Innovative Systems Design and Engineering
ISSN 2222-1727 (Paper) ISSN 2222-2871 (Online)
Vol.4, No.5, 2013
www.iiste.org

Integrating ICT in Library Management: Design and Development of an Automated Library Management System for Cavendish University Uganda

Mamman Salisu Jibia, Conrad M. Mubaraka & Odie Michael

1. Lecturer, Dept of Library & Information Science, Hassan Usman Katsina Polytechnic Katsina-Nigeria
2. Network Admin and Data Manager, Uganda-CWRU Research Collaboration
3. Deputy Principal, College of Higher Degrees and Research: Kampala International University, Uganda PO Box 20000 Kampala, Uganda

*Email: samujib35@yahoo.com, samujib35@gmail.com

Abstract
This study intended to solicit requirements for a proposed library information system and develop it for CUU as a step to automate its library services. The study employed prototyping method to come up with the system. The system met most of the objectives by enabling the library staff keep track of its clients and resources they manage. Report generation was made easy as all the information has become easier to manipulate due to the nature of electronic storage. Searching for reading material has been made easy since different criteria may be used to accomplish the task. The interfaces were user friendly and there was no need for retraining other than orientation. The researcher recommends that this system be continuously built to take care of other library services which include management of the serials and periodicals, book reservations, automatic email notification for reminders, use of bar codes, scanners and labels; and use of RFID (Radio Frequency Identification) tags to mitigate book thefts. It is also recommended that the library system, go online so that books and lecture notes are accessed over the internet by users.
Keyword: Library Management, network, Service Delivery

1. Introduction

Information technology (IT) has revolutionized and has made the lives easier by the various kinds of applications. In the light of the rapid changes in the use of IT, there are many tools, technologies and systems that have been produced and invented. Information technology is a combination of computer and telecommunication techniques which makes it possible for new systems and products to be developed to help people at work, in education and at home. In the modern world many processes may take place at the same time within a place and so there is need for integration of all the processes, creation of paperless environments and also to ensure efficient task management. The purpose of integrating computer based systems is to help to increase the market share and making it very easy for customers to use. Computer systems are increasing the demands being made by customers and for those businesses that do not head to computerization are bound to lose out due to the stiff competition and efficiency brought about by computerization.

Motivation

Many universities in Uganda struggle to put up libraries where students and lecturers can read and prepare notes and do research. Such places consist of textbooks, magazines, dailies, theses among others. Most libraries stretch spanning relatively long halls implying the books shelved therein must be numerous for the librarians to organise them every time students use them. It becomes cumbersome to locate certain books or literature source by the students and library staff. Moreover the registration books at times is misplaced, making it prone to loss in future. Cavendish University Uganda (CUU) has established study centers across the country which will definitely need to access library facilities, so appropriate preparation suffices. The researcher therefore posed the following questions: i) how should libraries improve services for the users? And ii) of what use can computers be in serving library users better?

2. Background

Cavendish University was named after Sr. Henry Cavendish who was an academician in London. In Africa it is a

franchise brought in 2005 by the Cavendish Africa group based in Lusaka, Zambia. In June, 2008, the Cavendish Africa group inaugurated the Ugandan branch in Kampala and named it Cavendish University Uganda (CUU). Since its inception, CUU has experienced a steady growth in both the number of students and teaching staff. This growth is putting a lot of stress on the services of the library. The library room is becoming too small for the growing number of students; services like borrowing and lending of resources are manually managed using a book log maintained by the different librarians. Users are not only finding it hard to search for books they need, but are also unable to tell whether the books they need are available or not. This leads to a lot of frustrations and waste of time. Furthermore, the library management staff has run out of space to shelve the additional books they receive. This has resulted into stacking of books onto each other making retrieval very difficult. It is also hard to manually track which books have been lent out or retuned making accountability a problem. Since the borrowed books are logged into a book, there are high chances of this log getting lost or misplaced. This could lead the library fail to recover borrowed books.The aim of this project was therefore, to develop and implement an electronic library management system that would enable an easy and efficient management of the library services, easy literature search utilities and expand access of reading materials by enabling users access electronic books from anywhere within the University. This is expected to greatly decongest the library as users can access the literature using their personal computers in the classrooms. All this work was done by reviewing the current manual library systems, review the documents involved, identify the strength and weaknesses of the system then propose a better system that would satisfy both users and management. The study was guided by the following specific objectives as to: i) examine the current library system; ii) establish system requirements for the proposed system; and iii) design and develop the proposed Library system.

3. Literature Review

Improved Service Delivery

Information systems and technologies have become a vital component of successful businesses and organizations. All companies and businesses need to update their business infrastructures and change the way they work to respond more immediately to their customer needs (O'Brien, 2002). Customers no longer need to waste more time but need things to be done fast enough. This has forced most companies to take advantages of the various technological innovations lest they would be outcompeted. This does not leave out the book libraries whose sole purpose is to serve knowledge to people especially students. Library users would need the items to always be available and accessed fast. Technology has changed the lifestyles of customers too. They will go to places where there is availability and easy retrieval facilities to avoid time wastage (Ddembe & Baryamureba, 2006).

