Designing a Web Based Digital Library Management System for Institutions and Colleges

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ABSTRACT

As the number of documents in digital library grows, it becomes increasingly difficult to store, manage the large amount of documents and find requested relevant documents by users. A Web based Digital Library management System (DLMS) was designed for this purpose. It helps to create unlimited quantity of digital information and make it available to the world in parallel. The system is designed to acquire research materials for the institution and then publish it to users in their remote areas. The design parameters are Java Programming language, PHP and HTML; Database type: MYSQL. It is designed as an interactive and content management system. The content management system deals with data entry, validation and updating while the interactive system deals with system interaction with the users.

KEYWORDS: Web, PHP, Database, MYSQL, Institution, Library

1.0. INTRODUCTION

A digital library is a library in which collections are stored in digital formats (as opposed to print, microform, or other media) and accessible by computers. The digital content may be stored locally, or accessed remotely via computer networks. A digital library is a type of information retrieval system. In the context of the Delos, a network of excellence on digital libraries, and dl.org, a coordination action on digital library interoperability, best practices and modeling foundations, digital library researchers and practitioners produced a digital library reference model which defines a digital library as; a potentially virtual organization, that comprehensively collects, manages and preserves for the long depth of time rich digital content, and offers to its targeted user communities specialized functionality on that content, of defined quality and according to comprehensive codified policies. [1, 2] Therefore, a Web Based Digital Library Management System is software designed for collection of digital/research material, storing them, and making available to users in parallel via the internet. In this thesis, a web-based digital library management system will be discussed, designed and implemented. The paper also contains a digital library write up which introduces the three types of relevant systems, i.e. Digital Library (DL), Digital Library System (DLS), and Digital Library Management System (DLMS). It describes the main concepts characterizing these systems, i.e. organization, content, user, functionality, quality, policy and architecture. It introduces the main roles that actors may play within digital libraries, i.e., end-user, manager and software developer. Finally, it describes the reference frameworks needed to clarify the DL universe at different levels of abstraction, i.e. the digital library reference model and the digital library reference architecture. [3]

1.1 LITERATURE REVIEW

A library is a room, building or an institution where a collection of books and other research materials are kept. It is a collection of sources, resources, and services, and the structure in which it is housed.

There can be no doubt that much of the literature in this area speculates on the future role of libraries – none of which is particularly clear. Since (1995), or what Tenopir calls the "post web world" (2003), libraries have been seen as in danger of "substitution" [4],[5]. The web is becoming "a ubiquitous source of information" giving an "illusion of depth and comprehensiveness" that leads to a questioning of the value of libraries and their collections. This review will not speculate on these future roles, but will focus instead on the certainty of changing technology, increasingly digital information resources and societal shifts that have changed user expectations of library services [6].

In recent years, research concerning digital libraries has focused on questions of website design, information provision and information retrieval. Digital library research draws mainly from computer science, information science, library and information studies [7],[8],[9].

Scholars have examined the usability of digital libraries both in terms of general information seeking and browsing including system's ability to facilitate user's "information journey" [10]. Different types of user's will have variable needs and these needs are likely to change over time. A digital library management system must take proactive steps to accommodate changes, it cannot be a "passive warehouse of static information" and should "support users' overall information work in context"[11]. Browsing behavior, which is often associated with less specific user needs, is also vital to the information seeking process. Browsing allows for serendipity and gives the information seeker an opportunity to re-think and re-evaluate an information need.

Research demonstrates how the usability of a digital library management system is enhanced when an information seeker has the option of combining searching with browsing and can browse digital resources by more than one type of metadata. The publication impact of digital library materials has been assessed as well as critical issues concerning preservation and sustainability [12],[13]. Society as a whole benefits when digital information is preserved both effectively and affordably. Research institutions have better opportunities for long-term cross-disciplinary collaboration, especially if collaborations depend on scientific data that are impossible to reproduce.

Archives, museums and libraries can protect and conserve cultural memory, and in situations where accountability is crucial, hospitals, clinics and other public institutions are in a better position to guarantee the authenticity and integrity of digital materials over time [14],[15],[16].

From a computer perspective there has been a growing concern with online security and the enhancement of digital library visuals[17].

Digital libraries are situated in unique environments, thus environmental factors have also been examined for their impact on users' awareness, acceptance and use habits[18]. Often the social contexts or domains surrounding a digital library are very different, for instance, clinical versus academic. Adams and Blandford (2004) demonstrate why it is important within academic contexts to market a digital library as a learning resource, but to show users within a clinical domain (e.g., a health care setting) how a digital library system can support evidence-based medicine with information that is "paramount" to decision making [19].

In this thesis, we present the core elements of the manifesto and introduce central aspects of the digital library framework. The discussion begins with an examination of the three types of relevant "systems" in this area: Digital Library, Digital Library System, and Digital Library Management System. It also explains how they interrelate. The discussion then moves on to examine three other core topics: the key concepts that characterize these systems encompassing content, user, functionality, quality, policy, and architecture; the range of roles that actors play in digital libraries

from application developer to administrator, to designer, and finally to end-user; and clarification of the different levels of abstraction that help us to talk intelligently about the DL Universe.

