A PRAGMATIC VIRTUAL LIBRARY SYSTEM FOR UNIVERSITIES
ACADEMIC ENHANCEMENT IN THE DEVELOPING COUNTRY

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ABSTRACT

This research was carried out to design a system that tackles the recent problem faced by academic researchers and public readers. The researchers looked into the present existing system of handling university libraries. The structured Systems Analysis and Design Methodology approach was adopted to proffer solutions to the existing problems after normal feasibility study was performed. A high level model of the proposed system was developed to guide the researchers design the new system. The data flow diagram that shows the flow of data in the entire organization was drawn. The interactions between the entities with respect to their attributes were equally shown. The proposed system design was drawn as well as the overview of the input and output design.

Keywords: University, libraries, High Level Model, Data Flow diagram, Methodology, input, output design.

1.0 Introduction

The development of library system in Nigeria can be traced from the pre-independence days when the consideration of Asquith’s report and eventual advice by the Secretary of State for the colonies, Authur Greech Jones in 1947 advocated establishment of two university colleges, as well as the Elliot’s recommendation of establishing University College in Ibadan. All these culminated in the establishment of University College Ibadan in 1948 and approval was also given for the transfer of about 104 students of Yaba Higher College to form the foundation students of the new university. Dr. Kenneth Mellanby was appointed the first principal of the University College (Abdulrahman Y. M. 2012). When this University was established it came along with library this brought the origin of library system in the Universities. Since then, successive Nigerian governments have continued to invest strongly in educational sectors. It must be realized that university libraries, being important academic parts of the universities, generally emerged simultaneously with their parent institutions. Hence, the more universities, the more the libraries are bound to exist. The proliferation of these universities, despite the economic down trend in the country since the 1980s, has increased the problems of the universities and their libraries so much that now their future seems very uncertain. Added to these problems are the problems of incorporating Information and Communication Technologies (ICTs) in Nigerian universities. Ever since the problem of the literature explosion became noticeable in the 1970s, the developed world has devised various systems to facilitate the flow of information both within libraries. The 21st century is characterized with information explosion with use of the modern technologies in information transmission. The problem now is how can the Nigerian universities adopt these modern technologies enable scholars have access to classic information at the very possible time. Perhaps in any discussion of application of modern technology in the library, as revealed by Ukok (1984), the first thing that comes to mind is the computer. The librarian does not have to be literate in the various technologies before employing them. In other words, he does not have to be a technical expert before using any form of technology
or a programmer before using a computer. However, he still is required to possess some technological knowledge, albeit at an abstract and intellectual level. Whatever we choose to call it, the computer has made such a tremendous impact on the organization, management, and dissemination of information that it readily commends itself to any library ready to accept it. The computer has become such a household word in the developed world that university libraries should see it as a great opportunity which should be taken up as soon as possible.

2.0 The Problems Facing Universities Libraries

The Nigerian universities libraries problems can be traced from the introduction of physical libraries system, this introduction made so demanding that the universities librarian always seeking for funds to meet the increasing demand of scholars.

1. Unjustifiable increase in the student population
2. Inadequate staffing in organizing libraries material:
3. Students’Proximity to Lecturers and lack of conducive learning environment
4. Inadequate Library Books and Materials
5. Poor Funding by Universities Founders

3.0 Objectives of Study

The physical libraries challenges threaten the academic performance of scholars to a large extent. The researchers proffer solutions that afford scholars easy access to electronic books and videos in Nigeria and the World at large even during lectures and other studying periods without necessarily having direct contact with the physical library.

4.0 Feasibility Studies

The major objectives of the Feasibility Studies were to evaluate the current performance of the existing Library System in Nigerian Universities, using two libraries sample cases - University of Calabar Main Library and Cross River University of Technology Library to ascertain the level of impact of physical level to the academic performance of students and the need for a new Library System which the Researcher considered best.

5.0.1 Other Related Work

According to (Candela, et al, 2011), A digital library is a library in which collections are stored in digital formats (as opposed to print, microform, or other media) and accessible via computers. The digital content may be stored locally, or accessed remotely via computer networks. A digital library is a type of information retrieval system (Eze U.F, 2013).

Goodluck I.I. (2011) of Covenant University made a case for marketing library and information services in Nigerian university libraries. He examines the practice and problems of marketing library and information services in Nigerian universities as well as proposed the way forward in dealing with identified problems. He discovered that if university libraries are carefully planned and executed, marketing could help the university library improve its public perception and win more readerships. He stressed that government-owned libraries are suffering from a low budgetary allocation for education which made the libraries difficult to operate with first class facilities that could have boost academic performance of students. Summarily, this research work was able to address the problem of poor funding of libraries in the Nigerian education system; it does not critically examine how this information can be market to attract public perception as stated in his publication. It actually identified the problems facing the Nigerian Universities libraries but far away from the solutions.

