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Design and Implementation of a Patrons' Services System For An Institutional Library

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ABSTRACT

The library patrons' services system of the Delta State College of Education, Mosogar; is an essential part of the institution's whole library system. The whole library system comprises the transaction system and the patrons'/user's services system. Even with an effective transaction aspect, the whole library system will not still be sufficiently resourceful without an efficient patrons' services aspect which combines to drive the operations of the College library system. The focus of this research work is the conversion of the manual College library patrons' services system into a computerized system for greater service delivery to the end-users. The challenges with the old patrons' services system were inaccuracies and delays in the end-users' registration, borrowing of books, returning of borrowed books, inconsistent details on borrowed/misplaced books with patrons' and the inappropriately computed charges for borrowers with books exceeding dates-due or that are lost. The computerization of the system is to eliminate the identified challenges and to modernize its services for the overall benefits of the library end-users. The resultant goal is to evolve a system with greater speed, accuracy and security features that will produce a user-friendly interface for staff and students. This is intended to create an easy and efficient access for the system patrons' and books' information in the system; capture dates-due and titles of borrowed books for each borrower, generate information on unreturned/lost books and borrowers' details. It is equally created to generate information on the most and least borrowed books, display the details of available books in the patrons' system by category, and automatically compute charges for overdue books in the patrons' accounts respectively.

1.0 INTRODUCTION

A Library (librairie in French and liber in Latin, meaning book), is an organized collection of books made accessible to a defined community for borrowing and referencing. Library systems exist to advance literacy and education to the patrons/users in a society. In the opinion of Dinesh (2015), the library was housed in rooms or physical compartments but as technology advanced, the library has been made accessible online to a sizeable number of users. The library plays a vital role in any academic institution by harnessing academic and research materials for learning and teaching of both academic staff and students. The basic functions of an institutional library system like that of the Delta State College of Education, Mosogar via Sapele; include: the promotion and dissemination of knowledge, provision of instructional books and materials, provision of research books and the platform for intellectual leadership, provision of resources for users' self-development and acts as a custodian of books that ensure their availability to the patrons.

Higher institutions of learning libraries in the present age require Information and Communication Technology (ICT) medium to provide speedy and efficient service to system patrons. The Delta State College of Education, Mosogar whose library patrons' service system is under study, required her service to be computerized so as to cope with the increasing number of patrons and their requirements for better service delivery.

The College's library system comprises of the transaction service and patrons service systems. The transaction service system deals with the internal services of the library system, that is, the activities carried out by the college library staff for the system's internal operation stability. The transaction system sees to the daily working and administration of the College library system, keeps record of purchases and acquisition of academic resources, and carries out cataloguing based on the American Library Association (ALA), Cataloguing Rules 1978, stated Young (1983).

On the other hand, the patrons' library system which is the focus of this research work, is the Library system's gate-way to the end-users and the busiest system structure of the library system, handling the lending and borrowing activities. The library patrons' service system is responsible for registering new users, issuing borrowers' cards and library clearance certificates for graduating students, renewal of memberships and the computing of charges for over-due books or lost ones on borrowers' accounts. It equally keeps statistics of the patrons' daily dealings with the library system.

The motivation to computerize the Delta State College

of Education library system patrons' service was borne out of the need to provide better service delivery and to forestall the loss of resources to the system and the end-users alike. A computerized system would ensure that the processes of tracking borrowed books in borrowers' possession, and computing charges on patrons' accounts on exceeded dates-due, among others are done automatically.

