Title: Web Able Library Catalog
For Elementary Schools

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Perpustakaan SKTM
Abstract

WALC is a Web Abled Library catalog and it is designed focuses on elementary school children as the aimed users. The main purposes in developing this library catalog are to facilitate information seeking of the elementary school children, to improve the management school libraries and to upgrade the quality of elementary school libraries by fulfilling the user requirements. Basically, the primary objective for this project development is to establish and develop a suitable or ideal library catalog at elementary level. One survey carried out shows that students seldom use the catalog cards to search for library materials and most of them never use Online library systems. The WALC interface is carefully designed in order to meet the school children levels and abilities. It is hoped that the expected outcome will be able to improve the management and function of elementary school libraries.
Acknowledgement

First of all I would like to ALLAH for giving me the time, health and strenght in venturing into this project. My special thanks to my supervisor, Madam Suraya Binti Hamid for committing her time with me and providing me with the necessary guidelines and fruitful advice. Her manner towards me has also given me the motivation and comfort that I need. Also special thanks, to my moderator, Mr Teh Ting Wah, for his contributions and ideas on the project. Not forgetting my former supervisor, Madam Abrizah Hj. Abdullah for her initial guide on the project development. Finally, I would like to thanks all my friends who have helped me in one way or another into the completion of the project.
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Chapter 1  Introduction
Chapter 1: Introduction

1.1 Project Overview

Lam (2002) defined library automation as the use of computer and networking technologies in the library. The areas of library automation include:

a) Automation of library functions such as cataloging, acquisition, and circulation.

b) The use of electronic resources such as CD-ROMs within the library.

c) Accessing of remote electronic resources such as the Internet

d) Office automation such as word-processing, spreadsheets and databases and

e) Automating patron services such as reference services, current awareness (CAS) and selective Dissertation of information (SDI).

Generally, libraries are automated to improve the level of service and quality of output and to fulfill needs that cannot be achieved by manual system, for example in the sharing of resources and information that appears only in electronic format such as CD-ROM, Internet resources and databases.

In this project, the library system developed focuses on automating elementary school libraries. The system is a Web Able Library Catalog that is specifically designed for elementary school children. Various things must be taken into considerations to accommodate this system at children level.

It also plays an important role to ensure student can easily access the required materials. The design also includes various search methods and strategies in
ways concordant with the children's learning, cognitive development and curriculum. Children are unique information seekers (Lee, 2001), they access library materials or information in various ways and strategies, and therefore library catalog developed will meet their needs.

To fulfill and to understand more about children seeking abilities, a survey is conducted in order to design the features that are needed in this system. This system consists of two main modules, namely an Administrator module and a User module. Some of the important sub modules to be developed are cataloging and circulation.

1.2 Project Purpose

The purpose of this system is to build a Web Able Library Catalogue (WALC) that will facilitate the information seeking process of the elementary school children. The WALC system also takes into consideration the children capabilities under the diversified levels and abilities. Specifically the system will be able to:

i) Facilitate students in searching information or materials needed effectively and efficiently.

ii) Improve the management of the school library, which includes cataloguing and library routine activities.

iii) Upgrade the quality of elementary school libraries by fulfilling the users requirements
iv) Make the students' information seeking process become more efficient and smooth.

v) Save students' time in doing search for the required material or information through the catalog service provided online

1.3 Project Objective

This system is aimed at school children who are also active information seekers. The library catalogues are mostly suitable for secondary school students, overlooking the thinking skills and searching behavior of children in elementary school level. The specific objectives are indicated as follows:

i) To design and develop a library catalogue for school children level including age, intelligence level, writing and keyboarding typing abilities.

ii) To establish an attractive and a consistant user graphical interface for a school library catalogue.

iii) To develop a web abled system that can not only be used for schools with an internet access but also for those schools without an internet access.

iv) To develop various search strategies and options to support children from different background

v) To facilitate the cataloguing activities for the librarians through the modules provided by this system.
Therefore, this system is a suitable or ideal library catalogue at an elementary school level, to support multilevel users and also to improve the management of the school libraries.

1.4 Problem Statements

i) Children as information seekers

Present library systems for elementary schools students have limited search techniques and browsing. It also does not have mode of searching using boolean operators to cater for more advanced searchers.

ii) The Existing Library Systems are Difficult to Use

Based on the observations and discussions carried out with teacher librarians, many of the existing library systems in Malaysia such as AutoPus and Micro CDS-ISIS are difficult and not suitable to be used by school children since they are DOS-based. The system that will be developed is specially designed to make it easy to use and at the same time attractive to the children.

iii) Library System is costly

Many of the existing library systems are expensive to produce. Specific software and hardware costs vary widely, from less than $4,000 for a single user circulation/catalog workstaton to more than $40,000 for a multi user network supporting an integrated multi-
function system (Murphy, 1989). Thus, WALC is developed to overcome this problem by providing a choice whether to be used as a web-based system or a standalone system. Thus, many schools will be able to own a library system that is not only efficient but also has a reasonable price.

1.5 Project Scope

The project scope of the project is described under two sub-sections;

a) System Requirement

b) System User

1.5.1 System Requirement

i) Security level

To make sure the security level for this system is guaranteed, a login function will be developed where only authorized users can gain access to the system. The administrators and users are provided with different security levels. However, users may perform their search without having to login.

ii) Cataloguing module

The cataloguing module enables searching, downloading, deleting, adding new records and updating the records into database. Each item has a unique ID number. This module is specifically provided to the administrators.
iii) Circulation module

This module enables users do daily routines in the library such as borrowing, return, renew, and reserving. This module will keep track patrons' and items' record from database. This function plays an important role in supporting circulation activities. This module can be accessed both by the administrators and the users with different accessible level.

iv) Reporting

Besides the important modules listed, this system is also capable to generate various reports. These reports are useful for the librarians when performing stock checking.

v) Help Desk

Help Desk function plays an important role as a users' guide while using this system. It provides useful information in performing certain library functions in any modules provided. This Help Desk is built specifically for users and it must be simple, attractive, and understandable to support multilevel users.

1.5.2 System Users

The project is targeted to users consisting of the administrators and the elementary school students. This project has two main
module, namely administrators' module and users' module. The user scopes of this project include the following:

i) Administrator Module

An administrator is a person that takes responsibilities in library management using WALC fully. This module gives authority to the administrator to carry out certain tasks such as updating borrowers' records, print record, doing cataloguing and so on. To gain access to this module requires a password for security reason.

ii) User Module

Users are school children using this system directly in searching for materials and/or books in the library. This module also requires a password, allowing only the valid user to access the system. This module enables the users to search the library materials, read news and announcements and also to give feedbacks to the administrators.