Chijioke F.U. et al (2011) established that Library building and space management is the umbrella sheltering both human and material resources and the engine propelling the educational and research goals of any university. Their paper explored the origin of academic library and the principles behind establishing the library as space and place in an academic environment. They pointed out different reasons for using the library by different people. Some implications of library as space and place were given and suggestion made for the appreciation of library building as an area of study in library and information science profession. Given an account of the emerging history of libraries formation Chijioke F. U. et al (2011) also stated that Libraries emerged in the ancient times as an institution to preserve the recorded knowledge which then was recorded in clay tablet called cuneiform by a form of writing known as pictographs. They also highlight the
migration from print to electronic resources, from the library as a place to the virtual library. 21st century is an era of information economy, and information literacy skill is indispensable to enjoying the economy. Again, the research work is an informative one indeed as they explored the various stages of library formation starting from the early stage of civilization to date. Although the paper was not able to point out how space and place impacted the academic performance of users. According to Eze U.F. (2013), Digital Library is all about the provision of digital collections, services and infrastructure to support continuous learning, research, scholarly communication as well as preservation and conservation of recorded knowledge accessible anywhere and anytime. A Web-Based library, provides access to the library anywhere and anytime with ease, restricts access from unauthorized users with the login details, in order to avoid over congestion in the network.

6.0 Research Methodology

This selection deals specifically on the details method adopts for the research work, designs and development procedure of the Virtual Library application. After deep consideration of the various methodologies available for implementation of application in Information Technology (IT), the Researchers consider the Structured Systems Analysis and design Methodology most suitable methods which cover the various stages of System Development Life Cycle (SDLC). SDLC by definition is the workflow for developing and maintaining information technology solutions. It can also be referred to as a process used by a systems analyst to develop an information system, training, and user (stakeholder) ownership (Osuagwu 2005).

![Figure 6.1: SDLC Diagram](Image)

IT Methodology is the delivery approach a project team takes to get to its destination of project completion. Basically, there are four major software methodologies commonly used by software developers which are the

The Structure System Analysis and Design:

The design of a system forms the bridge between the analysis of the problem and its implementation of the solution to that problem. Structured Design is a disciplined approach to computer system design, an activity that in the past has been notoriously haphazard and fraught with problems. It is the development of a blueprint of a computer systems solution to a problem having the same components and interrelationships among the components as the original (Osuagwu 2008) which allows the form of problems to guide the form of solution, seeks to conquer the complexity of large systems by means of partitioning the system into “black boxes” and organizing the black boxes into hierarchies suitable for computer implementation, uses tools especially graphic ones, to render system readily understandable, offers a set of strategies for developing a design solution from a well-defined problem and offers a set of criteria for evaluating the quality of a given solution with respect to the problem to be solved. Thus, structured design produces systems that are reliable, flexible, long-lasting, smooth development and efficient to operate (Osuagwu 2005).

7.0 Analysis of the Existing System and Organizational Study

The existing libraries in Nigerian universities using the two library samples, is physical. The Nigerian universities are yet to embrace the full implication of virtual library system. The details research studies conducted on these libraries view that libraries in Nigerian universities have the Chief Librarians (CLs) commonly known as the University Librarian with other subordinate staff which worked along with the Chief Librarian (CL). The primary duty is to oversee the total supervision of the entire library in term of procurement of library’s materials as well as staff discipline. The Libraries in context is made of various wards, each of which stocks with printed textbooks, the users are expected to present their identification in the entrance of each of the wards to the library attendant while all their personal belongings are kept outside the wards to prevent theft before being allowed inside the libraries. The libraries materials such as textbooks, journals and other inspirational learning materials are arranged on shelves, each of the users is expected to work to the shelves and make choice of materials needed where there is difficulty, the attendant is contacted for assistance. After studying periods which most times falls during the day, the books are left on the tables for the library attendants and other assisting staff rearrangement based on departmental levels or faculties. Users who borrowed materials from the library returned same after a specified period of time. In a case of theft or damage, financial equivalent of the material is surcharged for user.

Figure 7.1: Existing Library System
The diagram in figure 2 gives vivid structure of the existing library system in most universities library system in Nigeria which can further be explained as follows:

Main Entrance: The main entrance is entrance point where all the library users must pass through to the library. Most time, the main entrance has securities officer that guard the movement in and out of the library.

User: The user can be a student, lecturer or any other person that is going to the library for studies or for any other academic purpose.