O'Brien (2002) defines information systems as any organized combination of people, hardware, software, communication networks and a data resource that collects, transforms, and disseminates information in an organization. He states that a system is a group of interrelated components working together towards a common goal by accepting inputs and producing outputs in an organized transformation process. The speed in information processing capabilities and connectivity of computers and internet technologies can substantially increase the efficiency of business processes as well as communications and collaboration among the people responsible for their operation and management, which forms the main role of information technology. CUU library is currently using a manual information system involving the use of book logs pen and student library card which system is inefficient and out of date. According to Muzaki and Mugisa (2008), maintaining or improving quality with increasing numbers of students can only be effected with fundamental changes in academic instructions and learning how to use new tools and methods. They further stress that universities are now being evaluated against a different set of standards from those in the past. For example, the International Certified Evaluation and Accreditations 2009-2010 in one of their standards indicates that research should always be conducted in the university in a manner that forms a foundation for attaining education goals. In order to do research, the university should avail to the researchers' good library services which include current literature, in any form, conducive environment and accessibility using current technologies. The library should be well managed. Library resources like books, academic journals, audio visual material and other material needed for education and research are collected, classified and organized systematically, and are used effectively or made available for practical uses. There is no optimal way the library will be able to meet the above set standards without being enhanced by modern technologies and tools and whenever there is a mention of the words modern technologies ICT is involved, hence the use of computers in the library management system.

Library Management System

Library management system includes collection, acquisitions, classification, cataloging, circulation, reference and serial service, and, access and retrieval of information. When these library services are computerized, then it is

termed as library automation. Automation is defined as the technology concerned with the design and development of the process and systems that minimize the necessary human intervention in their operations. Library Automation is the general term for information and communication technologies (ICT) that are used to replace manual systems in the library (Shivaram, 2007). Library automation is justified by the following factors: i) The growth rate of information being too high has resulted into availability of a bulk of information in libraries. It has become difficult to handle and arrange the information with the traditional methods; ii) It is difficult to update the information due to the voluminous increase and rise in the degree of specifications involved; iii) Resource sharing among libraries and users can be handled easily by library automation with hope of achieving some savings; iv) Automation gives the advantage of high speed, more accuracy and vast storage capacity; v) Library automation improves our efficiency of work and provides consistency and impress our work control; vi) Automation also reduces repetitive work; and vii) It permits bibliographic controls, checking and updating.

In library automation, one uses computers to perform library services. Kasozi (2003) observes that computers have increasingly become both exercise books and textbooks for university students. This means that students who have not enhanced the new technologies would be left far behind since current information can now be readily available by use of computers. Most lecturers now prepare and deliver their presentations using computers and some schools have replaced the chalk boards with smart boards. This clearly shows that management of the library services are bound to be inefficient if new technologies are not adopted to organize these presentations. Library information for future generations can only be possible if it is digitized and stored in an electronic media which is small, portable and secure. Gone are the days when one had to store bulky books which occupy a lot of space. In another article by Kutesa in the New Vision Newspaper of Tuesday August 22nd, 2011, it is observed that gone are the days when everything that has to be read was only found in printed books tucked away somewhere in the library or store. With the advent of computers in the education world, it is no longer necessary to storm libraries or books stores for textbooks since people use electronic books and other kinds of soft copies. Someone just needs to carry a flash disk, CD or laptop instead of books. Soft copies are not bulky, are crafted in such a way that they are easier to use than textbooks and easier to navigate. The author also notes that soft copies are cost effective compared to university textbooks as one soft copy can be accessed by many people. Soft copies can also have animation which is not possible with hard copies and are rarely destroyed. However, using electronic books go with a cost. The user needs a computer or some reading device to read the electronic book. Computers are also rigid such that you must be in a particular posture while using it. It is less flexible like going to the riverside or forest to read.

Local Area Networks and Library Management System

Decreasing costs of microcomputers, coupled with significant increases in storage capacity, memory, speed, variability, are contributing to the increased prevalence of Local Area Networks (LAN). Networked computer systems are installed in business, academic and non-profit environments. LANs provide communication links with offices and by connecting LANS, through buildings, across campuses, oven globally. LANs provide communication links, resource sharing of hardware, software and information (Madron, 1994). Beyond resource storage and communication tools, LANs tend to become depositories and distribution sites of information in various stages of formation. LANs use a variety of organizational techniques to control and access resources. The organization feature is the file system within a file server which is the primary computer on the network. A file server is divided into volumes that are in turn divided into directories which may further be subdivided into subdirectories; where the least item in the hierarchy is the file or document. This is a common structure on microcomputers, file cabinets and various other storage and retrieval systems. This structure is also the primary step in the hierarchical or even relational classification of data or information. The file server is protected by assigning rights and controlling access based on the requirements and privileges granted to the user. These rights and account controls are attached to the user accounts and the restrictions determine which parts of the file server a user may enter and how resources may be used by that account. The rights ensure resource integrity and user privacy. Software files are placed in directories that may allow user access but do not allow modification of the executable code of the software package.

