DIGITAL LIBRARY OF HISTORICAL BUILDINGS IN MALAYSIA (DLHB)

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Under the supervision of

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Abstract

The Digital Library of Historical Buildings in Malaysia (DLHB) is developed with its goal to offer historical resources on Malaysian buildings that is comprehensive and could be used by anyone, anywhere and at anytime. The objective of developing Digital Library of Historical Buildings is to provide secondary students with a convenient method to access specific local historical information from the digital library in completing their history projects or assignments. It is hoped that the implementation of DLHB could provide better maintenance of archival materials and user information. Teachers can be involved as collaborators to enrich the repository content and also manage previously submitted project reports which are excellent. Finally DLHB would contribute to enrich local content of historical information system. Functions that are provided by the DLHB system are search and retrieve, indexing list, registration, feedback, bulletin and the administration tools to upload, modify and delete information. The database of DLHB is a multimedia database which includes electronic text, scanned text, images, audio and video. The limitation of this system is that the database covers only some selected school buildings and tall buildings in Kuala Lumpur and Selangor. DLHB is developed under Windows 2000 as the server platform and using Internet Information Server 5.0 as the web server. Apart from that, SQL Server 7.0 is used as the database management system. Programming tools selected for the development of DLHB are HTML, ASP, and JavaScript. On the other hand, Microsoft Visual InterDev, Macromedia Dreamweaver and Adobe Acrobat are used as the software applications in developing the system. During implementation, three areas of development were taken into consideration, which are programming development, database development and web page design. Every single task has its

own problem but was solved by reading reference books and seeking help from colleagues. In the stage of testing and evaluation, different testing techniques were applied to ensure that the system fulfilled its functional and non-functional requirements. In addition, user acceptance test is carried out in a real environment in one of the selected secondary school in Petaling Jaya. It is hoped that the Digital Library of Historical Buildings (DLHB) will serve its purpose in shaping and contributing towards the current smart learning environments in Malaysia.

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CHAPTER

1

Introduction

Chapter 1 – Introduction

1.1 What is a Digital Library?

There are many definitions of a "digital library". Terms such as "electronic library", "virtual library" and " library without walls" are often used synonymously. Library Technology Reports, in a recent proposed the broadcast definition, " a digital library" is a collection of computer accessible information or a repository of such information. Other believe that a digital library consists primarily of digital information be it text, images, sound or other multimedia resources. These resources may be housed in one or multiple locations and are generally networked together in some fashion (Morrice, 1995).

1.2 Importance of Digital Library

The Internet has long been considered as one of the greatest inventions by mankind. Over the years, it has evolved from a scientific network to a platform that is enables a new generation of activities ranging from banking to learning in the comfort of ones own home. With the Internet, system are changing from the traditional, time consuming and rigid system to modern, paperless, fast, easy and flexible online systems that can be accessed anywhere around the world. Hence, digital library has become one of the greatest learning channels for students due to the invention of the Internet.

Digital Library has played an important role in the current learning environments. It helps the means to collect, store and organize information and knowledge in digital form. The data in the Internet are highly volatile, heterogeneous, unstructured and

redundant in many ways. With the digital library, it is able to promote the economical and efficient delivery of information to all individuals. Students can access the specific information from digital libraries anywhere and at anytime, to complete their projects or assignments.

Apart from that, digital library also encourages co-operative efforts which leverage the considerable investment in research resources, computing and communications network. It helps to strengthen communication and collaboration between and among the research, business, government and educational communities (Association of Research Libraries, 1995). This will definitely increase the quality of learning environment among the students.

1.3 Historical Portals and Digital Library

Web portals are sites on the World Wide Web that one can use to identify other useful web sites in a particular subject area. They are " roadmaps" to the wealth of education-related resources on the web. In other word, web portal comprises web site that aims to be a "door way" to the World Wide Web, typically offering a search engine and/or links to useful pages, and possibly news or other services (Dictionary.com, 2001).

According to definition from a dictionary (Longman English-Chinese Dictionary of Contemporary English, 1989), historical study is defined as a study that is connected with history, which represents a fact/facts of history. Thus, historical portal is the combination of the two features above, historical and web portal. The historical portal is categorized as a dedicated portal that provides wide-ranging information on

historical works or studies. By looking at the definitions of these two terms, it is concluded that historical portal is a part of the digital library. They play similar roles in enhancing current learning scenario.

Historical portal contributes to learning by providing students a better way in searching and accessing information related to historical subject. The education system advocates history as one of the compulsory subjects to be studied by the school students. History acquaints people, especially the younger generation, with the total tradition of human thought and experience, valuable materials and building, and past incidents. All of this valuable information of important figures and facts should preserved for posterity, and this is exactly the function of a historical portal. The historical portal will take full advantage of the Internet and contribute to the domain of learning. It helps students to learn in a more effective and efficient way in local history and culture.

1.4 Digital Library of Historical Buildings in Malaysia (DLHB)

This project proposed the development of a digital library of historical buildings in Malaysia (DLHB). This digital library consists of mainly two different contents, such as tall buildings in Malaysia (DLTB) and school buildings in Malaysia (DLSB). This project is developed by a team of two members, each in-charge of different types of historical buildings.

This digital library will be build according to the features existing in the web based digital library found in the Internet. The main characteristics that will be applied in this DLHB are search and retrieve functions, indexing list, updated and

comprehensive content, and the administration tools to upload, modify and delete information. The database is considered as a multimedia database which consist of information in the digital form like electronic text, scanned text, images, photographs, animated graphics, audio, video and other relevant format of files.

The final deliverable of this project is an online digital library of historical buildings that can be accessed by general users and specifically by teachers and students of history in secondary schools. With the implementation of this system, it is hope that it can bring benefits to all stakeholders.

1.5 Project Motivation

This project – "Digital library of Historical Buildings in Malaysia" is important, as its implementation will contribute to the current learning environment particularly in learning history of buildings in Malaysia.

There are a few points to rise on why this project is important:

a) Digital library acts as a reference source for students and teachers when searching for specific information on local historical buildings.

b) It is an online medium that allows the students and teachers to share resources and knowledge on local historical buildings.

c) It enables students to practice self-accessed and self-directed reference, at their own learning pace. This will certainly encourage students' active usage of Information Technology in the learning process in line with the government's Vision 2020.

d) In fact, there is no general-purpose source of Malaysian historical buildings online, thus, this project seem to become premier to establish a digital library on local subject.

e) Learning from an online digital library will be more interesting as it is possible to include material in various formats such as audio, video and animated images.

1.6 Project Goals and Objectives

1.6.1 Goals

The goal of this project is to develop a digital library of historical buildings in Malaysia that consists of selected collections which could expand over time in number and scope to cover different landmarks in Malaysia. It should offer historical resources that is comprehensive and can be used by anyone, anywhere and at anytime.

It is hoped that Malaysians can utilize this digital library in their learning process, especially the secondary school students who are undertook research for their historical projects. This is to fulfill the sixth challenge in Vision 2020, that is to establish a scientific and progressive society that is innovative and forward-looking (Adi, 1998). In other word, it is hoped that we can realize the vision to built an Information Technology society by encourage students to be more Information Technology literate.

1.6.2 Objectives

The objectives of this project are:

(a) To enable easy and fast retrieval information from the historical database.

- The digital library will provide search and indexing functions that enables students to search for the information within the scope particularly related to Malaysia historical buildings.

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

- It is to represent Malaysian historical information in a more interesting and interactive manner.

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

- The digital library can be managed and administered by authorized personal to expand and update information in the database.

(d) To provide better maintenance of archival materials and user information.

- The collections of the materials will be kept in a proper database that is flexible allowing developers to expand information from time to time.

(e) To provide another alternative or facility for students to search historical information.

- Despite going to public library, students can gain information needed by accessing different types of digital libraries from the Internet.

(f) To improve the inconvenience of separate physical locations on a large site.

- Students can search for information at their own computer and they do not need to travel to libraries which may be located in a different area.

1.7 Project Scope

1.7.1 Target Users

The digital library is considered as an online property that can be accessed by World Wide Web users. Targeted users for this digital library are the Internet users in general and in particularly the secondary school students in Malaysia. This is because the contents in this digital library comprises of information about selected historical buildings in Malaysia, such as well-known school buildings and tall buildings.

1.7.2 Target Content Area

This is a team project that involved two members in developing a "Digital Library of Historical Buildings in Malaysia (DLHB)". The contents covered by the prototype system are selected well-known tall buildings and school buildings. Limitation to the content of area is that it only covers historical buildings in Kuala Lumpur and Selangor. The author is in-charge of gathering information about several tall buildings in Kuala Lumpur and Selangor area. The other team member is responsible for gathering information on well-known school buildings.

1.7.3 Modules and Functions

With the purpose of providing a comprehensive, functional and extensive access to historical portal, the project team has identified eight modules for the project and each member will be responsible for developing four modules. The author will focus on the Authentication module, Maintenance module, Registration module and Information management module. Besides that, the author is also responsible for gathering information about selected well known tall buildings in Kuala Lumpur and Selangor.

(a) Authentication Module

The authentication module is mainly build for the administrator and teachers to provide them with the permission to access to the server database and back-end system, which is confidential to the public users. When they click on an "Administrator" button, there will be a prompt box to let them login and key in passwords.

There are two types of permissions for these users:

(i) Permission for administrators

- "Upload", "View", "Modify", "Delete" information.
- Change system password and add users to back-end system.

(ii) Permission for teachers

- "Upload" and "View" information.

Apart from that, this module also includes the authentication part for public registered users to login so that they can view some information in more details.

(b) Maintenance Module

Maintenance module served as the back-end system whereby only users with permission are allowed to access. Functions comprise this maintenance module are:

(i) Add / Upload

- To expand contents in the database with new information.
- To allow teachers to upload students' projects to database by using an upload template.

(ii) Modify and Update

- To modify or edit specific information in the database.

(iii) Delete

- To delete unnecessary outdated information from the database.

(iv) Database (data mining)

- Data in the database is included in the format of scanned text, electronic text, images / graphic file, photograph, audio / video file.
- Data is arranged in proper way so that it can be modified or edited by administrators.

(c) Registration Module

Registration module is a sub module that lets users especially students to register so that they can view other student's project report uploaded by their teachers. This registration purpose is to track on number of students that fully utilized the digital library.

A registration form is created and requires the student to register and they will have login name and password to sign in for viewing information in detail from the digital library. The registration is free of charge for all the students.

(d) Information Management Module

Information Management Module is quite simple in the sense that it is the part which provide information to the users for their further understanding of the digital library. Criteria in this module are:

(i) Home – to link back to the main page.

(ii) About us – to introduce the background of the developers of this digital library.

(iii) User Guide / How To – step by step to guide users in using digital library.

(iv) FAQ – Frequently Asked Questions to give overall view to new comers.

(v) Term & Condition – Statements related to copyright issue.

(vi) Preservation – The importance of preserving historical data.

(vii) Digital Collection – Collections of scanned text, images, audio and video that used for specific purposes by users.

(viii) Related Resources – Some related links that will be useful to the users.

Below are four modules that will be developed by the other team member.

(a) Search & Indexing Module

This module includes the search and retrieval functions and indexing lists that can be sorted according to categories like alphabetical listing, listing by year, by location and by people. It also includes an image collection that let users download required images.

(b) Feedback Module

Feedback module provides facilities such as sending mail program to let users send feedback and questions to person-in-charge. Its purpose is to improve the quality of the contents in the database. A form of questionnaire is created to collect users' response.

(c) Bulletin Module

Bulletin Module is a board in the digital library that lets the administrator post announcements or latest news to inform users of any updated content. This bulletin board allows the sharing of notices and communication between the users and the administrator or teacher.

(d) Sidebar Hyperlink Module

Sidebar Hyperlink Module is mainly related to design sidebar of the page and create hyperlink. An attractive sidebar template of the web pages is designed as interactive as possible. The user-friendly concepts will be applied here. Besides that, hyperlink of each web page is concerned under this module as it is an essential feature in creating web pages.

1.8 Project Plan and Methods

A development strategy must first be incorporated before we begin to develop the actual system. Development strategy referred as the software process model or software engineering paradigm. Software process model describes the way software development should progress and the way software development is done in actuality. As a result, it forms a common understanding of activities, resources and constraints that are involved. In addition, it helps to identify inconsistencies, redundancies and omissions so that the development process will become more effective and efficient (Pfleeger, 2001). This will eventually ensure the project's success.

There are several popular software process models such as the Waterfall Model, V Model, Prototyping Model, Incremental Model and the Spiral Model. There is no clear distinction as to which model is the "best" model for all projects. Moreover, each and every of the models has it's own strengths and weaknesses. The appropriateness of each model to a particular project depends upon the various factors involved such as resource availability, project complexity, requirements volatility and others.

The project members have chosen the Prototyping Model. This is because Prototyping is a useful model for medium complexity projects that focuses on the user needs and requirements. Generally, Prototyping Model is defined as a rapid development and testing of spike solutions is based upon known requirements for user review (Jones, 1998).

A prototype is rapidly developed and then evaluated by the targeted users to seek the constructive feedbacks from the user reactions, suggestions, innovation and revision. These evaluation results and feedbacks will then provide further refinements to the existing requirements. A new refined prototype is then quickly developed and the process loops until the users are satisfied and approved the final prototype. Figure 1.1 depicts the prototyping model.

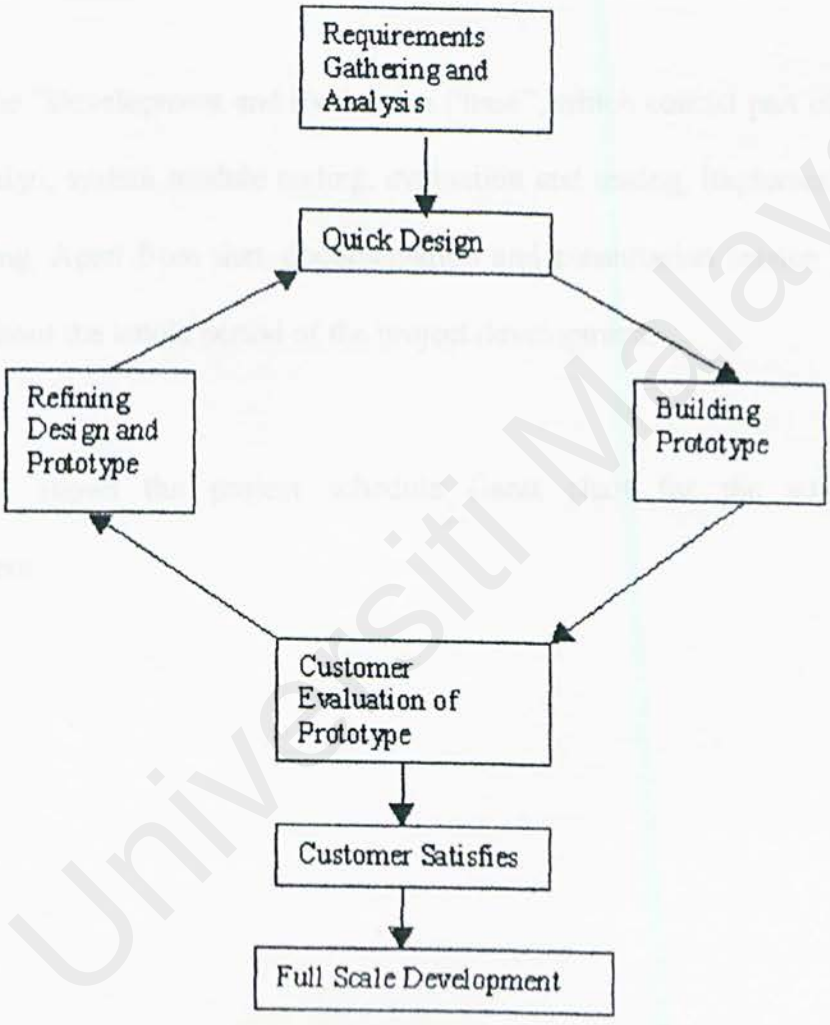

Figure 1.1 The Prototyping Model

The most significant rationale for applying this software process models comes from a very basic problem-solving approach. This is the importance of users getting an idea of how the system will function, and allowing the developer to gain an understanding of what are required.

1.9 Project Schedule

A project schedule is systematically planned to arrange time management and efficient working throughout the whole system development. Part 1 of the project development period is considered as the "Analysis, Design and Development Phase", whereby comprehensive system studies, literature review, user requirement study, viva, and initial system design are carried out.

Part 2 is the "Development and Evaluation Phase", which consist part of the initial system design, system module coding, evaluation and testing, implementation, and user training. Apart from that, documentation and consultation session are carried out throughout the whole period of the project development.

Figure 1.2 shows the project schedule Gantt chart for the whole system development.

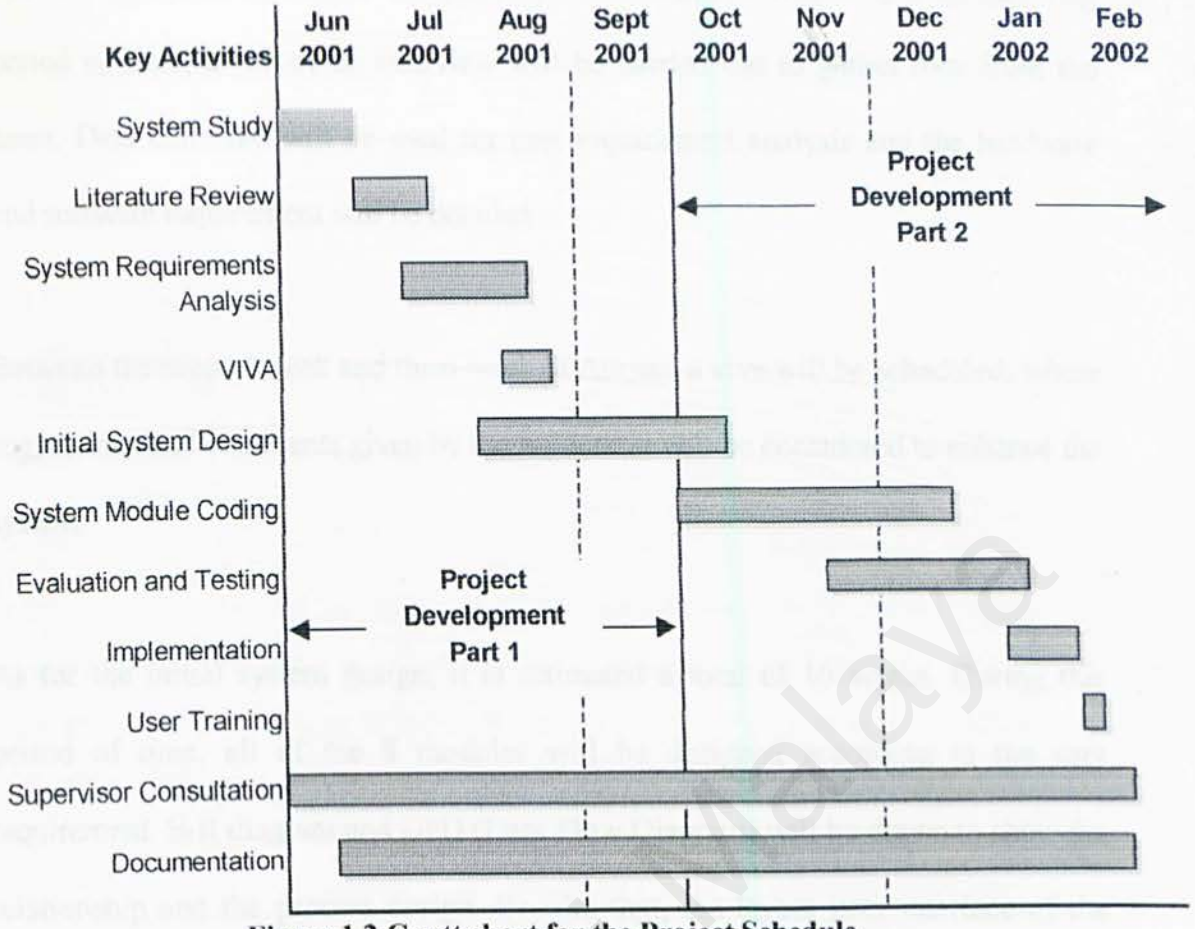

Figure 1.2 Gantt chart for the Project Schedule

1.9.1 The Project Schedule for Phase I

Three weeks are required for the system study, where the team particularly concentrates on defining the objectives, scopes, modules and contents of the project. Consultation with the supervisor takes place from time to time to clear misinterpret and problems encountered.

As for literature review, it is estimated that a duration of three weeks is needed to conduct the research from various sources. This includes information obtained from the Internet and the library.

System requirement analysis will be conducted within 5 weeks. During this long period of time, a survey or interview will be carried out to gather data from the users. Data collected will be used for user requirement analysis and the hardware and software requirement will be decided.

Between the second week and third week of August, a viva will be scheduled, where suggestions and comments given by the moderator will be considered to enhance the system.

As for the initial system design, it is estimated a total of 10 weeks. During this period of time, all of the 8 modules will be designed according to the user requirement. E-R diagram and DFD (Data Flow Diagram) will be drawn to show the relationship and the process design. Besides that, the layout user interface of the system will be designed as well.

1.9.2 The Project Schedule for Phase II

System model coding will take the longest period of time, which is about 11 weeks. This is due to the time consuming programming activities. Coding, debugging and correcting will take place for each module to ensure an effective and efficient system.

Upon completing the system module coding, evaluation and testing will be conducted for about 8 weeks. This is where the system will be integrated and tested from time to time to ensure that the system runs just the way it should. The supervisor will evaluate the system throughout this period of time.

Implementation of the final system is planned for 3 weeks in January. During the implementation stage, all modules will be integrated and will be reevaluating again. Users from a selected school will undertake this testing as well.

Finally, the last stage comprises user training which should extend one week in February. Its purpose is to train specific users on how to use the system and to train them for further enhancement and modification.

Supervisor consultation is carried out throughout the whole period of system development. The project is scheduled for a period of two semesters. The project team members are required to report the progress of the project to the supervisor at least once a week.

Project documentation is another important task to complete. It started on early in the month of June until the end of the project schedule. Documentation is important to keep record from time to time so that team members can refer back whenever problems are faced.

1.10 Chapters Summary

This section summaries the chapters proposed for this report.

1.10.1 Part 1 – Analysis, Design and Development Phase

There are four chapters under Part 1.

(a) Chapter 1 – Introduction

This chapter gives an introduction to the system and its objectives, as well as an overview of the proposal of the project. Sections contained here are the

project overview, project motivation, the goals and objectives, project scope, plan, methods, and last but not least the schedule of the project.

(b) Chapter 2 – Literature Review

In this chapter, the review of literature will be presented and existing similar systems will be analyzed. Research findings, review of the literature survey, summarization, analysis and synthesis of all the literature reviewed will be indicated. This chapter required references from the Internet, books, articles in journals, newspaper and other relevant sources.

(c) Chapter 3 – System Analysis

This chapter clearly identifies the methodology, mechanism and approach to be adopted. The quality of the proposed tools refers to the practicality of the chosen tools, effectiveness, and appropriateness in solving the problems is presented. System and user's requirement is also included in this chapter.

(d) Chapter 4 – System Design

The various components of the proposed system are clearly identified and explained in this chapter. The components include the architectural design, database design, functional design and also user interface design.

1.10.2 Part 2 – Development and Evaluation Phase

There are three chapters in Part 2.

(a) Chapter 5 – System Implementation

Under the specified design and development-operating environment, and in accordance to the designed blueprints, the system is developed. Following that, the system is implemented in the usual environment using real-time data. This is discussed in Chapter 5.

(b) Chapter 6 – Testing and Evaluation

The approaches for debugging and testing of the system are described here. The objectives, both achieved and unachieved, are outlined and the proposal of future work are considered. The problems faced and the solutions taken during the development period are highlighted.

(c) Chapter 7 – Conclusion and Future Enhancements

Following the conclusion on the finished system, the strengths and limitations of the final product are confirmed. A proposal for future enhancement is forwarded here.

At the end of the report, an overall conclusion based on the project development proposal is provided.

CHAPTER

2

Literature Review

Chapter 2 – Literature Review

2.1 Digital Libraries

2.1.1 History of Digital Library

With the ever expansion of Internet and World Wide Web, the topic of digital libraries becomes important. According to Li (1999), the history of digital libraries has been organized into three parts: early stage, booming ages and development period.

Early Stage

It is not clear when the first digital library came into being, but the concept did not appear until late 1980s. The emergence and development of digital libraries at this stage were driven by two main forces. First, digital technological development, and second, people wanted to share important information. As a result, the digital library systems came into being (Li, 1999).

In 1989, the World Wide Web project was first proposed and since mid 1993, it quickly grew at an exponential rate. Users could browse and set up a node on the network to put information on it. It was called by some people the beginning of a true digital library (Wilson, 1994). But the Web is a library without a card catalog, and many search tools or services were crude at the early stage.

Booming Ages

High levels of attention and funding were first given to digital libraries in the early and mid 1990s, which led to a booming era with large number of visions and

projects. Scholars in the field wanted to find ways to apply or create technologies in order to better use and share information on the network systems. The shared vision is best illustrated in the mission statement of Digital Library Initiative: "the Initiative's focus is to dramatically advance the means to collect, store, and organize information in digital forms, and make it available for searching, retrieval, and processing via communication networks" (Available Research, 1998). Digital Library Initiative (DLI) is the biggest, and the most important digital library research project among all.

Starting from 1994, DLI is a four-year multiagency research initiative sponsored by the National Science Foundation, Advanced Research Projects Agency, and the National Aeronautics and Space Administration. It demonstrates the US government's effect in building the National Information Infrastructure (Li, 1999).

Development Period

There is no clear-cut between the above era and this period. In many cases, they co-exist. The rapid expansion of the Internet and Web triggered, in some way, the sudden advances in the research and development in digital libraries, and at the same time proposes many questions to researchers.

Since 1995, various kinds of conferences, workshops and forums on digital libraries were held, and articles flooded discussing all kinds of questions from various perspectives on digital libraries. Digital libraries and digital library researches in Asia and Europe are also playing an active role. Recently, Digital Libraries Initiative Phase Two is proposed which "sought to provide leadership in research fundamental to the development of the next generation of digital libraries, to advance the use and

usability of globally distributed, networked information resources, and to encourage existing and new communications to focus on innovative applications areas." We believe digital libraries will continue developing with all these efforts (Li, 1999).

2.1.2 Characteristics of Digital Library

Define in a dry computerize manner, a digital library is a library that has reduced its contents to the dots and dashes of the binary code. These digitized pulses can carry music, voice, text or images that can be sent through telecommunication systems (Ang, 1995).

Ang (1995) pointed out that this definition, however, is difficult to grasp for the purposes of analysis. It is more helpful to define the digital library by its characteristics. From the user's perspective, the digital library is a library whose collection is largely stored, accessed or loaned out through these digitized means. There characteristics imply the following:

(i) A digitized library is computerized. The computer is used to capture, store and disseminate information.

(ii) Users have on-line access to the library's catalogue either through public terminals in the library or through telecommunications networks.

(iii) The library system allows for automated acquisitions, cataloguing and circulation.

(iv) Subscriptions to electronic information services like CD-ROM, on-line databases and multimedia services are essential.

(v) The library has dial-up access to local and overseas databases via telecommunications networks.

In brief, a digital library is one whose contents may not be visible to the eye, some form of equipment is necessary to access it (Ang, 1995).

A powerful and ubiquitous world information infrastructure is rapidly evolving from the tenuous personal, organizational, national and international networks that characterize today's information universe (Garrett, 1995).

According to Garrett (1995), while the technical, social and economic dimensions of this world infrastructure are still evolving, its necessary characteristic are already clear, some of this include:

(i) Ubiquity

- Some of the services must be accessible at any time from any physical location, although the level of service may vary by location.

(ii) Transparency

- The internal functioning of infrastructure components and interactions must be invisible to users. Users must be able to access services using their user interface of choice.

(iii) Robustness & scalability

- Powerful enough to withstand a wide range of potential risks and continue to function without disruption to users and service providers.

(iv) Security & confidentiality

- Include mechanisms which ensure that parties to any transaction can reliably be identified to each other, any goods and services which are exchanged conform to expectations and standards, the confidentiality

of the parties and the transaction can be assured where appropriate, and that the system cannot be easily compromised.

(v) Billing, payment, contracting

- Support both financial transactions in payment for goods and services and delivery and utilization of electronically generate and managed tokens.

(vi) Searching and discovery

- Must provide for a wide range of resource identification strategies, from highly specific searches to generic building browsing. Support user identification and access of the good or service that most closely satisfies a set of requirement.

2.1.3 Architecture for Digital Libraries

An architectural approach to the digital library is developed based on the two following notional architecture:

- A digital library approach to information management depends fundamentally upon a distinction between data and metadata. Metadata provide external classifying and organizing relations for data that may be unstructured, complex, or very large.
- Middleware services such as search, asset protection, and retrieval processes depend on metadata. Since metadata refers to data, which may be stored in separate hierarchical storage subsystems, integrity of reference must be maintained between metadata and data.

Operational Architecture

Operational architecture is an information management system represented in terms of the business processes it supports, and how information related to conduct of the business processes passes through the system's components.

The example shown in Figure 2.1 is an enterprise that conducts training by utilizing an extensive computer-based simulation system. The operational (business) processes, most obvious in the example, depend on the timely and well-organized capture of training information as it happens, and both contemporaneous and retrospective search and retrieval of information from a training event. Although the information is generated in several different enterprise domains (eight in the example), effective utilization of information often depends on cross-domain searches and retrievals. Therefore, digital library services must provide information interoperability in middleware (Ager, 1999).