Finally, at Nnamdi Azikiwe University, we have a digital library called Festus Nwako digital library. Here we have the digital materials stored in a particular place. These digital materials can only be accessed at the library, the materials in question is not properly catalogued, the internet access is almost not working but the new web based digital library gives institutions access to the library anywhere provided there is an internet access. The new library provides round the clock availability to users. It is purely an improved technology used to enhance learning in higher institutions.

2.0. THE ANALYSIS AND SYSTEM METHODOLOGY

In order to determine whether or not digital library management system is feasible, there must be some form of investigation into the goals and implications of the project. For very small scale projects this may not be necessary at all as the scope of the project is easily understood. In larger projects, the feasibility may be done but in an informal sense, either because there is no time for a formal study or because the project is a necessity and will have to be done one way or the other. Inevitably this report is a different document from the study itself for reasons of easy readability. By synthetically pointing out the main principles case by case it allows one to constantly refer to the various sections of the study itself; hence it may, because of its very structure, be used as an intelligent index to the digital library document in its complex whole. When a feasibility study is carried out, there are four main areas of consideration:

Technical - is the project technically possible?

Financial - can the business afford to carry out the project?

Organizational - will the new system be compatible with existing practices?

Ethical - is the impact of the new system socially acceptable?

To answer these questions, the feasibility study is effectively a condensed version of a fully-blown systems analysis and design. The requirements and users are analyzed to some extent, some business options are drawn up and even some details of the technical implementation.

A research methodology is a systematical programming approach of a well-defined procedure that should be followed in caring out a thorough research work. In other to attain quiet a reasonable acceptance of the research work we made use of the internationally accepted software engineering model, which is;

2.1 Structured System Analysis and Design Methodology (SSADM).

This is a set of standards developed for systems analysis and application design. SSADM uses a combination of text and diagrams throughout the whole life cycle of a system design, from the initial design idea to the actual physical design of the application.

The SSADM method involves the application of a sequence of analysis, documentation and design tasks concerned with the following stages.

Stage 0 - Feasibility study

Stage 1 - Investigation of the current environment

Stage 2 - Business system options

Stage 3 - Requirements specification

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Stage 4 - Technical system options
Stage 5 - Logical design
Stage 6 - Physical design

3.0.   SYSTEM DESIGN

Design Specifications

In the designing of Web Based digital library, specifications are necessary. The proposed system will be built using JAVA Programming Language and will be managed by the administration in the institution, with data supplied by the Library Systems Office (LSO). Web Based Digital Library Management System and LSO staff, along with designated representatives from selected collection providers (e.g., a staff member from the institution) will have maintenance privileges, and the database will otherwise be publicly inaccessible. The system will use annotated URLs to provide authorization data to the browser. Users will be able to use a password and user identity specific to be generated by this system; additionally, new users must create an account so that they can login [20].

In addition, the user/client inputs query of the required search into the "search and browse" input interface, the system performs the operation, and generates an output with respect to the input query. The user sends in a query to the digital Library database, then the query is being decoded, processed and the required output/result is being sent to the users interface for his digestion. This enables the user or client to have an easy access to all the research, materials available in the institutions web-based digital library management system.

Web Access Subsystem

The main purpose of this system is to allow users to upload and view research material and other library resources via the Internet.

This web interface will provide the users with a facility to view the library materials located in the remote storage. Users will be provided with facilities to upload acquired research material (admin), search for particular books in the collection (students). They will provide some textual description that will be matched with the description of each book and the matching books will be displayed. The users will be able to access the information with using the Internet browser. If the information contains the map data, the information will be PDF format, TXT etc.

Data Base

This is where information and data are being stored. It is classified into two: the collection and user database.

➢ **Collection Database**: The collection database will contain all discretely accessible Web based digital library management system collections, entered and maintained by admin staff.

The collection database will contain all relevant information about the collection for the purposes of this application, including:

Collection identifier (locally invented, but perhaps derived from cataloging information), Collection name (as cataloged or as supplied by publisher), Collection source (i.e., frequently publisher, but including any contributors), Collection "class" and so on.

> **The user database:** The user database will contain all relevant information about the user for the purposes of this application, the information includes: User name (in discrete fields for last name, first name, etc.), E-mail address, Institutional affiliation (if applicable) and so on.