4. Related Studies

A study done by Sharma (2000) on a survey of Library automation in College Libraries in Goa State, India it was found that most libraries were focused on only cataloging and circulation and hence the whole library management system was not complete. The study also showed that traditional barriers such as insufficient funds, lack of trained staff and lack of space were faced by a majority of libraries. However, it was concluded that libraries, librarians and college administrators must initiate automation in order to provide effective and efficient services to

the users. Also, Adegbore (2010) conducted a study in two Nigerian University Libraries and found that problems being encountered in the library automation are hardware breakdown, software problems, unreliable power supply, inadequate funding, staff training deficiency and planned obsolescence of commercial software. However, both universities stated the serious need for automation in university libraries.

During the 1st International Conference on African Digital Libraries and Archives (ICADLA-1) in Addis Ababa, Ethiopia, Sessanga (2009) from the Islamic University in Uganda-Uganda made a presentation entitled "The Automation/Digitization of Library Services of Islamic University in Uganda (IUIU) to enhance access to knowledge for development effectiveness". The presenter states that the goal of the Library services of IUIU was to enhance information access through equipping the library with modern technological facilities, literature and partnering with other stakeholders. The presenter stresses that digitization of library services blends well with the set goal initiative of IUIU. He further says that the knowledge at IUIU is embedded in the library's collections that include published books (both print and electronic); reports (government and other vital statistical reports); research reports, theses and dissertations; documentaries in form of video tapes, CDs; e-databases; photographs capturing the institution's heritage, major events, ceremonies and other vital regional and international developments aspects; artifacts mostly on Islamic culture i.e the traditional "mikalabanda"-wooden sandal for taking ablution as used by the early Arabs, "Njemeko"- first clay containers to take ablution. He adds that, as per the set recommended standards by the National Council for Higher Education (NCHE), indicators of a good quality library should consider having a student book ratio, E-Resource access/internet rates, student library space ratio, level of ICT integration in library services and relevance of stock as per their up to datedness as well as content among others. It was observed that the automation efforts of the University library services was graced with an internally developed library software developed by the library staff and the IT department with the help of some students of Computer Science and Information Technology.

Zarrummai et al (2004) notes that given the limited financial resources and capabilities, open source software provides a way for African educational institutions to help themselves to leapfrog into the information age through reduced costs, less dependence on imported technology and its ability to be customized to local languages. By giving users access to its inner workings, open source software could stimulate the local software industry. In identifying the potential problems faced by the traditional manual library services and the current technological trends, it is imperative that the adoption of ICT to automate the library services is the only way to go. If CUU is to remain competitive, it has to walk to the trend of the dynamic technological changes otherwise; there will be a big digital divide between it and other universities.

The literature sources reviewed above suggest that improved quality of education (QE) is a function of good library services (LS) and institutional commitment (IC) to academic transformation and development in general.

LS+ IC=QE

5. Methodology

The study was majorly qualitative in nature where the researcher interviewed library users, library staff and observed library use. The users (students and staff) were approached at their convenience in the library; while library staff were reached to in their office and the researcher observed for ease of accessibility of books shelves and general atmosphere in the library. This approach was used because it could give first hand information that guided the quick solicitation of requirements. Among requirements identified were functional and non-functional user requirements, other system requirements and the system specification. The information system was broken down into small, manageable modules (i.e. borrowing, returning, downloading, etc) other than being handled as one big task. Such structured design encourages the top-down design technique where the system is divided into independent modules for ease of understanding and design. Prototyping was used to develop the system. This approach was preferred because Larry and Nancy (2005) noted that users cannot know exactly what they want, nor they cannot recognize the potential of the system, until they have had an opportunity to work with it. Prototyping gave an actual opportunity to work with the functional aspects of the proposed system long before the system is implemented. In prototyping, the researcher analyzed the current situation to identify information needs and developed a model of the proposed system. The system was implemented using MySQL as a backend and PHP for the Front-end. MySQL is an easy to use, open source, widely used and robust software. It can run on many platforms and is able to maintain large relational databases. MySQL is also secure and has wide availability of technical support on the internet. The system was based on the client server architecture. The database management system and application server would all run on the same computer. The client access to the database server would be through a web server.

