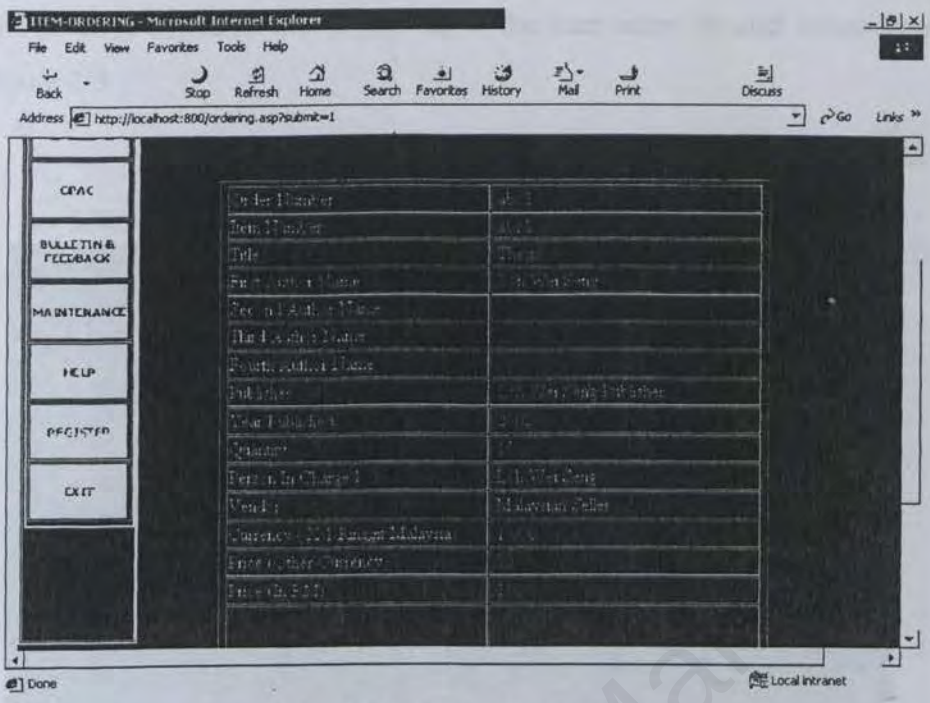


Figure 2.3 Confirmation Page

In the confirmation page, you can check the information. If you want to alter any information, click Previous.

Press Confirm to save the information as in figure 2.4

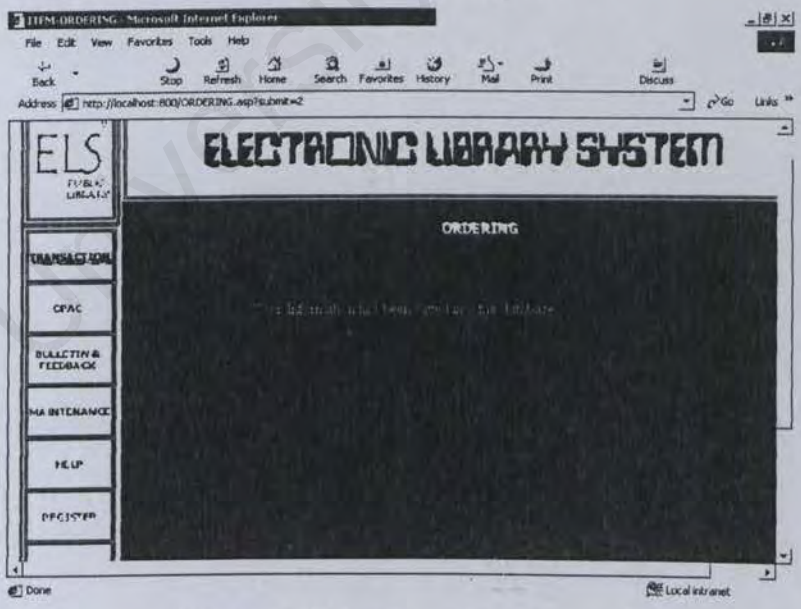


Figure 2.4 Confirmation Successful.

There might be error message boxes pop up if the user enter invalid information as shown in figure 2.5

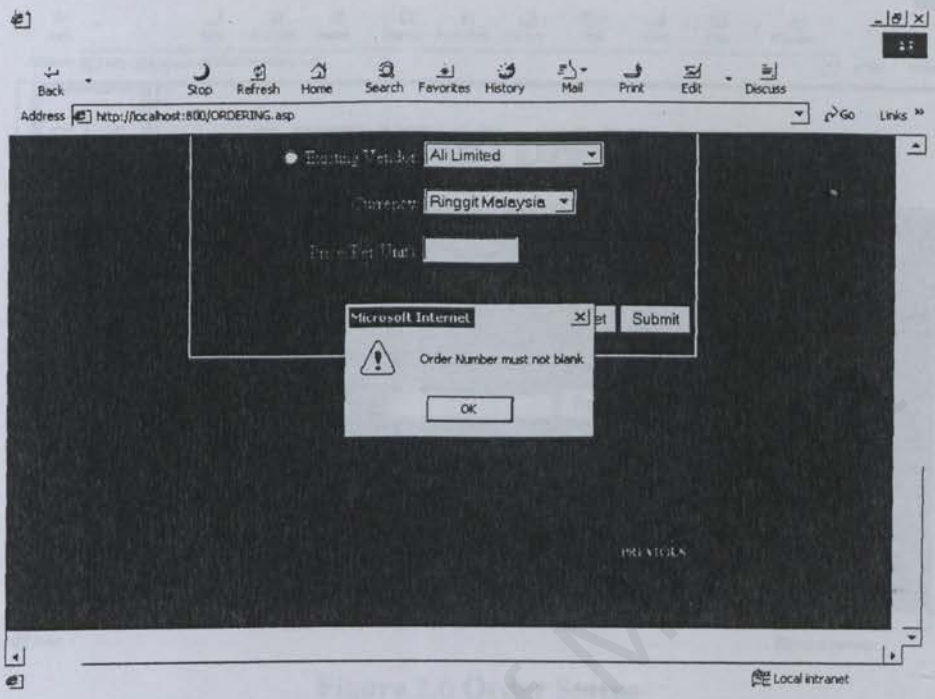


Figure 2.5 Error Message Pop Up

2.2 Order Status

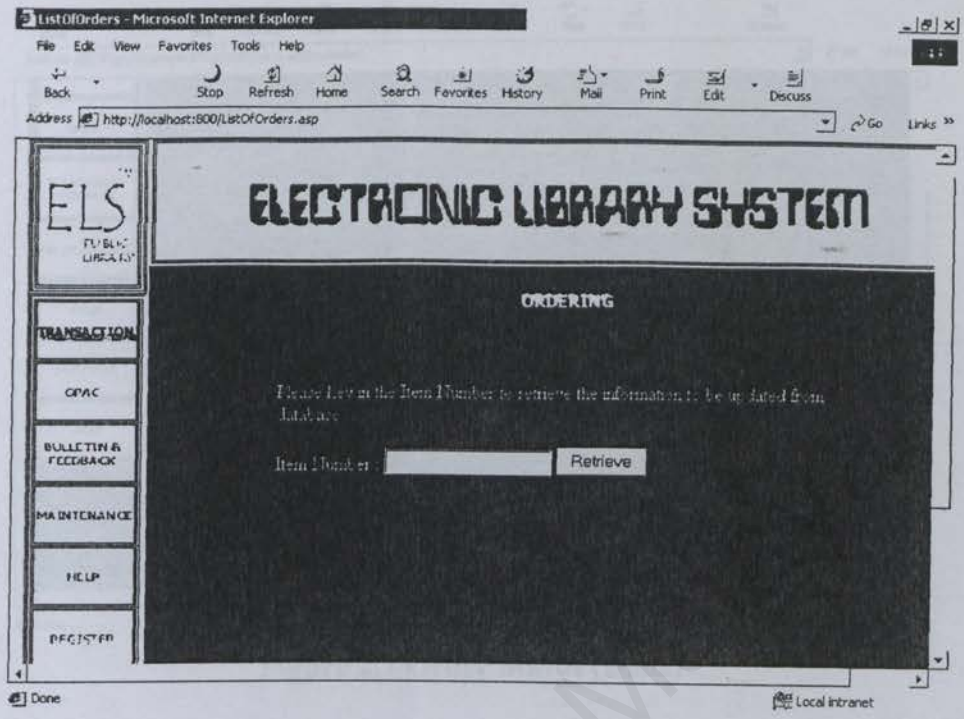


Figure 2.6 Order Status

This is where you changed the status of the order from active to done.

Step by step:

1. Key in the Item Number
2. Click Retrieve
3. You will reach another page where all the information if the particular item number.
4. Change the Order Status to done
5. Click Submit
6. You will reach the Confirmation Page with all the information in place.
7. Click Update to Update the information or Previous to go back to previous page.

See figure 2.7 and 2.8 for graphical information

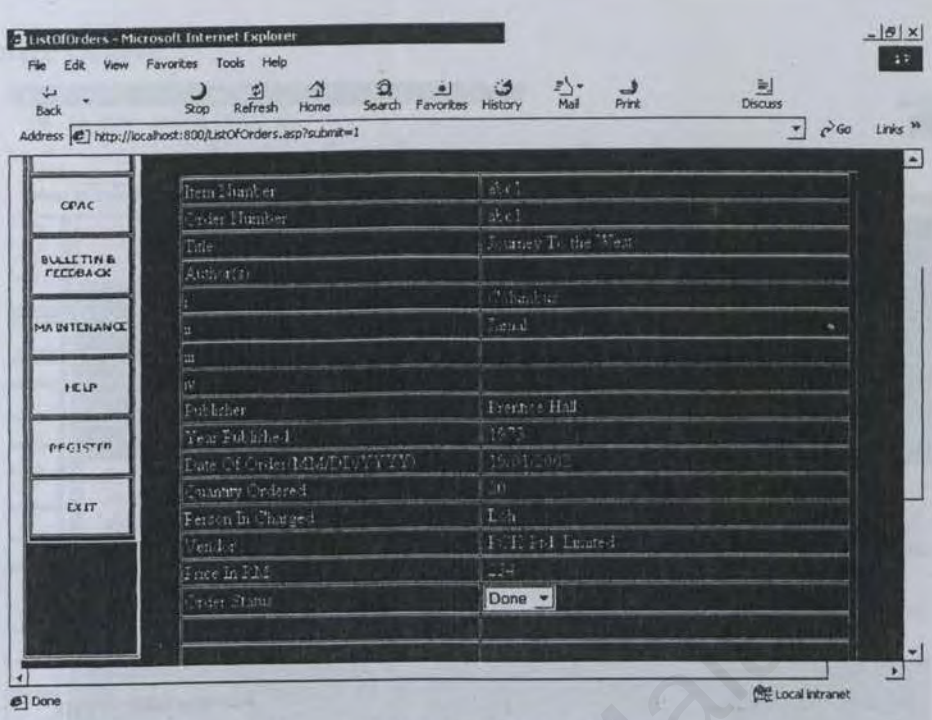


Figure 2.7 Order Status (Done)

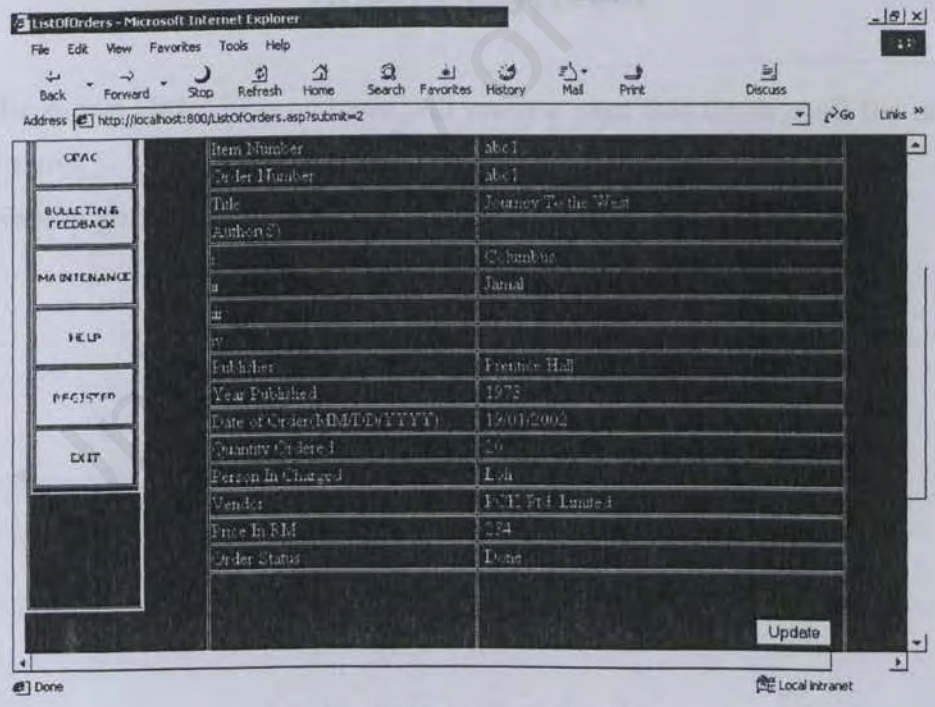


Figure 2.8 Confirmation Page

2.3 Active Orders

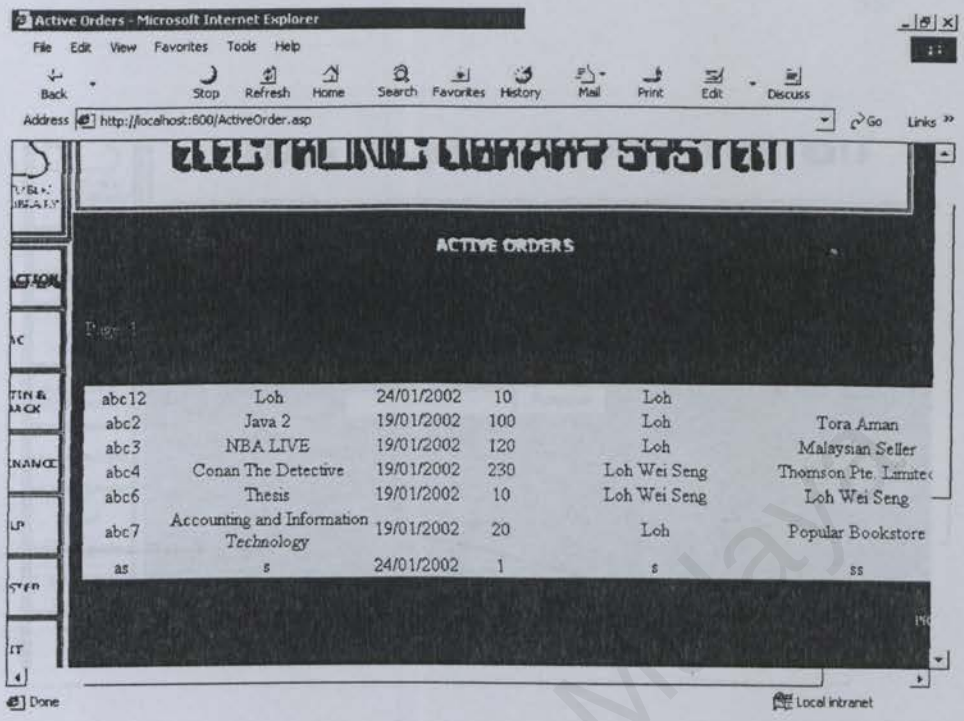


Figure 2.9 Active Orders

Click on the Active Order icon and you will reach a page that displays all the orders that is still active.

Click Previous to go back to the previous page.