1.6 Importance of The Project

WALC for elementary school is important in motivating the children's interest in seeking information in the library. This is the philosophy adopted in developing the system. Some of the characteristics of the system are:
i) The system designed is fully aimed at school children as the potential users. Hence, all the design features will necessarily be practical and of interest to these children. By developing this interest, it is hoped that the children's information seeking process may be improved.

ii) Apparently, ease of use and time saving has been seen as the two prime movers of online catalogue development (Peters, 1991). The system to be developed will also be online and has the benefits mentioned by Peters. It can be accessed from any place that has an access to the internet.

iii) The online catalogue s are easier to maintain and update than the earlier systems (Hildreth, 1989). The WACL is also easier to update and maintain. This can be done through the sub module that is found in the administrator such as cataloguing. It also facilitates the administrator's tasks.

iv) WACL is an alternative for schools to get a library system at an affordable cost.

1.7 Hardware and Software requirements

Several hardware and software requirements are needed in development and implementation phase in this project. The requirements needed in this project are as follows:
A) Development Phase

The software requirements are:

i) Microsoft Windows 98 or above

ii) MySQL database system

iii) PHP programming language

iv) Web server

v) Application server

The minimum hardware requirements are:

i) 64 MB RAM

ii) Pentium II Processor

iii) 275 MB hard disk space

iv) Any compatible monitor display

v) Keyboard

vi) Mouse

B) Implementation Phase

The software requirements are:

i) Windows 98 or above

ii) MySQL database system

iii) PHP programming

iv) Web server

v) Application server
The minimum hardware requirements are:

i) 64 MB RAM

ii) Pentium II Processor

iii) 275 MB hard disk space

vi) Any compatible monitor display

vii) Keyboard

viii) Mouse

1.8 Project Scheduling

The project will be developed in stages. Every stage, listed below, needs to be completed to finish the project. A project scheduling will be used to ascertain that the project will be completed within the specified period. The project schedule is shown in Figure 1.1.
i) Conceptualization and Planning
The activities involved in this phase includes identifying the aims and objectives of the project to be achieved and also the hardware and software requirements of the project.

ii) Literature Review
This phase is important since the researcher needs to review all the available systems and do comparisons to ensure that the system to be developed has all the necessary characteristics.

iii) System Analysis/Development Methodology
In this phase, the system development method will be identified. Analysis on the system requirement is also done in this phase by identifying function requirements and non-requirements.

iv) System Design
Some of the activities involved in this phase are the designs of programs, user interface, database and so on. The expected outcomes are identified in this phase.

v) System Implementation
This phase is important since it implements the analysis and design that have been carried out.
vi) System Testing

This phase is important because the implemented systems will be tested on the users. From this phase, the researcher will know whether every function implemented in the system worked correctly as expected.

vii) System Maintenance

Activities involved in this phase depend on the result obtained from the system testing phase. This phase is very important because the system performance can be increased to make the system meet the aimed users' requirements.

viii) Documentation

All the activities involved in the project development and implementation will be documented. The documentation activities are continuously since from the conceptualization and plannings until the documentation phase.

1.9 Chapter Summary

This chapter basically provides an overview of Web Able Library Catalogue (WALC) for elementary schools. This chapter begins by describing the purpose and objective of the project. This chapter also includes some problem statements and solutions to be taken in the system development. It also mentions in detail the importance of the project. A list of the hardware and software requirements is also given. Lastly, the chapter includes the project scheduling during the project development.
Chapter 2 Literature Review

2.1 Library Automation in Malaysian Schools

In Malaysia, School Resource Centres are part of the whole continuum of educational provisions. Hence, almost all schools in Malaysia have their own automated systems which have been either built by the school or bought from the open market. Most of these systems can
2.1 Library Automation in Malaysian Schools

In Malaysia, School Resource Centres are part of the whole continuum of educational provisions. Hence, almost all schools in Malaysia have their own libraries. A total (22%) of all the Malaysian School libraries have been automated which have been either built by the school or bought from the open market. Most of these systems can:

i) Manage the database of materials in the School Resource Centre for circulation, searches and Online Public Access Catalogue (OPAC).

ii) Print bar codes for materials

iii) Incorporate the list of materials borrowed with the data required for the NILAM Reading Program to reduce the teachers' burden of having to keep a record manually. (The NILAM Programme is an integration of all reading activities in schools with the aim of encouraging continuous reading and to inculcate the reading habit. It is a Programme that gives recognition to those who read. It is mandatory for all primary and secondary schools to conduct this programme.) (Fatimah, 2002)

The Malaysian Smart School Project, which was started in July 1999 involving 97 schools has produced several modules. One of the modules is the Educational Resource Management Module. According to Fatimah (2002), the module consists of functions such as maintaining an inventory of the school's educational resources and automating the library system, inputting and retrieval of teaching-learning materials, viewing the resources associated with a
subject or a learning area and maintaining an inventory of the school's educational resources.

The Project is due to end in December 2002. Malaysia plans to roll out (in phases) the Malaysian Smart School concept to all schools in the country in the year 2003. Thus, the future of school libraries in Malaysia is bright, especially in meeting new challenges of the development of information and communication technology and globalisation (Fatimah, 2002).

2.2 The Need For An Automated System For Malaysian School Children

The advancement of the information technology has led to children's education to be limited to the old methods. Unquestionably, a need for an automated library system is necessary in aiding the learning and teaching processes. Automating the school library besides bringing about a more effective way of managing the library collection and creating a better awareness of IT utilization, is also likely to spawn increased interest in information-related programs conducted by the schools (Kang, 1996).

There are many factors that contributed to the requirement for a library automation system. Some of these are:

i) To improve the library in terms of its management and arrangement of materials.

ii) Having an online library catalogue facilitates students to access materials and information without being limited to time constraints and distance.
iii) Students are active learners. Thus, it is necessary to have a creative knowledge acquisition strategy to stimulate students' creativities in their educations, especially in the methods of seeking information.

iv) To support life long learning. With the availability of an online system, the learning process becomes continuous, even after school hours.

v) To bring the level of the Malaysian education system comparable to that of the other countries.

vi) To meet the revolutionary challenge of information technology and the government's objective in bringing into reality an informative society.

vii) To produce creative-minded Malaysian students.

2.3 Previous Library Systems Developed by Final Year Students at FSKTM

Many systems have been developed by the final year students at FSKTM. Each system mostly supports the primary key functions of a library. It can be said that several main functions such as acquisitions, circulations and cataloguing have been supported by the systems.