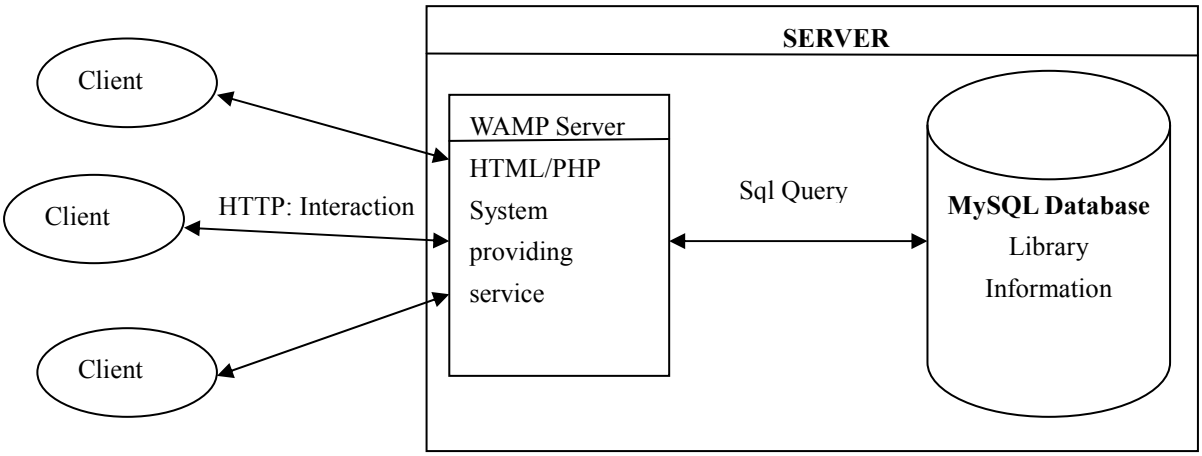

Figure 1: System Architecture

The users make request to the library system and the system gives a feedback. The library staff updates the system and a feedback is sent to the staff. The system offers an electronic catalog and reports back to both the users and the library staff.

