

DIGITAL LIBRARY INFRASTRUCTURE AND ARCHITECTURE

ABSTRACT

Information Technology has changed the modern day libraries as compared to traditional libraries. The conventional set up of brick, stone and mortar libraries that store information within a constrained physical space (Books/Print materials on the iron racks/wooden racks) have given way to digital multimedia information store houses that integrate data resources around the globe through the effective deployment of Information Technology, without straining the financial resources. Today it is obvious that the most effective way this is to create digital libraries, distributed information systems ensuring reliable storage and effective use of various collections of electronic documents (text, graphics, video, audio etc.) via global telecommunication networks in a way convenient to the end users. The information explosion has direct impact on the libraries as they have to devise ways of performing their tasks better and faster even when the volumes are increasing at a high pace. Terms such as electronic library and virtual library are often used synonymously. The emergence of Internet and wide availability of affordable computing equipment have created tremendous interest in the Digital Library and electronic publication concept.

1.0 INTRODUCTION

Traditionally, libraries have been collecting various kinds of sources and holding them in readiness for use by users. After World War II, there has been a knowledge explosion and consequent exponential growth of literature and information. There have been complexities in the information generation, handling and use. Libraries in the developed and developing countries witnessed the introduction of computers and IT from the 1960's. The growing impact of ICT (Information and communication technology), web technology and database technology has compelled libraries to use these technologies effectively to provide services to users. With growing number of e-sources, it has become imperative for library and information professionals to properly play their roles in disseminating information to their users. Information can be saved digitally and therefore this helps in immediate access to high demand and frequently by users. Digital library provides access to digital information collections, and includes a combination of structured/unstructured, text/numeric/graphical data, scanned images, and graphics, audio and video recordings. Digital library is now-a-days the most widely accepted term and implemented in all libraries.

Librarians, better known as library managers, are required to keep-up and satisfy the demand of the faculty, students and researchers against a diminishing budget.

2.0 DEFINITION : DIGITAL LIBRARY

What is Digitization? It is the process of conversion of an analog signal/code into digital signal/code i.e., the analog information is captured into digital form. Here technology is readily available in the form of cameras, DTP, other capturing devices like scanners that allow one to convert analog images into digital images.

Digital library stores materials in electronic format and manipulates and disseminates the large collection of information effectively. Various documents saved in digital format that can be accessed through the intranet or the World Wide Web.

The term digital library covers the creation and distribution of all types of information over networks ranging from converted materials to kinds of information that have been generated in the physical world.

Digital library consists of information in digitized form, where the information stored are electronically accessible using a computer which can store, provide access and disseminate without any conversion process. Information in digital form is stored electronically and accessed, where access to digital library has no boundary or particular restrictions in access with respect to space/age/time. This digital library helps to provide access to information through electronic gateways to remote digital database.

Digital libraries are well accessed with establishing the wide range of Internet accessible sources of information. To the user interest of information needs are accessible and with greater speed, 100% accuracy and reliability. This helps to access the 3-dimensions graphics, created by computer imaging, which leads to virtual library.

Most logical definition from the view point of librarians, which was proposed by American Digital Library Federation, 1998, which says "digital libraries are organizations that provide the resources, including the specialized staff, to select, structure; offer intellectual access to; interpret, distribute, preserve the integrity of; and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of computers."

Based on the above definitions, Cleaveland (1998) gave some of its characteristics. One of these characteristics is "Digital libraries are the digital face of traditional libraries and include both electronic (digital) as well as print and other (i.e. film, sound) materials."

Cleveland also says "In reality, digital libraries will not be a single, complete digital system that allows users to promptly access all information, for all disciplines, from anywhere around the world. Instead, they will most likely to be a collection of disparate resources and disparate systems, catering to specific communities and user groups, created for specific purposes. They will also perhaps include paper-based collections."

Sharma and Vishwanathan (2001) say that "Growth of digital libraries involves digitization of existing library materials; connectivity to the users in the world online and offline; integration with networking; and availability on the World Wide Web."