Library Attendants: The Library Attendants are the watch dog of what is going on in the library. They are usually the officer who direct user on the various catalog of books and procedure to follow. They educate users on the various library rules and conduct. The books and other library materials lie in their shoulder; they give account of the books available in their section, and also arrange the books back to the shelves after usage.

Identification Unit: This Unit plays an important role in the physical library management system. It is in charge of user authentication, i.e. ‘who is who?’ In this case, the user will be expected to identify himself by showing his identity card or library card issued to him by the Unit before being allowed access to the library. The reason is simple, to prevent theft of materials from the library. After usage, the Unit also makes sure the user does not escape with any of the library materials. In situation where user borrowed book and failed to return, the unit keeps record of the students and during library clearance for graduating students the monetary value of the book is billed to the student before clearing such student.

User’s Material Unit: This is a section where the materials of users are kept before being allowed access to the library. There are some materials which user must not carry to the main studying room or halls to prevent distraction, these materials are kept at the Material Unit and taking back by the user after studying period.

Shelves: The Shelves are where the books and other materials for studies are kept for ease access. The books in the shelves are most time arranged schools by schools or faculties by faculties. User will move round searching for the book that meets their need.

Reading Hall: This is the ‘study centre’, when the books are selected, the user take it to the reading hall which most time partitioned with plywood and table, there, the user will be expected to stay and study without being distracted.

Computer Room: Most modern physical libraries have computer room for user and are equipped with internet facilities so that if user wants to open documented materials, he can do that with ease. The essence for the computer room is not for virtual library system but for accessing CD-ROM materials, journals, etc.

8.0 A High Level Model of the Proposed System

A high level data model conveys the core concepts and principles of an organization in a simple way, using concise descriptions. The key to a high level data model is simplicity and clarity. In another word, the purpose of the high level data model is to describe complex information in a very simplified way. After the detailed analysis of the data collected from various sources, it becomes very imperative for the Researcher to draft the High Level model of the proposed system of the Virtual Library System which gives the various parts of the system and how it works.
The diagram above gives the building block of the proposed system, first in the diagram is the Introductory Screen, this is the first page in the Virtual Library Application which the user sees before logging in. Next is the User Authentication, just as in the physical library system, the library user is authenticated before being allowed inside the books shelves and reading hall, same in this application. The user is expected to identify his authenticity by logging in using the issued PIN. When this is done, the system automatically displays the Menu page, in the Menu Page, there are two main sub-systems: (i) Insert into Database and Retrieve Database

Insert into Database - this is strictly for the Database Administrator to manage, the user is not allowed to use this module. In the Insert into Database are two other sub-systems which are the Video Object and Text Object. The Video Object accommodates with the Video data such as tutorial on a particular subject, while the Text Object accommodates all forms of electronic books such Portable Document Format (PDF), Word Processing Format (Doc.), Power Point Text format (PPT), etc which are all inserted into the database.

Retrieve from Database – In other hand, Retrieve from database enables data objects to be retrieved from database, the user is expected to retrieve data which resides inside the database by typing the subject. The system contains two main modules – Video Object and Text Object. The Video Object contains the retrieved data from the database which are of visual format such wav, 3GP, .flv, etc while Text Object is concerned with data which are retrieved from database and are of text format such as PDF, PPT, Doc, etc. The Display Output is the area where the result is displayed.

9.0 Data Flow Diagram

Data Flow diagrams illustrate how data are processed by this system in terms of inputs and outputs. The data flows are pipelines through which packet of information flow. In this case, the arrows which information moves through it was labeled with the name of the data that moves through it. This stage is geared to explain more of flow of data in the proposed new system. The results that are expected as an output of this stage are the different exploded diagrams of the Data Flow

Figure 8.1: High Level Model of Proposed System
Diagrams. This output helps in the definition of additional details about the new local system.

The above diagram shows how data flows from various sections of the system. First we have the Personal Identification Number, which communicates with Integrated Database and compare the User’s card number with that of the database before allowing user in to the menu page. In the Menu, there are two modules, the Insert Database and the Retrieve Database – each of the modules communicates with the server which contains the data. Video Object communicates with database by inserting inside the server with all video materials while the Text Object communicates to Server with all the Text Object materials.

10.0 ENTITY RELATIONSHIP DIAGRAMS (ERDS)
ERDs are data models and tools used in analysis to describe the data requirements and assumptions in the system from top-down perspective. They also set the stage for the design of database later on the SDLC. Below is the Entity Relationship Diagrams (ERDs) which gives vivid description of the relation that exist between different entities in the Virtual Library Application.
The above diagram contains three entities, each of which performs a unique function in the database. First, is the Text Object database which contains entity that houses the Text object inserted into the database. Next is the PIN Verification database which contains the various Personal Identification Number used by the user for access into the Virtual Library and Video Object which contains all the Video data inserted into the database for user to make use.