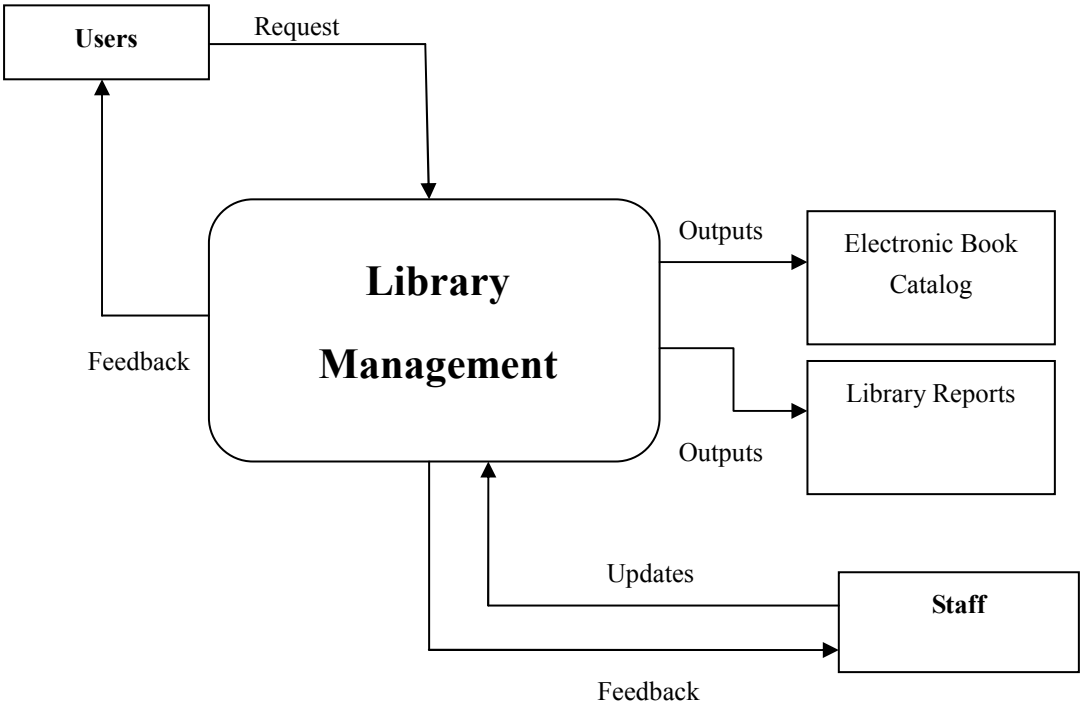

Figure 2: Information Modeling with Context Diagram

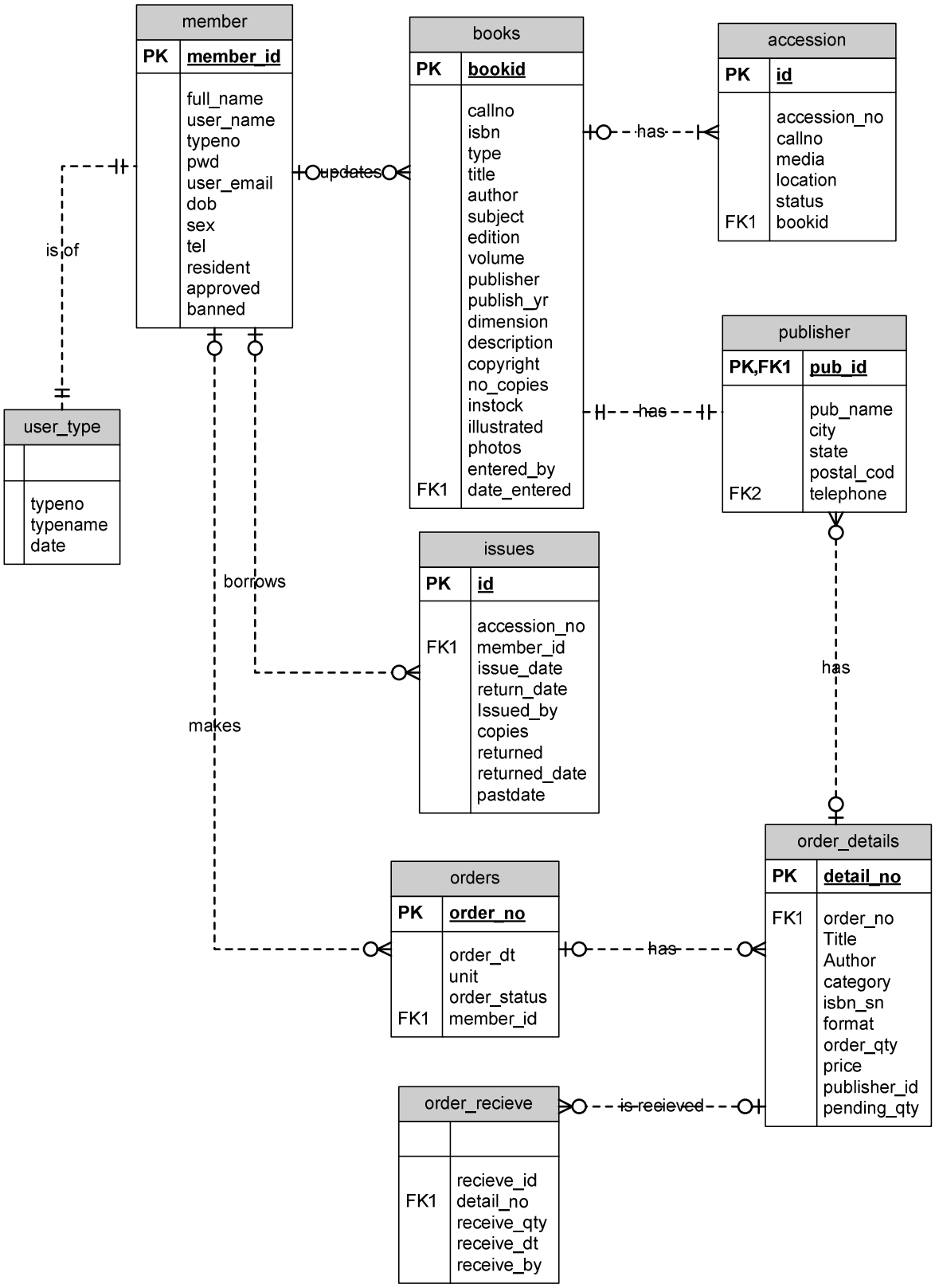

Figure 3: Data Modeling with ER Diagram

The following are sample snapshots of the Library information system prototype.

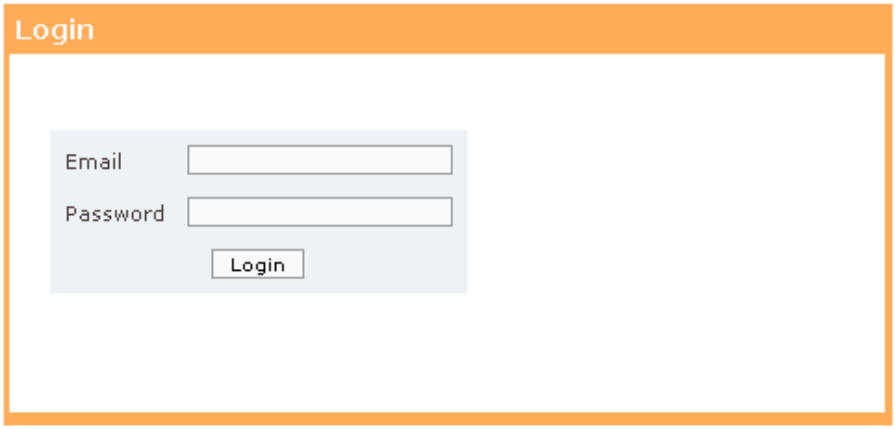

Figure 4: Log in Screen

Registration of new members and editing of existing member's data are done through screens below.