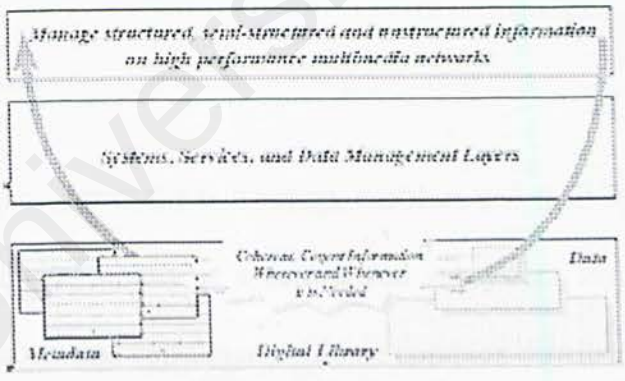

Figure 2.1 Operational Architecture

(Source: Ager,T. Architecture and Systems. WTEC Hyper-Librarian, 1999)

Technical Architecture

A technical architecture breaks down operational (business) processes into functional components and capabilities (Figure 2.2). Hardware and software implementations are still not resolved.

The utilization of digital library materials depends on the existence of metadata to give an efficient and accurate view of content. Metadata must be created as content is added to the digital library. Metadata and data must be bound together logically, and there must be a robust underlying technology to manage the logical connection through time, across platforms, and over geographical separations, all on a networked, distributed system (Ager, 1999).

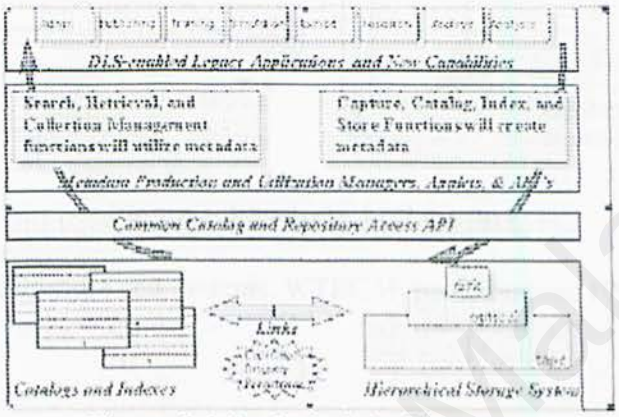

Figure 2.2 Technical Architecture.

(Source: Ager,T. Architecture and Systems. WTEC Hyper-Librarian, 1999)

Systems Architecture

A systems architecture shows the technology enablers and their inter-relationships. In Figure 2.3, the digital library is a centralized subsystem that interacts with a variety of data producers and consumers within a complex distributed system.

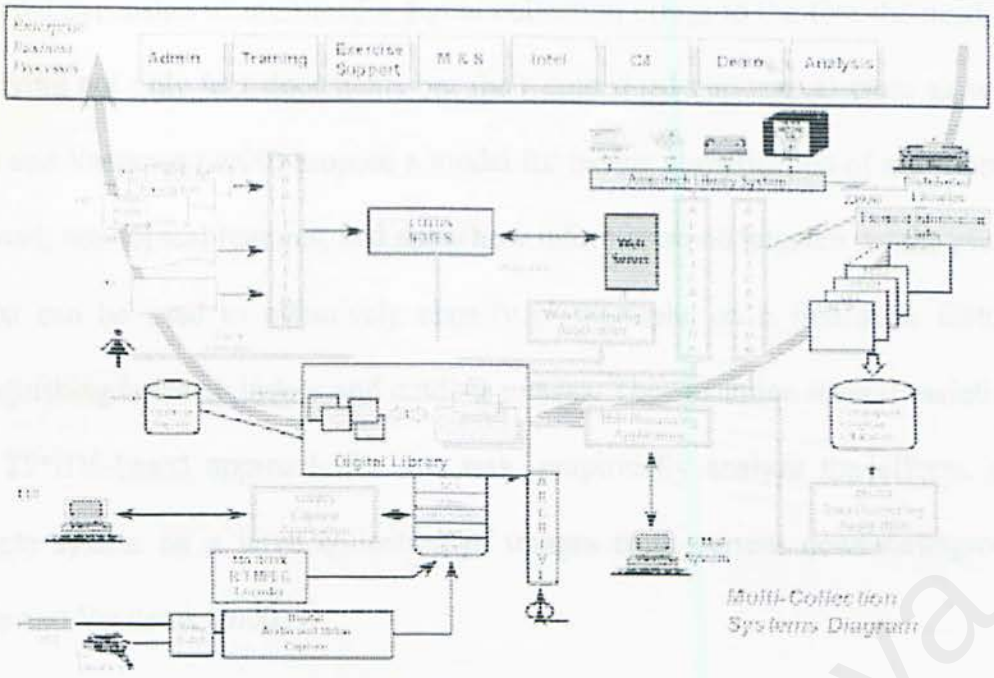

Figure 2.3 Systems Architecture

(Source: Ager,T. Architecture and Systems. WTEC Hyper-Librarian, 1999)

A fully detailed systems architecture resolves into software and hardware systems. Desirable systems properties such as scalability and extensibility can be taken into account at the systems architecture level. The systems architecture is rationalized relative to the operational and technical architectures (Ager, 1999).

2.1.4 Building Digital Collection

To most of us, "digital" means information that is accessed via computer. The computer has been equipped with whatever it takes to make the data connection and transfer possible. "Collection" is a group of parts that fit within defined specifications. In the library, "digital collections" are sources of information that come in a digitized format, are organized into defined groupings and are available and accessed using a computer (Holtum, Lord and Martin, 1997).

The rapid expansion of multimedia digital collection brings to the fore the need for classifying not only text documents but their embedded non-textual parts as well. Sable and Vasileios (2000) propose a model for basing classification of multimedia on broad, non-topical features, and show how information on targeted nearby pieces of text can be used to effectively classify photographs on a first such feature, distinguishing between indoor and outdoor images. They examine several variations to a TF*IDF-based approach for this task, empirically analyze the effects, and evaluate system on a large collection of images from current news newsgroups (Sable and Vasileios, 2000).

2.1.5 Metadata

Metadata is the data that describes the content and attributes of any particular item in a digital library. It is a concept familiar to librarians because it is one of the primary things that librarians do--they create cataloguing records that describe documents (Cleveland, 1998).

Metadata elements listed in the table are categorized according to three types: descriptive, administrative, and structural. Administrative metadata is used for managing and preserving objects in the repository; structural metadata is used primarily for storage of objects in a repository and for presentation; descriptive metadata is used for discovery of objects. The elements defined in the metadata table are to support structural and administrative functions. Functions served are access management, administration, discovery, persistent identifier, presentation, digital preservation and preservation reformatting (Library of Congress, 2000).

A hierarchy of information is proposed to accommodate the diversity of digital objects and to propagate data with some efficiency. Metadata elements may be supplied at multiple and various levels. Nesting of objects is expected and will be further clarified during the pilot phase of metadata capture and deposit. Information may be inherited from parent levels or may be specific to single objects at a lower level. For example, a collection may have general access rights but some of its items may be restricted. The access_rights attribute value on the collection (set or aggregate level) may be "public," but a single title (primary object level) in the collection may be "restricted."

The levels of metadata are set, aggregate, primary object, intermediate object and terminal object (Library of Congress, 2000).

2.1.6 Identifiers, Naming and Persistence

Identifiers

Libraries traditionally use unique identifiers for physical items in their collections -- by assigning call numbers and sticking labels on covers. A reader who identifies a book in a catalog can retrieve it by going to the shelf and looking for the label.

Meanwhile, digital resources must also be identified uniquely. Until recently, no attempt was made to provide standard names for digital resources in general, except for very limited applications or in closed systems, such as within a single database. However, a digital library built for the long-term cannot be a closed system. It must be built out of modular components that can be supplemented and upgraded as new technology is developed. As in the traditional collection, the name for an item in the

digital library will be the "key" that links catalogs, compilations, and references to the item itself (The Library of Congress, 1996).

Naming

The characteristics of digital resources pose challenges for naming. A file has no "cover" on which a label can be permanently fixed, and available to any user even if the file is copied to another computer. The only "cover" for a generic file is its filename. For digital resources that comprise a single file and have a fixed location, filenames do provide a basis for naming. Every file attached to a particular computer, whatever its operating system, must have a name, and the full name (which includes the "path" of nested directories in which the file is stored) must be unique within that computer's file system. Since every computer on the Internet (or any other computer network) must have an identifier unique across the network, the combination of computer identifier and filename provides a unique identifier for any file on the Internet.

Uniform Resource Locators (URLs), the identifiers used on the World Wide Web (WWW) today, generalize the two-part identifier (computer name, file name) by adding a third component specifying the network protocol which should be used to access the file. The addition of the protocol component to the identifier allows names to be given to resources that are not files, such as interactive terminal sessions or database query forms (The Library of Congress, 1996). Figure 2.4 depicts an example of primary access paths to American Memory collections.

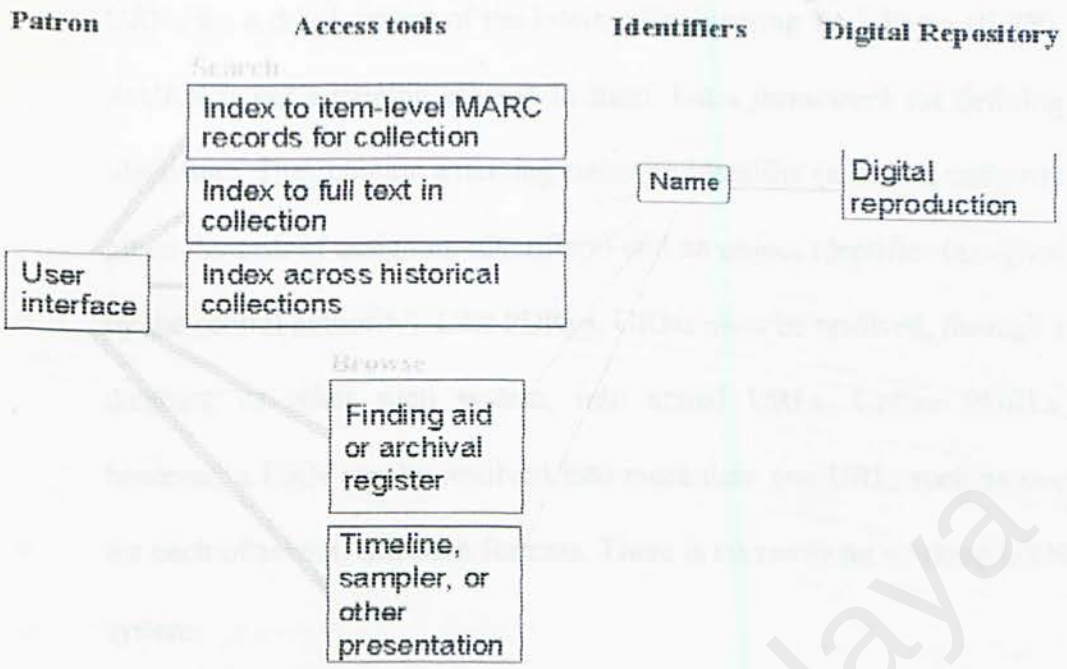

Figure 2.4 Primary access paths to American Memory collections

Persistence

Cleveland (1998) mentioned three examples of schemes proposed to get around the problem of persistent naming are PURLs, URNs, and Digital Object Identifiers.

a) PURLS.

- PURLs are persistent URLs. They are a scheme developed by OCLC in an attempt to separate a document name from its location and therefore increase the probability that it will always be found. PURLs work through a mapping of a unique, never-changing PURL to an actual URL. If a document moves, the URL is updated, but the PURL stays the same. In operation, a user requests a document through a PURL, a PURL server looks up the corresponding URL in a database, and then the URL is used to pass the document to the user.

b) **Uniform Resource Name (URN).**

- URNs are a development of the Internet Engineering Task Force (IETF). A URN is not a naming scheme in itself, but a *framework* for defining identifiers. They contain a naming authority identifier (a central authority given the task of assigning identifiers) and an object identifier (assigned by the central authority). Like PURLs, URNs must be resolved, through a database or other such system, into actual URLs. Unlike PURLs, however, a URN can be resolved into more than one URL, such as one for each of several different formats. There is currently no working URN system.

c) **Digital Object Identifier (DOI) System.**

- DOI is an initiative by the Association of American Publishers and the (American) Corporation for National Research Initiatives designed to provide a method by which digital objects can be reliably identified and accessed. The CNRI Handle system, which underlies DOI, is a system that resolves digital identifiers into the information required to locate and access a digital object. The main impetus of the DOI system is to provide publishers with a method by which the intellectual property right issues associated with their materials can be managed.

2.1.7 Copyright Management System

Copyright issues will be important to digital libraries. Participants of the copyright issues are copyright owners, authors, and publishers. The objectives are fee licenses and contracts for digital network use of published copyright materials. The final products should be copyrighted information (on-line) in digital libraries (Chen, 1995).

As computer databases become more publicly accessible through public networks, there is a growing need to provide effective protection for proprietary information. Without adequate assurances that their works will be protected, authors and other copyright owners may be reluctant to allow the full text of their works to be accessed through computer networks (Lyons, 1989).

The digital library system must include fast and powerful methods for managing intellectual property in a distributed networked environment (Garrett, 1995). The digital library copyright management system must:

- Provide for confidential, automated rights and royalty exchange.
- Ensure owners and users that information is protected from unauthorized accidental or intentional misattribution, alteration or misuse.
- Ensure rapid seamless, efficient linking of requests to authorization.

2.1.8 Building Components

According to Chen (1995), the basic components of a digital library (or any information infrastructure) include the following:

- Hardware, including storages systems, personal computers, high-end workstations, supercomputers, wireless laptops, smart TVs, sensors and peripheral devices.
- Software, including expert systems, database management systems, information retrieval algorithms, network management systems, application programs, visualization packages, and user interfaces.

- Infoware, including information services, databases, knowledge bases and information repositories which contain text, voice, video, graphic, images, movie, and hypermedia information.
- Also included in a digital library are the following system interface:
  - Information hardware-to-network
  - Information hardware-to-application
  - Application-to-application
  - Network-to-network

2.1.9 Issues and Challenges

Digitization efforts within the Library are being undertaken on an ad hoc basis, without the benefits of: cohesive vision and direction; strategic assessment of priorities; coordination of projects, expertise, and equipment; a broad view of customer needs; or an informed mechanism for project selection. Consequences of this situation include: ineffective use of human and financial resources; repeated learning by dispersed groups of key and often complex concepts, technologies, skills; failure to maximize economies of scale; inability of involved staff to dedicate adequate, undivided time and attention to learning and project development (University of Arizona Library, 1998).

The technological capability to store a range of digital material offers great potential for fast access to information. Computerization of library services such as catalogues and index / abstract services in the 1980s was only half the story. Now people expect more when they find a reference or citation-they also want to obtain the book, the article, the video, the map, the photo or the painting from the same source, and at the

same time. The Internet is providing the delivery mechanism and fuelling those expectations, and there is high-level technology available for the conversion and storage of digital library information (Wilson, 1995).

But there are some major hurdles to be cleared on the way:

a) Imaged digital files required large computer storage space.
b) Searching interfaces are needed which are easy to use but do not hide the complexity of the retrieval software used.
c) Network transmission is still slow for some digital files and can affect the quality of the documents being transmitted.
d) Methods and standards of digitization and compression of images are varied and affect quality of the product.
e) High-level machines may be required to obtain digital library information at the receiving end.
f) Copyright issues are limiting content.

2.2 Research and Development in Digital Library

Digital library basically store materials in format and manipulate large collections of those materials efficiently. Research into digital libraries is research into network information, systems, concerning on how to develop the necessary infrastructure to efficiently mass-manipulate the information on the Net. The key technologies issues are how to search and display desired selections from and across large collections. The initiatives focus is to dramatically advance the means to collect, store, and organize information in digital form, and make it available for searching, retrieval, and processing via communication networks-all in user-friendly ways.

The research and development of digital libraries are no easy task. They involve a large number of topics in library, information and computer sciences such as information indexing and retrieval, collection development, database management, reference services, human-computer interaction, interface design, digitalization and preservation, intellectual property, networking and interoperability, and etc (Li, 1999).

2.2.1 University of Virgina

Background

The Library of University of Virgina formed a research and development department in 1999 to develop the systems and approaches necessary to integrate all of the digital resources that created and for negotiate access. The general mission of the department is to develop the systems, tools and procedures needed to provide access to the digital resources and services in a major university research library in the 21st century. The primary assumptions are:

- Though digital collections and services will continue to develop rapidly, traditional collections and services will continue to be very central to the Library's activities and the digital library must be tightly integrated with them across the entire library.

- It is imperative that this department have a management system that makes it possible to keep track of all of the digital resources, the computer programs that needed to deliver them and all of the appropriate metadata as one complete, integrated collection. They must be able to do this tracking from

production, purchase or other source of acquisition, through long-term preservation, as appropriate.

- The digital collections will include resources in all content areas in a variety of media and encoding types.
- They must provide the tools that deliver a sophisticated level of access to all of our digital resources for a variety of users, both inside the University and to the outside world, as appropriate.
- Increasingly, they will be connecting to other repositories to retrieve digital resources that either buy or otherwise negotiate access to. The system should be prepared to interoperate with the other repositories to provide the most integrated access possible.

The Big Picture

The Digital Library Research and Development Group has been charged with developing a digital library management and delivery system that can serve a research library with broad, comprehensive electronic collections (University of Virgina Library, 1999). Figure 2.5 shows the big picture for the overall view of the digital library research.

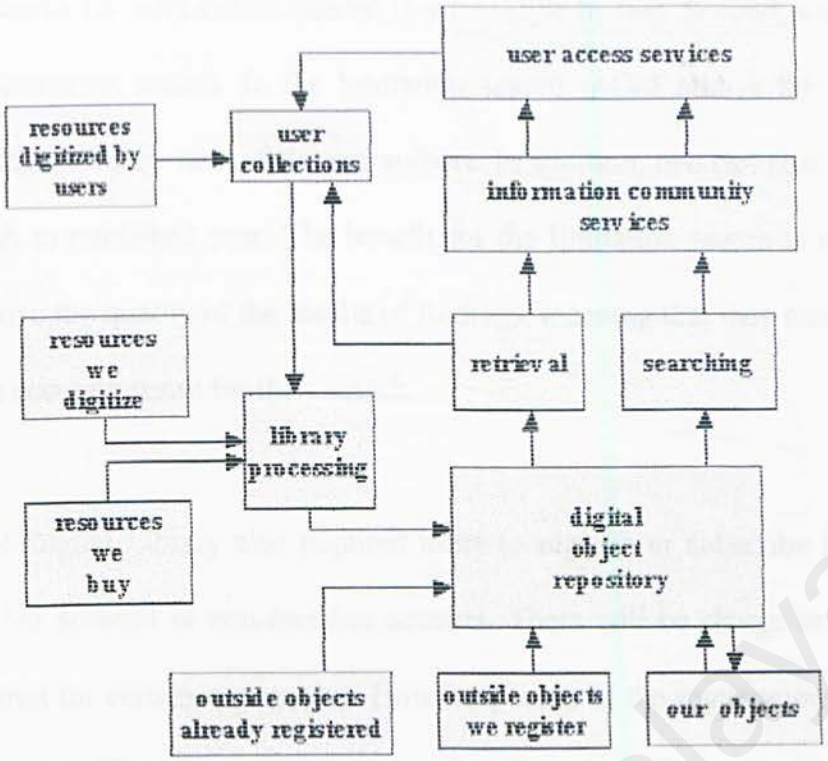

Figure 2.5 The Big Picture of Digital Library Research in University of Virgina

2.3 Historical Portals in Digital Libraries

2.3.1 Existing System Analysis

(a) ACM Digital Library

ACM Digital Library is one of the largest digital libraries. This digital library can be accessed via URL, http://www.acm.org.dl/ . From the main page of this digital library, it is stated some links on the page to navigate through other pages to get further information from the library.

Basically, search function is the common feature that we can find from any digital libraries on the Web, this is included in ACM Digital Library. There are two ways in using the search function in ACM Digital Library. First, we

can search for information needed in a free style by text. Second, we can use the limitation search. In the limitation search, ACM allows the users to search articles by term, field and authors. In addition, one can also limit the search to published year. The benefit for the limitation search is users can improve the quality of the results of findings, meaning that they can obtain a more accurate result for their search.

ACM Digital Library also required users to register or subscribe for either member account or non-member account. There will be charge or payment required for certain registration. However, some of the registrations are free of charges. The advantage for those who subscribe ACM is they can access to certain links in the library, for instance, "My Bookshelf".

Apart from that, ACM also provided a feature called feedback. When users click on it, there will be a send mail program to let users send their feedback to the person in-charged. Other features that appear in ACM digital library are information links to let users know more about this digital library.

ACM Digital Library provides variety features as compare to other digital libraries. However, the interface design for ACM is not very attractive. This is due to the burden of text on the first page. Users will feel that the main page is not very user-friendly. It is suggested that some of the permanent features can be replaced by icon or graphic instead of text. Figure 2.6 shows the captured screen of ACM Digital Library.

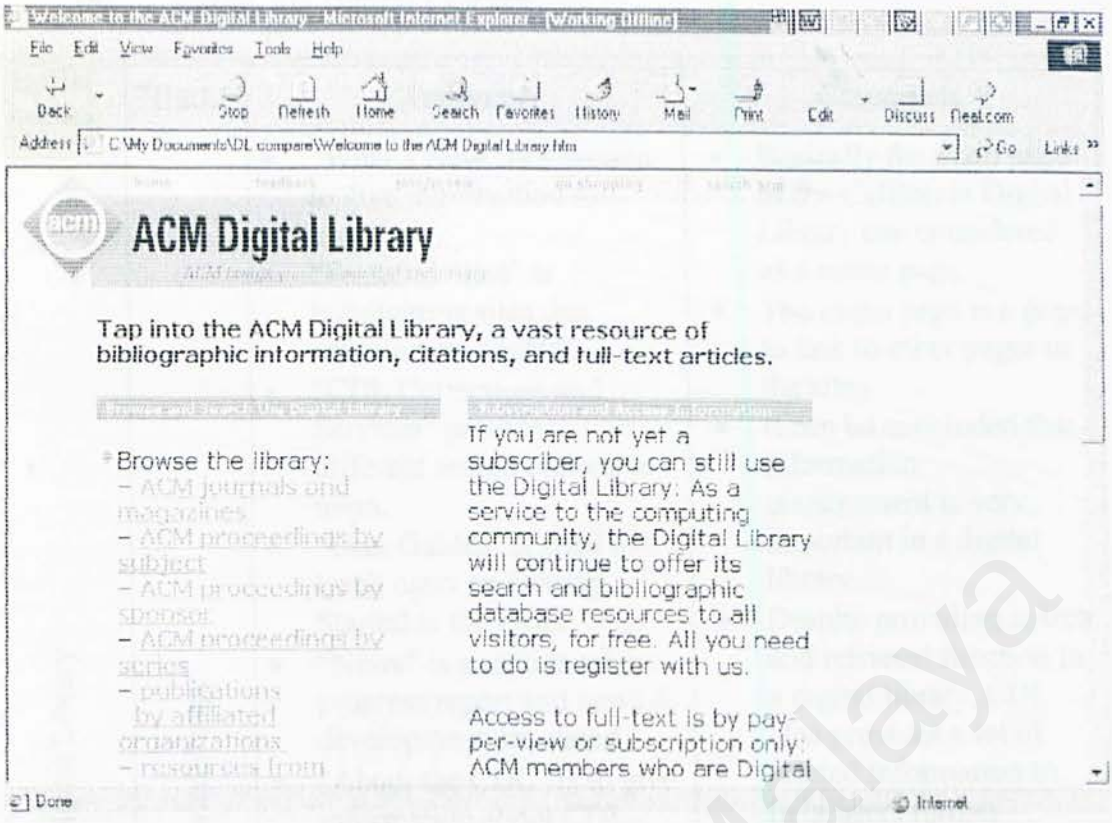

Figure 2.6 Captured Screen of ACM Digital Library

(b) California Digital Library

Initial System	URL	Features	Comments
California Digital Library	http://www.cdlib.org/	• "What's New" is a section to give introduction to users. • "Featured Sites" is highlighting sites that contain new content. • "CDL Collections and Services" provides different search options to users. • "User Guides" is used to teach users on Getting Started in the CDL. • "News" is a section where progress report and news & development are stated. • "About the CDL" is to give information about CDL. • "CDL Quick Links" provides different search functions. • "Copyright" point out terms and conditions for CDL. • "Credits" is to appreciate the developers of CDL. • "Search" is used to search the Internet, Books or Journal, Site Search and Directory Search. • "Feedback" includes a questionnaire for users to fill in and submit their feedback.	• Basically the main page of the California Digital Library can considered as a menu page. • The menu page is a page to link to other pages in the sites. • It can be concluded that information management is very important in a digital library. • Despite providing search and retrieval function in a digital library, CDL also provides a lot of related information to help users further understanding to this digital library. • The user interface design for CDL is quite interactive. • The search function included both free text search and limitation search. • Feedback questionnaire is good because it makes the feedback process easier.

(c) Berkeley Digital Library SUNSITE

Initial System	URL	Features	Comments
Berkeley Digital Library SUNSITE	http://sunsite.berkeley.edu/	• "What's New" is to update any news in digital library. • "Site Index" is used to facilitate access and list major site locations. • "Administration & Policy" is giving information on copyright statement, credits, and etc. • "Other SUNSITES" provides links to SUN web site. • "Catalog & Indexes" similar to search function. • "Help/Search" is to provide help for users to choose either search in digital library or search from the Internet. • "Java Corner" is a corner to teach Java Language. • "Teaching & Training" is an indexing site sorted under different topics. • "Collections" provides easier way in searching for digital collections. • "Information" stated information such as metadata, preservation, imaging, copyright, etc. • "Research & Development" tells users about the project related to digital library under SUN. • "Tools" mentioned about the software using to build digital library. • "FAST ACCESS" is used to search according to Journal. • Information at the bottom stated copyright and contact.	• User interface design is quite neat and applied to user-friendly concept. • Every link on the main page is arranged in column and it is easier for the users to click and link. • This digital library is more or less like an education center because despite let users to search for information, it also provides tutorial (Java Corner) or training (Teaching & Training) on certain topic. • It also tells users about some technical information which might be useful for other developers. • Mostly applied to indexing listing. • A good example of digital library.

Figure 2.7 and Figure 2.8 below depict the captured screen of the California Digital Library and captured screen of the Berkeley Digital Library SUNSITE respectively.

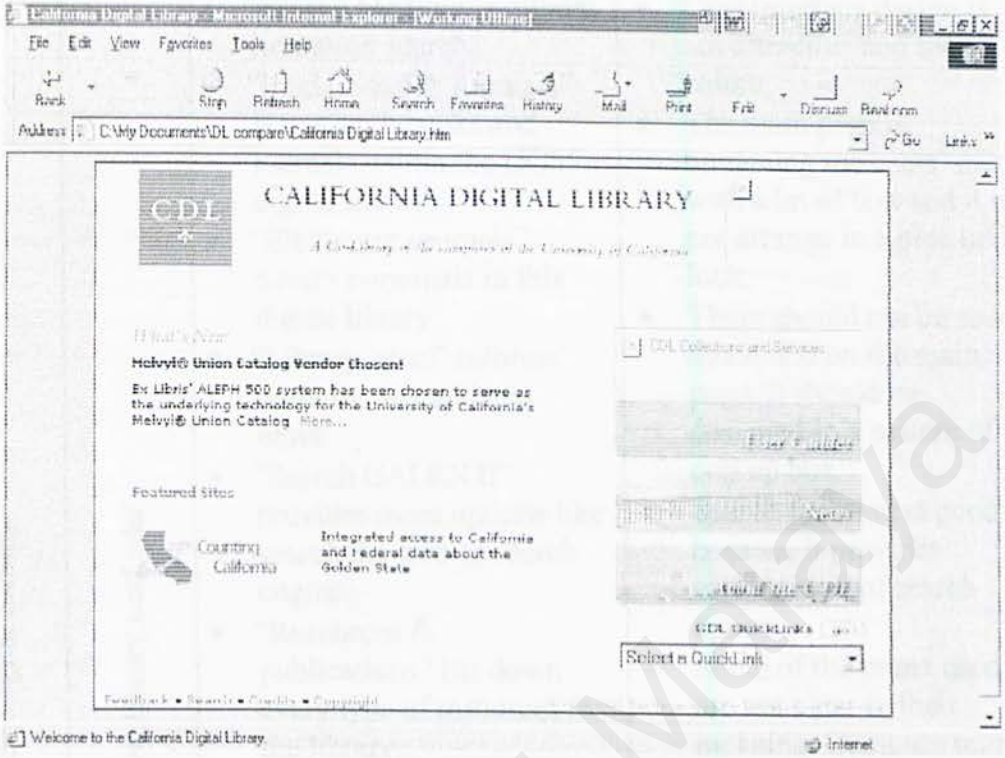

Figure 2.7 Captured Screen of California Digital Library

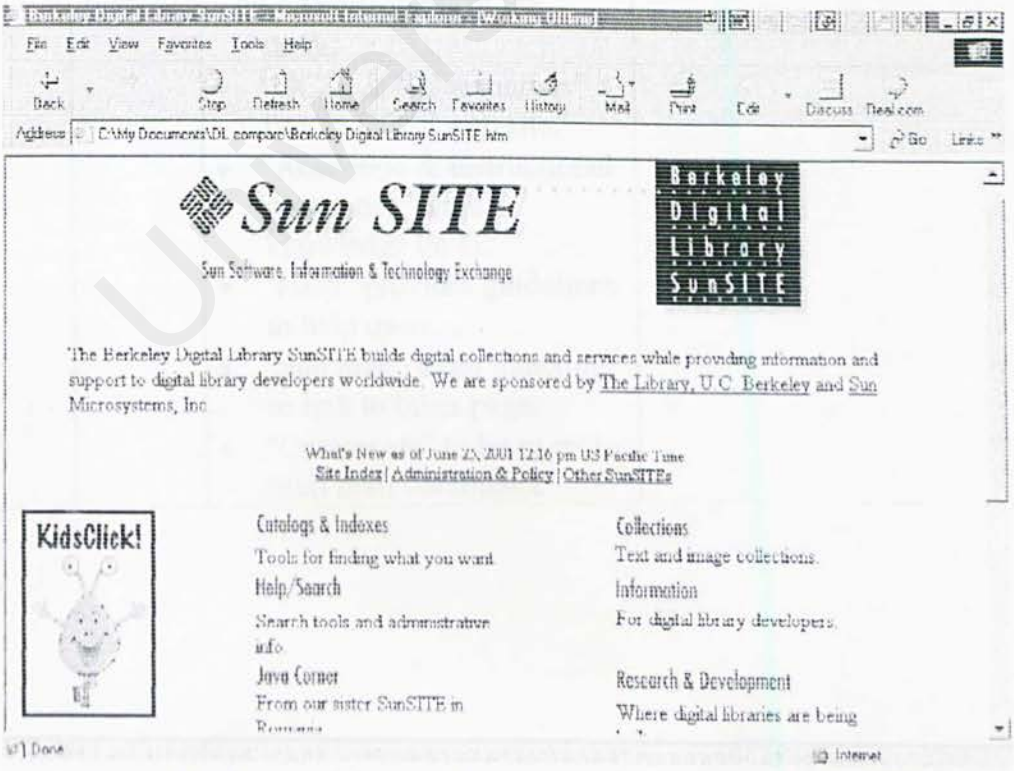

Figure 2.8 Captured Screen of Berkeley Digital Library SUNSITE

(d) The UCSF Digital Library

Initial System	URL	Features	Comments
The UCSF Digital Library	http://www.library.ucsf.edu/	• "Search Medline" provides limitation search. • "Find Books & Journals" is to search books and journals within the UCSF digital library. • "Electronic Journals" covers e-journals in this digital library. • "Library news" informs users for any updated news. • "Search GALEN II" provides more options like search the web or search engine. • "Resources & publications" list down every type of resources in the library. • "Highlights" sort out links according to topic. • "Services" provides help and collections to the users. • "UCSF & UC resources" link to UCSF web site. • "Academic & instructional computing" give knowledge on IT. • "Help" provides guidelines to help users. • "Site map" as an indexing to link to other pages. • "Comments" to let users to mail their comments.	• User Interface design is not attractive and mono colour. • The main page is burdening the users' eye with a lot of text and it is not arrange in a nice table look. • There should not be so much text on the main page. It should be designed in a pattern of pop up box. • Search function is good because it provides various type of search options. • Some of the terms used are not clear in their meaning. Common terms should be used so that users are not confused.