Block Diagram of Proposed system

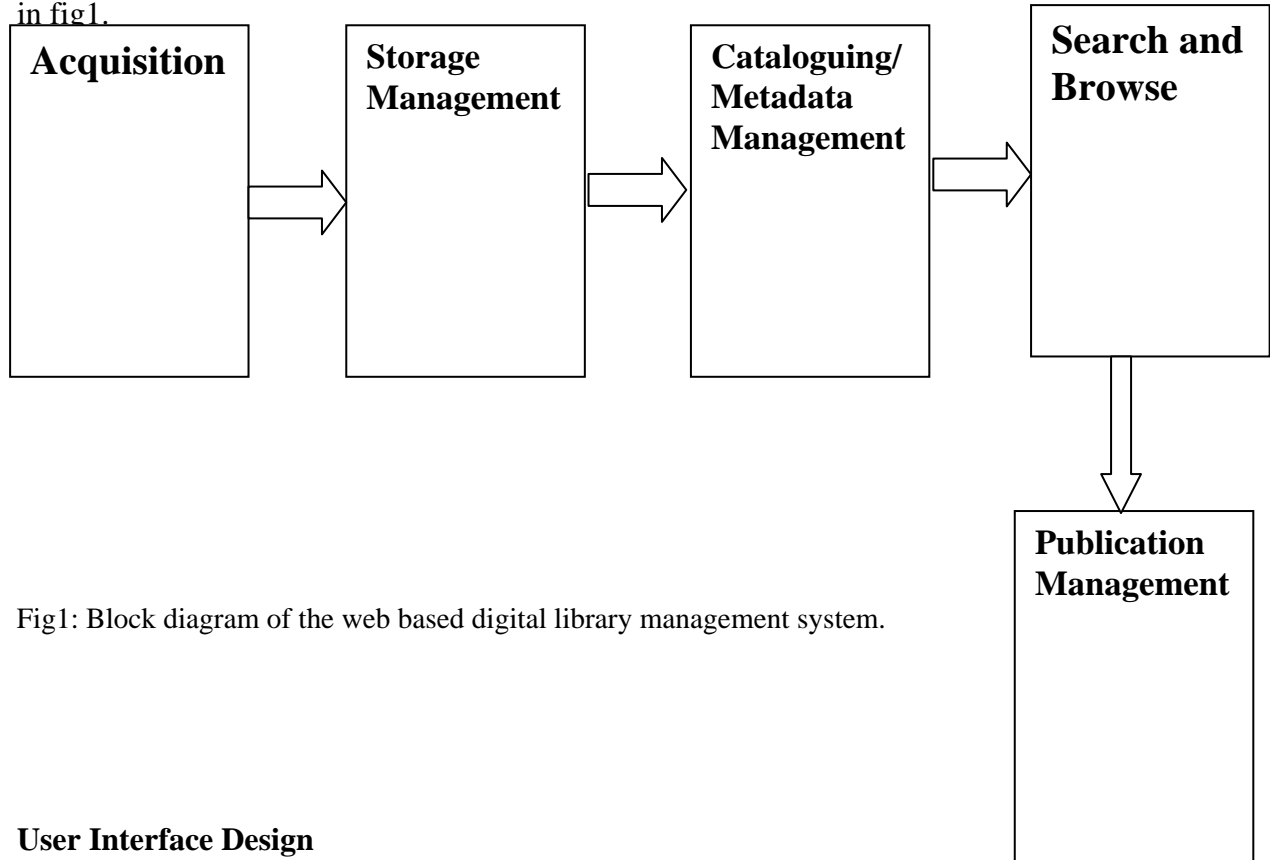The block diagram of the proposed Web Based Digital Library Management System is as shown in fig1.

Fig1: Block diagram of the web based digital library management system.

User Interface Design

All interactions between users (administrators, and read-only users) and the database should be possible through standard web browsers, preferably using standard HTML and SSL.
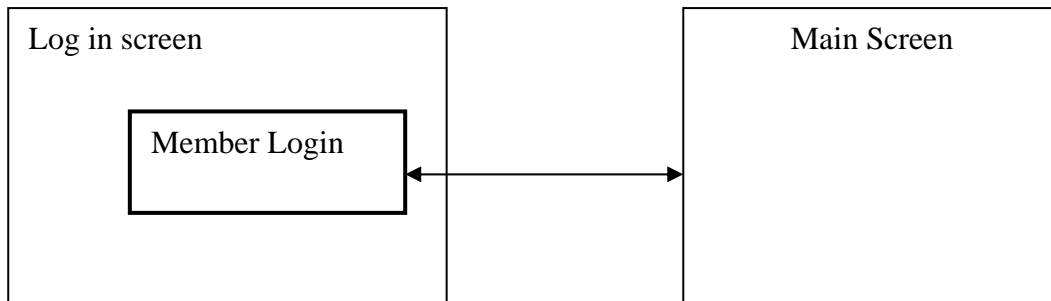

Data Structure of DLMS

Fig 2: proposed login page of a web browser

To meet the need of parallelization, one designs the parallel and extendable logical data structure as shown in Fig 3 below, which is made up of three hierarchies: Client, Mediator and Server. There are two kinds of users, end user and system manager. Any user connected to the Web can access the web pages of

DLMS through URL. These users are called end users. End users submit queries through the query interface and wait for the corresponding query results from the system. System manager accesses the system in local area network. Only the system manager authorizes system creation and maintenance. No matter the query operation submitted by the end users or maintenance operation submitted by the system manager, the Client accepts the operation, transmits it to MYSQL(which is the query language of DLMS), sends it to the Mediator and accepts the query results returned from the Server and displays them to the user. In figure 3, Mediator is in the middle layer of the DLMS architecture. It is the Web Server of the digital library. The Mediator accepts requests from Clients, analysis the requests, divides each request into sub-commands, creates the query execution plan, determines which Servers to execute these sub-commands, sends the commands to corresponding Servers and provides the results to Client. Mediator coordinates all the Servers to work together to execute any operation from the Client.

Server: Servers are composed of two kinds of processors, namely Query Processor and Data Collector.

