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Digital Library Of Historical Buildings

Authentication, Search and Retrieval, Uploading and Data Manipulation Modules

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ABSTRACT

This report describes the development Digital Library of Historical Buildings (DLHB). DLHB currently provides a comprehensive digitized collection of historical building repositories on-line. DLHB is an on-line digital library system, which caters for the educational communities need, especially Form three students, who are conducting research and gathering information on historical buildings for their history projects. It aims to provide a dynamic Malaysian e-learning environment in line with the Smart School e-learning Model. The DLHB system consists of eight main modules. The focus of this report is on the authentication, uploading, data manipulation, and search and retrieval modules. DLHB provides services for student to search and retrieve the desired historical building resources, for teachers and students to upload history projects and manipulate the projects that have been upload by them. The prototyping model is chosen to address user's requirement and expectations more closely. Analysis of both functional and non-functional requirement was conducted to fulfill the requirement of the systems. DLHB is developed using Microsoft Access 2000 as the database management system; Windows 2000 as the system platform, Active Server Page as the web-server programming language. The DLHB system will be a valuable instrument to enhance learning and to extend the reach of information gathering to those who needed them. It hopes to help promote the quality of e-learning environment in Malaysia. DLHB could become powerful collaborative local resources development for teachers and students at all levels as well as exposing them to digital library technologies.

ACKNOWLEDGEMENT

I would like to thank a few people for their guidance and help throughout the whole semester in analysis process, synthesis process and designing this Digital Library of Historical Buildings. First and foremost, I would like to express my highest gratitude and appreciation to my project supervisor, Assoc. Prof. Dr. Zainab Awang Ngah for accepting me as one of her project student and being kind to give guideline in this proposal phase. She also gives some ideas of how to design the systems. Besides that, I would like to thank Pn. Abrizah Abdullah, my moderator of this project for assisting and providing me with more ideas and opinions on to build a better and unique Digital Library of Historical Buildings. Not to forget, the Form Three students of Sekolah Menengah Sri Pantai, for their willingness to spend some of their time answering the questionnaire and the Ministry Of Education for given permission to carry out survey at the school. Last but not least, I would like to express my thanks to my project team member, Norashikin Sumailan who are willing to offer and exchange ideas and opinions with me to design and developed the system.

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CHAPTER 1 INTRODUCTION

1.1 Project Overview

This report proposed development of Malaysian historical building web portal. A historical building portal is a web site, which contains the information of historical building in Malaysia.

1.1.1 Definition of terms

Portal

A web site that aims to be an entry point to the World-Wide-Web, typically offering a search engine and/or link to useful pages, and possibly news or other services. These services are usually provided for free in the hope that user will make the site their default home page or at least visit it often. Popular examples are Yahoo and MSN. Most portals on the Internet exists to generate advertising income for their owners, others may be focused on a specific groups of users and may be part of an intranet or Internet. Some may just concentrate on one particular subject, say technology or science, and are known as a vertical portal.

(http://www.dictionary.com/ Accessed on June 20, 2002)

Historical

1. Relating to the study of history; "historical scholars'; "a historical perspective"
2. What is famous in the past;" historic victories"
3. Having once lived or existed or taken place in the real world as distinct from being legendary;" actual historical events"
4. Belonging to the past; "historical (or historic) times"
5. Used of the study of phenomenon as it changed through time.

(http://www.britannica.com/search?query=historical Accessed on June 20, 2002)

Historical building portal

A historical building portal is a website considered as doorway to other repositories of historical building archives. Users can search and retrieve information on historical building from the website. Some may considered it as digital library.

1.1.2 Definitions of Digital Library

There are many definitions of "digital library". Terms such as "electronic library" and "virtual library" are often be used. The elements that have been identified as common to these definitions are:

a) The digital library is not a single entity;
b) The digital library requires technology to link the resources;
c) The linkages between the digital libraries and information services are transparent to the end users;

d) Universal access to digital libraries and information services is a goal;

e) Digital library collections are not limited to document surrogates:

f) They extend to digital artifacts that cannot be represented or distributed in printed formats.

1.1.3 The Role of A Digital Library

New technology is changing the world. The library has the opportunity to be at the forefront of the change through the development and use of technology. To remain viable and competitive, the library must both meet the needs of users and maintain a favourable position relative to other information providers.

The digital library is not limited to books and periodicals. Services offered by commercial information and entertainment industries are indicative of the information-intensive environment in which the libraries operate and the changing needs and desires of users. Digital library offering access not only to text but to anything that can be digitized such as paintings, photographs, music, film clips, manuscripts and lots more.

The successful library will extend beyond the doors of one building. It will provide immediate access to a wide variety of print and electronic information resources when users need them. Electronic resource will supplement traditional print resources, and the library will be a centre for access to new information services and products.

The digital library has the opportunity to be the leader of innovation for information resources. The digital electronic library of the future is not just a place to get a book or ask a reference question. It is a vital part of the information society.

1.1.4 The Digital Library of Historical Buildings

The Malaysian historical building portal is an information repository of historical building in Malaysia. This portal is one of web based digital library application, using different information formats, such as, text, audio, image and video. This project is developed to help the students of secondary schools and teachers for their history project. Students and other user can access information easily, at any time, fast access to digitized materials through their computer.

1.2 Project Motivation

In the era of information communication technology (ICT), scope of education in Malaysia has been changed. Today, students are advised to use information technology in the learning process. Seeing that there is a trend to adopt the digital learning technologies to facilitate the current learning process, the promotion of electronic learning in our country has becomes necessary. Digital library collections are not limited to document surrogates: they extend to digital artifacts that cannot be represented or distributed in printed formats.

The traditional method of learning in Malaysia depends on the books and printed materials. This web portal will help the student and teachers to find information for the history project easily, at any time, fast access to digitized materials through their computer. Hence, the learning process become interactive and student become more interested and enjoying the learning process.

The portal can be access through the Internet. User can discover the historical building without visiting the building site; its will helps student from the rural area or far away to get information without spending a lot of their money and time traveling to the site. The resource can be shared amongst students, teachers and users from all over the world. Internet has functioned as collaboration among cooperating parties.

Compared with traditional repositories of historical building, this historical portal attempt to be user-friendly. The interface would make extensive use of icons, buttons, bars, and boxes to perform required tasks. The portal is indexed, so that users can search and retrieve information easily without taking so much time to find the sources.

Hopefully, this web portal will help to preserve the Malaysia heritage for the future. Users especially the young generation can gain information or knowledge about the historical building and event in Malaysia.

1.3 Objectives

1.3.1 Project Objectives

a) To establish web site of historical building in Malaysia that can be easily access, interactive and user-friendly for everyone.

b) To preserve Malaysian historical building information for a new generation as a valuable national heritage.

c) As a repositories that can be used by students' secondary schools and teachers for history project. Students and teachers can access information for the history project easily without spending much time finding other resources.

d) To develop a digital library application for the portal. Collect, store and organize information and knowledge in digital form.

e) To represent Malaysian historical information in a more interesting and interactive manner.

f) To support the effective learning for students; instil interest in students and users to learn more about the Malaysian historical building.

g) To act as a repository for Malaysian historical building information that can be managed and administered by those who had been given the permission.

1.4 Project Scope

This project involves group work of two persons. Each person has her own scope of historical building. They have to find information on different historical building that would be combined later to be the Malaysian historical building portal. Group members will be collecting historical building information about six building. There are A Famosa, Kuala Lumpur International Airport (KLIA), Putra Mosque, Sultan Abdul Samad Building, Shah Alam Museum and Bukit Jalil Stadium.

1.4.1 Project Modules

There are eight interdependent modules are identified for this project.

a) Authentication

b) Registration

c) Quiz and Edutainment

d) Uploading and Submitting

e) Tracking and Report

f) Information management

g) Data Manipulation

h) Search and Retrieval

1.4.2 Individual Modules

The author will focus on four mutual significant modules of the projects – Authentication Module, Data manipulations Module, Uploading Module and Search and retrieval Module.

a) Authentication Module

The authentication module provides different types of access to different type of registered users. The authorized users such as history teachers or students are allowed to upload historical data from their desks. Administrator is able to access administrative records, review the relevancy and suitability of data that had been uploaded by other types of user, delete the uploaded data, and finally posting the data in the historical buildings portal.

b) Uploading and Submitting Module.

The uploading and submitting module provides the functionality for users to upload their resources to the server of the historical building portal. Forms will be used to let the users uploaded their files and input other necessary details. Files that can be uploading are in formats such as text, images or zip file. Limitation will be set so that user won't upload too many information or images that will slowdown the retrieval process.

c) Data Manipulation Module

This module provides the functionality to manipulate the uploaded information. This module provides convenience to user for view, add and delete their submitted information. The information to be manipulated will be retrieved and display in a form. The latest information will be update when user submitted the form. If the user which to delete the uploaded information, warning box will appear to prevent any accidental deletion.

d) Search and Retrieval Module

This module provides an efficient way to search and retrieve desired information, collections or images. The historical building portal's collections can be search by keyword, year, location, name, images and other relevant search features. Indexing enable user to browse the system's collection by keyword.

1.5 Project Plan and Methods

Project plan is importance it helps to coordinate what we do and when we do it. We can call project plan as a process or project life cycle. Process is a series of steps involving activities, constraints, and resources that produce an intended output.

Processes are important because they impose consistency and structure on a set of activity. This is useful when we know how to do something and we want to sure we do it the same ways. For examples, author writes down the description processes of her

Malaysian historical building, this description is useful for her references if we want to update the system in future and as a reference for group member.

The process structure guides our action by allowing us to examine, understand, control and improve the activities that comprise the process. There are several of software process models such as waterfall model, V model, prototyping model, transformational model and operational specification models. Each model has their weaknesses and strengths.

For this project, a prototyping model is chosen. Prototyping model allows all or part of the system to be constructed quickly to understand and clarify issues, requirement and design require repeated investigation to ensure the system is develop with satisfactions. The goals are to reducing risk and uncertainty in development.

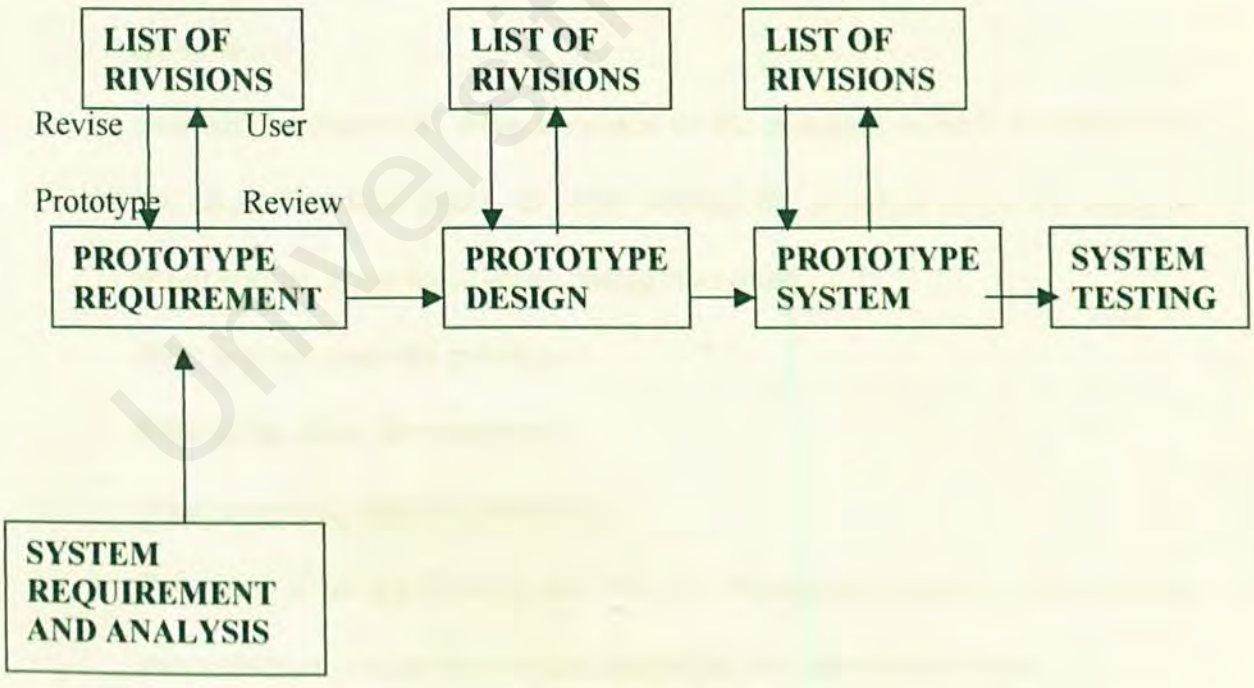

Figure 1.1 The Prototyping Model.

Prototyping is an iterative analysis. The purpose of a prototype is to show the possible design for the user interface of an application. A prototype is a small-scale, incomplete, but working sample of a desired system. By incomplete mean that a prototype will not include error checking, input data validation, security and processing completeness of a finished application. Nor it will be the polished or after user helps as in a final system. But it can quickly identify the most crucial of system requirements.

Four step to the prototyping process:

1. Determine the needs of systems. The requirements of users drive the development of prototype as they define the object that the systems must support. The requirements can be gather using interviews, questionnaire and etc.
2. Built the prototype. Using a prototyping tool or high-level language to develop the systems.
3. Evaluate the prototype. After a version of the prototype is built it needs to be evaluated. The main goal is to verify whether the prototype meets the needs of requirements. There basic issues during evaluation:

   What is good about the prototype?

   What is bat about the prototype?

   What is missing from the prototype?
4. Determine if we are finished yet. Stop the prototyping process, when find that the evaluation process is no longer generating any new requirements.

Advantages of prototyping.

1. User orientation

One major objective of prototyping is to develop systems that meet user needs to a greater extend.

2. Fast development time

It can take few weeks or months to obtain meaningful results, compared to the traditional approach, which can take years for the complete system to be in operation.

3. Fewer errors

Prototyping allows to be detected earlier.

4. More opportunity for changes

With prototyping, the user can see and work with the outputs from each subsystem or component so it is being developed, enabling the user to suggest changes during the development process.

1.6 Project Schedule

A project schedule describes the development cycle for project proposed by enumerating the phases of a project and breaking each into discrete activities to be done. The schedule also shows the interaction between the activities and estimate the time that each activity will take. The project development is divided into 2 parts.

Part 1 of project development period is considered as proposal phase. These include activities like system study, literature review, system requirement and analysis, VIVA and systems design.

Part 2 of project development period is considered as development phase. The activities that will takes are initial systems design, systems module coding, evaluation and testing, and user training.

Figure 1.2 below shows the project schedule Gantt chart of the entire systems development.

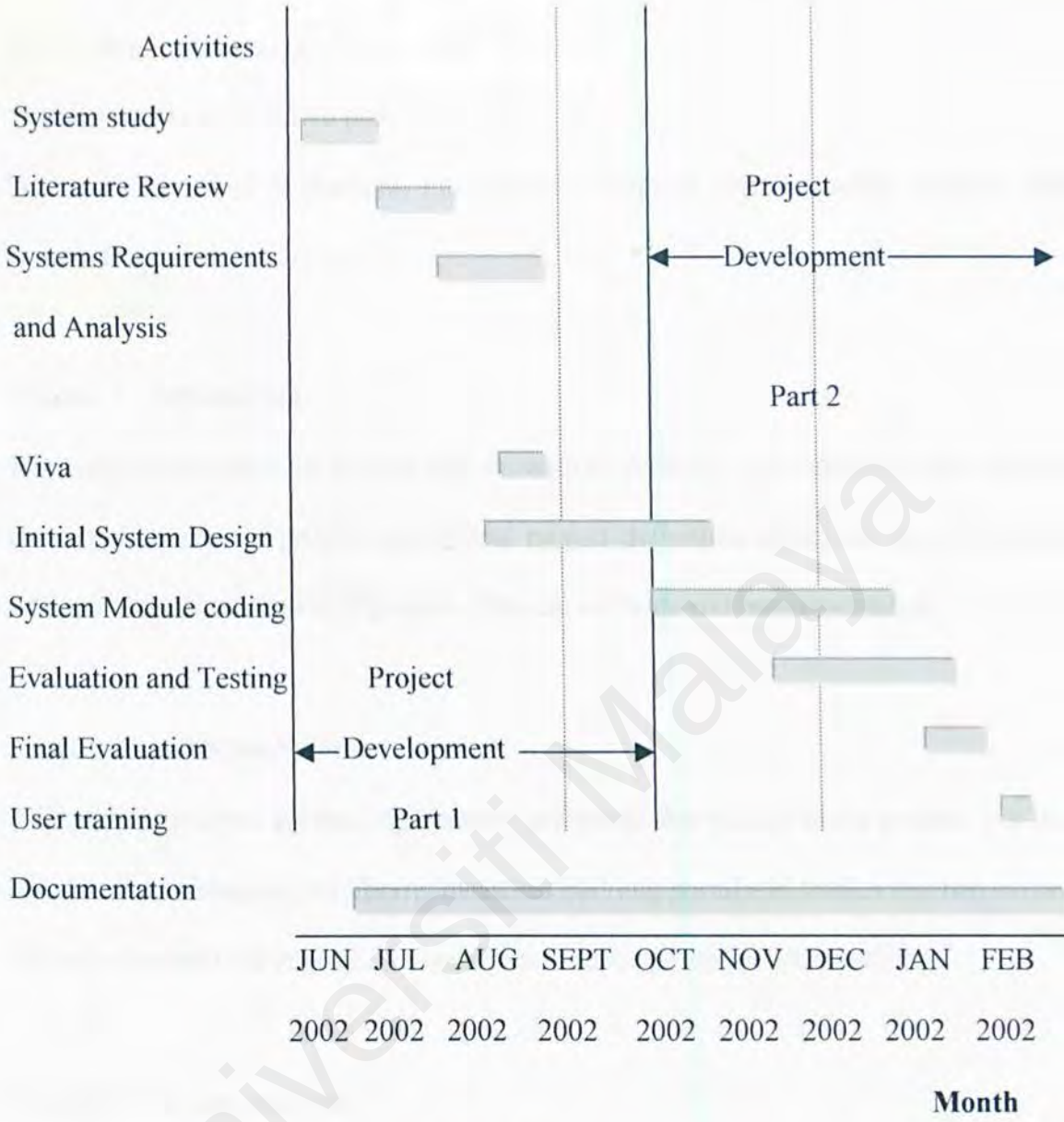

Figure 1.2 Project Schedule

1.7 Report Overview

This report divides into two parts.

Part one consists of 4 chapters; introduction, literature review, system analysis and system design.

Chapter 1 – Introduction

This chapter describes the project that we want to develop. The contents of this chapter are project overview, project motivation, project definition, objectives, project scope, relevance and significance of project, plan and methods and project schedule.

Chapter 2 - Literature Review

This chapter reviews on existing systems and portal that related to the project. For this chapter, the existing digital library, historical building portal and studies that had carried out are examined. At the end of chapter, importance points are summarizing.

Chapter 3 - System Analysis

This chapter describe in details system requirement such as functional and non-functional requirement, hardware and software requirement.

Chapter 4 – System Design

Based on requirement of the proposed system. This includes database design, data dictionary, data flow, program design, and detail diagram for module, interface and report.

Part two consists of 3 chapters; system implementation/development, system testing and conclusion.

Chapter 5 – System Implementation/Development

Elaborations of system development refer to modules and algorithms designed, which are converting in the form of commands, that can be, execute in computer programming language.

Chapter 6 – System Testing

This chapter describes the approaches for testing of the system, whether systems fulfil the requirement and specification.

Chapter 7 – Conclusion

Discuss the result, problem and solutions, system advantages and disadvantages, improvement that can be done in future, suggestion and conclusion of overall project.

CHAPTER 2

Literature Review

CHAPTER 2 LITERATURE REVIEW

Introduction

Resource from various sources such as web site, articles, textbook and conference paper are collected. Resources are searched, analyzed and examine to understand the existing digital library systems available in the market. These processes are importance to ensure the quality of proposed system is better than the existing systems.

2.1 Digital Library

New technology is changing the world. The library has the opportunity to be at the forefront of that change through the development and use of technology. Nevertheless, recent advance in digital storage and digitization technologies are making the digital archiving of large collection both feasible and cost effective (Newby, 1991).

Moreover, according to report by Peter Lyman and Hal Varian at the University of California at Berkeley, the world currently produces between one and two exabytes (a billion 8-bit bytes) of information each year. Most of the information is in the form of images, sounds, and numeric data; printed documents account for only 0.003% of the total. An increasing proportion of information being produced is created, stored, and can be retrieved in digital form; more than 90% of this output is stored digitally.

2.1.1 Digital Library Environment

One of the major issues that arises in any discussion of digital library research is to define exactly what a digital library is and how it is different from other systems that it may be equalized with, distributed, multimedia information system. The term "digital library" is used to capture everything that typically falls under a variety of terms, including "digital library", "digital museum", digital archive", and others.

There are three characteristics that make a system a digital library and distinguish it from other kind of systems:

http://www.dli2.nsf.gov/internationalprojects/eu_future.html

a) Functionality

It offers integrated services to a comprehensive digital collection of cultural of scientific information that is available primarily for reading and secondarily for expanding upon as well as annotation. Some of the features emphasized in digital library information systems are:

- Rich information needs
- Multiple sources of related information
- Heterogeneous information
- Rich data sources
- Multimedia information
- Defined user populations
- Motivated users

- Task-orientation
- Domain-orientation
- Collaboration

b) Purpose

It is mainly used for learning and research.

c) Lifetime

It provides access to information whose value is preserved across long periods of time.

Digital library application can be distinguish from typical web and database applications as shown in information space figure below:

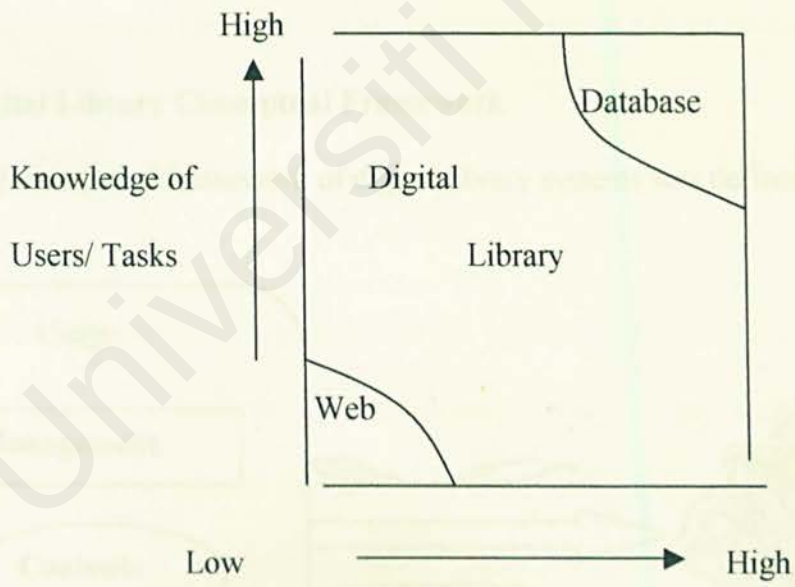

Figure 2.1 The Information Space for library

http://www.dli2.nsf.gov/internationalprojects/eu_future.html

An information space can be identified, with one dimension representing the level in which users and tasks are predefined, and the other dimension representing the level in which the data has (known) structure. Web search engine receive much attention in the commercial world, typical Web search engines assume very little about users, tasks, and the data they deal it. Database applications assume a great deal about users, tasks, and data. For examples, the interaction with database often limited to a few transaction types and data is typically defined using relational schemas.

The rest of the space can be overviewed as belonging to digital library applications. In this part, information systems attempt to exploit knowledge about users, tasks and domain to improve access, but retain the flexibility of ad-hoc querying, filtering, presentation, which is characteristic of many web based applications.