(e) **Digital Library Federation (DLF)**

Initial System	URL	Features	Comments
Digital Library Federation (DLF)	http://www.diglib.org/dlfhomepage.htm	• "What's New" shows any updated news arranged in periodically order. • "About" give information about DLF. • "Architecture" mentioned technical initiatives involved in building DLF. • "Preservation" stated out the research report of preservation. • "Collections" divides into two parts, such as new online collections and collections strategies. • "Standards & Practices" gives information of DLF activities. • "Use & Users" is regarding DLF sponsoring initiatives to help other libraries. • "Role & Responsibilities" stated out policies, organizations and practices. • "Forums" mentioned of forums organized under DLF. • "Publication & Resources" shows working papers, reports, and information resources. • "Search" provides two type of search functions such as normal text search and search within different site. • "Contact DLF" provides information of contact. • "Feedback" tells your thought to DLF.	• User interface design is quite attractive and using side links as navigations. • Overall features in DLF are similar to other digital libraries. • Compare to others, this digital library provides too much information related to the characteristics of digital library. • This library does not list down the content provided.

Figure 2.9 and Figure 2.10 below depict the captured screen of The UCSF Digital Library and captured screen of the Digital Library Federation (DLF) respectively.

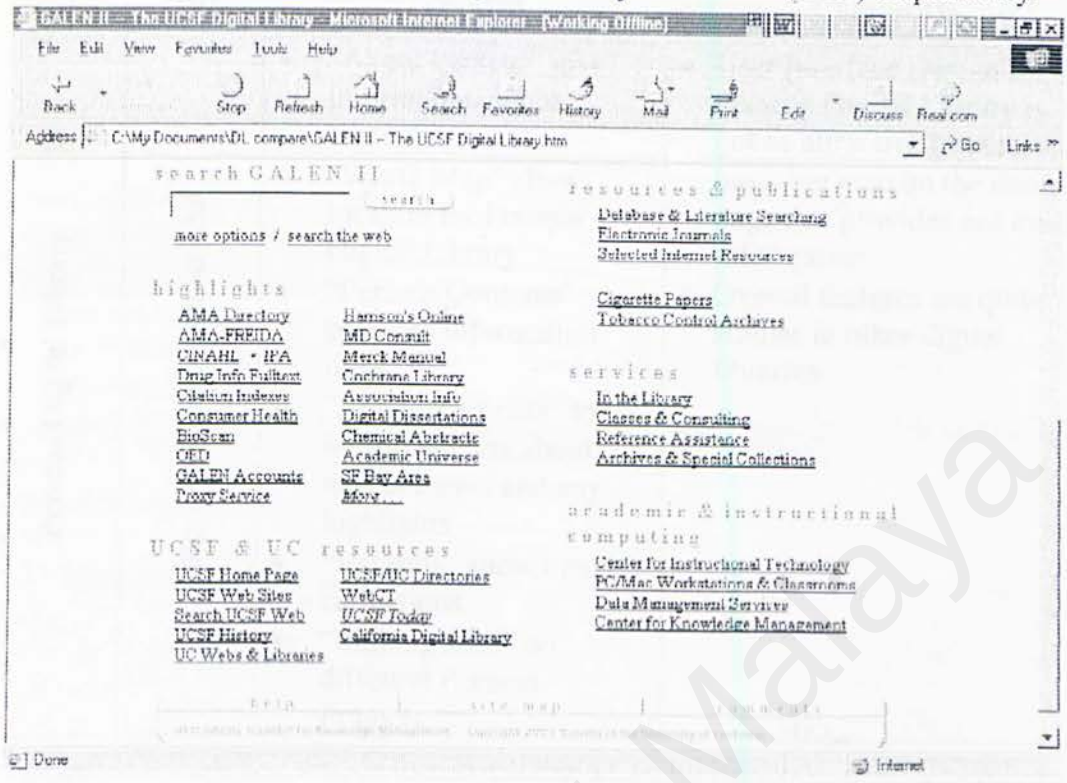

Figure 2.9 Captured Screen of The UCSF Digital Library

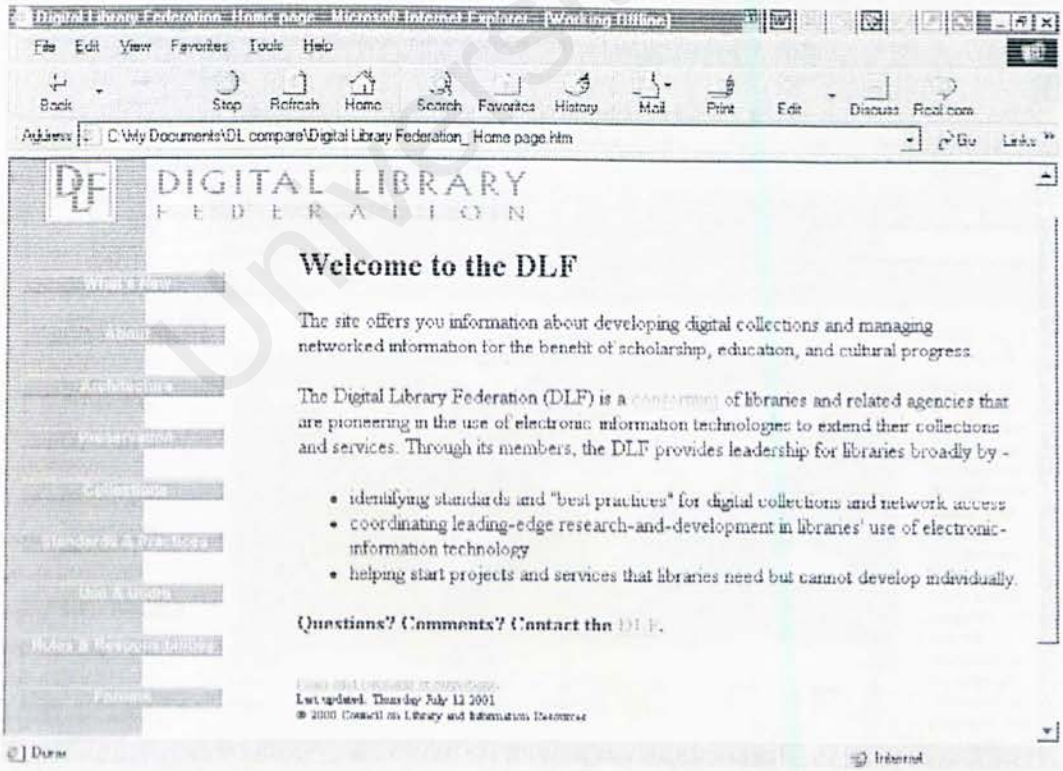

Figure 2.10 Captured Screen of Digital Library Federation

(f) Perseus Digital Library

Initial System	URL	Features	Comments
Perseus Digital Library	http://www.perseus.tufts.edu/	• "About Perseus" give information about Perseus. • "World Map" show location for Perseus Digital Library. • "Perseus Contents" provides information links. • "Announcements" to inform readers about new contents and any highlights. • "Exhibits" show image collections. • "Linking sites" on different Perseus Projects.	• User Interface Design for Perseus Digital Library is not so attractive because it has a big map on the main page that provides not much information. • Overall features are quite similar to other digital libraries.

Figure 2.11 shows the captured screen of the Perseus Digital Library.

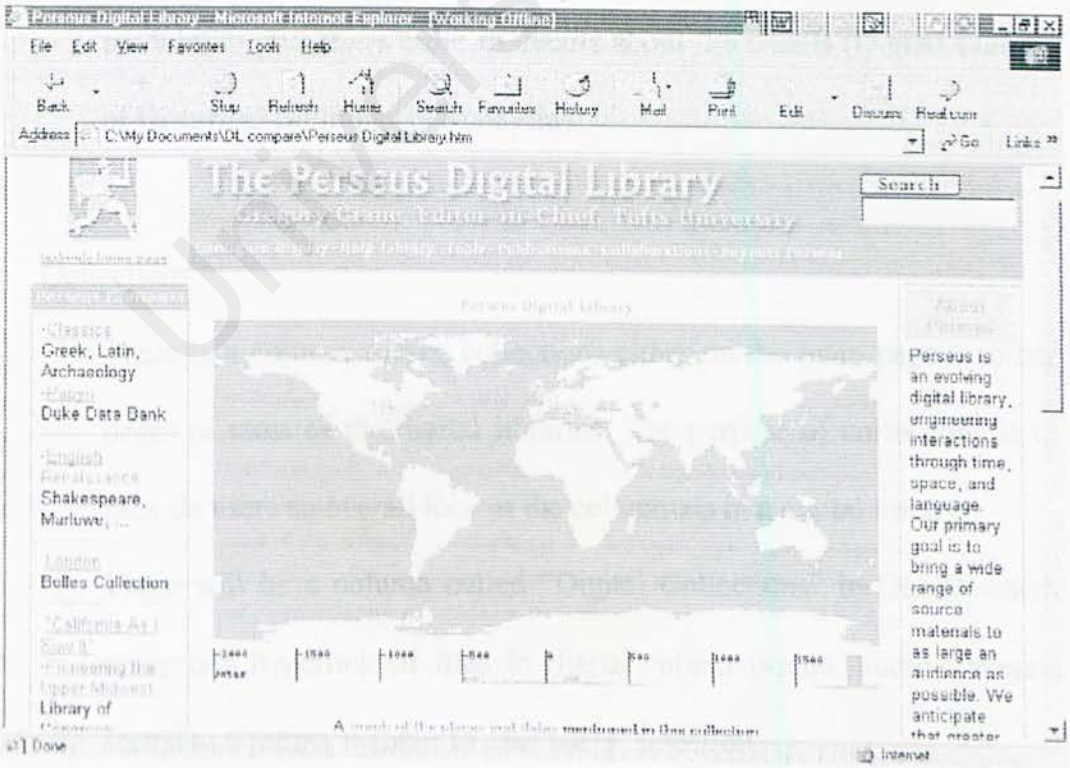

Figure 2.11 Captured Screen of Perseus Digital Library

2.3.2 To-Be-Adopted System Features

From the overall view of existing system analysis, it is indicated that the selected digital libraries have many similar features to each other. These features will be adopted in the system that will be developed. Although the selected existing systems that used for analysis are not closely related to the system build, the common characteristics are more or less similar.

The following are the features applied to the system which will be developed under the modules responsible by the author:

(i) Information Management

- Common information provided in a digital library are "What's New", "About Us", "User-Guides", "FAQ", "Term & Conditions", "Preservation", "Digital Collections", "Related Resources" and others.
- This information will be included in the Information management module, to give users more in details about the DLHB (Digital Library of Historical Buildings in Malaysia).

(ii) Collections

- There is a column named collections either on the main page or other pages of most of the digital libraries. The purpose of collections is to provide users an overall look at the collections in a digital library.
- There will be a column called "Digital Collections" in DLHB which comprises hyperlink of files in digital format (video, audio, images) sorted in a proper manner to ease users' selection.

(iii) Resources

- Resources are important for every library as well as for digital library.
- It stated out the publications resources that help users to further their references in particular subject. This is included in the system that will be developed.

(iv) Help

- Help is very common in every digital library. Therefore, it is included in DLHB to provide step-by-step to guide new users especially the secondary students, as most of them are not familiar with digital library.

(v) Subscribe / Register

- This feature is adopted in the system because it is to let the students to subscribe for further reference to other students' report. It can also use to track on the students' responses to the system which will be built.

(vi) User interface design

- Some of the existing systems' designs are quite attractive and interactive, thus, those designs will be used as example in designing the user interfaces of DLHB.

2.4 KLCC & Sources

"**KLCC**, which stands for **Kuala Lumpur City Center**, is more that just the Petronas Twin Towers, at 88 stories it is the tallest building in the world. It is part of a 100-acre development that includes a shopping center and a world-class park. It is both figuratively and literally Malaysia largest tourist attraction" (Malaysia's expat info center, 2001).

The 88-storey Petronas Twin Towers was completed in 1997. Standing at 1483ft (451.9m), it is the tallest building in the world and is 33ft higher than the Sears Tower in Chicago. (Acknowledged by the Council on Tall Buildings and Urban Habitat.) It is developed as an integral part of the Kuala Lumpur City Centre (KLCC) project, house PETRONAS' new corporate headquarters (Petronas Twin Towers, 2001).

Costing a whopping US$1.2bn and uniquely designed by Cesar Pelli & Associates, the twin towers symbolise strength and grace using geometric principles typified in Islamic architecture. The floor-plate of the Tower is designed based on geometric patterns common in architecture of Islamic heritage. It is composed of two rotated and superimposed squares with small circular infills. These geometric figures have been described by architects as symbolising unity, harmony, stability and rationality - all important principles of Islam.

Like the exterior design, the Towers' entrance design was also inspired by the country's cultural heritage, incorporating contemporary Malaysian motifs adapted

from traditional handicrafts such as songket and timber carvings. The overall character of the building is high-tech and international but distinctively Malaysian.

The towers are joined at the 41st and 42nd floors (175m above street level) by a 192ft-long (58.4m) double-decker skybridge - linking the two sky lobbies and facilitating the movement between the two towers.

The towers feature the following :

- The 864-seat Dewan Filharmonik PETRONAS, a venue of architectural and acoustic distinction. It is also home to the Malaysian Philharmonic Orchestra.
- The elegant new state-of-the-art GALERI PETRONAS.
- An interactive petroleum discovery center, PETROSAINS, will be made ready for science buffs and an art gallery.

Nestled between the PETRONAS Twin Towers is the six-level Suria KLCC - Malaysia's premier shopping destination. Overlooking the magnificent KLCC Park, Suria KLCC promises hours of leisurely pleasure (Petronas Twin Towers, 2001).

KLCC is certainly has its historical values to Malaysian. The following statements point out of this:

(i) It is a symbol of Malaysia's coming-of-age at the close of the millennium, a sky-high ego boost for the 44-year-old Third World nation.

(ii) This 88-story skyscraper is more than just a record-breaking feat.

(iii) The Petronas Towers symbolize the new spirit of Malaysia.

(iv) Building such a massive project has given Malaysian confidence to prove that we can do what others thought we couldn't do.

(v) The Petronas Towers beats out Chicago's Sears Tower, which, at 1,450 feet, held the tallest-building title from 1973 until 1996. The title is also claimed by the CN Tower in Toronto: It stands at 1,815 feet, but that includes a tall antenna.

(vi) In the early 1990s, as the economy boomed, the government charged Petronas with the task of building itself a massive headquarters in the heart of the city -- as a gift to Malaysians.

2.5 Dayabumi & Sources

The 1980s witnessed more development in the search for an independent Malaysian Islamic architectural identity, particularly within high-rise buildings. One of the most notable landmarks in Kuala Lumpur is the Dayabumi Complex, housing a 35-storey office tower, the Kuala Lumpur General Post Office and a two-storey shopping arcade. Modern Islamic reference was introduced to the design in the form of geometrically patterned grilles, which function as a sun-shading device, and pointed arches below the main tower block (Chen, 1998).

Dayabumi is located along Jalan Sultan Hishamuddin, Kuala Lumpur and built in 1984. According to Ahmad (1990), this is probably one of the most ambitious development projects undertaken by the Malaysian Government.

The Dayabumi Complex in the heart of Kuala Lumpur is one of the more ambitious developments undertaken by the city's Urban Development Authority (UDA). The unifying factor of the various components is the innovative use of grilles cast in an Islamic pattern that function as a sun-shading device. The floor plan of the tower is reti-form, which adds to the complex distinctive appearance. Even though the complex is one of the better examples of a nationalistic type of architecture, it could relate better to the surrounding streets cape in terms of its urban design. The complex was designed jointly by MAA & BEP and completed in 1984 (Yeang, 1992).

2.6 LUTH & Sources

The Lembaga Urusan Tabung Haji (LUTH) Buildings, commonly referred to as the Tabung Haji Building, is home to the offices of the Malaysian Muslim Pilgrim's fund. The elegant tower represents the architect's search for a sculptural model that continues the traditions of Islamic architectural forms in modern building. Perhaps fortuitously, the best structural solution to the unusual form of the Tabung Haji Building was found to be the use of five pillars, an allusion to the five pillars of faith in Islam. Likewise, the most economical way to bridge the gaps between the five pillars was to use shallow arches, themselves recognizable symbols of Islam (Chen, 1998).

Tabung Haji was designed by Encik Hijjas Kasturi, built at a cost of approximately RM 110 million, and was completed in September, 1985. The first noteworthy item

about the building is that it was the first project in Kuala Lumpur to be completely financed by cash before building commenced (Newbury, 1993).

This multi-storey building situated along Jalan Tun Abdul Razak is the headquarters for LUTH (Lembaga Urusan Tabung Haji) as well as rentable office spaces. The main unique feature of the design is its bold vertical curving from creating a commanding visual impact of Kuala Lumpur's skyline. Its dynamic features remain consistent both on the exterior and interior of the building with extensive use of arched ceiling forms and curving railings to complement the circular based planning of the building. The 'corsetted' form refers more to a sculptured symbolism with five external pillars symbolizing the five pillars of Islam (Ahmad, 1990).

As with the Dayabumi Tower, the institutional occupier of this building demanded that recognizable Islamic symbolism be incorporated into the design. The five vertical external form supporting the superstructure represent the "five pillars of Islam", and the word 'Allah' (god) is displayed in Jawi script on the top section of the building compared to most other high-rise building built in the same period in Malaysia, this building's open and easily accessible ground level relates well to the surrounding pedestrian areas. The easily recognizable waisted shape of the building makes it one of the city's most prominent landmarks, and represents the most daring attempt to date to develop an independent Malaysian Islamic high-rise identity (Yeang, 1992).

2.7 Historical Buildings within School Context

Education system in Malaysia required secondary students in Malaysia to sit for the examinations particularly Penilaian Menengah Rendah (PMR) in Form Three and Sijil Pelajaran Malaysia (SPM) in Form Five. Students in Form Three are compulsory to carry out academic projects to fulfill the requirement of those specific subjects.

Students are asked to carry out a Historical Project to fulfill the requirement of history subject as it is one of the evaluation methods in PMR. The common topics that covered in this Historical Project are "Historical Buildings in Malaysia", "Malaysian Biographical Repositories", "History of Malaysian Celebration days" and others.

As usual, students will search for information from the library or interview certain people to gain information for their project. They have to arrange the information gained according to the format and submit a report to teacher for evaluation. After all, we can see that the information gathered play a vital part in this Historical Project.

Despite going to public library at different locations to search for information, the students have another alternative, whereby they can use the online resources. However, we know that the data in the Internet are high volatile, heterogeneous, unstructured and redundant in many ways. In addiction, most of the information found from the Internet is in English and this information is rarely in Malaysia

context. Yet, this will certainly make difficult for the students to make use of the benefits on the Web.

Hence, it is important to develop a digital library in a Malaysia context to help these students to gain information in an easier way. Although there are many existing digital libraries online, however none of them are in Malay language or in Malaysia context. Therefore, we come in mind of develop a digital library that based on Malaysian students' need, which is the Digital Library of Historical Buildings in Malaysia (DLHB).

With this digital library, it is hope to encourage students' involvements in the Information Technology field and fully utilized the benefits of the Internet. Students can access information anytime and anywhere. Basically, the contents covered in the topic "Historical Buildings in Malaysia" are tall buildings, school buildings, palace, fort and historical landmarks in Malaysia. DLHB is covered the contents particularly on tall buildings and school buildings. The contents of this digital library can be expanded from time to time.

Another feature that need to be raised is that the digital library provide facility to allow teachers to upload students' work as the share resources for other students. This will improve communication between students and teachers.

Finally, there is no doubt to say that this web-based system (DLHB) will certainly help students in completing their Historical Project specifically on information searching.

CHAPTER

3

System Analysis

Chapter 3 – System Analysis

3.1 Fact Finding Techniques

System analysis starts with data collection. Useful information and recommendations are obtained through carrying some efforts of fact finding that is also known as requirement determinations. There are several systematic and structured fact finding techniques in system analysis, including sampling existing documents and hard data, interviewing, observing, questionnaires, site visits, prototyping, Rapid Application Development and Joint Application Development.

In most cases, a combination of these techniques is essential and is implemented to increase both effectiveness and efficiency in gathering factual information to support project development. The project team members need to examine both quantitative and qualitative information in order to piece together an accurate picture of the proposed project.

The technique being carried out to gather information about the nature of the development of digital library system includes readings about digital library, Internet surfing, conducting interview and user surveying such as carry out questionnaire and site visits. The details of these techniques are described in their respective section below.

3.1.1 Readings about Digital Library

There are a wide variety of printed materials available for the interpretation of literature reviews. This ranges from books, encyclopedias, almanacs,

yearbooks, periodicals, magazines, handbooks, manuals, directories, dictionaries, government documents and policies, statistics and others. One can rely on the contents of printed materials, as it still remains as the most authoritative resources in information gathering.

Most printed materials are ready-reference sources and are excellent for quick, accurate answers to factual queries. One of the weaknesses is some of the contents in the printed materials are not updated, and this will become problematic when one is seeking an answer to a question involving a recent event.

Part of the research work about this system involves reviewing periodicals such as journals, books, conference papers and magazines, that contain relevant information. All the periodicals were obtained from the Main Library of University of Malaya, Za'ba Library of University of Malaya, National Library of Malaysia and document room of Faculty of Computer Science and Information Technology, University of Malaya.

3.1.2 Internet Surfing

Surfing the Internet is indeed a good method of fact finding technique. Existing digital library at the web help in giving ideas on the features of the system, data that should keep track in the system database and the user interface designs. The information about available developing tools can be obtained from vendors' web site. This helps in evaluating and selecting the most suitable tools for the digital library.

On the other hand, electronic materials are a new breed from the applications of the Internet and the digital library technologies. Electronic materials in this context refer to electronically published medias such as E- books, E-journals and E-magazines. All of these electronic materials helped in providing the relevant literature needed for this project.

The Internet has provided information about digital libraries from authoritative international organizations such as the International Federation of Library Associations and Institutions, Digital Library Federation, Library of Congress, Berkeley Digital Library SunSITE and others. These web sites provide information about tools needed for digital library developers.

3.1.3 Interviews

An interview is defined as a meeting with a person whose views are requested (Ruse, 1989). Interviewing method is a very complex fact-finding technique that takes into special account of personal biases and perceptions. The frameworks of the person's education, intellect, upbringing, emotions and ethical will all serve as influential filters during an interview session.

Several interviews had been arranged to gather information for the Digital Library of Historical Buildings (DLHB). Some of the interviewees include Puan Suraya from Sekolah Menengah Kebangsaan Convent, Klang and Puan Mahani from Victoria Institution, Kuala Lumpur.

The types of questions inquired are open-ended and unstructured. This type of questions give interviewees more freedom in expressing their ideas and allow more spontaneity and to make phrasing easier for the interviewer. The analysis of interview with history teachers will be described in more details in section 3.2.2(a).

3.1.4 User Survey

(a) Questionnaire

Questionnaire is an information technique that allows the studying of attitudes, beliefs, behaviors and characteristic of the end users (Kendall & Kendall, 1999). It is typically used to obtain preliminary insight on the information needs of the various stakeholders. This preliminary information can then assist in identifying the areas that need further research with document reviews, interviews, and observation.

In general, the questionnaire is a limited approach and has a specific usage as a fact-finding technique. The benefit of employing questionnaires is that it permits efficient collection of information from a large number of stakeholders. The stakeholders can be widely distributed in geographical location and still participate through questionnaires. In addition, questionnaires are also helpful in answering quantitative questions

The questionnaire as shown in Appendix A contains 18 questions that is divided into 2 main parts. The first part of the questionnaire provides personal particulars of respondents and the second part solicits information

about their use of computer. The respondents are some of the selected form three students from Sekolah Menengah Kebangsaan Convent, Klang and Victoria Institution, Kuala Lumpur.

(b) Site Visits

Site visits is another technique used to examine and analyse the actual situation on site. The related site selected in this user survey is Heritage of Malaysia Trust or also known as Badan Warisan Malaysia (BWM) which located in Kuala Lumpur. Badan Warisan Malaysia is a non-profit organisation incorporated in 1983, committed to promoting the awareness for the conservation of Malaysia's building heritage. Facilities provided by BWM include exhibition and conference spaces, a resource center for the conservation of building heritage, a gift shop and office (Badan Warisan Malaysia, 2000).

A visit to BWM was conducted to collect information about content of the database and to carry out an interview with the librarian of BWM regarding the visitors' group to BWM. The resource center in BWM had allowed the researcher to find information on historical tall buildings such as Dayabumi, Menara Maybank and Tabung Haji. The analysis of interview with the librarian of BWM will be described in section 3.2.2(b).

3.2 Data Collection Analysis

3.2.1 Analysis of Questionnaire

This study has chosen the schools in Kuala Lumpur and Klang based on a few reasons. Firstly, the infrastructure for Internet connections is available throughout the selected area and the possibility of Internet connections in respondents' homes is high. Secondly, the schools chosen are those with the Internet facility and moreover, there are numerous cyber cafes scattered within the city for the convenience of the respondents to surf the Internet.

This study comprises 74 form three students from two schools in the Klang Valley. The response rate of the survey is 100%, though missing data occurs in some of the questionnaire. The results of the analysis are presented in pie charts, bar charts and rich pictures.

(a) Analysis on Purpose of Using Internet among Form Three Students

Figure 3.1 depicts bar chart for the purpose of using Internet among form three students. Searching for information, chatting (ICQ), windows shopping, e-mail service, computer games and others were the options used in the survey. The main purpose is to search for information, with a percentage of 33.17 of the students. Meanwhile, 29.65% of them used the Internet for the e-mail service.

The result showed that nowadays most of the secondary students who stay in city are very familiar with Internet surfing and use the Internet for various purposes.

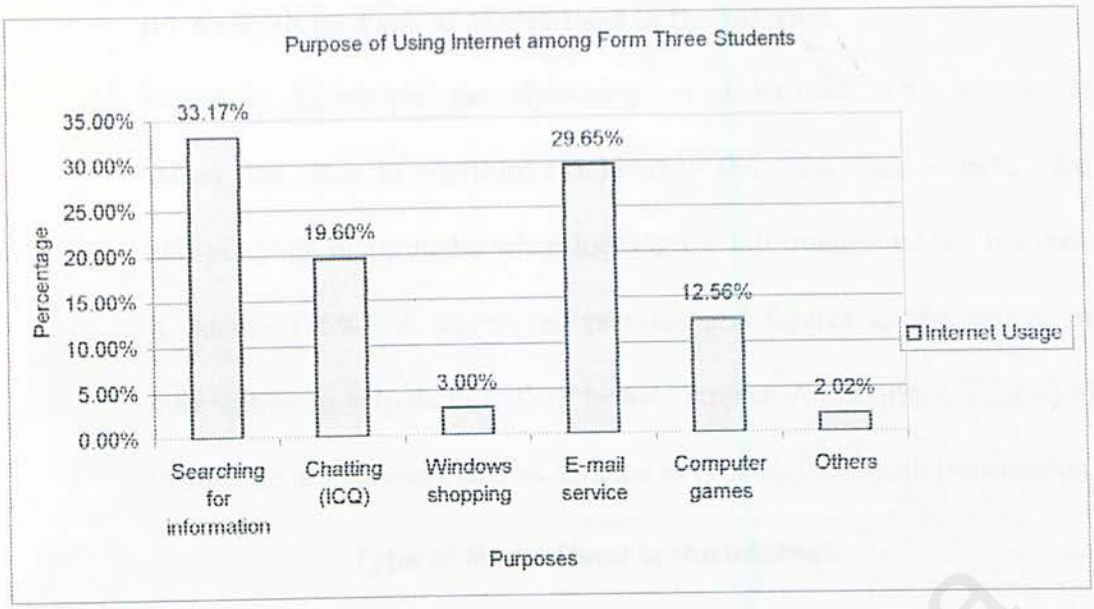

Figure 3.1 Bar Chart for the Purpose of Using Internet among Form Three Students

(b) Analysis on Search Method Used in Library

Figure 3.2 shows the pie chart of search methods used in the library among form three students. From the chart, majority of the respondents used a combination of keyword, title, author or subject when searching for information. However, 36.73% of the users used subject as the main method of searching for historical buildings information for their history project. This is closely followed by searching by title. Searching by author is the least popular method of searching among the respondents, which only makes up 6.12% of the total respondents.