1.1 Statement of the Problem

The library patrons' service system as a critical component of the College library system is required to provide efficient and prompt service to her patrons. However, the existing manual patrons' service system is prone to inefficiency and human errors in the service delivery, which has resulted in the following challenges:

i. Books access delay; because of the library's large database, the manual searches span hours to get completed and created inconveniences for the patrons and library staff alike.
ii. Delay in book borrowing and returning; during peak hours, the services get sluggish and time consuming, with loss of vital man hours needed to accomplish other pressing tasks by patrons.
iii. Tracking borrowed/lost books loaned out; borrowers sometimes lost books or keep them beyond approved time limit, depriving others of their use. The manual process makes it difficult to track these occurrences.
iv. Inappropriate charges; the current system failed most often to track defaulted borrowers/lost books and to appropriately charge these defaulters due to poor record keeping of the system.

Perhaps, if the patrons' service system of the College is computerized, the above challenges may be surmounted.

1.2 Aim and Objectives of the Study

The aim of the study is to computerize the patrons' services system of the college and the objectives of the study are to create:

i. patrons' access to books' information by the author name(s) and/or book(s) details,
ii. A system that will improve on books storage capacity for the patrons,
iii. A system that will minimize/eliminate the loss of books by keeping details on unreturned books and borrowers',
iv. A patrons' system with the capacity to identify the most and least borrowed book(s) by users,
v. a system that will automatically compute charges for overdue books on patrons' accounts to generate revenue for the College.

1.3 Scope of the Study

The study is on computerizing the manual library patrons' services system of the Delta State College of Education, Mosogar; library system in order to provide improved service delivery to the library users/patrons. The work will cover all the library patrons in the College community, such as the academic staff and the students who are the main target of the library patrons' services system.

1.4 Research Methodology

The study involved the manual system physical process observation to identify the system's requirements for its computerization. The data required for the study will be generated from the College library operational forms/cards, observations of the manual services procedures, interview of the patrons to identify their challenges with the present system and the study of literature materials on the subject. An interview will also be carried out and the responses will be analyzed and applied in the design of the proposed system.

The system will be modeled using the design tools such as: entity relationship (ER), class and unified modeling language (UML) use-case diagrams. The choice of the design tools is to achieve optimum performance of a computerized library patrons' service system. The proposed computerized system will jointly use the hypertexts mark-up language (HTML), JavaScript language, and the hypertexts pre-processor (PHP) language that are Internet-based languages. And the data will be stored with the MySQL database management system (DBMS).

2.0 LITERATURE REVIEW

2.1 Information and Communication Technology (ICT) in Library Patrons' Service System.

The emergence of information and communication technology (ICT), has permeated every facet of human activities including the library system. Okerulu (2003) stated that the emergence of ICT has created limitless opportunities and opened up access to global information. He opined that it has assumed the role of educators, teaching patrons to find, evaluate and use information effectively in the library. The limitations of the tradition library system and the efficiency and increasing popularity of ICT in service delivery, has caused the demand for computerized libraries in place of the manual libraries. Before the advent of the computer age, libraries manually provided services for patrons by the card catalogue mode (a cabinet or multiple cabinets) fixed with drawers filled with index cards that identify books. The emergence of information technology has led to the adoption of electronic catalogue databases, called 'web cat' or computerized public access catalogue (CPACs) in library systems, which allow library patrons access to library resources promptly and efficiently.

Nevertheless, some persons are of the opinion that the traditional catalogue system was both easier to navigate, as it retains information by writing directly on patrons' cards, unlike the electronic catalogue database system. The 21st century, provoked the application of computer

technology to harness and retrieve data in the library system. According to Applegate (2008), between 2002 and 2004, the average number of transactions in an American manual academic library declined by about 2.2%

In the opinion of (Applegate, 2008) the reason for the decline in the usage of traditional catalogue system globally was caused by undergraduates, postgraduates' students and other patrons' preference for application of computer-aided devices in retrieving educational resources from websites in the Internet. Library scholars have acknowledged that manual institutional libraries needed to computerize their services, to mitigate the risk of losing users as the future of institutional libraries is at stake without recourse to computer technology (Vrana, & Barbaric, 2007). From glaring facts, the new technology has rendered the traditional measures less effective in libraries' operations and services such as online referencing, instruction, document delivery, user–initiated loan, direct borrowing and self-checkout.