2.1.2 Digital Library Conceptual Framework

A general conceptual framework of digital library systems was defined below:

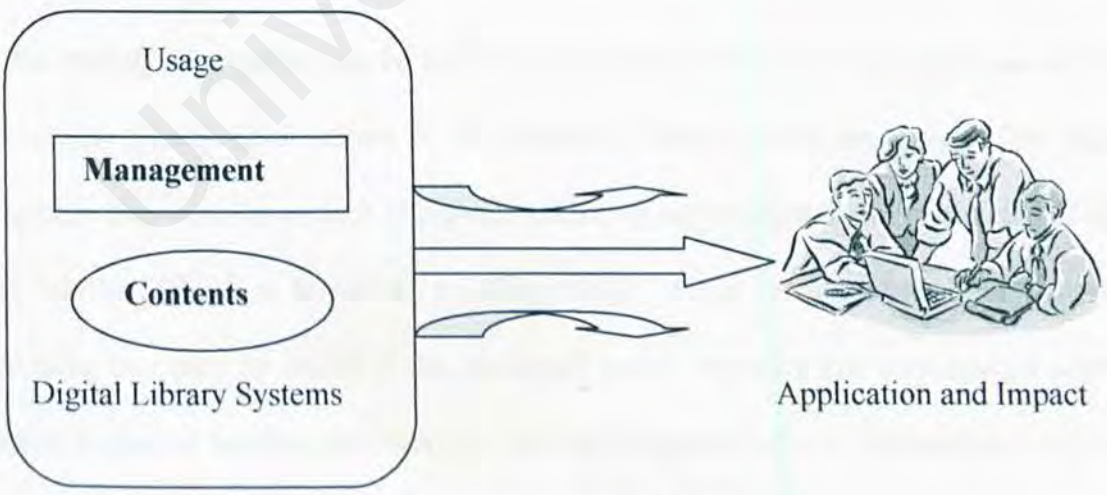

Figure 2.2 A Conceptual Framework for Digital Library.

There are three major components of digital library systems:

a) Contents

Contents of digital library.

b) Management

Is the core system, responsible for the management of the contents and for providing the necessary functionality.

c) Usage

At the front-end is the user interaction component, dealing with all aspects of the interface between user and the system.

On the right-hand side of the above figure, there is the outside world, the general society. This represents all applications that could benefit from advanced digital library systems.

2.2 Historical portals in digital libraries

Thousand of information can be found in the Internet. There are also numerous number of digital library applications in the Internet. Though, there are only a few digital libraries that were developed to provide inclusive information about historical building especially Malaysian historical building. Most of the information about historical building can only be found at the historical portal. As there are very limited sources about historical building in Malaysia, this has triggered off my enthusiasm to develop

this significant project. The historical information of Malaysia is very valuable and we should preserve this information for the future as a Malaysian heritage.

Four different web based system related to the historical building had been examine, analyse, synthesize and discuss in this chapter. The useful features will then be adopted in the development of the project.

a) State Historical Society of IOWA

URL : http://www.iowahistory.org/ Accessed on June 25, 2002.

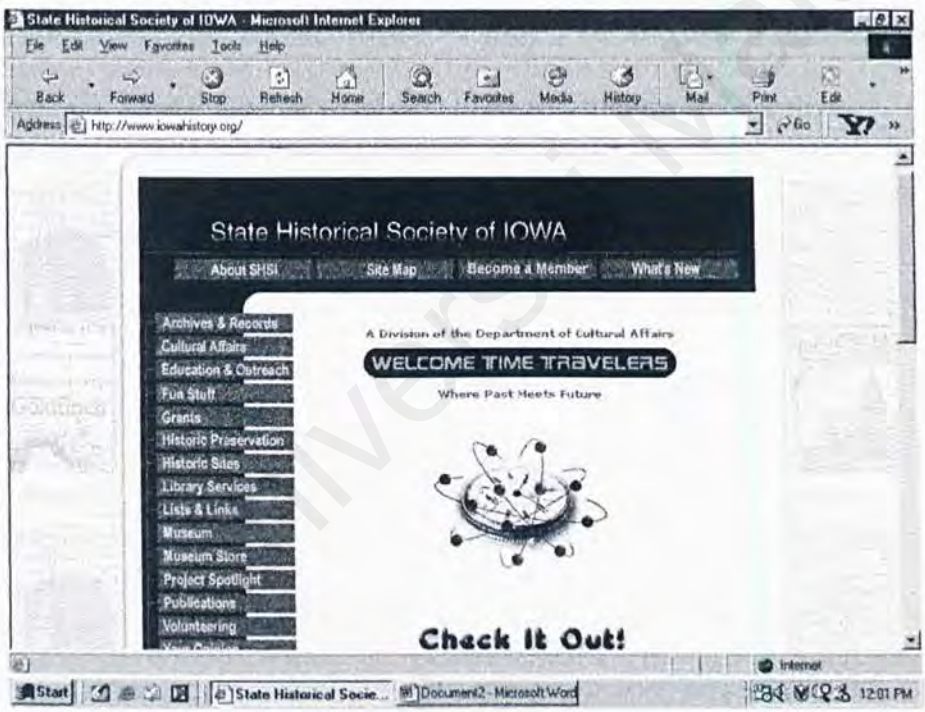

Figure 2.3 The main page of State Historical Society of IOWA Web site.

This website is develop to help Iowans know who they are and what they can become, the State Historical Society of Iowa serves as a trustee of Iowa's historical legacy and an advocate for understanding Iowa's past. This website has dual mission of preservation

and education. SHSI identifies, records, collects, preserves, manages, and provides access to Iowa's historical resources.

This website provide information on museum, historic preservation, historic sites, education & outreach, archives & records and publications. Beside that, it's provides information in text, audio, map and photograph.

The objective is to excite and educate the public about history, particularly Iowa history, by systematically providing historical and technical services, programs, exhibitions, and materials. This website provides links to digital libraries and web site related to history, culture, art, discussion and preservation.

Patrons can also register to be a member of the society. Patrons can also give their opinion, have a view of what new in society and project spotlight.

b) National Council For History Education

URL : http://www.history.org/nche/ Accessed on June 25, 2002

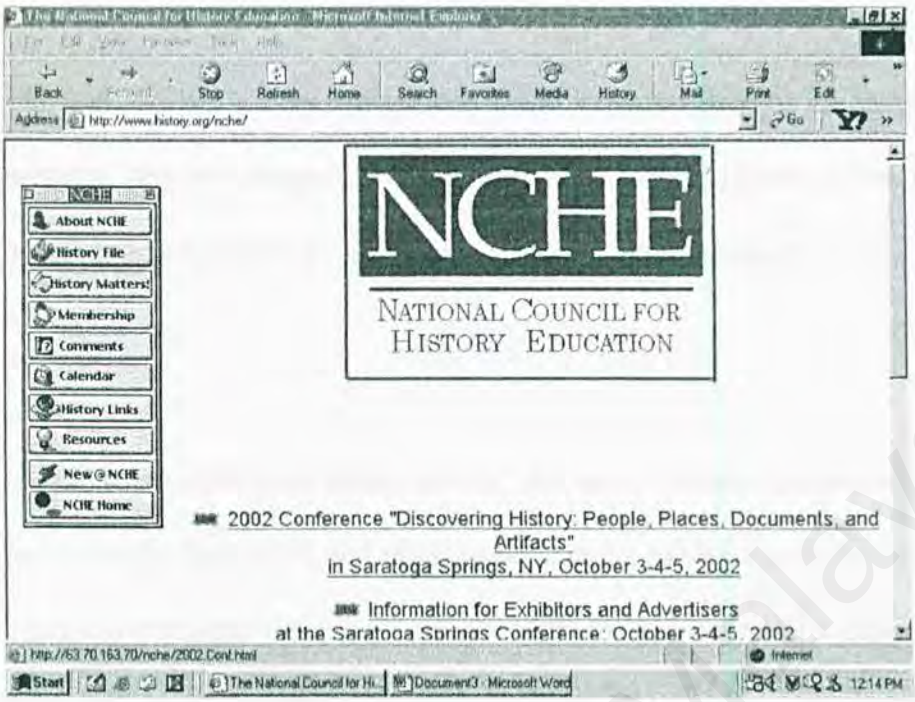

Figure 2.4 The Main Page of National Council For History Education

This website is develop by National Council for History Education of United State. It is dedicated to promoting the importance of history in schools and society. The Council is supported by the contributions of individuals and organizations. NCHE links history in the schools with many activities sponsored by state and local organizations. It provides a communications network for all advocates of history education, whether in schools, colleges, museums, historical councils, or community groups.

Patrons can register members to access all its facilities. NCHE membership consists of individuals, not organizations. Members include historians and history teachers, school

administrators, authors, publishers, historical association and historical museum personnel, history buffs, in short, anyone who loves history.

The website has a very simple and basic structure design. Its navigating buttons are arranged into ten categories. They are About NCHE, History Files, History Materials, Membership, Comments, Calendar, History links, Resources, New NCHE and NCHE Home.

NCHE supports history as the core of the social studies in the schools and links it to many pro-history forces and organizations in the profession and the community. NCHE encourages regular communication between those who teach history in the schools and those who promote history in the community.

c) American Memory

URL : http://memory.loc.gov/ Accessed on June 26, 2002.

Figure 2.5 The main page of the American Memory Web site.

The Library of Congress, with the support of United States Congress, is bringing the National Digital Library to the nation. Its aims to digitize and deliver electronically the American history holdings at the Library of Congress that includes manuscripts, books, photographs, maps, sound and video.

American Memory is a gateway to rich primary source materials relating to the history and culture of the United States. This websites provides three ways to find, search and

retrieve user information. They are collection finder, search and learning page. The site offers more than 7 million digital items from more than 100 historical collections. This website also provides system several useful modules such as FAQs, What's new, How to view, Copyright and Restriction, Technical Information and Future Collections. If we scroll down the web page, we can see four more sections; there are International Horizon, America's Library, Sponsor and LC/Ameritech Competition.

d) MyLib

URL : http://www.mylib.com.my/index.asp Accessed on June 26, 2002)

Figure 2.6 The main page of the MyLib Web site.

This website develop with the partnerships of National Library of Malaysia, this project was created under the Malaysian National Digital Library initiative, Multimedia Development Corporation and Telekom Malaysia.

The web site was divided into 4 main menus. There are Private domain, Public domain, Community Services and Mylib navigations. To enter the private domain users have to register first to access all its facilities. New member required filling in their personal information into the fields. But to access public domain users do not required to register first. In the public domain user can access information about variety of information that have in Malaysia.

At Myib Navigation user can access digital information in seven different kinds of information media. There are books, E-zines, newspaper, multimedia, conference, maps and reports.

2.3 Research and Development in Digital Libraries

In the 1990's three related tasks for library involvement has been define (Newby, 1991).

a) To upgrading existing services by making use of technology.

b) To plan and develop new services and products which make use of technology.

c) To study library users, anticipating and meeting their changing information needs.

It is noticed that much of the early attention related to digital library was technology-cantered and users-cantered. To remain viable and competitive the library must both meet the needs of users and maintain a favourable position relative to other information provider. The key to the evolution of the library for the information age is not to introduce technology on the basis of technological alone. It is necessary to consider the goals of the library and its users and then assess the appropriateness and utility of a given technology for achieving those goals.

In June 2001 the DELOS Network of Excellence organized a brainstorming workshop on "Digital Library Research Directions", the participants reached agreement on the following vision:

"Digital libraries should enable any citizen to access all human knowledge any time and anywhere, in a friendly, multi-modal, efficient, and effective way, by overcoming barriers of distance, language, and culture and by using multiple Internet- connected devices."

The digital library systems can be dividing into four importance elements, there are contents, management, usage and applications and impact. The next section will discuss this element.

2.3.1 Contents

Contents are the fundamental of the digital library system. A digital library may hold any type of contents. Some major technical areas where several problems remain unsolved and require attention will discuss here.

Information objects in digital forms, like those in other forms, move through life cycles. They are created, edited, described and indexed, disseminated, acquired, used, annotated, revised, recreated, modified and retained for future use or destroyed by a complex, interwoven community of creators and other owners, disseminators, value-added services, and institutional and individual users (Waters and Garrett, 1996).

Building an information collection appears to be a rather mundane task, it is a critical process and anything that can be done to facilitate it is importance. Information analysis and extraction can be simplified by generating "meta-information" on tops of the primary contents. Example processes for generating such information include annotation, link creation, summarization, classification, and others. Metadata about the database content is required (Lagoze and Fuhr, 1999). To a large extent, the resulting information tends to have value comparable to the primary/raw data. Situated

information organization is another way to collect information. Primary and secondary information is organizing in ways that are appropriate for specific situation, e.g., specific types of usage, specific conceptual approaches appropriate for different user groups, etc.

Accessing an information collection and navigating required efficient search algorithms and structures. With do many new forms of data and their combinations, new search algorithms and structures need to be developed that can take advantage of the particularities of the data, access it appropriately and provide results efficiently. The difficulty of this task is further exacerbated by the expanded nature of the searches users would like to perform on the data. The complexity of data search and manipulation in digital library systems demands new approaches to query optimization. Especially critical is the issue of size and cost estimation, which is an area with no prior work for most forms of digital library content. Advances in the area will help in providing sophisticated pre-execution user notifications with respect to cost and result size. Search mechanisms that give users more control over results is one of the most urgent needs (Bollean, 2000).

In addition to textual information, which has been the primary focus of digital library until now, scientific data collection should be emphasized as well, for a more direct impact of scientific experimentation. Digital libraries for the future will need to deal with several more kinds and forms of information than currently. Not only scientific data, but also the scientific processes themselves should become part of digital library.

Simulation models should be stored in digital libraries and become available through them. Thus, the entire spectrum of scientific discovery, from initial conception of ideas, to experimental exploration, to publication of the final result system will be served through digital library.

Digital technologies increasingly serve to integrate information resources. Text, numeric data, images, voice and video have therefore resided in print or other analog media for storage and transmission. When they are encoded digitally, either by conversion or at the point of creation, these various kinds of resource shares layers of technology (a common means of storage and transmission) that allows them to be brought together and used in both old and new ways (Waters and Garrett, 1996).

A specific kind of non-traditional object collection that requires attention due to its special importance in the world of digital library is that of multilingual and multicultural collections. Information should be available in much language and within the framework of many cultures. This is an inherently insolvable problem due to the richness of human communication. People express themselves in distinctive ways, and their terms often do not match those of the creators and indexers of the information required, whether human or machine. Conversely, the same terms may have multiple meanings in multiple contexts. In addition, the same text string may retrieve words in multiple languages, adding yet more variance to the results. Better retrieval techniques will narrow the gap between searchers and creators of content, but will never close that gap completely. To achieve the above, particular linguistic and cultural meta-

information should be identified that needs to be stored and used during the translation process. . Designing digital libraries for distributed environments involves complex tradeoffs between tailoring to local cultures and meeting the standards and practices necessary for interoperability with other systems and services (Borgman, 1996).

An important area that is only now becoming part of research agendas is that the preservation of digital library collections. Following are the features that determine information integrity and deserve special attention for archival purposes in the digital environment:

a) Content of digital information

What digital archives are trying to preserve after all is the intellectual substance contained in information objects. The conception of content is itself a complex idea that operates at several different of abstraction. To preserve the integrity of objects in their charge, digital archives must decide at which level, of abstraction they are defining information context (Hedstrom, 1995). Preserving the integrity of an information object in this sense means preserving the bit configuration that uniquely defines the object. There are various well-established techniques, such as checksums and digests, for tracking the bit-level equivalence of digital objects and ensuring that a preserved object is identical to the original (Lynch, 1994).

Text today is generally covered by an international ASCII standard for representing character formats. Standard extensions exist for encoding diacritic characters in

romance languages other than English and a new standard is slowly emerging to incorporate scripted languages under a new common encoding scheme (UNICODE). IBM maintains its own EBCDIC character encoding scheme, Apple and Intel-based personal computers differ in the ways that they support extended ASCII character sets. For documents in which any of these character codes can effectively represent the contents, the differences in encoding schemes may matter little and digital archives can manage object integrity by mapping character sets from one to the other. However, for works involving multiple languages or complex equations and formula, where character mapping is imperfect or not possible, character set format takes on considerably more significance over the long-term as a matter of content integrity. Markup systems, such as implementations of TeX and the Standard Generalized Markup Language (SGML), as a platform-independent mechanisms for identifying and tagging for subsequent layout and retrieval detailed structural elements of documents (Cole and Kazmer, 1995).

The preservation of images comprises another example of the ways in which content, defined in terms of structure and format, poses integrity problems for digital archives. Image resolution, accuracy of color representation and compression for storage all require attention. In general, the higher the resolution and the richer the color register, the larger the file size and more costly the storage. The use of compression technologies further complicates the equation because the application of some algorithms to reduce space needs may involve an irreversible loss of data. The popular JPEG algorithm, for example, supports lossy compression, whereby the greatest degree of compression requires the maximum settings for allowable loss (Lynch, 1994).

b) Reference of Digital Information

The information object must have a consistent means of reference. Information objects come into being and acquire their distinctiveness in relation to various other objects in an information space. For an object to maintain its integrity, its wholeness and singularity, one must be able to locate it definitively and reliably over time among other objects (Dollar, 1992).

Systems of citation, description and classification provide the necessary means of reference so that one can consistently discover, identify and retrieve relevant objects. Such systems traditionally include bibliographies, catalogs, indices, data dictionaries, directory systems, finding aids and the like, all of which collect, assemble and organize references to bodies of work. Creators of these resources are already extending them with such innovations. Moreover, in the electronic environment, there are also emerging sophisticated tools for automatically gathering and presenting in new kinds of products referential information from textual, image, sound, video and other kinds of digital objects (Waters and Garrett, 1996).

Part of general problem of identifying and consistently referring to digital works is the specific problem of resolving names and locations for them. Active research and development has led to rising agreement that several factors contribute to the unique identification of digital information objects. Two of the most important factors are the Uniform Resource Name (URN) and the Uniform Resource Locator (URL). A Universal Resource Identifier (URI) is a member of this universal set of names in

registered name spaces and addresses referring to registered protocols or name spaces. A Uniform Resource Locator (URL) is a form of URI, which expresses an address, which maps onto an access algorithm using network protocols (Lee, 1994). The URL refers to the specific place where a digital object resides and is currently the dominant method of object location on the World Wide Web. The weakness of the URL, is that it may frequently change, especially as an object migrates from one machine to the next. The URN, is supposed to apply uniquely and permanently to a distinct object and to allocate it independently of its particular location at any point in time. URNs today exist more in concept than in practice. Thus, resolving the name and location for variant digital works and thereby providing consistent reference to them means moving from a conceptual design of the relation between names and locations to an operational reality through the implementation of naming authorities, which assign URNs, and the development of digital services that translate names into currently valid URLs (Lynch, 1994).

c) Provenance of Digital Information

Provenance has become one of the central organizing concepts of modern archival science (Dollar, 1992). The assumption underlying the principle of provenance is that the integrity of an information object is partly alive in tracing from where it came. To preserve the integrity of an information object, digital archives must preserve a record of its origin and chain of custody.

For some information objects, the formal process of publication creates a trusted channel of distribution and serves to establish a sophisticated record of provenance, at least from the creator through the point of release. In the digital environment, the problems of documenting provenance through a record of publication are bound up with the problems of fixity, and particularly with issues involved in tracing multiple versions and editions (Lynch, 1996). Outside the path of publication, however, there are several other channels of information creation and distribution, including tracing the path of migration within their own organization, that digital archives need to document in order to preserve the integrity of digital objects in their custody.

d) Context of Digital Information

Another attribute of information integrity that bears on preservation of digital information objects is their context, the ways in which they interact with elements in the wider digital environment (Dollar, 1992). The context of digital information includes a technical dimension, a dimension of linkage to other objects, a communication dimension and a wider social dimension. Digital archives must be attentive to the ways in which each of these contextual dimensions affects the integrity of the objects in their care.

The technical context of digital information is to specify its hardware and software dependencies (Bearman and Sochats, 1995). Digital object by nature, require the use of computer hardware and software to create and use them. In some cases, an object may be closely dependent on a configuration of technology. For example, a particular digital

document may require a particular word processing program running on a machine with a special kind of computer processing chip and operating system. Other objects, such as an image file, may be readable using a variety of software programs, but may be stored on disk in a format that is readable only with a special computer. For still other objects, like World Wide Web documents marked-up in HTML, the hardware and software dependencies may be specified in very general terms because they are readable with a software browser that is available on almost any hardware platform. The archival challenges for preserving the integrity of these various kinds of objects are to represent faithfully the context of the objects in terms of their hardware and software dependencies and, on the other hand, to overcome, through appropriate migration efforts, those dependencies that threaten to hinder future use (Waters and Garrett, 1996).

2.3.2 Management

Management is the kernel component of a digital library system. Several major technical areas of management were identified, there are several problems related to the system's architecture unsolved and require attention.

The digital library of the future will be ever-expanding systems. An open architecture implies that the overall functionality of the digital library will be partitioned into a set of well-defined services (Nikolaou and Wellman, 1999). A digital library will consist of independent systems that will each provide different functionality or access to different

contents. When a new services added to the systems functionality, a new component should be able to come up and work. That is, it should become possible for individual systems to be easily plugged into digital library systems as components. An important aspect of providing the required openness is the ability for systems (and information collection) to be self-describing so that, when plugged into a system, they can be automatically registered and configured.

Interoperability is the core of digital library systems requirements. Metadata of information and software interfaces should be automatically correlated so that syntactic and semantic heterogeneity can be addressed (Lagoze and Fuhr, 1999). This will allow software to interact with other software and information to be move from onto another within an open, multi-component environment. Software for data conversion should be developing and made available to the community as a resource shared and used by everyone (Bearman and Sochats, 1995).

Interoperability and complexity. In all forms of human communication there is a tension between the need for simplicity and a desire for complexity. This has been apparent in the work on the Dublin Core descriptive metadata set. Such core schemas are extensible via additional elements or local refinements, but complexities adaptations can compromise interoperability. To control this, registries could use constructs such as interlinguas to link diverse ontologies of metadata among themselves. Work is needed on models and formalisms for describing such relationships and linkages among metadata schemes (mappings and crosswalks). Interoperability over time can be ensured

only if social processes that allow user communities to negotiate global meanings while adapting them to local needs support such constructs. As metadata sets are developed for functions other than description (Lynch, 1999).

Managing the flow of the session and work of the user is critical. The modelling process required here. The appropriate models for interacting with a digital library should be identified, so that all other aspects of session-flow management can be based on them. Based on the model conceived, appropriate semantics for correct and consistent session should be defined.

Security is another importance issue in digital library. Three of the typical aspect of security is privacy; anonymity and authorization appear to be addressable by standard approaches, not affected by any particular characteristic of digital library. Integrity and confidential is an importance aspect of security due to the complexity and richness of digital library environment. The information integrity and confidentiality requires attention. A very importance aspect is how to protect the intellectual property rights of the owner of the digital material (Waters and Garrett, 1996).

Issues of authenticity have always been critical in some areas of scholarship in which a resource is going to be used in a new way. For example, if we hope that by locating original data from an earlier study we will be able to collate some of its findings with new data we have collected, there are a multitude of questions about the original data and its representation (and intermediary analysis) which must be answered before we

can safely combine the two sources. The apparent, relative ease of manipulation of digital datasets makes this research strategy seem more attractive; however, the lack of readily accessible repositories of documented research resources is still a major impediment (Bearman, 1996).

Quality criteria of digital library should be developing formally so that the meaning of quality may be identified. They should consists of specific criteria related to information correctness, information completeness, information age, guaranteed service termination, information and service cost ant others. Often a digital library process requests based on criteria. These criteria may be imposing by user or system in general.

A digital library administrator controls overall systems, including the design, population and organization of the contents of digital library, as well as the definition of its individual users and user communities. The concept is similar to the data base administrator.

2.3.3 Usage

The highest-level component of a digital library system is related to the system usage. User interface, information visualization, community information spaces, multilingual and multicultural interactions, personalization and customisation, collaboration, universal access and multi-channel access are the particular research issues that popular.

Much work in the area of user interfaces affects a great variety of applications. User interface generation: interface description languages like UIML (user interface markup language) should be developed so that interface families are described, and then particular ones generated from those specifications, suitable for various combination of devices. Interaction with digital library can take many forms depending on the task that is being performed. A universal, generic interface is bound to be ineffective, so effort should be put into developing interfaces that facilitate particular tasks (Lagoze and Fuhr, 1999).

Personal profiles of interaction with a digital library can be identified either explicitly or implicitly. Examples include through initial interviews, or through observations of past user behaviour and data mining on the findings, respectively. Static and dynamic profiling can be done either statically (e.g., at user registration time only) or dynamically (e.g., throughout the user session and throughout the operation systems). The challenge is to develop techniques that will support the dynamic generation of profiles, so the changes in user behaviour are reflected in the system reaction as well.