Fig.3. Data Structure Diagram of a Digital Library Management System.
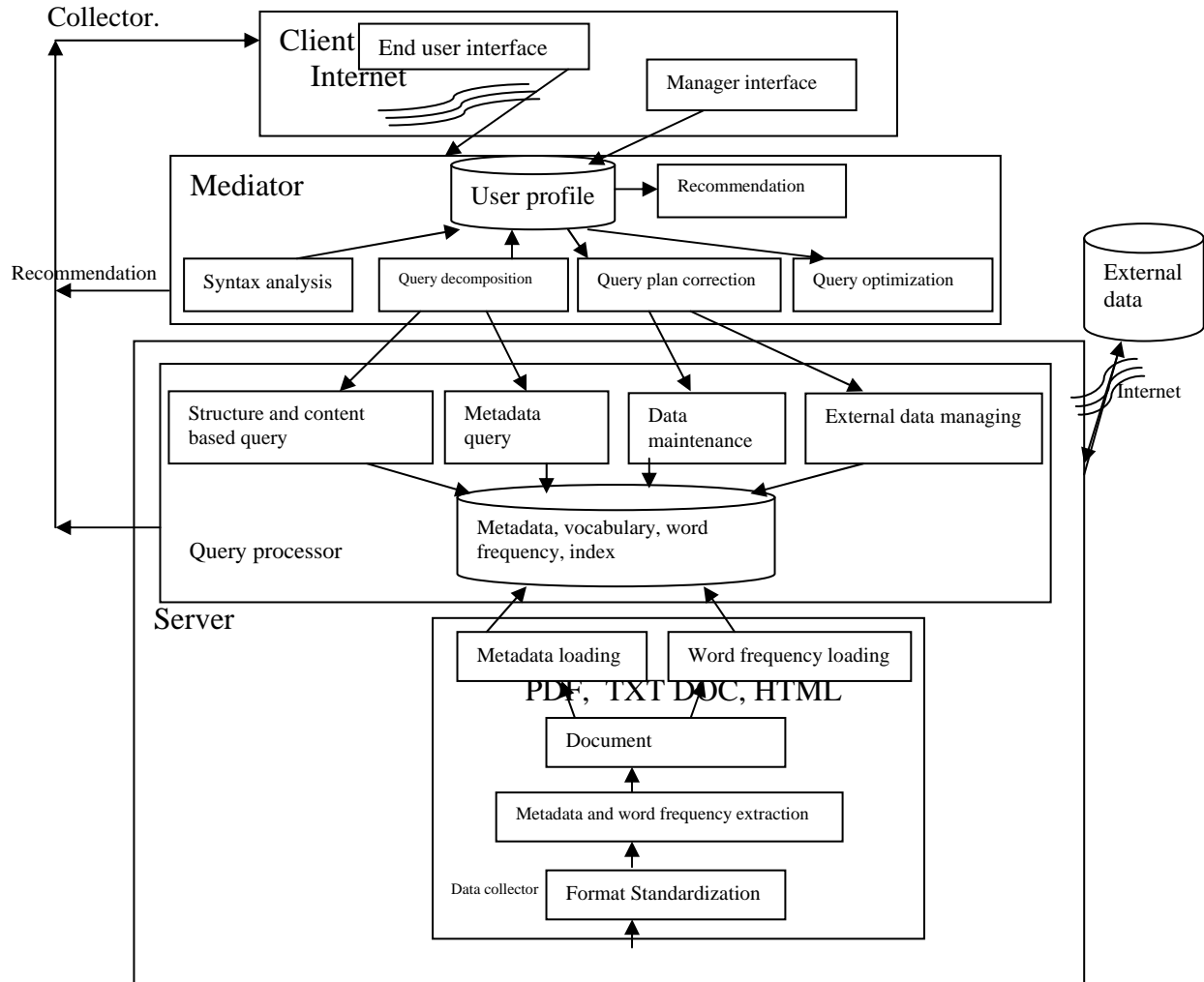
Each Query Processor is a node of a parallel computer. On one hand it stores data in the digital library including the original documents, the index file and the metadata extracted. On the other hand, it executes queries on the stored data and returns the query results to end user or manager.

Data Collector is simply named as a Collector. Collectors are personal computers on which the documents that need to be added in the digital library are stored. Collectors run on Windows operating

system and are controlled by the Mediator. They collect documents, extract relevant information, create classifier, classify documents and load all the data into corresponding Query Processors. [21]

Portal Design

A portal is a website which involves collection of web pages (documents that are accessed through the Internet). A web page is what you see on the screen when you type in a web address, click on a link, or put a query in a search engine. The name used in the design is https//localhost/digital_library. The name can be modified. A web page can contain any type of information, and can include text, color, graphics, animation and sound.

I choose to make my website in a blue colour for easy and brighter view.

In the web page for digital library, I have the following features: Home page, Organogram, Uploads, Repository, Online gateway and Feedback. Programming Language(MYSQL) is used for the design of all these web application and the codes are shown in the Appendix I. The web design features are discussed below.