2.4 Receiving

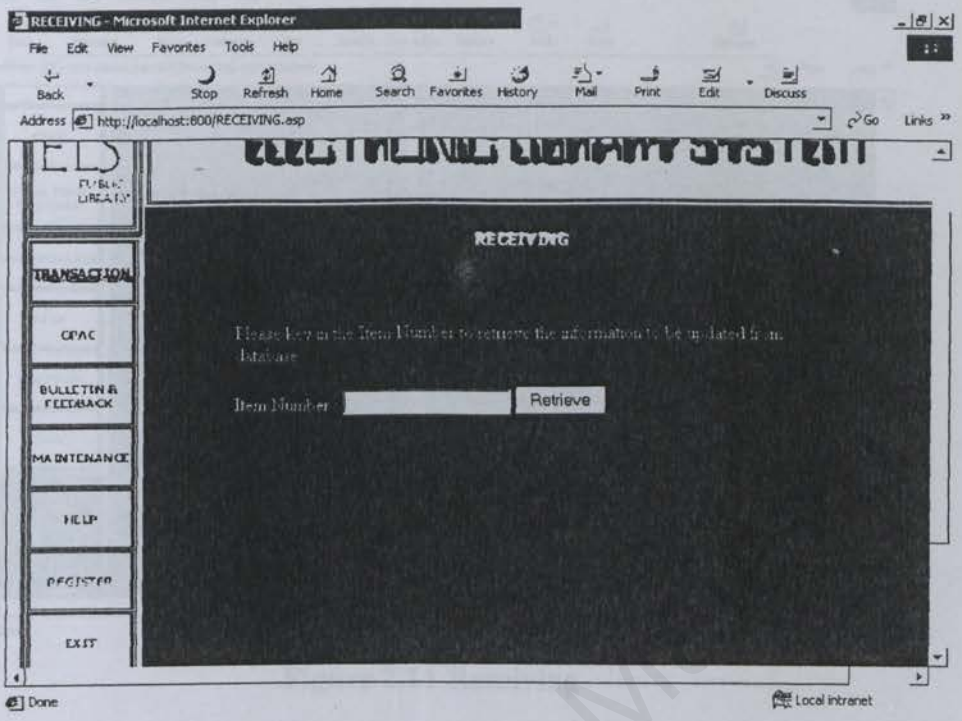


Figure 2.10 Receiving

Step by step:

1. Key in the Item Number to retrieve the particular item
2. Click Retrieve
3. You will reach a page where all the information about the item is displayed
4. Key in the Receive Number
5. Key in the Quantity Received
6. Key in the Person In Charged
7. Key in the Date Received
8. Click Update
9. You will reach a Confirmation Page with all the information listed
10. Press Update to update the database or Previous to go back to previous page

See figure 2.11 for graphical information

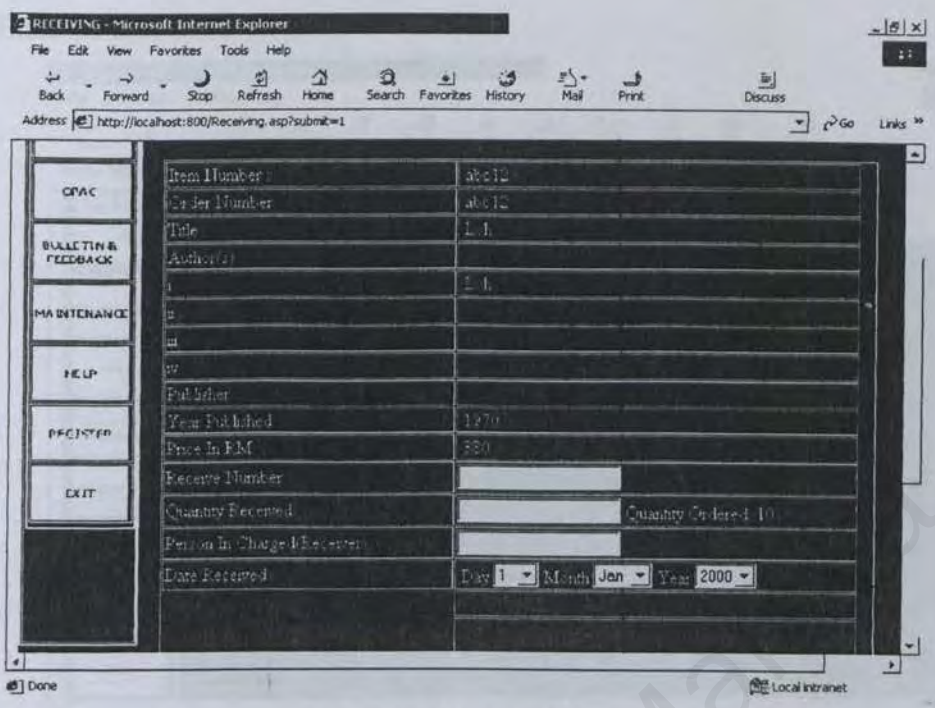


Figure 2.11 Receiving

Same as Item Ordering, whenever the user make or fill in invalid data, an error pop up message box will appear as in figure 2.12.

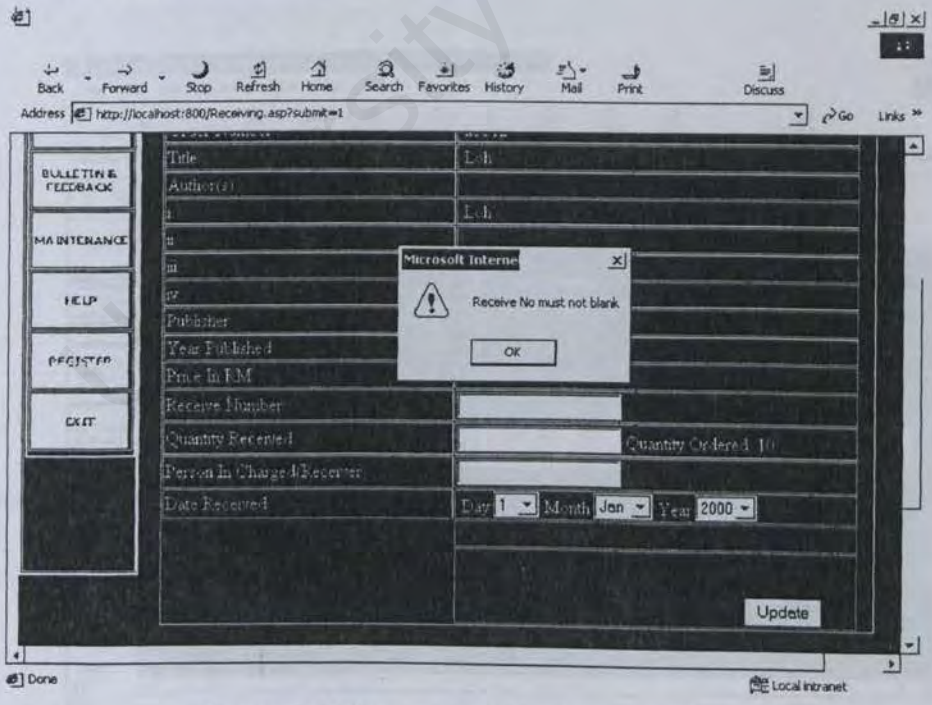


Figure 2.12 Error Pop Up Message Box

2.5 Lists Of Received Item

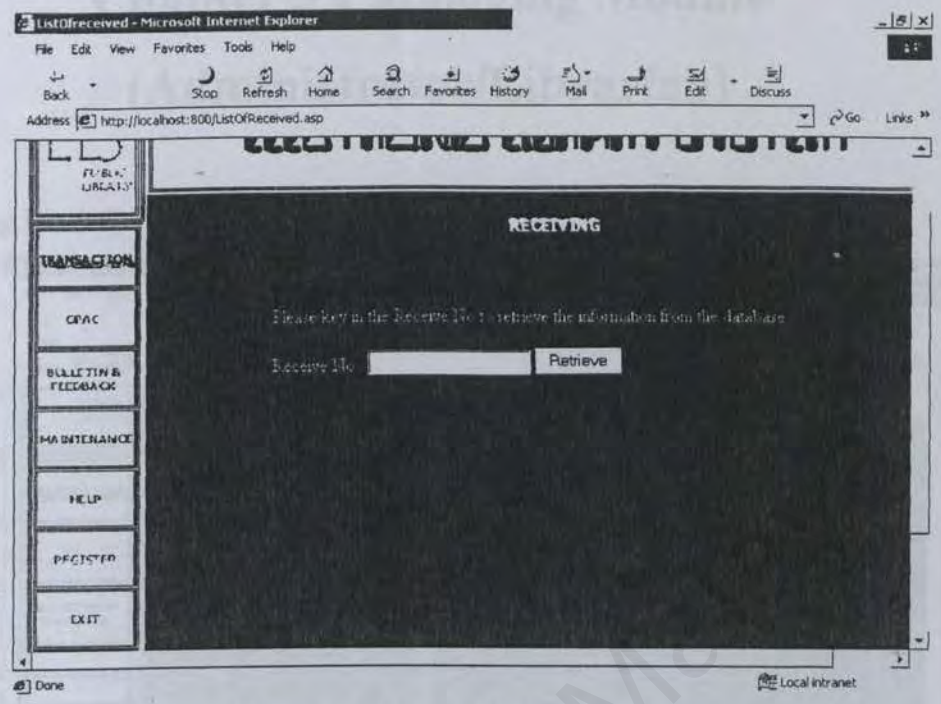


Figure 2.13 Lists Of Received Item

Key in the Receive Number to retrieve all items from the receipt. You will reach the pages where all item and their information will be displayed as in figure 2.14

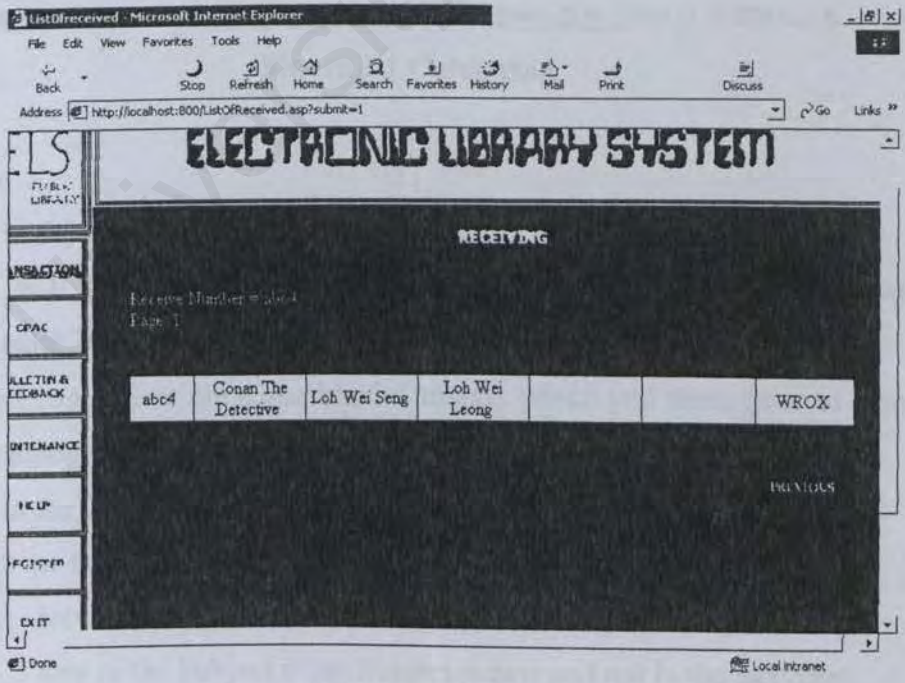


Figure 2.14 Lists Of Received Item

Chapter 3 Cataloging Module (Administrator/Librarian)

Cataloging Module

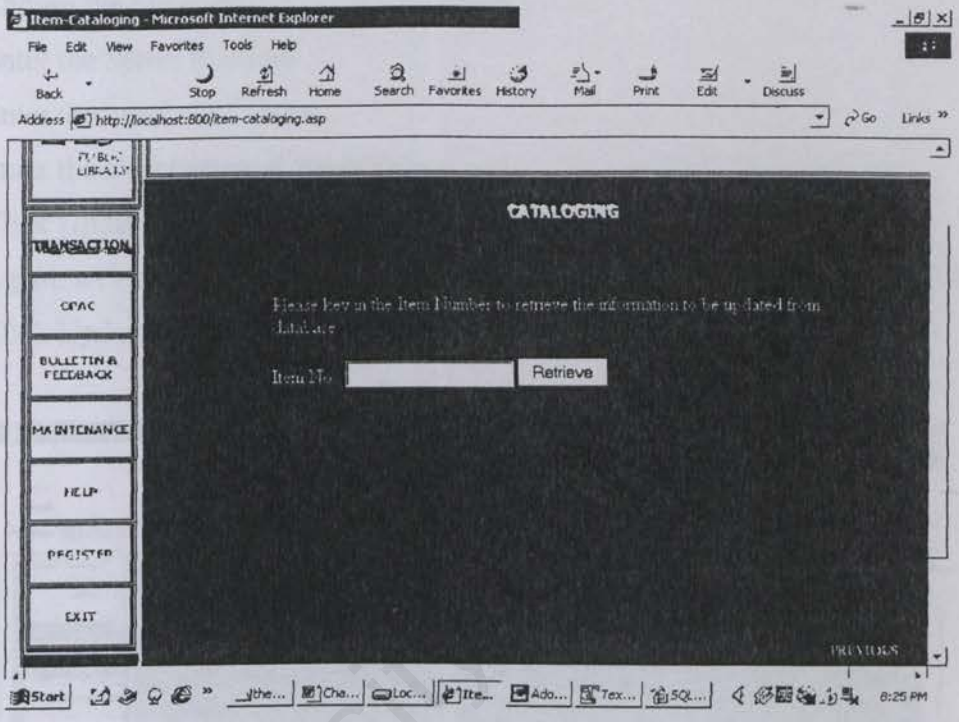


Figure 3.1 Cataloging

Step by step:

1. Key in the Item Number
2. This will bring you to another page where all the information about the particular Item Number is displayed.
3. In this page, there are some blanks textbox which you must enter to complete the cataloging process as in Figure 3.2 (a) and Figure 3.2 (b)
4. Key in the Call Number
5. There are two choices for Subject:
    a) New Subject

        Key in the Subject if the Subject is new and not in the database

b) Existing Subject

Choose from the list of Subjects

6. Do the same with the other two subjects
7. Choose the Category
8. Choose the Language
9. Choose the Location
10. Enter the Series Number
11. Enter the number of Pages
12. Enter the Description of the item
13. Click Update
14. Again, a Confirmation Page will displays all the information as in Figure 3.3
15. Click Update to save the information into the database