An importance new aspect that is raised by digital library with respect to collaborative systems is "synchronous digital library visits". A platform develop to permit multiple users to interact with digital library simultaneously, each one being aware of the presence of the other and being able to interact with each other as well. This will approximate the experience of visiting a traditional library or museum, and the educational benefits that non-individual, collective visits may have.

Digital library system needs to identify and create "Community Information Spaces", where users belonging to different communities can observe a different behaviour of the system. In order to allow the members of a community to collaborate through the digital library resources, it very important to extend the support of annotations to the community level. Ratings: opinions of some in a community can help guide others, as in peer review and other scholarly publishing processes (Bollen, 2000).

2.3.4 Application and Impact

The technology of digital library will help many other area of scientific, engineering, or business. Some of application area that could benefit from the digital library technology is such as education, medicine, entertainment, cultural heritage, science and technology.

Digital library is always been use for the education. In formal learning setting libraries are the canter of the school. Digital library will lead to closer integration among formal, informal and professional learning. Digital library has potential to support collaborative learning as well system to provide intermediation services to aid participants in shaping question, finding relevant materials and using information. With the Internet, the web and digital libraries, everything changes. Distance education programs can mount sets of materials on web servers to support each course. So long as the materials are accessible only by specified students, licensing problems are unlikely to be a serious barrier (Arms, 1998).

In socio-economic application, digital library become commonplace for business modelling. The issue is most of digital library will provide content that is privately owned. Sustainability is another issue. Digital library must remain current. Hence, mechanisms should be identified to fund the continuous renewal of materials in digital library and maintain users' awareness of their offering.

2.4 The Historical Building – A Famosa.

2.4.1 The Portuguese Occupation

A great Portuguese adventurer had opened up a new trade route between Portugal and the East. His name is Vasco da Gama and in 1948 he sailed round the Cape of Good Hope boldly striking across the Indian Ocean until he reached Calicut in India. Calicut was the chief trading post, from here rich spices, cloves and nutmegs, pepper and sandalwood, porcelain and tortoise shell were shipped to the Maditerranean by way of the Red Sea to Cairo and Alexandria. The Turks there were very powerful and allowed only the merchants of Genoa and Venice to buy silk and spices. These Italian merchants had to pay high prices to the Turks, but they pay willingly because they could charge higher prices to all the European merchants who wanted these commodities very badly. Vasco da Gama realized that the spice market was a rich and profitable one and hurried back to Portugal to tell the news.

The Portuguese had already decided to win the spice trade for themselves. They were merciless towards the Moors, attacking their strongholds in East Africa and at Calicut, and pillaging their ships. At Goa they established their own port. They realized however that Malacca was the key to the spice markets, that Malacca was the door, through the narrow Straits, which was the vital link between East and West. "Whoever is Lord of Malacca," wrote a Portuguese adventurer in the 15th century, "has his hands on the throat of Veice."4

Portuguese under Captain General d'Alburquerque attacked Malacca in 1511 with 19 ships, 800 Portuguese and 600 Indian soldiers. At that time Malacca was under Sultan Mahmud administration. Alburqueque threatened Sultan Mahmod with war if he did not give up his prisoners and pay compensation. Sultan Mahmud defied the Portuguese and began to build stockades around the hill and by the sea front. Alburqueque replied by burning the Moorish ships in the harbour and prepared to attack the town even though Mahmud, now frightened, had returned the prisoners. For several days the Sultan hid nearby at Muar hoping that the Portuguese would plunder the town and depart. Instead, d'Alburqueque sent a force after him and he fled once more to Pahang. D'Alburqueque made preparation to build a great fortress on the seashore. The Portuguese called it as "A Famosa".

2.4.2 A Famosa and the City in 1604

Porta De Santigo or famously known as A Famosa, it is a building that built for Portugal defence. This fort was built at the seashore by Alfonso d' Albuquerque in 1951.The existing gateway is the only surviving remains of the famous old Portuguese fortress, parts of the gateway. Hundreds of workmen, slaves and captive were set to work. Stones from broken-down mosques and the tombs of bygone nobles were used to build the tick walls of the fortress. When it complete, with guns on its walls and soldiers on guard within, it filled the townsmen with great surprise and fear at its strength. Inside it, the Portuguese were safe from attack. Though it was besieged twenty times in the next hundred and thirty years, no enemy ever managed to climb over its walls.

Later a larger fortress was built to enclose the whole hill and European town. Within its walls were the Governor's Palace, the Bishop's Palace, the Government Council Chambers, several churches, barracks, two hospitals, a monastery and a prison. D'Alburqueque encourages the merchants to reopen their business. He sent missions of friendship to Siam, Java, China and to the Moluccas Islands. Soon Malacca was trading again with all parts of South East Asia. Far from being destroyed, Malacca continued as a busy port.

Soon there was a population of about twenty thousand, seven thousand of whom were Portuguese. The heart of the city lay within the walls of the fortress. Along the narrow streets running around the hill could be seen many big houses of wood and stone, and

among them were the palaces of governor and the bishop, the town hall, five churches and two hospitals. Where had been the Sultan's palace, was built a castle with a tower 120 feet high. From it the guards kept watch over the town and harbour. On the stop of the hill was the tall tower of the church of Saint Paul, the ruins of which are still standing. To the north of the river along the sea shore was a large suburb surrounded by a wall, the quarter of the trading colonies of Javanese, Indians and Chinese, Around the town were rice fields and orchards, but Malacca never grew enough rice to feed the population. Every year two hundred ships came from Java alone, bringing food to be sold in the Java market by the bridge. At times when the city was attacked and besieged, the townsfolk from the suburbs came crowding into the fortress, and they suffered terribly from starvation.

2.4.3 The Dutch Occupation

The Dutch unlike the Portuguese had no political axe to grind. They came as traders and the first of these to arrive at the Malay Peninsula was Jacob von Heemskerck who signed a trading agreement with the Sultan Johore in 1606. Early in 1606 they struck at the Portuguese. Two Dutch Admiral Cornelius Matliet de Jonge and Steven Vander Hagen anchored off Malacca and subjected the Portuguese to a fleet bombardment. This proved rather ineffective and so a battery of guns from the fleet was manhandled onto the Ilha de Noas(Pulau Jawa) the small island opposite St. Paul's Hill. The Sultan of Johore aligned himself with the Dutch. After negotiations, a treaty was drawn up, by the terms of which the town of Malacca was given to the Dutch, and the surrounding

country to the Sultan of Johore. This conquest was short lived. A powerful Portuguese squadron from Goa forced the Garrison Commander to withdraw hurriedly to Johore.

The fortress of Malacca did not fall for many years. The old walls of Albuquerque were made stronger, and in the Stratis a bigger fleet was kept to guard the harbour. The Dutch, unable to take the town, turned away to build up a prosperous trade in the East Indies. They made Batavia their chief port. At the sane time they kept ships in the Straits ready to pounce on any Portuguese ships. Gradually the trade of Malacca began to diminish. In July, 1640, the Dutch Governor General, Anthony Van Diemen planned an attack on Malacca by sea and by land. The fortress was badly damage cause of the attacked.

When the Dutch took Malacca, they found it in ruins and its trade gone. Native boats had given up calling there, and at first one officer was enough to collect all the customs duties. But the Dutch worked hard to put things in order. The fortress walls were repaired and the houses rebuilt. A deep moat was dug around the walls to drain the water into the sea, and in it the thrifty Dutch kept fish. A garrison of soldiers was put in the fortress, and officials and merchants came to govern the new conquest and to bring back its old trade and prosperity.

2.4.4 The Destruction of A Famosa

The following eyewitness account from the Hikayat Abdullah, an autobiography by Munshi Abdullah, describes the destruction of A Famosa, in 1807.

"All of sudden there arose a rumour in Malacca that the English intended to destroy the fort. Nobody believed that the fort could easily be destroyed. One said, 'The work will not be finished during the Resident's lifetime'. Thus everyone thought, for the fort was strongly built with breastworks and hard stone and covered a small area,. Therefore it did not occur to anyone the thoughts that passed through people's minds. Some said, ' At last all the poor people of Malacca can become rich by the money they demolishing the fort'. One man said, 'If they so much as touch the fort, many will die; for there are many jinns and devils in it'. But a few said, 'These English are very cunning and that is why they are going to destroy the fort. Supposing it were to fall into the hands of another power, it would never be recaptured in war, for it is strong and well built'.

Thus, William Farquhar, the Resident, set about demolishing the Malacca fort. He called coolies of all races together and bid them smash the fort first from the Bukit China side. Hundreds of coolies tried to break the stone but after two or three days they were unable to do so, for they afraid because they fully believed that there were ghosts and devils in the fort. Because of their belief many had all sort of nightmare, and there are rumours of man slapped by devils, vomiting blood, suffering sudden death from various kind of illnesses. And as the terror grew, so the price for their labour increased, but obviously their fears were groundless, the very strength of their beliefs and superstitions being responsible for their injuries. Now the mortar, which was sticking to the stone, looked and smelt as if it were newly put on. When Farquhar saw how difficult it was to smash the stone he gave instructions to dig down the foundations of the fort.

But however deep they dug still the foundations were not reached, even after they had gone down to a depth equal to the height of the fort. So they stopped trying to work down the foundations. Then Farquhar ordered them to start demolition from the seaward side. The work caused sickness, and there were many who were afraid to go on because of the deaths and injuries.

After about three months of illness and trouble. Farquhar ordering a hole to be dug under the bastion on the seaward side, in which boxes of gunpowder were to be placed for firing. Then orders were given to close the hole, and stones and earth were rammed down tight inside.

2.5 The Historical Building - Kuala Lumpur International Airport (KLIA)

KLIA was a new international airport to replace the Sultan Abdul Aziz Shah International airport at Subang, which became operational on 1st September 1965. Its development enhanced Malaysia's potential to become a regional hub and international gateway. The KLIA represent the gateway into the country physically, and implicate as a significant milestone in its technology development. Such was the challenge at the outset when the master planning studies started in early 1992. The visionaries in the Government bureaucracy saw the airport at Sepang principally to be the most modern state at the airport. Furthermore, it had to be flexible to accommodate future changes and demands and function as a hub airport. KLIA located 50 km south of the faderal capital, Kuala Lumpur. KLIA is linked by the North-South Expressway and the Nort-

South Highway via interchange north of Nilai, in Negeri Sembilan. Anew highway is built from KLIA to KL through Putrajaya, the country's planned government and administrative centre.

2.5.1 Airport In The Forest

The chairmanship of Malaysian Japanese Airport Consortium, Dr. Kisho Kurakawa from Kurakawa Group developed the theme "airport in the forest" and "forest in the airport". His paramount objective was to stress the marriage between ecology, high technology and Malaysian culture as the design parameters of KLIA. He emphasised an interaction between natural vegetation and high-made structure. In this way, the greenery of the country becomes the determining factor for the concept, design and planning for the airport. KLIA's forest theme portrays the forest as a symbol of Malaysia's heritage while highlighting the ecological awareness of the nation. The forest is depicted in the design of the airport in its literal and natural sense in the form of landscaping.

2.5.2 KLIA Architecture

The opening of the first phase of KLIA is in June 1998, several months before the Kuala Lumpur 98 the XV1 Commonwealth Games, comprised a main Terminal Building, a Contact Pier and a Satellite Building, two parallel runways of 4 km each, a control tower, cargo, aircraft maintenance and flight catering facilities, car parks and other ancillary facilities.

KLIA have two mega terminals, four remote satellites, four full service runways and other associated facilities to cater for 100 million passengers per annum. The KLIA is principally divided into three parts. Main Terminal Building, a Contact Pier and a satellite Building located 1.2 km away from the Contact Pier and accessed by passengers through a dedicated track transit system.

a) Main Terminal Building

At 25 million passengers per year capacity, a single Main Terminal Building of six structural bays wide will process all domestic and international passengers. The building houses six check-in islands, which provided 216 check-in counters, and all processing facilities as well as high information and ticket purchases. A 55 m long bridge spans the international departure level through the "forest" and connects the departure concourse to the observation deck at the Contact Pier node.

Within the departure concourse a lovely atmosphere is attained by the variety of retail or concession areas and the vertical movements people through glass elevators and open escalators connecting the various level below. The international departure passport control with 48 immigration counters. The arrival level as on the forth level catering for both domestic and international arrivals. For the international passengers arrivals, they are directed toward the 61 passport control counters before entering the baggage handling area via 12 baggage carousers. Passengers also have the opportunity to do their last minute duty free shopping at the concession areas within thus hall. The 24 custom counters for quick processing of arriving passengers control the exit from this hall.

The VIP Lounge can be reached from the departure level and arrival levels of the Main Terminal Building and the ground floor of the Contact Pier. Eight VIP rooms are located within this facility. The concept of interior design was developed around a contemporary and modern design using materials with feature highlights. Incorporating decorative paint finishes on very small parts of the walls.

b) The Contact Pier

The Contact Pier consists of 4 levels, 28.0 m wide and 897.6 m long. A viewing deck on level 4 (which is the same level of the departure concourse at the MTB) is connected and accessed via the departure level by the MTB by a bridge spanning the international concourse, which is on level three.

The central node at level three contains the Aerotrain Station for departing and arriving passengers from the satellite buildings. This is the transfer area for departing passengers who have cleared their passport processing on the same level at the Main Terminal Building and arriving passengers who shall be directed down the escalators of glass elevators to the level below for immigration and baggage reclaim area, which is in level two of the Contact Pier. Contact Pier can accommodate a maximum of 30 domestic aircraft stands.

c) The Satellite Building (SAT)

The Satellite Building consists of four arms (measuring 591m east-west and 609 m north-south), which radiate from the circular hub containing the "forest". It has four levels two of which are for passengers. The top level contains the CIP Lounges, concessions and amenities. In the east arm, this level accommodates on 80 rooms airside hotel. SAT is approximately 140 000m^2 and caters for primary international departing and arriving passengers with 26 gate lounges, CIP lounges, duty free shop and restaurants and airline facilities.

The concept of the Satellite Building containing airside functions, refer to the form of the aircraft which they serve by the introduction of gently curving lines to create aerodynamically sweeping roof forms supported by dynamically raked internal struts. The design consists of a simple gable roof, which is also reminiscent of the traditional Malaysian architecture with the overhanging eaves and verandahs.

The central hub is an inverted cone, which will house the "forest in the airport" which is exposed to natural daylight. At the apron level, SAT contains the plant rooms, storage areas, airport facilities as well as ramp facilities for the various airlines. The west arm at this level contains the bus lounge for remote aircraft stands.

2.6 The Historical Buildings: Putra Mosque

The Putra Mouse is located at the Putrajaya. The mosque is name after the first Malaysian Prime Minister, Tunku Abdul Rahman Putra Al Haj. The Putra Mosque was also among the first buildings to be constructed when work on the Putrajaya ownship started. In its entirety, the mosque site includes a dataran or square and occupies a 28acre plot, including the lake, a man-made lake. Putra Mosque is the first mosque to be built on a lake in the country. The other floating mosque, in the northeastern state of Terengganu, extends out into the sea.

The main contractor for the mosque project was Saudi bin Ladin, an international construction group, tagged as a builder of palaces and mosques. It established a Malaysian subsidiary company, Putaran Mutiara (M) Sdn Bhd, to undertake the project. A prominent Malaysian architectural firm, Kumpulan Senireka was appointed to oversee the design. The group also designed the famous Kuala Lumpur Tower. A local engineering firm, Perunting HTA, was invited to overcome the complex acoustic challenges and to design a superior sound system.

2.6.1 The Architecture

Putra Mosque reflects the evolution of mosque design in Malaysia, with its Islamic-inspired architecture taking into account traditional design elements and craftsmanship, local materials and weather conditions. The mosque is modelled after Persian Islamic

architecture of the Safavid period with several elements derived from other Muslim cultures. As with all mosques, the Putra Mosque faces Kiblat, the direction of Mecca. The main entrance to the mosque is patterned after gates to public buildings in Muslim Persia. The building was constructed mainly with rose-tinted granite, which is offset by brown-stained cengal woodwork to enhance the decorative features on the doors, windows and panels.

In Malaysia, domes are usually of blue or green color, but Putra Mosque dome are pink. Pink is the natural color of Malaysian granite. The shiny dome makes an outstanding landmark. The highly glazed pink glass mosaic is weatherproof and does not gather moss even in this damp and humid Malaysian climate. Computer designed motifs add intricacy and artistry to the mosque. Every piece of mosaic is numbered in order to get the design right. The mosaics are locally manufactured and each piece is pasted on to fibreglass with polyethylene base, which is supported by a steel structure. The main dome is 36metre in diameter and there are eight smaller domes with diameters of six meters. The beauty of the dome is enhanced from within with traditional motifs and geometric designs taken from religious books.

The mosque contains three main functional areas. There are:

- The Prayer Hall
- The Sahn or courtyard, with the minaret
- Learning facilities and function rooms

a) The Prayer Hall

The prayer hall is simple and elegant. It is an airy space with no internal walls; instead 12 columns that prop up the 36 metre-diameter main dome support it. The highest point, which is below the dome, is equivalent to a 25-storey building. The cavernous hall has no fans or air conditioners and is ventilated by land and lake breezes wafting across the verandah, mashrabiyah or vertical grills, ventilation ducts on the columns and openings above the stained glass windows. These features combine to provide a cool and comfortable prayer area. The 'hoods' surrounding the dome and the covered verandah, meanwhile, help reduce glare and driving rain, which are commonplace in Malaysia's tropical climate.

The focal points in the prayer hall are the mimbar (pulpit) and the mehrab, the niche denoting the direction of Mecca. Both are adorned with khat (Islamic calligraphy).
The hall has a capacity for 8,000 men on the ground level and 2,000 women in the gallery, where they sit behind a finely crafted timber screen. Lobby lifts transport female congregants to the gallery overlooking the main prayer hall.

b) The Sahn or Courtyard, with the minaret

When the prayer hall is full, congregants gather in the sahn or paved courtyard. It is in front of the prayer hall and can accommodate up to 5,000 congregants. The open courtyard is landscaped and contains several decorative water features. Colonnades border the remaining sides of the sahn with the umbrella-shaped roof found in Masjid

Negara, the national mosque. The high point here is the 116-metre minaret, which is influenced by the design in the Sheikh Oman mosque in Baghdad. It has five tiers representing Rukun Islam or the Five Pillars of Islam and five times daily praying ritual of Muslims. The cross-section of the minaret is based on the Islamic style of rotating a square to create a star. This star pattern is also found on the floor of the sahn.

c) Learning Facilities & Function Rooms

These facilities are found in the basement floors, which comprise three wings. The North Wing is the religious learning centre, with lecture rooms, seminar rooms, a manuscript room and an administration office. The South Wing contains the living quarters of the caretakers and the Jenazah room. The East Wing houses a 420-capacity auditorium, exhibition foyer and a large dining room for 400 guests. It also contains ablution and rest rooms, which are located directly below the sahn.

2.5 Historical Building Within School Context

PMR (Penilaian Menengah Rendah) examination is a national level formal examination catering for all form three students in Malaysia.The history subject is one of the compulsory subject to be taken by students who are going to sit for the examination. The PMR history exam can be divided into two type of evaluation, which are:

1. Center Stage Evaluation

   Conducted by the Lembaga Peperiksaan Malaysia and according to KBSM (Kokurikulum Bersepadu Sekolah Menengah) which include Form 1 to Form 3 syllabus.

2. School Stage Evaluation

   This is conducted according to local history project paper. Students will be given a title and have to complete their projects within the time given. History teacher's will evaluated the project paper.

The proposed project, the Digital Library of Historical Building is developed to assist the students, especially the form three students, in preparing their history projects. There are a few methods in searching information for the history projects. Usually student will do a survey, interview, reading from books and most recent method is surfing the Internet. With the web based historical building portal, students can facilitate the portal in completing their history project. Students would no longer be bound by

geographical limitation to go to the places to obtain information, which normally very limited numbered and widely distributed in the country.

This web portal also helped students save valuable time when they don't have to visit more than one place for information gathering. Cost of processing data and pictures are reduced because students only have to download the image and information they want for free. Students can access this web page at any time and anywhere they want.

Meanwhile, it is hoped that all student will gain benefits from the portal. The source may be informative enough for the students so that they get some of what a good history project would be like, of what are the good features. Ideally, the historical building portal would be emerged as a comprehensive educational portal contributing to Malaysia's smart learning environment.

CHAPTER 3

System Analysis

CHAPTER 3 SYSTEM ANALYSIS

Introduction

System analysis is an important phase because it is used to identify the systems functional and non-functional requirements as well as the software and hardware requirements that are needed to support the identified functions. The emphasis throughout this phase is to produce user-oriented description of what the systems will do. All user requirements for proposed systems are documented well.

3.1 Fact Finding Techniques

Information on several areas such as digital library systems is obtained by a process called fact finding. Before developing a system, developer needs to analyse and examine different types of data and information. This is to ensure the developed system will fulfil the requirement of the systems. There are a few of data –gathering methods used to define requirements. A combination of different techniques is use to gathering factual information for the systems. The fact-finding techniques used include interview, surfing Internet, research and questionnaire.

3.1.1 Surfing Internet

Nowadays, Internet has become a popular way for gathering information. There are a lot of materials that information available on the Internet. We can find a lot of academic information in the Internet that provides the opportunity to scholars and researchers to communicate and exchange information remotely. Communication can be done through emailing, forum and discussion groups. Academic information such as E-book, E-magazines and E-journal are the example of electronic materials, which can be access through the Internet.

While carrying out the literature review in chapter two for the proposed system, the Internet has become an effective ways in gathering information related to digital libraries. Many sample of digital library from various country and region around all over the world available in the Internet that can be used as guidelines in determining the system's functional requirement. For example I have been analyse about two digital libraries and two web portals in chapter two. They are portal of State Historical Society of IOWA and National Council For History Education, the digital libraries of American Memory and Malaysian National Digital Library. We also find information of digital library through the electronic materials such as E-journal, E-forum and E-books.

3.1.2 Utilising Printed Materials

The printed materials refer to books, encyclopedias, magazines, dictionaries, journal articles and periodicals. These materials help the developer to understand concept and

definition for terms and the function and features of digital library. The information mostly be obtained at the UM library.

3.1.3 Interviewing

An interview is carried out when two people meet and discuss a particular issue. Interviewing method is a complex fact-finding technique that takes into special account of personal perceptions and biases. The personal background and experiences do effect the collected information from the interviewees' opinion. Before conduct the interview the first thing should do is to prepare and know what question are we going to ask, who are the interviewees' and the interviewees' background.

3.1.4 Questionnaire

Questionnaire is a list of questions to be answered by a targeted group of people. By using questionnaire, information from a large number of targeted users can be collected. The project team uses this approach seeing that the targeted users are the secondary school student and the history teachers. This group of users involved a large number of people. By using the questionnaire, information can be gain easily and in the effective way. Thus, the project team can get an overall opinion before the system project is done.

3.2 Data Collection Analysis

The project team has chosen Sekolah Menengah Kebangsaan Sri Pantai in Kuala Lumpur. We have distributed 50 questionnaires to form three students. The questionnaires were collected about after half an hour. The survey resulted in 100% response rate despite there were some missing data in some of the questionnaire.

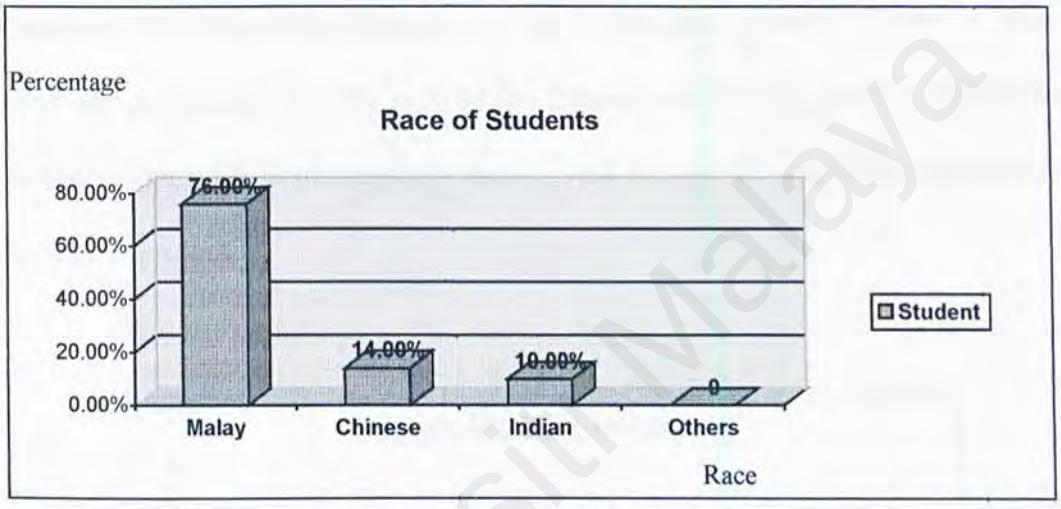

Figure 3.1 The Percentage of Student Based on Race

Figure 3.1 shows the percentage of student Sekolah Menengah Kebangsaan Sri Pantai Based on race. The chat indicates that 76.00% of the students are Malays, 14.00% of the students are Chinese and 10.00% are Indian.