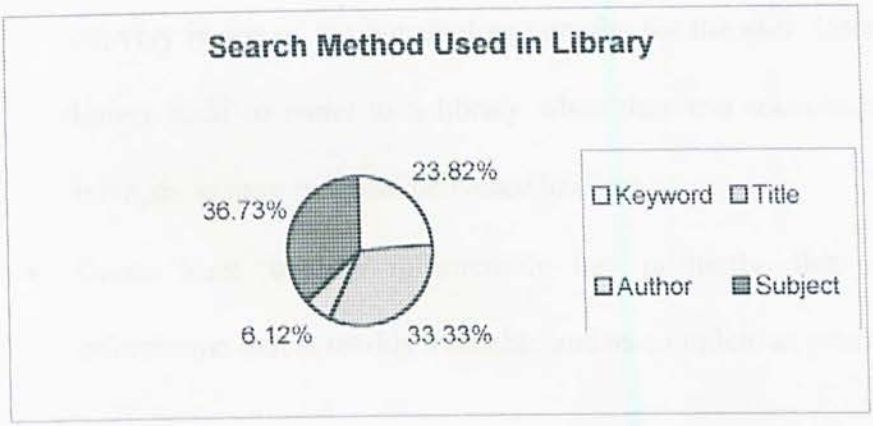

Figure 3.2 Pie Chart of Search Method Used in Library

(c) Analysis on Type of Media Used in the Internet

Figure 3.3 depicts pie chart shows type of media used in the Internet. It shows that close to one-third (31.11%) of those surveyed searched for photos as the main media when looking for information on the Internet. A quarter (25%) of them used pictures and figures as the source of information to help them in their history project. A minority (12.22%) of them were able to use video as a media to provide them with information.

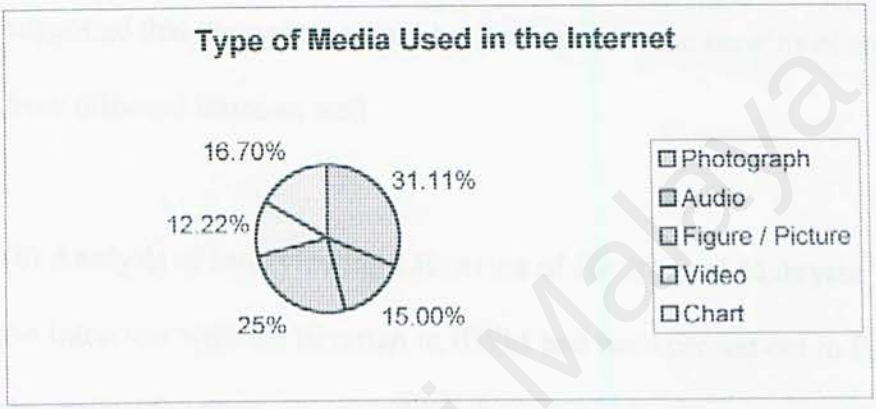

Figure 3.3 Pie Chart of Type of Media Used in the Internet

(d) Analysis on non-quantifying questions

Some of the analyses of non-quantifying questions are as below:

- Users want equitable easy and convenient access to information
- In a digital library environment improved communication and delivery is one of the outstanding benefits for the user. Users no longer need to come to a library when they can use electronic methods to have material delivered to them.
- Users want quality information but primarily they want information that is readily available and as complete as possible.

3.2.2 Analysis of Interview

(a) Analysis of Interviewing Form Three History Teachers

The purpose of the interviews is to find out about form three History teachers' opinions on the proposed system. Generally, the teachers being interviewed were more than willing to participate in the development of the proposed DLHB. They agreed that the Internet is a good source of information to assist the students in their projects, and some even suggested that the system would be developed for the benefits of students from different forms as well.

(b) Analysis of Interviewing Librarian of Heritage of Malaysia Trust

An interview with the librarian in BWM had been carried out to find out the group of visitors who mostly visits to the resource center in Heritage of Malaysian Trust (BWM). According to the librarian, most of the visitors who visit to the resource center in BWM are those pursuing tertiary education and some government staff. The printed materials in the resource center cannot be borrowed out due to the copyright issue. However, visitors can make photocopy to the printed materials and there is limitation for the number of copy made. Visitors are charged RM 5 per entrance and the rate of the Photostatting is high as well. There is also secondary students visit to BWM but it is not so common.

3.3 Requirements Defining

3.3.1 Rich Pictures

(a) Rich Picture of Methods of Information Gathering

This section provides the rich picture (Figure 3.4) of the various methods secondary form three students use to gather information needed for their history projects.

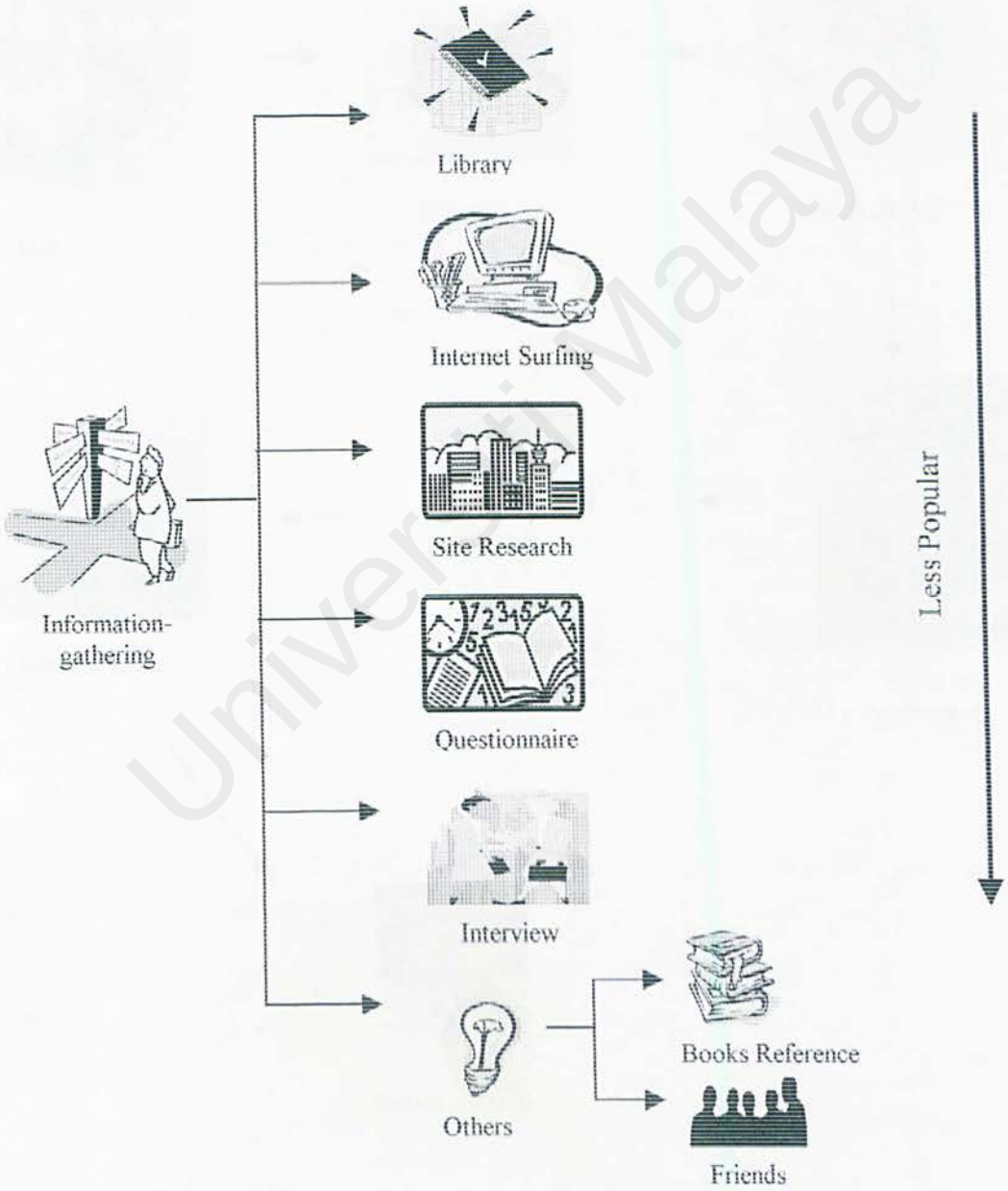

Figure 3.4 Rich Picture of Methods of Information Gathering among Form Three Students in Completing Project History

3.3 Requirements Defining

3.3.1 Rich Pictures

(a) Rich Picture of Methods of Information Gathering

This section provides the rich picture (Figure 3.4) of the various methods secondary form three students use to gather information needed for their history projects.

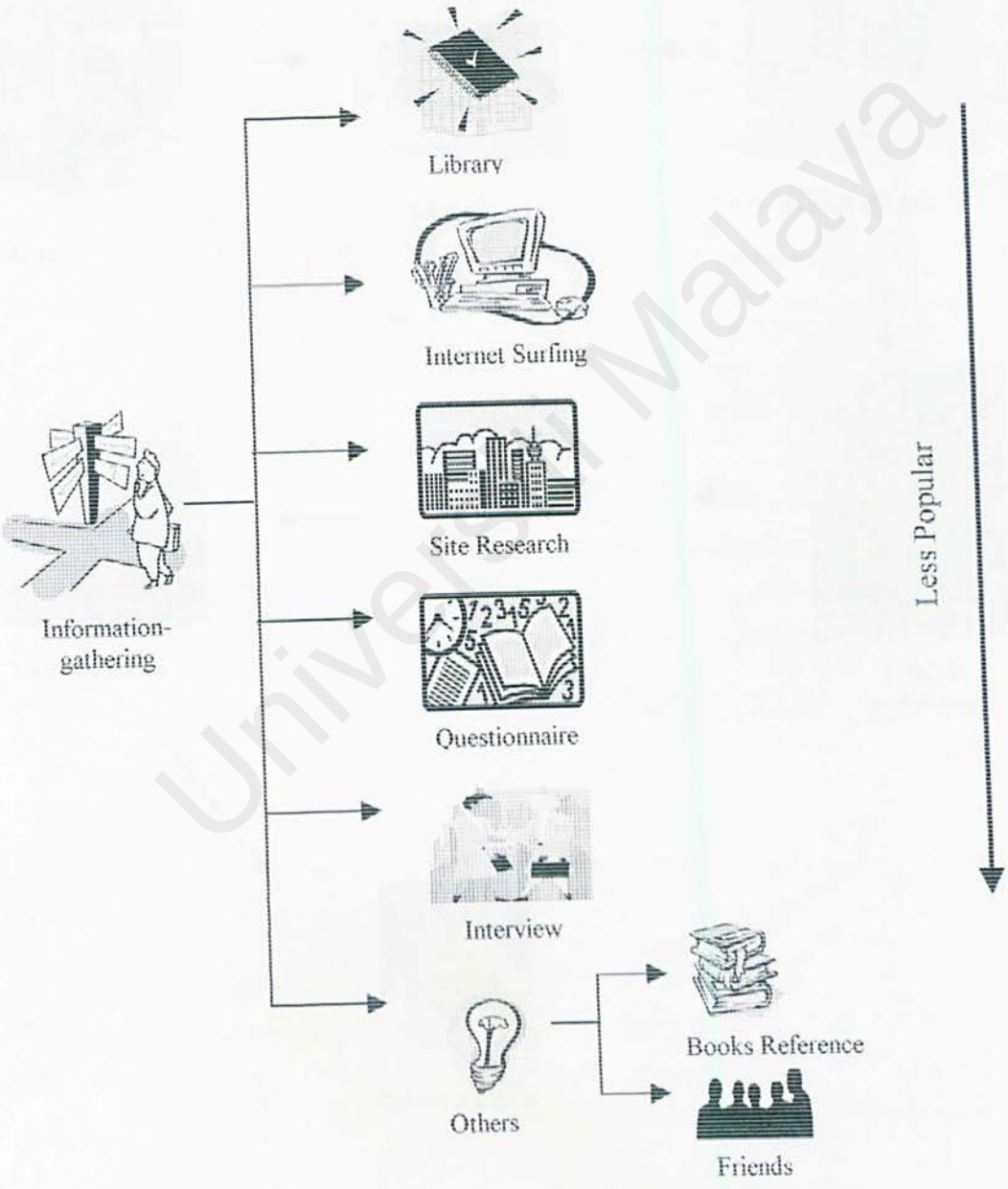

Figure 3.4 Rich Picture of Methods of Information Gathering among Form Three Students in Completing Project History

(b) Rich Picture of Methods of Information Gathering with Traditional Library Method

This section provides the rich picture (Figure 3.5) of the traditional method of gathering information from the library.

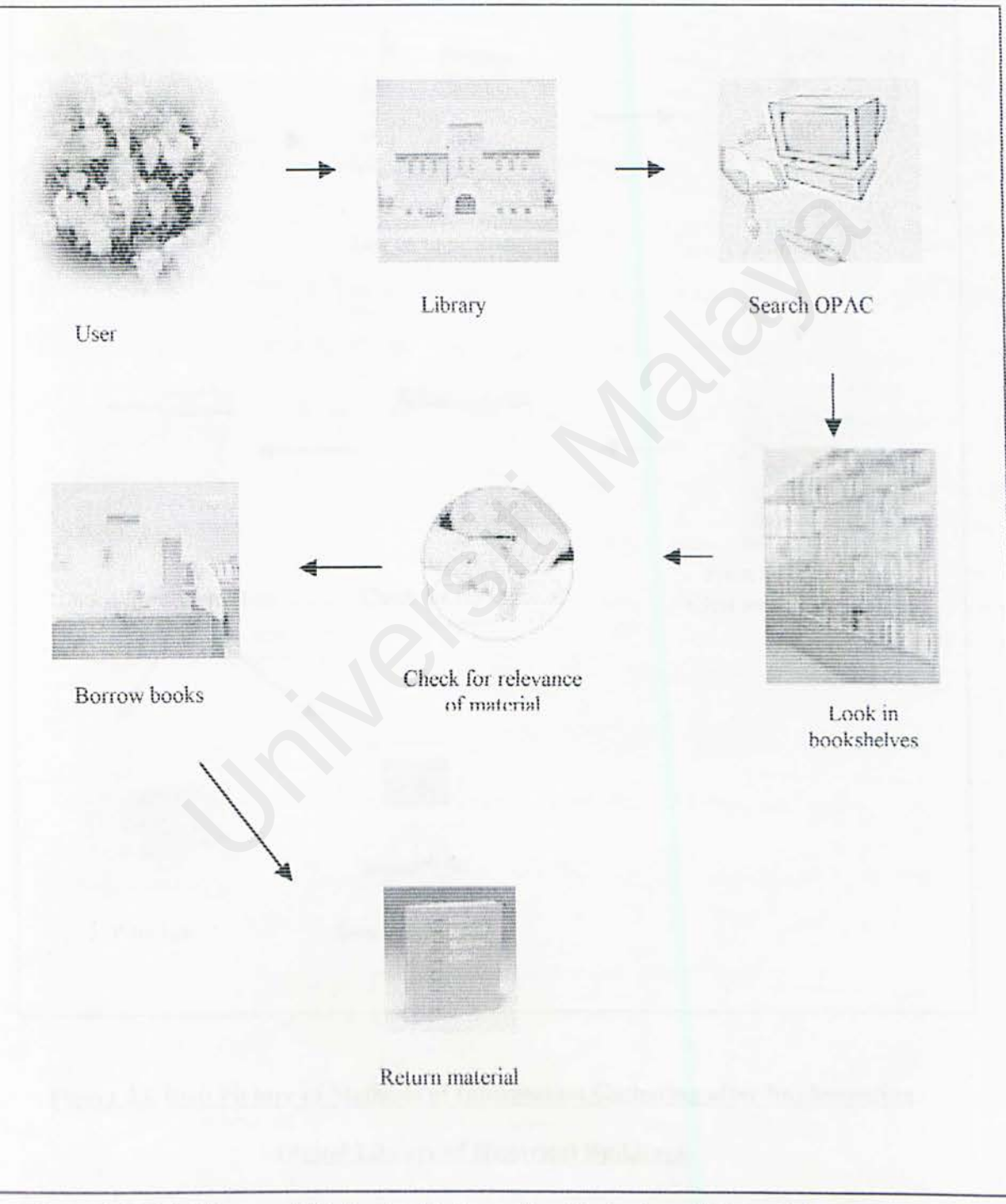

Figure 3.5 Rich Picture of Methods of Information Gathering with Traditional Library Method

(c) Rich Picture of Methods of Information Gathering after Implementing Digital Library of Historical Buildings

This section indicated the rich picture (Figure 3.6) of the process of gathering information through the Digital Library project.

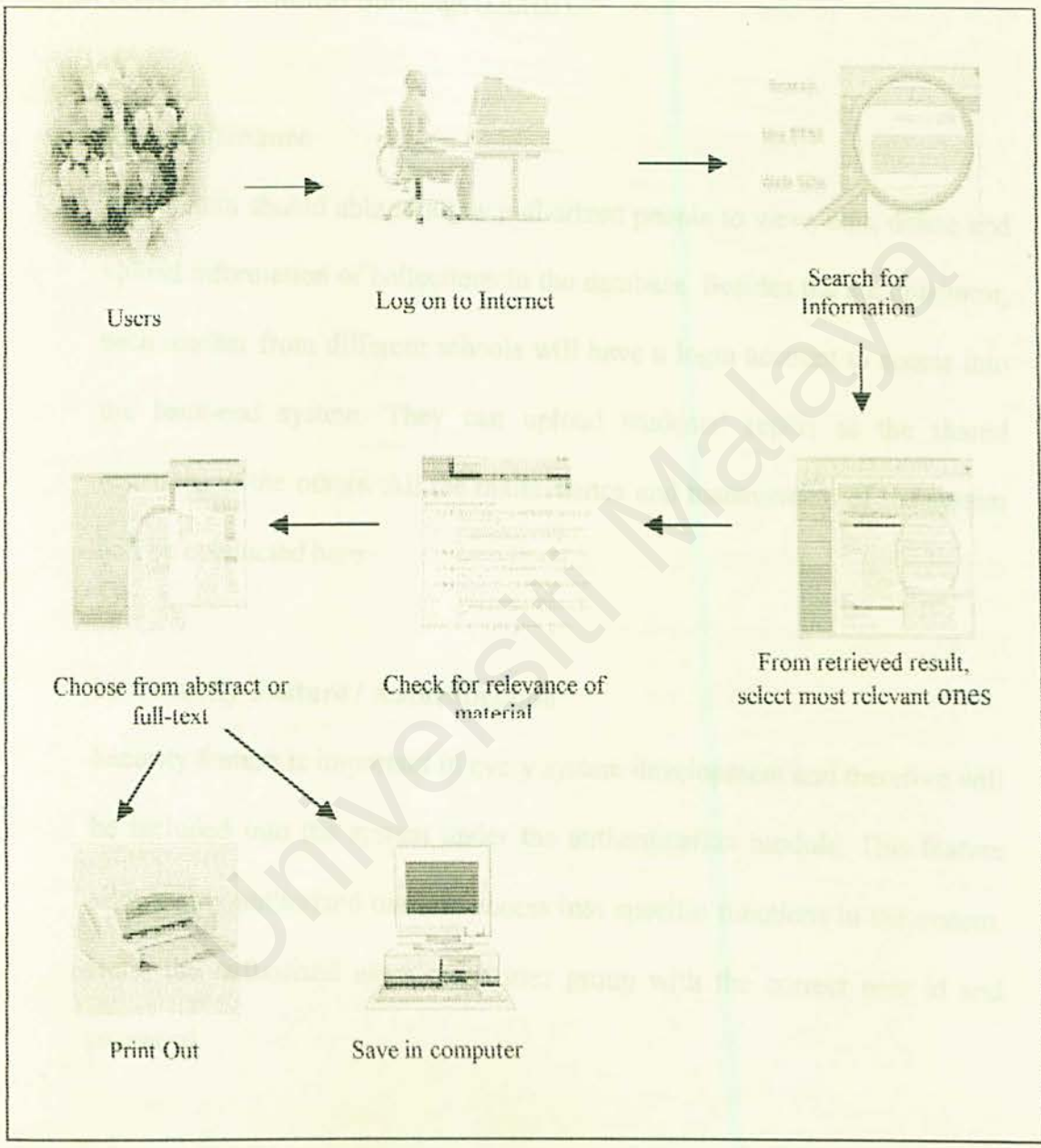

Figure 3.6 Rich Picture of Methods of Information Gathering after Implementing Digital Library of Historical Buildings

3.3.2 Functional Requirements

Functional Requirement is the function that a system must provide in order to fulfill user's requirements. A functional requirement describes an interaction between the system and its environment. Following are the functional requirements for the Digital Library of Historical Buildings (DLHB).

a) Maintenance

The system should able to allow authorized people to view, edit, delete and upload information or collections in the database. Besides the administrator, each teacher from different schools will have a login account to access into the back-end system. They can upload students' report as the shared resources to the others. All the maintenance and management of the system will be conducted here.

b) Security Feature / Authentication

Security feature is important in every system development and therefore will be included into the system under the authentication module. This feature allows only authorized users to access into specific functions in the system. Here, the authorized users mean user group with the correct user id and password.

c) Registration

The system should be able to allow new users to register themselves in the DLHB system. A form will be displayed for the users to enter their particular details, user id and password for security control in the future. The purpose

of registration is to keep track of the number of users / students who fully utilized the system.

d) Information Management

The system should be able to provide guide and useful or necessary information to assist users in using the system such as searching, uploading student's report and registration. Information management is essential, and it should be organized in a proper manner without confusing users. For instance, the user guide should contain search hint and step by step guide to perform certain task.

e) Search and Indexing

Search and indexing is another function that is provided by the DLHB system. This function is very important, as it is the feature every digital library should have. It provides an efficient, powerful and easy way to search and retrieve desired information, collections or images with Boolean (AND and OR) combination field. Besides this, the indexing feature allows the user to browse the system's collections by name, location, year, alphabetical order and thumbnail images.

f) Feedback

The system should be able to collect feedback from users through a survey form provided. Users can enter their questions, comments or opinions about the system in the textfields that are provided in the survey form and submit to the system administrator. Apart from that, e-mail can be sent to the

administrator directly through the e-mail address provided. Every system should has this function to maintain and improve the quality of the system from time to time.

g) Bulletin

Bulletin is another useful function in DLHB because it can provide the latest news to the users in an effective way. An electronic board will be build to display the latest information from time to time. Updates information likes new uploaded content and new features in the system will be displayed on the bulletin board.

h) Submission

Another feature of the DLHB system is the submission feature, which allows authorized users (administrator, managers/teachers) to submit or upload their collections and student's projects into the DLHB database. It provides a place to store the student's projects instead of putting them on the bookshelf or thrown away.

3.3.3 Non-functional Requirements

Non-functional requirements are the set of constraints under which a system must operate and the set of standards which a delivered system must meet.

a) Graphical User Interface (GUI)

The system should provide a user-friendly interface with WIMP (Window, Icon, Menu and Pointing device) features. The system should be designed in such a way that users would not feel uneasy and frustrated in using the system.

b) Portability

The system must ensure the capability of the application system to operate on various platforms regardless of manufacturer or operating system. This is important to identify the portability of the components in operating on various platforms without any modification, recompiling, reconfiguration or redesign of the component.

c) Usability

The system must be easy to use. The system can enhance and support rather than limit or restrict business processes. Human interfaces need to be intuitive and consistent with other application system in the environment and within them.

d) Manageability

Application hardware and software will be capable of being managed and easy to operate. They should effectively meet the following management criteria: -Remote management via agents

-Remote management via remote login

-Local management

e) Scalability

The scalability is to promise the capability of the system to migrate as a client or server to machine of greater or lesser power, depending upon requirements, with a little or no change to the underlying components. The solution can be scaled using hardware or application configuration or a combination configuration of them.

f) Response Time

System's response time becomes an important issue when the database become very large. The user should not ask to tolerate with the slow response time. To solve this problem, better and faster hardware is needed.

g) Reliability

Reliability is the extent to which a program can be expected to perform its intended function with required precision. Therefore, the system should be reliable in performing its functions and operations. To ensure system reliability, exhaustive testing should be carried out.

h) Robustness

The system should be robust enough to handle expected or unexpected system failure. Any errors detected will either be corrected or eliminated. Again, robustness of the system is achieved after thorough testing.

3.4 Platform and Web Server Consideration

3.4.1 Development Platform Consideration

Development platform provides support for the other development tools and programming languages. Two popular development platforms had taken into consideration by the team members for the proposed DLHB, which are Microsoft Windows NT server 4.0 and Microsoft Windows 2000 server.

(a) Microsoft Windows NT Server 4.0

Microsoft Windows NT Server 4.0 is a robust, multipurpose network operating system that offers dependable file and print services, while providing the architecture to run powerful client-server applications. With built-in support for communications and Internet services, Windows NT Server is a network operating system that includes Internet and intranet capabilities. The new features built into Windows NT Server provide more choices for accessing information – especially through a wide range of built-in Internet tools. New features also provide users with easier, lower cost networking and improved performance.

Windows NT Server inter-operates with a broad range of operating system including Netware, UNIX, Microsoft LAN Manager, SNA and Macintosh.

In conclusion, the features of Windows NT Server 4.0 include:

- Support more protocols and file sharing
- Easy and simple setup and management
- Integrated security

- Easy Integration
- Integrated Web Server (IIS – Internet Information Server)
- Faster access to information
- Complete communication services
- Fast reliable and secure
- Low cost dial-up connectivity

(b) Microsoft Windows 2000 Server

The Windows® 2000 Server operating system provides centralized, customizable management services to reduce total cost of ownership (or TCO). TCO includes not only the initial cost of hardware and software, but deployment expense, hardware and software update costs, training, day-to-day maintenance, and technical support as well. Further, these management services work with existing management solutions and mixed-platform distributed networks, thus allowing the organization's IT department to get maximum value from their current infrastructure.

Following are the features of Windows 2000 Server :

- Easier to Deploy
- Easier Network Configuration
- Easier Daily Maintenance
- Centralized Management Services

Services that provided under Microsoft Windows 2000 server include Group Policy, Windows Management Instrumentation (WMI), Windows Script Host (WSH) and Microsoft Management Console (MMC).

(c) Chosen Platform

Microsoft Windows 2000 server is chosen, as it is a complete powerful platform that provides server operating system. Moreover, Microsoft Windows 2000 Server is tightly integrated with the Windows Exchange 2000 server. Windows 2000 server serves as a platform to publish and share information in a secure way over Internet and intranets.

3.4.2 Web Server

(a) Internet Information Server (IIS)

The IIS is a port of a couple of Internet services to Windows NT Server. Vulnerability in Microsoft Internet Information Server (IIS) for Windows NT 4.0 allows server scripts to be viewed by the client side. Server-side scripts (also called script-mapped files) are programs that produce HTML code to be viewed on the client side.

Commonly, server scripts contain sensitive information, such as passwords for accessing databases. Or, seeing the content of a script might allow an attacker to discover a way to attack the server.

3.4.3 Hardware

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

- Intel Pentium III Xeon 1000-MHz Processor (upgradable to dual processing);
- 256 KB second level ECC Cache;
- RCC LE 3.0 Chipset with 133-MHz Front Side Bus;
- 128 MB PC133MHz SDRAM DIMM Memory (expandable to 4 GB);
- 1.44 MB Diskette Drive;
- High Speed IDE CD-ROM Drive;
- NC3123 Fast Ethernet NIC PCI 10/100 WOL (this is a network controller);
- Integrated Dual Channel Wide Ultra2 SCSI Adapter;
- Wide Ultra2/Ultra3 SCSI Drive Cage standard (6 x 1")
- Compaq SmartStart;
- Compaq Insight Manager
- The OS Support are: Microsoft® Windows® 2000; Microsoft® Windows® NT; Novell NetWare; and other which compatible.

3.4.4 Application Software

(a) Microsoft Visual Interdev

Microsoft Visual InterDev 1.0 is built on top of Microsoft 's Visual Studio 97, which gives it a very robust editing and online reference system. Visual Studio 97 is the same programming environment used in Microsoft Visual C++ and Microsoft Visual J++. It supports macros, VBA Automation,

floating/dockable windows and tool bars along with many other features to make programming large applications fairly easy.

Also integrated are a number of essential tools for developing dynamic Web sites referred to as content editors. Visual InterDev serves as the focal point for HTML, ActiveX components, graphics, video and audio. The Microsoft Visual InterDev development system provides the comprehensive resources necessary for successful Windows development. From building e-commerce Web solutions that take advantage of the new Windows 2000 clustering technologies, such as network and component load balancing, to scalable data-driven business applications.

Visual InterDev provides the ease of use and support, extensibility, and server-side scalability. The features of Microsoft Visual Interdev include Integrated Visual Tool, Robust Development Support, Database Connectivity and Web Site Management.

(b) Adobe Acrobat 5.0

Adobe Acrobat is a document distribution software that uses PDF (Portable Document format) as its format. PDF handles scalable art without degrading image quality and support recent generations of system that output PostScript. Acrobat (PDF files) allows documents created on a word processor to be made available on the web.

Adobe Acrobat software enables businesses or electronic publication organization to be easily shared across a broad range of hardware and software. Files converted into Adobe Portable Document Format (PDF) via Acrobat look exactly as intended, with layout, fonts, and images intact.