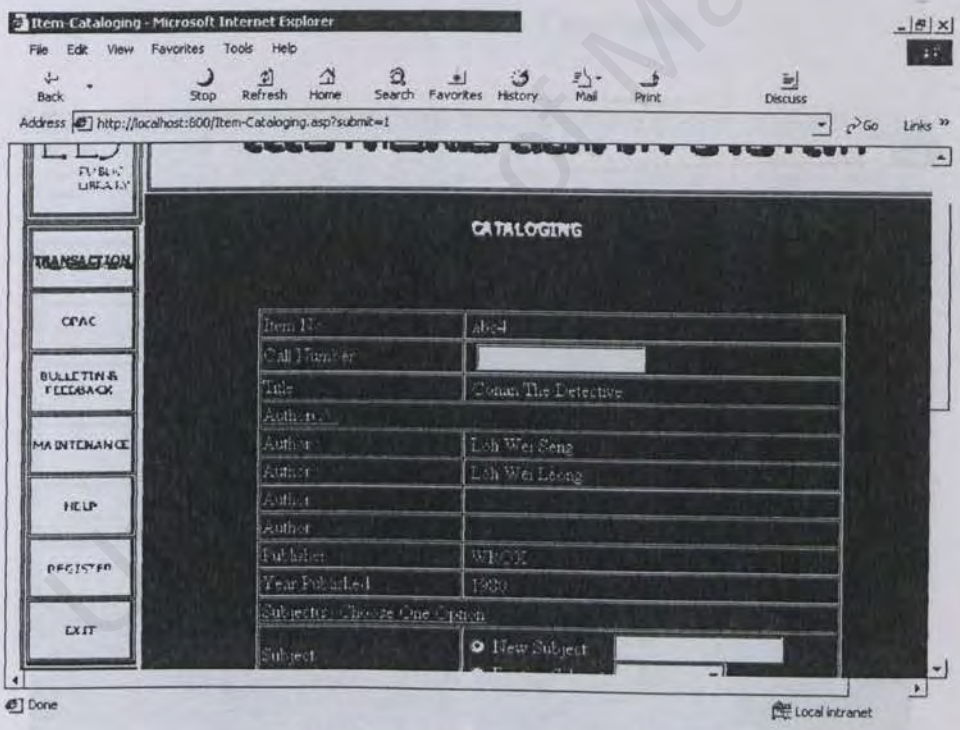


Figure 3.2 (a) Item Cataloging

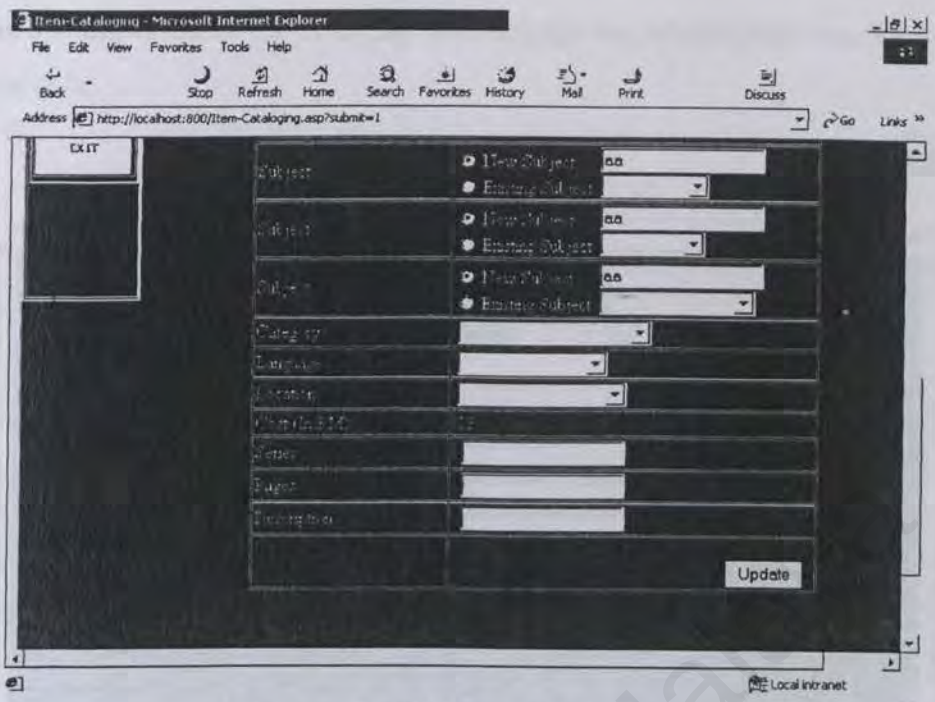


Figure 3.2 (b) Item Cataloging

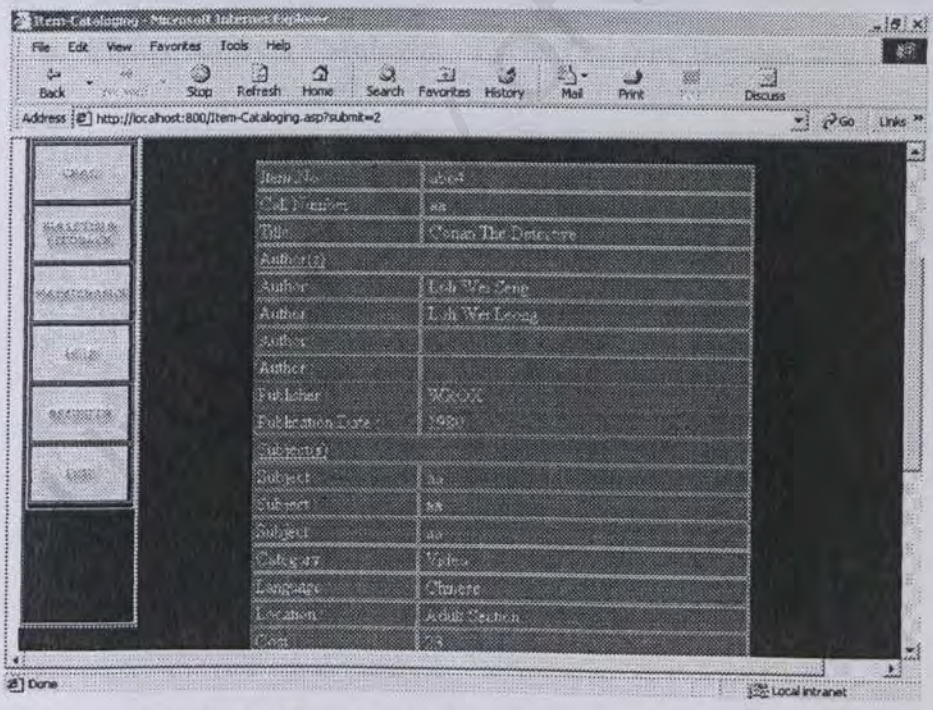


Figure 3.3 Item Cataloging-Confirmation Page

Figure 3.4 shows one of the error pop out message box where pages much be of integer data.

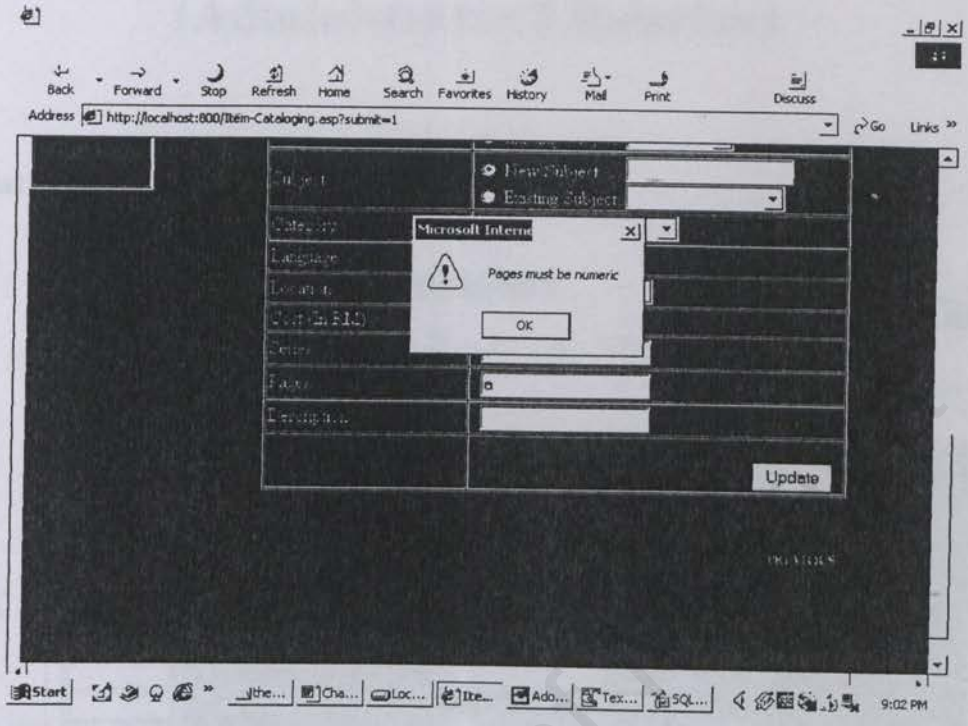


Figure 3.4 Item Cataloging- Error Pop Out Message Box

Chapter 4 Circulation (Administrator/Librarian)

Circulation

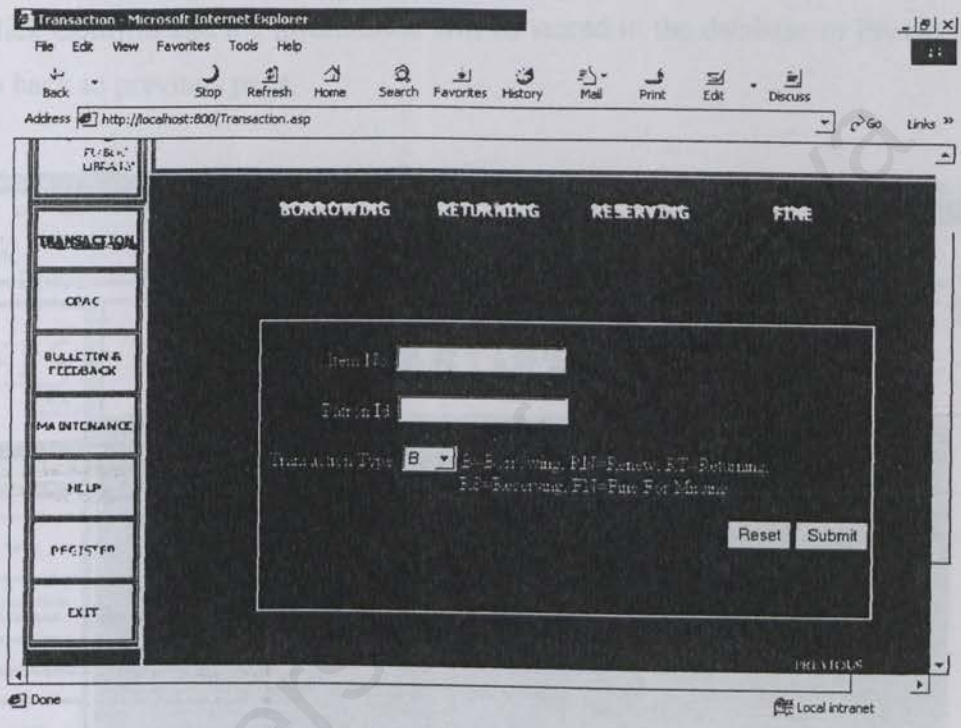


Figure 4.1 Circulation Module

This module lets you, the user to keep record of transaction such as loaning of books, returning, renewing and etc.

Step by step:

1. Key in the Item number
2. Key in the Patron ID
3. Choose your transaction
4. Click on Submit to submit the data or Reset to rest the textbox.
5. If the Item Number and Patron ID are valid, you will proceed.

6. If the Item Number is invalid, you will receive an error message stating that there are no such particular items. See figure 4.2
7. If the Patron ID is invalid, you will receive an error message stating that there is no such Patron ID. See figure 4.3
8. If all goes well, after clicking Submit, you will come to a confirmation page where information about the item is listed as well as the patron id. See figure 4.4
9. Click Confirm and the information will be stored in the database or Previous to go back to previous page

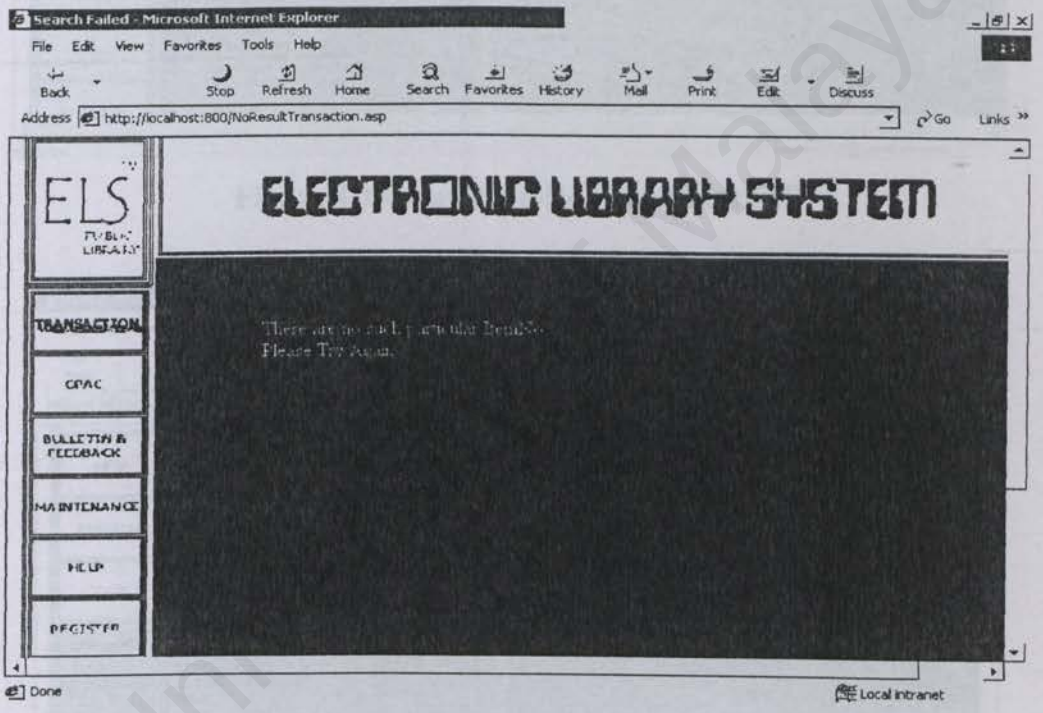


Figure 4.2 Error Page-No Such Item Number

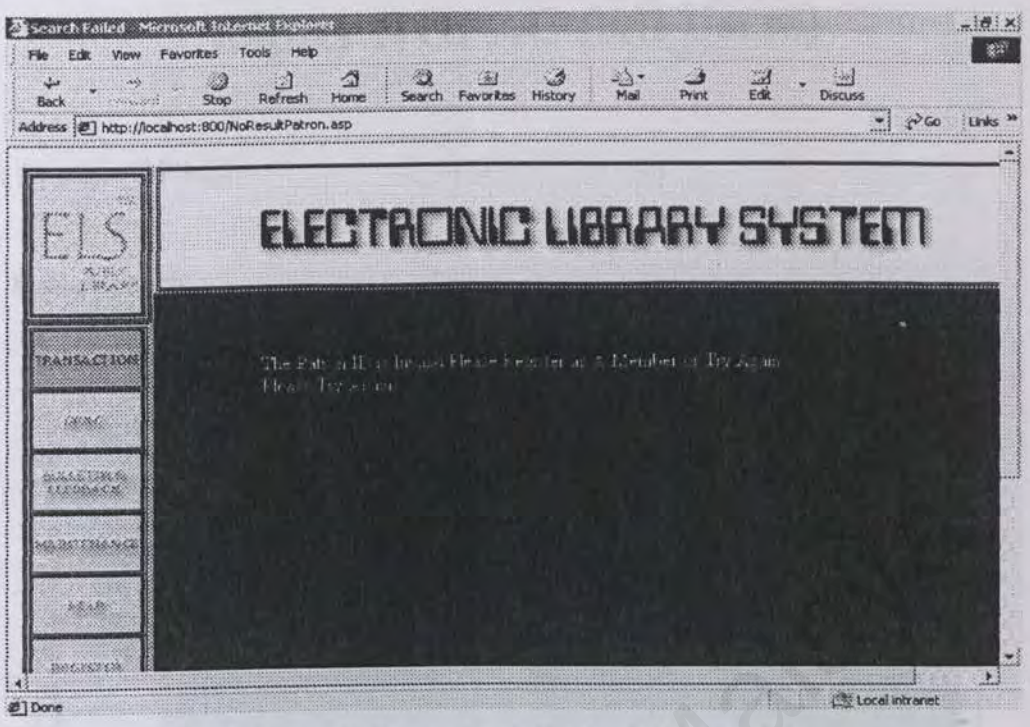


Figure 4.3 Error Page-No Such Patron ID

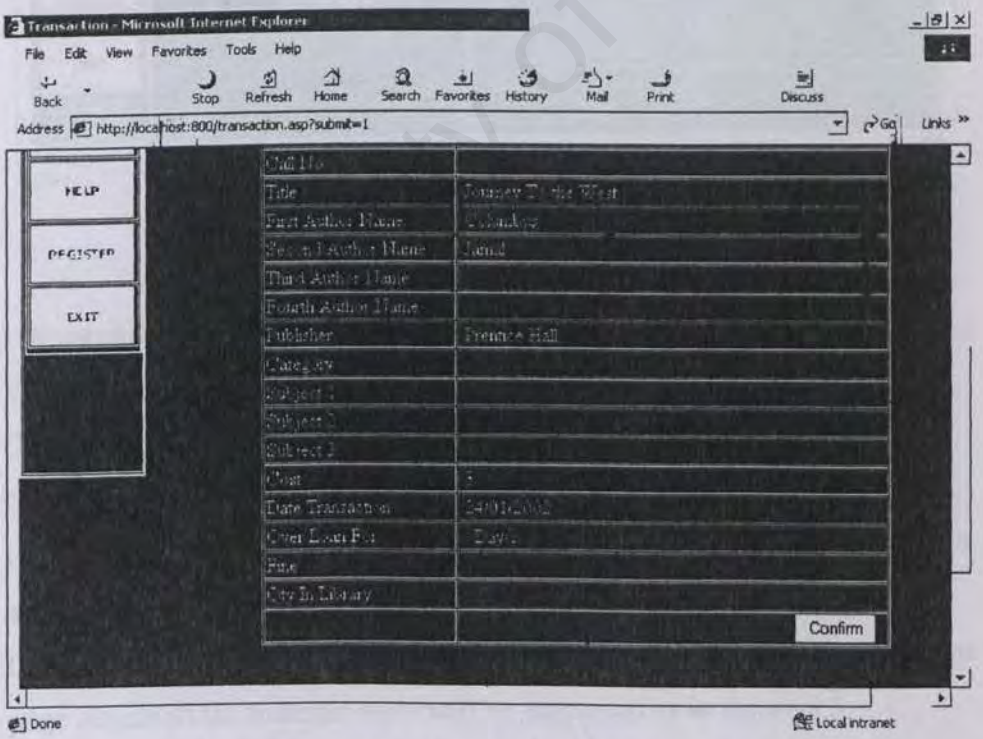


Figure 4.4 Circulation-Confirmation Page

Chapter 5 OPAC (All Users)

Search Engine (OPAC)

5.1 Basic Search

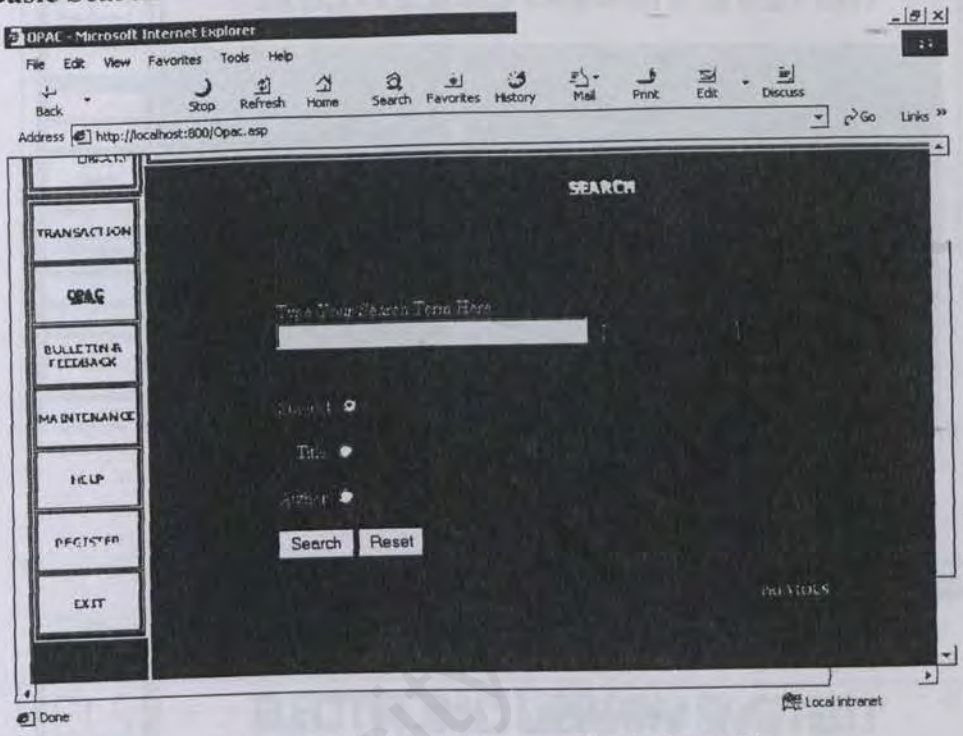


Figure 5.1 OPAC (Normal/Basic Search)

Step by step (Basic Search):

1. Type in the search in the textbox
2. Choose the search criteria whether subject, title or author.
3. Click Search to search the database or Reset to reset the search title
4. If the search title is not available in the library database, an error page will appear as in figure 5.2 (No Result Found)
5. If the search topic matched some of the item in the database, you will come to a page where all the matches item will be displayed as in figure 5.3.
6. Click on the item you desire and you will come to page where the full record of the item will be displayed. See figure 5.4.