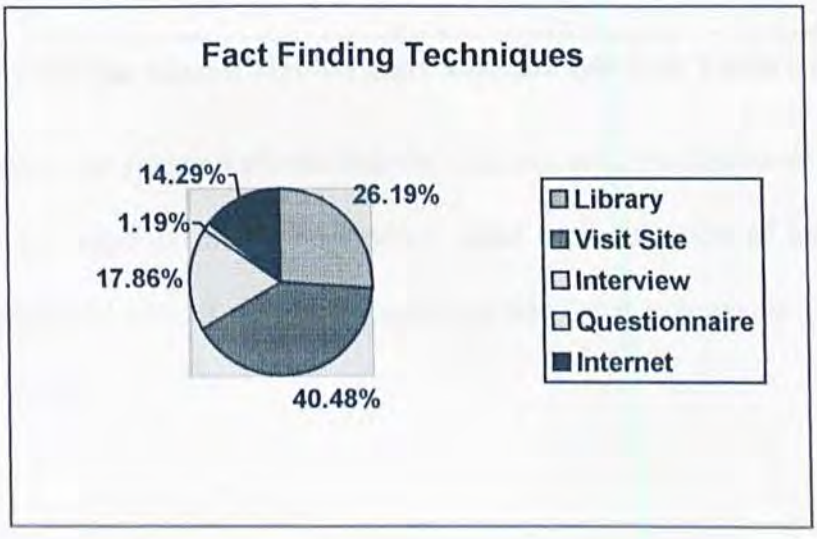

Figure 3.2 Fact Finding Techniques Use by Students For History Project

Figure 3.2 shows the fact-finding techniques use by student for their history project. The pie chart shows that 40.48% of the respondents used to visit the site for gathering information. 26.19% of the students use the books from library, 17.86% of students carried out interviews, 14.29% surfing the Internet and 1.19% conduct questionnaire. This shows that most of the students used to visit the site for gathering information for their history project.

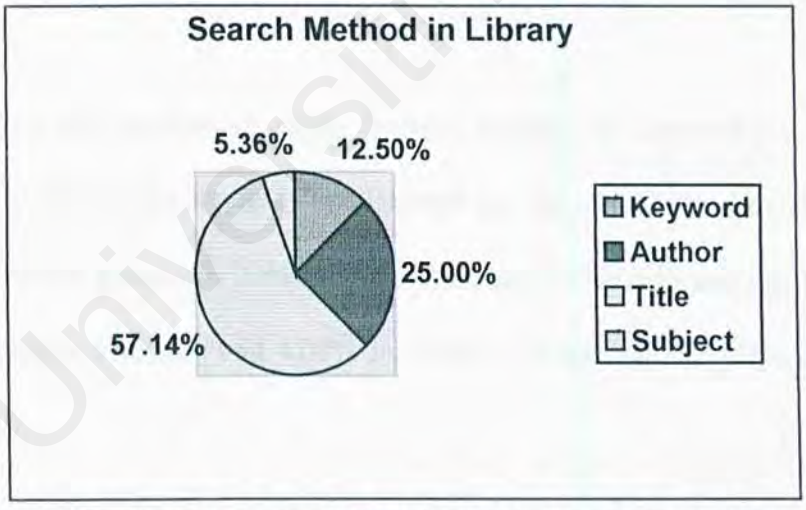

Figure 3.3 The Search Method That Students Use In A Traditional Library

Figure 3.3 shows the search methods that the students use in a traditional library. The pie chart shows majority of the respondents used a combination of keyword, title, author or subject. 57.14% of student use title as a key word in a search. This is follow

by 25.00% search by author, and by keyword 12.50%. The pie chart also indicates, that searching by subject is not very popular among the students, which make up 5.39% of the total respondents.

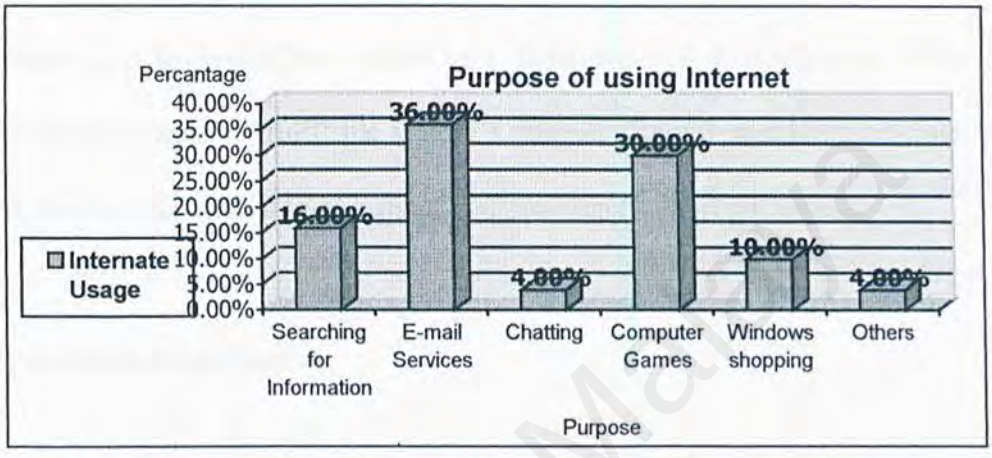

Figure 3.4 The Purpose of Using Internet Among From Three Students

Figure 3.4 shows the purpose of using Internet among the respondents. The chart indicates that 36.00% of the students use Internet for the e-mail services, 30.00% use Internet for computer games, 16.00% use Internet to search for information, 10.00% use Internet for windows shopping and 4.00% for chatting. Meanwhile, 4.00% use Internet for other reasons.

3.3 Defining Requirement

A requirement is a feature of the system or a description of something the system is capable of doing in order to fulfil the system's purpose. Requirement can be class into two group, they are functional requirement and non-functional requirement.

3.3.1 Functional Requirement

A functional requirement describes an interaction between the system and its environments. Additionally, functional requirements describe how the system should behave given certain stimuli. The following are the functional requirement for the proposed historical building portal:

a) Maintenance

The system allow authorized people to view, edit, delete and upload information or collection in website and database. Teachers have a login account to access into the backend system to upload student report. All maintenance and management of system will be conduct here.

b) Registration

Registration make new user able to register in system. Form will be display and user has to enter particular details, user id and password for security control in the future. By administrator can keep track the number of users who fully utilized the systems.

c) Authentication/ Security features

Allow only authorized users to access into specific functions in the systems. The system should be able to provide different level of access to different types of users, depending on user id and passwords. The system should enable verifying the validated user's login id and password. The system should also allow user to change their password from time to time.

d) Guest book

The system should enable to acquire the users feedback from a survey form provided. Users should enable to ask questions, input information and give comments. Users can also give their feedback to the administrator through the email address provided.

e) Information Management

The system should provide guide and useful or necessary information to assist users in using the system such as searching, developing user help, About us, Frequently ask question (FAQ). Information management deals with terms and conditions, digital collection information and other useful or related resources.

d) Search and Indexing

Search and indexing are the features that every digital library should have. Search provides an easy way to search and retrieve information, image, and collection can be search by keyword, location, name and other relevant features. And the indexing features allows user to browse the system's collection by name, location, year and alphabetical order.

e) Upload and Data Manipulation

Submit or upload collections and students projects into the database. This feature allows authorized users (administrator/teachers) to submit or upload their collections as well as student's project into database of the portal. This provides an alternative way to store project besides using the traditional methods.

g) Tracking and Report

The system should enable to track the records in the database and display it in a table. Student records will also be used to produce statistical tables or reports on student when required.

h) Quiz and Edutainment

This features attempts to let the users to assess their knowledge through entertaining and educating materials. This feature will install interest in the user, especially student about the historical building and making the learning process enjoyable.

3.3.2 Non-Functional Requirement

The non-functional requirements define system properties and constraints. The non-functional requirement for the proposed projects are as following:

a) Robustness

Refer to the capability of systems to defend itself against anomalous input with regard to external stimuli; system is designed to handle beyond specific range of data. When any mistake detected, this system should prompt an error message to indicate the mistake. For example, if user does not key in the value for a mandatory field, an error message prompt.

b) Response Time

One of the crucial factors in retrieving information using a web-based system and in establishing a connection to the database server is the response time. User should not keep waiting for a long time for the result.

c) User friendliness

The designed of the system and its interface should be friendly, easy to use and interactive to attract more users to using it. The systems should be consistent in terms

of screen design and error messages displayed. The system should also provide accommodation to any level of users, both professional and novice users. Others criteria are the system should appropriate error handling with associated pop-up window messages and the high degree of understand ability and avoid too much using of commands and memorizations of events.

d) Modularity

Modularity is important for further enhancement and modification as the users' requirement change over time.

e) Accurate

The system should response to the search queries requested by the user accurately.

f) Flexibility

As the project's implementation is based on web technology, it is foreseeable that newer web technology that can work with existing web technology will have no problem integrating to the project.

g) Maintainability

A product is maintainable if the program is easily understood by the maintenance programmer and easy to modify and test when updating to meet new requirements, rectifying a deficiency, correcting errors, or moving to a different computer system.

h) Completeness

Completeness describe the extent to which all of the parts required to implement a programs functionality is included in the operational program. System can be incomplete because something was not coded, because it was not designed, or because it was not specified as an explicit requirement.

i) Multi-user Environment

The system should support not only a user but is able to cope with a large amount of people who access the system concurrently.

j) Reliability

A reliable system should be consistence and functionally well. This system should run smoothly although there are many web users using the system simultaneously. The system should not produce dangerous or costly failures when it used in a reasonable manner.

3.4 Web Server Consideration

Web server is a program that sits on a machine on the Internet, waiting for a web browser to connect to it and make a request for a file. Once a request comes over the wire, the server locates and sends the file back to the browser. Web servers and web browser communicate using HTTP, a special language created specifically for the request and transfer of hypertext documents over the web. Because of this, web server often called HTTPD servers. Every computer on the Internet that contains a web site

must have a web server program. Web servers often come as part of a larger package of internet-and-intranet related programs for serving e-mail, downloading request from FTP files and building and publishing web pages.

a) Internet Information Server (IIS)

Internet Information Server (IIS) is a group of Internet servers (web or HTTP) and other capabilities for Microsoft Windows NT and Microsoft Windows 2000 server operating systems. With IIS, Microsoft includes a set of programs for building and administrating web sites, a search engine and support for writing web-based applications that access database. IIS is tightly integrated with the Windows NT and the Windows 2000 servers in a number of ways, resulting in faster web page serving. The benefits of IIS can be seen by the services it provided. IIS provides a high speed, secure platform for publishing information on Internal networks or Internet. The server is specifically designed to provide the kind of performance that is necessary for handling an increasing number of web users and users who are connected with high-speed links, such as ISDN and leased lines.

IIS includes security features and it is easy to install. It works closely with the Microsoft transaction server to access database and provide control at the transaction level. It is also work with Microsoft Netshow in the delivery of streaming audio and video delayed of lives.

b) Apache Web Server

Apache is currently the leading UNIX web server. This particular web server is quick at handling requests and responses. It is available as open source and is definitely free of charge. ASP are supported, as are the newer JSP. The ability to run Java servlets means that Apache users can run application created with Java Application servers, such as Enhydro. If Apache were have to support servlets and JSP, an additional patch would have to be added to link with the original Apache WEB SERVER. This particular patch is called Apache Jakarta.Tomcat. The main problem here is that these servers are quite difficult to be configured for use. There are a lot of configurations need to be done.

From the above point of view, each web server can be conclude as:

Table 3.1 Comparison of Strengths and Weakness of Apache Web server and Internet Information Server.

	Apache	Internet Information Server
Strengths	Freeware, good performance, reliability, support for HTTP 1.1 Protocol, Quick technical support via Use Net	Free download, Superior admin control, HTTP 1.1 SUPPORT, virtual Server Support, excellent combination with Windows NT.
Weakness	NT version is in its infancy, lack of graphical administration tools for configuration and	NNTP does not support USE NET feeds, SMTP does not support pop mail boxes.

	administration tasks.	

3.5 Platform and Web Development Tools Consideration

3.5.1 Development Platform Consideration

There are a numbered of development platforms for developing client–server application. For the proposed project, 2 popular development platforms have been taken for consideration. They are Microsoft Windows NT server 4.0 and Microsoft Windows 2000 server.

a) Microsoft Windows NT

Microsoft Windows NT Server 4.0 is a network foundation for the future, designed to meet the most demanding requirement of today's business computing world. Windows NT Server is also the easiest network operating system to set up, manage and use. Windows NT Server inter-operates with a board range of operating systems including Netware, UNIX, Microsoft LAN Manager, SNA and Macintosh.

The benefits of Windows NT 4.0:

1. Easy examination of the system. Includes information on devices, driver information, network usage and system resource are all presented in an easy to view graphical tool make it easier to examine the system.
2. Systems administrator can manage and maintain users desktop in a consistent manor with the system policy editor and user profiles provided by Windows NT. System policies are used for the standardization of desktop configurations and control the user work environment and actions.
3. The task manager provides information on each application and process that are running on the workstation as well as memory and CPU usage.
4. Point –to- point Tunnelling Protocol (PPTP) provide a way to use public access public data network, such as the Internet, to operate a virtual private network, connecting client personal computer with server. PPTP offers protocols encapsulation to support multiple protocols via TCP/IP connections and data encryptions.
5. New application programming interfaces for service application developers and better server performance deliver improved throughput and scalability the server applications.

The weakness of Microsoft Windows NT:

1. Insignificant changes to a Windows NT configuration require or request a shutdown and reboot in order to make the changes take effect. We have to reboot although the changes we made is just the IP address of the default gateway.

2. Users will have to buy a separate software package in order to set up an e-mail server.
3. The further maintenance and support requirements of Windows NT can make them much more costly to run.

b) Microsoft Windows 2000 Server

The Windows 2000 Server operating system is designed to increase the value of existing investments while lowering overall computing costs. Windows 2000 Server is easy to deploy, configure and use because it provides centralized, customisable management services to reduce total cost of ownership. These include the initial cost of hardware and software, but deployment expense, hardware and software update costs, day-to-day maintenance and technical support.

The services provide by Windows 2000 Server:

1. Windows Management Instrumentation (WMI) provides unified access and event services, allowing to control and monitor Windows-based environments, Simple Network Management Protocol (SNMP) devices, and all host environments that support the Web-based Enterprise Management(WBEM) standards initiative of the Distributed Management task force(DMTF).
2. Group Policy helps to control user access to desktop settings and applications by group rather than by individual user and computer. It helps to define and control the amount of access users have to data, applications and other network sources.

3. Windows Script Host (WSH) allows to automate and integrate common tasks using a variety of scripting environments including Microsoft Visual Basic, Scripting Edition (VBScript), Microsoft Jscript and Perl.
4. Microsoft Management Console (MMC) gives a common user interface presentation tool to integrate all the necessary Windows-based and Web-based administration components needed to fulfil a specific task.

The advantage of Windows 2000 Server:

a) Security

One of the primary design goals for Windows 2000 was to provide the highest of security. Windows 2000 actually builds on the Windows NT 4's security model but more security features are provided and upgraded. The many new features Windows 2000 introduces to help protect Windows 2000 environment include:

1. Encryption of data that is transmitted over network.
2. Encryption of data that is stored on disk.
3. The use of Kerberos version 5 for authentication while also supporting multiple authentication methods for compatibility.
4. Kerberos transitive trust relationship.
5. Central storage of security policy and account information.
6. Automatic updating and synchronization of all security policy and account information across domain controllers.
7. Access control for all objects in the AD.

b) User Friendly Interface

The user interface is similar to Windows 95, Windows 98, Windows 2000 easier to use for those have experience using Microsoft operating system. Those who do not have any experience using Windows 2000 Server before will able to use this operating system without much problem.

c) Reliability

Windows 2000 provides reliability through the following features:

1. Error and exception handling
2. Component redundancy

d) Scalability:

Windows 2000 is a scalable system that will run in many hardware environments. Windows 2000 is adaptable to many processing environment and will take advantage of multiprocessing capabilities of a computer. Windows can run on anything from a Pentium CISC-based system, to EISC- based system, to a symmetrical multiprocessor (SM)

3.5.2 Database Management System

a) Microsoft SQL Server 7.0

SQL is a standardized query language for requesting information from a database. Microsoft SQL Server 7.0 is a defining release for Microsoft Database products, building on solid foundation established by SQL Server 6.5. SQL supported by personal computer database system because it support distributed database (database that are spread out several company system). This enables several users on a local-area network to access the same database simultaneously.

Many database product support SQL with proprietary extensions to the standard language, although SQL is both an ANSI and on ISO standard. Queries take the form of a command language that lets you select, insert, update, find out the location of data, and so onward. Microsoft SQL Server is a suitable database engine for processing website. Through integration with Internet Information Server (IIS), data query and updating via a popular web browser can be made with little effort. It has the nature of Open Database Connectivity that lets it inter-operate smoothly with Internet Database Connector (IDC) Interface, which is include Windows Internet Information Server.

Apart of meeting requirement of client/server computing, it's also designed with the Internet and Intranet in mind to provide high performance access to information. It is capable of supporting thousand of concurrent users, processing million of transaction per day.

Microsoft SQL Server is an example of n-tier system. The user can manipulate the data directly from the client side. Most of the time, the data is validate before it is updated into the database in server side. It is tightly integrated with Microsoft Back Office

family product to enable organization to improve decision-making and streamline the business process. Microsoft SQL Server maintains referential integrity, security and ensures that operation can be recovered in the event of numerous types of failure. SQL server can control the access for the type of information that can be retrieved by user.

b) Microsoft Access 2000

Microsoft Access 2000 is a relational data based management systems designed for small office or home user to use for storing data in relational type. Microsoft Access targets the desktop category and works best for individuals and workgroups managing megabytes of data.

With data access interface paradigm such as Remote Data Object (RDO) and Data Access Object (DAO), Microsoft Access 2000 can be used as a database in client-server or and n-tier architecture system. It provide intuitive and user-friendly interface to create a database easily. However, Microsoft Access 2000 is quiet slow in processing transaction compared to Microsoft SQL server 2000.

Table 3.2 Comparison features between Microsoft SQL Server and Microsoft Access 2000.

Features	Microsoft SQL Server 7.0	Microsoft Access 2000
Data capacity	1 Terabyte per Database	1.2 Gigabyte per Database

Solution for transaction-based database of downtime	Rollback automatically, reduce the expense of downtime	Do not support automatic recovery, data can be lost.
Degree of Security	Offering logon ID and password, user permissions, and encryption.	Allow developers to customize security to their needs.
Application run time	Fast	Slow
Maximum number of users	32 767 users connections	255

3.5.3 Web Application Programming Technology

Developing web-based applications rely on many network and application components working together to deliver information to the clients. Some of the development tools that are to create web pages are:

a) Active Server Pages

ASP is a component of Microsoft's web server software that allows user to embed server-side script code in web pages. It is a server side enhancement because all the script code runs on the server. Users can now create web sites that are dynamic and database driven by using the client-side script, Java applets, dynamic HTML, or Active X control. Typically, the script in the web page at the server uses input received as the result of the user's request for the page to access data from a database and then builds or customizes the page on the fly before sending it to the requestor. ASP is a feature of the

Microsoft Internet Information Server (IIS), but, since the server-side script is just building a regular HTML page, it can be delivered to almost any browser. An ASP file can be created by including a script written in VBScript or Jscript in an HTML file or by using Active X Data Objects(ADO) programs statements in the HTML file. The HTML file named with the ".asp" Fill suffix. Microsoft recommends the use of the server-side. ASP rather than a client-side script, where there is actually a choice, because the server-side scripts many not work as intended on older browser.

b) Java Server Pages (JSP)

JSP is a technology based on the Java language and enables the development of dynamic web sites. It is on extension of the Java Servlet technology and shares the "Write once, Run Anywhere" characteristics of Java technology.

It allows server side development by using server-side scripting that is actually translated into Servlet and compiled before they are run. JSP files are HTML files with special tags containing Java source code that provide the dynamic content. It consists of HTML or XML markup into which special tags and code blocks are inserted. The code is executed on the server and the result is a dynamic page that is returned to the client browser. Although JDP are simple to build, they have at their disposal the full power of object-oriented Java and the Java Server API. JSP make heavy use of Java Beans, which follows a standard pattern of a no-argument constructor (required in JSP) and public GET and SET methods.

JSP are HTML pages with special JSP tags embedded. These JSP tags can contain Java code. The JSP file execution is .jsp rather than .htm or .html. the JSP engine parses the .jsp and creates a Java servlet source file. It then compiles the source file into a class file, this is done the first time and this why the JSP is probably slower the first time it is accessed. Any time after this the special compiled servlet is executed and is therefore returns faster.

Table 3.3 The comparison between JSP and ASP.

Characteristic	Java Server Pages (JSP)	Active Server Pages(ASP)
1) Web page execution speed	Slow if executes for the first time, fast later	Intermediate Needs optimiser to enhance running speed
2) Portability	Yes	Integrated tightly with Microsoft products. Not recommended changing server platform.
3) Open source software availability	No	No
4) Programming language use	Java	VBScript
5) Market competitiveness	High	High
6) Integration of client and	Client and server side	Client and server side

server side programs	programs are combined	programs are combined

3.5.4 Web Programming Language

a) HTML

HTML is the lingua franca for publishing hypertext on the World Wide Web. It is a non-proprietary format based upon SGML, and can be created and processed by a wide range of tools, from simple plain text editors to sophisticated WYSIWYG authoring tools. HTML is the set of markup symbols or codes inserted in the file intended for display on a www browser. The markup tells the web browser how to display a web page's word, and images for the user. The individual markup codes are referred to as elements but many refer them as tags.

HTML allows web publishers to create complex pages of text and images that can be viewed by anyone else on the web. A word processor such as Microsoft Word and a working knowledge of HTML are needed to create an HTML page instead of any special software. HTML is just a service tags that are integrated into a text document. One can add many functions inside HTML. VBScript and also JavaScript can be added inside HTML to make it become dynamic HTML. Besides displaying information, they can show database record on the Internet and get response from other users.

b) Java Script

JavaScript is an interpreted programming or script language from Netscape. It is similar in capability to Microsoft Visual Basic, Sun's Tool Command Language, the Unix-derived Practical Extraction and Reporting Languages are easier and faster to code in than the more structured, compiled languages such as C and C++ and are ideal for smaller programs or limited capability or that can be use and tie together existing compiled programs. Script languages generally take longer to process than compiled languages, but are very useful for shorter programs.

JavaScript gives developers the ability to do things such as check form contents, communicate with user based on their actions, and modify the web page dynamically without the web page being re-loaded and without the use of Java, plug-ins or ActiveX controls.

JavaScript is used in website development to do such things as, automatically change a formatted date on a web page, cause a linked-to page to appear in a popup windows and cause text or a graphic image to change during a mouse rollover. JavaScript also support functions, again without any special declarative requirements. Functions can be properties of objects, executing as loosely typed methods. JavaScript uses some of the same ideas found in Java, the compiled object oriented programming languages derived from C++. JavaScript can also be run as the server as in Microsoft Active Server Page before the page is sent to the requestor. Both Microsoft and Netscape browsers support JavaScript, but sometimes in slightly different ways.

c) VBScript

VBScript is an interpreted script language from Microsoft that is a subset of its visual basic programming language. VBScript can be compared to other script languages designed for the web, including:

- Netscape's Java Script
- Sun Microsystems Tool Command Language
- The Unix-derived Practical Extraction and Reporting Language.
- IBM's Restructured Extended Executor.