Simple Library Automation System (SLASH)

Basically this library system consists of three main modules; cataloguing, circulation and administrator's module. This library system uses two search
strategies, namely normal search and advanced search using Boolean operators. The system has a good security level providing different access levels to the administrators, librarians and students. Both search strategies enable children to perform their search by title, author, call number or subject. In circulation function, the services include loan, return, renew and reserve. Additionally, the system has a print report function. The help function provided by the library system is useful to children who have difficulties using the system. This system uses Iterative approach as the development methodology. The library system database is designed using Sybase SQL Server and the interface is designed using Power Builder Enterprise version 5.0. The system interface is attractive and it implements GUI principles. Some of the system limitations mentioned by the developer are low processing time and no barcode scanner.

**Virtual Library (Graphical Based Online Primary School Library System)**

This library system was developed by Lee Hui Lan for the 2000/2001 session. On the overall, this library system is very good and complete since it fully supports the school library operations. Basically this library system consists of administrator module and patron module. Some of the key functions available on this system are circulation, inquiry, report, info desk, and help. The system search strategies takes into account multilevel children skills. Among the search strategies provided by the system are browsing, ABC search, Shelf search, Type search, and expert search (using Boolean operators). The school children are able to perform their search by author, title, subject and keywords(s). The circulation activity has several services such as borrowing and returning, renewing and also reserving the library materials. The users can give any
relevant feedbacks and comments to the administrator. The development methodology used to build this library system is the Waterfall methodology. The softwares used by the developer were Microsoft Access 2000 (for database) and Visual Basic 6.0 (for the interface design).

Electronic Library Information System (ELIS)
Developed by Cheah Sooi Peng (2000/2001), the system is divided into six modules which are acquisition, circulation, cataloguing, OPAC, maintenance and feedback. Users scopes are divided into three parts. These are system administrator, librarian and patron. Each system user has a different access level in order to protect all the information in the database. In the circulation activity, users are allowed to borrow and return library materials only. The patron is provided normal search function. The system has several searching methods such as search by author, title and subject. In addition, there is an advanced search using Boolean operators. The system was developed using Iterative methodology. Softwares used by the library system are Microsoft Access 2000 (database design) and Visual Basic 6.0 (Interface design). The weakness of the system includes absence of support for barcode scanner.

Web Based Library Management System (WBLMS)
This system was developed by Khoo Mei Li (2000/2001). The user scope for this library system is divided into three parts, namely User, Teacher-librarian and Administrator. The functional requirements provided by the developer include acquisition, cataloguing, circulation, OPAC, help, maintenance and information management. The circulation module has several functions such as
renewing, borrowing and reserving a particular item. OPAC module enables users to perform search using simple search and advanced search. Simple search can be done by using the following fields: title, author, subject, and keyword. Like the previous systems discussed, the advanced search can be done using Boolean operators. This library system used Waterfall methodology and was developed using Microsoft Visual Interdev for the interface design and Microsoft Server 7 for the database design. Some of the advantages of WBLMS are it has an attractive interface and it is easy to use. The major limitation of WBLMS is that the number of consortium members at present is fixed only to schools due to database allocation and disk space constraint.

**Library Management System (LMS)**

LMS was developed by Cheah Huan Chin for the 2002 session. This library system has two main components which are Library section and Librarian section. The system catalog provides various search methods such as search by author, title, keyword, class number, call number, publisher and wild card. The LMS was developed using Waterfall methodology. The interface design was used Visual Basic 6.0 and Microsoft Access 2000 for the database design. Some of the disadvantages identified on this system are that there is no advanced search and the search method does not support browsing.

Table 2.1 compares all the library systems developed by the FSKTM students that have been described above.
<table>
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2.4 Library Systems Available Commercially

There are many library system softwares that are currently available in the market developed by vendors or the library itself. Each system has its own features and advantages. Below is a list of some of the systems and their features that have been investigated.

**Marmot Kids Online**

This library catalog has been specifically designed for children at elementary school level. It has attractive graphical icons and a colourful interface. The interface and instructions are simple and easy to follow. The children can search for books by typing, using the visuals and browsing. Searching can be done using the keywords title, author, series and subject. The library catalog provides support for children that do not have keyboard skills and spelling abilities by means of the browsing and visual searching methods available. However the catalog does not provide any advanced search strategy for children at a higher level. The system source codes revealed that library catalog uses VB script programming to design the interface. Figure 2.1 shows the main screen of Marmot Kids Online.
INFIHIO – Online Catalog

The interface of this library catalog is heavily text-based and hence is not as attractive as the previous interface just discussed. The library catalog provides two search strategies, namely easy search and advanced search. The easy search strategy uses the keywords author, title, series, and search all fields. In the advanced search strategy, users can perform their search by using Boolean operators and qualifiers. The search option enables users to limit their search to language, date and type of materials. The interface was designed using Java Script. Figure 2-2 shows the easy search screen of INFOHIO catalog.
Figure 2-2: Easy search screen INFOHIO catalog

Alice Woods Sunizona Library

This library catalog uses several keywords search methods such as by subject, author, title, call number, ISBN, ISSN, and words. However, the search methods assumed that the children have acquired keyboard skill abilities because there is no browsing search method available on this library system. There is also no advanced search strategy. The interface is attractively colourful and uses appropriate graphical icons. The help module provided by this library system is quite useful, simple and understandable to the children.
PANDA Elementary School – Library Catalog.

This library catalog is similar to the Alice Woods Sunizona Library Catalog. However, in addition, the catalog has two search strategies, easy search and advanced search. The easy search include search by title, author, subject and keywords. To use the advanced search, the children need to use Boolean operators. The total of search total can be limited by location and materials. The help module provided by the library system is not suitable to many children since it uses text-based instructions. The library system is more suited to children who have spelling and typing abilities because no browsing search method is provided.

Table 2.2 compares all the commercial library systems that have been analysed above.
<table>
<thead>
<tr>
<th>LIBRARY SYSTEM</th>
<th>SEARCH OPTION</th>
<th>CONTEXTUAL SEARCH</th>
<th>BROWSING</th>
<th>ATTRACTIONAL GRAPHICAL INTERFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marmot Kids Online</td>
<td>Basic: YES, Advanced: NO</td>
<td>Title: YES, Author: YES, Year: NO, Subject: YES, Call Number: NO, Keyword: YES, Series: YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>INFOHIO</td>
<td>Basic: YES, Advanced: YES</td>
<td>Title: YES, Author: YES, Year: NO, Subject: NO, Call Number: NO, Keyword: YES, Series: YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Alice Woods</td>
<td>Basic: YES, Advanced: NO</td>
<td>Title: YES, Author: YES, Year: NO, Subject: YES, Call Number: YES, Keyword: YES, Series: YES</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>PANDA</td>
<td>Basic: YES, Advanced: YES</td>
<td>Title: YES, Author: YES, Year: NO, Subject: YES, Call Number: NO, Keyword: YES, Series: NO</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>
2.5 A System For School Libraries

A library-automated system must be relevant in terms of its costs and operations and must be suitable to the school level. There are currently 1,395 secondary and 6,891 primary schools in the country based on the 1992 figures (Malaysia, 1994). Any consideration to automate all the schools in the country using commercial automated library management packages would be very costly (Kang, 1996). A number of factors need to be considered when implementing a library system in schools. In particular, the following factors need to be considered:

i) System Design

The design should be simple and the interface should be user-friendly. There must be an on-line help to guide users who face problems using the system.

ii) Hardware Requirements

The hardwares used to build the system must not be costly nor difficult to maintain.

iii) Operability

The system must be flexible in its operation, that is, it must be able to operate online or standalone.