The widespread adoption of computer technology in library operations, has reduced barriers to accessing patrons' accounts by minimizing the digital divide, (Singleton and Mast, 2000). The first application of computer technology in the library system in Nigeria was in the catalogue of Serial system in the Ibadan University library (Ehikhamenon, 1990). Institutional libraries in Nigeria are realizing the need to evolve from the traditional system to the computerized system which began at the university level in the 1970s. According to Akinbulumo (2008), ICT application is the only way to attract academically hungry users to the library outside reading to pass examinations. Therefore, it makes the library a new competitive space for information services in the higher educational institutions of learning (Hughes, 2000).

A system design is concerned with the internal structure and operation of individual components and the high-level design activity (Daintith, 2004). According to Waldo (2006)," the most creative and challenging phase of the system life cycle is the system design which is the process of planning a new system, or to replace or complement an existing system. He added that it is the technical specifications applied in implementing the system and which involves the construction of program and program testing. He further opined that, its first step is to determine the manner of output production and format, followed by the input data and master files designed to meet the requirements of the proposed output with the operational phases achieved through program construction and testing."

2.2 The College Library System Structure

The library system globally, comprises of such sections as the Circulation Section, Reserve/Reference Section, Serial Section, Technical Section, Collection Development Section, Acquisition Control Section, Cataloguing Section, and the virtual Section. But in the Delta State College of Education library system these are merged into five (5) sections; Administrative Section, Serial Section, Technical Section, Collection Development Section, and Readers' Services Section.

The study is focused on the Readers' Services Section concerned with the patrons' services. The library patrons' service system is the first point of call and interaction with patrons. It handles the registration of new patrons, issue borrowers' cards, issues and renews patrons' membership, the returning and shelving of books, computes charges for overdue or lost books and keeps statistics of the daily activities, and lastly provides reserve/reference and periodical units' services.

2.3 Analysis of the existing Library Patrons' System:

System analysis is the act, process or profession of studying an activity (procedure/business function) in order to define its goals/purpose and to discover the operations and procedures for accomplishing them most efficiently (Hordijk, 2007). According to Kumar *et al* (2004), System analysis is the dissection of a system into its components for the purposes of studying how these components relate to give the system outputs. While Whitten *et al* (1998), see it as a problem solving technique that decomposes a system into its components for the purpose of upgrading it or evolving a new system for better output. System Analysis also called logical design is driven by business concerns, especially those of system users. The strategies/techniques for performing system analysis are; modern structured analysis, information engineering, prototyping, and object-oriented analysis.

The manual state of the Delta State College of Education, Library Patrons' Service system process is laborious and inefficient, hence the analysis to determine its strengths and weaknesses.

2.4 Challenges of the Existing Patrons' Library System

1. It lacks a user-friendly interface because of its manual nature,
2. It is not efficient in identifying borrowers with over-due and lost books,
3. It fails in most occasions to correctly charge defaulters for overdue/lost books,
4. It has poor record of users' activities'
5. The process of users' searches, borrowing and returning of books is very slow,
6. It is unable to capture the most and least borrowed book(s) by users,
7. Manual users' registration process is sluggish and error prone.

2.5 The Library Patrons' Services System Design

System design is the activity of proceeding from an identified set of requirements for a system to the design that meets those requirements. Equally, it is the evaluation of alternative solutions and the specification of a detailed computer-based solution. Dubberly (2006), defined system design as a systematic and rigorous approach

demanded by the scale and complexity of many systems problems. System design deals with the implementation-dependent aspects of the system and build on the knowledge derived from the system analysis (Whitten et al, 1998).

3.0 THE PROPOSED SYSTEM PROCESS AND ARCHITECTURE

1. Loading and Categorization of Books: This is the process of loading the library books into the System database, for the system to automatically categorize into classes A-E and labeled accordingly.