VBScript is Microsoft answer to Netscape's popular JavaScript. Both are designed to work with an interpreter that comes with a web-browser – that is, at the user or client en of the web client/server session. VBScript is designed for use with Microsoft Internet Explorer browser together with other programming that can be run at the client, including ActiveX control, automation server and Java applet. Although Microsoft does support Netscape's JavaScript it convert it into its own Jscript, Netscape does not support VBScript. For this reason, VBScript is best used for intranet websites that use the Internet Explorer browser only.

3.5.5 Web Application Development

a) Microsoft Visual Interdev 6

Microsoft Visual Interdev is a comprehensive, web-based application development tool. It provides an integrated environment that brings together various technologies to work toward a common goal of building robust and dynamic applications for the web. It achieves this integrated development environment through the use of Microsoft

Development Environment, also employed by Visual J++. User can open and work on Visual J++ projects while simultaneously creating visual Interdev project. This feature greatly enhances productivity, especially when building component using the Microsoft Component Object Model (COM) and incorporating these objects into the Visual Interdev application. It cans also multiple Visual Interdev projects within the same workplace.

Visual Interdev enable the developer to built applications that are dynamic and interactive. Visual Interdev enables developer to built dynamic web pages through the use of client and server side script. By default, Visual Interdev supports the use of VBScript and Jscript. Scripting language such as Perl Script, can be used for project development given that the appropriate scripting engine for the language is available.

Database integration is vital to application Visual Interdev provides a rich of robust set of visual database tools for immediately enhance the developers' productivity. Visual Interdev support the major Open Database Connectivity (ODBC) compliant database, which enable to connect to almost any database from high-end databases, such as Oracle, IBM DB/2 and SQL server, down to desktop databases, such as Microsoft Visual FoxPro and Microsoft Access. It adds database connections to a website without any programming including visually sorting connection properties such as cursor drivers, query time-out and so on. It also dray and drop from the data environment to quickly create sophisticated data-driven HTML forms.

Besides, managing the web site once it has been developed is a very crucial part. Visual Interdev provides a set of tools to overview and maintain the site. These tools are similar and compatible with the site management tools found in Microsoft FrontPage. Visual Interdev supports the major object oriented technologies that exist for developing web-based application including ActiveX control and Java applets transformation of script code into "object-based" functions.

Visual Interdev 6.0 enable single developer to work and test ports of a project against local web server without interfering with team then synchronize and display changes to the shared master web server. Query Builder allows developers to visually construct complex SQL statement against any ODBC database.

Table 3.4 The features of Microsoft Visual Interdev

Features	Microsoft Visual Interdev
Integrated Visual Tool	The Project Workspace uses the standard hierarchical view of data and documents that Windows Explorer uses.
Robust Development support	Visual Interdev supports both client and server side scripting. VBScript, Jscript and other plug-in scripting languages.
Database Connectivity	Offer full support of ODBC, enabling to connect to almost any database from high-end databases, such as Oracle and SQL server, down to desktop database such

	as Microsoft FoxPro and Microsoft Access.
Web Site Management	Provides many management facilities. For example, link view offers a visual representation of the web site's links from page to page. File View, enable to create folders and file and automatically creates directories and files on web server.

b) Macromedia Dreamweaver 4.0

Macromedia Dreamweaver 4.0 is a professional visual HTML editor for creating and managing web sites and pages. It gives developers the productivity of a visual web page layout tool, the control of an HTML text editor, and support for new Web technologies, all in one software package. Developer can use Dreamweaver to create web sites visually, with confidence that the HTML being generated is concise and always editable. Dreamweaver includes advanced features that take advantage of the latest innovations on the web, such as Dynamic HTML and cascading style sheets, while still insuring that web pages work will in a variety of web browsers. All of the code generated by Dreamweaver is carefully created to work on as many platforms and browsers as possible.

Other features of Dreamweaver include the easy integration of ActiveX components, Java Applets, and plug-in for improved web page interactivity. Dreamweaver also integrates seamlessly with other components of Macromedia, such as Flash Movies,

Shockwave and Fireworks, which are essential for the development of interactive web pages.

c) Adobe Acrobat 5.0

Adobe Acrobat 5.0 converts any document to an Adobe Portable Document Format (PDF) file. The document can be open across a broad range of hardware and software, and it look exactly what we intended, with layout, fonts, links and image. PDF document can be published on World Wide Web and read in web browser or Acrobat viewers used as helper applications with web browser. Adobe Acrobat helps to overcome barriers to sharing information. Today, a lot of information is stored in electronic documents and can be shared around the world via Internet, Acrobat Reader solutions consist of products, services, and integrated partner solutions that form the bridge between paper-based and digital information. Acrobat electronic forms not only look and feel like paper, but they're also universally accessible across a broad range of hardware and software and can securely integrate with enterprise systems including SAP, PeopleSoft, and other e-business applications.

The features of Adobe Acrobat 5.0:

1. Secure content delivery. Distribute secure electronic documents for e-business processes, such as e-commerce. Encrypt documents and use digital signatures for added security.

2. Adobe Acrobat 5.0 software lets IT professionals implement a flexible, cost-efficient document solution that works with their existing tools and technologies.
3. Adobe PDF files maintain the exact look and feel of the original document, and they can be opened and viewed by anyone, anywhere across a broad range of hardware and software with Acrobat or the free Adobe Acrobat Reader software.
4. Reduce the cost and time associated with paper documents, their management, and storage.

3.5.6 Selected Tools and Technologies

After analyzing all the available tool and technologies in above sections, the appropriate tool and technologies have been chosen for the development of the project. The technologies and tool selected can fulfil the requirement and suitable for the system development. The selected tool and technologies chosen are:

a) Server and Server Platform

The Microsoft Windows 2000 server is chosen as a server platform for this project over Windows NT server 4.0. Windows 2000 is chosen due to security, reliability, user-friendly and scalability features. Windows 2000 provide the highest of security. Windows 2000 actually builds on the Windows NT 4's security model but more security features are provided and upgraded. There are many new features Windows 2000 introduces to help protect Windows 2000 environment. Windows 2000 provides

reliability through the error and exception handling and component redundancy. Windows 2000 is a scalable system that will run in many hardware environments. Windows 2000 is adaptable to many processing environment and will take advantage of multiprocessing capabilities of a computer.

b) Database Management System

The Microsoft SQL Server 7.0 will be used as the systems database to store all the information and data of the historical building digital library. Microsoft SQL is chosen because it is a suitable database engine for processing website. Through integration with Internet Information Server (IIS), data query and updating via a popular web browser can be made with little effort. It has the nature of Open Database Connectivity that lets it inter-operate smoothly with Internet Database Connector (IDC) Interface, which is include Windows Internet Information Server. Microsoft SQL offers a large data capacity and fast application run time. With a large data capacity, the system can support the increasing of data in the future.

c) Web Application Programming Technology

Active Server Pages (ASP) is chosen as web application programming technology. ASP is a component of Microsoft's web server software that allows user to embed server-side script code in web pages. VBScript is using by default as programming language in ASP.

d) Programming Language

HTML and VBScript is chosen as web page programming language. HTML is the lingua franca for publishing hypertext on the World Wide Web, meanwhile VBScript is a programming language that using in ASP.

e) Web Development Tools.

The team has decided to use the Microsoft Visual InterDev, Macromedia Dreamweaver 4.0 and Adobe Acrobat 5.0 as a development tools for the purposed project. These tools are essential to efficiently develop a professional and maintainable portal.

3.5.7 The Development Server Specifications

The server used throughout the design and development phase is Compact Proliant ML530, and its specifications are listed below:

- Intel Pentium III Xeon-Mhz Processor;
- 256 KB second level ECC Cache;
- RCC LE 3.0 Chipset with 133-MHz Front Side Bus;
- 128 MB PC 133MHz SDRAM DIMM Memory;
- 1.44 MB Diskette Drive;
- High Speed IDE CD-ROM Drive;
- NC3123 Fast Ethernet NIC PCI 10/100 WOL;
- Integrated Dual Channel Wide Ultra2 SCSI adapter;
- Wide Ultra2/Ultra3 SCSI Drive Cage standard;
- Compaq SmartStart;
- Compaq Insight Manager;

3.6 Summary of the Selected Hardware and Software for the Project Development.

Following are the tools and technologies that used in this project:

- √ Windows 2000 as the server platform
- √ Microsoft SQL server 7.0 as the database management system
- √ Internet Information Server 5.0 as the web server
- √ Internet explorer 5.5 as the web browser
- √ Active Server Pages (ASP)
- √ HTML
- √ VBScript
- √ Microsoft Visual InterDev 6.0
- √ Macromedia Dreamweaver 4.0
- √ Adobe Acrobat 5.0
- √ Microsoft Word 2000

CHAPTER 4
System Design

CHAPTER 4 SYSTEM DESIGN

System design is a process which requirements are translated into a model of representation of the software that can be assessed before the coding starts to meet the user requirement and satisfaction. This phase is enables us to determine a set of components and inter component interfaces that will satisfy the specific sets of requirements. System design involves the team member's move back and forth among activities involving understanding the requirement, proposing possible solutions, testing aspects of a solution for feasibility, presenting possibilities to the targeted users, and documenting the design. Therefore, the prototyping model is suitable for the proposed system design. With the result of produce in this phase, we are able to change the abstract logical model to the concrete physical implementation.

4.1 System Architecture Design

The system architecture for this project is chosen based on the scope and the complexity of this project. The systems architecture of this Digital library of Historical Building is the 3-tier architecture, which is based on client/server approach.

4.1.1 The 3-Tier Architecture.

The 3-tier architecture generally divided into three layers. The three layer architecture is chosen because it allows any part of the system to be modified without having to

change the others two parts of the system. Thus, it allows the system to operate at its highest efficiency.

The three-tier software architecture emerged in the 1990s to overcome the limitations of the two-tier architecture. The first tier, which is user system interface where user services such as session, text input and display management reside. The browsers will be the applications in this client tiers. Browsers like Internet Explore is used to display the user interface (web pages) to the user of the system.

The middle tier is the tier where the application server of the system, Internet Information System (IIS) resides. This tier provides process management services such as process development, process monitoring, process performance and process resourcing that are share by multiple applications. In this tier, the application server process the requests from the client tier and then returns required results in the web pages format. It will process any data requested by linking to the database server.

The third tier consists of Microsoft SQL Server 7.0 as the database server. The third tier provides database management functionality and is dedicated to data and file services. Microsoft SQL Server maintains the data repository of the system. Every request from the application server will be authenticated first and the results will the pass back to the second tier. The data management component ensures that the data is consistent throughout the distributed environment.

The first tier of system architecture of this Digital Library of Historical Building is the client tier, the second tier is the application server and the third tier is the database server. The following diagram describes the system 3-tier architectures.

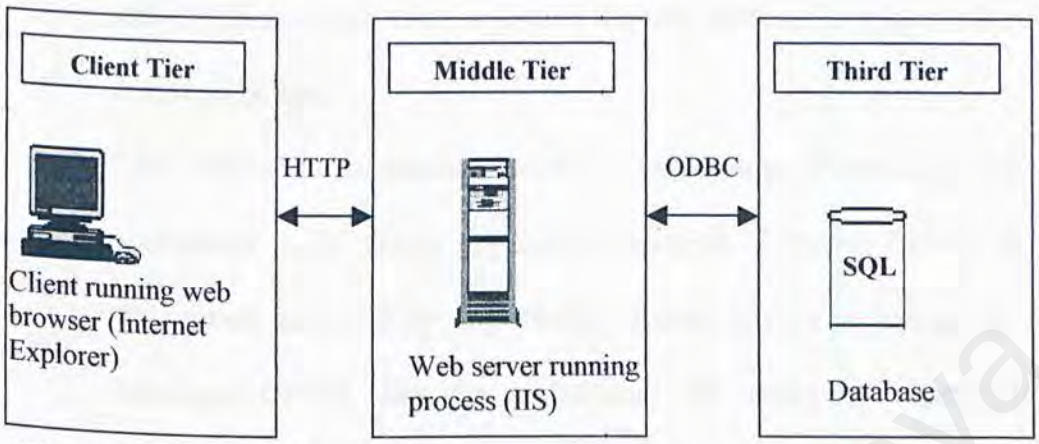

Figure 4.1 The 3-Tier Architecture

4.1.2 Advantages of 3-Tier Architecture.

The three-tier architecture appeared to overcome the limitations of the two-tier architecture. In the three-tier architecture, a middle tier was added between the user system interface client environment and the database management server environment. The three-tier architecture solves a number of problems that are inherent to two-tier architecture. Following are the advantages of three-tier architectures.

1. The middle tier can perform queuing, application execution, and database staging. For example, if the middle tier provides queuing, the client can deliver its request to the middle layer and disengage because the middle tier will access the data and return the answer to the client.

2. The three-tier client/server architecture has been shown to improve performance for groups with a large number of users and improves flexibility when compared to the two-tier approach. Flexibility in partitioning can be a simple as "dragging and dropping" application code modules onto different computers in some three-tier architecture.
3. The three-tier architecture have a Transaction Processing (TP) monitor technology with ability to update multiple different DBMS in a single transaction, connectivity to a variety of data sources including flat files, non-relational DBMS, and the mainframe, the ability to attach priorities to transactions and robust security
4. The three-tier application server architecture allocates the main body of an application to run on a shared host rather than in the user system interface client environment. The application server does not drive the GUIs but it shares business logic, computations, and a data retrieval engine. Advantages are that with less software on the client there is less security to worry about, applications are more scalable, and support and installation costs are less on a single server than maintaining each on a desktop client.

4.2 Process Design

There was several design methodology for the process design. This system is designed base on the data flow oriented-design methodology on the structured design. Data flow oriented-design has the origins in earlier design concepts that stressed on modularity, top down design and structured programming. This design focuses on system structure design and data flow design.

4.2.1 System Structure Chart

The system structure is used to represent high-level abstraction of a specified system. The use of structure chart is to describe the iteration between independent modules. Major functions from the initial component part of the structure chart, which can be broken into detailed sub-components. A structure chart is simply a diagram consisting the movies and connecting arrow.

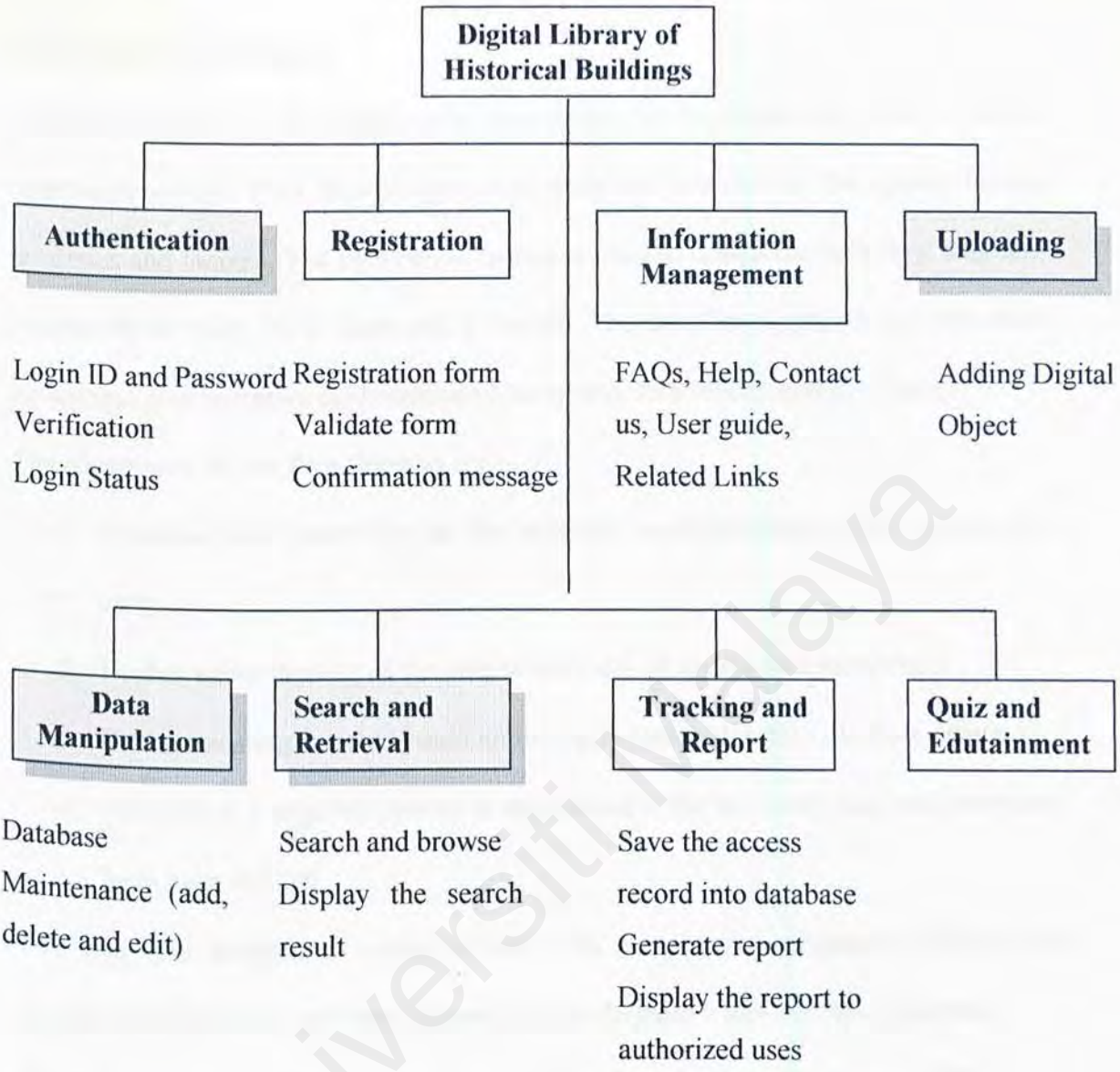

Figure 4.2 The Structure Chart of the Digital Library of Historical Buildings

4.2.2 Data Flow Diagram

Data flow diagram, which graphically characterize the processes and flows in online community system. Data flow diagram will show the overview of the system inputs, processes and outputs. The convention, which is used to design the data flow diagram, is based on the work by C. Gane and T. Sarson. The data flow approach has four chief advantages over narrative explanations of many way data move through system,

The advantages of data flow diagram are:

1. Freedom from committing to the technical implementation of the system too early.
2. Further understanding of the inter relatedness of system and subsystems.
3. Communicating current system knowledge to users through data flow diagram.
4. Analysis of a proposed system to determined if the necessary data and processes have been defined.

The data flow diagram is conceptualised with a top-down perspective. Hence, the diagram will be drawn, and then followed by the diagram 0 and the child program.

The following are the four basic symbols used to chart the data movement on DFD.

Table 4.1 Symbols used in DFD

Symbols	Meaning	Description
	Entity	Used to show an external entity that can send data to or receive data from the system.

	Flow of Data	Movement of data from one point to another, with the head pointing towards the data destination.
	Process	Show occurrence of a transformation of data.
	Data Store	Used to represent a data store where the data is held within the system.

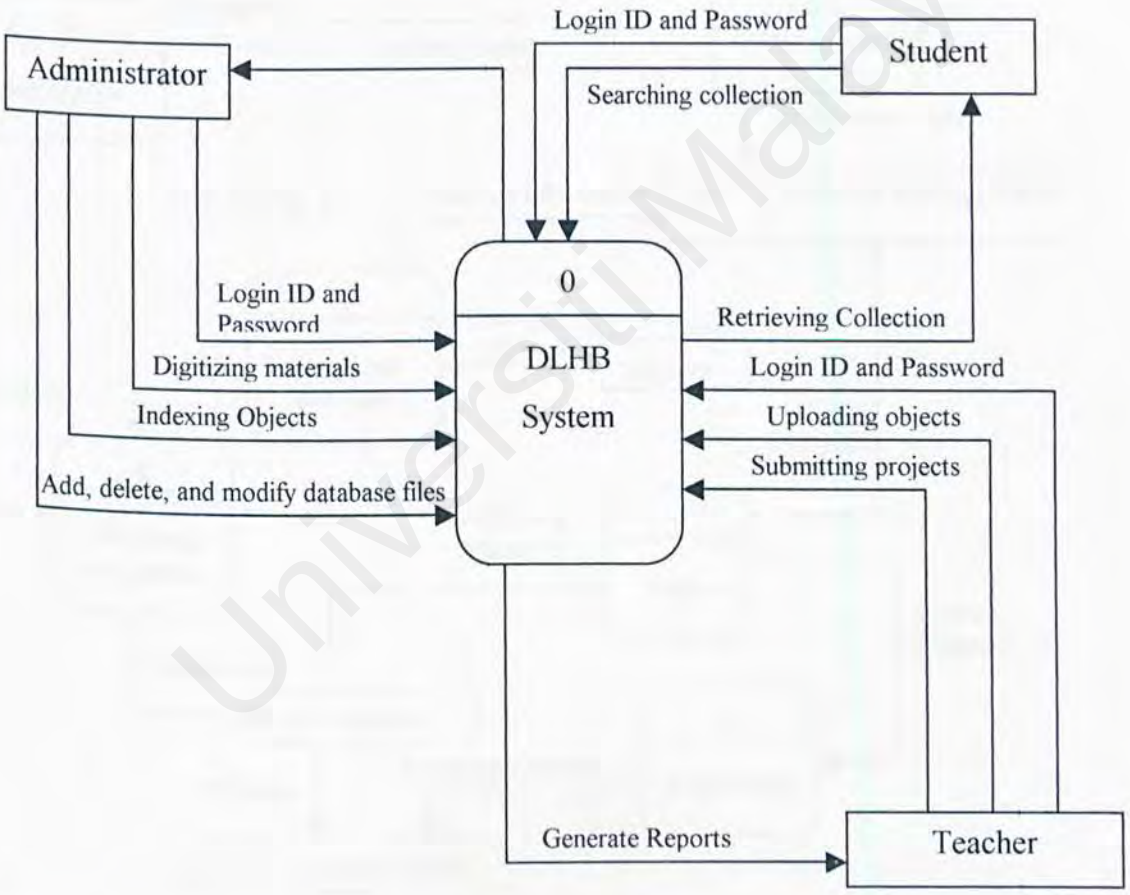

Figure 4.3 The Context Diagram of the Digital Library of Historical Building Systems

