DESIGN AND IMPLEMENTATION OF A LOCAL AREA DIGITAL LIBRARY NETWORK (DLN) AT DEPARTMENT OF COMPUTER SCIENCE, KWARA STATE POLYTECHNIC, ILORIN

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Abstract

As the Internet and the World Wide Web expanded so fast, digital library has become a very hot venture. Library users physically go to the library and search for the information they need by reading in the library or taking the hard copy information out of the library. These physical boundaries are gradually dwindling due to the advent of the internet and library technology. This library technology has recently made many institutions to include digitization of library in to their plans and policies. Digital library is the automation of a library in order to facilitate efficient access to collection of books, journals, texts, videos and other information available for a large community of users in a digital format. Digitization of Library gives room for preservation of documents and allows users to access the library from remote locations without physically going to the library. This research work deals with a designed and implemented digital library at the Department of Computer Science, Kwara State Polytechnic, Ilorin. The software was developed with HTML5, CSS3, Java Script for client side, PHP (Hypertext Pre-Processor) as server side programming language and MySqli (My Structural Query Language Improved) as relational database. The latter language was chosen because of its flexibility and features for developing online based applications. However, WAMP (Window Apache MySql and PHP) server was used for local hosting and testing. The digital Library developed demonstrated a speedy and organized access to books, journals and other information in an efficient manner.

Keyword: Library, Digital Library, Local Area Network, Digitalization, Internet

1. Introduction

Because of World Wide Web, access to the Internet has become part of our daily life. A huge number of people search the Internet every day. More and more people need to search indexed collections [1]. Library has been termed a living record of people's progress from the Stone Age to the present space age, because through libraries people communicate their vision and experience from generation to generation. Therefore, it was believed that a library is not just an institution, building, or storehouse of materials, but an agent of educational, social, economic, and political changes or revolutions in the community whose doors are well opened to all who need them [2]. Libraries, whose resources include collection of journals, reports,

conferences, proceedings, documents, cuttings, illustrations and books are mostly found in educational institutions, Industrial and Research Institutes, Professional Associations, Banks, Medical Libraries, Law chambers , Newspaper Houses etc [3]. Libraries are found in higher educational institutions such as Colleges of Education, Polytechnics, Colleges of Technology and Universities to perform functions directly related to the mission of each institution [2]. Users' direct interaction with the library, physically going to the library, searching or browsing for certain information and taking the hard copy of the information out of the library are slowly becoming past history with the introduction of library technology [4]. Due to the new challenges the web created for information retrieval, the trend of library digitization has been spreading all over the world since it started in 1960s in the USA [6].

There are various definitions of digital libraries, but within the context of libraries, digital libraries may be viewed as technical services performed electronically with an entirely electronic application [5]. Researchers in [8] define digital libraries as a collection of services and information objects that support users of the library in dealing with information objects and the organization and presentation of those objects which are available directly or indirectly via electronic/digital means. Because the academic community is the largest and the most important user group of digital libraries, digital library should contain additional resources like course calendars, university statutes, various courses being offered, course registration, thesis and dissertation guidelines, style guides, laboratory facilities, availability of software, hardware, equipment, course materials, reserve book/handout collections, local publication databases, locally produced theses and dissertations and so on [6].

However, since storing and accessing information available for a large community of users should be made easier by digital libraries, large numbers of researches focus on the development of efficient information retrieval techniques and optimized data storage [4, 18]. Libraries which take the form of a combination of general and special collections of multiple resource types in both digital and print form are known as hybrid libraries [6]. Most digital libraries share common functional components highlighted below [11]:

i. Selection and Acquisition: This component has to do with the selection of documents to be added, the subscription of database and the digitization or conversion of documents to an appropriate digital form.

ii. Organization: This component involves the assignment of the metadata (bibliographic information) to each document being added to the collection.

iii. Indexing and storage: The indexing and storage of documents and metadata are carried out here for efficient search and retrieval.

iv. Search and retrieval: This is the digital library interface used by the end users to browse, search, retrieve and view the resources provided by the digital library.