With Acrobat 5.0, new features and enhancements significantly extend electronic document sharing throughout enterprises and over the Internet. IT professionals can efficiently install and maintain Acrobat across a network. Acrobat 5.0 allows large corporations and small businesses to share content. Enhanced security provides greater control over shared documents. Extended workgroups can work together by adding comments and approving documents via the Web. The tight integration between Acrobat and Microsoft Office for Windows lets any business any business user easily create Adobe PDF files.

As a whole, the features of Adobe Acrobat 5.0 include:

- Install and Maintain Acrobat Across an Enterprise
- Save Time by Repurposing Content
- Protect Shared Documents
- Review and Share Comments Online
- Migrate Forms to the Web
- Gather Research Data from the Web
- Work Smarter

(c) **Macromedia Dreamweaver**

Macromedia Dreamweaver 4 provide tools that can help to develop a professional Web site. Macromedia Flash graphics can be built directly in Dreamweaver. Dreamweaver's visual layout tools or its text-editing environment make it easy to develop an intuitive Macromedia User Interface.

Below are the features of Macromedia Dreamwearver 4:

a) Code View
b) JavaScript Debugger
c) Integrated O'Reilly Code Reference
d) Layout View
e) Macromedia Flash Buttons and Text
f) Asset Panel - Track all site media in a central location.
g) Roundtrip Graphics Editing
h) Microsoft Visual SourceSafe and WebDAV Integration
i) Site Reporting
j) Macromedia Exchange for Dreamweaver

3.4.5 Web Development Technology

Developing web-based applications relies on many network and application components working together to deliver information to the requesting client. It transforms the global network into a reliable application. Some of the development tools that used to create web pages are:

(a) Active Server Pages (ASP)

Active Server Pages (ASP) is an open, compile-free application environment in which the developer can combine HTML, scripts, and reusable ActiveX server components to create and run dynamic, interactive and high performance web pages from the server side using a scripting language. It is a technology that allows for the programmatic construction of HTML pages just before they are delivered to the browser.

ASP supports ActiveX scripts and ActiveX server components on the server. It supports ActiveX components that are developed in any language, such as C++, Visual Basic, Java and COBOL. By combining scripts and components, developers can create dynamic content and powerful Web-based applications. The output of an ASP file is plain HTML, the content of which can be customized for the capabilities of the client.

ASP allows persistent connections between the client and server, the development of client server sessions, and the access and management of databases from the client side. They are not static pages, but rather they are dynamically produced from information stored in a database. Each time the database is updated, the Web site is updated. Figure 3.4 shows how ASP files are interpreted.

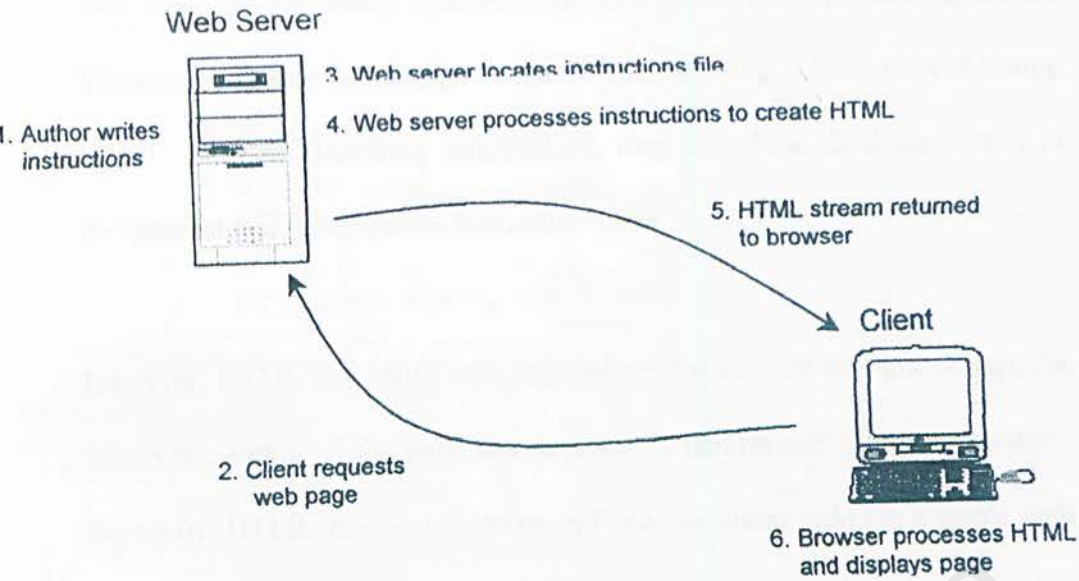

Figure 3.7 How ASP Files are Interpreted

(b) Hyper Text Markup Language (HTML)

HTML is a collection of platform-independent styles (indicated by markup tags) that define the various components of a World Wide Web document. HTML files can be viewed by using any browsers, such as Internet Explorer 5.5 or Netscape Communicator.

HTML allows the individual elements on the Web to be brought together and presented as a collection. HTM acts as the glue that holds everything together in a web page. In addition to being a markup language for displaying text, images, and multimedia, HTML provides instructions to Web browsers in order to control how documents are viewed and how they relate to each other.

The users can add many functions inside HTML. They can add their own VBScript and also JavaScript inside HTML to make it become a dynamic HTML. Besides displaying information, they can show database record in the Internet and get response from other users.

However, HTML is a static web page where the content will not change for which the author of the page has completely determined the exact content. Normally, HTML files are "interpreted" on the client side (in a user's web browser). Figure 3.5 shows how HTML files are interpreted.

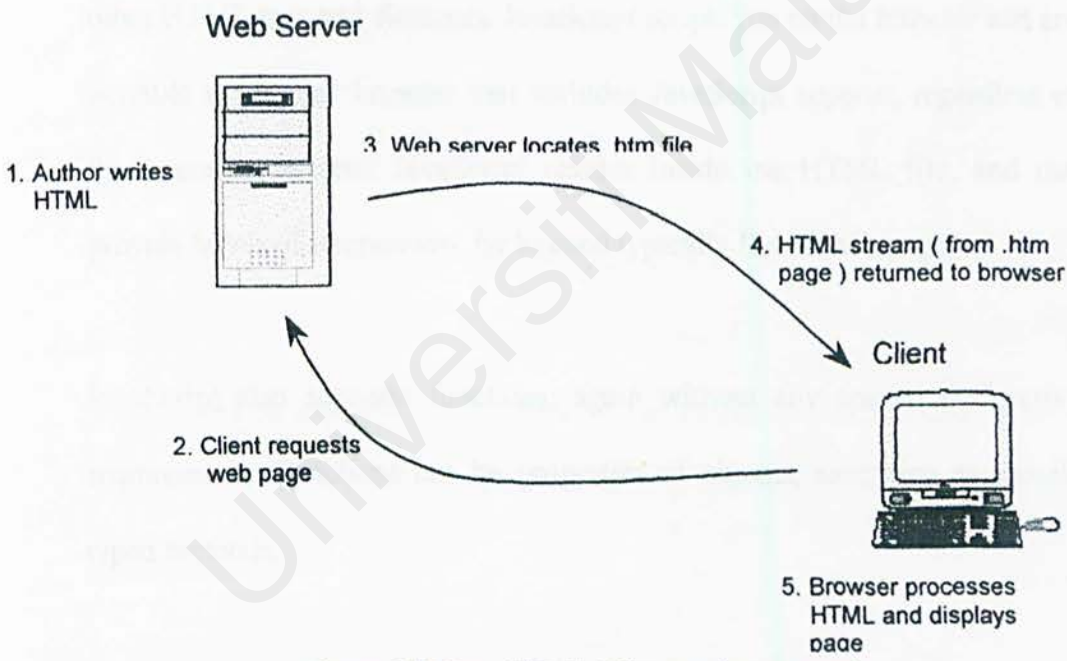

Figure 3.8 How HTML Files are Interpreted

(c) JavaScript

JavaScript is an interpreted programming or script language from Netscape. JavaScript is an easy to use object scripting language designed for creating live online applications that link together objects and resources on both clients and servers. JavaScript is designed for use by HTML page authors

and enterprise application developers to dynamically script the behavior of objects running on either a client or a server.

JavaScript gives developers the ability to do things such as check form contents, communicate with the 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.

What makes JavaScript special is the way it integrates with the Web. JavaScript code is included as parts of a standard HTML document, just like other HTML tags and elements. JavaScript scripts run on the browser and are portable across any browser that includes JavaScript support, regardless of the operating system. JavaScript resides inside the HTML file, and can provide levels of interactivity far beyond typically flat HTML pages.

JavaScript also supports functions, again without any special declarative requirements. Functions can be properties of objects, executing as loosely typed methods.

(c) VB (Visual Basic) Script

Visual Basic Scripting is a lightweight scripting language that provides programming functionality based on the Visual Basic programming language. It is natively executed on the Internet Explorer browser and can be executed in the browser through plug-in technologies.

VBScript lets the user interact with a Web page rather than simply view it. VBScript can take input from the user and check the data to make sure it is valid or meets certain criteria. Then, it can put an Internet server to work either by actually storing the data or causing some action to take place on the server based on the information given.

VBScript also play an important role in many ways, including validating data, pricing, providing impressive multimedia feedback, and initiating data storage. The user can use VBScript to sequence the questions based on responses.

3.4.6 Database Management System

(a) Microsoft SQL Server 7.0

Microsoft SQL Server 7.0 is a defining release for Microsoft's database products, building on the solid foundation established by SQL Server 6.5. SQL Server is the relational database management system (RDBMS) of choice for a broad spectrum of corporate customers and independent software vendors (ISVs).

Table 3.1 depicts some of the Microsoft SQL Server 7.0 standard features, which adds to the advantages of Microsoft SQL Server 7.0.

Feature	Function
OLAP Services	This new, fully featured online analytical processing (OLAP) component of Microsoft SQL Server 7.0 provides fast, efficient analysis of complex information essential to reporting, data analysis, decision support, and data modeling.
Simplified on-disk Storage	New sophisticated yet simplified on-disk storage architecture allows scalability from small laptop databases to terabyte-size enterprise databases.
Multiphase Query Optimizer	Multiphase Query Optimizer finds the optimum plan for queries to improve performance of complex queries.
Parallel Queries	This allows steps in a single query to be executed in parallel, delivering optimal response time.
English Query	This allows users to pose questions in English instead of forming queries with complex SQL statements.
Auto Statistics	Auto Statistics extract statistics using fast sampling, enabling the Query Optimizer to use the latest information and increase query efficiency
Tools and Utilities	Tools and utilities run much faster and are designed to have less impact on server operations.
Active Backup	Active backup provides high performance online backup with minimal impact on operational systems.
Merge Replication	Merge Replication allows users to work freely and independently, then combine their work later-built-in priority-based conflict resolution resolves merge conflicts.

Data Transformation Services	Data Transformation Services simplifies the process of importing and transforming data from multiple, heterogeneous sources, either interactively or automatically.
DBCC	Checks physical and logical consistency of database. Patented single-pass algorithm speeds performance. New features are supported and can fix some problems. New Storage Engine architecture minimizes need for DBCC, but it's still a good practice.
Dynamic Locking	This automatically chooses the optimal level of lock (row, key range page, or table) for all database operations. It maximizes the trade-off between concurrency and performance, resulting in optimal usage. No tuning is required.
Dynamic Self-Management	This enables the server to monitor and manage itself, allowing for hands-off standard operations.

Table 3.1 Features of Microsoft SQL Server 7.0

(b) Microsoft Access 2000

Microsoft Access 2000 is a powerful relational database application that a desktop user can use to efficiently create and manipulate database systems. Microsoft Access targets the desktop category and works best for individuals and workgroups managing megabytes of data.

Microsoft Access provides ease-of-use wizards throughout, such as the Database Wizard for getting up and running quickly, and the Simple Query Wizard for easily finding information from the data. The combination of ease-of-use and power in Microsoft Access makes it a good choice among

developers who frequently use Microsoft Access as a front-end to SQL Server in a client-server scenario.

3.4.7 Summary of Technology Consideration

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

- ✓ Windows 2000 as the server platform
- ✓ Internet Information Server 5.0 as web server
- ✓ Microsoft Access 2000 as database
- ✓ SQL server 7.0 as database management system
- ✓ Internet Explorer 5.0 as web browser
- ✓ Active Server Pages (ASP)
- ✓ Hyper Text Markup Language (HTML)
- ✓ VB Script
- ✓ JavaScript
- ✓ Macromedia Dreamweaver 4
- ✓ Adobe Acrobat 5.0
- ✓ Notepad and Microsoft Visual InterDev – to write the ASP and HTML codes
- ✓ Microsoft Word 2000 – documentation

CHAPTER

4

System Design

Chapter 4 – System Design

System design is a process of synthesizing or reassembling the components and functional identified during analysis. In system design, requirements are translate into a model or representation of the software that can be access for quality before coding begins. The purpose of design is to specify the components and functions of the system that will be most efficient, effective in meeting the organization's information needs.

4.1 System Architecture

4.1.1 Client / Server Architecture

A client is defined as a requester of services and server is defined as the provider of services. A single machine can be both a client and a server depending on the software configuration.

The client / server software architecture is versatile, message-based and modular infrastructure that is intended to improve usability, flexibility, interoperability and scalability as compared to centralized, mainframe, time sharing computing. This approach introduced a database server to replace the file server. Using a relational database management system (DBMS), user queries could be answered directly.

The client / server architecture reduced network traffic by providing a query response rather than total file transfer. It improves multi-user updating through a Graphical User Interface (GUI) front end to a shared database. In client /server architecture, Remote Procedure Calls (RPCs) or standard query

language (SQL) statements are typically used to communicate between the client and server.

4.1.2 Three-tier with an Application Server

A three-tier architecture is a flexible way of organising distributed client-server systems. In the simplistic approach suggested by the name, every client is connected to every server. In a three-tier architecture, an intermediate connecting layer is introduced. Each of the client programs and servers then communicate with the intermediate layer. This provides a clear separation of the client programs from the data sources/sinks and allows them to be maintained more easily. Servers are typically SQL databases but they could equally be devices as well as other types of databases (Strand Software Technologies, 1995).

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 rather it shares business logic, computations, and a data retrieved engine. Advantages are that with lest software on the client there is less security to worry about, applications are more scalable and support, and installation cost are less on a single server than maintaining each on a desktop client. The application server design should be used when security, scalability, and cost are major consideration.

4.1.3 DLHB: Three-Tier Client / Server Architecture

The Digital Library of Historical Buildings (DLHB) is implemented using three-tier client-server architecture as shown in Figure 4.1.

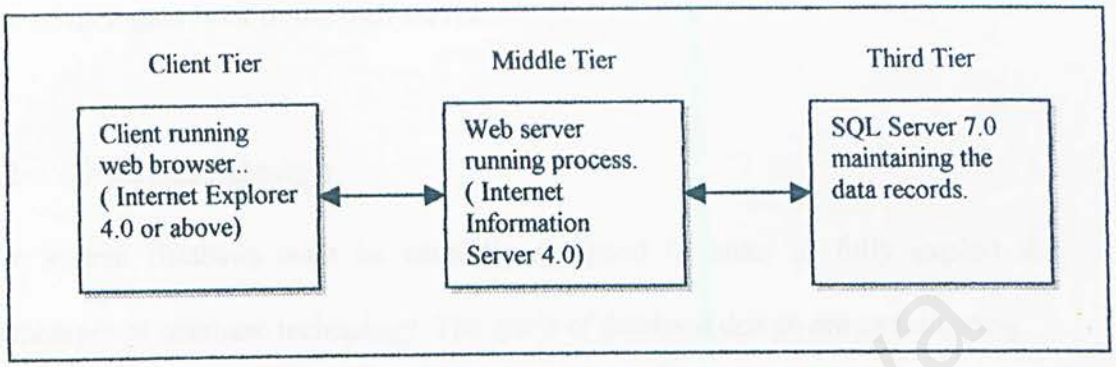

Figure 4.1 Three-Tier Client / Server Architecture of DLHB

- **Client-tier**

  For this system, client-tier is constituted of computers with Internet Explorer (4.0 or above). User interfaces are provided for clients to process their application and manipulate their data.

- **Middle-tier**

  Middle-tier consists of Internet Information Server 4.0 as the web server. All application programs or files will be resided in the middle-tier (web server). The web server processes the request from the client & then returns required result in web pages format. It will process any data request by linking to database server. For example, authenticating and validating users that login to the server.

- Third-tier

  The third-tier consists of the Microsoft SQL Server 7.0 as the database server. Microsoft SQL Server 7.0 maintains the data records. Every query requested from the web server will be authenticated first and the results will then pass back to the web server.

4.2 Database Design

The system database must be carefully designed in order to fully exploit the advantages of database technology. The goals of database design are as following:

a. Provide for efficient storage, update and retrieval of data.
b. Be reliable where the stored data should have high integrity data.
c. Be adaptable and scalable to new and unforeseen requirements and applications.

4.2.1 E-R Diagram

E-R diagram is used to show all the entries including organization, users, program and data that play roles in the system. Figure 4.2 shows the ER diagram for the table relationship in the database of DLHB.

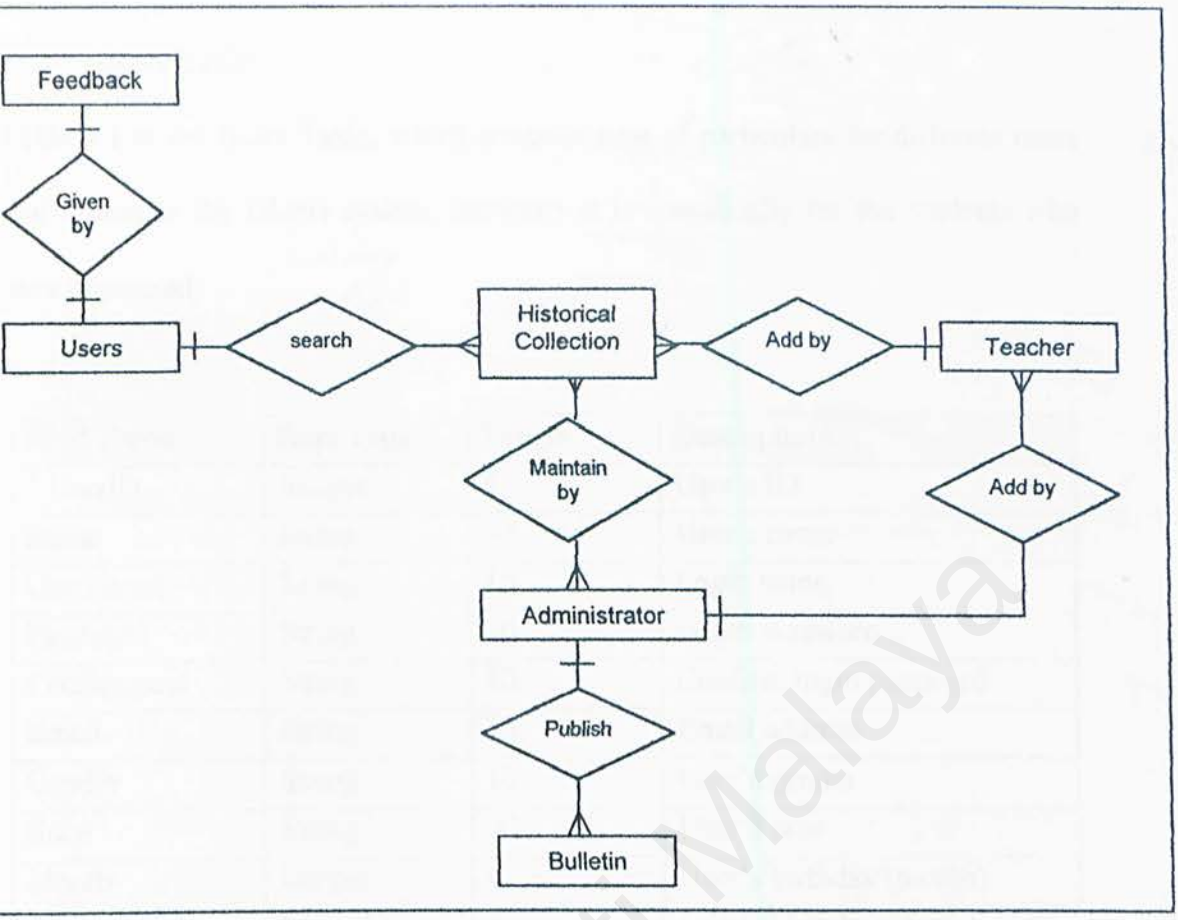

Figure 4.2 E-R Diagram for Digital Library of Historical Buildings (DLHB)

4.2.2 Table Master

There are 6 tables in the digital library database including Users, Administrator, Teacher, HistoricalCollection, Feedback and Bulletin. Each table contains at least one primary key which marked with '*'. The User, Administrator and Teacher information are kept in the database to keep track of individual particulars and to ease the control of management.

On the other hand, table of HistoricalCollection contains specific information for the contents of the database. Search & Indexing functions will be using this table to retrieve information from the database. Feedback and Bulletin tables are used to retrieve information inquired by the administrator.

Users Table

Table 4.1 is the Users Table, which contains type of particulars for different users that access to the DLHB system. Basically it is specifically for the students who have registered.

Field Name	Data Type	Length	Descriptions
* UserID	Integer	4	User's ID
Name	String	50	User's name
UserName	String	15	Login name
Password	String	10	Login password
Confirmpass	String	10	Confirm login password
Email	String	30	Email address
Gender	String	10	User's gender
Race	String	20	User's race
Month	Integer	4	User's birthday (month)
Days	Integer	4	User's birthday (day)
Years	Integer	4	User's birthday (year)
Occupation	String	30	User's occupation
School	String	100	User's school
Form	String	20	Level of form
Address	String	200	User's address
Postcode	String	10	Postcode
City	String	30	City
State	String	30	State
Country	String	30	Country

Table 4.1 User Table

Administrator Table

Table 4.2 shows the type of particulars that will be included in the DLHB database under Administrator table.

Field Name	Data Type	Length	Descriptions
*AdminID	Integer	4	Administrator's ID
Name	String	50	Administrator's name
LoginID	String	15	Login ID
Password	String	10	Login password
Info	String	15	Person category
LastLogin	Datetime	8	Date & time of last login

Table 4.2 Administrator Table

Teacher Table

Table 4.3 depicts Teacher Table that contains the type of information for teachers, as one of the management of back-end system in DLHB.

Field Name	Data Type	Length	Descriptions
*TeacherID	Integer	4	Teacher's ID
Name	String	50	Teacher's name
LoginID	String	15	Login ID
Password	String	10	Login password
Email	String	30	Email address
Gender	String	10	Teacher's gender
Race	String	15	Teacher's race
School	String	100	School name
SchoolAddress	String	200	School Address
SchoolTel	String	15	School contact number
State	String	30	State
Info	String	15	Person category
LastLogin	Datetime	8	Date & time of last login

Table 4.3 Teacher Table

HistoricalCollection Table

Table below contains the type of information for historical buildings (content) that will be helped in searching for information in DLHB.

Field Name	Data Type	Length	Descriptions
*ContentID	Integer	4	Content ID
Title	String	150	Content title
ContentType	String	20	Type of media
ConType_details	String	50	Specific type of media
Size	String	10	File size
Author	String	50	Content author
School	String	50	Author's school (for report)
ReportYear	String	4	Report year
Keyword	String	300	Content keywords
DateUploaded	Datetime	8	Content upload date
YearBuilt	String	4	Year of built
FileName	String	50	File name
FilePath	String	200	File path
Location	String	30	Building location
Founder	String	200	Building founder
Abstract	String	500	Content abstract
PersonID	Integer	4	Person ID who upload
PersonInfo	String	15	Person category who upload
LastModified	Datetime	8	Date of last modified
BuildingType	String	50	Type of historical building

Table 4.4 HistoricalCollection Table

Feedback Table

Table 4.5 below is the feedback table that will be used to follow-up feedback by administrator.

Field Name	Data	Lengt	Descriptions
*FeedbackID	Integer	4	Feedback ID
DateSubmitted	Datetime	8	Date of submitted feedback
Occupation	String	20	Visitor's occupation
Interest	String	20	Visitor's interest of historical buildings
School Location	String	30	Visitor's school location
FrequencyUsed	String	20	Frequency use of DLHB
Success	String	20	Describe the success of DLHB
Discover	String	30	Discover through
Access From	String	30	Location Access
Benefit	String	300	Benefit of using DLHB
Broken Link	String	50	Broken links of DLHB
Comment	String	500	Visitor's comment

Figure 4.5 Feedback Table

Bulletin Table

Table 4.6 is Bulletin Table that contains simple information regarding the bulletin in DLHB.

Field Name	Data Type	Length	Descriptions
*BulletinID	Integer	4	Bulletin ID
Title	String	50	Bulletin title
Announcement	String	300	Announcement
DateUploaded	Datetime	8	Bulletin uploaded date
DayRemoved	String	3	Bulletin removed day
MonthRemoved	String	3	Bulletin removed month
YearRemoved	Integer	4	Bulletin removed year
AdminID	Integer	4	Administrator's ID

Table 4.6 Bulletin Table

4.3 Program Design

The program specifications produced at the end of program design must ensured the program satisfy user requirements. A part for satisfying the user requirements, the program must easy to read and understand. It enables other person to amend it later. The program should accommodate system changes occur after the system is built. A variety of design tools including structured chart and data flow diagram are helped in developing well-structured program.

4.3.1 Structured Chart

Structured chart show the top-down design of a program. Each box or module in the chart indicates a task that the program must accomplish. Figure 4.3 shows the Structured Chart in DLHB system.

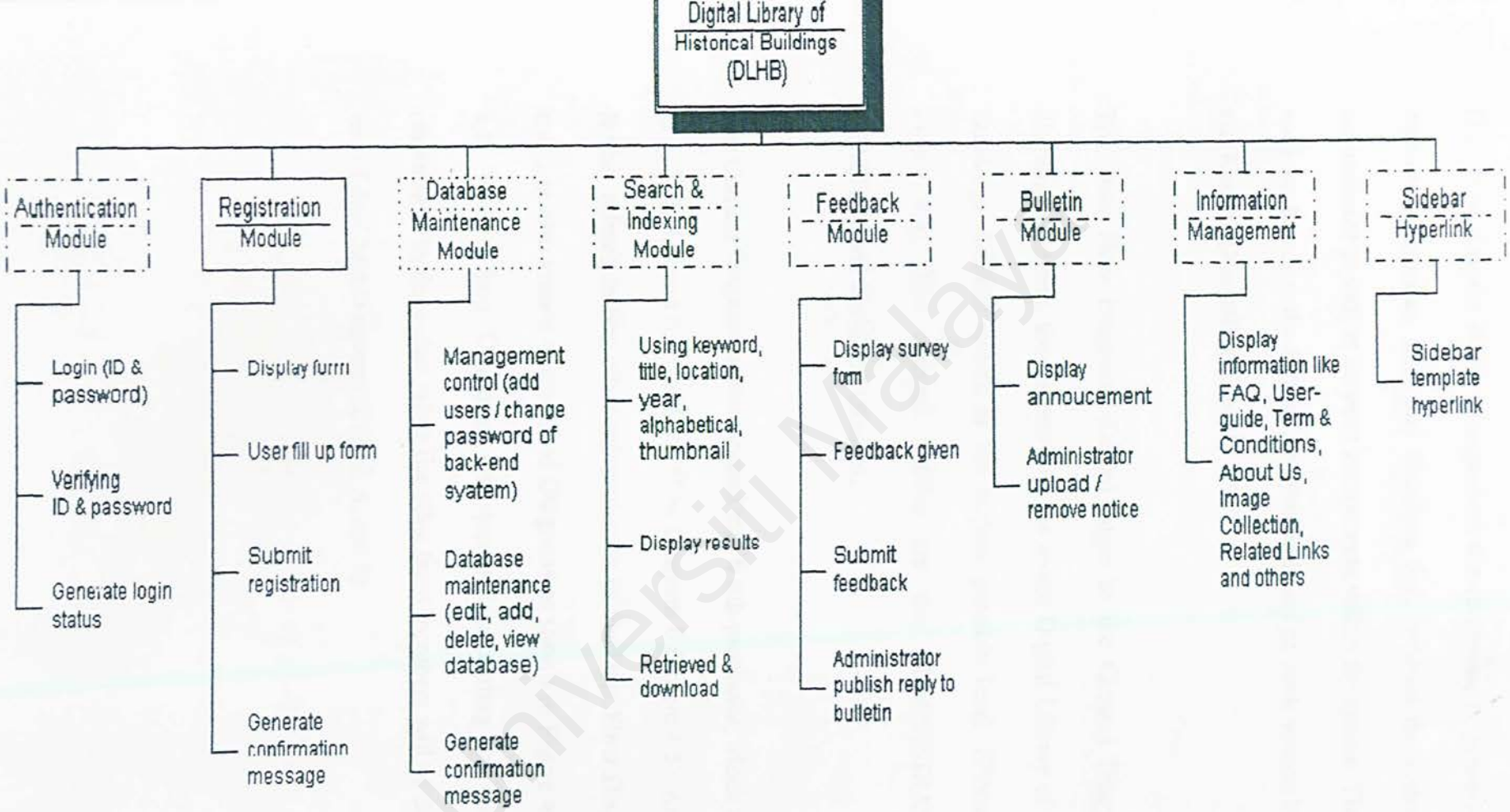

Figure 4.3 Structured Chart of DLHB System

4.3.2 Data Flow Diagram (DFD)

Data flow diagram is use to represents the functions, or processes, which capture, manipulate, store and distribute data between the system and its environment as well as between components within the system. The symbols used are based on the System Analysis and Design book written by Kendall and Kendall (Kendall & Kendall, 1999).

The Data Flow Diagrams (DFDs) begin at the Context Diagram. This diagram represents the overview of the entire Digital Library of Historical Buildings (DLHB) system at the highest possible level. (Please refer to Figure 4.4). The external entities are the ADMINISTRATOR, the TEACHER and the USER (student).

The Context Diagram is decomposed into 6 sub-processes, which are labeled as 1, 2, 3, 4, 5 and 6 in the Data Flow Diagram 0 (Figure 4.5). And they are further refined to few other sub-processes in the Data Flow Diagram 1, 3, and 6 or also known as the Child Diagrams as shown in Figure 4.6, 4.7 and 4.8. These Child Diagrams are designed according to the modules responsible by the author while the other team members will be designed the rest of the Child Diagrams (DFD 2, 4, and 5).