2.6 Children As Information Seekers

Being active learners (Lee, 2001), children are also active information seekers. To develop a library school system, certain aspects must be considered so that
the system can suitably and appropriately be used by children at all levels, bearing in mind that children have different levels of creativity and intelligence. Being creative, children are easily stimulated by anything that appears interesting to them. The system interface must thus be designed to be attractive in order to win the children’s attention.

2.7 Chapter Summary

In short, this chapter investigates on children’s computer literacy and also analyses on some of the existing library catalog systems developed by the past FSKTM students and the online library system that are available commercially.
Chapter 3  Methodology and System Analysis

A software life cycle refers to a set of activities that constitute a software project. Many models have been proposed to deal with the problems of defining activities and associating them with each other. The RUP model is one of these.
Chapter 3: Methodology / System Analysis

3.1 Software Life-Cycle Model

A software life cycle refers to a set of activities that constitute a software project. Many models have been proposed to deal with the problems of defining activities and associating them with each other. The first model to be formally proposed was the waterfall model.

3.1.1 The Waterfall Model

The waterfall Model is illustrated in Figure 3.1.

![Waterfall Model Diagram]

Figure 3.1: Waterfall Model
Explanations of all the phases are describe as follow:

i) Requirements Analysis and Definition

This phase is concerned with collecting the system requirements. In this phase, the software requirements are elicited and analyzed. It involves iterative discussions with the clients to extract all the necessary information required to design and build the system. The deliverable of this stage is a document detailing the requirements intended by the clients.

ii) System and Software Design

Once the requirements have been gathered and analyzed, the software system is designed to meet the clients' requirements in the design phase. The design includes data structure (the information to be processed by the system), software architecture (how will the application be constructed) and interface construction (what will the system looks like).

iii) Implementation

In the implementation phase, the system software is created. Requirements and system specifications from the previous phase are translated into machine-readable computer code. This phase is also known as coding.
iv) Testing

In this final stage, the system is tested to verify that it works as expected and meets the clients' requirements. The testing includes observing the behavior of the system when given a range of inputs and also checking on the statements in the coding itself to ensure that the code is efficient, standardized and well documented. This phase may be a labor-intensive process.

3.1.2 The Prototyping Model

The prototyping model was developed on the assumption that it is often difficult to anticipate all the system requirements at the beginning of a project. In the prototyping model, a prototype system is first designed and built and then presented to the clients for evaluations. The feedbacks given by the clients are then used to build another prototype. This process is repeated until eventually all the requirements have been elicited. The prototype is then discarded and the final requirements are then used to design and build the system. Figure 3.2 shows the prototyping model.
Both models discussed above pose certain disadvantages. The waterfall model assumes that the clients can anticipate all the requirements of the system at the start of the project. The clients can only see a working version of the model when the phases are complete. Also, problems are only detected after the completion of the phases and this may be constraining as far as the system developer is concerned. In the prototyping model, the developers use whatever software and algorithm available in order to quickly...
come out with a prototype model. Consequently this model does not best represent the actual working model due to the inappropriated implementation choices. Worst still, the clients have the tendency to decide adopting the prototype model and it ends up that the prototype model is taken as the final working model instead of being discarded.

An alternative approach will be to combine both models is a combination of both of the models discussed previously. This model is illustrated in figure 3.3. This model is more suited to the project to be developed since it allows the software to be continually improved before the final submission. It also provides a mean by which the project supervisor can monitor progress and give relevant feedbacks before the completion of the project.
Figure 3.3: Waterfall-Prototyping Model
3.2 Fact Findings Techniques

In the Requirement Analysis and Definition phase, the fact-findings techniques are the most important techniques to design that system being developed. There are several techniques involved in the fact-findings activities. Among these techniques are:

3.2.1 Research Reviewing Periodicals

Among important materials that need to be referred and investigated to develop this system are doing some readings and research on relevant books, journals, conference papers, and previous thesis reports. Examples of some research and reviewing that have been investigated are Library Guidebook By T.K Cassidy, International Association of School Librarianship (IASL) presented paper, Virtual Library (A Graphical Online Library System for Primary schools) and others.

3.2.2 Internet Surfing

Surfing the internet looking for related information about conferences report, journals, books that have been published on the Internet have also been carried out. From the Internet, some of the online commercial library systems such as Marmot Kids Online, Alice Woods Sunizona Library and Kid’s Catalog have been investigated.
3.2.3 Questionnaire

A survey was conducted on school children. A set of 20 questionnaires were distributed to the school children around the areas of Kg. Padang Balang, Taman Gombak Ria and Sungai Buluh. The questionnaire consists of a list of questions that are related to the children’s computer literacy background and the searching techniques that they use in finding information. A sample of the questionnaire can be found at the appendix A.

3.3 Analysis from survey that has been carried out

The results of the analysis are divided into parts A and B.

3.3.1 Part A Analysis

The result obtained from this part shows that of the 100% of the children that go to the library, 40% go to the library at least once. 75% of these children go to the library to borrow story books. Most of them (95%) go to the library shelves to find books without any assistance from the librarians. Half (50%) of them face difficulties in finding the books they are looking for. A majority of these children surveyed (90%) have used the computers and they feel more comfortable using the mouse than the keyboard. All the children (100%) are fluent in Bahasa Melayu.
3.3.2 Part B Analysis

The result obtained from part B shows that only 40% of these children use the library catalogue cards. Of these, 75% have difficulties in spelling authors with long names and those authors from the west. Many of them (70%) find books through the book titles. Most of the children (90%) never use the online library catalogue which is not available from their school libraries. The 10% of the children that have used the system are not familiar with the boolean operator.

Conclusion

Even though the survey is not carried out on a big scale, it does provide the necessary feedback that serves an important guideline in developing the WALC in at least that it will highlight the problems faced by these children.

3.4 Requirements analysis

There are two requirements that need to be fulfilled in developing a system. These are functional requirements and non functional requirements.

3.4.1 Functional requirements

Two main modules will be established in this system, namely, user module and administrator module.