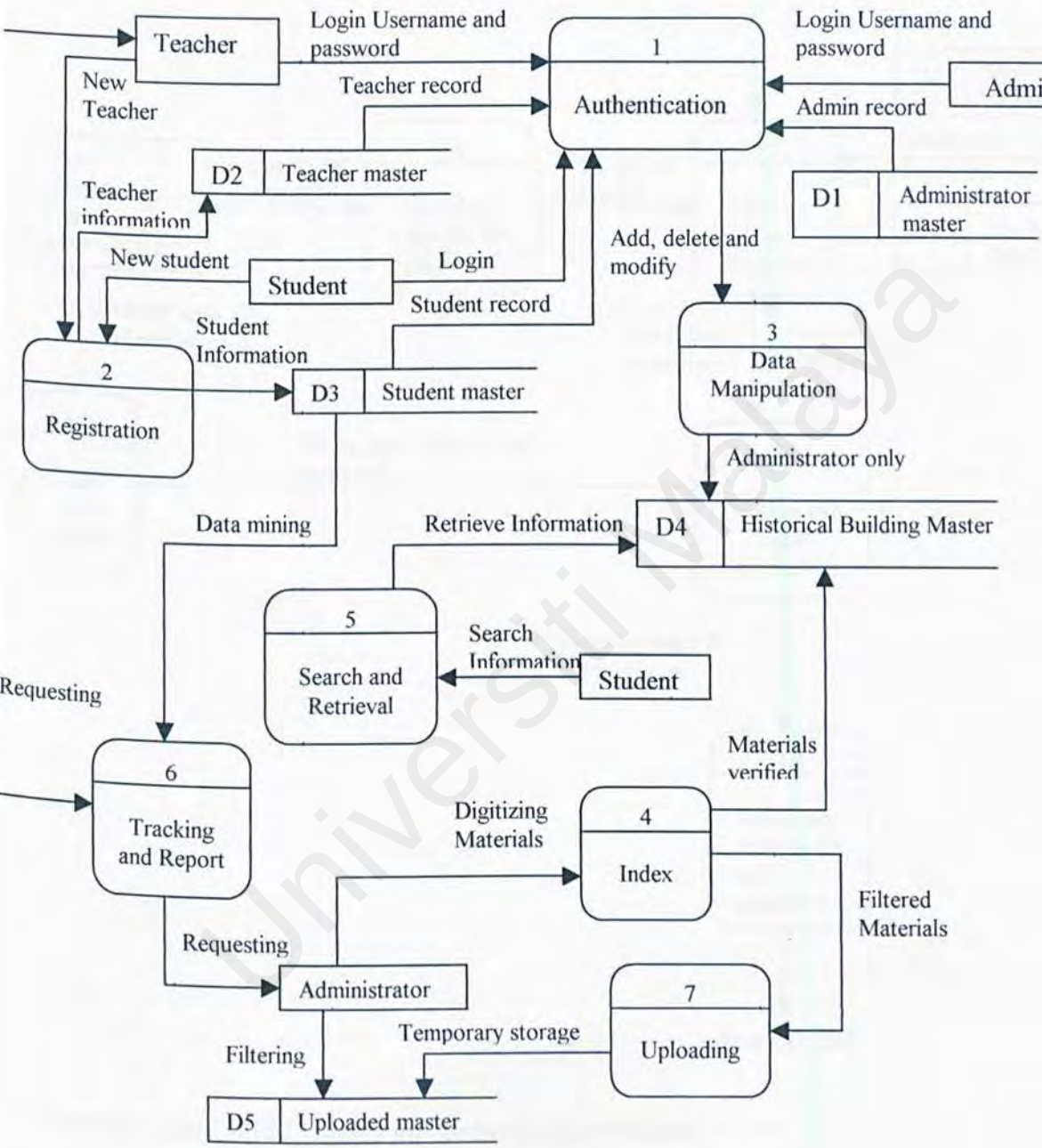

Figure 4.4 The Diagram 0 for Malaysian Biographical Portal

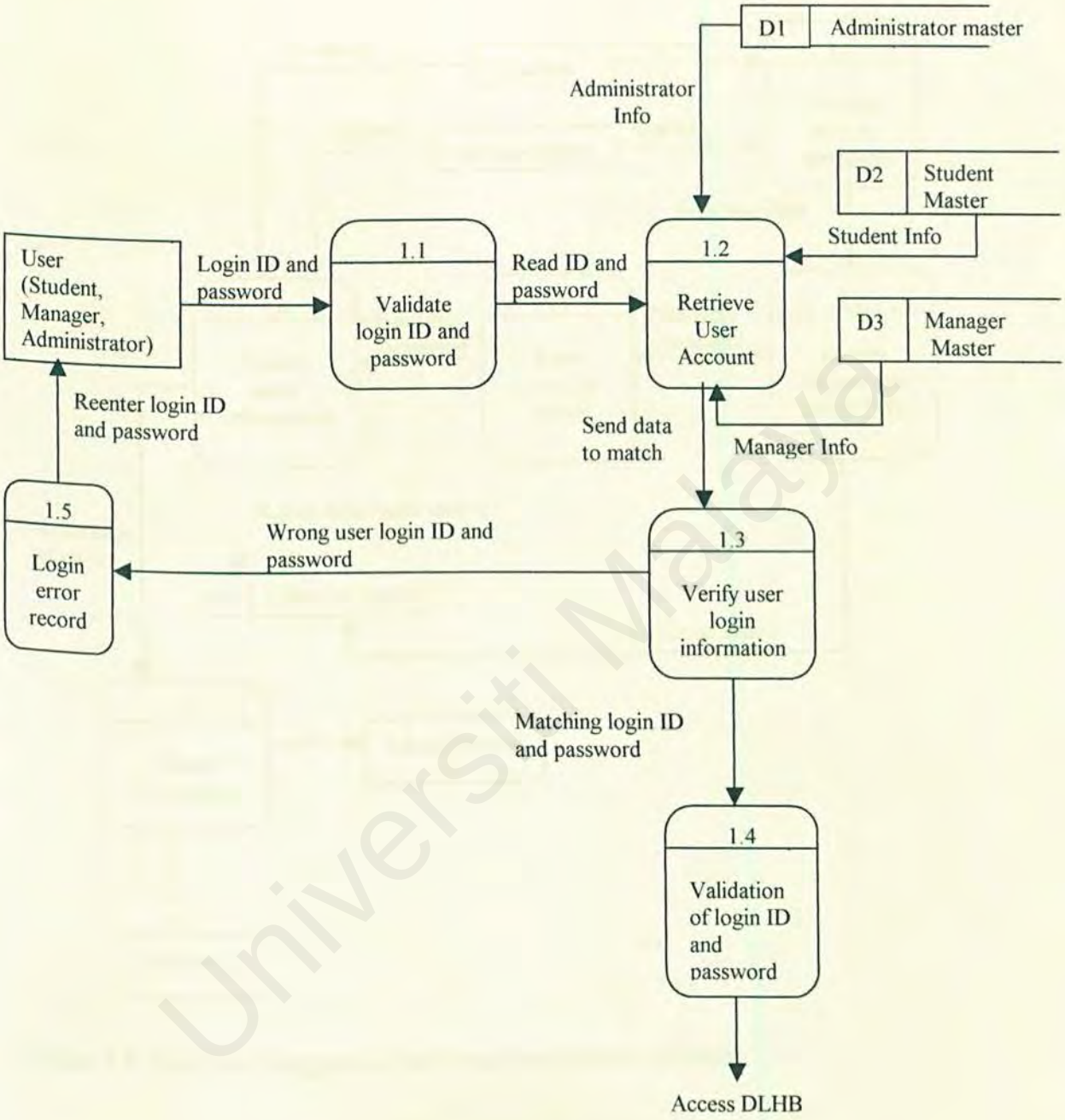

Figure 4.5 The Child Diagram for Authentication Process

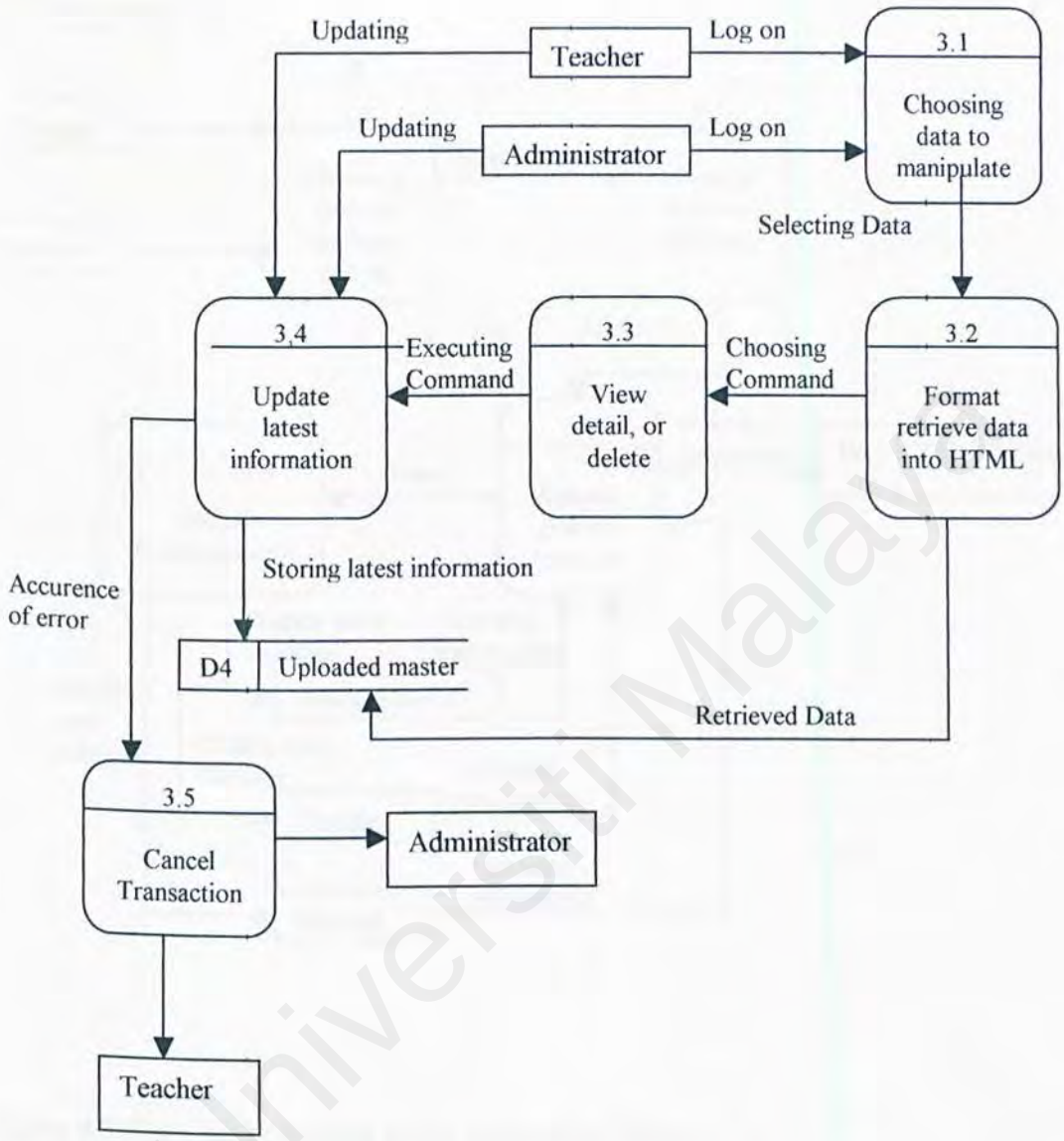

Figure 4.6 The Child Diagram of the Data Manipulation Module

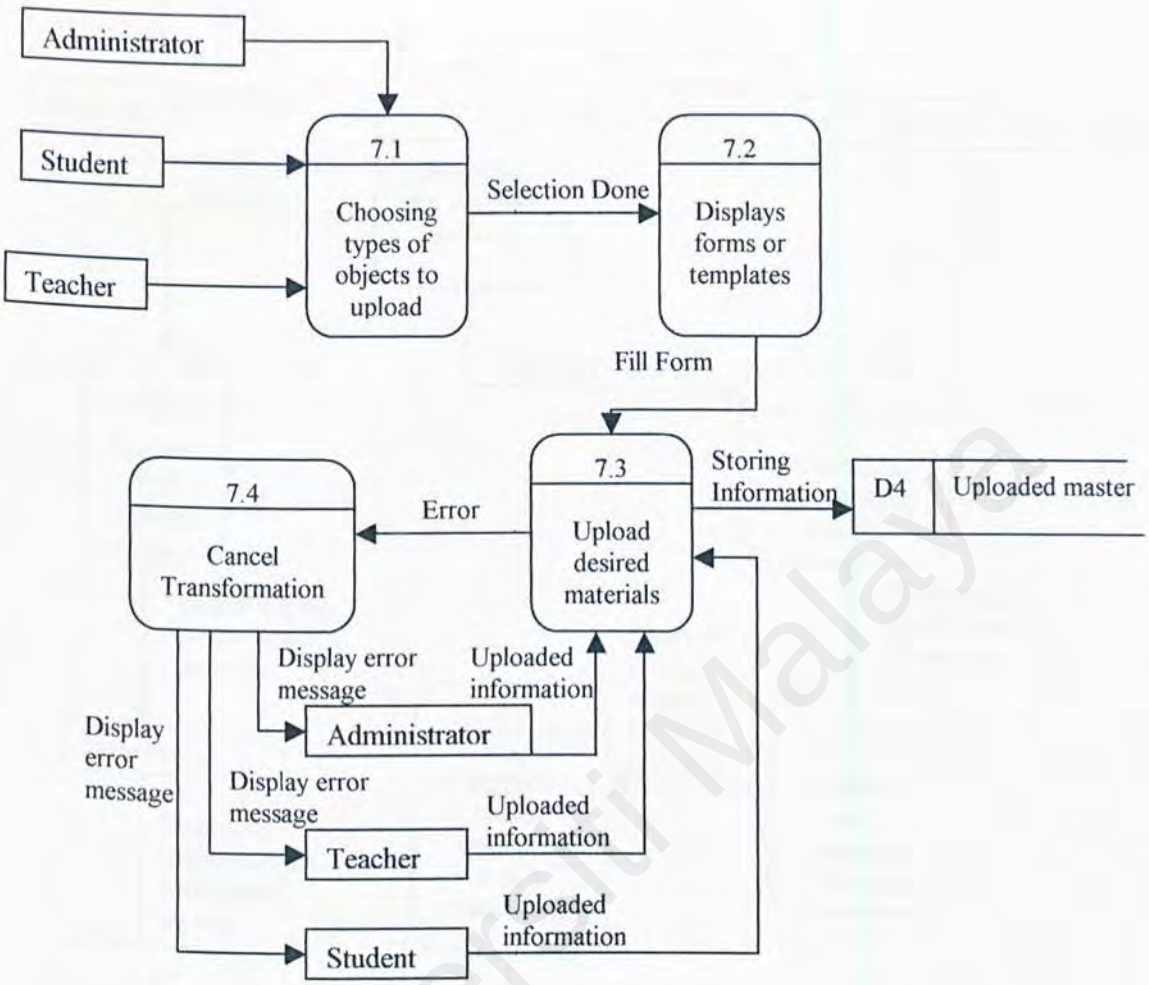

Figure 4.7 The Child Diagram of the Uploading Module

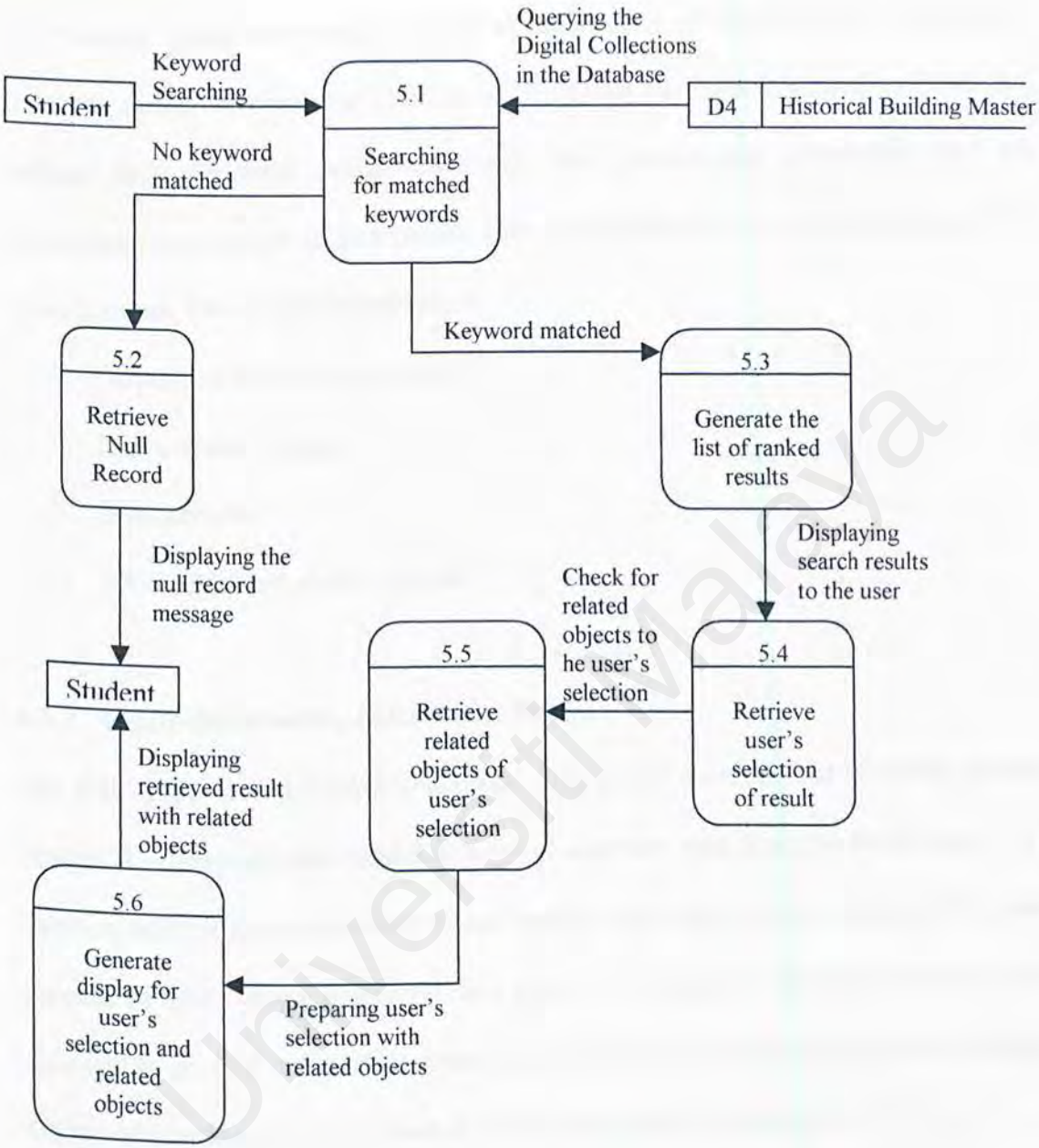

Figure 4.8 The child Diagram of Search and Retrieval Module

4.3 Database Design

The relational database model is used in database implementation for the system. Database design involves the process of designing the structure used to store and manage data. Database design transforms the unstructured information and the processing requirements of this project into representations that define the functional specifications. The design objectives are:

1. Purposeful information retrieval.
2. Efficient data storage.
3. Data integrity.
4. Efficient updating and retrieval.

4.3.1 Entity-Relationship (ER) Model Design.

The E-R model is a high-level conceptual data model developed to facilitate database design. A conceptual data model is a set of concepts that describe the structure of a database and the associated retrieval and update translations on the database. The main purpose of developing a high-level data model is to support a user's perception of the data and to conceal the more, a conceptual data model is independent of the particular DBMS and hardware platform that is user to implement the database.

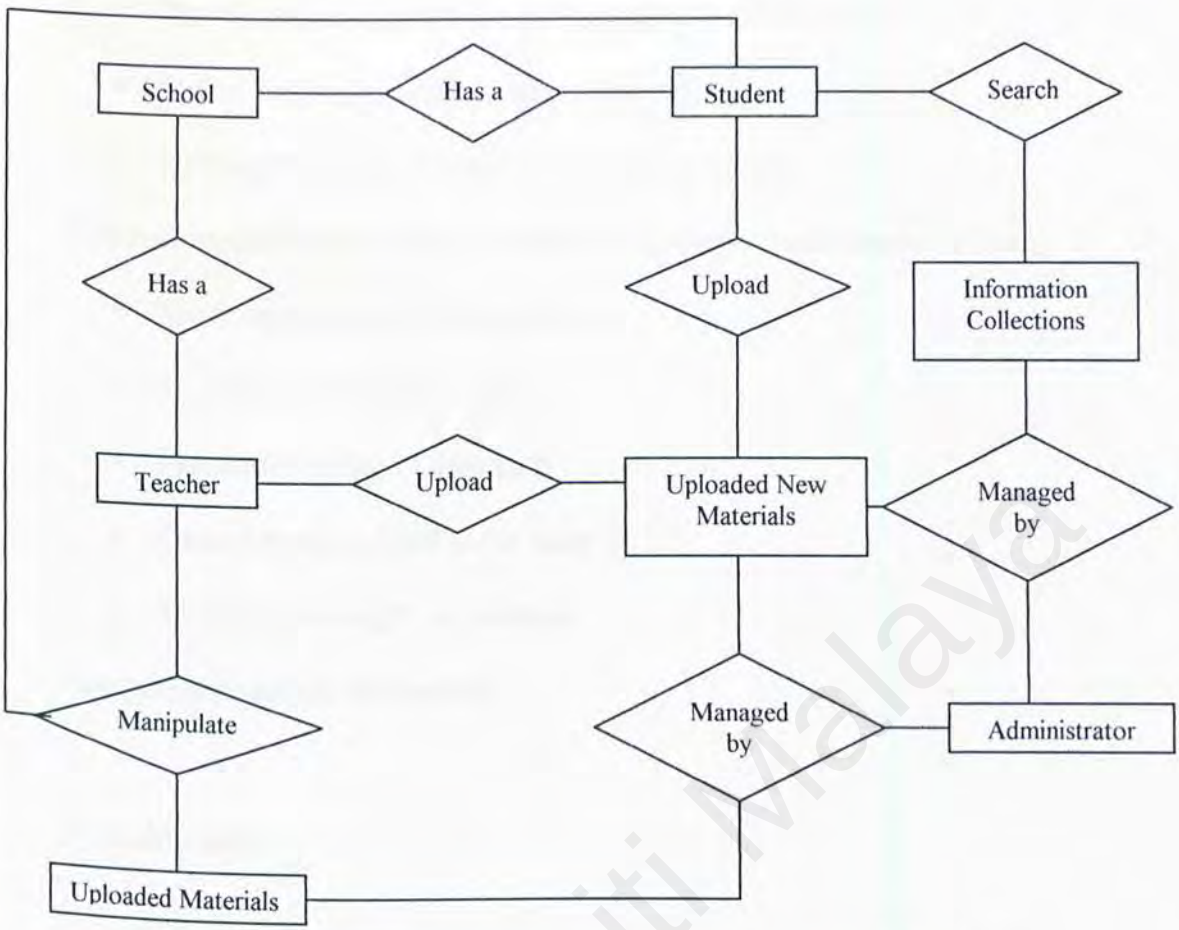

Figure 4.9 The E-R Diagram of the Digital Library of Historical Buildings.

4.3.2 Data Dictionary

The of the DLHB is designed using the third normal form of normalization. Data dictionary is a repository of all the elements in a system. It is logical characteristic of current systems data stores. Data dictionary identifies processes where the data are used and where immediate access to information is needed. It also saves as the basic for identifying database requirement during system design.

The data dictionary may be used to:

- Validate the data flow diagram for completeness and accuracy.
- Provide a starting point for developing screens and reports.
- Determine the contents of data stored in files.
- Develop the logic for data flow diagram process.

A data dictionary should contain specific categories of information including:

- Name and aliases of the data item.
- Description of the data item.
- Permissible range of data item
- Data elements related to the entry
- Its allowable length information.

