DEVELOPMENT OF LIBRARY SYSTEM AUTOMATION SOFTWARE: A STUDY OF FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA LIBRARY

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Abstract

The paper examined the provision of automated software for Library services in Nigerian Universities, using Federal University of Technology, Minna Library as a case study. The system design methodology was used in the study. The general objective of this study is to explore the potentials of providing effective and efficient library services of record-keeping of books and users; and giving easy access to these records to users when needed, using a desktop Java application at the University Library. This software is used to register students and staff, new books that arrive the circulation unit, lend out books to users and make returning of the books easy. With the software, the library staff can view user record, edit the record, and calculate fine of defaulters automatically. The software can also send e-mails to various users/members who default in returning borrowed Library books. The software also generates report for the Chief Administrator to view activities carried out in various units of the Library. This software was designed and developed with Java Programming Language. The software will enhance Library services and boost professional standing of the librarian as well. Based on this study, it is recommended that provision of digital library services in Federal University of Technology Minna as well as other tertiary institutions of learning should be implemented in line with current global digital trend.

Keywords: Digital library, Java programming, library automation, library management

Introduction

The advent of the computer system has ushered in a lot of new, more convenient and faster means of performing some existing routines. Routines are integral aspects of computing which have enhanced development of faster methods of computing. The computer, being a programmable machine can be used to solve a myriad of problems. It performs better than man, especially in terms of speed and accuracy; a task that may take a human being several years can be done by a computer in a matter of seconds. Speed and accuracy are important in achieving success and progress, and computer has helped in this regard. The duo of speed and accuracy was once thought impossible to achieve, as it was once believed that whatever is fast cannot be entirely accurate. However, with computing, it is now a different ball game. The use of the archaic manual keeping of records of books and users information in the library has become cumbersome over the years. Users have to search through shelves on end just to find the books they need; they have to walk up and down library halls just to be in touch with the available books. This can be cumbersome, especially as the volume of information increases daily and this search for it becomes more and more difficult.

Despite the fact that catalogue cards and accession numbers are kept in the library, access to books and journals can still take a great deal of time, sometimes running into several hours. Improving access to information with all the logistic details it involves has therefore been a primary concern of the libraries for a long time. This concern has also driven current research

to generate a lasting solution to the problem by library automation. An important step towards implementation of this automation will be to create a network within the library that will become part of the existing network of the institution. Networking of computers within an organization will help the users to browse the cataloguing system from any of the workstation/ terminal.

A very handy technology available for library in this respect is the CD-ROM products which can be considered at the third level. The development of CD-ROM collection not only conserves space but also provides multi-user access in a network environment. There are many self-tutorial CD-ROMS available with multi-media effect. Libraries facing high incidence of mutilation of materials will benefit from such electronic products. Moreover, people doing empirical research can download data and directly take it to other software platform for analysis and making graphical presentation (Crawford, 2006). Other technology which libraries can make use of is the e-mail system. This not only reduces the recurring expenditure but also provides a fast communication system. Sending reminders for non-receipt of journals by e-mail has proved to be very cost-effective. In addition to this, sharing of resources among libraries becomes easy. Few public domain e-mail software are available and there will be no additional expenditure incurred (Miller, 2005).

Generally, the development of the Internet technology has revolutionized the information world. Subscribers to the Internet, in addition to getting access to various public domain databases and services, will also get free e-mail and fax facility. Some publishers have started giving content pages of journals, and libraries that subscribe to such journals can also have full text of the articles. Many academic and research institutes have given free access to their working papers.

Library automation is the application of ICTs to library operations and services. The functions that may be automated are any or all of the following: acquisition, cataloguing, public access (OPAC and WebPAC), indexing and abstracting, circulation, serials management and reference (Crawford, 2006). Put differently, library automation can be defined as the use of computer and networking technologies in the library. Automation is done in order to improve the level of service and quality of output and to fulfill needs that cannot be achieved by manual system. Such needs include sharing of resources as well as using of information that appears only in electronic format like Internet resources and CD-ROMs (ihome.ust.hk/iblkt/diploma/libauto). Many activities of a library are routine in nature; a few are repetitive. Automation of these activities helps in managing the library's resources in a better way at the same time saving time,money and manpower. Automation also offers freedom from doing repetitive and routine works as well as enables providing efficient services properly. (Moorthy, 2004)

Automation is pivotal towards enabling libraries to provide more convenient access to information. The use of computers in libraries and information applications improves library activities in two major ways:

i. It improves the speed at which information is accessible to users;
ii. It takes over various routines and repetitive tasks.