3.4.2 Administrator module

The administrator module consists of a number of sub modules to allow the administrators to perform their tasks. These sub modules are listed as follow:
i. Cataloguing

This sub module allows the administrator to perform tasks associated with cataloguing. An example of the activity that can be done in this sub module is book classifications.

ii. Maintenance

Within the maintenance sub module the administrator can add, delete, edit and update book information in a library.

iii. Announcement

Announcement sub module enables the administrator to display any related announcement to the users such as the arrival of new books.

iv. Backup Function

The backup function ensures that all the information contained in the system is preserved. Every system should have the backup function to face any casualties such as virus infection, fire breakout and flood.

v. Report Function

This module enables the users to print reports. This function thus facilitates the users to do referencing.

3.4.3 User Module

The users are also provided with several sub modules to help them in their routine activities associated with the library. This module is elaborated below.
i) Search
This module provides two choices of searching strategies, namely, easy search and advance search. Easy search is intended for use by the novices or first timers whereas the more experienced users can use the advance search. The searching methodology provided by this module includes search by title, author, year, subject and others.

ii) Help Desk
Help Desk is very important in any system. Any information related to the system application can be obtained from this sub module. Thus a user confronted with difficulties may seek information provided within this sub module.

iii) Circulation
This module enables users do daily routines in the library such as borrowing, return, renew, and reserving library materials.

3.5 Non Functional Requirement

i) User Friendliness
The system to be developed should be user friendly since it involves users from different backgrounds. Users should not consume much time to understand the system developed as a whole. The system thus needs to be necessarily simple in its applications.

ii) Reduce Human Error
The features provided by the system should reduce users from errors. A simple searching strategy such as browsing in alphabetical order
may cut down the errors committed by the users such as typing and spelling errors.

iii) Response Time
The primary criteria in analyzing a system performance is through its response which is heavily dependent on the operating system and hardware components.

iv) Security
The system has a security feature. Every user needs to enter the correct password when logging in. Access level differs for the users and the administrators. Understandably, access to the system by the user is more limited for security reason.

3.6 Language Programming Choice
The system is developed using php programming language. The reason why PHP has been chosen is explained below:

i) PHP is free
PHP, from the first release has been free. Thus a system developed using PHP may require a minimum budget and this is crucial to any small company that cannot afford to own an expensive system.

ii) PHP runs on a free web server
PHP runs on virtually any web server. Traditionally, it is wedded with the free Apache web server which runs on most Unix and windows platform. Since PHP can be part of the Apache server, it makes the system fast and stable.

iv) PHP works with a free SQL database server
PHP works with MySQL which is a free database server that is also fast and stable.
v) PHP is open-source software

PHP is part of the open-source software. Open-source software has a tradition of longevity and stability. And it is great because basically the world of software developers are working on it, trying to improve it continuously.

vi) PHP is a traditional programming language

PHP is easy to learn. Also, the structure of PHP is C-like, so that for a C programmer, his may be an added advantage.

3.7 Other System Requirements

3.7.1. Client/Server

Client/server was originally developed to allow more users to share access to database applications. Compared to the mainframe approach, client/server offers improved scalability because connections can be made as needed rather than being hard-wired. The client/server model also supports modular applications. In the so-called "two-tier" and "three-tier" types of client/server systems, a software application is separated into modular pieces, and each piece is installed on hardware specialized for that subsystem. In a client-server information collection and retrieval environment, the client program usually accepts user requests and provides screen displays. Server programs generally reside on more
powerful machines and are used to process information, generally stored in databases. When client-server programs are on different machines, the client and server machines are linked together by networks. To take a particular example, a Web server will often contain large amounts of memory and disk space, whereas Web clients often include features to support the graphic user interface of the browser such as high-end video cards and large-screen displays. Thus, client-server applications are naturally modularized into client, server, and networking components. Application developers are required to divide application tasks and logic into these components. The biggest advantages of using the client-server model for implementing application systems are the natural modularity of the application code and the flexibility in adapting to changing computing environments. Figure 3.4 presents example of the client-server environment.

Figure 3.4: Client/Server environment
3.8 Chapter Summary

This chapter covers a great deal on the methodology used in system developing and the techniques applied in information gathering activities. Also mentioned in this chapter are the system’s functional and non-functional requirements and also the choice of programming languages for developing the system.
Chapter 4 SYSTEM DESIGN

4.1 Introduction

System design is the process of synthesizing or reassembling the components and functions identified during system analysis (Lec. 2001). The designed system must include certain factors to meet users' requirements.

4.2 Program Design

The program designed must ensure that the program satisfies multiple user requirements. The designed system must be user-friendly. The system's design should be efficient.

4.2.1 Administrator Module

This module is designed specifically for the Administrator, and the system's password and access level are required to access this module. The Administrator module provides several main functions as shown in Figure 4.2.
Chapter 4: System Design

4.1 Introduction

System design is the process of synthesizing or reassembling the components and functions identified during system analysis (Lee, 2001). The designed system must include certain factors to meet users' requirements.

4.2 Program Design

The program designed must ensure that the program satisfies multilevel user requirements. The designed program must be user-friendly. The structured chart as shown in figure 4.1 illustrates the system design.

![Structured chart of WALC](image)

Figure 4.1: Structured chart of WALC

The WALC consists of two types of users namely Administrator and User

4.2.1 Administrator Module

This module is designed specifically for the Administrator and the accurate password are required to enter this module. The Administrator module provides several main functions as shown in figure 4.2.
The functions of the administrator module are elaborated below:

i. Control

The control function allows the administrator to change password for security reason.

ii. Report

The administrator can also view or print any needed report within this module.

iii. Announcement

The announcement module handles the maintenance of the catalogue module and displays new arrival books.

iv. Cataloging

This module allows the administrator do their routine cataloguing activities. The administrator adds new items into
the database within this module. This module also allows the administrator to add or delete item records as required.

v. Help

Help function provides help supports for the librarian in using the system.

4.2.2 User Module

The user module, illustrated in figure 4.3, provides a number of main functions required by the users. Each of the functions is explained as follows:

Figure 4.3: Structured Chart of The User Module

i. Search

Search module provides the users two search strategy options, namely advanced
search and easy search. The easy search strategy provides three search methods namely browsing, visualization and alphabetical.

ii. User information

This module provides the relevant information such as status and addresses associated with the registered users. Users may obtain their information from this module such as user information and status.

iii. Help

This module provides help supports to the users. It is meant to serve as a guide to users that have difficulties in using the system. It is especially useful to first-time users such as a guideline to perform an advanced search.

iv. Feed back

The users can give any positive and negative feedback related to the system through this system.

4.3 Input Form Design

The input form design must be simple and easy to understand by the users. All the input forms must be consistent and follow the GUI principles. The
functional buttons should be provided at each input form to facilitate navigation.

An input form design is illustrated in Figure 4.4.