Digital libraries are used as a means of easily and rapidly accessing books, archives and images of various types now widely recognized by commercial interests and public bodies alike. Benefits from use of digital library include no physical boundary, 24/7 availability, multiple accesses, easy information retrieval, preservation and conservation, requires no space, cost of value added services and downloading [10].

The following setbacks are envisaged: computer viruses, lack of standardization for digitized information, quick degrading properties of digitized material, different display standard of digital product and its associated problem, health hazard nature of the radiation from monitor etc, makes digital libraries not so attractive. The system suffers from Copyright and licensing, digital preservation, speed of access, high initial cost, bandwidth and efficiency [10, 12].

However, this research work deals with a designed and implemented digital library at the Department of Computer Science, Kwara State Polytechnic, Ilorin. The software was developed with HTML5, CSS3, Java Script for client side, PHP (Hypertext Pre-Processor) as server side programming language and MySqli (My Structural Query Language Improved) as relational database. The latter language was chosen because of its flexibility and features for developing online based applications. However, WAMP (Window Apache MySql and PHP) server was used for local hosting and testing. The digital Library developed demonstrated a speedy and organized access to books, journals and other information in an efficient manner. The objectives of the research are:

i. To examine the infrastructural facilities required for digital information system such as computer, software, OCR, output media, access points, network support etc.

ii. Design digital library that will facilitate access to the collection of literature and related information in tune with the Polytechnic vision and mission.

iii. Design and implement a Local Area Digital Library Network (DLN) which will cater for training and research needs

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1. Literature Review

In order to provide a baseline understanding of the current state of research into and practice in the sustainability of digital preservation, the concrete components that drive costs in the area of digital preservation is reviewed. Researcher in [4] opined that since digital documents should be easily retrieved and archived, large numbers of researches focus on the development of efficient information retrieval techniques and optimized data storage. The researchers designed and presented an E-Library Search System whose database contains books names and thesis titles, to make it special for the academic organizations like universities and research centers. This system serves the researchers and other users with many facilities in searching stage by many means such as author name, book name, interested area, number of copies, and year of issue.

According to authors in [5], digital libraries present several prospects to the users far beyond what poly-media libraries provides. Having a global reach to all national and international networks through the digital library is a great advantage to educational advancement in the Northwest zone. They further stressed that digital libraries do not only support the conventional university system but also the distance learning programmes in Nigeria. Researchers in [2] stressed that the term electronic library (e-library) has been applied to a wide variety of domains such as collection of electronic materials and software agents that support inquiry-based education. The existing library systems serve as reservoir for several materials resulting in their non-effective in time taken to search and retrieve needed materials. The researchers presented an Internet-Based Library System (ILS) that offers greater and efficient services. The system has modules for database, web browser and services affiliated to institutions of learning.

However, authors in [6] outlined the architecture, the basic components and functionalities of a Digital Work Environment (DWE) that forms the basis of a user centred digital library development at Nanyang Technological University in Singapore. Based on the experience of a continued research on the design and development of the DWE, a set of generic guidelines for the design of a user-centred digital library system was provided. The researchers revealed that current digital libraries or information systems do not generally organize information according to the various user tasks. As a result, users usually employ the trial and error method to move from one Web page to another or from one information resource or system to another. The user-centred approach to digital library design is therefore desirable as it aims to shift the focus from a system-oriented to a user-oriented design in an attempt to meet users' real needs and facilitating means and ways to support their information seeking and use behavior.

Finally, researchers in [3] revealed that although web accessible digital libraries (DLs) have greatly increased potential information accessibility within academia, the use of these resources varies widely

across disciplines. The researchers are of the opinion that Web-accessible DLs are identified as changing the roles and working patterns of academic staff (i.e. lecturers, librarians and computer support staff).

3. Research Methodology

The proposed network consists of three layers of components, namely application software, network software and network hardware. Application Software consists of computer programs that interface and permits the sharing of resources, such as files, graphics, and disks. Network software consists of computer programs that enable implementation of protocols or rules. It consists of transmission media (which carries the computer's signals e.g. cables) and network adapter (which accesses the physical media, linking computers, receiving packet from network software, transmitting instructions and requests to other computers). To set up the DLN (figure 1), the following basic hardware are required:

i. Seven (7) sets of computer systems
ii. One (1) 24-port switches
iii. Unshielded Twisted Pair (UTP) Cat-6e cable connection
iv. Rj-45 connectors
v. Printer and Scanner.