7. Click Search Again if you want to proceed with another search.

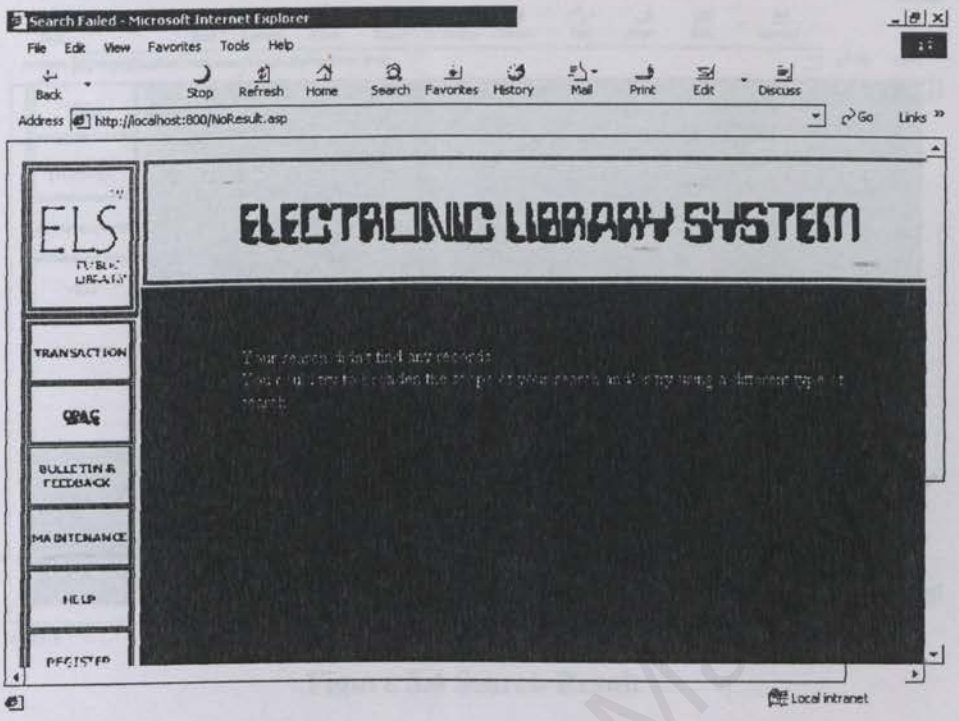


Figure 5.2 No Result Found

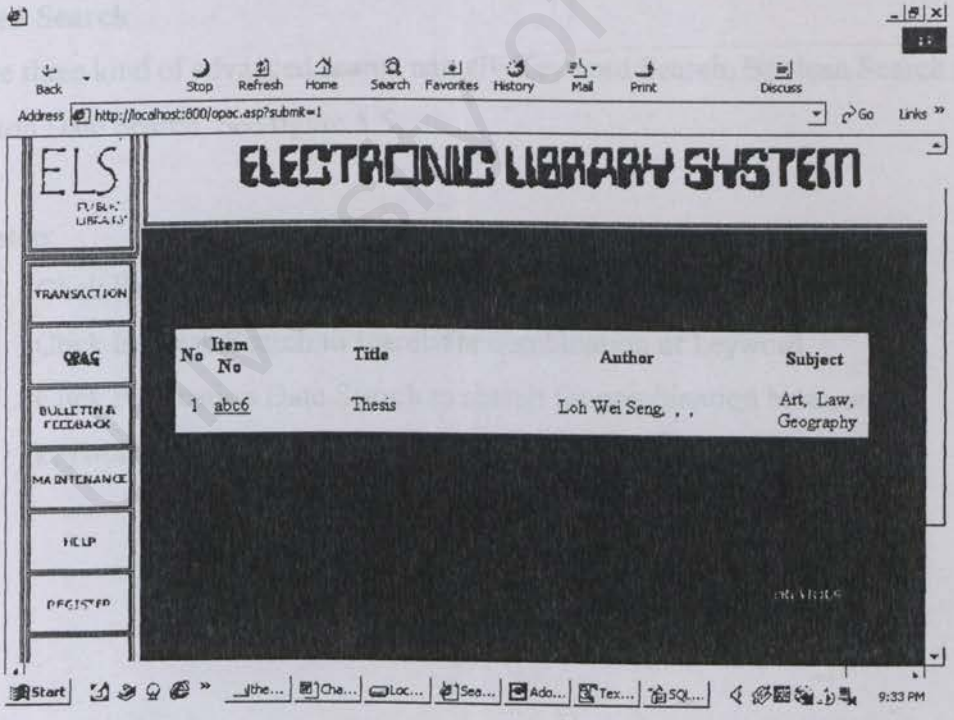


Figure 5.3 Matched Result!

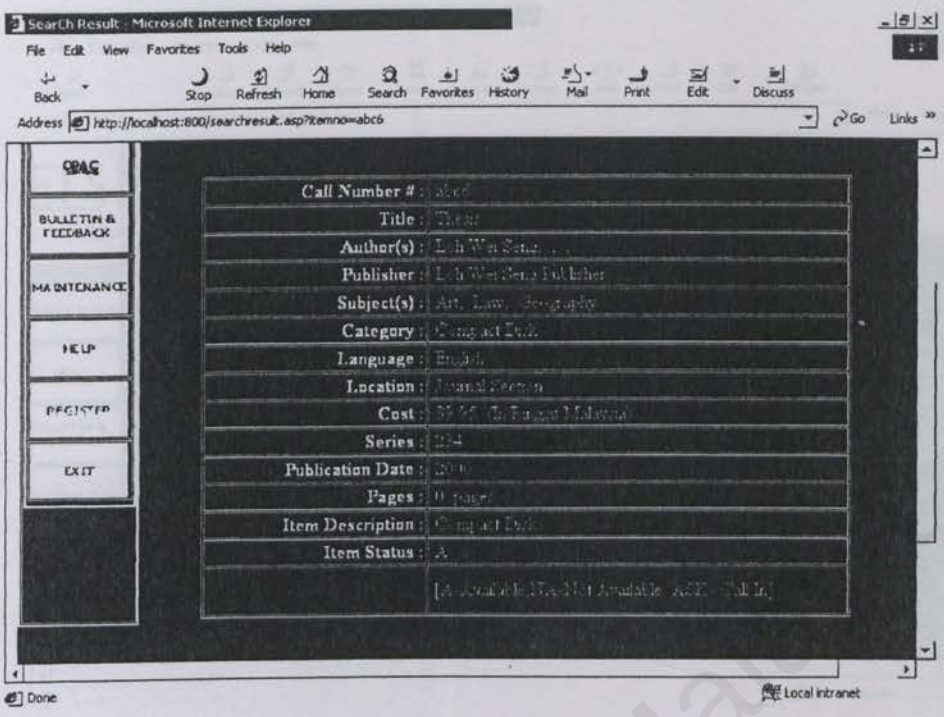


Figure 5.4 Search Result

Advanced Search

There are three kind of advanced search namely Keyword Search, Boolean Search and Publication Date Search. See figure 5.5

Step by step:

1. Click Keyword Search to search keyword
2. Click Boolean Search to search for combination of keyword
3. Click Publication Date Search to search for combination between a keyword and the publication date.

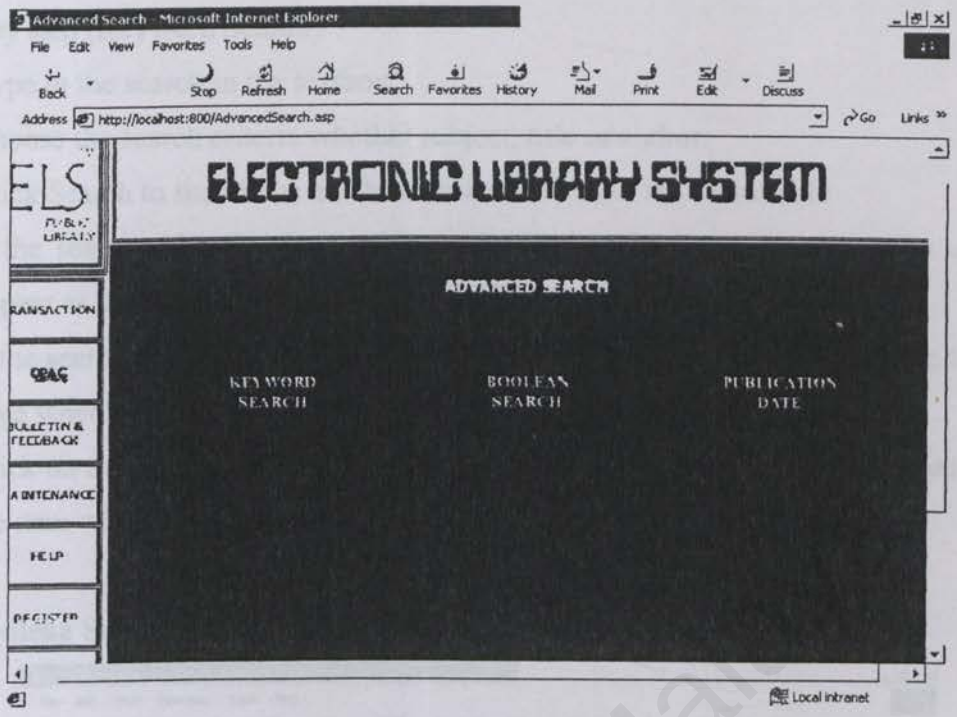


Figure 5.5 Advanced Search

5.2 Keyword Search

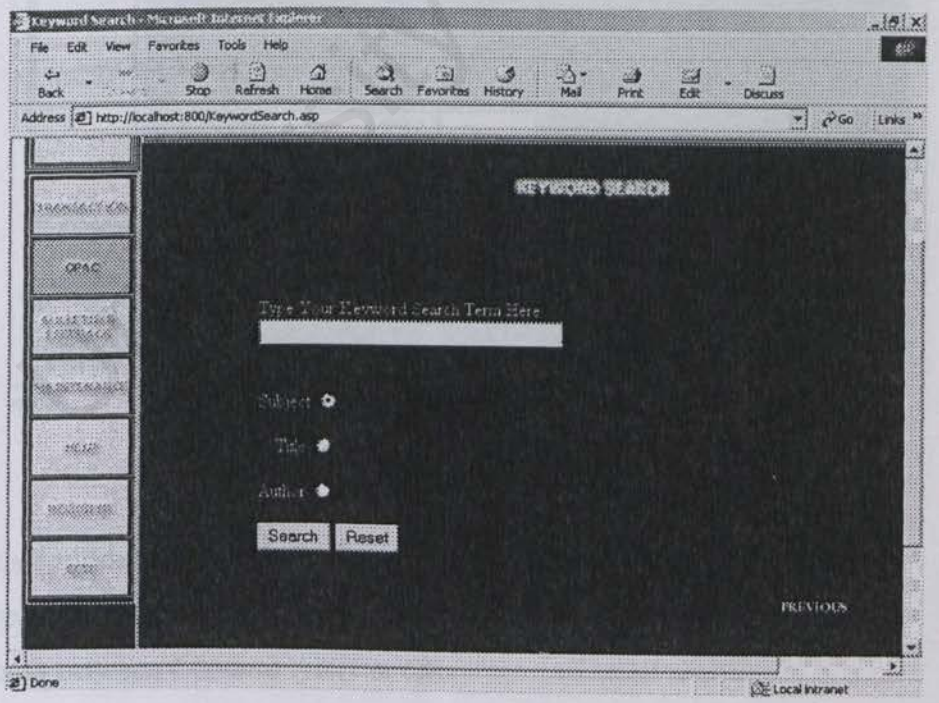


Figure 5.6 Keyword Search

Step by step (Keyword Search):

1. Type in the search in the textbox
2. Choose the search criteria whether subject, title or author.
3. Click Search to search the database or Reset to reset the search title
4. If the search title is not available in the library database, an error page will appear as in figure 5.2 (No Result Found)
5. If the search topic matched some of the item in the database, you will come to a page where all the matches item will be displayed as in figure 5.3.
6. Click on the item you desire and you will come to page where the full record of the item will be displayed. See figure 5.4.

5.3 Boolean Search

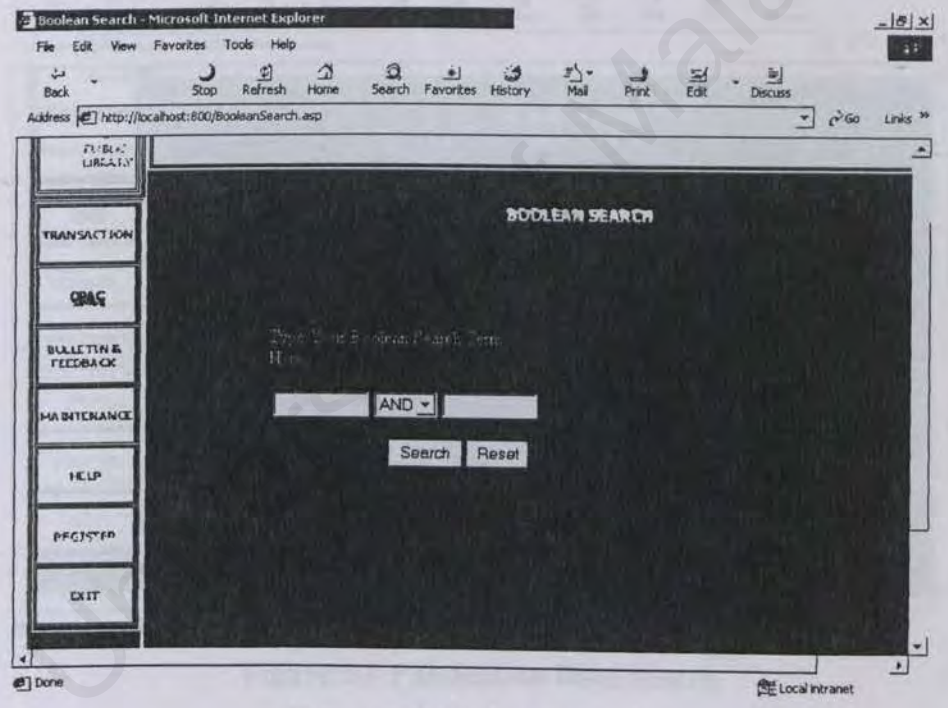


Figure 5.7 Boolean Search

Step by step (Boolean Search):

1. Type in the search in one or both the textbox
2. Choose between Operator AND or OR

3. AND searches for a combination of both searches while OR searches for both or only one of the search topic.
4. Click Search to search the database or Reset to reset the search title
5. If the search title is not available in the library database, an error page will appear as in figure 5.2 (No Result Found)
6. If the search topic matched some of the item in the database, you will come to a page where all the matches item will be displayed as in figure 5.3.
7. Click on the item you desire and you will come to page where the full record of the item will be displayed. See figure 5.4.

5.4 Publication Date Search

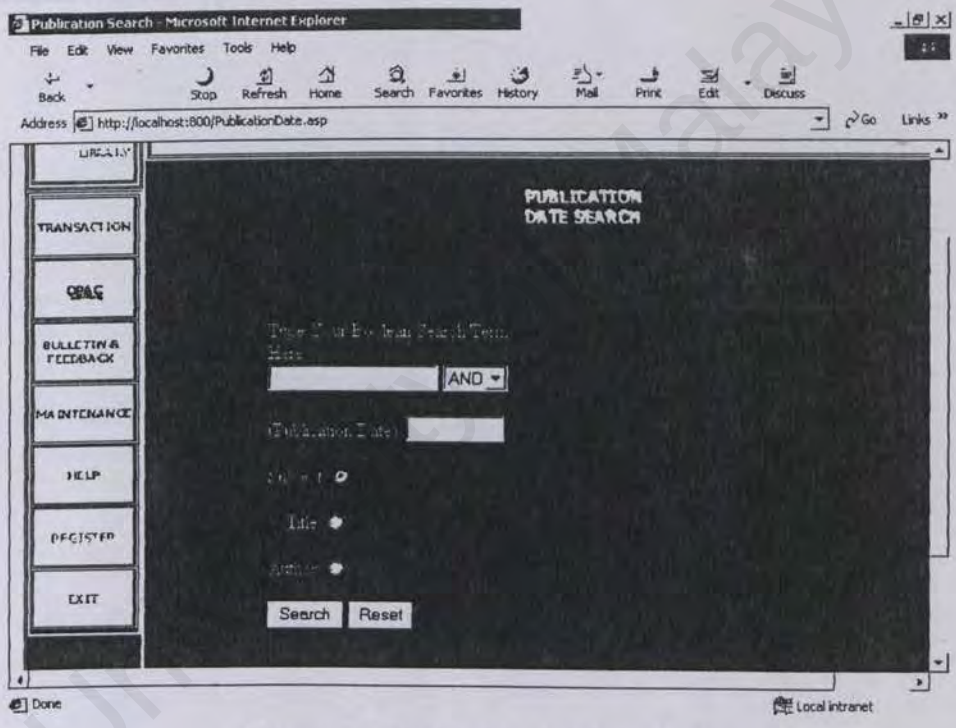


Figure 5.8 Publication Date Search

Step by step (Publication Date Search):

1. Type in the search in one textbox and the publication date in another text book
2. Choose between Operator AND or OR

3. AND searches for a combination of both the search topic and the publication date while OR searches for both or only one of the search topic or publication date.
4. Choose the search criteria whether subject, title or author.
5. Click Search to search the database or Reset to reset the search title
6. If the search title is not available in the library database, an error page will appear as in figure 5.2 (No Result Found)
7. If the search topic matched some of the item in the database, you will come to a page where all the matches item will be displayed as in figure 5.3.
8. Click on the item you desire and you will come to page where the full record of the item will be displayed. See figure 5.4.