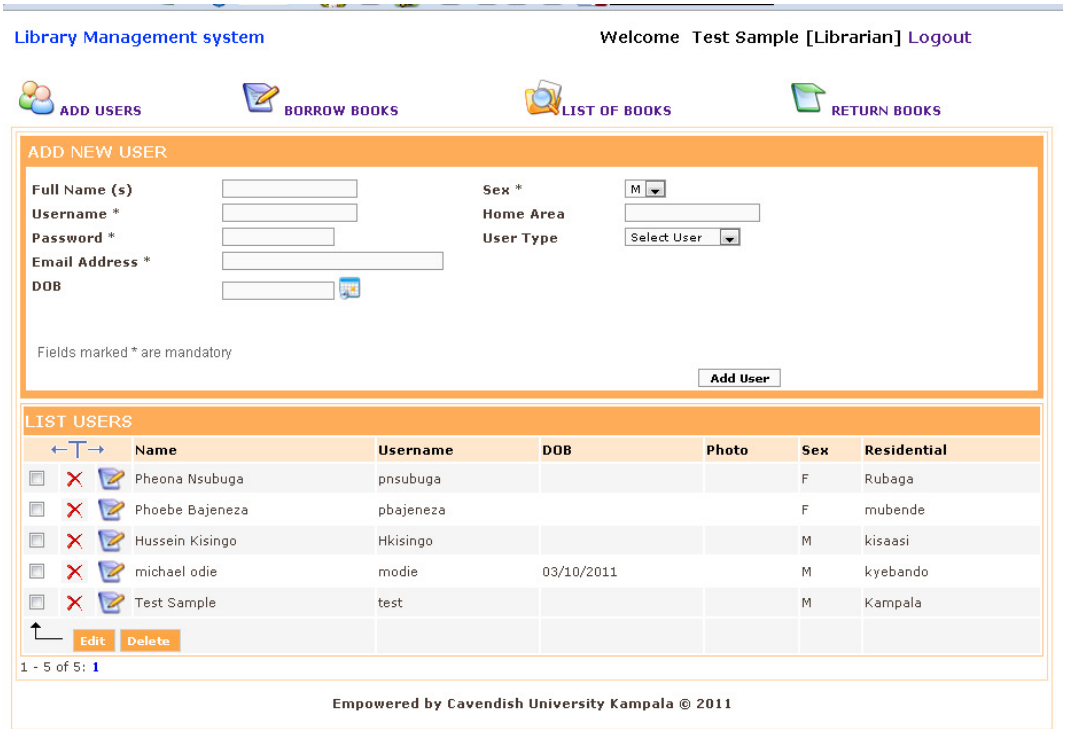

Figure 5: New Member Registration

Figure 6: Editing of Existing Member's Data.