Context Diagram

Figure 4.4 depicts the context diagram for the DLHB system.

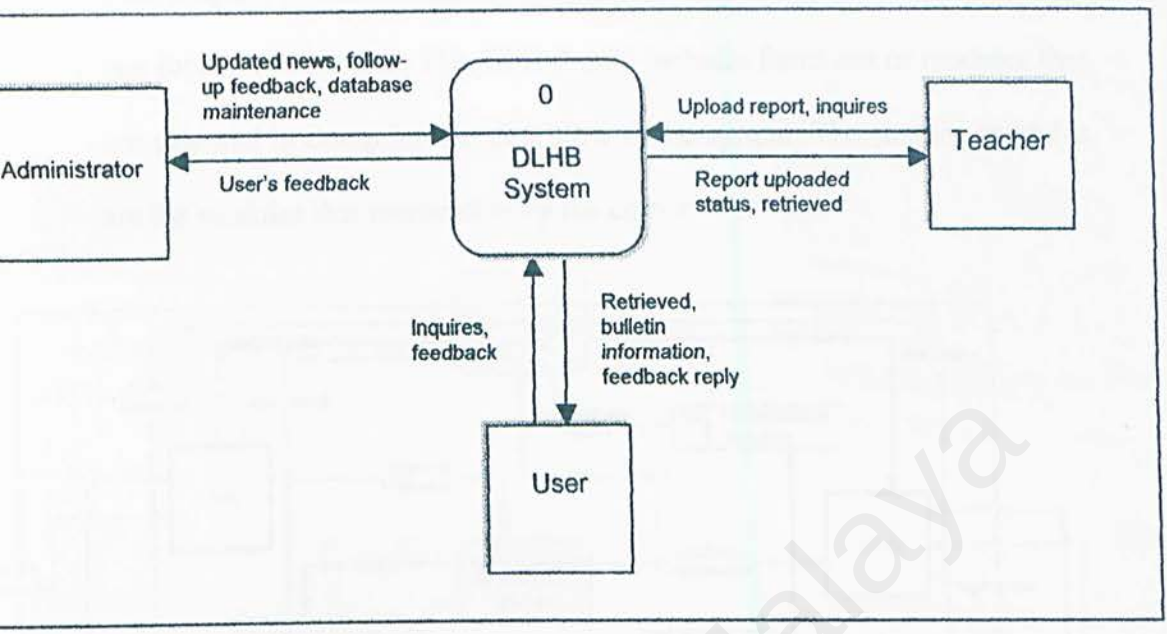

Figure 4.4 Context diagram for Digital Library of Historical Buildings (DLHB)

Data Flow Diagram 0 (DFD 0)

Figure 4.5 shows the Data Flow Diagram for the whole system of DLHB. This diagram is also known as DFD 0. It shows on how the data flow from one function to another. This DFD 0 only includes functions or modules that are essential in designing the data flow in the system. The shading modules are the modules that responsible by the author.

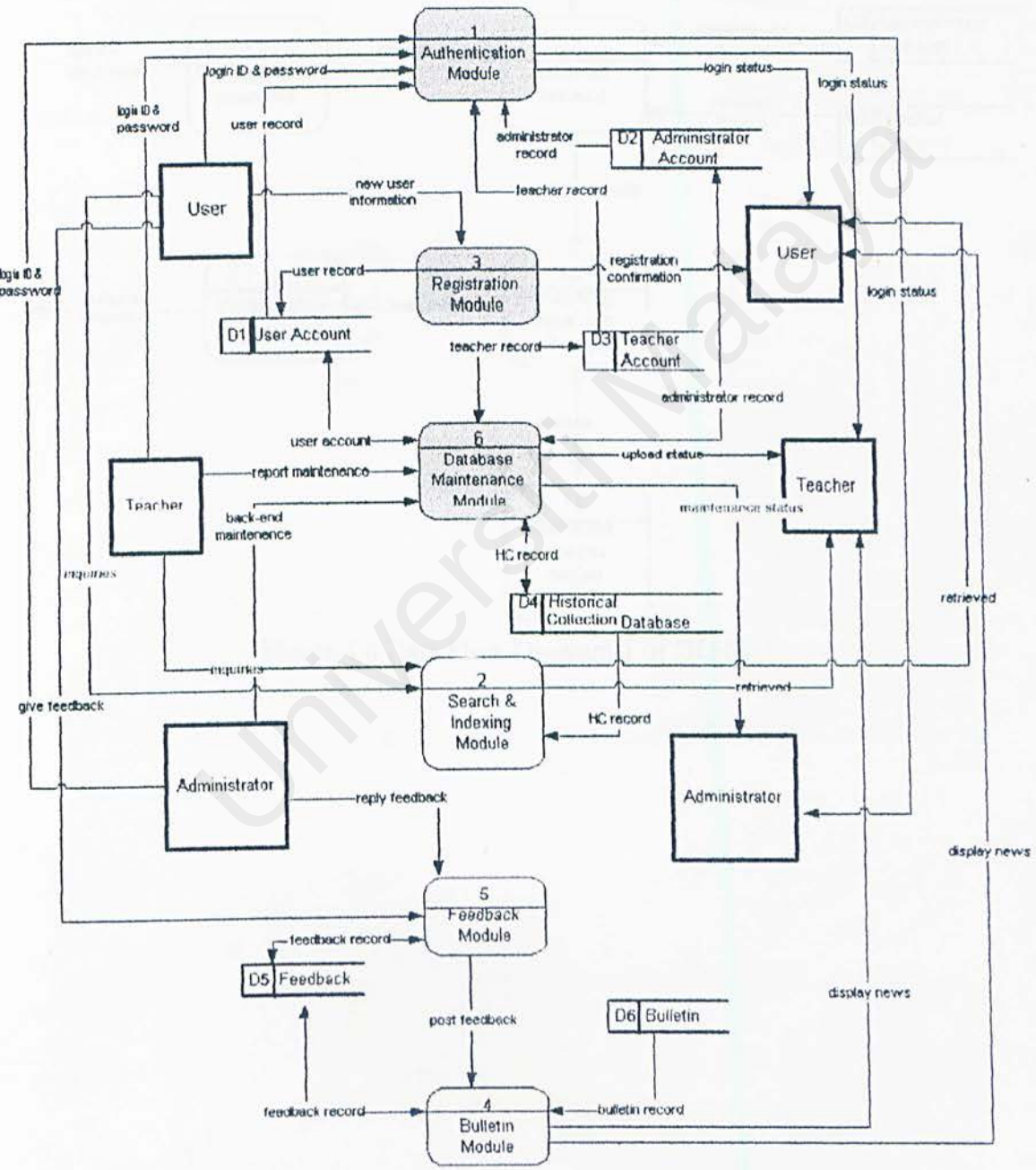

Figure 4.5 Data Flow Diagram 0 of DLHB

Data Flow Diagram 1 (Authentication Module)

Figure below depicts how the data flow when authentication takes part in the system.

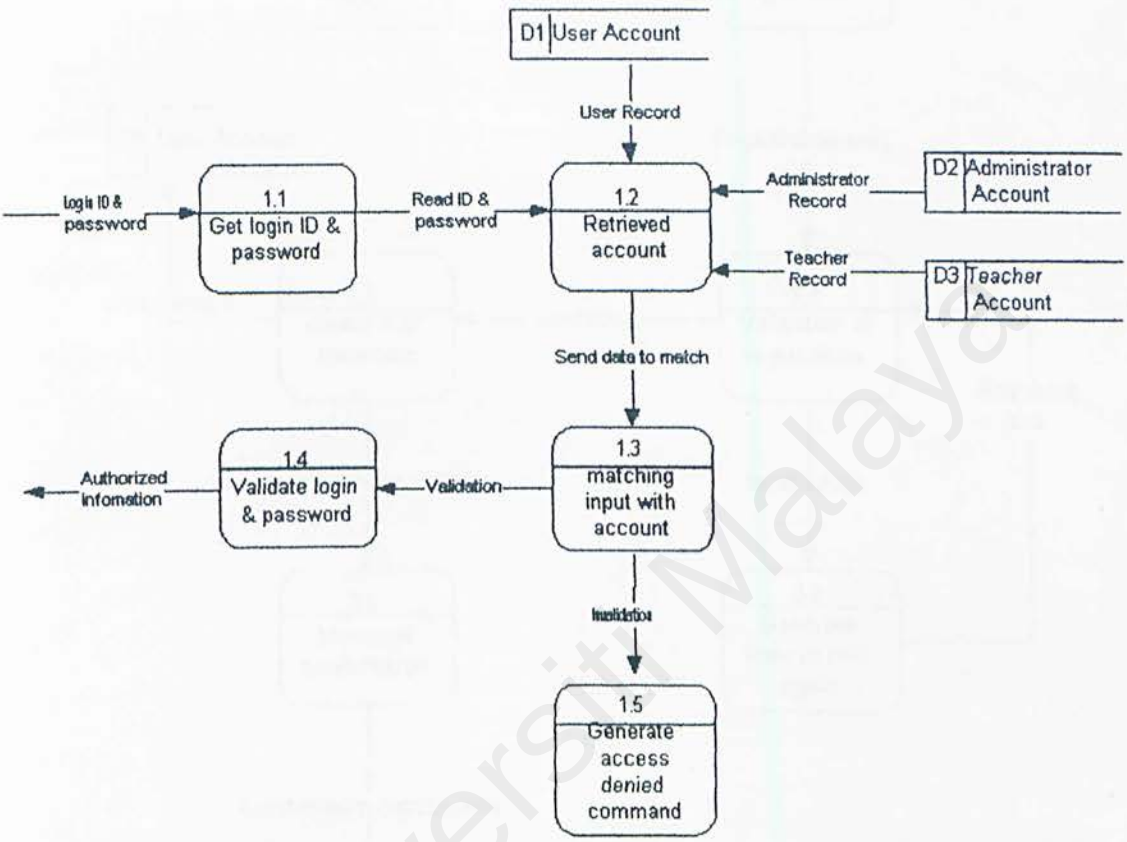

Figure 4.6 Data Flow Diagram 1 of DLHB

Data Flow Diagram 3 (Registration Module)

Figure 4.7 is the Data Flow Diagram for the registration module.

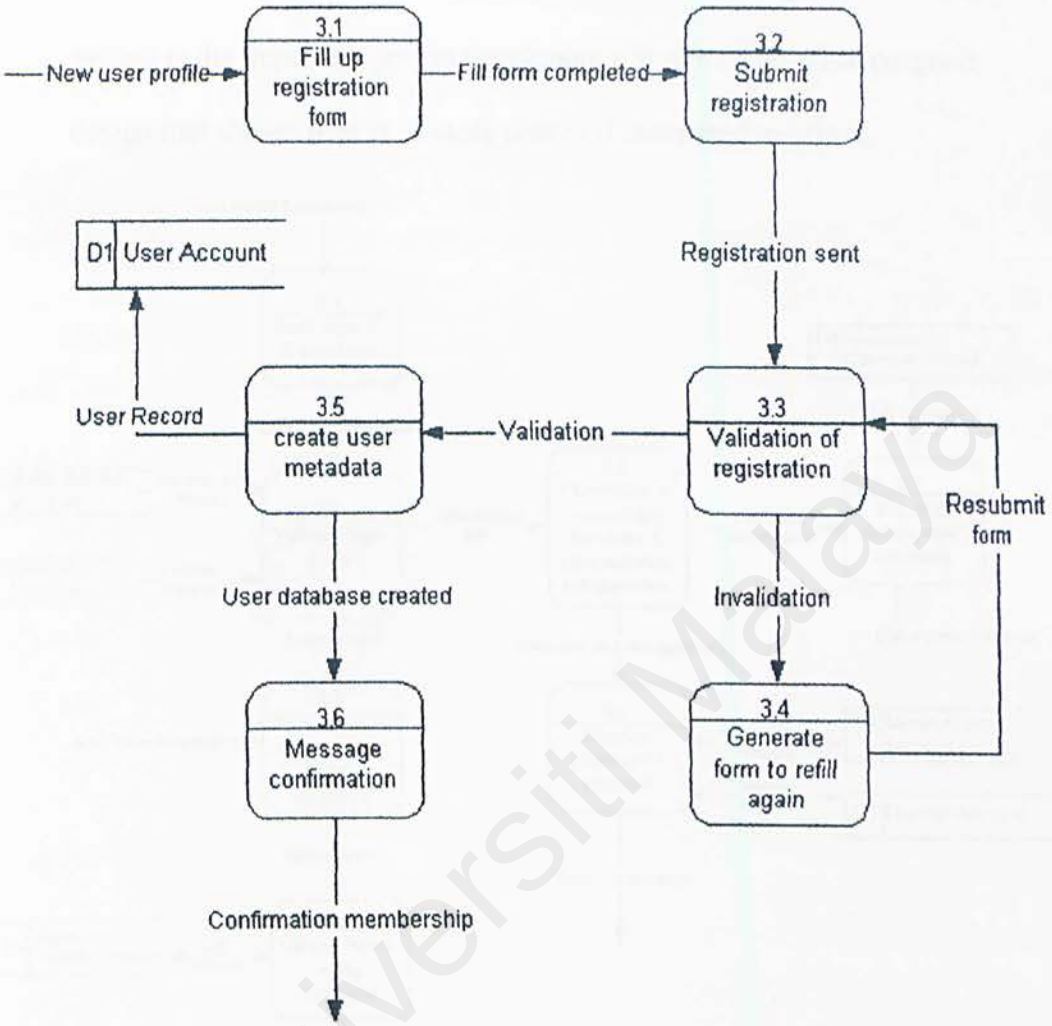

Figure 4.7 Data Flow Diagram 3 of DLHB

Data Flow Diagram 6 (Database Maintenance Module)

Figure 4.8 depicts the data flow diagram of database management. This module is complicated as compare to the other child diagram. Back-end system is the important part in developing a system. Therefore program design that shown here is in more details if compared to others.

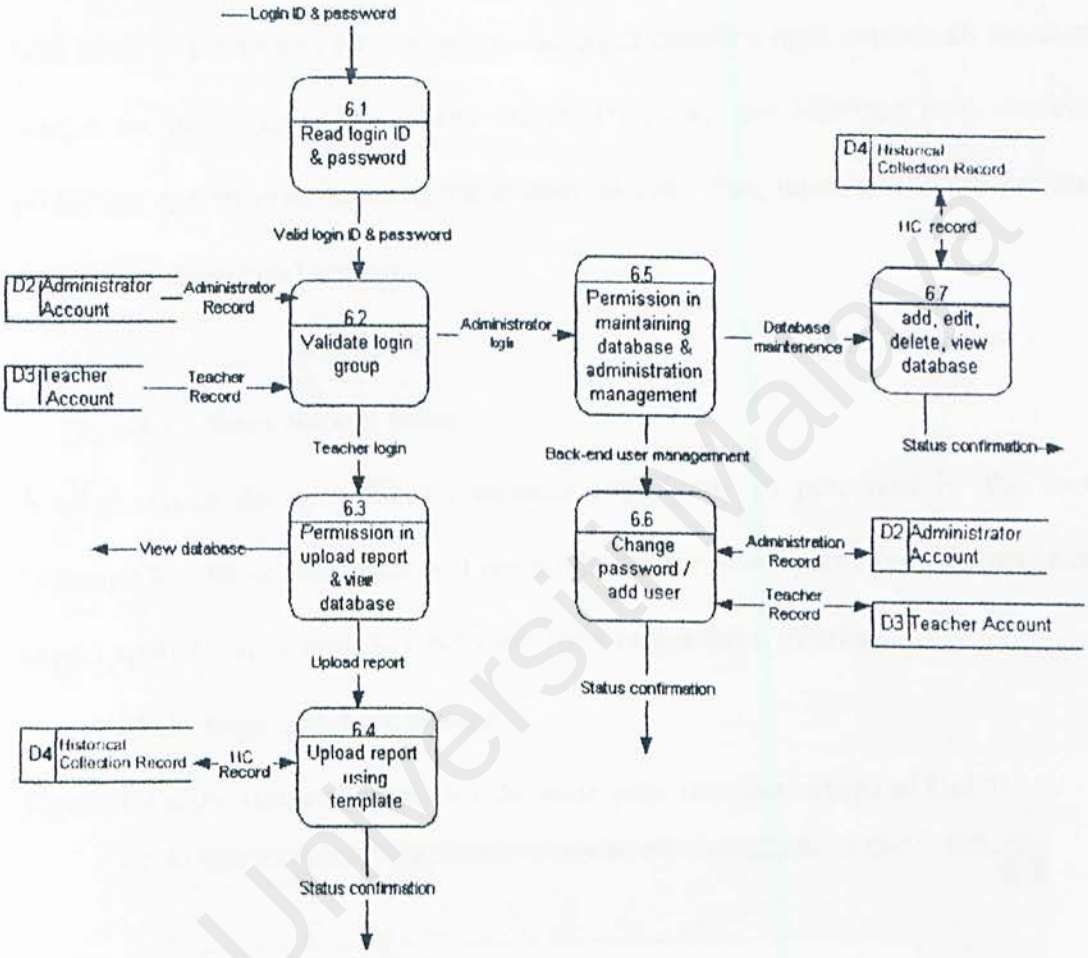

Figure 4.8 Data Flow Diagram 6 of DLHB

4.4 User Interface Design

Interface design is the specification of a conversation between the system user and the computer. A good, ease to use and user-friendly interface will make user's job easier and more pleasant. User interface design must take into account the needs, experience and capabilities of the system user (Sommerville, 1995). Interface covers both input and output in the computer. The input interface must capture all the data needed for the system without any errors. Therefore, the interface must contain protection against error entering the system. Besides that, input must well line out and easy to understand and use.

4.4.1 Basic Screen Design

A good screen design reduces interfaces complexity as perceived by the user. Although text-based interfaces will remain in use for many years, users increasingly expect application systems to have some form of graphical interface.

Main Page Interface Design

Figure 4.9 is the captured screen for the main page interface design of DLHB.

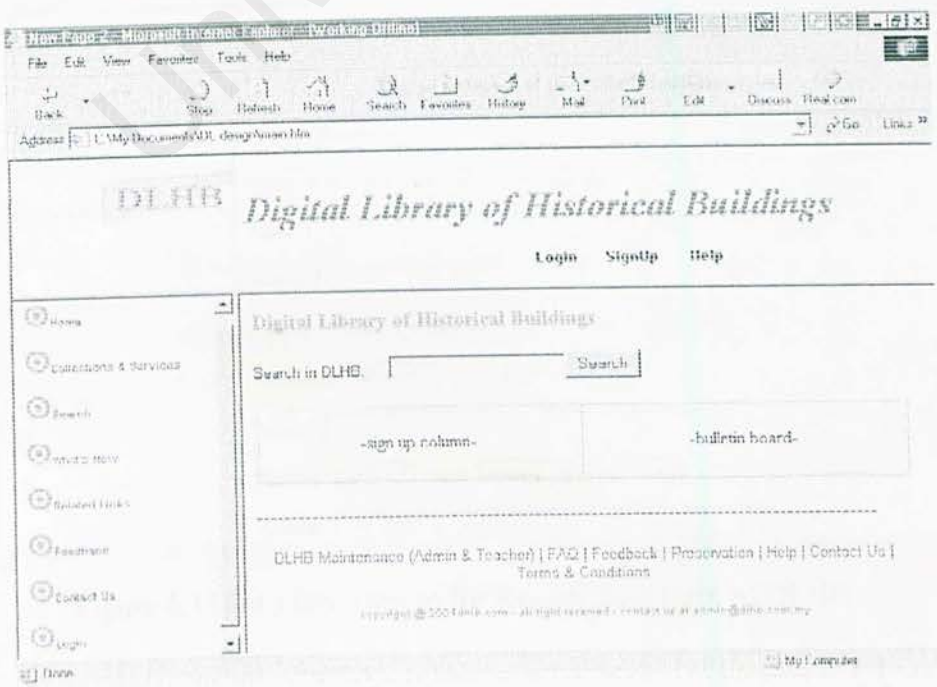

Figure 4.9 Interface Design for main page of DLHB

Authentication Interface Design

Authentication interface design is showed in Figure 4.10 below.

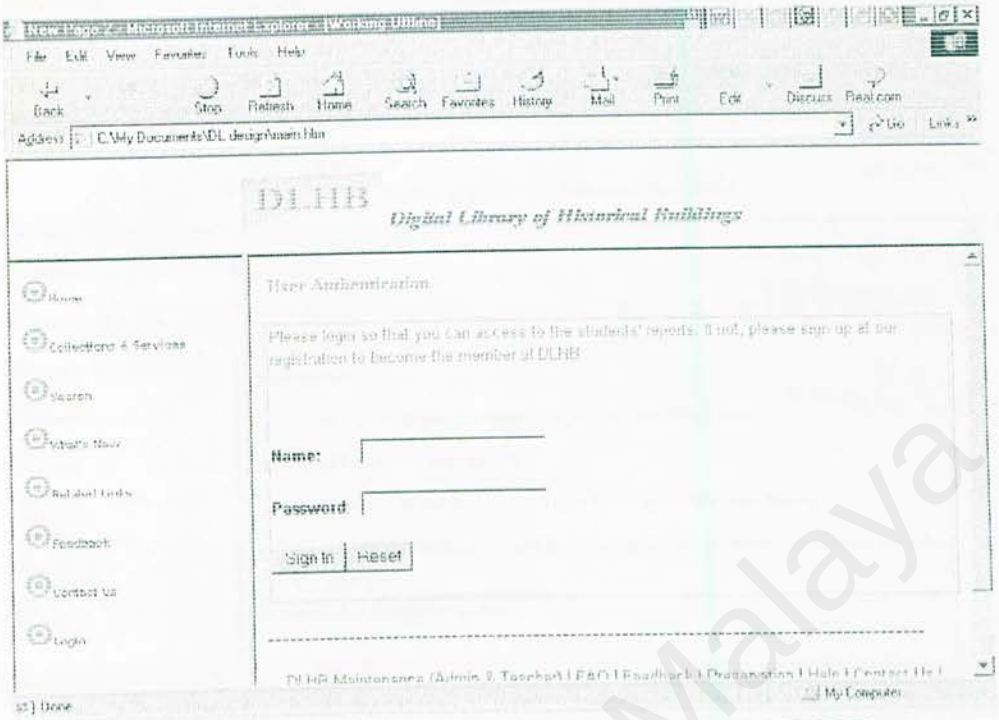

Figure 4.10 Interface Design for Authentication of DLHB

Registration Interface Design

Figure below shows the registration form of DLHB system.

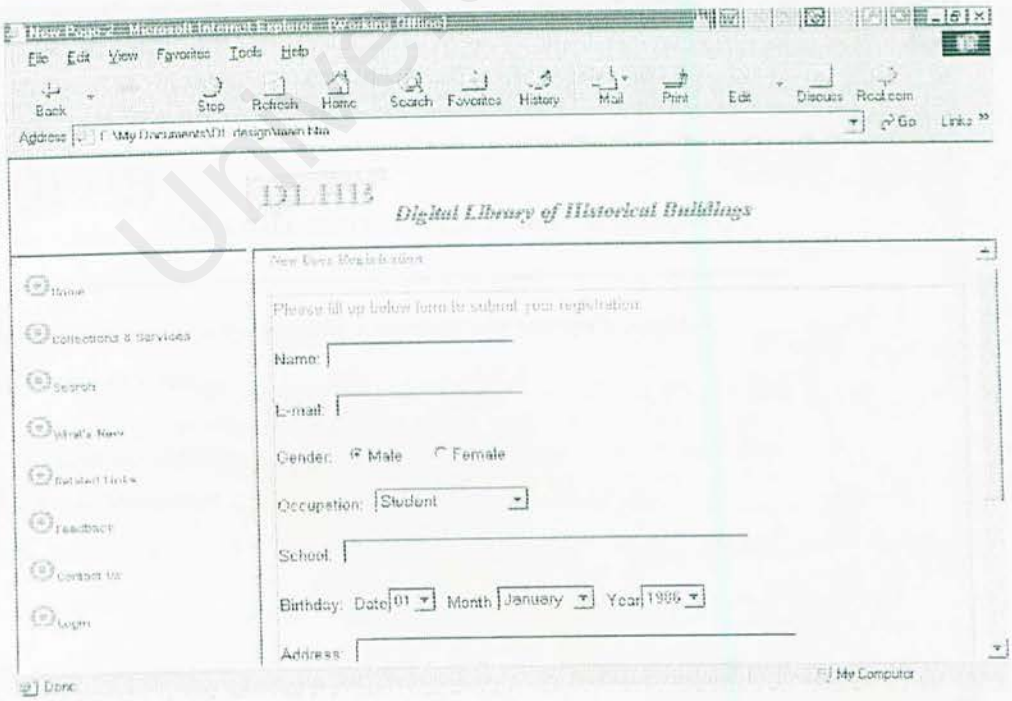

Figure 4.11 Interface Design for Registration form of DLHB

Information management (User-Guide) Interface Design

Figure below show the user interface design for user-guide.

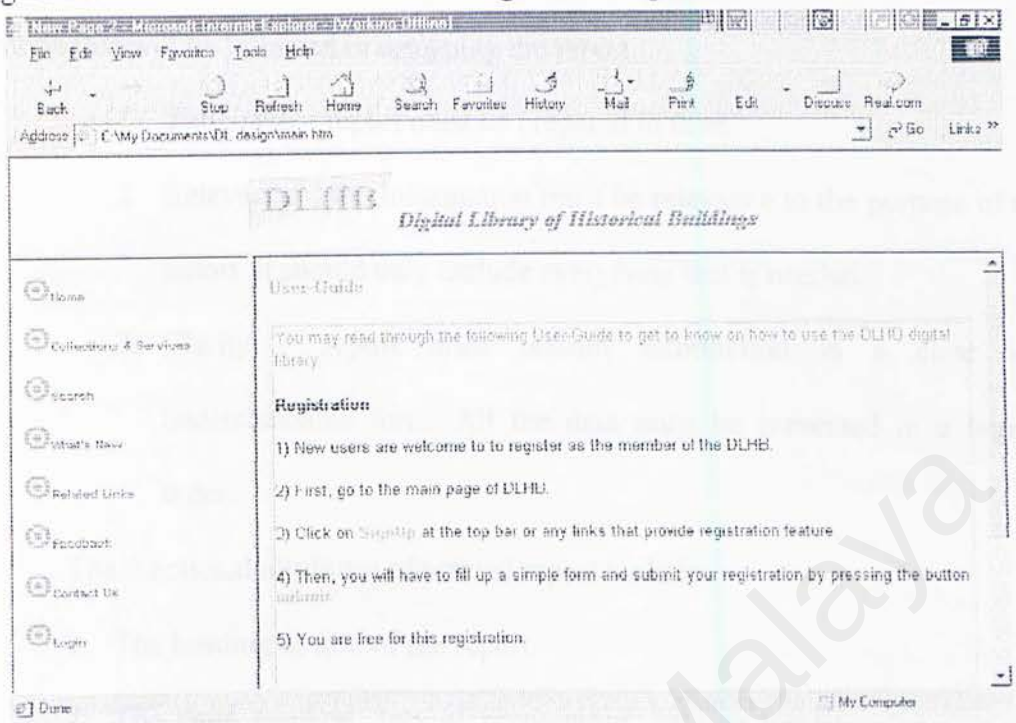

Figure 4.12 Interface Design for User-Guide of DLHB

Maintenance Interface Design

Figure 4.13 is the user interface for the administrator's maintenance.

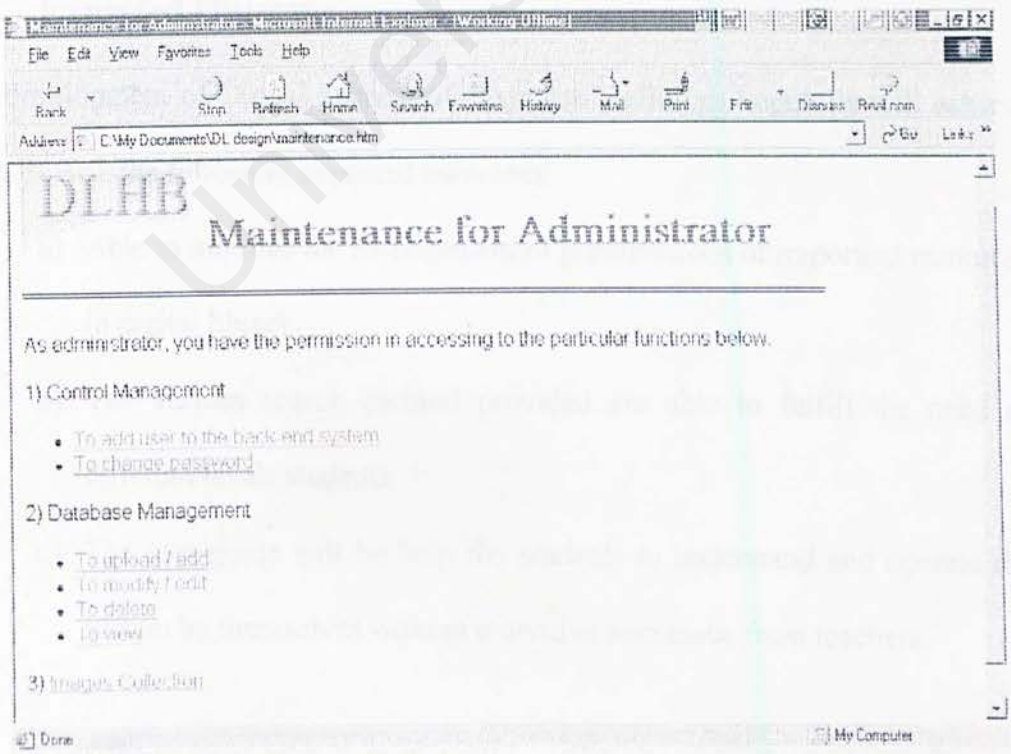

Figure 4.13 Interface Design for Maintenance (Administrator) in DLHB

4.4.2 Report Design

Reports convert information from computer file to the users. There are several criteria that will be followed in designing the report:

1. Timeiness – report must be prepared in time.
2. Relevance – the information must be relevance to the purpose of the report. It should only include everything that is needed.
3. Clarity – report must present information in a clear and understandable form. All the data must be presented in a logical order.