Home Page

This is the main page in the web design; it contains all the information and guides in the site. It contains all other information, including the heading, title, background, vision, mission of the web site design. The block diagram design
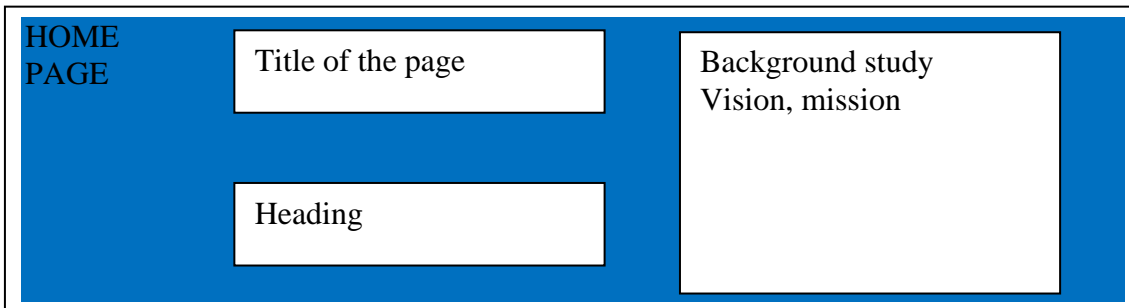is as shown below:

Fig. 4: Home Page

Uploads

Uploads as the name applies is used for acquisition of materials. All digital data that is being stored in the data bank are added in the upload interface. When a data or material is converted or acquired, it will be stored in the system disk. These digital data stored in the system disk can be made available to the users in their remote systems by uploading them in the server through the upload link in the website. This can only be done by authorized and registered admin/staff in the institution.

It has these features: Login/out, File, Browse, Author, Book Title, Book Category, Description,
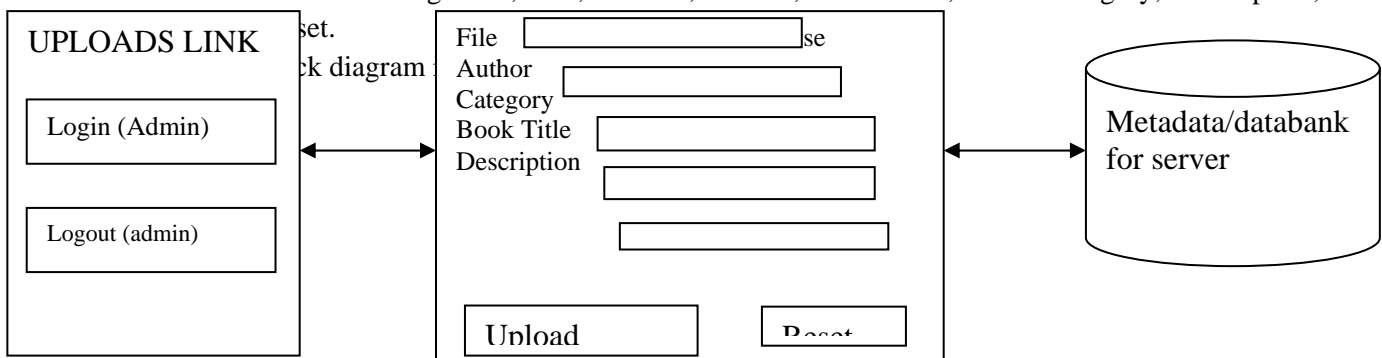

Fig.5: Data Upload Design

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Online Gateway

Online gateway gives the link to all online research materials. This serves for advance search for digital information which is not found in the institutions database. The gateway will always give access to the world wide best research material.

REPOSITORY

This is the key aspect of the whole design. It gives the link where all digital data can be found. It is the access link to all digital information and research materials. In the repository, the books are classified according to discipline and departments. It equally has a search and browse link where the user can type in his query and wait for publication. The diagram is as shown in figure 6a.
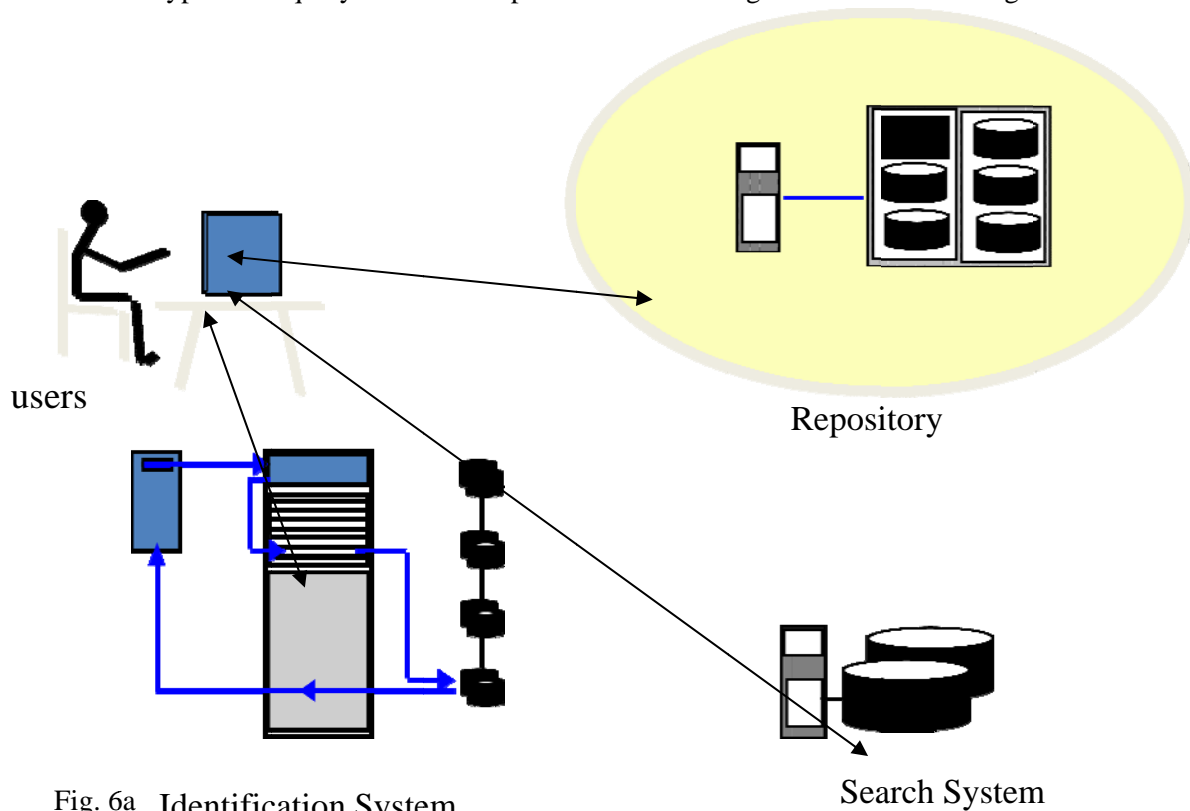