11.0 SYSTEM DESIGN

This phase gives the fully automated system of the Virtual Library Implementation System for Academic Enhancement of the Nigerian Universities. The detail design of the software is being diagrammatize to give the system outlook before fully coded by the programmer. In System design, the different interfaces are put into consideration. Below is the design for this project.

The diagram above gives illustration of the proposed system structure, starting from the Introductory Screen that gives the user the first impression about the Virtual Library. The user is expected to login using the PIN Authentication section, if the PIN is correct, the user is automatically directed to the Menu Page or else, the user is log out and message pop out requesting the user to ask for correct card number.

12.0 Overview of Input and Output Design

Systems need inputs which they process to produce output. Therefore, Input and Output Design is an important part of the design phase which determines the type of data enters into the computer and the results generated for the users. The way the data is actually entered would include some type of data entry, data type and the result. Input design involves the selection of the best strategy for getting data into the computer system at the right time and as accurately as possible. This is because the most difficult aspect of input design is accuracy. The use of well-defined documents can encourage users to record data accurately without omission.

For example, if an Author's telephone number is a needed input data, the Virtual Library form should have a specific line that is clearly labeled "Author’s telephone number". Having several lines labeled "Author information" would be less effective. This is because sometimes only the name and address would be filled in leaving out the telephone number. Input design must capture all the data that the system needs, without introducing any errors. Input errors can be greatly reduced when inputting directly by using appropriate
forms for data capture and well-designed computer screen layout.

Below is the input design form that contains the relevant elements for Authors details in this Research.

![Input Design for Text Object of proposed System](image)

**Figure 12.1:** Input Design for Text Object of proposed System

The diagram above is the input of text object for the proposed system. First the title of the application form which is the Virtual Library for Academic Enhancement of Nigerian Universities. Next is the **Book Code** which is generated by the program to different one textbook from another, next is Book title which the book title is inputted, and then the **Author Name** that contain the author name, then the publisher of the book, next the address, next the **published date** of the book, then the number of pages of the book, after this is the **telephone number** of the publisher and **Description** of book which gives the brief description of the book which the user is about to view and the attachment which the book is to be attached to the server. The Submit and the Cancel button are controls that enable the data on the input form to be submitted or cancelled.
The diagram above is the input of video object for the proposed system. First the title of the application form which is the Virtual Library for Academic Enhancement of Nigerian Universities. Next is the Video Code which is generated by the program to differentiate one video inserted from another, next is video title which contains the title of the video, and the Name of Actor/Author that contain the actor or author of the video to be inserted to the database, then the producer of the video, then the parts number of the video, after this is the telephone number of the producer and Description of video which gives the brief description of the video which the user is about to view and the attachment of the video which is to be attached to the server. The Submit and the Cancel button are controls that enable the data on the input form to be submitted or cancelled.

Figure 12.2: Input Design for Video Object proposed
The above diagram gives the details of the output generated from the input type in the search engine. All the details starting from the **Book Code**, the **Title**, the **Author**, the **Publisher Name** and **Address**, **no of pages**, **date published** as well as the **Telephone Number** are included. A brief about the book is also included as well as the contents of the book which when the user is clicked its contents display.

![Diagram](image_url)
The diagram above gives the full details of the output design of the proposed Video Object. The user is expected in this case to download the video from the Virtual Library server, play it and follow the sequence of teaching in the video.

The Search Engine plays a vital role in this project. It bridges the gap that exists between the input and the output design. It performs the duties of data fetching from the Virtual Library Database where the user is expected to type in the keyword of the material needed and click search, the Virtual Library server will now compare the keyword with the existing data in the database and display results accordingly.

13.0 FUTURE DIRECTIONS

As a future work, the Researchers recommend for implementation process of the Virtual Library Application which will accommodate the various electronic books and other materials that will enhance the academic performance of scholars. The design process gives the overview of the system including the database structure. Therefore the design gives an easy road to implementation to other researchers.

14.0 CONCLUSIONS

In this paper, new results have been derived for the design and implementation of Virtual Library System for Nigerian Universities Academic Enhancement. The researchers were able to establish the problems commonly associated with the physical libraries system which mitigate the best performance of students as well as scholars, designed new systems for the substitute of the one in practice and give the possible implementation process, we therefore recommend for full implementation to other researcher using the blueprint and designs.
REFERENCES