The functional attributes of printed report include:

1. The heading or title of the report.
2. The page number; data of preparation; column headings; grouping of related data items together; and use of control breaks.

4.5 Expected Outcome

The development of Digital Library of Historical Buildings hopefully will achieve its goals with the following expected outcomes:

a) Able to improve the management of preservations of important resources in digital library.

b) The various search method provided are able to fulfill the need of different levels students.

c) The user-guide will be help the students to understand and operate the system by themselves without extensive assistance from teachers.

CHAPTER

5

System Implementation

Chapter 5 – System Implementation

5.1 Introduction

System Implementation is the acquisition and integration of the physical and conceptual resources that produces a working system (Meyer, Baber and Pfaffenberger, 1999). It is the physical realization of the database and application designs (Connolly and Berr, 1998). System implementation includes building and testing its contained modules and sub-modules, involving system requirements and design conversion into programme codes.

5.2 Development Environment

The usage of a dynamic and suitable hardware and software could help accelerate the development or construction of any system. The following sections describe the hardware and software tools used to develop and document the Digital Library of Historical Buildings in Malaysia (DLHB).

5.2.1 Hardware Development Environment

The hardware configuration of the DLHB development environment is listed below:

- Dell Computer Corporation OptiPlex GX110 (Desktop);
- BIOS – Dell Computer Corporation A02 01/28/2000;
- Dell Compatible Computer – 128MB RAM, Intel ® Pentium III 733MHz processor;
- 50x speed WDC WD204BB 07.0 CD-ROM driver;
- SVGA 800x600 pixels 15-inch color DELL monitor;
- 20.5 GB Hard Disk;
- Standard floppy disk drive, printer, speaker and standard modem for Internet connection.

5.2.2 Software Development Environment

(a) Software Tools for Design and Documentation

"Design" in this section explicitly refers to the processes of the structure chart, data flow diagrams and entity-relationship diagram drawings in the initial development phase of DLHB. The tools used in the development of DLHB are Microsoft Word 2000, Microsoft Excel 2000, and Microsoft Visio.

(b) Software Tools for the Prototype Development

Table 5.1 summarizes the software tools used in the development of DLHB module prototypes.

Software	Usage	Description
Microsoft Windows 2000 Server	Development Environment System Requirement	Operating System
Microsoft Visual InterDev 6.0	System Development	Prototype module coding and interface design
Microsoft SQL Server 7.0	Database Design	Database design, construction and implementation for data storage and manipulation.
Macromedia Dreamweaver 4	System and Interface Design	Solution for professional Web site design and production
Macromedia Flash 5	Interface Design	Solution for producing high-impact, vector-based Web sites
Adobe Photoshop 6.0	Interface Design	Artwork image files and interface images scanning

Table 5.1 Summary of Software Tools for the Development of DLHB

5.3 Database Development

The first step in the system development is to develop the system's database based on the logical data model for the Digital Library created during the system design

phase. The database used for the initial development stage of the DLHB System's was Microsoft SQL Server 7.

The database development was started by creating an empty database called *DLHB*. All the tables are then created by specifying all the fields for each table and the field properties. A primary key is allocated for each table in the database. Figure 5.1 shows captured screen of list of tables in the database development of DLHB using Microsoft SQL Server 7.

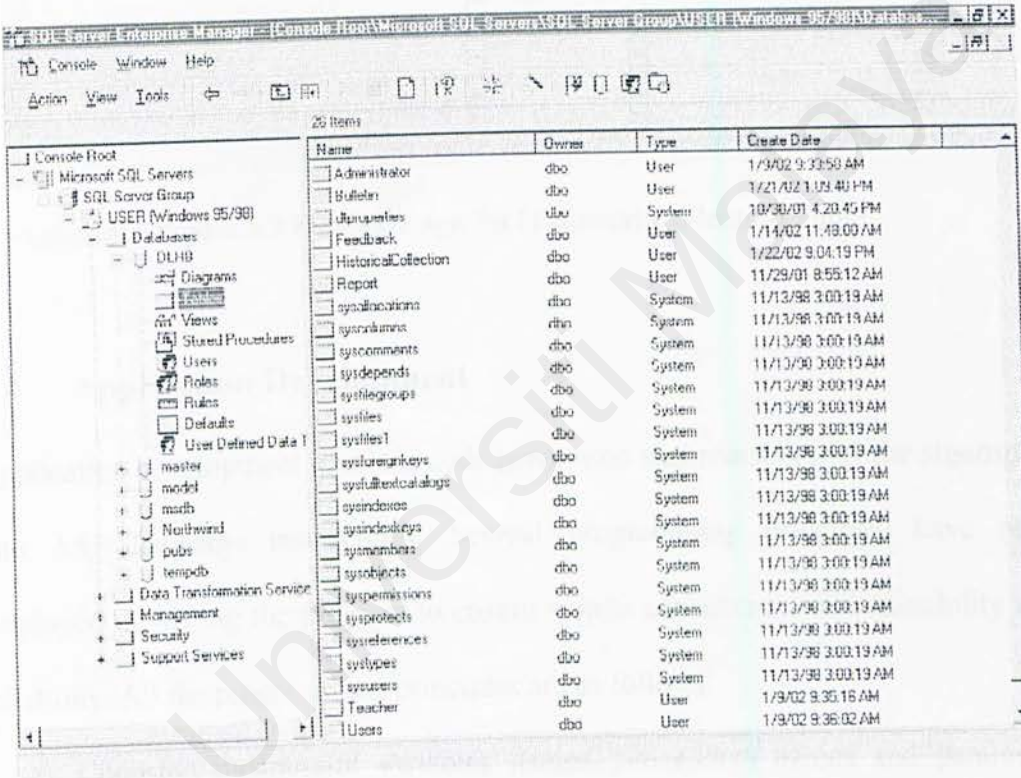

Figure 5.1 Captured Screen: List of Table for DLHB database in SQL Server 7

Figure 5.2 depicts the field's design for the Historical Collection Table in the database development of DLHB

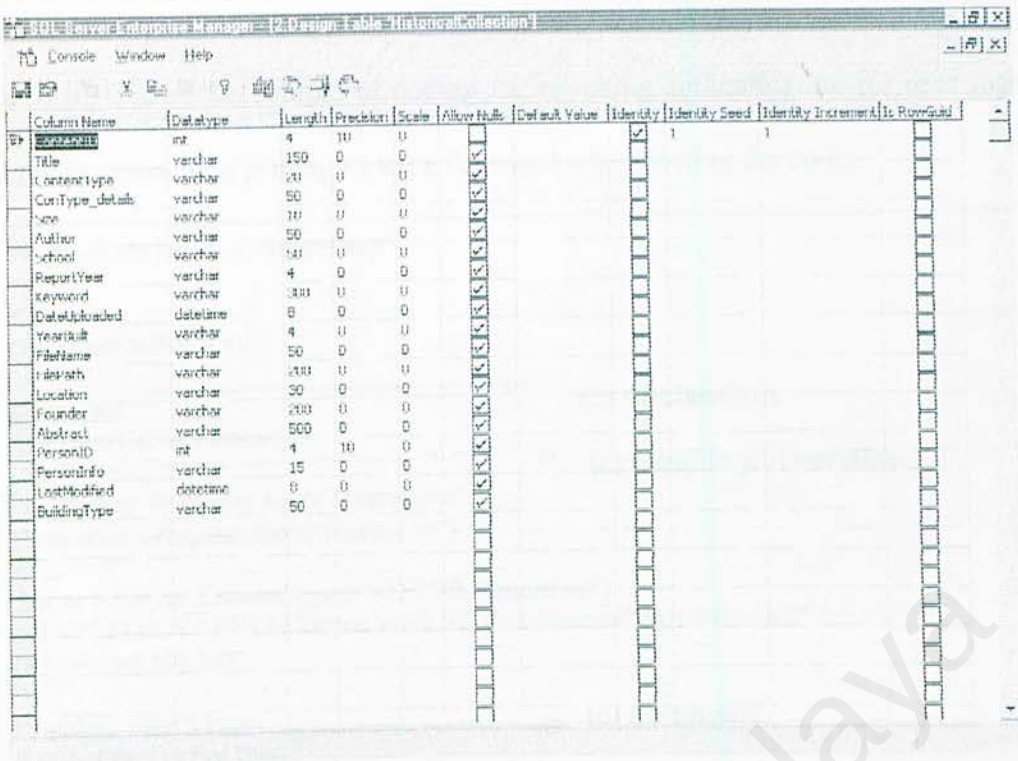

Figure 5.2 Fields Design for Historical Collection Table

5.4 Application Development

Application development involves code generation that translates all the algorithms into ASP language instructions. Several programming principles have been employed in writing the program to ensure system consistency, maintainability and reliability. All the programming principles are as follows:

a) Choosing meaningful variables names, procedures names and parameter variable names helps a program to be "self-documenting" without excessive use of comments.

b) All declarations are placed at the beginning of procedure and declarations are separated from the executable statements in that procedure with a blank line to make the declarations stand out and contribute to program readability.

c) Insert comments to document the programs and improve program readability.

Figure 5.3 shows the sample of coding for checking authentication for user login. All the programming principles were followed when writing the codes.

```
<!--#include file="../Connect.asp"-->

<%
response.buffer = true

dim rs,sql                                          (b) declaration
dim UserName,Password                               (a) meaningful variables

UserName = request.form("UserName")
Password = request.form("Password")

Set rs = Server.CreateObject("ADODB.Recordset")
sql = "SELECT * FROM Users WHERE UserName='"&UserName&"' "
rs.open sql,objConn

' validate user's login                            (c) comment
if rs.eof and rs.bof then
        Response.write "<script>alert('No such Login Name.\nIf you are a new user,
please register...');location.href =  'userlogin.asp';</script>"

else
        while not rs.EOF
                if rs("Password") = Password then
                        session("auth") = Password
                        session("id") = rs("UserID")
                        response.redirect "index.asp"
                else
                        rs.MoveNext
                end if
        wend
   Response.Write "<script>alert('Password wrong!\nPassword is Case Sensitive');
                        location.href='userlogin.asp';</script>"
end if

%>
```

Figure 5.3 Sample Code of DLHB - Checking Authentication for User Login

5.4.1 Web Server

(a) Internet Information Server (Windows 2000 Server)

IIS 5 is an extremely fast Web server. It includes a File Transfer Protocol (FTP) Server to upload and download files, a Network News Transfer Protocol (NNTP) to

serve newsgroup and a Simple Mail Transfer Protocol (SMTP) for sending email. IIS 5 provides integrated security, access to content and an interface for COM.

IIS differentiates file types based on the file extension. To respond to requests, the server first strips the file extension from the filename, looks up the associated program, and then launches that program to return the file.

(b) The Root Directory

All files for the DLHB web sites reside under the DLHB directory in the D drive of the Web server (Proserver2). A virtual directory (DLHB) was then created at the IIS and it points to the physical directory, which was created in the D drive, the DLHB directory. The default document is named Home.asp and it resides in the Home directory under DLHB directory.

5.4.2 Programming Language – ASP

(a) The Tool – Microsoft Visual InterDev 6.0

Visual InterDev 6.0 provides a rapid application development (RAD) environment that lets developers design, build, debug, and deploy data-driven Web applications faster. It includes a new page editor designed specifically for professional developers. The editor provides maximum control of the appearance of the HTML while still allowing complete access to the source code, without sacrificing the formatting of the source code.

Visual InterDev 6.0 makes it easier to connect to and explore the database, to create and reuse complex queries across multiple pages, and to bind databases to Web pages in a virtual manner. It offers enhanced database design tools that make it

easier to create and modify SQL Server and Oracle database objects (tables, views, and stored procedures).

(b) The Working Space

Figure 5.4 shows the working space for Microsoft Visual Interdev 6.0

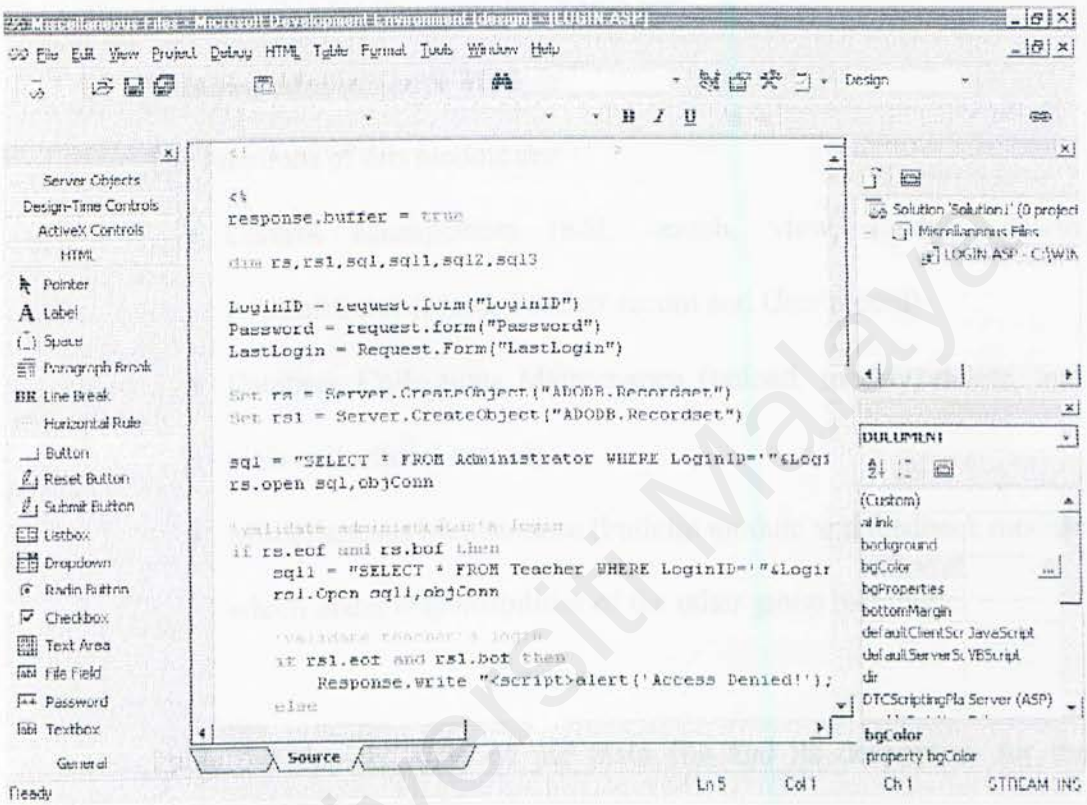

Figure 5.4 The Working Space for Microsoft Visual Interdev 6.0

(c) The ASP Engine

When an ASP file reaches the Web server, the request is routed to the ASP engine. The ASP engine reads the requested file and then executes 3 actions. The first action that the ASP engine does is it inserts any include files. After the insertion, the IIS processes the file exactly as if the inserted file were part of the original requested file and it occurs before the ASP engine processes any code.

The second action is that it begins to interpret the code in sequence, except for code sections marked as Functions or Subs. The third is that the ASP engine will return the response.

(d) The Method

The author is responsible for four modules. These are:

i. Database Maintenance Module

The functions of this module are:

- Control Management (add, search, view, modify, delete Administrator record, Teacher record and User record)
- Database Collections Maintenance (upload, modify, delete, and view collections' record).
- Miscellaneous Maintenance (bulletin module and feedback module which under responsibilities of the other group member).

Table 5.2 depicts some of the main file and its description for the Database Maintenance module.

No.	Filename	Description
1.	Add.asp	Add new data to the database.
2.	Adminlogin.asp	Administrator login page.
3.	Adminmain.asp	Administrator maintenance page.
4.	Alert.asp	Send mail to alert administrator when teacher login.
5.	Catchinfo.asp	Catch session data to insert in the database.
6.	DatabaseRecord.asp	Count the number of media type contained in the Historical Collection database.

7.	Details.asp	Show information in details for a single entry.
8.	Editdel.asp	Edit or delete record / file in the database.
9.	Index.asp	Checking authentication and redirect to correct page.
10.	Login.asp	Checking authentication for login id and password.
11.	Logout.asp	Close session and redirect to homepage.
12.	Mailinform.asp	Send mail to inform new teacher for the login details.
13.	Maintainhelp.asp	The DLHB Maintenance Help page.
14.	Obj_FileUpload_beta_full.asp	Fully functions for upload procedure.
15.	Record.asp	Display different functions for different records.
16.	Saveaudio.asp	Upload audio to server.
17.	Savedoc.asp	Upload document to server.
18.	Saveimage.asp	Upload image to server.
19.	Savereport.asp	Upload report to server.
20.	Savevideo.asp	Upload video to server.
21.	Search.asp	Retrieve specific data from the database.
22.	Teachermain.asp	Teacher maintenance page.
23.	Teacherregister.asp	Form for new teacher registration.
24.	Upload.asp	Set the uploaded materials' information into session.
25.	Viewall.asp	View all data from database in table.

Table 5.2 Main File and its Description for Database Maintenance Module

Edit or Delete Data in the Database

Edit or delete function are essential in Database Maintenance module. Every single data or entry in a database has to be manipulated from time to time so that the database is up-to-date. The data is edited by retrieving the data using RecordSet and modifying it using UPDATE query in SQL statement. Apart from that, the data is deleted from the database using DELETE query in SQL statement. The sample codes for edit and delete functions are as follow:

```
<%
dim useraction
dim sql,sql1,rs
Dim
ContentID,ContentType,Author,School,ReportYear,Title,Founder,YearBuilt,Location,Key
word,Abstract,LastModified

ContentID=cint(request("ContentID"))
useraction=request("action")

set rs = Server.CreateObject("ADODB.Recordset")
select case useraction
case "updatemyupload"

ContentType = Request.Form("ContentType")
Author = Replace(Request.Form("Author"),"'","''")
School = Replace(Request.Form("School"),"'","''")
ReportYear = Request.Form("ReportYear")
Title = Replace(Request.Form("Title"),"'","''")
Founder = Replace(Request.Form("Founder"),"'","''")
YearBuilt = Request.Form("YearBuilt")
Location = Request.Form("Location")
Keyword = Replace(Request.Form("Keyword"),"'","''")
Abstract = Replace(Request.Form("Abstract"),"'","''")
LastModified = Request.Form("LastModified")

sql = "update HistoricalCollection SET
ContentType='"&ContentType&"',Author='"&Author&"',School='"&School&"',ReportYear='
"&ReportYear&"',Title='"&Title&"',"
sql = sql &
"Founder='"&Founder&"',YearBuilt='"&YearBuilt&"',Location='"&Location&"',Keyword='"&
Keyword&"',"
sql = sql & "Abstract='"&Abstract&"',LastModified='"&LastModified&"' where
ContentID="&ContentID
objConn.execute(sql)
response.write "<script>alert('The record modified
succefully');location.href='details.asp?ContentID="&ContentID&"';</script>"

objConn.close
set objConn = nothing
```

```
case "delmyupload"

        sql1 = "SELECT * FROM HistoricalCollection where ContentID="&ContentID
        rs.Open sql1,objConn

        FileName = rs("FileName")

        Dim objFSO
        Set objFSO = Server.CreateObject("Scripting.FileSystemObject")

        objFSO.DeleteFile ("d:\DLHB\TeacherUpload\Temporary\"&FileName&"")

        sql = "DELETE from HistoricalCollection where ContentID="&ContentID
        objConn.execute(sql)

        response.write "<script>alert('The data and file has been
deleted!');location.href='view.asp';</script>"

        Set objFSO = Nothing
        rs.Close
        Set rs = nothing
        objConn.close
        set objConn = nothing

case "editmyupload"

        sql = "SELECT * FROM HistoricalCollection WHERE ContentID="&ContentID
        rs.Open sql, objConn
        objConn.close
        set objConn = nothing end select
%>
```

Figure 5.5 Sample Code: Edit and Delete Data / File (Database Maintenance Module)

ii. Authentication Module

The Authentication Module includes three categories of users who access the DLHB Web site. These are:

- Administrator – is given the highest permission to access to the DLHB Maintenance Site, the most restricted page of DLHB Web site.
- Teacher – is given the limited permission to access to the DLHB Maintenance Site, only allowed to upload materials and view or modify own records.

- User – is required to login when users want to read other students' report and to manipulate their own profile.

Every protected page in DLHB Web site is protected by using session which catches the user's particular ID. Once the user logouts, the session is abandoned and the user is not allowed to access to that particular page. The user will be redirected again to the main page.

Table 5.3 depicts list of filename and its description for the Authentication module.

No.	Filename	Description
1.	Edit.asp	Let users edit their own personal profile.
2.	Forgot.asp	User submits information to retrieve login name and password.
3.	Index.asp	Checking authentication and redirect to correct page.
4.	Login.asp	Validate user's login information.
5.	Logout.asp	Session is abandoned and is redirected to DLHB homepage.
6.	Myprofile.asp	List of options to let users manipulate their own record.
7.	Password.asp	Let users change their own password.
8.	Reply.asp	Send mail to particular user with the login name and password (auto-generate).
9.	Userlogin.asp	User login page.
10.	View.asp	Let users view their own profile.

Table 5.3 List of Filename and its Description for Authentication Module

Administrator's and Teacher's Session control

The Maintenance's Module's main function is the database maintenance. There are two categories of users who are allowed to login to the database maintenance site. Each page under this module is considered as a protected page. Therefore, session control is used to control the access of users who are allowed to access to the DLHB Maintenance Site.

The access control for the web pages are carried out by the insertion of the following codes:

```
<%
if session("auth")="" or session("id")="" then%>

<script LANGUAGE="JavaScript">
function redirect()
{window.location = "adminlogin.asp" }
 setTimeout("redirect();", 10*200)
</script>

<center>
<h1><FONT face="Verdana" color=#0066cc>ACCESS
DENIED!</FONT></h1>
<p><b><FONT face="Verdana" color=#0099ff>YOU ARE NOT AUTHORIZED
TO VIEW THIS PAGE</FONT></b></p>
</center>

<% else
        if session("info")= "Administrator" then
                Response.Redirect "adminmain.asp"
        else
                Response.Redirect "../TeacherMaintain/teachermain.asp"
        end if
end if %>
```

Figure 5.6 Sample Code: Session Control for Maintenance Site

(Authentication Module)

If the session's password or id is nothing, then the user will be redirected to the adminlogin.asp page. If not, if the session's information is "Administrator" then the user will be redirected to adminmain.asp page.

Else, it will be considered as teacher login and redirected to teachermain.asp page.

iii. Registration Module

Different registration forms are designed to let different group of users to register their required particulars so that the administrator can retrieve the data for further use of functions.

Table 5.4 depicts list of filename and its description for the Registration module.

No.	Filename	Description
1.	Reg.asp	Insert users' particulars in the database.
2.	Regform.asp	User Registration form.

Table 5.4 List of Filename and its Description for Registration Module

Post Form data

The post form data method used in the DLHB system is the *post method* instead of the *get method*. The reason is that the `get` method limits the size of data passed to the server where else the `post` method does not. Apart from there, the `get` method provides user with the opportunity to change the values and it also shows the variable names entered by user.

```
<form name=form1 id=form1 action="login.asp" method=post>
```

Insert data in the Database

Before the data is submitted, validation of data is done using Javascript. Once user submits the registration form, the data was collected by using Request.form in ASP code. Some specific data is compared with records

in database so that there is no duplicate data. Then, data is inserted into database using the INSERT query in SQL statement.

The following codes show the validation of data using JavaScript:

```
<script>
function valid(){
        var UserName = document.registration.UserName.value
        var UserNameLength = document.registration.UserName.value.length
        if(UserNameLength<6 || UserNameLength>10 || UserName==""){
                alert("User field should contain 6-10 characters");
                document.registration.UserName.focus()
                return false
        }
        var Password = document.registration.Password.value
        var PasswordLength = document.registration.Password.value.length
        if(PasswordLength<6 || PasswordLength>10 || Password==""){
                alert("Password field should contain 6-10 characters");
                document.registration.Password.focus()
                return false
        }
        var Confirmpass = document.registration.Confirmpass.value
        if(Confirmpass != Password){
                alert("Confirm password wrong! Please reenter");
                document.registration.Confirmpass.focus()
                return false
        }
        var Name=document.registration.Name.value
        if(Name==""){
                alert("Please type your name")
                document.registration.Name.focus()
                return false
        }
        var Years=document.registration.Years.value
        var YearsLength = document.registration.Years.value.length
        if(isNaN(Years) || YearsLength<4 || Years == ""){
                alert("Invalid Year")
                document.registration.Years.focus()
                return false
        }
        var Email=document.registration.Email.value
        if(Email==""){
                alert("Please type your Email")
                document.registration.Email.focus()
                return false
        }
        if(Email.indexOf('@', 0) == -1 || Email.indexOf('.', 0) == -1){
                alert("No valid e-mail address!");
                document.registration.Email.focus()
                return false
        }
}
</script>
```

Figure 5.7 Sample Code: Data Validation Using JavaScript (Registration Module)

Sample codes below show the insertion of data into database.

```
<!--#include file="../connect.asp"-->
<%response.buffer = true

'declaration
dim rs,sql,sql1
dimUserName,Password,Confirmpass,Name,Month,Days,Years,Gender,Race,Email,Occup
ation,School,Form,Address,City,State,Country,Postcode

'collect data from form
UserName = Replace(Request.Form("UserName"),"'","''")
Password = Replace(Request.Form("Password"),"'","''")
Confirmpass = Replace(Request.Form("Confirmpass"),"'","''")
Name = Replace(Request.Form("Name"),"'","''")
Month = Request.Form("Month")
Days = Request.Form("Days")
Years = Replace(Request.Form("Years"),"'","''")
Gender = Request.Form("Gender")
Race = Replace(Request.Form("Race"),"'","''")
Email = Replace(Request.Form("Email"),"'","''")
Occupation = Request.Form("Occupation")
School = Replace(Request.Form("School"),"'","''")
Form = request.form("Form")
Address = Replace(Request.Form("Address"),"'","''")
City = Replace(Request.Form("City"),"'","''")
State = Request.Form("State")
Country = Replace(Request.Form("Country"),"'","''")
Postcode = Replace(Request.Form("Postcode"),"'","''")

'response.write user & email & other '***debug
'database objects

Set rs = Server.CreateObject("ADODB.Recordset")
'sql query
sql = "SELECT * FROM Users WHERE Password='"&Password&"' or
UserName='"&UserName&"' "
rs.open sql,objConn
if rs.eof and rs.bof then
        sql1 = "insert into Users
(UserName,Password,Confirmpass,Name,Month,Days,Years,Gender,Race,Email,Occupatio
n,School,Form,Address,City,State,Country,Postcode)"
        sql1 = sql1 & " values
('"&UserName&"','"&Password&"','"&Confirmpass&"','"&Name&"','"&Month&"','"&Days&"','"&Y
ears&"','"&Gender&"','"&Race&"','"&Email&"','"&Occupation&"','"&School&"','"&Form&"','"&Ad
dress&"','"&City&"','"&State&"','"&Country&"','"&Postcode&"')"
        objConn.execute(sql1)
        response.write "<script>alert('You registered
succefully');location.href='../Home/Home.asp';</script>"
else
        response.write "<script>alert('Login-name or password already
exist');location.href='regform.asp';</script>"
end if

rs.close
set rs = nothing
objConn.close
set objConn = nothing
%>
```

Figure 5.8 Sample Code: Insert Data into Database (Registration Module)

iv. Information Management Module

This module does not require any coding. Research is done to collect relevant information and web pages are designed and linked by using design tools like Macromedia Dreamweaver 4, Macromedia Flash 5, and Adobe Photoshop 6.0.

Table 5.5 depicts list of filename and its description for the Information Management module.

No.	Filename	Description
1.	ContactUs.asp	About DLHB or contact DLHB page.
2.	Faq.asp	Frequently asked questions page.
3.	Help.asp	DLHB help page.
4.	RelatedLinks.asp	Related resources page.
5.	Term&Condition.asp	Terms and conditions page.

Table 5.5 List of Filename and its Description for Information Management Module

Inserting flash Application to the page

Some of the design pages are using flash application to attract user's attention. To insert a flash application, the following codes are generated:

```
<object>
classid="clsid:D27CDB6E-AE6D-11cf-96B8-444553540000"
codebase="http://download.macromedia.com/pub/shockwave/cabs/flash/swflash.cab
#version=5,0,0,0" width="15" height="15">
        <param name=movie value="Images/triangle.swf">
        <param name=quality value=high>
        <embed src="Images/triangle.swf" quality=high
pluginspage="http://www.macromedia.com/shockwave/download/index.cgi?P1_Prod
_Version=ShockwaveFlash" type="application/x-shockwave-flash" width="15"
height="15">
      </embed>
</object>
```

Figure 5.9 Sample Code: Inserting Flash Application to Web Page (Information Management Module)

5.5 Problems Encountered and its Solution

During the period of coding and implementation of this system, various problems were encountered. These problems were solved through research of different sources in fields such as the Internet, Digital Library Website, journals and reference books. These problems, along with solution approaches are highlighted in the following sections.

5.5.1 Web page Design

The first challenge was to learn up the tools that were used, Macromedia Dreamweaver 4 for web page design, Adobe Photoshop 6.0 and Macromedia Flash 5 for logo design and graphics design. It was however fun because it dealt with various graphics and colors.

The designing part is the difficult part because it actually depends much on own's creativity and ideas. Much initiative was taken by my partner and myself in changing or enhancing the design of graphics, logo and banner of the web page. Seeking advices from friends and seniors are also ways to improve the design of the interface.

5.5.2 Database

When starting to create the database using Microsoft SQL Server 7.0, my colleague and I faced the problem of one-user access to the database at one time. We discovered that this problem is caused by the license limitation. When we reinstalled Microsoft SQL Server 7.0 again, this problem is then solved.