Chapter 6 Bulletin & Feedback (Administrator/Librarian)

Bulletin & Feedback

This is where librarian can key in latest news about the library, holiday occasion as well as view feedback from user.

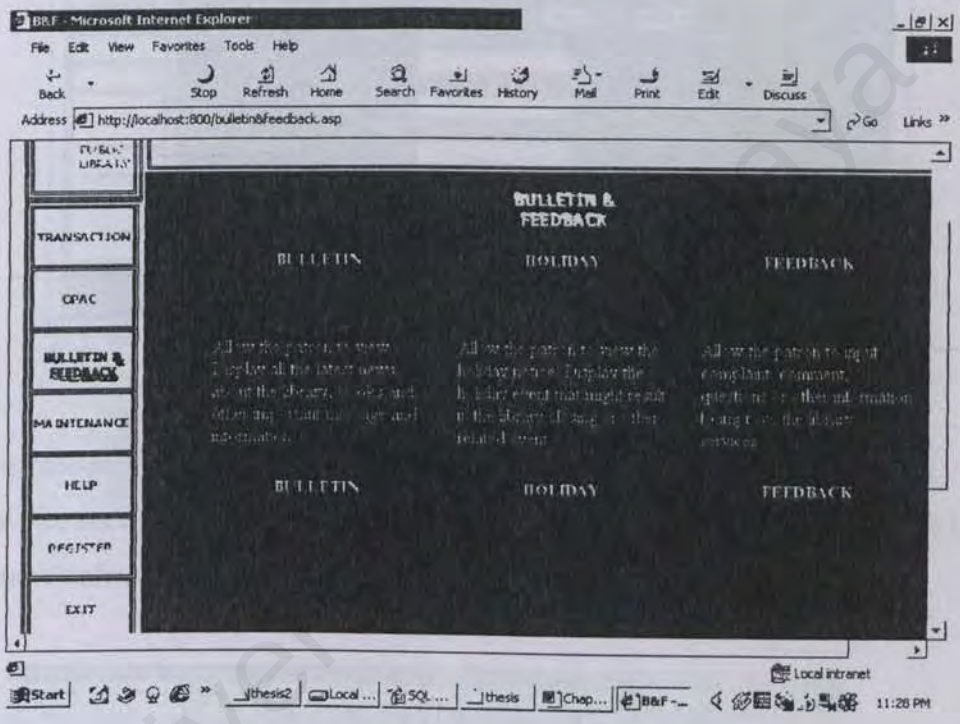


Figure 6.1 Bulletin & Feedback Menu

6.1 Bulletin

This is where librarian keys in latest news and happening bout the library.

Step by step:

1. Key in the name of the Activities
2. Key in the Date of activities
3. Key in the Venue where the activities is expected to be held
4. Key in the explanation about the activities

5. Key in the objectives of the activities
6. Key in the name of the person who is in charged of the activities
7. Click Submit

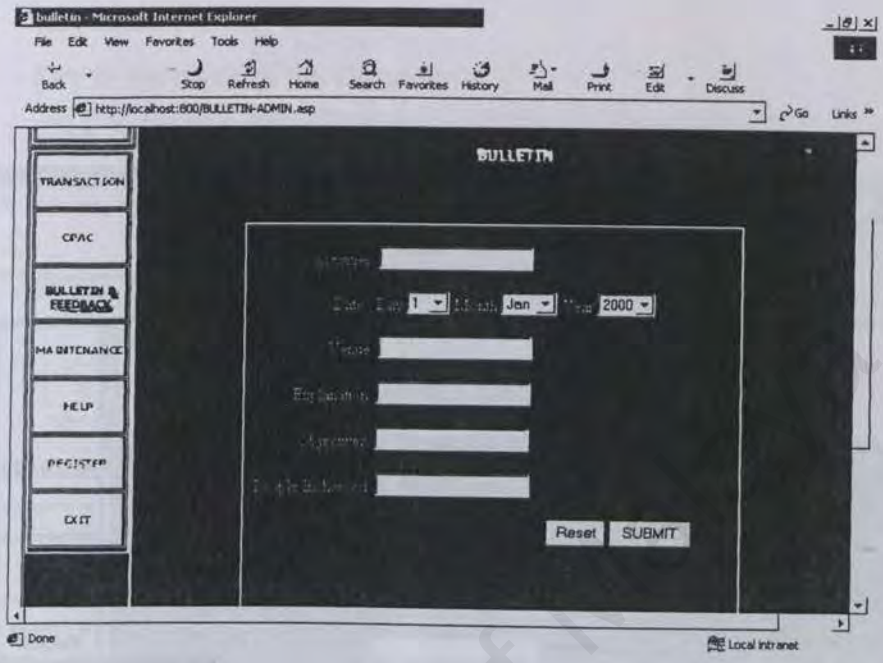


Figure 6.2 Bulletin

After all the information has been keyed in, you will be redirect to the confirmation page where you need to confirm the activities as well as the information related to it by clicking icon Confirm. See figure 6.3.

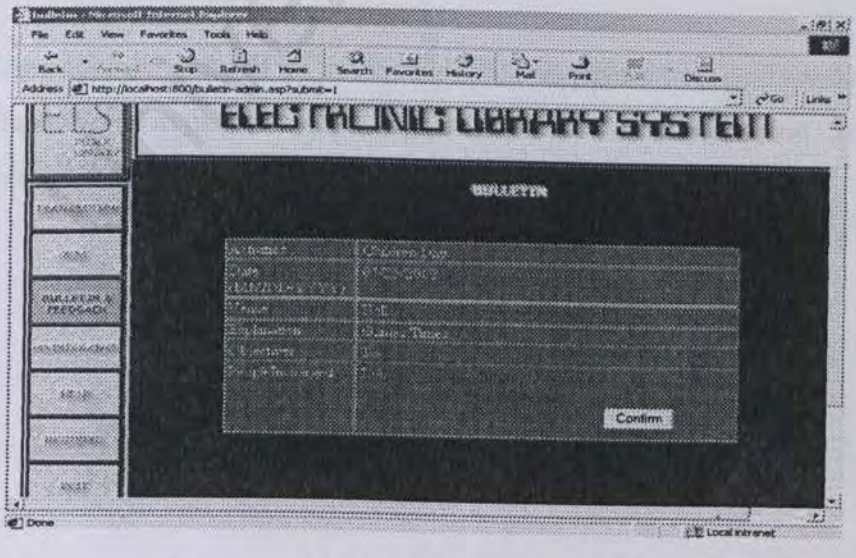


Figure 6.3 Bulletin-Confirmation Page

6.2 Holiday

This is where librarian key in the holiday occasion of a particular year

Step by step:

1. Key in the Holiday date
2. Key in the name of the Occasion
3. Click Submit

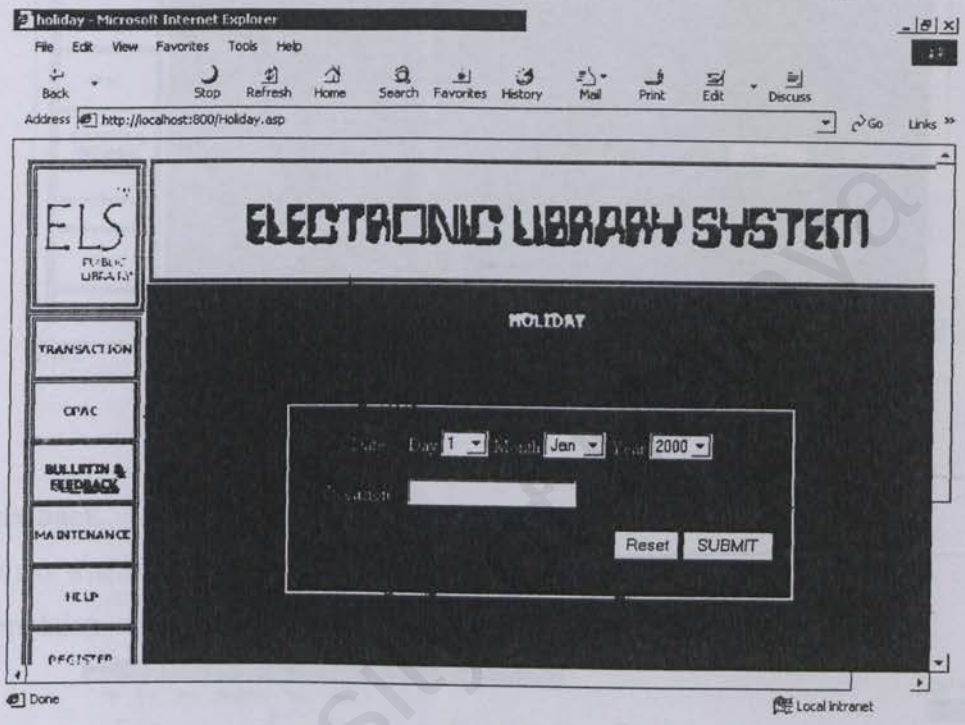


Figure 6.4 Holiday

After clicking submit, you will be in the confirmation page where you need to confirm what you have keyed in earlier by clicking Submit. After clicking submit, the information will be saved in the database. See figure 6.5.

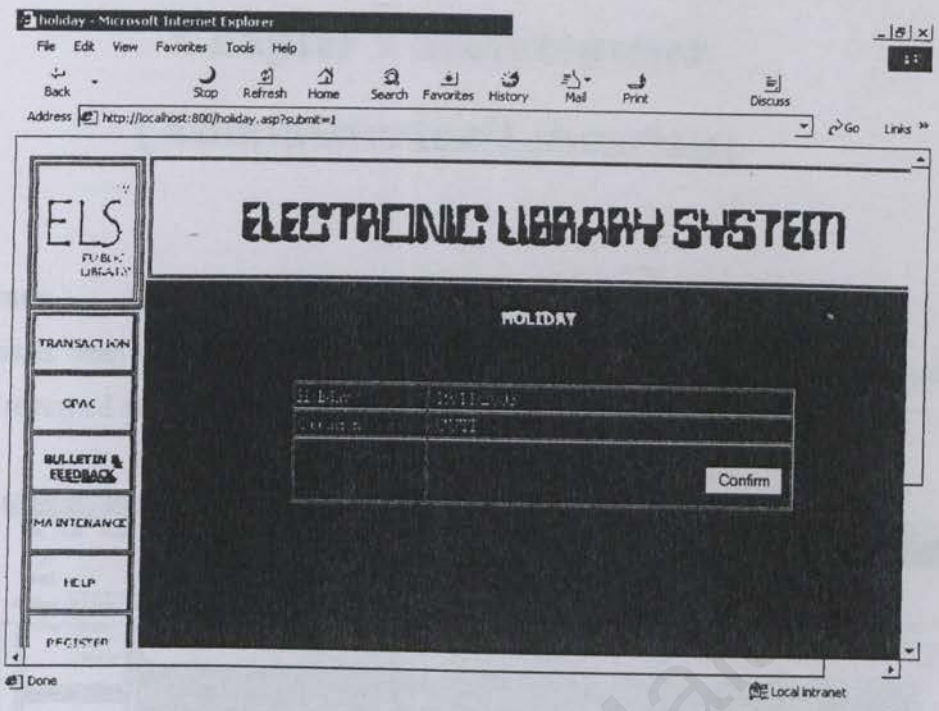


Figure 6.5 Holiday-Confirmation Page

6.3 Feedback

This is where librarian can view user's feedback, suggestion as well as complaints.

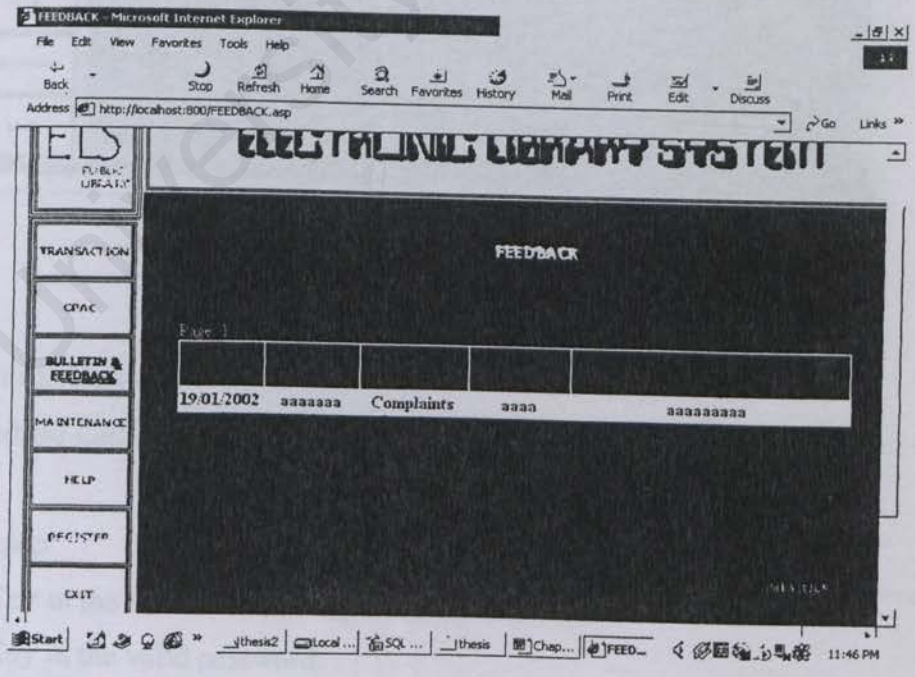


Figure 6.6 Feedback

Chapter 7 Maintenance (Administrator/Librarian)

Maintenance

This is where librarian can modify the user information, the item information, view item reserved as well as edit transaction.

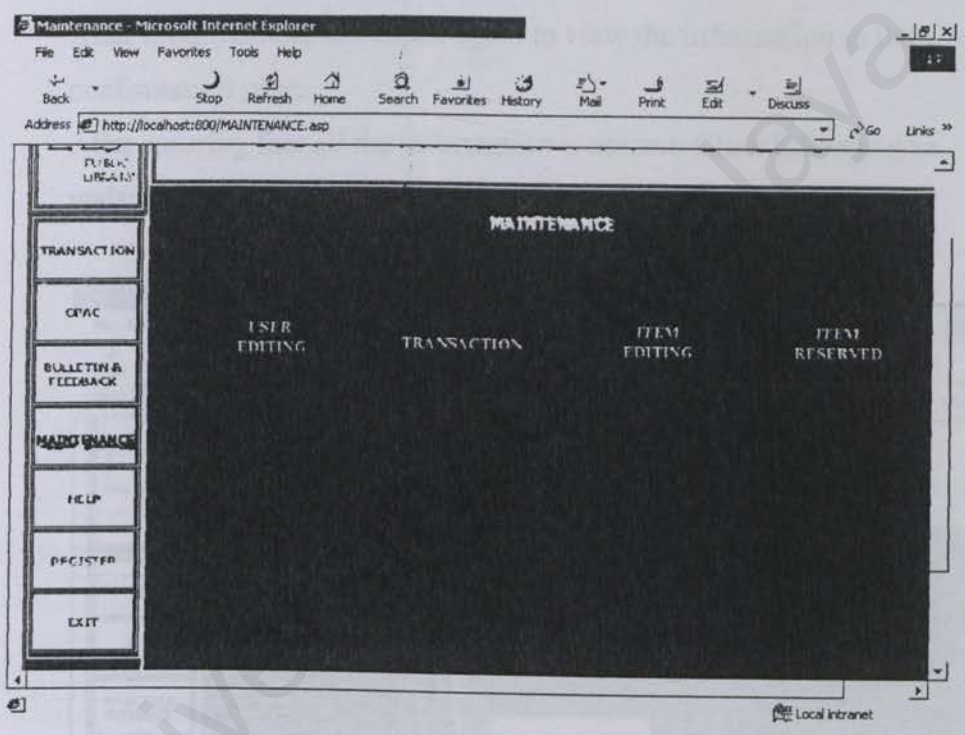


Figure 7.1 Maintenance Module

7.1 User Profile/Editing

This is where user can change their information and update them. See figure 7.2.