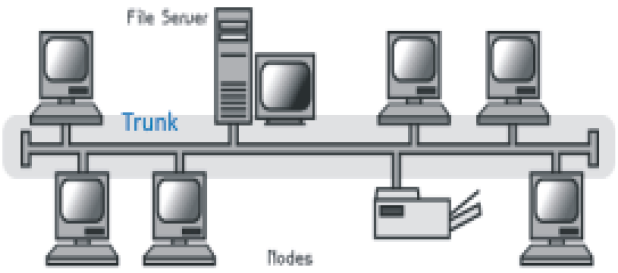

Figure 1: Computers Connected on a network

The DLN consists of (6) workstations connected to a special computer called a server. The server stores and manages programs and all networked group's data which enables LAN workstations to stand without large storage capabilities. The proposed workstations and a server were connected together with the aid of a 24-port switches using linear bus topology. The physical arrangement of the systems is as follow:

i. The server was connected to the Switch.
ii. Six workstations were also connected to the Switch.
iii. Other ports will provide additional ports for other users whom may come to the place with their laptop to have access to digital library.
iv. The server was connected to the Internet through wireless Internet access subscription.

v. The workstations on the network were configured, installed Network Operating System (Window 2013 Server) and established links between the workstations and the server.

To complete the DLN, some networking materials will be required. The tables below list items of hardware and software requirements:

Table 1: Hardware Requirements

S/N	Server	Workstations
1.	Core i3 Processor of 5.0 GHz speed	Dual Core Processor of 2.4 GHz speed
2.	4.0 GB RAM	2.0 GB RAM
3.	750 GB Hard Disk or Higher	250 GB Hard Disk
4.	DVD Writer	CD-ROM/ Writer
5.	Wireless LAN Card	Network Interface Card

Table 2: Software Requirements

S/N	Server	Workstations
1.	Network Operating System e.g. Window 2013 Server	Operating System e.g. Window XP/Vista
2.	Software and Database Package Containing Information about various Courses	General Application Packages
3.	Distributed Resources	Accesses to the Available Resources
4.	Internet Connectivity	LAN Connection
5.	Web Browser e.g. Mozilla Firefox	Web Browser e.g. Mozilla Firefox
6.	Strong Anti Virus Program	Strong Anti Virus Program

After successful networking connection, the software was developed with HTML5, CSS3, Java Script for client side, PHP (Hypertext Pre-Processor) as server side programming language and MySqli (My Structural Query Language Improved) as relational database. This language was chosen because of its flexibility and features for developing online based applications. However, WAMP (Window Apache MySql and PHP) server was used for local hosting and testing. The digital Library developed demonstrated a speedy and organized access to books, journals and other information in an efficient manner.

4. System Implementation

The developed Digital library software application was run on the system using local host and found to operate as expected. The computer software application is required to be independent of any platform. Figure 2 below shows the login page when the program is started. User needs to login before user can have

access to the digital library. The login window requests a valid username and password from User to be able to gain access into the digital library. However, new user can register and then login to have access to the digital library.