2. The Library Administrator: The function inbuilt will register and grant users access to search for and borrow needed books according to categories by the system issued user-name and user-password that will aid user login.

3. Overdue books: Users are automatically charged after dates-due.

4. Users' login and logout: User login to system to borrow books/ to return books borrowed and to/display charges for excess days if any, then user logouts.

Figure 1 shows the architecture with the inbuilt processes the library patrons' services system is modeled after.

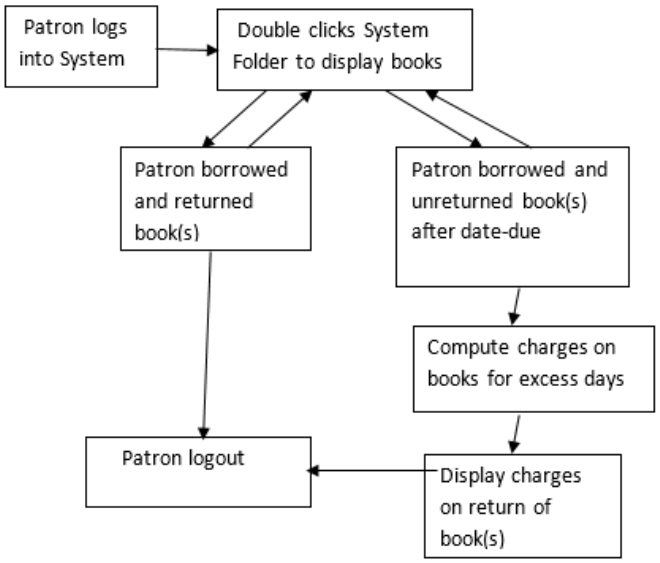

Figure.1: The proposed system architecture.

3.1 Features of the Proposed System

The features of the proposed system are routines that:

1. Create a user-friendly interface system for users.
2. Make easier and more efficient access on books' information for registered patrons,
3. Have in-built instruction to show dates-due and the details of borrowed books and borrowers' details, and be able to alert borrowers of their dates-due,
4. Produce as output, information on unreturned/lost books and borrowers' details, the most and least borrowed books by author name and book title,
5. Compute charges automatically for overdue/lost books excess days after the date-due on patrons' accounts on book(s) return/clearance after graduation,
6. Have the capacity to give available books' details by category and books identities/labels to minimize search errors and time.

It will be created with the MySQL database management system (DBMS) as a back-end to manage the system and ease the previous drawbacks of the manual system, providing quick access to system database for the patrons. The MySQL is a scalable back-end that does not require space upgrading for a long time.

The computerized patrons' services system is to be designed and developed with the HTML, JavaScript and (PHP) as the programming languages of choice. It works and runs efficiently in Windows operating system. The programming languages are object-oriented and internet-based languages that provide the dynamic interfaces in programming with MYSQL database for the implementation and manipulation of the library patrons' database management system. The languages are compatible with Windows 7 operating system and Mozilla Firefox web browser available in the library patrons' system personal computers for Internet compliance.

3.2 System Requirements Gathering for the Proposed System:

The library patrons' service system is required to hold information on its patrons and books, identified by such details as; author name(s), title, edition, etc. For multiple copies of the same book, each copy is assigned a unique identification label according to the category. During the patrons' registration, each patron supplies user name, address, email address, department and status (staff/student). After which the patron is assigned a unique user-name and a temporary password that will be customized by the patron.

The entity relationship diagram (ERD) model is the tool used for the system design. It is problem-oriented and helps to describe the system real data in a simple graphical way. The ERD model is used to represent information with entity types, entity properties and entity relationships within the College library patrons' service system. The ERDs are converted into the ERD model and optimized. Then each entity such as the Patron, Book, Borrow-Book and Return-Book, is converted into a data table. The data table properties (table's fields) constitute the entity properties, and the primary key is the relationship. The analysis of the fields and tables relies on the ERD diagrams of the College library patrons' service system to create the system database model in Figure 2.