users

Repository

Fig. 6a   Identification System

Search System

Users

Search and browse/See it all

Data classified according to different classes and department.
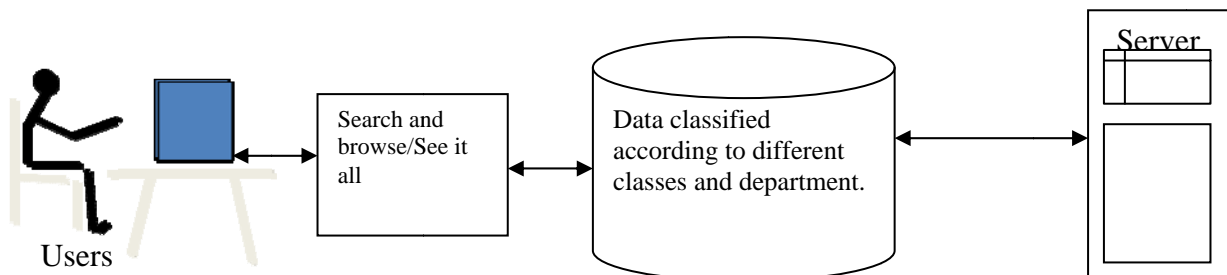
Server

Fig.6b: Repository design diagram

Input and Output Design

Inputs: Inputs are carefully and correctly added to ensure accuracy and to enforce security.

All inputs to digital library management system are checked using the inbuilt validation module. The purpose of this is to ensure that incorrect data is not allowed in, and with this the database receives only query from a correct input data.

The input to the login design diagram is as shown fig.7.

MEMBER LOGIN

Username

Password

Login

Create new account.

Fig. 7 Input to login diagram.

In the "create new account" window, one will have a column for email address, first name, last name, password, password confirmation and submit. This enables the student to create an account and register with the digital library. The design format is as shown fig.8

Email address:

Last name:

First name:

Password:

Repeat password:

Submit

Figure 8: Create new account form.

The output

This includes the feedbacks and the server responses to user's request. It is typically based on the users request for a particular book, journal, article, thesis etc. this is generally known as publication. It gives out searched items according to the input query. Figure 9 describes the Data Flow Diagram (DFD) and System Flow Chart of a Web Based Digital Library Management System is shown in figure 10.

Dataflow diagram of a web based digital library management system.