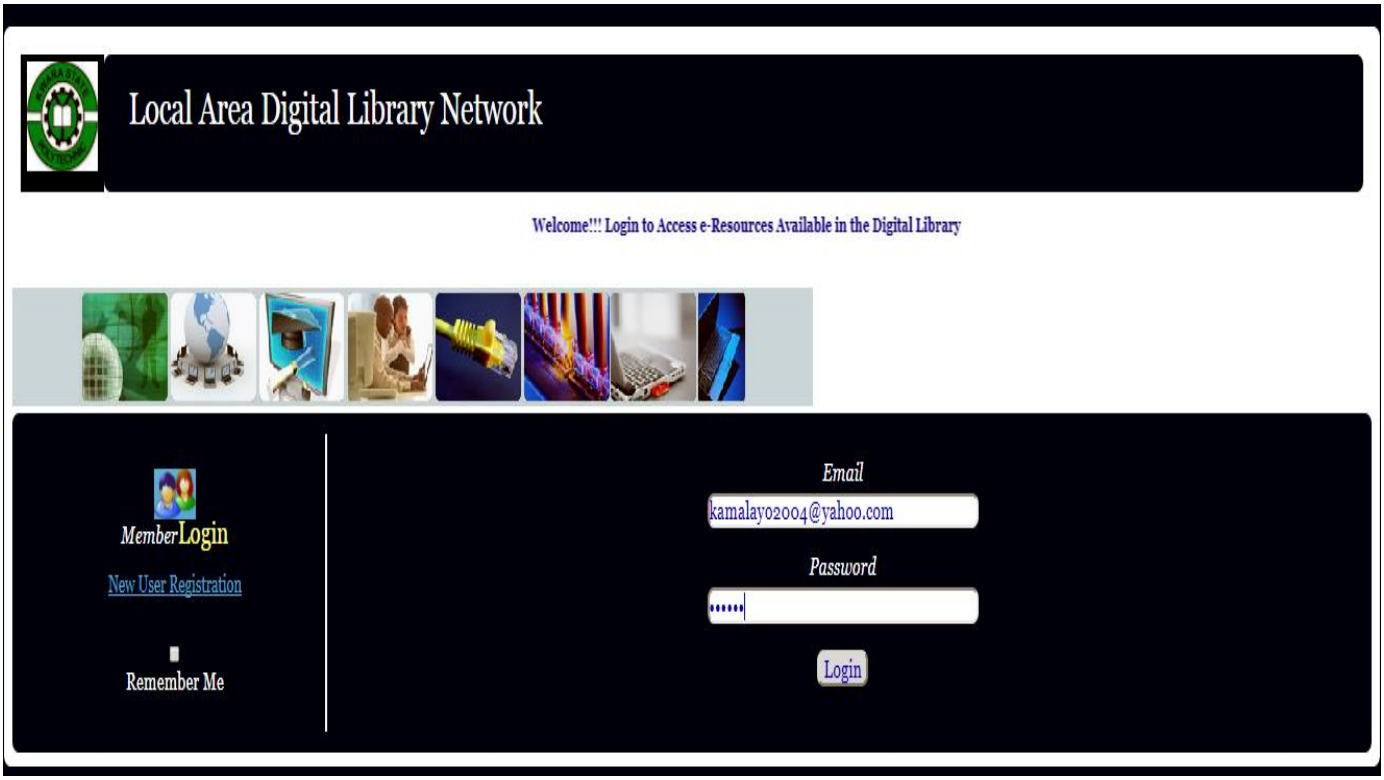

Figure 2: Login Menu to digital library

The Digital Library Network (DLN) has an up-to-date scientific approach within research, by implementing and disseminating new interdisciplinary views in the field of Computer Science and Technology. By means of integrating the specialty studies of highly reputed researches, this DLN has the latest information in the field of Computer Science, applicable to many investigation domains. After successful log-in as there are seven links available as shown in figure 3 below, these are E-Books, E-Videos, E-Articles, E-Library, Virtual Library, Student e-Resources, and About the Researchers.