These have greatly reduced the work of library staff and thus enable them to concentrate on some other things (Crawford, 2006).

The Federal University of Technology, Minna Library was established in February 1984. It was housed in the former Students' Dining Hall at the Bosso campus of the University, but has expanded in conformity with the general expansion of the University. With the completion of the main campus library, it has now become the main library, housing the University Librarian's office, support services, etc. The main library serves the School of

Engineering and Engineering Technology, School of Agriculture and Agricultural Technology, School of Environmental Technology, School of Information and Communication Technology, School of Entrepreneurship and Business Technology. The Bosso campus library now serves the School of Physical Sciences, School of Life Sciences, School of Science and Technology Education and School of Postgraduate Studies. Federal University of Technology (FUT) Minna library has a total book collection of twenty nine million, five hundred and seventy three thousand, four hundred and forty one volumes of Journals and a seating capacity of five hundred and thirteen readers(www. futminna.edu.ng).

Statement of the Problem

FUT Minna library is characterized by the following challenges:

i. The value of work in the library increases daily, especially the storage and retrieval of books, thus, there is need for a faster and more efficient way to manage these activities. The existing system is time-consuming for library users who, just to borrow book(s), often have to go through the catalogue shelves row by row, book by book searching for the book they need before bringing the book to the circulation desk.
ii. The process is also time-consuming and stressful for the staff in the circulation unit as they have to check catalogues for students who want to get information on availability of a particular book.
iii. Users keep books for long periods of time after the due date for returning them, thereby depriving others the access to the books.
iv. Lack of effective mechanism to reach users with books in their possession that are beyond due date.
v. Inconsistency in penalizing users as some library staff collect less fine on overdue books, or even nothing from users who are their friends or relatives.
vi. Poor record of fine collected from users.

This paper therefore presents a way out of these challenges by automating the circulation aspect of library routine which includes borrowing, returning, cataloguing, registration, messaging, easy book searching and information retrieval systems.

Review of Related Literature

Libraries parse and organize collection of documents of all sorts (Journal of library review, 1980). Library can be defined as the long-term storehouse of knowledge, the first place of recourse for those in search and a special collection of the past classified for enhanced reference asset (Journal of Librarianship, 1986). Furthermore, library can be defined as a system comprising a collection of recorded knowledge, retrieval devices, users and library personnel, all associated in such a way as to maximize the knowledge transfer process (Oyedum, 2006). Thus, library could be described as a place where both printed materials such as books and non-printed materials such as films, maps, real objects projector, tapes, cassette recorders are selected, collected and organized to be used for reading and to support teaching activities. A library should become recognized as a center for interested members of the general public, offering a specialized collection of books for reference. A library can also be a center for answering serious inquiries from visitors. Library can also be defined as an organized department for retrieving of information and in which collection of materials needed for education purposes such as project, research, lecture references and journals can be found (Bennet and Policell, 1993).

Different types of library exist which serve different systems or organizations. Thus libraries exist to aid in the achievement of the aims and objectives of the institutions and organizations in which they are established. There are about five types of libraries, but more emphasis will be laid on the Academic/University library for the purpose of this paper. Academic libraries

are libraries that are established in tertiary institutions. Their collections reflect the aims and objectives of the institution in which they are established. An instance is the Federal University of Technology, Minna Library (also known as the Ibrahim Badamasi Babangida Library), Minna. The university library was founded almost the same time as the institution itself and has the following goals:

i. . To provide the educational and reference materials needed by staff and students for good/efficient performance; and this would enable the library to promote the teaching, learning and research activities of the parent institution;
ii. . Provision of access to the information needed by staff to work productively;
iii. Preservation of knowledge.