![Kids Catalog](image)

**Figure 4.4: WALC Input Form design**

### 4.4 Database Design

The database must be carefully designed in order to make the system operates effectively and efficiently. The database design must have efficient storage and data update and retrieval capabilities. The effective design should lower the maintenance cost. Tables 4.1 to 4.7 have been created to store the information relevant to the WALC system.
### Table 4.1: Table structure for Administrator login

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Username</td>
<td>Text</td>
<td>Login user name to administrator module</td>
</tr>
<tr>
<td>Password</td>
<td>Text</td>
<td>Login password to administrator module</td>
</tr>
</tbody>
</table>

### Table 4.2: Table structure for User login

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Username</td>
<td>Text</td>
<td>Login user name to user module</td>
</tr>
<tr>
<td>Password</td>
<td>Text</td>
<td>Login password to user module</td>
</tr>
</tbody>
</table>
Table 4.3: Table Structure of items

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Field properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item ID</td>
<td>Auto Number</td>
<td>Identification item for the book</td>
</tr>
<tr>
<td>Call Number</td>
<td>Text</td>
<td>Call number of the book</td>
</tr>
<tr>
<td>Title</td>
<td>Text</td>
<td>Title of the book</td>
</tr>
<tr>
<td>Author</td>
<td>Text</td>
<td>Author of the book</td>
</tr>
<tr>
<td>Description</td>
<td>Text</td>
<td>Brief description of the book</td>
</tr>
<tr>
<td>Location</td>
<td>Text</td>
<td>Location of the book available</td>
</tr>
<tr>
<td>Publisher</td>
<td>Text</td>
<td>Name who published the book</td>
</tr>
<tr>
<td>Price</td>
<td>Text</td>
<td>Price of the book</td>
</tr>
<tr>
<td>Quantity</td>
<td>Number</td>
<td>Quantity of books available</td>
</tr>
</tbody>
</table>

Table 4.4: Dewey Decimal Classification Table

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Field properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDC Id</td>
<td>Auto Number</td>
<td>Identification of DDC</td>
</tr>
<tr>
<td>Subject</td>
<td>Text</td>
<td>Subject of the DDC</td>
</tr>
<tr>
<td>DDC</td>
<td>Text</td>
<td>DDC’s number</td>
</tr>
<tr>
<td>Description</td>
<td>Text</td>
<td>Description of Classification</td>
</tr>
<tr>
<td>Related Subject</td>
<td>Text</td>
<td>Subject Belongs to Classification</td>
</tr>
</tbody>
</table>
Table 4.5: Table structure of new arrival items

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item ID</td>
<td>Text</td>
<td>The item’s ID</td>
</tr>
<tr>
<td>Add date</td>
<td>Date/Time</td>
<td>When the item available in catalogue</td>
</tr>
</tbody>
</table>

Table 4.6: User Information Table

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Text</td>
<td>Name of registered users</td>
</tr>
<tr>
<td>Student No</td>
<td>Text</td>
<td>User’s student number</td>
</tr>
<tr>
<td>Address</td>
<td>Text</td>
<td>User’s home address</td>
</tr>
<tr>
<td>Card No</td>
<td>Text</td>
<td>User’s card number</td>
</tr>
<tr>
<td>Status</td>
<td>Text</td>
<td>User’s current status</td>
</tr>
</tbody>
</table>

Table 4.7: Announcement Table

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Field Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Announcement</td>
<td>Text</td>
<td>Name of announcement</td>
</tr>
<tr>
<td>Time</td>
<td>Date/Time</td>
<td>Time of the announcement made</td>
</tr>
<tr>
<td>Description</td>
<td>Text</td>
<td>Description of events</td>
</tr>
</tbody>
</table>
4.6 Expected outcome

With the WALC in existence, it is hoped that the following may be achieved:

i. To facilitate students in searching reference materials using the various searching methods

ii. Able to fulfill the needs of children from different levels.

iii. Able to improve the management and function of elementary school libraries by automating routine activities such as cataloguing function.

iii. The attractive interface should stimulate children’s interest in using the system.

4.7 Chapter Summary

This chapter primarily focuses on the system design. The system design includes the program design, input form design, user interface design and database design. The system design is an extension of the analysis and survey that have been done previously.
Chapter 5: Systems Implementations

5.1 Project Overview
System implementation is the acquisition and integration of the physical and conceptual resources that produce a working system (Meyer, Baber and Pfeffenberger, 1999). It is the physical realization of the database and application designs (Connoly & Begg, 1998). There are two main tasks in the system implementation phase, namely, system development and testing.

5.2 System Development
The hardware and software requirements must be met before the system is developed.

5.2.1 Software Requirement
The software tools used in the project are:

i) Operating System – Windows 98
ii) Programming language – PHP (version 4.3.3)
iii) Relational Database – MySQL (version 4.0.15)
iv) Database server manager – phpmyadmin (version 2.5.3)
v) Web Server – Apache (version 1.3.27)
vi) HTML editor – Macromedia Dreamweaver MX
vii) Php IDE – php coder (version R2 Beta)

The easyphp version 1.7 installer package has been used to install the PHP, MySQL and Apache software.
5.2.2 **Hardware Requirement**

The minimum hardware requirements to successfully run the above softwares are:

i) 300 MHZ pentium II processor
ii) 64 MB RAM
iii) 275 MB free hard disk space
iv) A 256-color monitor capable of 800 X 600 pixel resolution
v) A CD-ROM drive

5.3 **System Implementation**

It is common that before a system is going to be implemented or used, description or demonstration of the usage of the system is required. This is necessary because it enables users to operate the developed system easily and thus the demonstration provides the users an easy learning environment. However, user manual is also necessary to guide users using the system.

5.3.1 **System Security Control**

Security control is another important aspect that requires attention in the system implementation. Its priority includes preventing the system from being intruded and to ensure that data or information is not stolen. The developed system will consists of two types of security. These are:

i) security control
ii) system control
5.3.1.1 Security Control

Security control is a must for a system with database. Without security control, there is a possibility of intrusion on the system database. Thus, a user needs to undergo some form of authentication before he or she can use the system. The user will be required to login using a password. Any user that enter the wrong password will not be authorized to use the system and will be prompted with an error message instead.

5.3.1.2 System Control

Security control alone may be insufficient to protect the system from being intruded. System control serves to further strengthen the system security. It is divided into 4 parts discussed below.

(i) Interface Control

This is the interface that the users interact with. This is where a user enters his or her username and password. The interface control determines whether a user is authorized to enter the system or not.

(ii) Input Control

The purpose of the input control is to ensure that data entered is correct and relevant. Otherwise it will generate an error message.

(iii) Output Control

To make sure that the output is generated correctly, only correct report would be printed and this increases the reliability of the system.