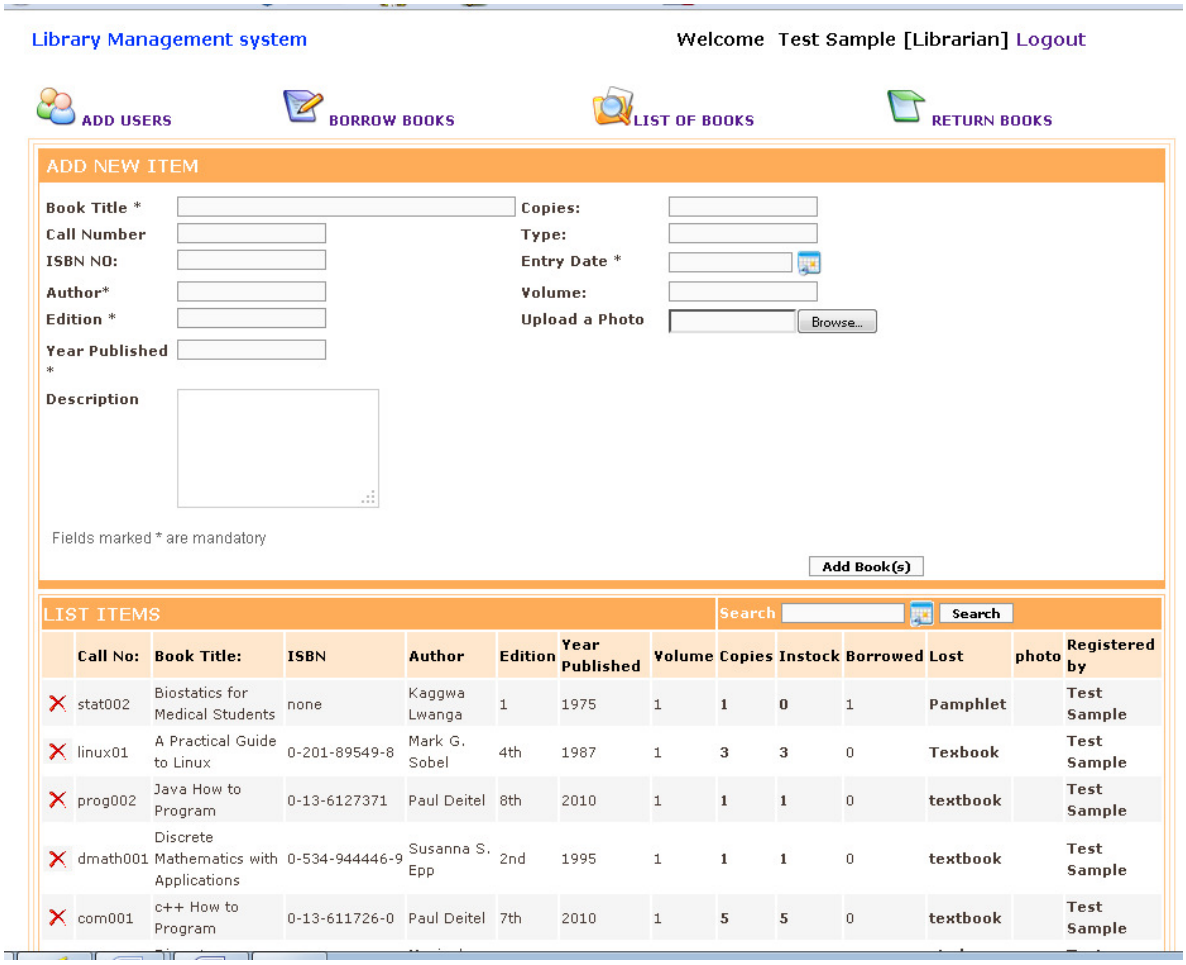

Figure 7: Book Cataloging

Borrowing and returning books respectively

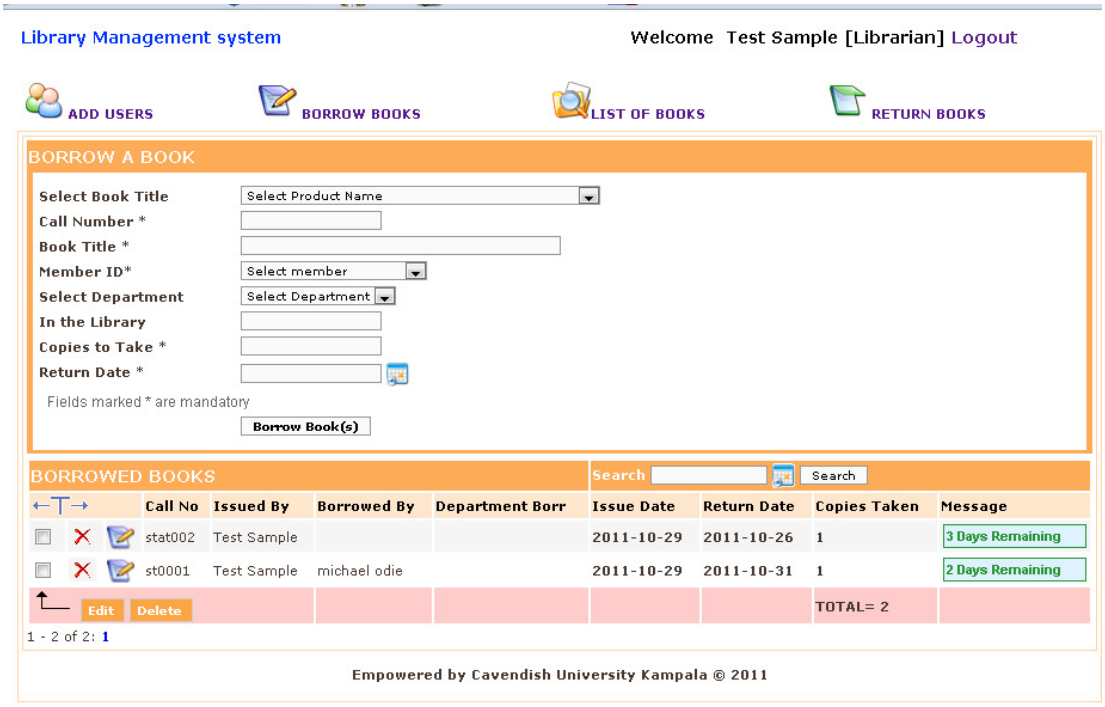

Figure 8: Book Borrowing

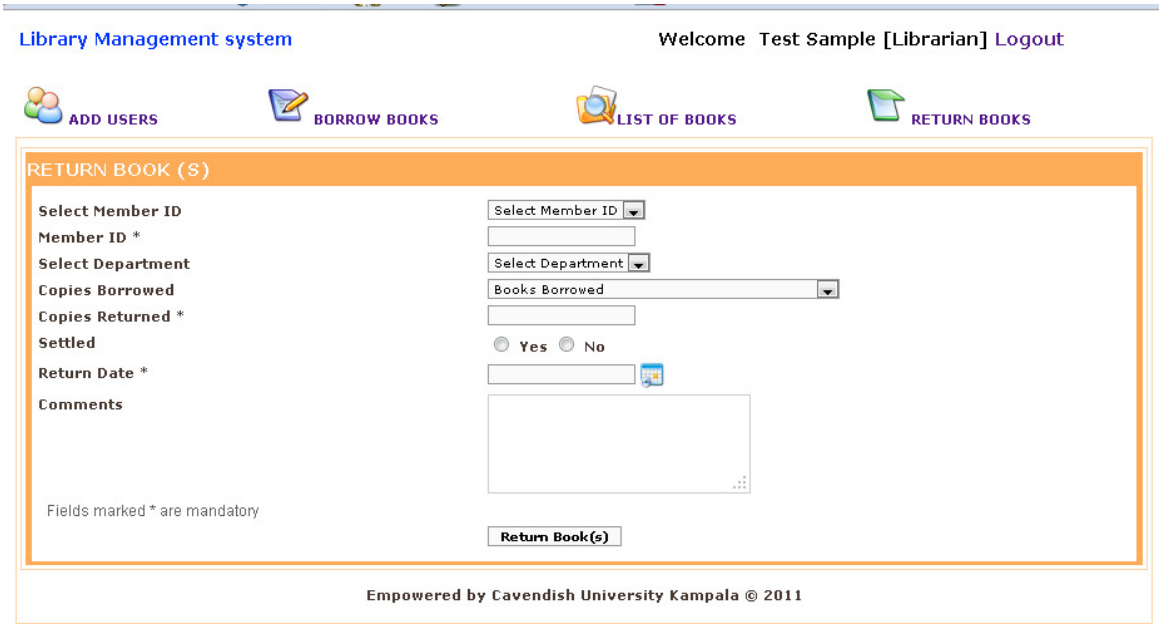

Figure 9: Book Returns

During the system development process, individual modules were tested separately, after which each module was integrated and testing repeated until a complete system was integrated as a complete unit. All errors that were identified were corrected before progressing. Validation checks were performed so as to make sure that only valid data gets into the system. The whole system was then tested to ensure full functionality and making sure that all errors were rectified and corrected. The system was then tested with actual data to evaluate its compliance with the specified requirements. Validation was done to ensure that the outputs from the system made accurate, valid and made sense.