Step by step:

1. Key in the Patron ID/Library Card number
2. Key in the valid password.

3. If one of the number or password is invalid, an error page will warn you. See figure 7.3.
4. Else, if both the Patron ID and password is correct, you will be sent to a page listing all your personal information.
5. Click Edit to edit the information
6. Here, you can modify the information.
7. Each of the text book is error checking textbox where if the you unintentionally generate error, an error message will be shown. See figure 7.4.
8. After modification, click Edit again to view the information in the confirmation page.
9. After assuring that all the information is correct. Click Edit again to update the database.

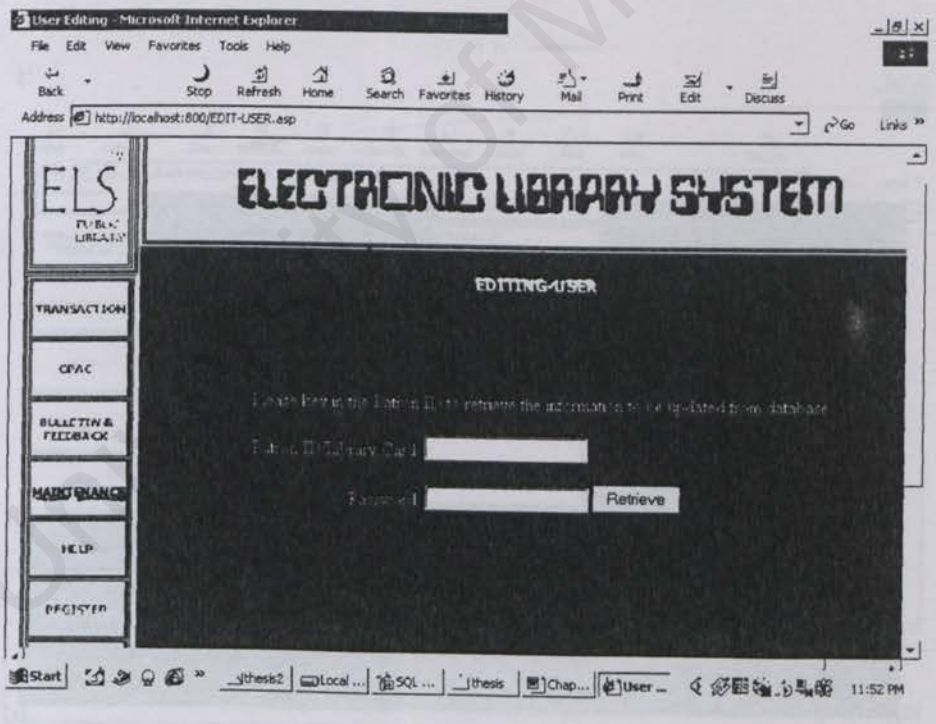


Figure 7.2 User Editing

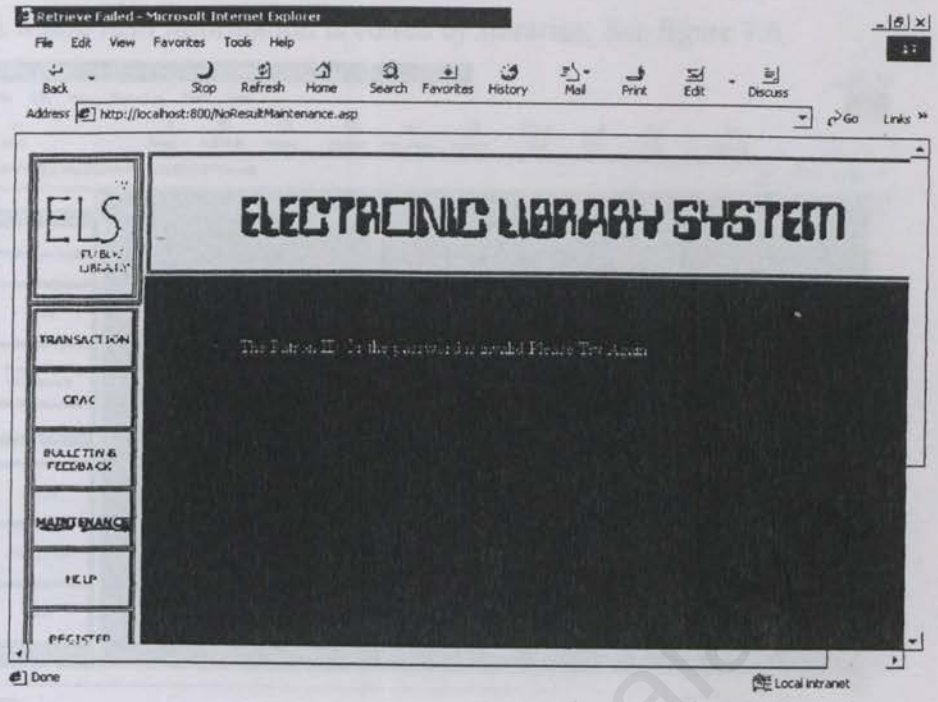


Figure 7.3 Invalid Patron ID or Password

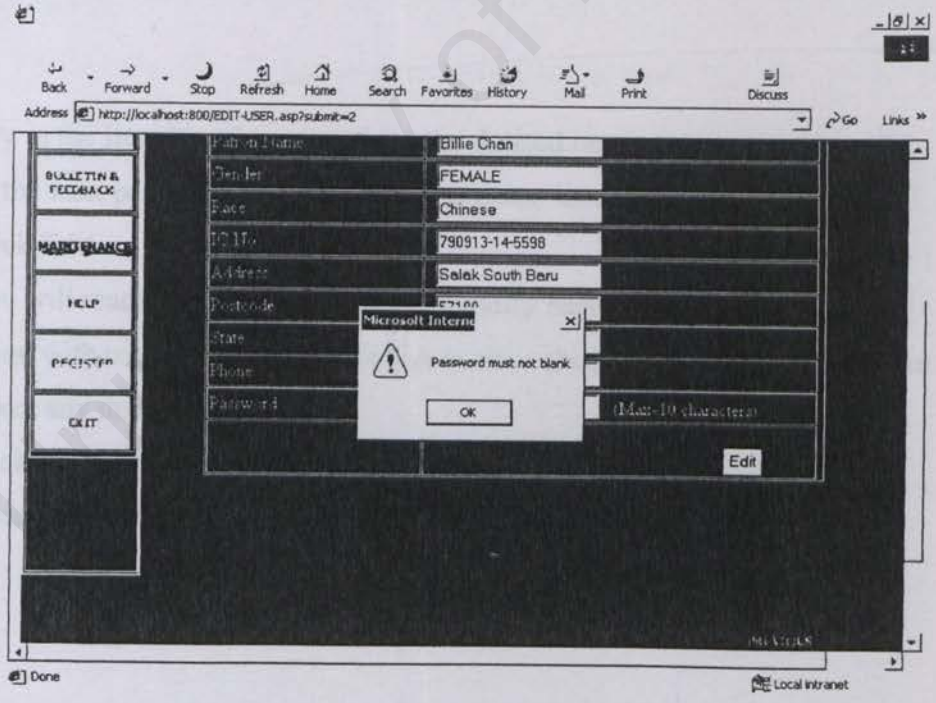


Figure 7.4 Error Message Box

7.2 Item Editing

This is where item information is edited by librarian. See figure 7.6.

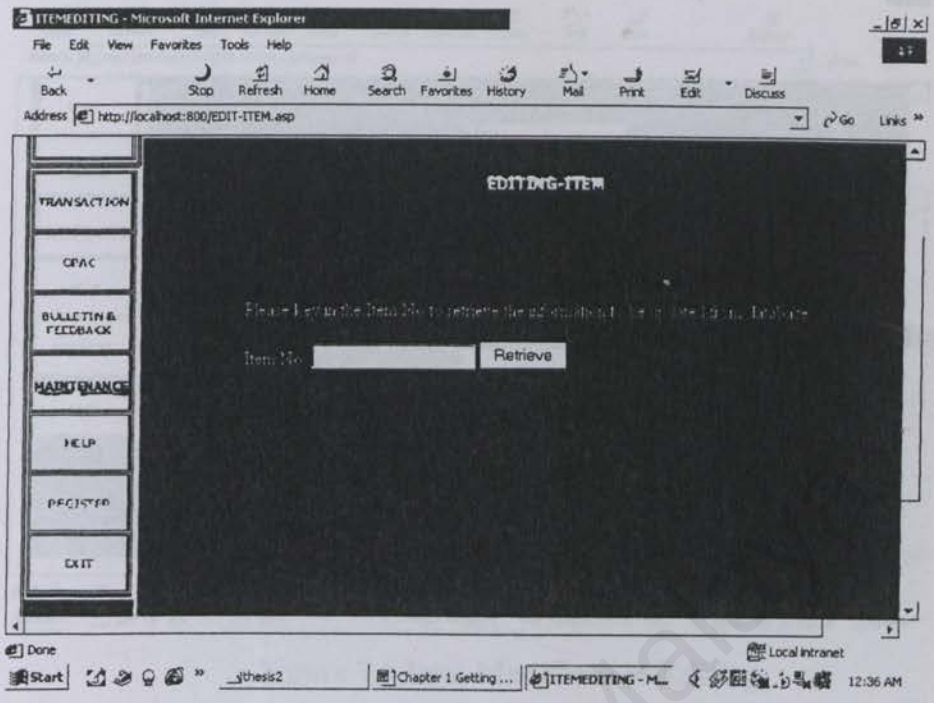


Figure 7.5 Item Editing

Step by step:

1. Key in the Item Number to retrieve the desired item
2. At the next page, you can see the information listed about the item.
3. Click Edit
4. You will reach a page where you can modify each attribute. See figure 7.7
5. Same with user editing, each textbox is error checking textbox and they can detect any invalid data.
6. Click Update after you finished modifying the information
7. Your information has been updated.

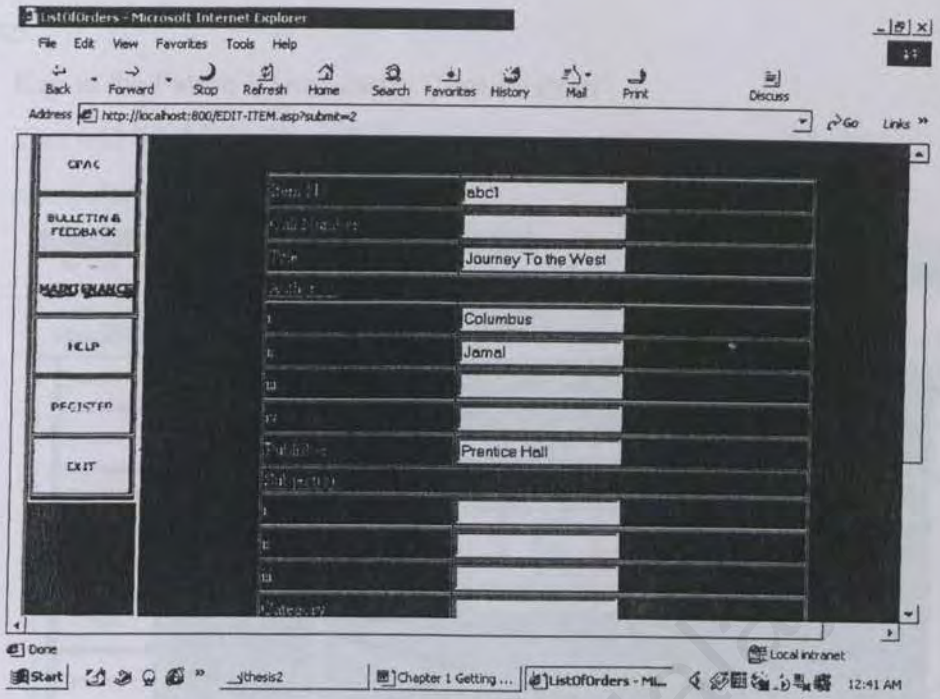


Figure 7.6 Item Modification/Editing

7.3 Item Reserved

This is where librarian can view the items that have been reserved by library 's user. See figure 7.8

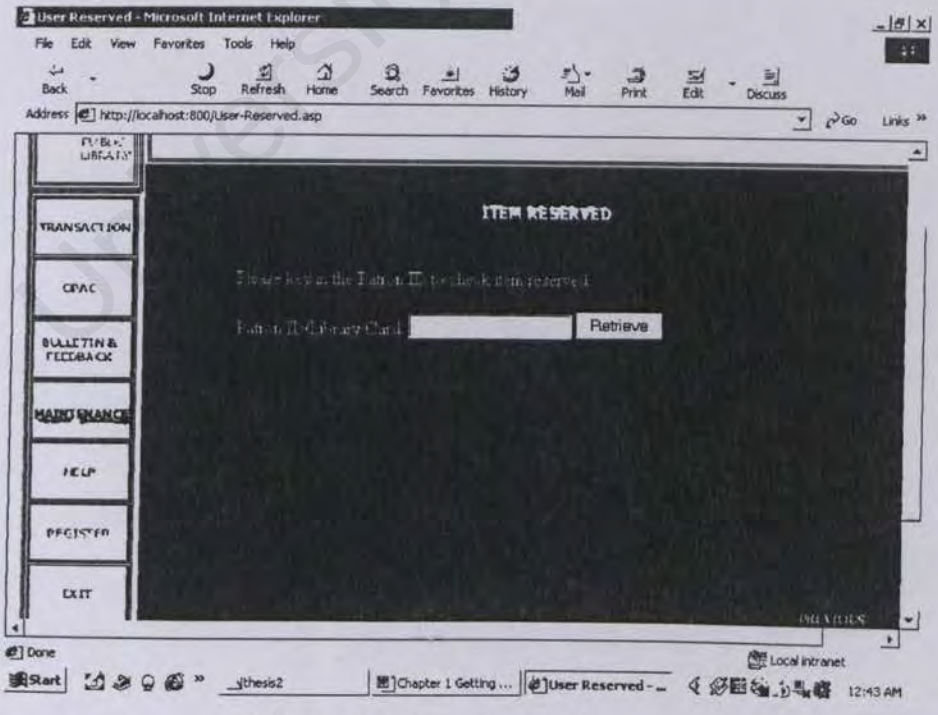


Figure 7.7 Item Reserved

Step by step:

1. Key in the Patron ID or Library Card Number
2. You will be able to view all the items that have been reserved by the particular user. See figure 7.9

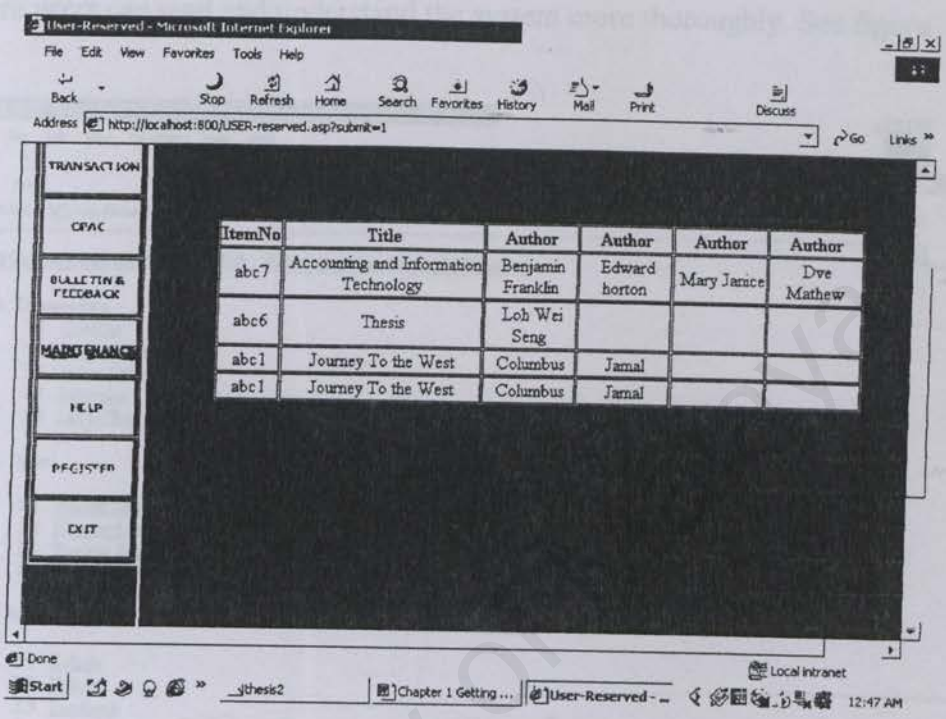


Figure 7.8 Item Reserved By User

Chapter 8 Help (All Users)

Help

This is where users can read and understand the system more thoroughly. See figure 8.1