(iv) Process Control

Process control is handled by the programmer based on error feedbacks from users. It enables the programmer of the system to provide information to the users based on these feedbacks.
5.4 System Coding

The coding of the program is done at this phase. This is where all the design specifications derived from the system design phase will be converted to instruction codes in the programming language. Activities in this phase include producing compiled program modules systematically.

5.4.1 Important factors in programming process

In the design phase of the system, the system is a structured and clear module. The system is then divided into subsystems or processing groups and specific functions. Each function contains one or more programming modules.

5.4.1.1 Programming Method

The subsystems in the system are designed based on the logic equations, data requirements and sequential functions. Each subsystem consists of one or more programs. The 'colloboration' concept in the programming design will produce modular programming while the 'binding' concept will produce structured programming.

5.4.1.2 Processing Systems

Another important programming aspect is the processing method that is used. Commonly, the system operates on two processing methods, the cluster system method and the the online system (real system) or a system that uses both the methods. The WALC system employs the first method because it uses a stand alone computer that does not require the computer to be online. The database will be on the computer disk where the system is operating.
5.4.2 Programming Process Implementation

In the implementation of the programming process, priority is given to the preparation of the specifications of the programming coding, programming module coding, testing of each programming module and integrated system and documentation of the developed programs.

Implementation of the process requires the following steps:

i) coding specification  
ii) program coding  
iii) program compilation and collection

5.5 Chapter Summary

This chapter discusses on the system implementations. Both the software and hardware requirements which were generally discussed in Chapter 1, are specifically mentioned again here. Additionally, this chapter also highlights on the programming aspects of the project.
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 present.

These methods are not only support the assessment of quality but also help to achieve and preserve the software quality. Software testing is for every software because it ensures that the device is ready for testing.

They are:

(i) Testing the software components

(ii) A good test case is one which has a high probability of finding an error

(iii) A successful test is one that achieves

6.2 Testing Principles

There are many testing principles available today. Therefore, before applying them to design an efficient testing strategy, a software developer should understand the base principles that guide a good strategy. For WAFS, one of the principles has been identified below.
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 defector errors present. Thus, software testing embraces a wide range of activities that not only support the assessment of equality but also help to achieve and preserve the software quality. Software testing is essential for new software because it ensures that the developed software System implementation is the acquisition and integration of satisfies users requirements.

6.2 Testing Objectives

A number of rules have been created that can serve well as testing objectives. These objectives are:

i) Testing is the process of finding error by executing the system, program or software.

ii) A good test case is a case where the probability of finding an error is high.

iii) A successful test is one that uncovers

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 WALC, a set of principles has been adopted. These are:
i) All test should be traceable to user requirements. Since the objectives of system testing is to uncover errors, testing needed to be done such that it follows that the most severe defects are those that cause the program or system to fail in meeting its user requirements.

ii) Test should be planned

Test planning can begin as as the user requirement model is completed. Details of the test definitions 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.

iii) 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 even 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.

iv) Testing should start with ‘small testing’ and progress towards ‘larger testing’

The first test normally is planned and executed on individual components. As the testing progresses, the focus will shift in an attempt to find error from general component to integrated clustered of components and finally the entire system.
6.4 Technique (Testing)

Different types of testing is needed for different types 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 identification (ID) that is different in nature and objectives. The main objectives are still looking for errors but different type of errors are looked for at each level. The levels of testing in software development encompasses unit, component integration testing, system testing, acceptance testing as well as installation testing.

6.4.1 Unit/Module Testing

Unit 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 who has written the code earlier will test the code himself although this is not necessarily 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 cataloguing is tested in unit or module testing. This can ensure that each module goes through a number of different tests and that all modules are tested. During unit testing, the system programmer needs to review the code that he or she has written earlier. There are two types of code review. These are:

i) Code Walkthrough

Here, the code accompanied by the 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 codes, not coder.
ii) Code Inspection

In code inspection (Fagan, 1976, IBM), it is quite similar to walkthrough except that it is more formal. The review team will check the code and documentation against prepared concerns. For examples, in WALC, 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. Some of the units that are tested during unit or module tested are:

i) Local data structure
   The purpose here is to ensure that data stored temporarily will maintain its integrity during all steps in an algorithm's execution.

ii) Error handling path
   The purpose here is to ensure that the system can handle expected and unexpected area by applying error-handling routines. In WALC, error handling event is the validation of information inputted by the system user such as password and so on.

iii) Module interface
   The purpose of the module interface is to ensure that the information properly flows into and out of the program unit under testing. For example, checking each icon and button to see whether there is a link or the link is a deadlink or an orphan link.

iv) Condition (boundary)
   The purpose here is to ensure that the module operates properly at boundaries established to limit or restrict processing.
6.4.2 Component Integration Testing

This type of testing is used to determine the existence of integration bugs such as the inconsistencies between sub modules or between sub elements. This test only focuses 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 or elements are tested as elements from the point of view of structure and function, with tests 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 consider are:

i) Read/write access to a particular file or file creation

ii) The system does not corrupt other systems even though it does not fail itself.

Some of the more common interface errors encountered are:

i) The parameters may not be in correct order

ii) The parameters may not be of the right data types or formats

iii) Exception errors such as requesting information not found in the database

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

a) Top down testing

Top down testing is a type of testing that starts with the module in the call graph and add one module at a time to the set of merged modules. The top modules 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 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. After that, the next higher-level modules is called and tested, one at a time, with these tested modules.

c) Modified top down testing
Top down testing has one major problem in that it may be impossible to test certain logical conditions 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. However, 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 are strict and non strict modified top down testing, depending on the conditions for selecting the next module to be merged.

Generally, there are no best techniques. Rather, the best testing makes use of as many techniques as are relevent and useful. What is important here
is that whatever test technique is chosen, it should ensure that among other things, correctness or appropriateness in level of security, storage size, implementations and so on.

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-functionality quality attributes such as performance, reliability, maximum volume, stress tolerance, usability, maintainability, security and so on. Therefore, it can be said that system testing is a series of different tests designed to fully exercise the system to uncover its limitations and measure its capabilities. The objective is to test an integrated system and verify that it meets all the user requirements. System testing can also be carried by independent tests to get a better result.

6.4.4 Acceptance Testing

Acceptance testing is a kind of testing that shows the transitions 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’s 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.

6.4.5 Installation Testing

The final round of testing involves installing the system at the user’s site. In WALC, the user’s site is in University Malaya’s laboratory. If
acceptance test has been performed on site, then installation testing may not be needed. Installation testing requires that the system developer works hand in hand with the end users.

6.5  Chapter Summary

This chapter discusses on the testing phase of the system. Apart from discussing the aim and objectives of a system testing, the chapter also elaborates on the testing techniques.
Chapter 7
SYSTEM EVALUATION
AND CONCLUSION
Chapter 7 System Evaluation and Conclusion

7.1 Introduction

After testing the system, the system will be evaluated to determine its quality. The Web Able Library Catalog is evaluated based on specific specifications. Problems arising from developing the system will be discussed and possible solutions will be taken to solve the problems in the future.