2.1 Digital Library – Goals:

- To increase the access i.e., all types of information availability to users – both offline and online.
- To preserve the original documents and manuscripts

- Qualitative and quantitative resource sharing
- To improve the library services
- Ensuring the effective usage of information storage in digital format
- Effective utilization of funds invested on digital library.
- User acceptability from their desktops
- To satisfy the five laws of library science.

3.0 HISTORICAL DEVELOPMENT OF DIGITAL LIBRARIES

From the conventional role as static storehouse of information, the library has matured into a proactive model of information generation and effective dissemination. The revolution in computer, information and telecommunication technology is bringing about significant changes in all types of libraries. Availability of powerful computers at affordable cost, spread of telecommunications networks to even remote areas, advent of internet, increasing interest in creating digital content are some of the significant forces accelerating the pace of changes in functioning of our libraries.

Licklider (1965) refer to a digital library "Library of the future" referring to a fully computerized library. Later, Lancaster, F. W. (1978) termed digital library as "Paperless Society". Presently many synonymous terms like "Electronic Library"; "Virtual Library", "Library without walls", "Paperless Library" are used.

The three main characteristics of digital library are the storage of information in digital form, usage of communication networks to access and obtain information and copying by either downloading or online/offline printing.

3.1 Developing Digital Libraries

Very few people will have all the skills required to set up a digital library. Library professional alone cannot develop the digital library. The total technology in developing digital library is too specialized for the librarians or any other layman. In conclusion, the digital library development projects are very much a team effort. Group co-operation and co-ordination can lead to fruitful results in developing the digital libraries. The important point that should be borne in mind before initiating the project of setting up of a digital library is that the main characteristic of a digital library i.e. information is selected on the basis of quality; should be accessible to everyone and there is no restriction for definite user groups. Information stored in a digital library can be changed when needed and after obtaining the necessary permissions.

The five laws of library science coined by Dr. S. R. Ranganathan should be implemented in designing of digital library.

3.1.1 First Law : Books/Information are for use

Digital library should be designed in such a manner that it is easy for use, with a web-based user interface that can be customized for the institution, individual or department etc. Digital Library comprises the information in digital format that will be easier to access only when necessary technology links, well-built infrastructure and computer systems are available to users. The users must be given orientation/training for searching and retrieval of information in the vast

digital library. Digital libraries are expected to play a major role in formal learning as well as by providing the teacher and students with more information in a variety of media. The acquired/stored information in the database of digital library must be qualitative rather than quantitative. The information available in digital library must be readily available for the user. The stored information must not be soon outdated. Well-maintained networks should be established.

3.1.2 Second Law : "Every Reader his or her Book/Information"

Any user who steps in for information in the digital library, the information acquired, gathered, stored, retrieved or disseminated in the action of digital library must be so relevant to the user, so that the information can find its own user in a short period of time. There should not be any obstacles in the search of information for the user. The digital library can be constructed in such a manner, that it substitutes for the librarian or online/offline databases. A number of open source software available for the implementation of a digital library, which can be reorganized, developed according to our needs with latest developments of Information Technology.

3.1.3 Third Law : "Every book/information its Reader"

The user can obtain the required information or data from the database. For the same, the information must be so qualitative and the search path or retrieval path must be designed in such a way that the information can attract the user towards it. Internet is also termed as metadata (data about data or information about information). Over the years, metadata formats have been developed for a wide range of digital objects. Within the range of formats, there is a degree of consistency across all metadata schemes that support inter-operability i.e., most schemes provide for the title field, data field, and identifier field. Metadata creation must benefit the user.

3.1.4 Fourth Law : "Save the time of the user"

The searching tool or path must be well designed, the indexing part in the database must be regularly updated, qualitative index pattern must be used for framing keywords, search techniques must be easy, in such a way that the layman can easily retrieve information. User friendly software can be installed in retrieving the information. Generally search operations provide a large amount of information to the user, which is both related and unrelated to the topic of search. For narrowing the search, he can use the Boolean logic for reduction in search time. The search engines can be framed based upon the key terms entered into the digital conversion library.