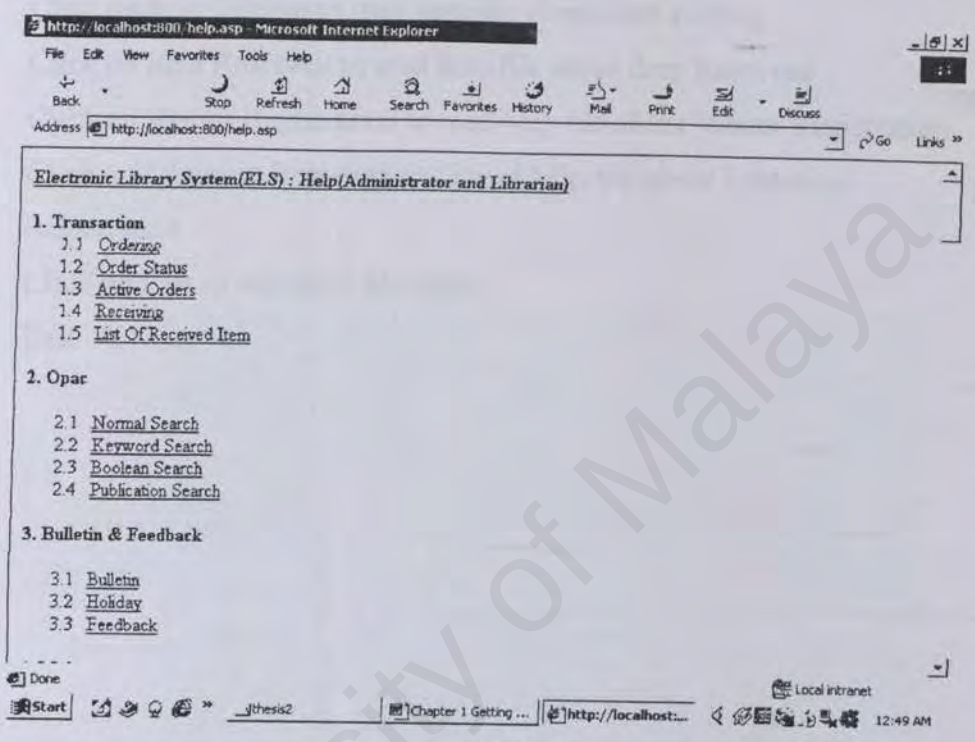


Figure 8.1 Help

Step by step:

1. Click on Ordering to read help file about Ordering
2. Click on Order Status to read help file about Order Status
3. Click on Active Orders to read help file about Active Orders
4. Click on Receiving to read help file about Receiving
5. Click on List of Received Items to read help file about List of Received Items
6. Click on Normal Search to read help file about Normal Search
7. Click on Keyword Search to read help file about Keyword Search
8. Click on Boolean Search to read help file about Boolean Search

9. Click on Publication Date Search to read help file about Publication Date Search
10. Click on Bulletin to read help file about Bulletin
11. Click on Holiday to read help file about Holiday
12. Click on Feedback to read help file about Feedback
13. Click on Item Editing to read help file about Item Editing
14. Click on Item Reserved to read help file about Item Reserved
15. Click on Visitor Registration to read help file about Visitor Registration
16. Click on Librarian Registration to read help file about Librarian Registration
17. Click on Exit to read help file about
18. Exit

Chapter 9 Registration (All Users)

Registration

Two types of registration are available in ELS: the visitor registration and the librarian registration. See figure 9.1

User Interface only shows one kind of registration, the user/visitor registration

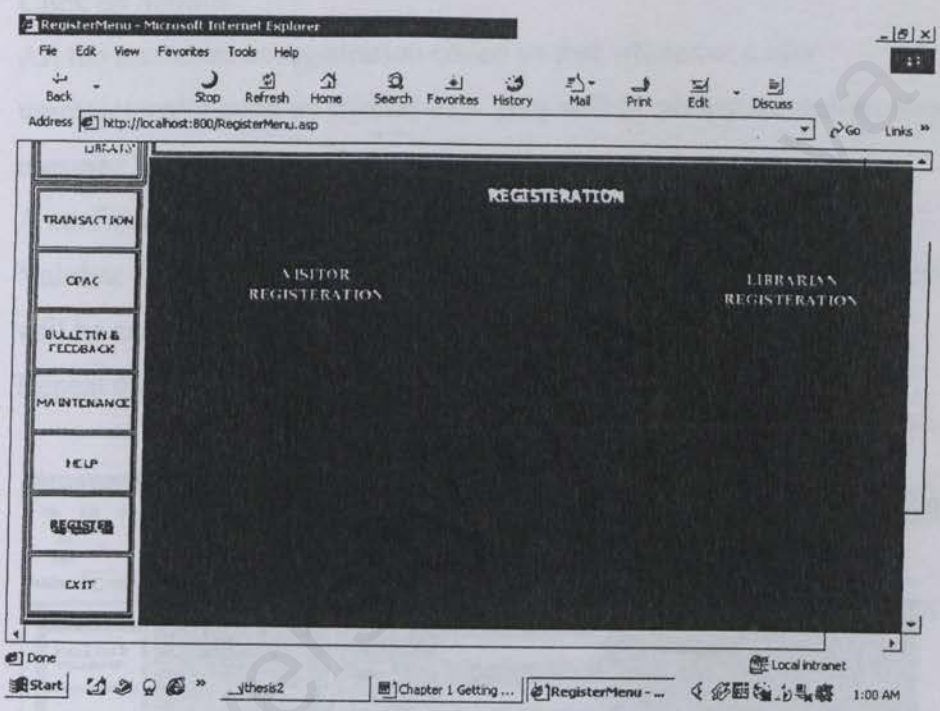


Figure 9.1 Registrations

Both type of registration is the same, therefore, the steps in filling up online form will only be show once.

Step by step:

1. Click on of the registration
2. You will be able to see form which you need to fill up. See figure 9.2
3. Key in your library card number
4. Key in your name

5. Choose your gender
6. Choose your race
7. Key in your Identity Card Number
8. Key in your Address
9. Key in the postcode
10. Choose your state
11. Key in your contact number
12. Key in your password
13. Click on Submit
14. All the textboxes in registration coded so that whenever a user unintentionally enter an invalid data, they will be prompted with an error message box. See figure 9.3
15. A confirmation page will appear after you click the Submit button.
16. Validate the information by clicking Confirm button and your information will be saved.
17. Repeat the process 1 – 16 for librarian registration

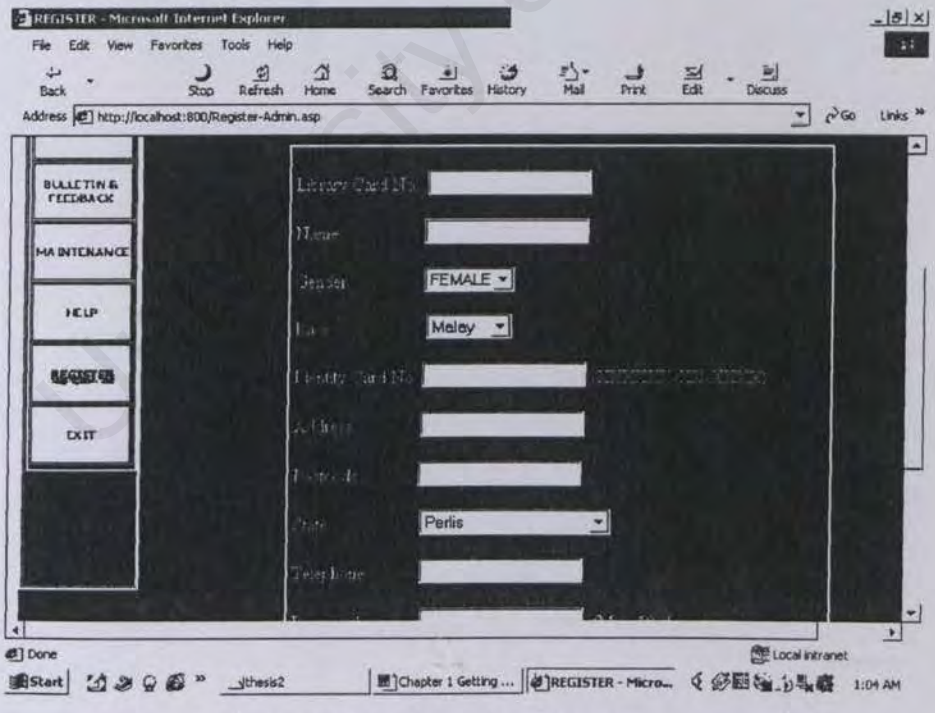


Figure 9.2 Registration Form

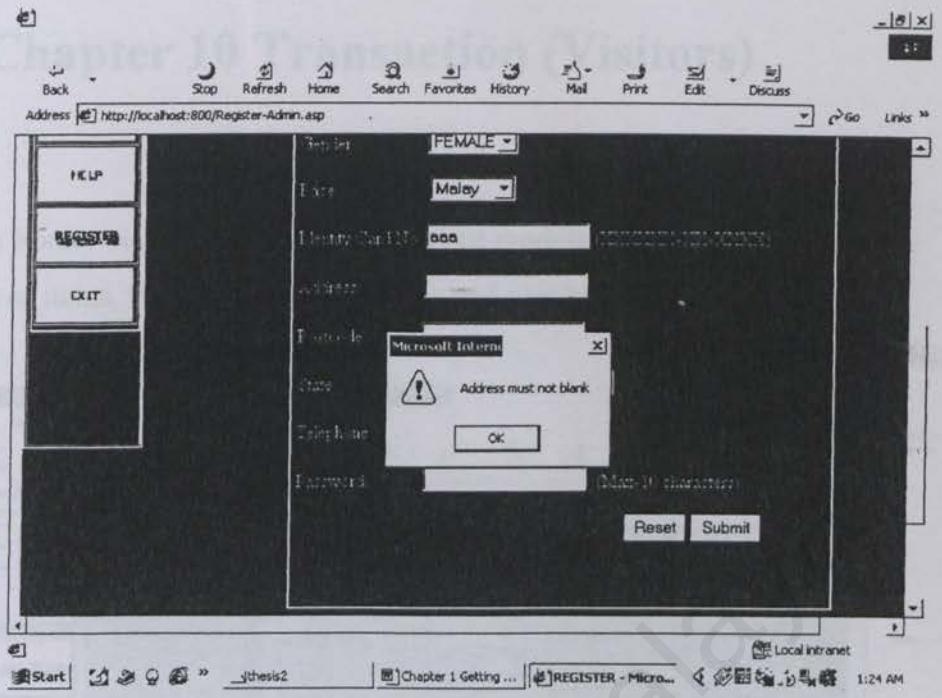


Figure 9.3 Error Message Box

Chapter 10 Transaction (Visitors)

Transaction

This page is for library visitor/users. Three important modules which the user can view is the reserving of items, views the reserved items and user profile. See Figure 10.1

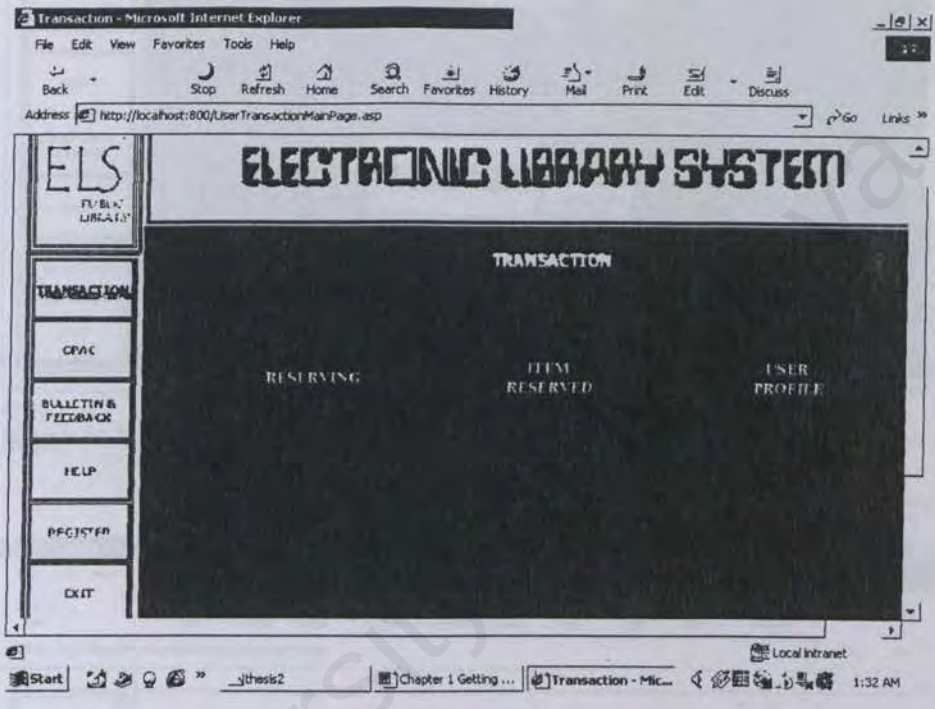


Figure 10.1 Transaction

10.1 Reserving

This is where user/visitor can reserve particular item that is not available at that time due to loans or new arrival. See figure 10.2

Step by step:

1. Key in the Item Number and the Patron ID.
2. If one of the information is invalid, an error page will be shown. See figure 10.3
3. Else, you will be directed to a page that contained the information about the item and the user who want to reserve it

4. Click the Reserve button to reserve the item.

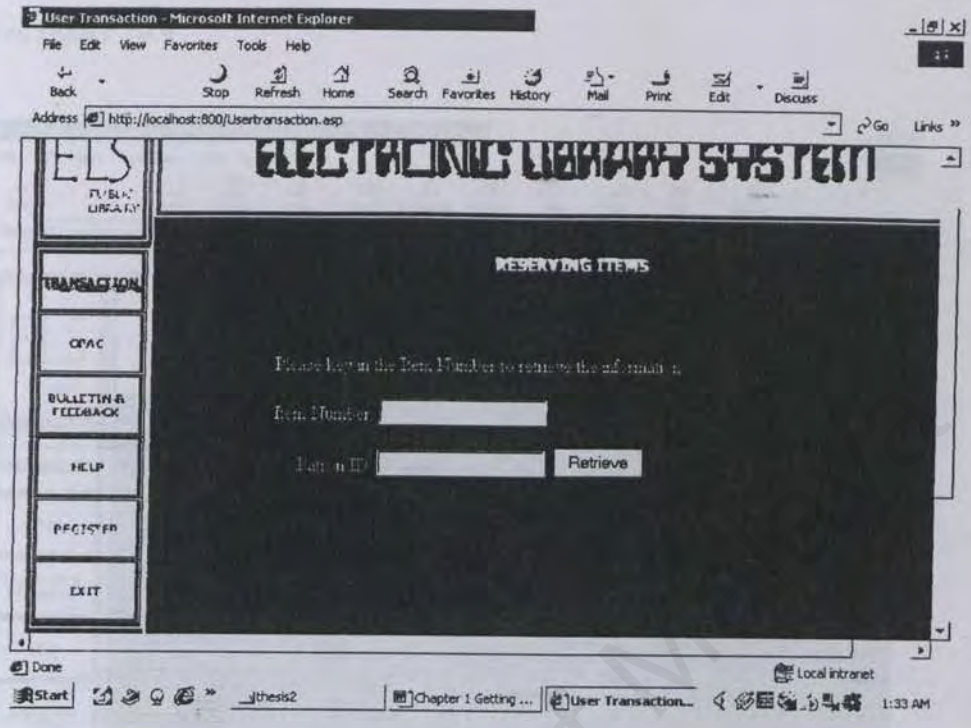


Figure 10.2 Reserving Item

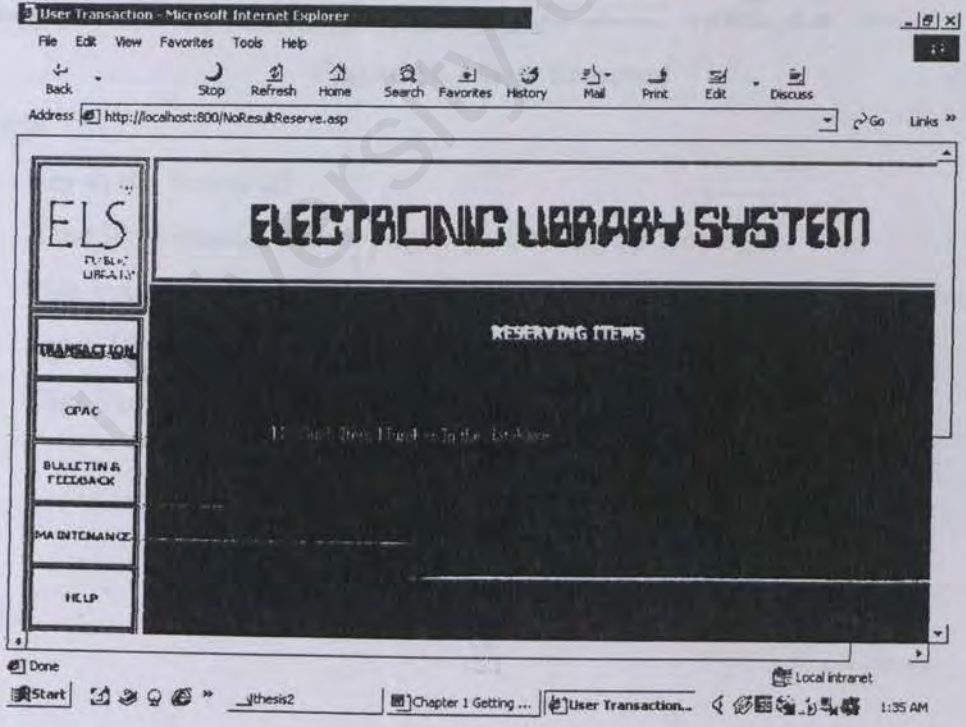


Figure 10.3 Transaction-Error Message

10.2 Item Reserved

This is a page where the user can view the items that they have reserved earlier. See figure 10.4