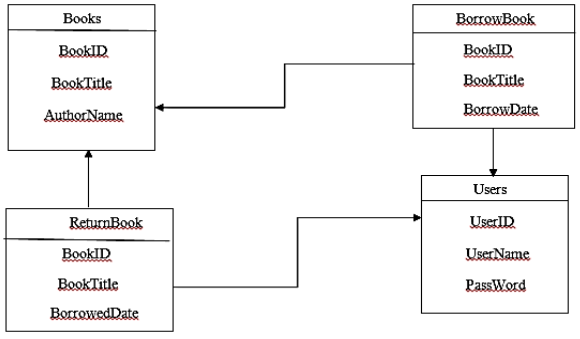

Figure 2: The library system ERD optimized model.

a. The Program Modules Structure: In developing the system, various modules were created and integrated into one main system. The structure has programmable modules called the main menu, users'/patrons' details table, and books' details table, borrow books details table, and the return books details table after the model in Figure 2. The structure also included reports generation, patrons' login and logout menus.

b. Main Menu: This controls the other modules of the system. The structure has pull down menu with sub-menus created from the modules. The other modules act as children, allowing for easy access/navigation from module to module.

c. Patrons: These include (staff and students) within the institution. To be eligible, they must be registered with the library. The module is used to create the database for the system users.

d. Books: The books module captures all system books details purchased or received in the library. From this module, any book purchased/received is stored in the system, before it is made available for patrons to access or borrow.

d. Borrowed Books: This module serves as the front desk for the library system. It permits only registered library system patrons to borrow books. The borrowed date is automatically entered against a patron's account by the system timer, and the date-due is generated by adding two (2) and three (3) weeks to students and staff respectively from the date it was borrowed. The module will produce details of borrowed books by patrons, capture the most and least borrowed books by system patrons.

e. Returned Books: This module records books returned by borrowers and the dates of return. If borrowed book(s) exceed date-due, the excess days are automatically computed against the patron's account.

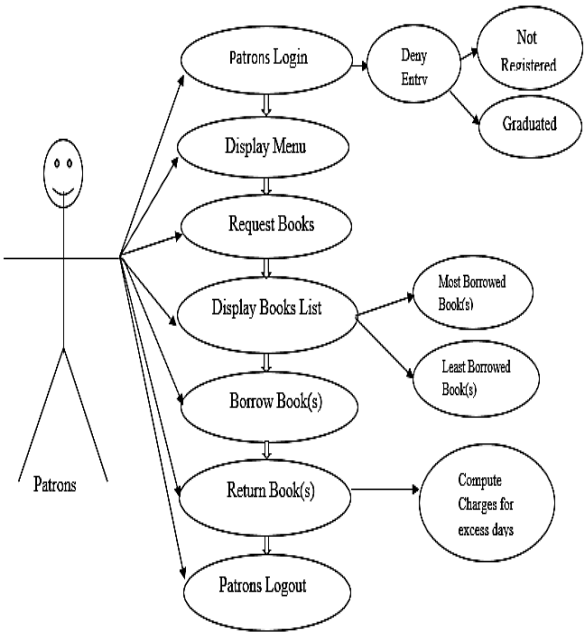

Figure 3: The Library Patrons' Service Use Case diagram (Modified from Larmanand, 2004).

f. The Patrons Service System Procedure Design: The Use-case diagram in Figure 3, captures the relationship that exists among the modules of the library patrons' service system. The program codes were generated from the ERD specifications and coded in JavaScript programming language. The process starts with the patrons' verification to authenticate if patron is registered with library. If registered, the system grants patron access into system Database to search or borrow book(s) with the date-due automatically captured by the system. If date-due is exceeded, the excess days are automatically computed against borrowers' accounts. Each of the file format design tables carries the fields needed to design and develop each of the library patrons' service system stages.