Figure 3: Screenshot showing home page of the digital library

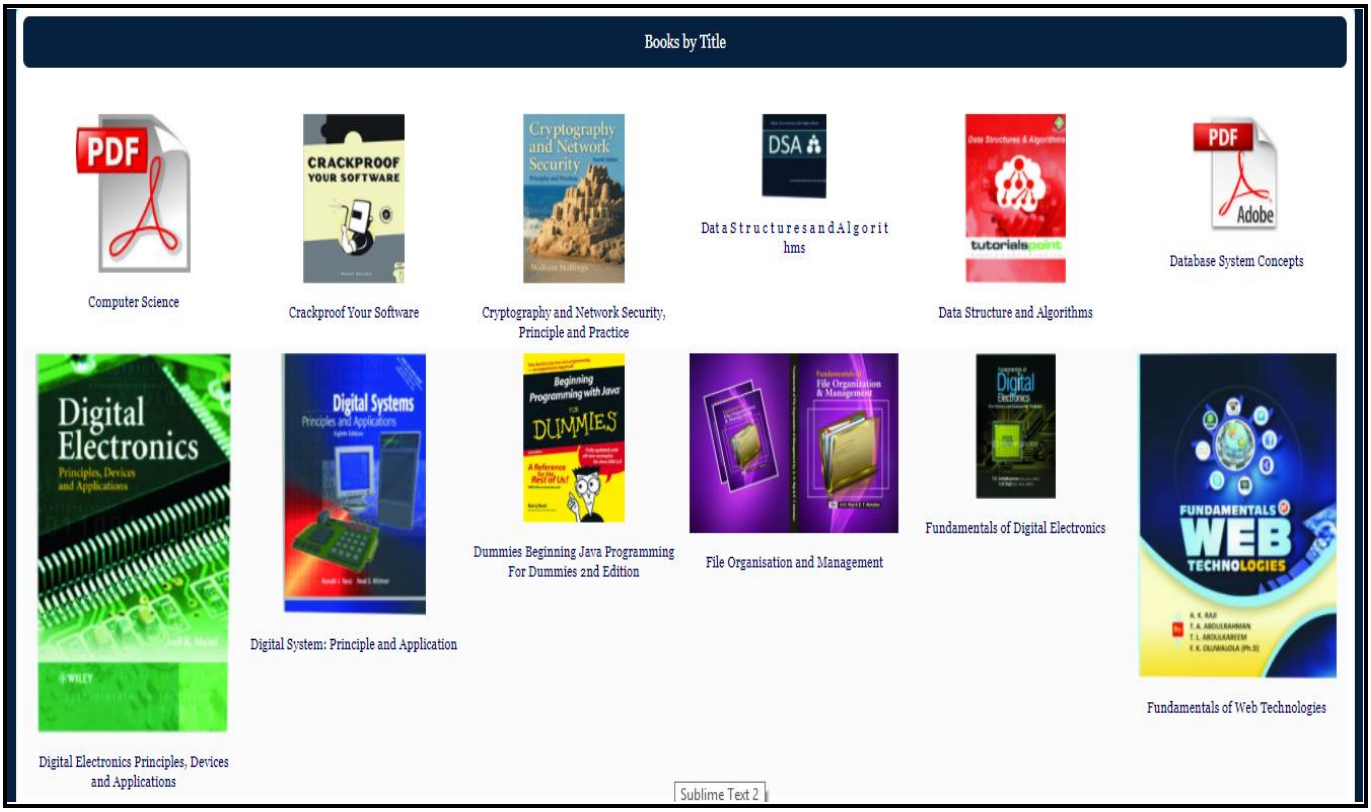

Figure 4: Screenshot showing list of books by title

E-Books: This link allows users to view/download books either by title (as shown in figure 4), by author's name or by subject.

E-Videos: This link allows users to watch/download video tutorials either by title, or by subject.

E-Articles: This link allows users to view/download journal articles or Thesis/Dissertation.

E-Library: This link allows users to connect to the Polytechnic e-library to access numerous database such as Eaglesoft, Ebrary, Khoa, Egranary and Ebsohost.

Virtual Library: This link allows users to connect to either National virtual libraries or International virtual libraries. It contains links to various virtual libraries available around the world.

Student e-Resources: This link allows user to have access to numerous digital course materials within the Department. It is very useful to students and staff.

About the Researchers: This link contains the curriculum vitae of the researchers.

6. Conclusion

It is worth mentioning that digital libraries are not going to replace the physical existence of document completely but no doubt to meet the present demand. To satisfy the non local user digitization must be introduced so that at least libraries becomes of hybrid nature. However, digital libraries emerged with increased availability of digital information and user demand for services in digital format. They became widely used in the research and academic world with the feasibility of data dissemination speedily over networks. Just as library networks emerged for resource sharing networked digital libraries also share the same aims and objectives.

However, the planning and implementation of a digital library network poses new challenges and involves policy making regarding the members, content, content management, governance, maintenance and the technical know-how. The designed DLN system provides an efficient means of displaying digital resources. Lastly, the system is flexible and runs on a web browser. It is reasonably secure, enforces data integrity from the use of a relational database management system, it also minimizes data redundancy and it is user-friendly. However in the networked world where more and more information is made available online and through distributed systems, properly implemented DNL would be very impactful in promoting research and education.

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