This shows how data flows in and out in digital library management system. It describes how information flows from the client to admin, and other components that make up the digital library management system. The diagram is as shown below:
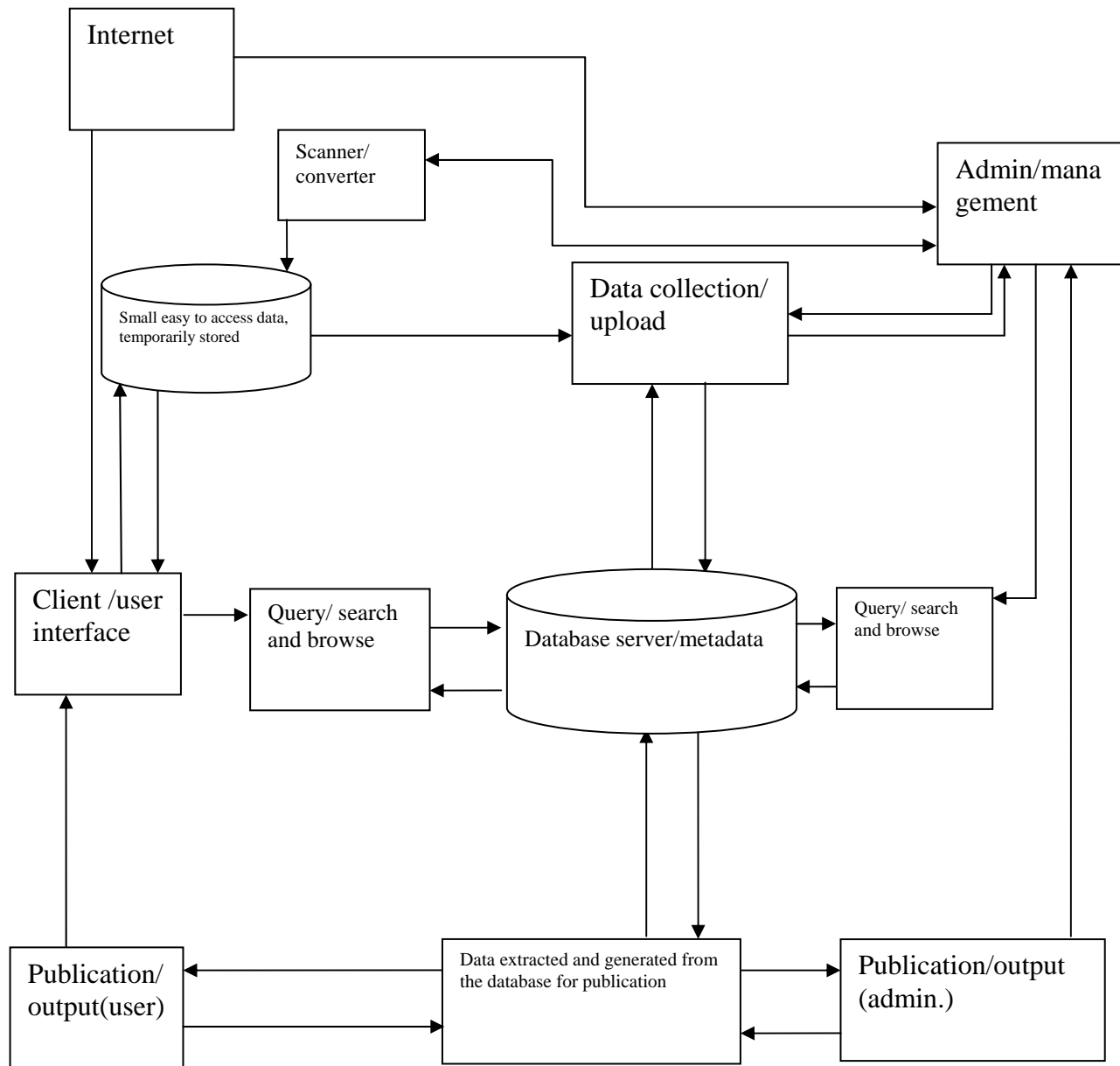

Fig 9: The data flow diagram of a web based digital library management system.

Pseudo Code Algorithm of a Web Based Digital Library Management System.

Start
(Initialize the computer system)
Input username and password

IF password ok, THEN
Display page
ELSE
Input username and password
Upload/book query
IF query is ok THEN
Perform operation
ELSE
Display page
LO

System Algorithm and Flow Chart

```
                    ┌──────────┐
                   (   Start    )
                    └────┬─────┘
                         │
                 ╱───────────────╲
                ╱  Input username  ╲
                ╲  and password.   ╱
                 ╲───────┬───────╱
                         │
                    ◇─────────◇
                   ╱  Login    ╲───── No
                   ╲   ok      ╱
                    ◇────┬────◇
                        yes
                         │
                ┌────────────────┐
                │  Display page  │
                └───────┬────────┘
                        │
                 ╱──────────────╲
                ╱ Upload/Book Query╲
                ╲──────────┬──────╱
                           │
                     ◇─────────◇
                    ╱  Query    ╲───── No
                    ╲   ok      ╱
                     ◇────┬────◇
                         yes
                          │
                ┌──────────────────┐
                │ Perform operation │
                └────────┬─────────┘
                         │
                    (   End    )
```
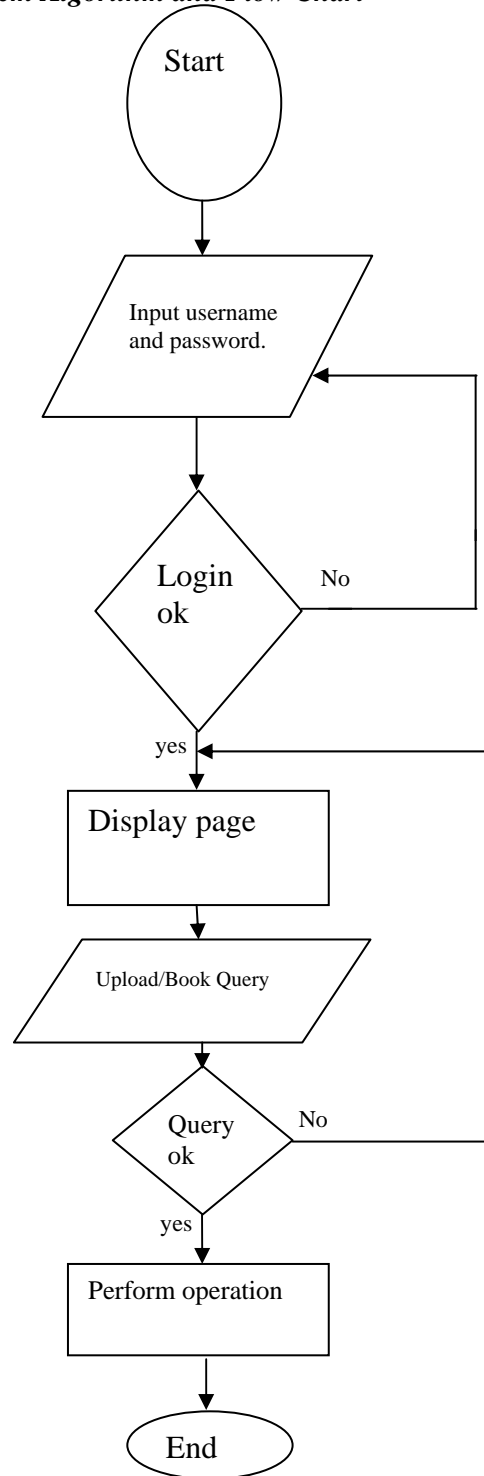
Fig.10: The Flow Chart of Web Based DLMS