g. System Software Development and the Hardware: A structural approach, object-oriented and event-driven concepts are applied in the software development. A most challenging decision in the development of the system is the choice of the software (Ajala, 1999). The development of the software involved:

i. **The Back-end** which creates the system database design tables with the aid of the wampserver and the structured query language (SQL) as database management system (DBMS). WAMP is an acronym for Windows, Apache, MySQL and PHP.

ii. **The Front-end** which formed the interfaces created with the programming languages. The development used the network friendly SQL facilities to quicken access to system books by the patrons of the College library patrons' system to create an efficient process. The system is placed on Windows 7 professional operating system platform for use in Windows 2010.

The system was implemented with the html, JavaScript and PHP languages that are Internet-based. The html was used to create the users-friendly interface; the JavaScript, a client-based scripting language was the user-browser interpreter or the Internet interface; while the PHP acted as the server-side scripting language. The wampserver was the application that helped the system to run the program codes on the local machine offline.

The wampserver and SQL were used because of their compatibility, speed and efficiency in the program development. The programming languages have the ease to create the system forms and interfaces with the SQL DBMS capabilities to attain the desired outputs. The linkage of the menus is actualized with the Mozilla browser. The system software configuration is made to operate with the aid of the hardware configuration of the random access memory (RAM).

3.2 The Library Patrons' Service System Configuration: The installation and configuration of the system for the patrons will be connected to the Internet so as to link the Delta State College of Education, Mosogar library system to the global community of patrons. The networking of the College library patrons' service system

involved the interconnection of personal computers (PCs) to enable valid patrons' more efficient access to system books.

The system configuration was achieved by running the setup file following these steps:

i. Open My computer
ii. Open the application folder
iii. Locate wampserver.exe icon
iv. Double click the wampserver. exe file
v. Click installed application
vi. After the installation process, click finish
vii. Start wampserver
viii. Open browser
ix. Input URL: http://localhost/library

The application has embedded database that runs automatically as soon as it is launched.

3.3 The Library Patrons' System Implementation: The implementation of the Delta State College of Education, Mosogar; Library Patrons' Service System was made possible by the application of the software and hardware mentioned above.

i. On patrons' registration; the system allocates the user a unique user-name (lib/2024/***) and a User-password-1234.

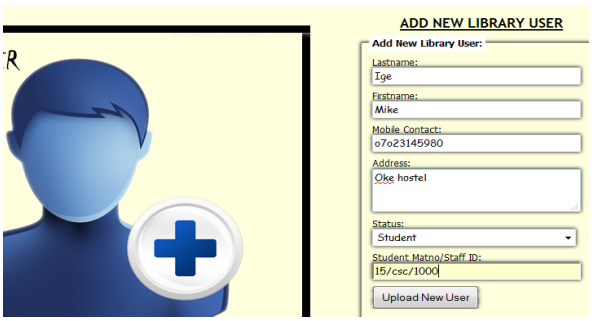

Figure 4: Shows the successful registration of a user with user-name and password

ii. On adding book(s) by author(s) and title to book store, the system displays the book(s) and author(s) details with a successful notice.

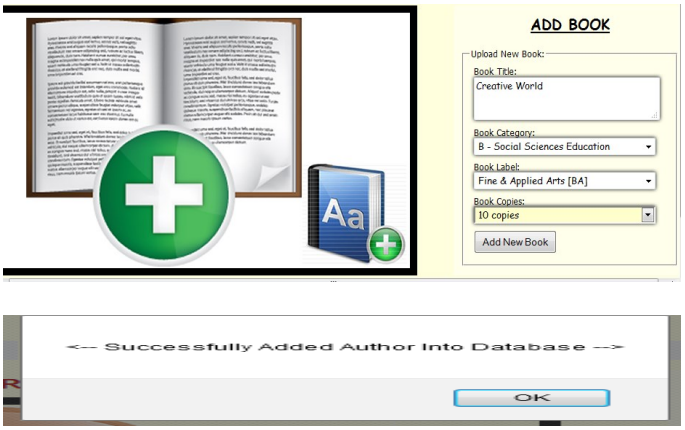

Figure 5: displays books and authors details of added books to system database. It showed a successful notice.