In order to achieve these goals, the library is divided into five main departments/areas.

i. Technical Service Division: This division handles the buying and maintenance of the library's materials. It is usually referred to as the behind the screen department, because most of the activities of the staff are carried out of sight of regular users of the library. This area is made up of the following:
   - The acquisition section: the selection of library materials of all kinds is done in this section by the librarian in charge.
   - The cataloguing section: library materials, on receipt from acquisition section, are classified and catalogued here.
   - Serial section: various journals subscribed to by the library are selected, ordered, received, processed and shelved by the serial section.

ii. Readers Services Division: This is the area where the activities of library staff are glaringly seen. The area is made up of various sections. These are:
   - Circulation section: This section is where materials that go on loan are charged to patrons/users and discharged on return to the library. Information about a material that is not found where it belongs on the shelves could be sought from circulation section.
   - Reference section: This section specializes in the provision of reference services as well as giving readers advice in addition to keeping reference material.
   - Reserve section: This kind of service area is where study materials in short supply, but in constant and extensive demand, are kept for in-house use.

iii. Research services department: It is also made up of certain sections:
   - Documentation section: This section houses vital government publications such as from federal, state and other government agencies. International organizations publication are collected here, processed, stored and used to provide the information needs of the readers.
   - Private collection section: This section of the library houses the collection of renowned scholars and important dignitaries in the community.
   - Maps and manuscript section: This section acquires processes and preserves maps and other manuscripts that are vital to research.
   - Non-print media resources section: Here, materials that are not print-based are housed, organized, preserved and used for the provision of information needs of the patrons of the library. The non-print media are called audiovisual materials because it requires auditory and visual appreciation to use them.

Borrowing System of the Library

Only students of the university, Academic staff and senior Administrative/Technical staff of the University are to borrow book(s). Each person in these categories is given two library cards for borrowing books.

When a book is to be borrowed, the user's card is demanded; the book card is then taken from the book and kept in the user's library card which is then kept in the library card box. When the user returns the book, the librarian in charge brings out his card and checks the class mark on the card against that on the book; if it tallies with that of the book, the book is then accepted and the user's library card is returned to him/her. However, with the new system all this will no longer be necessary because the analog process would have been replaced with the digital borrowing system where the face of the user is captured with other relevant information of the user during registration; when the user comes to borrow a book(s), only the ID card (matriculation number or generated ID card) will be required; this is inserted into the software and automatically the face is captured from the database and appears on the screen to affirm certainty of the identity without necessarily showing the ID card. This process enables the administrator to be sure of the borrower, what is borrowed and what is returned which will considerably enhance the security feature of the library.

Book(s) for loan may be borrowed by the member of teaching staff for a period of one month, or by students and others for a period of 14 days. The teaching staff are allowed to borrow up to five books, while students are allowed two books at a time. A book on loan may be renewed on request if only no other user wishes to use the book. However, any loaned book is subject to immédiate recall in cases of emergency. Due to limited number of books in the library, no reader is allowed to borrow book(s) for more than three consecutive times. Reference books, reserved books, manuscripts, rare books, microfiche, current and volumes of journals and government's documents may not be borrowed from the library except by special permission from the University librarian.

A fine of two naira was initially charged, but now five naira is charged for each day a book is kept overdue. The date due slip is pasted at the front cover of each book. If a book is recalled from a reader who has charged it out for the second time or if a book is recommended to be placed on reserve, the user must return such a book within three days from the day of the notice of recall sent to him/her. Failure to return the book within the stipulated time, the user was initially charged at the rate of five naira per day but now ten naira, for the number of days the book is held in excess of the three days.

A borrower shall be charged five times the replacement value of lost/damaged book(s). All proven cases of stealing and mutilation by students shall attract a penalty of expulsion from the University. In case of the students defaulting in the payments of charges, the amount shall be deducted from their deposits, where the deposit would adequately cover the charges. Where the deposit will not cover the charges, the user shall be expected to make up from other sources.

A user being surcharged for a lost/damaged library material shall have his/her identity card impounded until such payments are fully made. Staff defaulting will get the accrued charge deducted from his/her salary. All books borrowed by students shall be returned to the library before proceeding on vacation. Failure to do this shall attract ten naira per day as overdue charges.