3.1.5 Fifth Law : "Library is a growing organism"

The digital library should be designed with an eye for the future. The database storage capacity should be high. A system with good hardware capabilities should be installed for storage of information as Main Server. As 5th law of library science says, that in formal libraries, the books/print media are the main acquisition products. But in a digital library, there are a large number of e-documents, which will be always increasing. Books can be kept in the library for

reference, where as the electronic resources are stored in a server, which can be made, centralized or distributed over WWW or local intranet.

Information and communication technology has given way to develop a new technology in the field of library science to transform the traditional library into the digital library. The other skills needed to design the digital library by the team (Librarians and IT Professionals).

- Technical skills (Knowledge of IT, Hardware, software etc.)
- Project management
- Database creations and development
- Computer programming
- Web designing
- Cataloguing/classification/indexing
- Preservation
- Graphic design/digitalization technique and skills

Other than these

- Elicit suggestions from the end users/subject experts/digital librarians
- Good co-operation and co-ordination among the team of library, IT professionals and users.
- Computer systems for Providing access to users
- Various databases
- Servers

The parent organization must provide adequate finance and suitable working environment.

The Team : The Team should consist of the following experts.

- Subject
- Management
- Conservation
- Digital and film photographers
- Cataloguers
- IT specialist
- Administration

4.0 DIGITAL LIBRARY – INFRASTRUCTURE

The implementation of digital library can be achieved after discussing the framework between the librarians, information professionals, IT professionals, hardware / software / network professionals, management professionals, with the help of non-technical professionals. The main steps in the creation of digital library are as follows:

Digital Library – Ideology, manuscript creation, literature search.

Digital Library – Creation

Digital Library – Acquisition

Digital Library – Cataloguing, indexing

Digital Library – Preservation

Digital Library – Access / dissemination

4.1 Digital Library – Ideology, Data Collection, Manuscript Creation, Literature Search

To begin the idea of digital library, there must be some data collected related to it. These data may help us to get an ideology, problems faced by the other libraries suggestions and directions of professionals etc. Also, information about new developments is to be collected.

4.2 Digital library – Creation

Building the digital libraries begins with creating digital content and collections. There are many open source softwares for the creation of digital library like D-space, Green stone etc., which along with free supply of software, also provide the guidelines, basic requirements, procedure etc. Digital creation is the act of producing the information product in digitized format. The creator may be a human or a piece of equipments. There must be some specification for the purpose of standardization in terms of literature. Here in this step, there must be good coordination between IT professionals and Librarians. The digital library infrastructure can be built by IT professionals, as per the requirement of the library.

4.3 Digital library – Acquisition

The acquisition of digital library products is divided into different categories, i.e., print and non-print version, utility for present and future. Many commercial agencies have emerged for providing commercial electronic resources through providing IP address with user name and password. At the same time, based on usage, the print version can be continued.

4.4 Cataloguing and Indexing

As books are acquired by the library, the accession number is assigned after all the normal actions like reviewing, ordering and purchasing. It is then sent to classification and cataloguing for identification purpose. In the same manner, for a document that has been acquired in digital format, it is necessary to assign the identification number and to catalogue it. This helps the digital library to manage the digital/electronic resources smoothly and for easy accessibility. Identification provides a unique key for finding the object and linking the object to other related objects; cataloguing helps in the organization and access.

4.5 Digital library – Preservation

This is the aspect of archival management that preserves the digital content of a digital library. Here preservation of digital content is mostly based on time frame and also depends upon the hardware and software.

These days a new release of database or word processor can be expected every few months for few years by making it better by updating. Software vendors also provide backward compatibility upto 2 to 3 versions. So these problems must be kept in mind while dealing with computer hardware, software and peripherals. For journal articles, the majority of projects reviewed use image files, PDF or HTML. For purely electronic documents, PDF is most prevalent format. In PDF format, if the document is put in internet, it will consume more bandwidth as

compared to HTML font, however the HTML format, the tables and pictures are not possible.