Table 1.0: Database content screen sample.

S/N	BOOK TITLE	CATEGORY	BOOK LABEL	BOOK No.
1.	A BRIDGE TOO FAR	E - General Books	Documentaries [ED]	10
2.	ADVANCED ECONOMIC THEORY	B - Social Sciences Education	Economics [BE]	10
3.	AGRICULTURAL BASICS	C - Vocational Education	Agricultural Science [CA]	10
4.	ANIMAL SCIENCE	C - Vocational Education	Agricultural Science [CA]	6
5.	BASIC ECONOMICS	B - Social Sciences Education	Economics [BE]	6
6.	BIOLOGICAL SCIENCE	A - Science Education	Biology [AB]	5
7.	BUILDING THE ENTREPRENAUR	C - Vocational Education	Agricultural Science [CA]	10
8.	CALCULATIONS IN PHYSICS	A - Science Education	Physics [AP]	6
9.	CASSELS FRENCH & ENG. DICTIONARY	B - Social Sciences Education	Economics [BE]	10
10.	COLLEGE BIOLOGY	A - Science Education	Biology [AB]	5
11.	COMPR. CERT. CHEMISTRY	A - Science Education	Computer Science [AC]	3
12.	CONCISE DICTIONARY OF POLITICS	B - Social Sciences Education	Economics [BE]	10
13.	Creative World	B - Social Sciences Education	Fine & Applied Arts [BA]	10
14.	EDUCATIONAL RESEARCH	D - General Education	Psychology [DP]	5
15.	EDUCATIONAL RESEARCH & DEVELMT	D - General Education	Psychology [DP]	10
16.	ENCYC. OF EDUCATION DEVELOPMENT	D - General Education	Psychology [DP]	11

iii. On patron search/query for book/author; the system displays the details of available books or informed patron if borrowed with the borrower's details and date-due.

iv. On the system database query, the number of books, authors and sum copies in system are displayed.

v. Automatic computation; the system equally computes charges for books with over-due dates.

4.0 CONCLUSION

From the inception of the College cum the library in 2003, the problem of poor library service to the patrons had persisted, impending scholarship among the patrons. The solution was to design and implement a computerized library patrons' service system that would operate on the local area network (LAN) connectivity running on Windows 7 Professional that grants patrons easier access to books and eliminated the problems associated with the old manual system. The project work covered the back-end and front-end of the system. The back-end carried the database files created with the SQL server and wampserver. The files included the main menu, the users' file, books file, borrow-books file and the return-books file. The front-end is the interfaces developed with the programming languages based on their object-oriented capabilities, to evolve an efficient and easy to operate users-friendly service system for the College library patrons.

The new system on implementation, achieved the following:

i. provided a user-friendly interface system for patrons,
ii. produced an easier and more efficient access for patrons to obtain books' information and for security of the library system books,
iii. captured and displaced the authors, dates-due and titles of borrowed books with the categories for each patron, thereby minimizing search errors and time by patrons.

4.1 Recommendation

In the light of the amount of human and computing resources employed to creating the College library patrons' services system with its attendant benefits, the following were proffered for the stakeholders-the patrons, administrator and College management that:

a. The developed system be approved for use by the College management for the College library system instead of a foreign one alien to the environment.
b. The College librarian/administrator should cooperate with management to create an enabling environment for the developed system to function when eventually adopted, considering the patrons' distress with the manual system.
d. The library administration should be in tune with growing trends in information technology so as to update the patrons' service system and/or create replacement as the need arises to provide cutting edge information technology service for her patrons.
e. Future upgrade of the patrons' service system should involve audit trail to give account on who issued what book to a patron.

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