Library Security

The following are areas of library securities:

- Protection of the book stock against unauthorized removal.
- Security of reader's personal possessions.

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- Security of reader's personal possessions.

- Protection of premises against intruders outside business hours.
- Protection of equipment.
- Staff and readers safety.
- Confidential documents (Katz, 1982).

Libraries and their staff have always been interested in serving their patrons in a professional and conscientious manner. From the time of Cutter, there has been a definitive ideology that places the needs and the convenience of the public before anything else, including the cataloguers' preferences. Time constraints, labour shortages, lack of proper funds, and an overall inability to know how to go about the awesome and never-ending task of authority control has hampered the public in their quest for information, and has caused long periods of anxiety for librarians. Based on manual system of catalogue cards, most libraries could barely meet the daily necessities.

The introduction of computers changed the way libraries perform their operations. With the advent of computers, many librarians now believe they could breathe a sigh of relief and leave the worry of authority control to the mysterious inner workings of the computers. If a library had done little toward the achievement of authority control, it always had the awareness that whole sections of their inventory were still inaccessible to all but a handful of experienced users, and Cutter's vision was not being optimally implemented. A major consolation is that all the work does not have to be done in-house anymore and many changes and updates are made easier with computer technology; help is only as far as the online authority files or as close as an automated networked library.

Research Methodology

The analysis of the existing system is an important stage between investigation and design implementation. The research methodology for the study is system design. The existing system in the circulation unit of the Federal University of Technology Minna library consists of the following manual process:

When a student comes into the library the student shows his/her ID card to the staff at the circulation desk before the student is allowed into the library. A Student may use materials of the library only within the library and only students who have registered with the library and have their library cards with them can borrow books out from the library.

To be able to register, the student presents his or her ID card and is then given a form to fill which reflects the student's information; then the student is given two library cards containing his/her name, department, library and matriculation number with which the user can borrow at most two books. Borrowing a book is usually stressful as most students have to go through the catalogue shelves to search for the book they want, after finding it the student now brings it to the staff at the circulation where the borrowing is processed and recorded.

The current practice is that all the transactions on books are done manually; so taking a long time for a transaction like borrowing a book or returning a book, for searching for books by users. Another major disadvantage is that it takes even longer time to prepare the list of books borrowed and the available books in the library. Presently it takes up to a day for verifying all records. So after conducting the feasibility study it is clear that the manual library management system needs to be computerized.

System Access

The System Access has to do with the category of individuals that will be able to access the system as in this case not all individuals will be allowed access into this system, because the application have been developed for the administrator's use only; such that the administrative functions of the library is lessened by automatically performing these functions instead of the usual manual processes. Only the administrators that have been granted privilege on the

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application would be able to add or delete books and members that have already been stored in the database. The Students and Staff of the University do not have access to this system which is only operated by the administrative staff of the library that have the knowledge and understanding on how the application should be used and operated. The administrators have the power to do virtually everything in the system. This includes granting access to library staff, delete and edit user's records (these aspects can only be carried out by high level administrators). Such staff must comply with the demand of inputting the appropriate password into the system before he/she is recognized and allowed to make necessary changes in the record. This is to prevent unauthorized deletion of records or abuse by the library staff.

Program Design

The Library Management System Automation Application consists of eight main modules and a couple of functions in the file menu bar such as the Screen Snapshot, the E-Mailing and deleting functions. The eight main modules on the application include:

i. **The Add Books Module:** This is the module that supports the addition of books in the library, mostly new books. This module consists of several fields such as the Book Title, Book authors, Subject, ISBN, Shelf number and so on; this module holds the major details of each book being added for easy identification and proper documentation.

ii. **The Add Members Module:** This module is responsible for the user's registration. With the aid of this module users of the library are added to the database and kept for record sake. This module is much more for registration because new users are added as well as their pictures for proper identification and documentation. In this module the fields involved are Student ID, Staff ID (which is generated by the system in the process unlike the Student ID which is their unique matriculation number), the photo field, user's information such as the department, course of study, phone numbers and e-mail addresses, names of the user. With this, it is easy for the system to send messages (via the e-mail addresses provided by the users) to the users, and to easily identify a user when necessary.