Hardware Specification

The hardware requirement of this design is a computer system with at least this configuration: Pentium IV computer system or IBM compatible, 1.8GHZ processor speed, 1GB RAM memory

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capacity, 10 GB free Hard disk space for the installation of the necessary software, Large Hard Disk space on the database is required to contain the library data and metadata, Internet/intranet connectivity hardware, Security Implementation Hardware such as firewall and so on.

4.0 System Implementation:

System implementation is an important phase in software development life cycle. Web based digital library management system(DLMS) is implemented on Windows operating systems. In system implementation stage, the newly developed system is delivered to the users, organization after proper and adequate testing. System implementation encompasses series of stages and each of these stages are essential to the successful implementation of any system.

Implementation: The implementation stage is carried out in the following aspects:

➢ Home page interface implementation.
➢ Input/login interface implementation.
➢ Acquisition/Upload interface implementation.
➢ Repository interface implementation.

Home Page Interface Implementation:

The home page is the key aspect of the project, because it gives the basic user interface stand for a web based digital library management system. It comprises of; Project title, the header, background Study, Vision , Mission , Login interface.

- **Project Title:** This is the basic part of the project implementation and programming. It defines the name of the project designed. This gives one the direction on where to base the programming. For instance, the title of this project design is "Web Based Digital Library Management System".

The implementation is based on programming language, which transforms every design into codes. The programming codes for the title is as shown below:

```
<title>Web Based Digital Library Management System:::Home</title>
<style type="text/css">
<!--
.style1 {color: #FFFFFF}
-->
</style>
<link href="style.css" rel="stylesheet" type="text/css" />
<style type="text/css">
<!--a:link {</style>
```

- **Login Interface:** This is another important feature displayed in the homepage. It is where authorization is being managed. It grants the user access to the page. All these mentioned above is being controlled by programming codes which are in turn transformed into real features. The programming codes is as shown below:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
```

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```
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<meta name= "Description" content="Festus Aghagbo Nwako digital library is an Anex Anex and
equally a unit of the main Nnamdi Azikiwe University library.it is responsible for all digital operations
and services in the library. ">
<meta name="Keywords" content="Nau library,unizi e-library,Nnamdi Azikiwe University digital
library,School Library,Libraries in Nigeria,Nnamdi Azikiwe University Law library,Nnamdi Azikiwe
University Medical library,Nnamdi Azikiwe University Pharmarceutical library">
<title>Web Based Digital Library Management System:::Home</title>
<style type="text/css">
<!--.style1 {color: #FFFFFF}
--></style>
<link href="style.css" rel="stylesheet" type="text/css" />
<style type="text/css">
style>
<script type="text/javascript">
function MM_CheckFlashVersion(reqVerStr,msg){
  with(navigator){
   var isIE  = (appVersion.indexOf("MSIE") != -1 && userAgent.indexOf("Opera") == -1);
   var isWin = (appVersion.toLowerCase().indexOf("win") != -1);
   if (!isIE || !isWin){
    var flashVer = -1;
    if (plugins && plugins.length > 0){
     var desc = plugins["Shockwave Flash"] ? plugins["Shockwave Flash"].description : "";
     desc = plugins["Shockwave Flash 2.0"] ? plugins["Shockwave Flash 2.0"].description : desc;
     if (desc == "") flashVer = -1;
```

5.0   SUMMARY / CONCLUSION

In recent years, modernization has made so necessary for any sphere of life to adapt to the new and easier technology especially in the research institution. In the academic context delivery, research is the front runner. Library analogue research has metamorphosed into what can be delivered to remote systems in clients/ users homes, offices, hostels and so on.

This project work is aimed at making the institution library available to students or clients at a click of mouse in respective areas of choice. It enables students to have access to latest learning facilities such as, articles, journals, textbooks, thesis, projects, newspapers, etc. with their computer systems without going through the rigorous steps and routine in the conventional institution libraries.

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