Any pertinent editing information.

a) Student table

Table 4.2 The Student Table Definition

Field Name	Data Type	Field Size	Description
*StudentID	int	4	The unique identifier assigned to the data element
FirstName	varchar	30	Student's first name
LastName	varchar	30	Student's last name
LoginID	varchar	15	Student's login ID
Password	varchar	15	Student's password
Gender	varchar	6	Student's gender
Race	varchar	10	Student's race
BirthMonth	varchar	10	Student's month of birth
BirthDay	char	2	Student's day of birth

BirthYear	char	4	Student's year of birth
Address	varchar	100	Student's address
State	varchar	15	Student's state
ContactNo	char	12	Student's phone number
E-mail	varchar	30	Student's e-mail address
School	varchar	50	Student's school
LastLogin	datetime	8	Student's last login

b) Administrator table

Table 4.3 The Administrator Table Definition

Field Name	Data Type	Field Size	Description
*AdminID	int	4	The unique identifier assigned to the data element
FirstName	varchar	30	Administrator's first name
LastName	varchar	30	Administrator's last name
A_LoginID	varchar	15	Administrator's login ID
A_Password	varchar	15	Administrator's password
Gender	varchar	6	Administrator's gender
Race	varchar	10	Administrator's race
SchoolID	varchar	50	Administrator's school ID
ContactNo	varchar	12	Administrator's contact number
E-mail	varchar	30	Administrator's e-mail address
LastLogin	datetime	8	Administrator's last login
LastUpdate	datetime	8	Administrator's last updated
Status	char	1	Administrator's access level

c) School table

Table 4.4 The School Table Definition

Field Name	Data Type	Field Size	Description
*SchoolID	char	6	The unique identifier assigned to the data element
SchoolName	varchar	50	Name of school
Address	varchar	100	Address of school
Postcode	char	5	Postcode of school
City	varchar	15	City of school
State	varchar	20	State of school
ContactNo	varchar	11	Telephone number of school
FaxNo	varchar	11	Fax number of school
LastUpdated	datetime	8	Date information updated
HomepageURL	varchar	30	URL of the homepage

d) Digital object table

Table 4.5 The Digital Object Table Definition

Field Name	Data Type	Field Size	Description
*ObjectID	int	4	The unique identifier assigned to the data element
Title	varchar	100	Object title
Creator	varchar	100	Object creator
Subject	varchar	100	Subject headings
Description	varchar	300	Object description
AdminID	int	4	The administrator who indexed the

			object
Date	datetime	8	Date object created
Type	varchar	10	Type of objects
Format	varchar	3	File extension
Size	float	8	Size of the object
Keywords	varchar	300	Keywords that identify the objects
Rights	varchar	100	Description of the rights
Filename	varchar	50	The name of the object
Filepath	varchar	200	Location (URL) of the object
Thumbnailpath	varchar	50	Location of the secondary or metafile of the object
Uploaded	bit	1	Indication of whether the object is uploaded or not
UpMaterialID	int	4	The unique identifier from the Uploaded Material table
Collection	varchar	50	The collection which the object belongs to
Ranking	int	4	Initial ranking value of the object
TemRank	float	8	The ranking value generated from each search

e) Document Table

Table 4.5 The Document Table Definitation

Field Name	Data Type	Field Size	Description
*DocumentID	int	4	The unique identifier assigned to the data element
ObjectID	int	4	Object's ID
Language	char	2	Language of the object

f) Project Table

Table 4.6 The Project Table Definition

Field Name	Data Type	Field Size	Description
*ProjectID	int	4	The unique identifier assigned to the data element
ObjectID	int	4	Object's ID
Language	char	2	Object's Language

g)Image Table

Table 4.8 The Image Table Definition

Field Name	Data Type	Field Size	Description
*ImageID	int	4	The unique identifier assigned to the data element
ObjectID	int	4	Object's ID
ImageWidth	int	4	The width of the image (pixel)
ImageHeight	int	4	The height of the image (pixel)

h)Hyperlink Table

Figure 4.9 The Hyperlink Table Definition

Field Name	Data Type	Field Size	Description
*HyperlinkID	int	4	The unique identifier
ObjectID	int	4	Object's ID

i) Relation Table

Figure 4.10 The Relation Table Definition

Field Name	Data Type	Field Size	Description
*RelationID	int	4	The unique identifier assigned to the data element
ObjectID	int	4	The object's ID
RelatedObjectID	INT	4	Id of the related object
Relation	varchar	100	Description of relation to other objects

j) Uploaded materials table

Table 4.11 The Uploaded Materials Definition Table

Field Name	Data Type	Field Size	Description
*UpMaterialID	int	4	The unique identifier assigned to the data element
StudentID	int	4	Student's ID
Title	varchar	50	Material's title
Category	varchar	50	Category of the material
Desription	varchar	100	Description of the material
Date	datetime	8	Date the material being uploaded
Dateupdated	datetime	8	Date information updated
Time	datetime	8	Time the material being uploaded
Filepath	varchar	100	Location (URL) of the material
Filesize	varchar	10	Material's size
Filename	varchar	50	Material's name

k) TecUploadedMaterial Table

Table 4.12 The TecUploaded Materials Table Definition

Field Name	Data Type	Field Size	Description

*TecUpmaterialID	int	4	The unique identifier assigned to the data element
AdministratorID	int	4	Teaher's ID
Title	varchar	50	Material's title
Category	varchar	50	Category of the material
Description	varchar	100	Description of the material
Date	datetime	8	Date the material being uploaded
Dateupdated	datetime	8	Date information updated
Time	datetime	8	Time the material being uploaded
Filepath	varchar	100	Location (URL) of the material
Filesize	varchar	10	Material,s size
Filename	varchar	50	Material's name

4.4 User Interface Design

User interface design is the specification at a conversion between the system user and the computer. This conversion generally results in either input or output. There are a number of human engineering factors that incorporated in to the interface design of DLHB.

- The screen should be formatted so that the various type of information and instruction will always appear in the same display area and easy to be seen by user.
- User displays an attribute sparingly.
- Simplify complex functions and reduce typing by providing the system user with selection lists and function keys.

The user interface for this Digital Library of Historical Building is Graphical User Interface (GUI) based. GUI allows direct manipulation of the graphical representation on the screen, which can be accomplished with keyboard and a mouse.

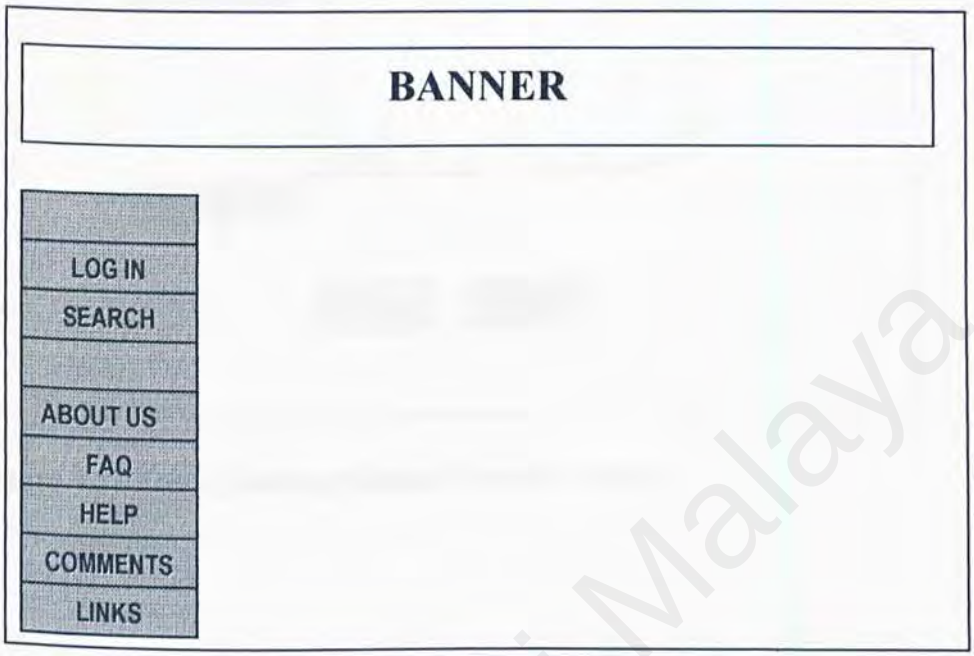

Figure 4.10 The Digital Library Historical Building Homepage Interface Design

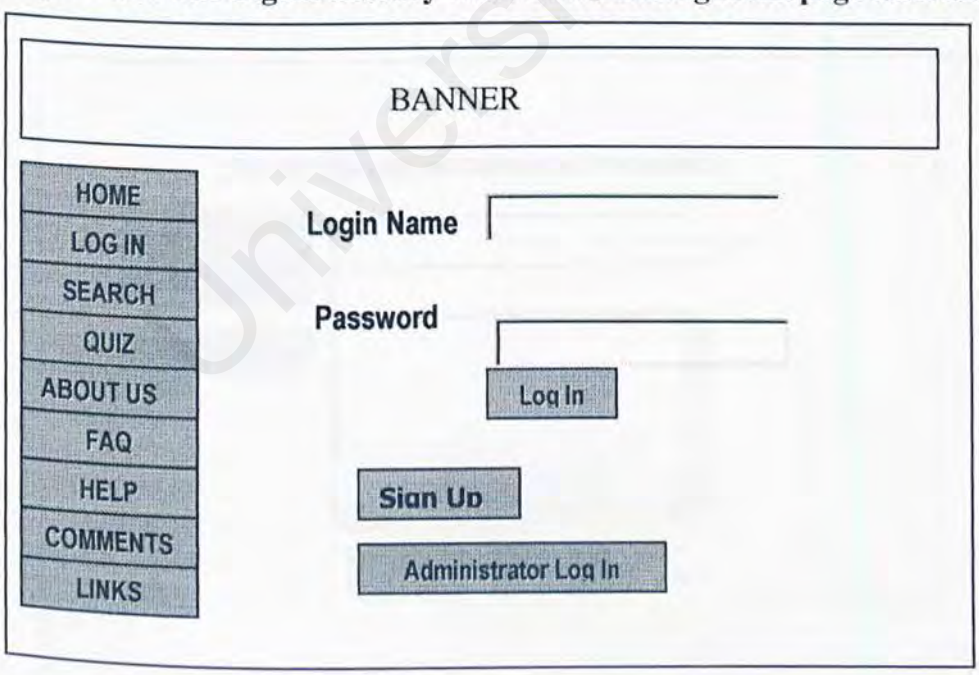

Figure 4.11 The Login Page

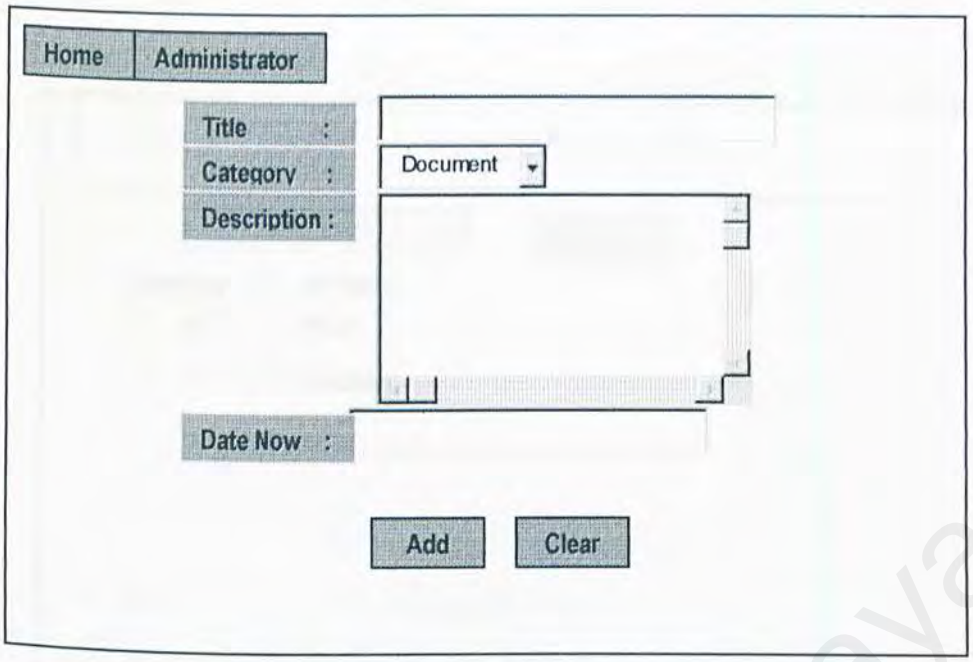

Figure 4.12 The Uploading Module Interface Design

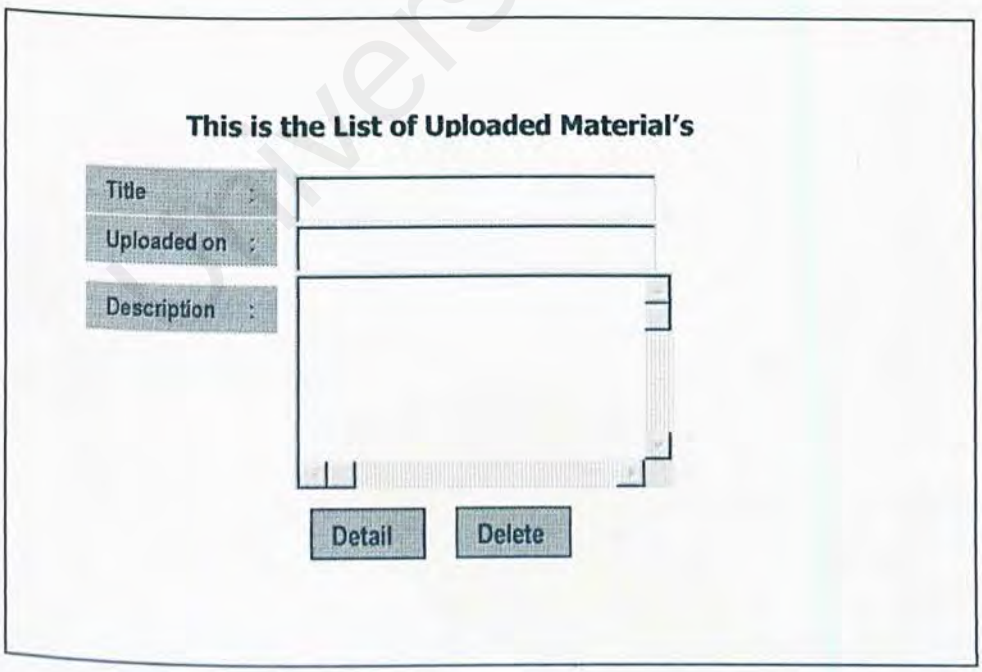

Figure 4.14 The Data Manipulation Module User Interface Design

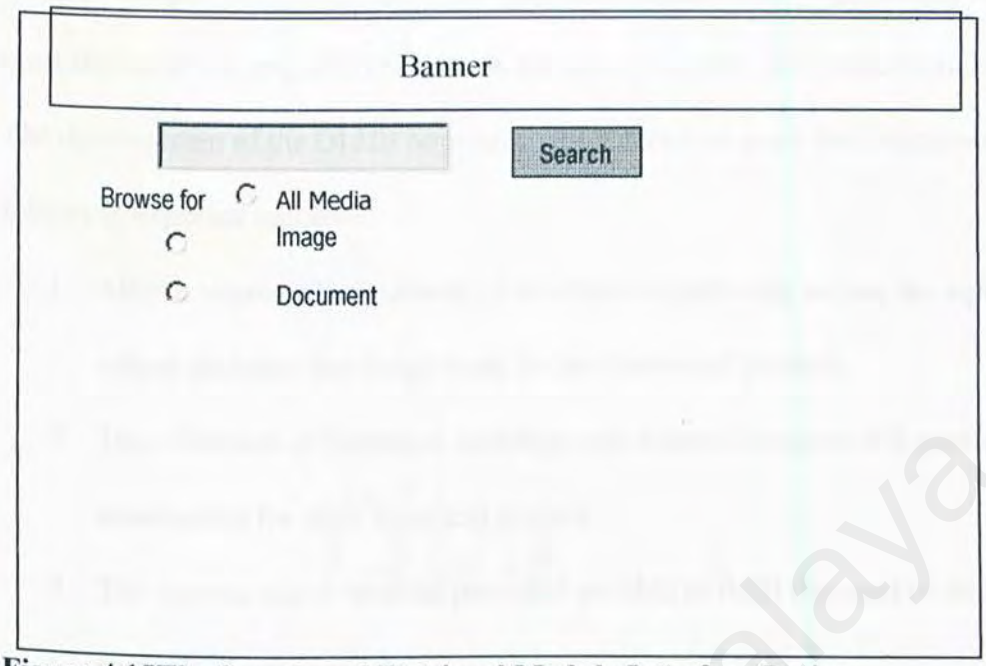

Figure 4.15The Search and Retrieval Module Interface Design

4.5 Expected Outcome

The final output from this project is a web-based digital library application that aims to meet the needs and requirement of both the school teachers and students in Malaysia. The development of the DLHB hopefully will achieve its goals and objectives with the following expected outcome:

1. Able to improve the methods of information gathering among the secondary school students, that helps them in their historical projects.
2. The collection of historical buildings and student's reports will provide useful information for their historical project.
3. The various search method provided are able to fulfil the need of different level students.
4. The uploading modules encourage students to exchange their information and develop collaborative among students.

CHAPTER 5

System Implementation

CHAPTER 5 SYSTEM IMPLEMENTATION

5.1 Introduction

Systems implementation involves the system development environment, program coding and database development. It also involves some modifications to the previous design due to the limitations of the programming language used. During the, systems development every modules was developed separately and later combined into a fully functional systems.

System implementation translates a detail representation of software into a programming realization. Normally the translation process continues when a computer accepts source code as input and produces machine code. So, it is important to have appropriate tools and suitable languages to code the programs. In order to develop the system, a number of software tools were chosen.

5.2 Development Environment

During the process development of the system, the suitable hardware and software is use. The following section discusses the software and hardware tools used to develop Digital Library Of Historical Buildings.

5.2.1 Hardware Development Environment

The hardware configuration of system development:

- Intel Pentium III 733 MHz processor
- 128 MB RAM

- 20.5 GB Hard Disk
- Dell Computer Corporation OptiPlex GX110
- 52X speed CD-ROM driver
- Dell Monitor
- Standard floppy disk driver, printers and speakers.

5.2.2 Software Development Environment

List of software tools used in the system development and documentation:

- Operating Systems

  Windows 2000 Professional

- Web Server

  Internet Information Server 5.0

- Browser

  Internet Explorer 6.0

- Web Application Development Application Tools

  Microsoft Visual Interdev 6.0

- Program Coding

  User Interface Creation : Hypertext Markup Language(HTML)

  Server Side Scripting : Active Server Pages(ASP), VBScript

  Client Side Scripting : VB Script, Java Script

- Documenting

  Microsoft Words 2000

5.3 Development of the System

The system development includes developing the system application and setting up the system database and connecting them to database.

5.3.1 Application Development

Application development involves codes generation that translates all the algorithms into VB Script language. Application is a set of functional program.

a. Program Coding

Active Server Pages (ASP) is chosen as web application programming technology. ASP is a component of Microsoft's web server software that allows user to embed server-side script code in web pages. VBScript is using by default as programming language in ASP. While, Java Script is used for client side scripting. For the user interface creation such as forms, fames, tables and text, Hypertext Markup Language(HTML) was used. ASP, is almost as efficient as writing the code directly to the server's application program interface. The scripting language used by the ASP application is specified by using the statement <%@LANGUAGE="VBSCRIPT"%>. This statement is placed at the beginning of the ASP application.

Microsoft Visual Interdev Development Environment-program code view

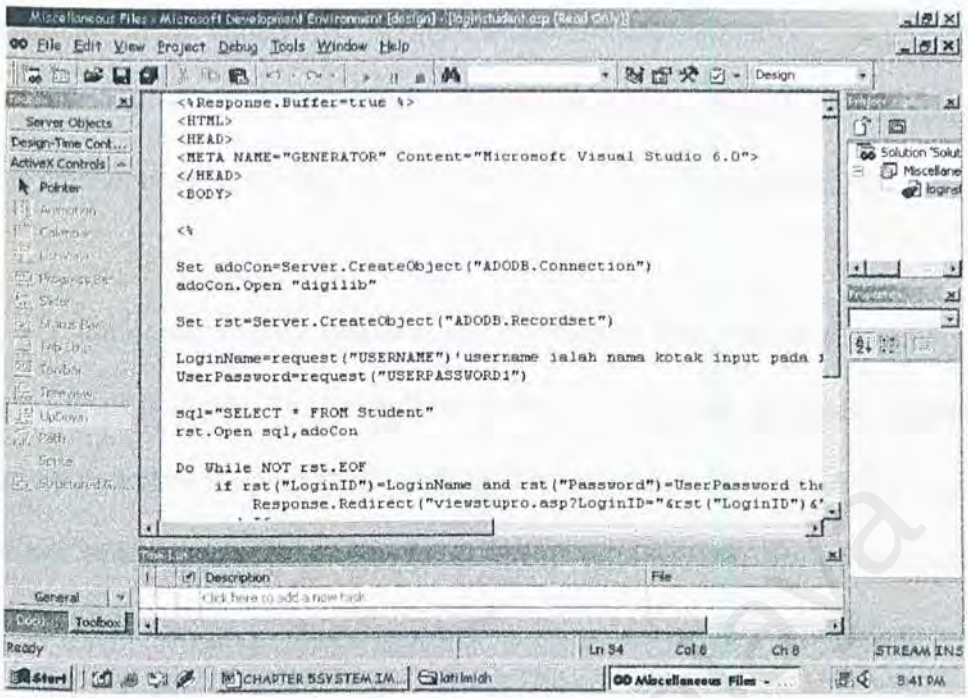

Figure 5.1 Microsoft Visual Interdev Development Environment

b. Coding Principles

Some programming principles are applied in coding the program to ensure the system consistency, readability and system maintainability.

- Using a variable naming convention consistently increase the program consistency and maintainability.
- Indenting, formatting and commenting the code help to increase the program code's readability.

c. Coding Approach

Top-down approach and the bottom-up approach are the two approaches were used. The top-down approach starts by looking at the large picture of the system and

then exploding to smaller parts or subsystems. Top-down approach allows the higher-level modules to be coded first before the lower-level modules. It ensures that the important or core modules of the system to be developed and tested first. This approach prevents developer from loosing track of what the system is supposed to do.

The bottom-up coding approach starts coding at the lower level modules before the higher-level modules. The completed lower level module will then be integrated with newly completed higher-level module. This approach is used when many of the lower level modules are general-purpose utility routines that are often invoked by others, when the design is object0oriented or when the system is integrating a large number of stand-alone reused modules.

5.3.2 Database Development

The system database is developed using Microsoft Access 2000. The relational database is easy to change unlike the networking and hierarchical database. The building blocks of database design are entities, attributes and relationship. A table represents a single entity whereas the attributes are the facts or properties about each entity.

Database integration is vital to application Visual Interdev provides a rich of robust set of visual database tools for immediately enhance the developer productivity. Visual Interdev support the major Open Database Connectivity (ODBC) compliant database, which enable to connect to almost any database from high-end databases.

The database is based on the database design model during the system design process with a little change. Creating an empty database called "mymhbp" starts the database development. Then creating tables that needed by specifying all the fields for each table and the field's property. Relationships between the tables are established after the tables have been created to enforce referential integrity.

5.4 Summary

In a nutshell, coding section is important part of system development because most of the error and fault occurred in the code. Every coding done must make sure that the coding is appropriate and the module is reusable. Furthermore, the ASP document is easier to compiled and required automatically the next time it is required. Generally, the advantage of using scripting language to built web pages is it makes it easy to modify the web site.

CHAPTER 6

System Testing

CHAPTER 6 SYSTEM TESTING

Testing is verification and validation process. Verification refers to the set of activities that ensures that the software correctly implements a specific function. Below statements are some of the rules that can serve well as testing objectives:

- Testing refers to a process of executing a program with the intent of finding an error.
- A well test case is one that has a high probability of finding an as-yet-undiscovered error.
- A successful test normally is one that uncovers an as-yet-undiscovered error.

In fact, if testing is conducted successfully, it will uncover errors in the system. As another advantage, testing demonstrate the system's functions appear to be working according to specifications and which performance requirements appear to have been met. Normally, a good test has the following attributes:

- High probability of finding a bug or errors.
- Should be neither too complex nor too simple.
- Not redundant.

6.1.1 Error Detection

Error detection involves identifying errors. This not only involves classical testing methods but also inspections and walk-through for error detection. At the unit level, these involve test strategies based on functional testing or behavioral testing.

6.1.2 Error Removal

Error removal involves debugging and other strategies for identifying where the error occurs in the code, the process necessary to identify what in the code causes the error and removing it. Debugging techniques such as performing traces, setting traps, identifying error states and identifying the algorithm, function or module in which the error occurred are applied to remove the errors that have been identified.

6.1.2 Error Tracking

In this section, whenever an error has occurred anywhere in the software, it means that somebody or something has failed. It is as important to find and correct the cause of the error, as it is to fix the error itself.

6.1.3 Regression Testing

Regression testing is testing to see like the fix or rework to the code actually fixes the error, fixes it in one place and breaks it in another or breaks the code in other places without actually fixing it at the point in the software where the fix was attempted. Regression testing is used to retest the system after functional improvement or fixes are

made to he product. The regression testing confirms that the fix to resolve the original problem has not created any new problems.

6.2 DLHB System Testing

DLHB involved three stages of testing. These three stages are The Unit Testing, Integration Testing and System Testing.