7.2 System Evaluating aspect

Evaluation should be made to the fully developed system. This is very important to determine the quality of the system. In evaluating the system, the following aspects are look into:

7.2.1 System Security

Security is one of the most important characteristics of all systems. The developed system should have a good security. This is because security can prevent the system from being intruded by unauthorized individuals. A system with a login module can provide a control on individuals accessing the system. In this library catalog, only those administrators with the preregistered username and password can login into the system. Similarly, patron can login using their preregistered Patron Id. Unauthorized users who try to gain access to the system will be prompted with an error message
7.2.2 Data Security

Data security needs to be given extra attention as to ensure the integrity of the data. Evaluation should be made whether the data is safe or not. Data security can only be achieved if the data can only be accessed by certain individuals. In this case only the administrator will know the login page and password is given to the administrator. This is very important to make sure unauthorized people does not access that database and prohibit any deletion and alteration done by them.

7.2.3 Data Access Security

In the data access security, data is stored based on a certain key point. Data that need to be restored should be done based on the key point which includes the location and the required key to access the data.

7.2.4 Graphic Representation

An attractive graphic representation can be appealing to the user. The user interface is very important because it is the thing that users see and interact with the system. Good interface is based on its user friendliness, systematic structure, and attractive features.

7.2.5 System Speed

Evaluating a system means getting the feedbacks from users using the system. For user satisfaction, application speed is an important factor. Most users would be displease with a slow system. A faster system means more can be done with less time and result can be obtained at ease. The
Web Able Library catalog has a moderate processing speed.

7.3 System Strength

WALC has the following strengths:

i) Security features

In the catalog, information is stored in a database that can be accessed by authorized users only. To access the system, a system administrator will login using a username and password and students login using their patron IDs.

ii) Speed features

In the data access, WALC can retrieve and display information at a tolerable speed. It is relatively faster compared to many other applications.

iii) Accuracy features

Accurate information is the main concern of users and a system that is capable of producing accurate information is a reliable system. The WALC system is accurate and reliable.

iv) Search Engine

A simple search engine is provided for users to be able to find books. They may enter their search for title, author name, subject or the call number of the book. Although the search engine is small, it is sufficient in providing simple search.
7.4 System Constraints

Every system has its own system constraints. The constraints of this library catalog are:

i) Security

Since registration is open to all, the security of the system can be at stake and this is especially true if a user has a deliberate intention in hacking the system. The security of the system thus need to be improved and upgraded from time to time.

ii) Search Item

Presently, the system can only search for information related to books. In the future, other information such as cds, cassettes, videos and so on will be included in the search category.

iii) Limited function modules

The system has a limited function modules. In the future, more modules will be added. One example is the FAQ module.

iv) Simple Retrieval System
The search engine can be improved in the future to search for the items so that the search results will be more precise.

7.5 Problems Encountered and Solutions

In the planning and development phases, a lot of problems have been encountered. Some of these are mentioned below.

i) Information Gathering

In the information gathering process, quite a few numbers of users refused to cooperate in giving their opinions and suggestions and this resulted in the unclearness of the users need.

A solution to this problem was to use a different method of approaching users. One way was to choose a better environment so that users felt comfortable when answering questions.

ii) Programming Language

PHP has been the language of choice in building the project. The language, however, is still new and foreign to the programmer. Initially codings of the program were not smooth since it took time for the programmer to become familiar with the language of PHP. Apart from that, the programmer had to work with a database system so that the whole project was actually a combination of PHP-MySQL programming.
A solution to the above problem was for the programmer to gain familiarity of the PHP-MySQL programming by referring to good resources such as the internet and books. These resources may be referred in the reference section of the report.

iii) Project Time

The practical side of the project is allocated for only one semester. The time was insufficient unless the programmer is well experienced.

A probable solution was to spend more time in the project. The programmer thus spent many times working in the extra hours in order to meet the deadline of the project completion.

7.6 Future Enhancement

The WALC system requires a lot of enhancement since the present system has limited functions. Some of the proposed enhancements are:

i) better user interface with more user-friendly features

ii) more function modules added

iii) fixing bugs in the programming software

iv) making the system more interactive

7.7 Knowledge and Experiences Gain

The student gain a lot of experiences and new knowledge when undertaking the project. Some of them are:
i) learning a new programming language, namely, PHP. The project gives the student an opportunity and a motivation to learn PHP.

ii) learning MySQL. Since the project involves the use of database, the student has an opportunity to learn MySQL.

iii) What is more important, the project enables the student to put into practice all that have been learned.

7.8 Chapter Summary

This chapter discusses on the features of the developed software, its enhancement, limitations and also suggestions for further development. Apart from that, it also mentions on the benefits on the side of the student doing the project.
REFERENCES
References


http://cochise.lib.az.us/sunsona.html

http://panda.pkwy.k12.mo.us/elem3/welcome3.html


http://www.millennium.marmot.org:90/kids

http://www.perpustam.edu.my/ar98/khidmat98.htm


Murphy, Catherine. (1989, May). "A primer on automating the school library media center." Electronic Learning, 8(7): 34-37.

Figure 1

Patrons need to click the "To Library" to access the patron menu (see figure 2). Patrons are not allowed to access administrator modules.
User Manual

Web Abled Library Catalog (WALC) user guide

User Module

The homepage of the WALC is shown in figure 1.

![Welcome to Kids Library Main Page](image)

**Figure 1**

Patrons need to click the “To Library” to access the patron menu (see figure 2). Patron are not allowed to access administrator module.
The Patron main page consists of the following menu:

- Search
- User Info
- Feedback
- Announcement
- Help

To go to the search menu, click button or icon search. The following page will be displayed (see figure 3)
The user may select to click on any button to begin the search.

If the user click the Call No. search, for example, the following page will be displayed (see figure 4)
Figure 5 shows the result if the user enters the call number TK100.4
The user can send feedback by clicking the feedback button from the main page (see figure 1). The user will then be directed to the page shown below (see figure 6).
The user can check on their particulars and to update them if necessary. The user, however needs to enter his or her Patron Id for security reason (see figure 7)
Figure 7
Figure 8 shows the page for new users to register.

![Library Catalog](image)

**Figure 8**

**Admin Module**

The admin module can only be accessed through a username and password (see figure 9).
A successful login leads to the Admin main menu page (see figure 10)
The administrator can catalog new books by clicking on the ‘cataloging’ button which displays the page shown below (see figure 11)

![Admin Modul](image)

**Figure 11**

Finally, an administrator can also check on his or her particulars by entering a valid Id (see figure 12)
Figure 12