5.5.3 Lack of Knowledge in ASP

Previous knowledge in traditional, two-tier non web-based system does not seem to solve the lack in web-based system. Since there was no prior knowledge of programming in ASP, there was an uncertainty on how to organize the codes in a web page.

These new programming languages and concepts were not taught before and to implement such an application requires a fair grasp of the languages. These programming approaches seem to be totally different from the traditional programming languages covered by the courses that have been undergone.

Although it takes a great deal of time to learn the new technology, choosing to program with system in ASP proved to be a wise move. Most of the problems faced were manageable through browsing the Internet for related materials and referring to the reference books available in the market. Discussion with friends especially seniors using the same technology was a great help. A more efficient method was through trial and error during the coding phase.

5.5.4 Difficulty in Choosing a Suitable Development Technology, Programming Language and Tools

There are many software tools available to develop an online web system as stated in the earlier chapters. Choosing a suitable technology and tools was a critical process as all tools possesses their own strengths and weaknesses. In addition, the availability of the required tools for development was also a major consideration.

In order to solve the problem, seeking advises and views from project supervisor, course mates and even seniors engaging in similar project were carried out. Furthermore, a lot of research and studies were done before any decision was made.

CHAPTER

6

Testing and Evaluation

Chapter 6 – Testing and Evaluation

6.1 DLHB System Testing

Software testing is one of the main phases in the development of DLHB system. In this phase, the process of testing and debugging are done to detect defects and bugs of a system. These processes are usually done incrementally with system development.

The objectives of software testing are (Pressman, 2000):

- To reveal different classes of errors and do so with minimum amount of time and effort.
- To demonstrate that software functions appear to be working according to specification.
- To demonstrate that behavioral and performance requirements appear to have been meet.

6.2 Testing Principles

There is a set of testing principles that should be understood to guide the system testing. Several testing principles suggested by Davis (1995) have been followed in testing the ASP for DLHB including:

a) All tests were traceable to customer requirements.

b) Test was planned long before testing began. Testing planning began as soon as the requirement model was complete.

c) Testing began "in the small" and progressed toward testing "in the large". The first test planned and executed generally focus on individual

components. As testing progressed, focus shifted in an attempt to find errors in integrated clusters of components and ultimately in the entire system.

6.3 Testing strategies

There are various testing strategies available to assess completeness and correctness of a system. The testing strategy, adopted for the DLHB system was divided into 3 main tests, the Unit Testing, Integration Testing and System Testing:

6.3.1 Unit Testing

Unit testing focuses verification effort on the smallest unit of software design which is the software component or module. All the important control paths in this project are tested to uncover errors within boundary of the modules. The relative complexity of tests and uncovered errors is limited by the constrained scope established for unit testing.

The tests that occur as part of unit tests are illustrated schematically in Figure 6.1.

a) Module interface is tested to ensure that information properly flows into and out of the program unit under test.
b) Local data structure is examined to ensure that data store temporarily maintains its integrity during all steps in an algorithm's execution and the local impact on global data should be ascertained during unit testing.
c) Boundary conditions are tested to ensure that the module operates properly at boundaries established to limit or restrict processing.
d) All the independent paths through the program structure are excised to ensure that all statements in a module have been executed at least once.

e) All error handling paths are tested to ensure its ability to detect and recover all fatal errors during system execution.

Figure 6.1 depicts the unit test for DLHB system

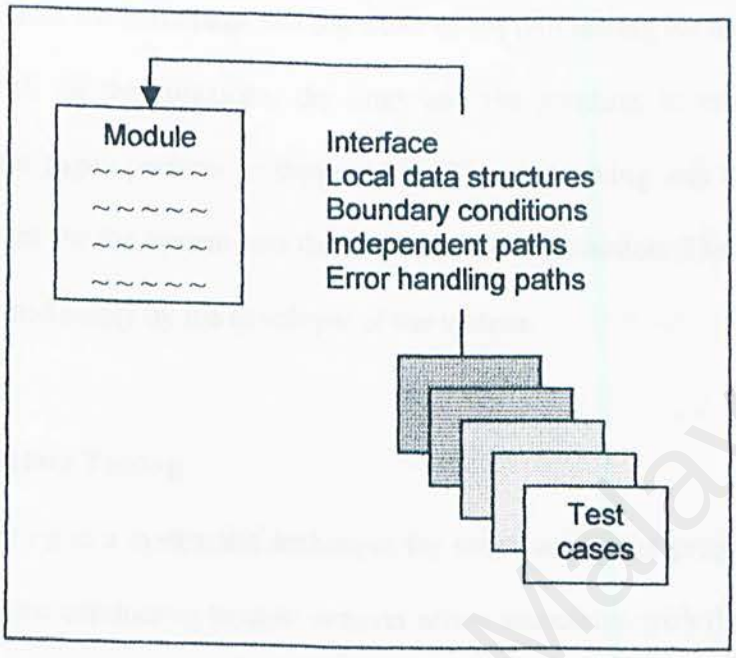

Figure 6.1 Unit Test

The following areas were tested during unit testing for this project:

(a) Boundary value analysis

Ensure that the module operates properly at boundaries established to limited or restrict processing.

(b) Error handling paths

Ensure that the specific module execute the recovering process should an error occurs. For example, the updating process should be able to continue to function again after encountering duplicate record in the database.

(c) All possible independent program paths are executed

Ensure that the control structures are implemented correctly.

The objective of this part of the unit testing was to check on all the links and buttons to ensure that they bring users to the destination page. The alignment of images and the behaviors of the Onmouseover function are also tested. Apart from the homepage, the objective of the unit testing for the system was to check on the functions, the links and the graphics to ensure that the function pages perform as supposed to. The unit testing was carried out as the pages for the system was developed at the workstation. The unit test was performed solely by the developer of the system.

6.3.2 Integration Testing

Integration testing is a systematic technique for constructing the program structure while at the same conducting tests to uncover errors associated with the interfacing. The objective is to take unit tested components and build a program structure that has been dictated by system. This testing will ensure that the interfaces such as Information Management Module in this project are arranged correctly.

The Objectives of the System Integration Test are as follows:-

- To ensure that the system delivered meets user requirements
- To detect and fix all errors found
- To ensure that the system meets the requirements specified in Chapter 3, Section 3.3.2, Functional Requirements
- To ensure that the system is ready for Acceptance Test Phase at the end of the System Integration Test Phase.

The approach used in this phase is the bottom-up integration. Bottom-up integration testing begins construction and testing with modules at lowest levels of the system and then moving upward to the modules at the higher levels of the system.

6.3.3 System Testing

System testing is a series of different tests designed to fully exercise the software system to uncover its limitations and measure its capabilities. The objective is to test an integrated system and verify that it meets specified requirements. Although each test in this project has a different purpose, all work to verify that system elements have been properly integrated and perform allocated functions.

There are several types of system testing that are worthwhile for a software system. For this project, three types of system testing are used:

a) **Function Testing**

System testing begins with function testing. This focuses on system functionalities. Each function can be associated with system components that accomplish it. Some functions may involve the whole system; others may involve only sub-modules or individual modules. Effective function testes have high probabilities to detect system faults. DLHB employs several guidelines for function testing:

- High fault detection probabilities.
- Know and anticipate expected actions and output.
- Test all valid and invalid input data types.
- Include stopping criteria.

Functional Test was performed to ensure that the system is able to execute the functions as described in the Chapter 3, Section 3.3.2, Functional Requirements.

b) Performance Testing

The purpose of this testing is to test the run-time performance of software within the context of an integrated system. It requires both hardware and software instrumentation. Resource utilization is measured in an exacting fashion.

Performance testing addresses the non-functional requirements of DLHB after function testing is completed. System performance is measured using performance objectives set by potential users as highlighted in the non-functional requirements section as guidelines. In the case of DLHB, performance testing examines how effective data manipulations are carried out, query (record retrieval, searching, and sorting) speeds, inter-module communication speed and also image file-loading speed from the DLHB database.

c) Acceptance Testing

After completing functional and performance testing, DLHB is determined to be able all requirements specified during initial stages of its development. The next step involves its potential users. Users lead acceptance testing and define their own real-time business data sets to be used as test cases. The reason this is done is enable users to determine if DLHB is really usable and is capable of meeting their performance expectations and educational needs.

The User Acceptance Test was officially tested by the users from Sekolah Menengah Taman S.E.A, Petaling Jaya. The parties involved were the students and history teachers. The purpose of this test was not to zoom into individual components that will constitute the total DLHB solution, but to officially test what has already been tested in t he System Integration Test. The difference is that the audiences (official testers) are the students and teachers.

The objective of the User Acceptance Test are as follows:-

- To ensure that the system meets the requirements specified in Functional Requirements section as stated in the earlier chapter.
- To ensure that the system is ready for Production at the end of the User Acceptance Test Phase.

6.4 User Evaluation

6.4.1 Objective

Upon completion of the system, a user evaluation cum testing was conducted to assess the effectiveness and the general outlook of the systems. The idea of an evaluation is to gauge the accuracy of the system and to see if the system meets the requirements of the users. This testing was conducted in one of the secondary school in Petaling Jaya, which is Sekolah Menengah Taman S.E.A, Petaling Jaya.

The user evaluation sheets can be obtained from Appendix C at the end of this report. As noted from the appendix, the evaluation sheets are divided into 2 forms.

One to determine the evaluation feedback from the history teachers while the other one is for the form three students.

6.4.2 Sample Size

Sample size = 6

In the sample size,

i. Number of testers who are teachers of the selected school = 2

ii. Number of testers who are form three students of the selected school = 4

6.4.3 Results to Questions

(a) Interface Design

Generally, 50% of the respondents felt that the navigation around the DLHB website was easy, while the other 50% stated average. It can be summarized that the DLHB homepage is easy to navigate. This implies that the site navigation is simple and can help someone who has never been to the site to figure out where to go.

Most of the respondents voted for Suitable background color / image applied in the DLHB web site. The background color of the web site is based on the individual's preference.

In addition, there are 5 out of 6 respondents noted that the download time for DLHB web site was fast. It is important for the users to have a fast download time because no one has the patience to wait for a page to load. Download time is affected by the image content as well as the traffic in the Internet.

Generally the images on the web site and overall of color combination are accepted by the respondents as attractive. The result comes to show that text styles, Arial and Verdana are well accepted among the users because of their clear-cut style.

One of the respondents stated that the ease of viewing contents is hard while the rest stated average for the ease of viewing contents. Finally they were quite satisfied with the overall display of the DLHB Web site.

(b) Functions of the System

The result shows that there is a need for an online information distribution system (DLHB) to increase the convenience of searching Malaysia context information from the Internet. In addition, the study of history subject using an online resource will be more interesting and attractive.

The search function incorporated into the DLHB is an important function, which can help users to find exactly the information that they wish to view based on a search on Title, Location, Timeline, or Content Media. Most respondents felt that it is useful.

The students stated that the FAQ or DLHB Help page were quite useful to them especially for those new comers to DLHB. Majority of the students will considered using DLHB system to search for information in completing their historical project.

The result shows that history teachers understood the step by step on how to register as member of DLHB Maintenance Site and step by step on how to upload file to the

server. However, they were not very sure for the overall functions provided by the DLHB Maintenance Site.

(c) Content

The history teacher found that only some of the contents in DLHB system were suitable for the format or syllabus for history subject. While the students stated that the contents were quite suitable in completing their projects.

(d) Suggestions

Suggestion from the history teachers is to enrich the DLHB database by adding more contents that suite the syllabus outlined by the Ministry of Education. The content provided should be in more details. Research need to be carried out to find out more about current history project topics.

One of the respondents suggested that the system should provide the content in Malay language. This is to ease the understanding among form three students in searching information. Apart from that, idea to add a forum for discussion in DLHB system is suggested by another respondent.

6.5 Error Handling and Debugging

Error handling enables the development of clearer, more robust and more fault-tolerant programs. Error handling provides the ability to attempt to recover from infrequent fatal errors rather than letting them occur and suffering the consequences (Deitel, 1999). In DLHB, error handling codes only applied at place where errors are likely to occur handling codes only applied at place where errors are likely to occur because it will make the code more difficult to understand and maintain.

Debugging is the process of finding and correcting errors or bugs in the source code of computer program (Meyer, Baber and Pfaffenberger, 1999). There are a number of debugging tools being used in performing the system debugging, including Toggle Breakpoint, Step Into, Add Watch and so on. When debugging the system, the Locals window and Immediate window are used to check the value of variables.

CHAPTER

7

Conclusion and Future Enhancements

Chapter 7 – Conclusion and Future Enhancements

7.1 Strength and Significance of the System

(a) Attractive and Simple Graphic User Interface

The DLHB interface is attractive and simple, where it relies heavily on browsing and pointing especially for the "administrator menu". The site navigation is straightforward and thus users can maneuver themselves easily around the site. The color combination is parallel to the usage of text style, Verdana and Arial increases the professional outlook of the site.

(b) Security Features

Security issues are taken into consideration for the maintenance module so as to prevent any unauthorized users from manipulating the data stored in the database. The maintenance module is protected with password and only the administrator or teacher is allowed to update and manipulate data in the database.

As for other web users, "User Name" and password are required to access the certain modules of the system and authorized person is allowed to change the password anytime.

(c) User Help / FAQ

The system also provides user guides to the DLHB users. As most of the target users for DLHB Web site are secondary school students, they may not be familiar in using online information resources, the help page and FAQ page provided by the DLHB

Web site will be useful to those new user in solving their problems when browsing the DLHB Web site.

(d) Reminder for those who forgot password

The system also provide a tool that will send mail to remind the user's password, in case the user forgets his or her password. The tool is auto-generated that the DLHB administrator does not need to manually mail to that particular user.

(e) Flexibility in changing data in database

DLHB Maintenance Site can be considered as the back-end system for DLHB. It is the site that makes use by the administrator to manipulate data in the database. The administrator can choose to add, search, modify, delete or view different records in the DLHB database.

(f) Collaborative with teacher by uploading materials to the server

One of the significance of the DLHB system is it allows history teacher in secondary schools in Malaysia to collaborate and hence enrich the DLHB digital collections. History teachers with permission are encouraged to upload students' historical project to the DLHB site as share resources to other students. Apart from that, the teachers are also encouraged to upload various type of contents in digital format such as scanned text, image, audio and video.

(g) Fast Response Time for Document Retrieval

The Web pages are designed in such a manner that they are loaded in a reasonable amount of time to ensure users need not wait for a long time to view the pages.

Heavy graphics are avoided and ActiveX controls are kept to the minimum wherever possible.

7.2 Weaknesses and System Limitations

(a) Simple web page design

The strength of the homepage of DLHB is also the weakness of the system. There were some opinions stating that the homepage is too simple. Web page designing has always been considered as one of the simplest yet tedious jobs considering that users' requirements change often.

(b) Not compatible with certain browser

Another weakness with the DLHB homepage is that it is not compatible with certain browser or certain version of a browser such as Netscape. The image can sometimes displace itself from its original position.

(c) Session TimeOut

The upload function is limited to upload file that less than 1 MB. This is because file with size more than 1 MB can cause session timeout for the server and the error will occur.

7.3 Suggestions for further improvements / Future Enhancements

Further development and many new ideas have come about while the system was being implemented. Owing to time constraint and other factors, not all of the ideas could be incorporated into the system. It is hoped that the following aspects could be considered in future:

(a) Improve in Interface Design

Much can be improved to the DLHB Web site and the functional system. For the Web site design, more complex graphics can be incorporated into the web design. However, complex graphics has its pros and cons, for example the download time. The web page needs to be changed frequently and it is vital that the information is up-to-date. All the systems' web pages under the Digital Library Project should be standardized to project a uniform look.

(b) Expanding DLHB Database

As for the system, future rework can be done to expand the contents or digital collections in DLHB. As the database in DLHB is an relational database that it can be expanded from time to time. More contents written in Malay language can be added to the database.

(c) More Administration Task

Administration task can be further enhanced to include more features to ease the maintenance process. Among the features that may be included are report generating, analytical tools and database backup.

(d) Error Detection Features

This system actually needs a more comprehensive error detection feature to ensure that only valid input is being passed to the server and it is done through client-side scripting like JavaScript. This is important in ensuring that the DLHB system is robust and easy to maintain the reliability of the system.

7.4 Conclusion

Overall, this project has achieved and fulfilled the objectives and requirements as a Digital Library web-based application that provides the information resources to the students over the Internet. The completion of this project will also encourage the secondary students in Malaysia who are required to carry out their history project for PMR to use this system as one of the main resources to gather information.

A number of research and studies was done during literature review in order to gain the information needed for the development of this project. This information gathered includes development methodologies, development tools, web development tools and digital collections in a digital library. All these information were analyzed to determine the suitability of the development methodology, development tools and digital objects to be used in this project.

Throughout the development of the system, a lot of knowledge was gained such as knowledge in setting up Internet technologies, programming and concepts as well as using Microsoft SQL Server. Programming in ASP, HTML and JavaScript proved to be a valuable experience. ASP technology has captured the attention of many software and web developers. The core of the ASP technology lives in the implementation of object-oriented technology. As such, the object-oriented programming skill has improved.

Finally, all the problems faced and experiences gained during the system development should be useful in the future endeavors. This is because electronic library has shown its potential power to revolutionize the structure of educational industry around the country.

I truly believe that if the Digital Library Project is further refined, we can hope for a higher level of utilization of the Internet. It is without doubt that the project still needs to be further improved but with the completion of this phase, a stepping-stone has already been created for the future students to further polish the systems.

Hopefully with the implementation of DLHB, Corporative Resource Development Project can be fully implemented in Malaysia. The potential is tremendous when properly applied to its designed context.

References

References

ACM Digital Library. Available: http://www.acm.org.dl/ (Assessed: 2001, July 22)

Adi Afzal Bin Ahmad. (1998). Malaysia's Vision 2020: Nine Challenges Facing the Nation. Available: http://www.angelfire.com/ny/ZanyTeacher/v2020.html (Assessed: 2001, June 26)

Adobe Acrobat 5.0. (Adobe.com). Available: http://www.adobe.com/products/ (Accessed: 2001, August 2)

Ager, T. (1999). Architecture and Systems. WTEC Hyper-Librarian. Available: http://itri.loyola.edu/digilibs/04_03.htm (Assessed: 2001, July 3)

Ahmad Kamal Md Hassan. (1990). 100 Years Kuala Lumpur Architecture (1890-1990). Kuala Lumpur: Pertubuhan Akitek Malaysia.

Ang, P.H. (1995). The Impact of the Digital Library on Society. *Paper presented at Digital Libraries Conference, Singapore,* March 27-28, 1995.

Annamalai, M. (1997). Designing An Efficient Distributed Digital Library Database for Image Data (Indexing, Retrieval). Unpublished doctoral dissertation, Purdue University. Retrieved from Proquest database (DAO, CD-ROM, Jan 1997 – Sep 1998).

ASP 101. Available: http://www.asp101.com/ (Assessed: 2001, November 2)

Association of Research Libraries (1995, October). Available: http://sunsite.berkeley.edu/ARL/definition.html (Assessed: 2001, June 26)

Available Research. (1998). Available: http://www.dli2.nsf.gov/dlione/ (Assessed: 2001, July 22)

Badan Warisan Malaysia. (2000). Conserving Our Heritage. Available: http://www.bwm.org.my/company/conserving/ (Assessed: 2001, July 26)

Bangunan LUTH. Available: http://home.t-online.de/home/wleonhard/klbaluth.htm (Assessed: 2002, January 23)

Berkeley Digital Library SunSITE. Available: http://sunsite.berkeley.edu/ (Assessed: 2001, July 22)

California Digital Library. Available: http://www.cdlib.org/ (Assessed: 2001, July 22)

Chen, S.S., (1995). Technologies for Digital Libraries. *Paper presented at Digital Libraries Conference, Singapore*, March 27-28, 1995.

Chen, V.F. (1998). The Encyclopedia of Malaysia – Architecture. Archipelago Press an imprint of Editions Didier Millet Pte Ltd.

Cleveland, G. (1998). Digital Libraries: Definitions, Issues and Challenges. Available: http://www.ifla.org/VI/5/op/udtop8/udtop8.htm (Assessed: 2001, July 21)

Compaq NZ - Proliant ML530. (Compaq.com.nz). Available: http://www.compaq.co.nz/products/servers/proliants/ml530/default.asp (Accessed: 2001, August 2)

Connolly and Berr. (1998). System Development. McGraw-Hill.

Covi, L. M. (1996). Material Mastery: How University Researchers Use Digital Libraries for Scholarly Communication. Unpublished master's thesis, University of California. Retrieved from Proquest database (DAO, CD-ROM, Jan 1994 – Jun 1997).

Danesh.A. (1997). JavaScript Interactive Course. Corte Madera: Waite Group Press.

Davis. G. (1995). Software Development and Testing. Ohio: AEC Ltd.

Dayabumi Sources. Available: http://www.kiat.net/malaysia/KL/attractions.html#dayabumi (Assessed: 2001, November 10)

Deitel. (1999). System Analysis and Design. US: Prentice Hall International, Inc.

Dictionary.com. Available: http://www.dictionary.com (Assessed: 2001, June 26)

Digital Library Federation. Available: http://www.diglib.org/dlfhomepage.htm (Assessed: 2001, July 22)

Garrett, J.R. (1995). What is a Digital Library? *Paper presented at Digital Libraries Conference, Singapore*, March 27-28, 1995.

Gordon, A.S. (1998). The Design of Knowledge-Rich Browsing Interfaces for Retrieval in Digital Libraries. Unpublished doctoral dissertation, Northwestern University. Retrieved from Proquest database (DAO, CD-ROM, Jan 1997 – Sep 1998).

Haneng.com. Available: http://www.haneng.com/ (Assessed: 2001, November 2)

Hijjas Kasturi Associates. Available: http://www.did.net/data/scripts/company/index.idc?Company_no=129 (Assessed: 2002, January 23)

Holtum, E., Lord, L. & Martin, D. (1997). Building Digital Collections Symposium. Available: http://www.lib.uiowa.edu/ref/forum/ (Assessed: 2001, July 22)

Internet Related Technologies. (2001). Microsoft Visual InterDev 6.0. Available: http://www.irt.org/software/sw011/ (Assessed: 2001, August 13)

Johnson, S. (1996). Digital Format Conversion: Issue and Chalenges. *Paper presented at National Conference on Multimedia Digital Libraries: Meeting the nation's needs of the 21st century*, Kuala Lumpur, November 19-21, 1996.

Jones, B. (1998). Seng 611 – Requirements Engineering. Available: http://www.cpsc.ucalgary.ca/~jonesb/seng/611/techniques.html (Assessed: 2001, June 28)

Jones.A.R. (2000). Mastering Active Server Pages 3. San Francisco: Sybex.Inc

Kendall, K.E. & Kendall, J.E. (1999). Systems Analysis And Design (4th ed.). New Jersey: Prentice-Hall.

KL Skyline Gallery. Available: http://baqthier.tripod.com/skyline.html (Assessed: 2001, November 10)

Knowles, A. (2001). An Internet Information Server Overview. Available: http://docs.rinet.ru:8080/DIIS/imp01fi.htm#I1 (Assessed: 2001, August 13)

Kuala Lumpur Garden City of Lights. Available: http://www.hotelmalaysia.com/placesofinterests/kualalumpur/index.htm (Assessed: 2001, December 15)

Kuala Lumpur know your city pages. Available: http://metro.thestar.com.my/pdf/kl2001.pdf (Assessed: 2001, November 2)

Law, S.W. (2000). Literature review, In Law, S.W. *Clinic management system.* Kuala Lumpur: University of Malaya, pp. 19-30, 34-39

Learning ASP. Available: http://hotwired.lycos.com/webmonkey/programming/asp/ (Assessed: 2001, November 2)

Li, Bin. (1999). The History of Digital Libraries. Available: http://www.ils.unc.edu/~lib/digital-library.html (Assessed: 2001, July 22)

Library of Congress. (2000). Core Metadata Elements. Available: http://lcweb.loc.gov/standards/metadata.html (Assessed: 2001, July 3)

Longman English-Chinese Dictionary of Contemporary English (1989). Longman Group (Far East) Ltd, Hong Kong.

Lyons, P.A. (1989). Policy Issues in Computer Networks: Multi-Access Information Systems. *Paper presented at the Annual Telecommunications Policy Research Conference (17th, Airlie House, Warrenton, VA, October 1-3, 1989).* Retrieved from SilverPlatter database (ERIC, CD-ROM, 1982 – 1991).

Macromedia – Dreamweaver. (Macromedia.com). Available: http://www.macromedia.com/software/dreamweaver/ (Accessed: 2001, August 2)

Malaysia Info. Available: http://members.tripod.com/~nita_73/index-Malaysia.html (Assessed: 2001, November 10)

Malaysia's expat info center. (2001). The many faces of KLCC. Available: http://www.expat.com.my/tmklcc.htm (Assessed: 2001, July 22)

Maltsev, A. (1999). Visual InterDev 6.0 Versus FrontPage 2000. Available: http://www.microsoft.com/mind/defaulttop.asp (Assessed: 2001, August 13)

McManus, S. (2001). To VB or Not to VB? Available: http://www.vb123.com/toolshed/99_vbscript/vbscript_why_how_when.htm (Assessed: 2001, August 15)

Meyer, Baber, Pfaffenberger. (1999). Engineering: Software and Hardware. Harlow: Addison-Wesley.

Morrice, A. (1995). Defining Digital Libraries And Its Impact on Business. *Paper presented at the Conference on Digital Libraries for Business Information, Le Meriden, Singapore*, September 25-26, 1995.

mylibrary (2000). Available: http://www.mylib.com.my (Assessed: 2001, August 13)

Newbury, P. (1993). KL Through the Looking Glass Volume V. Malaysian Culture Group Exploration Group Tour Reports (Sep 1993 – May 1996). Kuala Lumpur: Stenoprint Sdn Bhd.

Penton Media, Inc. (2001) The Future of SQL Server. Available: http://www.sqlmag.com/Articles/Index.cfm?ArticleID=8993&Key=Data%20Warehousing (Assessed: 2001, August 15)

Perpustakaan Digital. (2000). Available: http://members.nbci.com/rycee79/ (Assessed: 2001, August 13)

Perseus Digital Library. Available: http://www.perseus.tufts.edu/ (Assessed: 2001, July 22)

Petronas Twin Towers. Available: http://members.tripod.com/~D_Factor/klcc/ (Assessed: 2001, July 22)

Pfeeger, S. L. (2001). Software Engineering Theory and Practice. U.S: Prentice Hall International, Inc.

Post, G.V. (1999). Database Management Systems: Designing and Building Business Applications. Singapore: McGraw-Hill.

Pressman. (2000). Software Engineering. Singapore: McGraw-Hill.

Pro Solutions, Inc. (2001). Active Server Pages (ASP) Technology. Available: http://www.prosolutionsinc.com/asp.htm (Assessed: 2001, August 15)

Rajiv, K. (1998). More on ASP Vs CGI. Available:
http://www.rit.edu/~rxk1626/asp/faq.2more.html (Assessed: 2001, August 15)

Ruse, C. (1989), *Oxford Student's Dictionary of Current English For KBSM*, 2nd ed, Penerbit Fajar Bakti Sdn. Bhd., Petaling Jaya.

Sable, C.L., & Vasileios Hatzivassiloglou. (2000). Text-based approaches for non-topical image categorization. *International Journal on Digital Libraries, 3* (3), 261-275.

Selangor The Industrial Hub of Malaysia. Available:
http://www.hotelmalaysia.com/placesofinterests/selangor/index.htm (Assessed: 2001, December 15)

She, A.C.H. (1998). Color, Texture and Shape Features for Content-based Image Retrieval (Image Retrieval). Unpublished doctoral dissertation, University of Illinois, Urbana-Champaign. Retrieved from Proquest database (DAO, CD-ROM, Jan 1997 – Sep 1998).

Skyscraper.com. Available: http://www.skyscrapers.com (Assessed: 2002, January 23)

Smullen, P. (2001). When To Use Active Server Pages. Available:
http://www.intranetjournal.com/articles/200002/wd_02_25_00aa.html (Assessed: 2001, August 15)

Sommerville, I. (1995). Software Engineering (5th ed.). Harlow: Addison-Wesley.

Strand Software Technologies (1995). ClearingHouse Tiers™ Architecture Overview. Available: http://www.ftech.co.uk/~moleskin/sstl/tierdesc.htm (Assessed: 2001, August 26).

The Library of Congress. (1996). Identifiers for digital resources. Available: http://memory.loc.gov:8081/ammem/award/docs/identifiers.html (Assessed: 2001, July 3)

The UCSF Digital Library. Available: http://www.library.ucsf.edu/ (Assessed: 2001, July 22)

University of Arizona Library. (1998). Charge to the Digital Library Initiatives Group. Available: http://www.ual.edu/inigro.htm (Assessed: 2001, July 7)

University of Virgina Library. (1999). Digital Library Research and Development. Available: http://www.lib.virginia.edu/dlbackstage/resndev/ (Assessed: 2001, July 3)

Visual InterDev Production Information. (Microsoft.com). Available: http://msdn.,icrosoft.com/vinterdev/productinfo/new.asp (Accessed: 2001, August 1)

Wilson, A.L. (1994). The Digital Library. Available:
http://www.ad1440.net/~devnull/work/dig_lib.html (Assessed: 2001, July 22)

Wilson, K. (1995). An Overview of Digital Library Projects in Australia and the United States. *Paper presented at Conference on Digital Libraries for Business Information, Le Meriden, Singapore,* September 25-26, 1995.

Windows 2000 Server Family: Advanced Manageability. (Microsoft Windows 2000 Home). Available:
http://www.microsoft.com/windows2000/css.asp?template=EP (Accessed: 2001, August 1)

Windows NT 4.0 Features. (Microsoft Window NT Server Home). Available:
http://www.microsoft.com/ntserver/ProductInfo/features/Features.asp
(Accessed: 2001, August 1)

Yeang, K. (1992). The Architecture of Malaysia. Kuala Lumpur: The Pepin Press, Amsterdam.