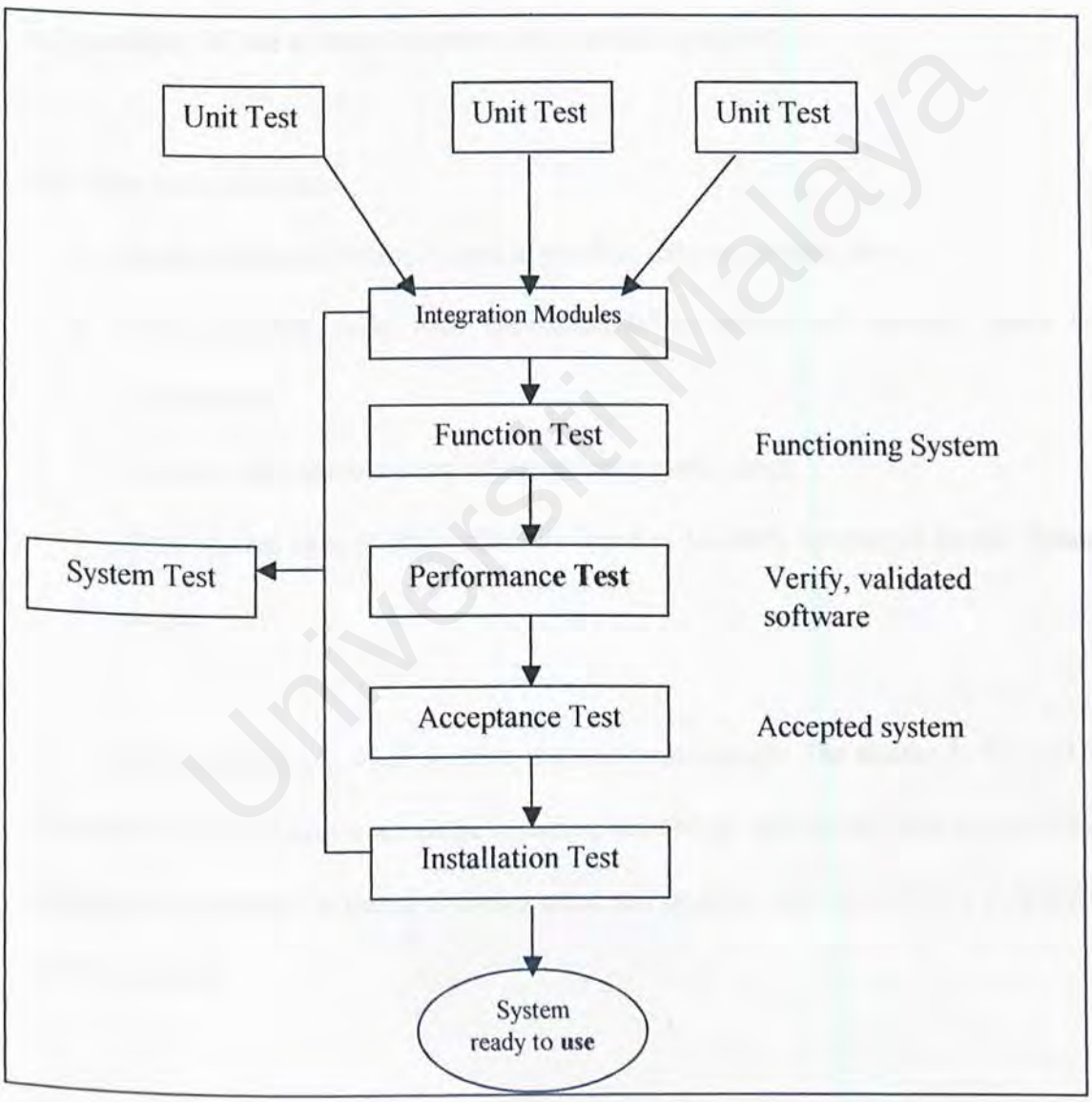

Figure 6.1 Flow Chart of Steps Used for Testing

6.2.1 Unit Testing

The objective of unit testing is to identify and eliminate both execution errors, which cause the program to abnormal terminate, logic errors, which are errors in accuracy and completeness of a program processing. The unit testing is white-box oriented and the steps can be conducted in parallel for multiple modules. Unit testing focuses on verification effort on the smallest unit of software design namely module. It is the initial stage for the completion of each module. Each module is tested independently of one another to ensure their correct operation.

The steps for unit testing:

- Reading the code, trying to spot algorithm, data and syntax error.
- Comparing the code with specification, to ensure all relevant cases are considered.
- Compile the code and eliminate remaining syntax fault.
- Develop test case to show that the input is properly converted to the desired output.

In the unit testing, each module is tested individually. The testing is focused on 4 modules. These modules are authentication, searching, upload and data manipulating module. Each module is tested to detect error and problem are solve before proceed to another module.

The following section discusses testing of each module:

a. Authentication

User Login

- Login as a student who has registered with the correct login ID and password. User has to register first before login into the system.
- Login as student with either incorrect login ID or password. The program will alert the user that they have entered wrong login name or password.
- User have to login to enable them upload files to database, the files can be shared by other users.

Figure 6.2 shows the partial source code of the authentication module:

```
<%

Set adoCon=Server.CreateObject("ADODB.Connection")
adoCon.Open "digilib"

Set rst=Server.CreateObject("ADODB.Recordset")

LoginName=request("USERNAME")
UserPassword=request("USERPASSWORD1")

sql="SELECT * FROM Student"
rst.Open sql,adoCon

Do While NOT rst.EOF
    if rst("LoginID")=LoginName and rst("Password")=UserPassword then
        Response.Redirect("viewstupro.asp?LoginID="&rst("LoginID")&"")
    end If
    rst.MoveNext
Loop

Response.Redirect("loginfail.asp")

%>
```

Figure 6.2 Authentication-Partial Source Code View.

Administrator Login

- Administrators have their own login name and password to enter the system.
- The administrator will give the login name and password by e-mail to teachers.
- Login with either incorrect login ID or password, the program will alert user that they have entered wrong login name or password.

b. Searching and Retrieval Module

- User can search and retrieved information about the historical building they want using keyword.
- The search results will appear after user click the search buttons. The results are arranged in alphabetical order.
- The scope of searching is limited to six historical building that we covered.
- User can also browse for historical building image and download it.
- Besides that user can also browse for information of Malaysian Historical Buildings Collection.

c. Uploading and Submitting Module

User Uploading

- User can upload their history project to the system. The upload files will be insert into the database.
- Users can upload binary data such as image, document and zip file to a database.

Teacher Uploading

- Teacher can upload binary data such as image, document and zip file to a database.

Figure 6.2 shows the partial source code (Loader.asp) of the uploaded module:

```
<%
Class Loader
Private dict
Private Sub Class_Initialize
Set dict = Server.CreateObject("Scripting.Dictionary")
End Sub

Private Sub Class_Terminate
If IsObject(intDict) Then
intDict.RemoveAll
Set intDict = Nothing
End If

If IsObject(dict) Then
dict.RemoveAll
Set dict = Nothing
End If
End Sub

Public Property Get Count
Count = dict.Count
End Property

Public Sub Initialize
If Request.TotalBytes > 0 Then
Dim binData
binData = Request.BinaryRead(Request.TotalBytes)
getData binData
End If

End Sub

Public Function getFileData(name)
If dict.Exists(name) Then
getFileData = dict(name).Item("Value")
Else
getFileData = ""
End If
End Function
```

```
Public Function getValue(name)
Dim gv
If dict.Exists(name) Then
gv = CStr(dict(name).Item("Value"))
gv = Left(gv,Len(gv)-2)
getValue = gv
Else
getValue = ""
End If
End Function

Public Function saveToFile(name, path)
If dict.Exists(name) Then
Dim temp
temp = dict(name).Item("Value")
Dim fso
Set fso = Server.CreateObject("Scripting.FileSystemObject")
Dim file
Set file = fso.CreateTextFile(path)
For tPoint = 1 to LenB(temp)
file.Write Chr(AscB(MidB(temp,tPoint,1)))
Next
file.Close
saveToFile = True
Else

saveToFile = False
End If
End Function

Public Function getFileName(name)
If dict.Exists(name) Then
Dim temp, tempPos
temp = dict(name).Item("FileName")
tempPos = 1 + InStrRev(temp, "\")
getFileName = Mid(temp, tempPos)
Else
getFileName = ""
End If
End Function
```

Figure 6.2 Uploading Files - Partial Source Code View

d. Data Manipulation Module

User Module

- User can view file that has been uploaded by teachers and other users.

Administrator Module

- Teacher can upload file to the database. Teachers can view the uploaded file by student.
- Teachers also have authority to delete file uploaded by the students and by themselves.

Figure 6.3 shows the partial code for delete uploaded file (delete.asp):

```
<%
If Len(Request.Form("ID")) Then

' Declaring variables
Dim form_id,sql_delete, con
form_id = CInt(Request.Form("ID"))

' Creating Connection Object and opening the database
Set con = Server.CreateObject("ADODB.Connection")
con.Open "digilib"

sql_delete = " delete from UploadedMaterial where ID = " & form_ID
con.Execute sql_delete
con.Close
Set con = Nothing
Response.Write "<P align=center><font color=blue><STRONG>Record No. : " &
form_ID & _
" was successfully deleted from the database."
Else
Response.Redirect "showall.asp"
End If
%>
```

Figure 6.3 Delete Uploaded Material –Partial Source Code View

6.2.2 Integration Testing

The integration testing is carried out after all the individual modules are tested and working correctly. The DLHB system carries out the integration testing to ensure valid linking and dynamic relationship establishments between sub modules of the whole system. Integration testing is carried out by testing two or more program together that are depend each other. Integration testing will usually uncovers errors associated with the interfacing among 2 or more modules.

There are about 4 approach of system testing such as top-down approach, bottom-up approach, Sandwish approach and Big Bang approach. The bottom-up approach is chosen in integration testing of DLHB system. It was a popular approached using in integration testing. When this method is used, each component at the lowest level of the system hierarchy is tested individually first. Then the next components to be tested are those that call the previously tested ones. This approached is followed repeatedly until all components are included in the testing.

For example consider the components and hierarchy in Figure 6.4.

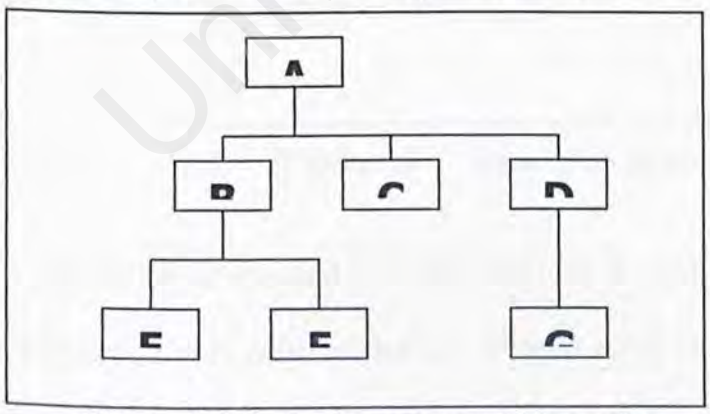

Figure 6.4 Example component hierarchy

To test this system from the bottom up, we first test the lowest level: E, F and G. When we are satisfied that those-three components work correctly, we move to the next higher level. Unlike, the lowest-level components, the next-level components are not tested separately. Instead, they are combined with the components they call. In this case we test B, E and F together. If a problem occurs, we know that its cause is either in B or in the interface between Band E or B and F, since E and F functioned properly on their own. Had we tested B, E and F without having tested E and F separately, we might not have been able to isolate the problem's cause so easily. Similarly, we test D with G. Because C calls no other components together. Figure 6.3 shows the sequence of tests and their dependencies.

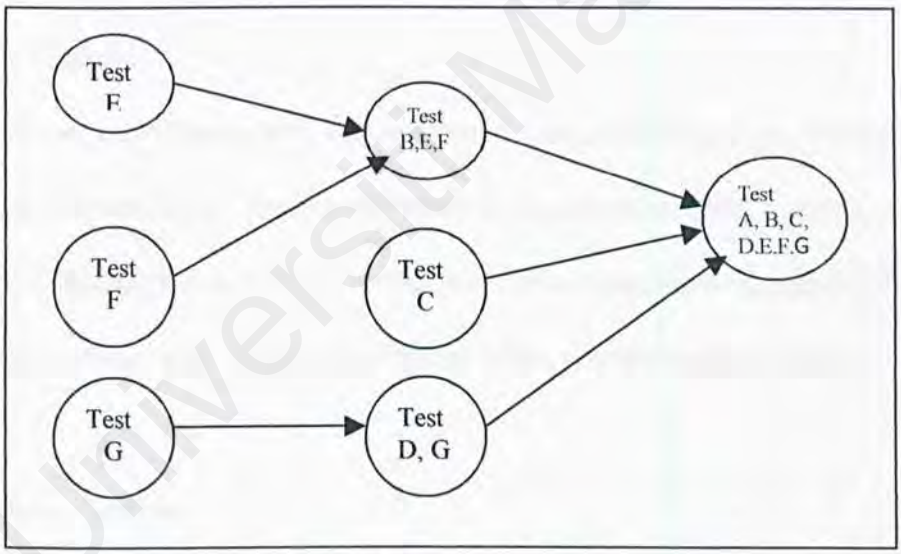

Figure 6.3 Bottom-up Testing

The bottom-up method is useful when many of the low-level components are general-purpose utility routines that are invoked often by others, when the design is object-oriented or when the system is integrating a large number of stand-alone reused components.

6.2.3 System Testing

Testing the system is very different from unit and integration testing. The objective of unit and integration testing was to ensure that the code implemented the design properly. In system testing, we have a very different objective: to ensure that the system does what the customer wants it to do. There are several steps in testing a system:

- Function testing
- Performance testing
- Acceptance testing

a. Function Testing

A function test checks that the integrated system performs its functions as specified in the requirements. These requirements, including security, accuracy, speed and reliability, constrain the way in which the system functions are performed. Effective function testing contains high probabilities to detect the system bugs and errors.

b. Performance Testing

Once the test is convinced that the functions work as specified, the performance test compares the integrated components with the nonfunctional system requirements of this system. These requirements, including security, accuracy, speed and reliability. Constrain the way in which the system functions are performed.

c. Acceptance Testing

After completing the functional and performance testing, user tests the system to determine that all the requirements met the criteria specified during initial stages of its development. Acceptance testing is carried out to determine that the system is really usable and is capable of meeting the users performance exceptions and requirements.

6.3 Errors Handling and Debugging

6.3.1 Error Handling

Error handling provides the ability to attempt to recover from infrequent fatal errors rather than letting them occurs and suffering the consequences. To create a clear, robust and fault-tolerant program, a program should anticipate possible script errors and fault-tolerant program; a program should anticipate possible script errors and include error-handling code in the program. The error-handling code should attempt to resolve the occur or return an appropriate message to the user. In case of both ASP server and client scripting. There are many tools that can be used to handle the occurs in scripting, including the run-time errors. The most important tools are the On Error Resume Next statement and the Err Object.

a. On Error Statement

The On Error statement enables an error-handling routine and specifies the location of the routine within a procedure. The On Error statement syntax can have any forms. They are:

- On Error Resume Next

When a run-time error occurs, control will go to the statement immediately following the statement where the occurred, and execution will continue.

- On Error Go To 0

  Disables any enabled error handler in the current procedure.

- On Error Go To line

  Enables the error-handling routine that starts at the line specified in the required line argument. The specified line must be in the same procedure as the On Error statement; otherwise, a compile-time error occurs.

b. Handling Errors with the Err Object

When an error does occur, Internet Explorer stores the error information in the Err Object.

To detect run-times errors, check the number property of Err object after each statement that might cause an error. If Number is zero, an error has not accured. If it is otherwise, an error has occurred. To retrieve information about the error, check the Description property of the Err object.

When an error occurs, the Err object will contain the error information until another error occurs. If a statement runs successfully, the Err object will not be cleared. Therefore, after an error occurs, invokes the Clear method of the Err object to clear the error.

6.3.2 Debugging

Script debugging is integrated into Microsoft Visual Interdev 6 and Internet Explorer 6.0. This integrated debugging tools has facilitated the DLHB system debugging works.

Debugging is the process of finding and correcting errors or bugs in the source code of computer program. This process allows Web developers to debug, edit and browse .htm and .asp files. These debugger works with VBScript, Jscript and other scripting languages. Debugging is enabled automatically for client script in a .htm page. To debug scripts in ASP pages, a programmer must first enable debugging and be running Microsoft Internet Information Server 5.0 or later.

If the browser or server encounters a syntax or runtime error in script, it displays a message that offers the opportunity to start the debugger at the line where the error occurred.

Features of the Visual InterDev debugger includes:

- Breakpoints

  Users can set breakpoints anywhere in code. In break mode user can single-step through the code. An immediate window will display the value of variables.

- Call Stack

  A call stack window display which procedures have been invoked.

- Syntax Coloring

  The HTML and script syntax is displayed with different colors to help reading and debugging script.

CHAPTER 7

Evaluation And Conclusion

CHAPTER 7 EVALUATION AND CONCLUSION

7.1 Introduction

Throughout of the development and implementation of DLHB, there are problems and difficulties encountered. Solutions have to be reached in order to solve the problem. Due to time constraints and some other factors, some of these difficulties have resulted the system limitations. This chapter will focuses on the evaluation of the system. Problem and solutions, system features and strengths, system's limitations and constraints, future enhancement as well as the knowledge and experience gained will be discussed in this chapter.

7.2 Problem Encountered and Solution

Some problems were encountered during the development of DLHB. These problems, together with the approaches taken to solve them are documented. The following are some of the major problems encountered during the development of the system.

7.2.1 Difficult In Choosing Development Technology, Programming Language and Tools

There are many technology and software tools are available nowadays in the market to develop a web-based system. As a result of this choosing a suitable technology and tools to develop the system is a critical process as all the tools have their own strengths and weakness. Besides, the availability of the required tool for

development is also to be considered. A though decision is needed to choose from among the available tools.

To ensure that the most suitable tools are chosen for this system, defining the need of the system is the first step. Then, by surfing the Internet and seeking advice from course mate, finally, the best combination of software development tools has been determined.

7.2.2 Lack of Web-based Programming Language

Since there are no prior knowledge of web-based programming there was an uncertainty on how to organize the codes in web page. This is a major problem at the concept of web-based programming is very much different from the normal stand-alone programming.

Basically the problem encountered in web pages coding involves the HTML coding, VB scripting, Java scripting and ASP programming especially the study of ASP which is very crucial to development of the system. This is due to the ambiguity and lack of knowledge of ASP programming language. Comprehending and understanding such a large amount of information in a short time was not an easy task. It was difficult to understand the functions, application level variables, session level variables and the recordset objects to ASP beginner.

Due to lack of web-based programming language knowledge, the coding phase is carried out using the trial and error approach and it has proven to be an efficient way.

Although it took time for me to learn the new technology, choosing to program in ASP however proved to be a wise action as most of the problems encountered are manageable through surfing the Internet for related materials and referring to reference books available in the market.

Therefore, surfing the Internet for information and reading up the concept of client-server and web-based programming which included the operation of web-server, are some of the approaches taken to overcome and solve this problem besides to have advice and guidance from course mates.

7.2.3 Difficulties in Setting Up SQL Server

Setting up the web server and SQL Server for the database is the initial stage in the development of a web-based system. The major problem occurs while the configuring the SQL Server during setup. The configuration was unsuccessful because the server not functioning properly. Hence, more effort and more time need to be spent in order to setup the server and working platform. To overcome the problem team members had decided to change to Microsoft Access 2000 as software for database development.

7.2.4 Retrieving Data and Inserting Data Into A Recordset

At the early stage of the development process, it was difficult to understand how the database is actually works. This is due to the ambiguity and lack of knowledge of database development. But after referring to reference books, searching the Internet for tutorials and discussing with the team members and course mate, did solve the problem although its took a lot of time.

7.2.3 Understanding the Error Messages.

The error messages from the Internet Information Server 5.0 usually comprise of error code and error message, which are sometimes blurred and unclear cause. To understanding the error messages involve process of debugging, correcting, undoing and testing it until the program is correct. Some error were solved with a clear understanding of why the error occurred but some were solved with a clear understanding of why the error occurred but some were solved with a clear understanding of why the error occurred but some were solved without knowing why the errors occurred or why the solution works. This is due of my poor and lack of experience in ASP programming.

7.3 System Strengths

DLHB demonstrates some good features in terms of certain functions and user friendliness. The following feature the strength of DLHB.

7.3.1 Provide An Easy to Use Tool

The layouts of DLHB are simple and well organized. It is easy to use and learn. The user without computer knowledge will find that it is easy to handle especially to the target user, the secondary school student. Most of the operations can be performed by 'pointing' and 'clicking', hence the user can navigate from page to page without much effort.

7.3.2 Provide Standard Interface and User Friendliness

The DLHB provides the standard interface. The standard interface will give the user a good image for the system and the user will have more confident to use this system.

7.3.3 Authentication

This system can be accessed user; they are students (users), teachers and administrator. Student must register with the system on-line to get the permission to access the system, whereas teachers will be given password to access the system. Every user has a login name and password where only authorized users are allowed to access the system. Users have to register to upload files to the system.

7.3.4 Search and Browse Functions

The DLHB is a focused on knowledge-sharing oriented portal. Therefore the development of an information-retrieval system is necessary to render information accessible and useful. The simple search basically provides basic information retrieval functions. On the other hand, the browse function allowed user to browse information and image of historical buildings.

7.3.5 Uploading and Submitting File

DLHB provide the upload function. Users can upload binary data such as text, image and zip file to the system. The upload function allowed register user and teachers upload their file to the database system. The uploaded file can be view by the user. These allow students to exchanged information with other register users and teachers. Teachers have access to delete uploaded file by students.

7.3.6 Informative Messages and Pages

The system will prompt out messages to the user when the user attempts to perform illegal action, such as wrong password and login name. These are helpful for the user because it allow the users to kept up-to-date with what is going on. The system also provides information module that include About Us, Frequently Asked Question, Help and related links of historical buildings in Malaysia.

7.4 System Constraint

Due to lack of experience of project team, time constraint and limitation of development tools, there are several limitation in this system, which can be, addressed in future enhancement.

7.4.1 Search Function

Although the DLHB provided the search function, the search function is not enough as there should be more function provided for user to get more useful information.

7.4.2 Forgot password

In DLHB, there isn't any function to retrieve your password if the user happens to forget his/her password.

7.4.3 Backup and Restore Function

The backup and restore function was mot considered earlier due to initial functional requirements. This information is very important if an accidental occurred causing damage to the system and database. So the contingency planning is needed because the disaster will cause loses to the organization.

7.4.4 Security

The system security is control by the login module. This will make it difficult to protect the database integrity and output the unreliable database. The unauthorized users can access to the system if they can crack the login module.

7.4.5 Tracking and Report Module

Administrator cannot track records by others criteria which are not provided by the tracking module. Therefore, tracking records is limited to the present criteria. The system also cannot generate chart or graph report.

7.5 Future Enhancements

7.5.1 Add More Search Function

It is suggested that more search function should be added. Current DLHB only provides some of the needed search function to generate main information. By the right, the user should be able to search the database on more categories.

7.5.2 Add Forgot Password Function

It is suggested that this function should be added in order to help the DLHB users who had forgot their password to retrieve their password. With this function, they don't have to reregister to login the system.

7.5.3 Add More Tracking and Report Function

Record tracking can be further enhanced to let the administrator customize the tracking criteria instead of the present criteria. Record tracking should generate report in graph or chart .

7.5.4 Automatic Backup and Restore Function

This function is important should an accident occurred and caused damage to the system and database. So, the contingency planning is needed to reduce loses to the minimum due to the disaster. The function should be in one proper manner and in such way that the important and critical data will be automatically backup daily. The restoration process should begin immediately once the disaster happens and causes damage to the database.

7.6 The Knowledge Gained

Much knowledge was gained throughout the development of DLHB. A lot of research, time and effort have been involved in making this project successful. The most valuable experiences is being able too go through the system development life cycle. Software engineering techniques were also applied in the software development.

Programming in VBScript, JavaScript for Active Server Pages (ASP) proves to be a valuable experience. The author has acquired a lot of new and valuable knowledge.

There is improvement in skills of finding information and solving problems besides an enriching experience in problem solving and acquiring the ability to work independently. Better documentation and report writing skills were also obtained.

7.7 Summary

DLHB has been completed successfully, with some strength as well and limitations as mentioned. However, some enhancement should be done in the future enhancement session so that it can become the most wanted system that meets all the users needs. DLHB assists to promote the nation's aspiration of the local electronic content of historical resources. DLHB plays a part in providing a place for sharing electronic resources online for teachers and students. Both teachers and students can upload history projects to this electronic resource-sharing portal. With the DLHB, teachers and students will be involved in resource development and benefit from it. This will promote e-learning process among secondary school students and teachers.

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