iii. **The Borrow Book Module:** This is the module responsible for issuing out books to users of the library. In this module the Book ID and User ID are entered to confirm the user taking away the book as a registered user of the library; when this is confirmed in the database the photo of the user is shown visibly before proceeding. This is the area of the security while borrowing out books from the library. The information of the borrower is also taken alongside with the collection and returning date. After this the user can then successfully borrow a book from the library to be returned at the appointed date, and failure to return at the appropriate date issued will result in a penalty on the user.

iv. **The Return Book Module:** This module is responsible to register every returned book in the database. In this module the Book ID and User's ID are entered to display the User photo for confirmation; it also has to do with the security of the system. After confirmation, the fine button is pressed to display the penalty charges on the user. If the fine equals zero, then it means that the user did not overshoot the returning date issued, else the fine portion automatically displays the amount of charges to be paid by the user. Until payment is done by the user the fine is being recorded and kept; and the user will be indebted to the library until clearance is effected in the library.

v. **The Issued Books Module:** This module helps to show the list of books that have been borrowed out of the shelves in the library; this is good for proper documentation purposes and to keep track of the available books to be borrowed in the library.

vi. **The Reserve Book Module:** This module consists of the Book ID, Book Subject, Current Date and the Valid Date fields. This module helps to reserve a particular book that is not meant to be borrowed by any user, but to which a user can be granted access within the library vicinity for research purposes.

vii. **The List Members Module:** This module reveals the list of registered users of the library by displaying their information according to their categories in a table for visualization and for the sake of information collection.

viii. **The List Books Module:** This module reveals the list of registered books in the library by displaying their information on a table for visualization and the sake of information collection.

E-Mail Messaging

The E-Mailing feature is a very necessary and important feature added to this application. Though it is not one of the eight modules contained in this application, it is still a necessity that it is referred to and spoken about because it has its own unique function in this application. This feature can be found in the File Send E-Mail in the task bar of this application. The E-Mailing feature helps to send information to users of the library to send all necessary information to the users by the library management. On this frame, the e-mail of the user to whom the information is to be passed, is inputted into the e-mail address field and sent. This will send the information to the user's e-mail where the user can have access to the information. However, this can only be achieved with internet access to the computer system being used; otherwise the message sending will not be achieved. With this, the user will be duly informed about overdue of book borrowed and the payment to be made as fine for the penalty, as well as other necessary information that may arise from time to time.

System Flowchart

The relationship between the user and the system to produce a result is shown as a flowchart below:

System Implementation and Testing

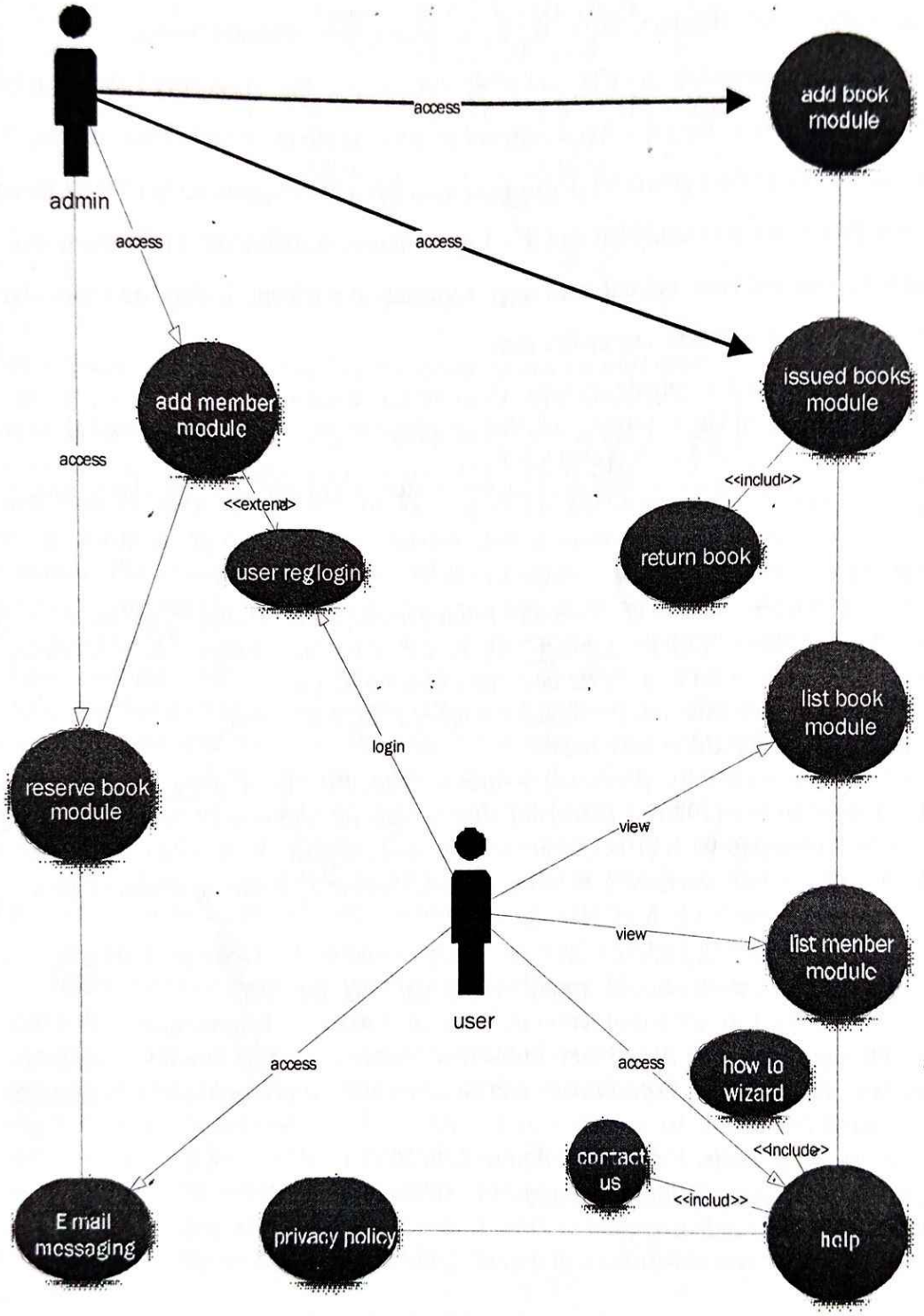
Implementation is the stage in the project where the theoretical design is turned into a working system. The implementation phase constructs, installs and operates the new system. A vital requirement of a new system is that it works efficiently and effectively.

Some of the steps involved in implementing such a new project are:

- End user training
- End user Education
- Training on the application software
- System Design
- Parallel Run And To New System
- Post implementation Review

After providing the necessary basic training on the computer awareness, the users will have to be trained on the new system such as the screen flows and screen design type of help on the screen, type of errors while entering the data, the corresponding validation check at each entry and the way to correct the data entered. It should then cover information needed by the specific user or group to use the system.

The system was successfully subjected to several testing in line with Library operations. It will enhance the efficiency and relatively ease users and material management of the Library, especially by passing out proper information to users, tracking down of offenders and ensuring that proper payment is made by the defaulters.



Sources: Authors' Conception, 2016

Conclusion and Recommendations

The work describes the activities of the library system, and some of the functions to keep track of the library users through registration and proper data collection, enforce the prescribed penalties to offenders, and make quick searches on relevant books.

The paper/designed project is an effort to satisfy the needs in the University Library. It is user friendly, and extensive coding has been adopted to make it effective and efficient. This package shall prove to be a powerful package in satisfying the requirements of the Library. The manual procedure was analyzed and the disadvantages enumerated. The system was designed to be menu-driven and enhance easy information retrieval. It also has a modular design in order to make future expansion easy.

To obtain maximum benefits from this system, it is recommended that:
the library materials should be sensitized such that signals could be automatically picked at the exit by a sensor if illegal removal of a book is attempted.
proper maintenance and regular upgrading of the new system is strongly recommended to sustain its efficiency.

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