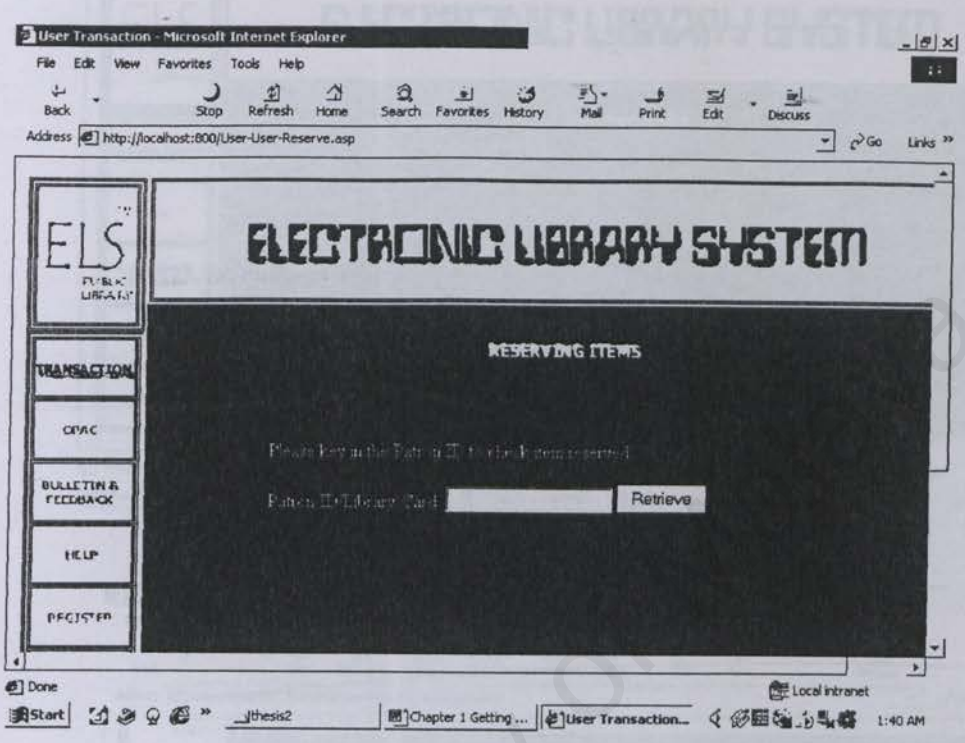


Figure 10.4 Item Reserved

Step by step:

1. Key in the Patron ID
2. If the ID is invalid, a error page would be shown. See figure 10.5
3. Else, you will be able to view all items that you have reserved earlier. See figure 10.6
4. Click Previous to go back to previous page

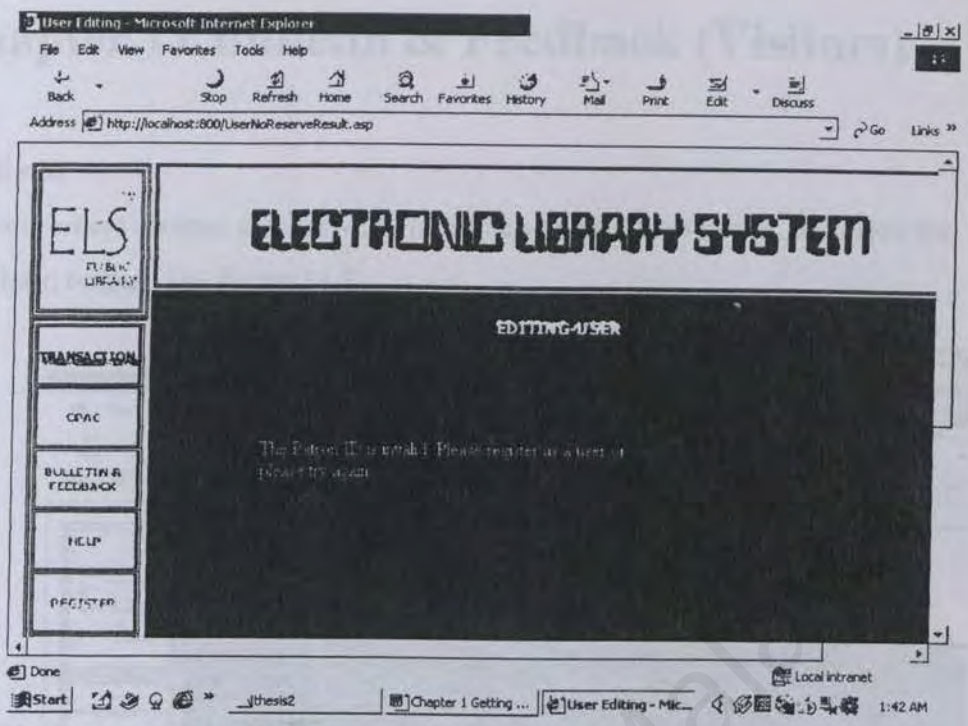


Figure 10.5 Item Reserved-Invalid Patron ID

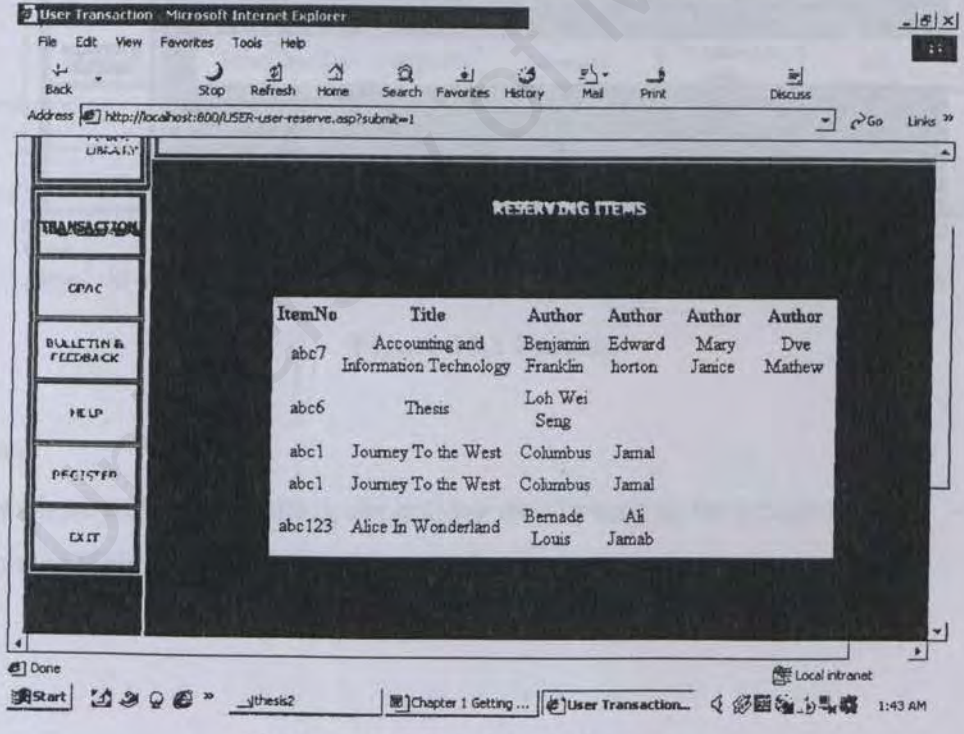


Figure 10.6 List of Item Reserved

10.3 User Profile

Refer module 7.1.

Chapter 11 Bulletin & Feedback (Visitors)

11.1 Bulletin

This is where visitors can view the latest news about the library. Just click the Bulletin button. See figure 11.1

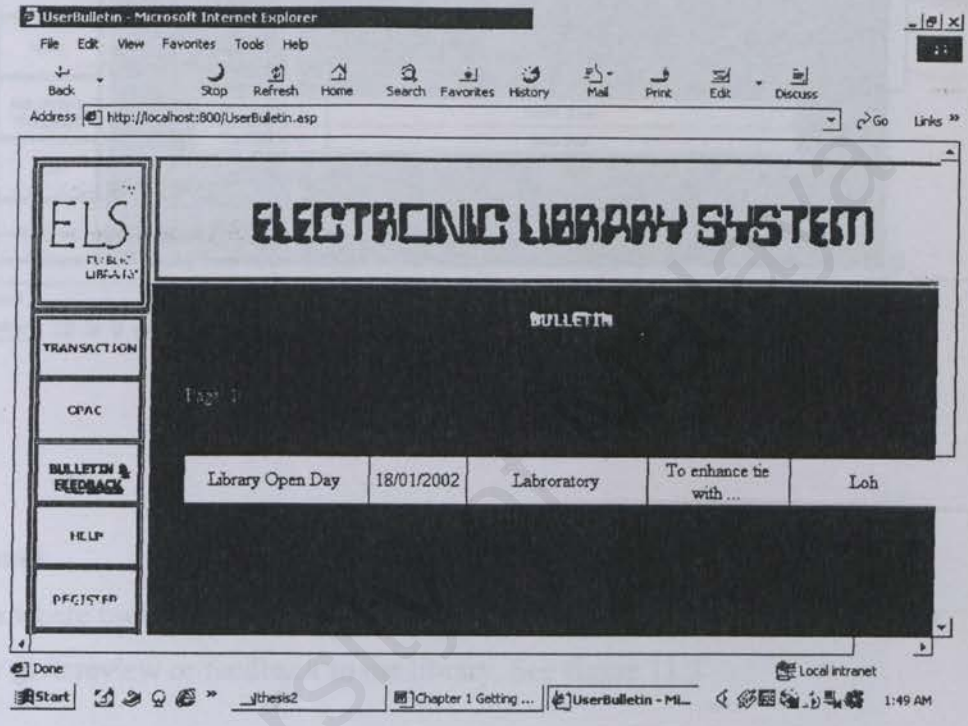


Figure 11.1 Bulletin

11.2 Holiday

This is where the user can check the holiday date as well as the occasion. Just click on the Holiday button. See figure 11.2

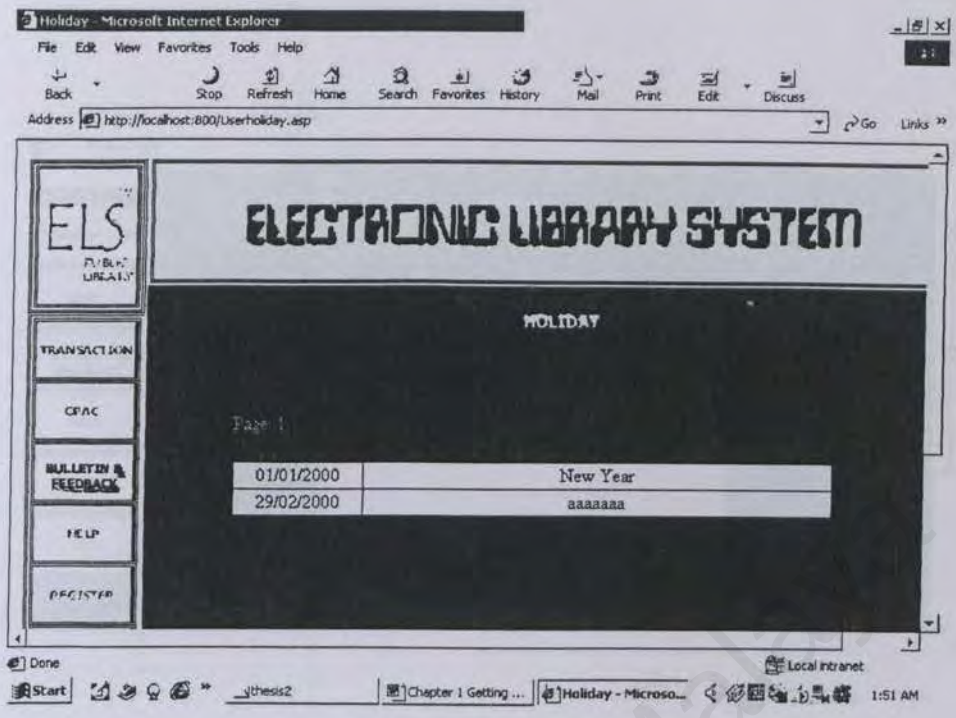


Figure 11.2 Holiday and Occasion

11.3 Feedback

This is where user/visitors can express their dissatisfaction about the services or simply give review or feedback to the library. See figure 11.3

Step by step:

1. Key in the Title of the feedback
2. Choose the feedback type whether it is a comment, suggestion, etc.
3. Key in the sender's name
4. Key in the Content of the feedback
5. Each of the textbox is coded to handle error. See Figure 11.4 which shows textbox error because the user did not fill up the required information.
6. Click Confirm in the confirmation page to save the information

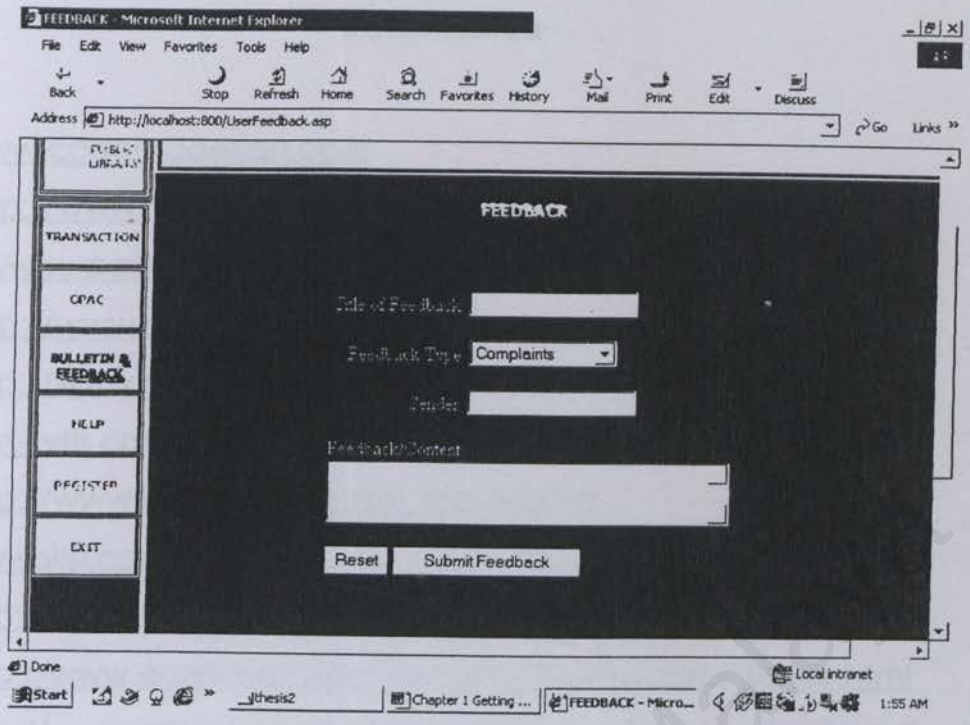


Figure 11.3 Feedback

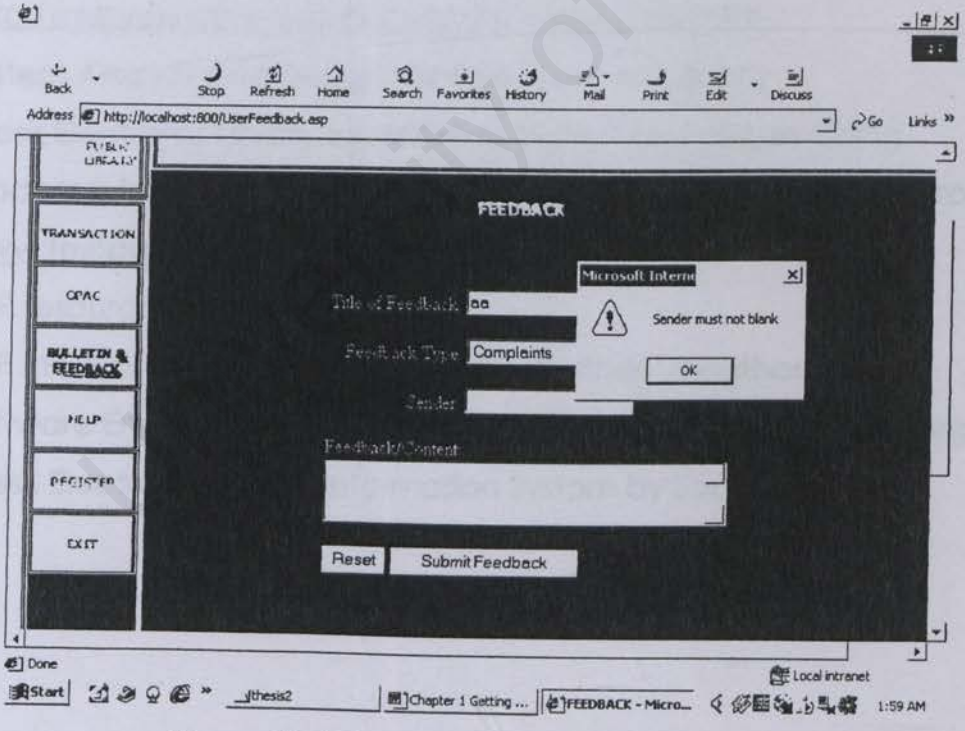


Figure 11.4 Feedback-Error Message

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