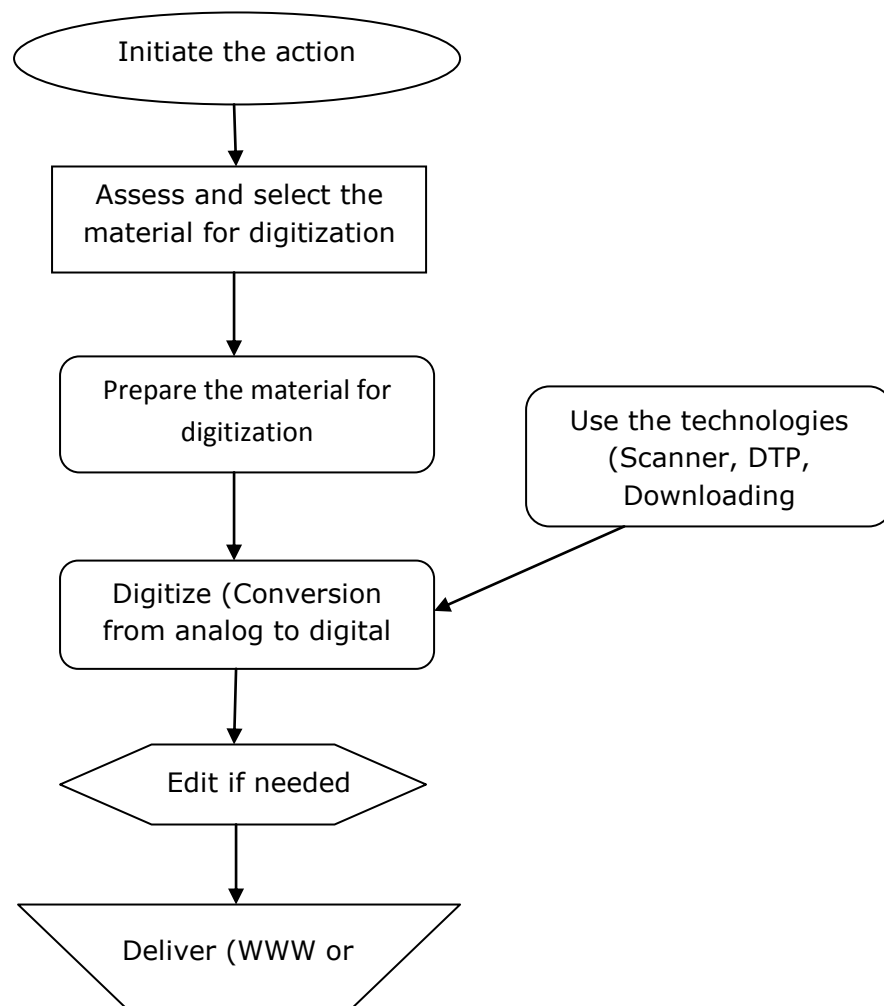
4.6 Digital Library - Access

The information stored in a digital library server i.e., document or e-information can be accessed through search or retrieving software. As in a physical library, we use library catalogue for efficient search and to retrieve the books. The software involved in digital library helps to retrieve the metadata after analyzing the contents stored in the server. Appropriate Boolean logic needs to be used to narrow the search from a larger set.

5.0 LIFE CYCLE FOR DIGITIZATION PROJECT

The life cycle of a typical project consists of the following parts :

Initiation of the project is shown in the following chart.



To initiate the project of digitization, following points are essential:

- Are there sufficient funds?
- Have copyright and any other rights related issues been secured?
- Can we protect the authorship i.e., IPR?
- Does the institution have enough expertise?
- Is there a partnership with a commercial provider?
- Do the results of digitization justify the costs?
- Are the necessary equipment available and also easy to use?
- Are any necessary precautions taken for preservation?
- What services can be added in digital library to offer to the users?
- How can we establish and control the accuracy of information sources i.e., quality and quantity?
- Authority control problems
- Organizational problem etc.

6.0 CONCLUSION

Digital libraries are going to play a very vital role in this century and are an important component for disseminating the required information. The context of physical sources of information are being transformed into digital for its various advantages which can lead to multiple usage and easy access. Traditional libraries are undergoing rapid changes to meet the targets with demands of fast changing information request from its users. The advent of computers, IT, advancement in telecommunication and storage devices and disseminating techniques have given new dimensions to collecting, organizing and disseminating the vast amount of information.