6. Discussion

The study discovered that with the proposed library information system there was significant improvement in service and use of library facilities. The librarians can easily locate a literature source, tell who borrowed what books, when and when is it due returning. Students no longer crowd book shelves in search of literature, instead with use of their laptops within the radius of hotspot, students can access them. These results agree with Zarrummai et al (2004), Sessanga (2009), Adegbore (2010) and Sharma (2000) all of who acknowledge that with such intervention information gaps are bridged, efficiency levels increase and generally improve services.

7. Conclusion

This system was developed for CUU as a step to automate its library services. The system met most of the objectives by enabling the library staff keep track of its clients and resources they manage. Report generation was made easy as all the information has become easier to manipulate due to the nature of electronic storage. Searching for reading material has been made easy since different criteria may be used to accomplish the task. The interfaces were user friendly and there was no need for retraining other than orientation. The researcher recommends that this system be continuously built to take care of other library services which include management of the serials and periodicals, book reservations, automatic email notification for reminders, use of bar codes, scanners and labels and use of RFID (Radio Frequency Identification) tags to mitigate book thefts. It is also recommended that the library system, go online so that books and lecture notes are accessed over the internet by users especially from study centers.

References

Adegbore, A.M. (2010) Library Philosophy and Practice – Automation in Two Nigerian University Libraries. University Library, Fountain University, Osogbo, Osun State, Nigeria.

Daily Monitor Newspaper, Friday August 5, (2011). Who will come to the Rescue of Our Libraries; by Alan Shonubi. Monitor Publications, Kampala, Uganda.

Daily Monitor Newspaper, Monday August 8th, (2011). Public Libraries Relevant for Excellence; by Joseph Mazige and Sheila Nduhukire. Monitor Publications, Kampala Uganda.

Ddembe, W. & Baryamureeba. V. (2006) Measuring Computing Research Excellence and Vitality, 2006; Fountain Publishers, Kampala Uganda.

Group BIT 11-93 (2011); A Mobile Coffee Price Updater Application; A Case Study of Uganda Coffee Farmers. School of Computing and Information Technology, Makerere University (Project Report-unpublished).

Institutional Certified Evaluation and Accreditation: Universities Standards for Evaluation and Accreditation (2010). National Institution for Academic degrees and University Evaluation 1-29-1, Gakuen-Nishimachi, Kodoira, Tokyo 187-8587 Japan. www.niad.ac.jp

John, W. H. and Gardd. B, (1996). Local Area Networks in brief-: Introducing and Managing Academic Library Automation Projects, The Greenwood Library Management Collection. ISSN 0894-2986.

Kasozi, A.B.K, (2006). University Education in Uganda: Challenges and Opportunities for Reform. Fountain Publishers, Kampala.

Kizza, J. (2003). Ethical and Social Issues in the Information Age, 2nd Edition.

Larry, L and Nancy. L. (2005) Computers: Information Technology in Perspective; 12th Edition. Pearson Education, Inc, 2005.

New Vision Newspaper, Tuesday August 22, (2011). Is this the Beginning of the End of Textbooks? By Hillary Kuteisa. New vision Publication, Kampala Uganda.

O'Brian,J.A. (2002). Management Information systems 5th Edition,2002

Philip, J. P. and Joseph. J. A. (2008) Concepts of Database Management, 6th Edition, Grand Valley State University, Course Technology, Cengage Learning

Sharma, P. (2008) Library Philosophy and Practice – A survey of Library Automation in College Libraries in Goa State, India. Shivaji University, Kolhapun 416004 Maharshatra India.

Shivaram, B.S. (2007). Library Automation: An overview. Dr. TB Rajashekar Memorial Seminar on Emerging ICT Skills for the Information Professionals; 3rd November, 2007.

Ssesanga, I. (2009). Presentation at 1st International Conference on African Digital Libraries and Archives (ICADLA-I, Addis Ababa, Ethiopia; "The Automation/Digitization of Library Services of Islamic University in Uganda (IUIU) to enhance access to knowledge for development effectiveness".

Thomas, M. C. & Carolyn. E. B. (2005) Database Systems- A practical Approach to Design, Implementation, and Management, 4th Edition 2005. Pearson Education Limited.

Zarummai, S.N., Chage, & I.A. and Uwadia. C. (2004) "The Deployment of FOSS Tools for Long Distance

e-learning in African Universities". *In Proceedings of the International Conference on Universities Taking a Leading Role in ICT-enabled Human Development*, 6th-8th Sept, 2004, Kampala, Uganda.

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage: http://www.iiste.org

CALL FOR PAPERS

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. There's no deadline for submission. **Prospective authors of IISTE journals can find the submission instruction on the following page:** http://www.iiste.org/Journals/

The IISTE editorial team promises to the review and publish all the qualified submissions in a **fast** manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar