RFID Technology used in Small Library - Case Study at Transilvania University

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Abstract: The paper summarizes the authors’ concerns regarding the development of a mechatronic system with application in automation and management of the small libraries. The proposed system provides a combination of Koha open source integrated system with RFID technology in order to achieve an economical solution with large applicability.

Keywords: Automation, mechatronics, RFID, library, integrated system.

1. INTRODUCTION

An area where Mechatronics finds new and important applications is that of automation and computerization of activities in libraries. Lately, more and more the concept of an integrated library system was developed. It is a global solution for library problems, addressing conceptual and practical throughout the chain from procurement to user satisfaction.

Managers have to supervise many activities which are performed smoothly and simultaneously in the library. The most important activities in a library are: check-in/check-out of items; shelve items; prevent thefts; check inventory.

Library of the 21st century requires an exceptional management optimization and automation of its elements. Making an automated system to modernize the activities within a library requires a system for identifying, inventorying and managing books, magazines, CDs, tapes, videos and DVD’s etc. Embedded systems in modern libraries often use Barcode identification system and security strips. But barcodes and security strips (Electronic Article Surveillance or EAS) have their limitations.

Barcodes characteristics are: line of sight required; identifies only item category; scans only single item at a time; no writing capability; smudges make it difficult to read; limited data storage capacity; require proper orientation; can be easily printed.

Another new technology used in library automation is the RFID technology. RFID (Radio Frequency Identification) is known in literature as an automatic identification method that relies on storing and transmitting data using devices called RFID transceivers. An RFID device is an object that can be attached to or incorporate into a product, animal or person, in order to be identifiable by radio. In each and every activity within a library, RFID technology will provide a greater amount of efficiency and error free operation. RFID tags contain a memory chip and RF antenna that can send and receive several bits of data. Such RFID tags are known as smart labels or digital identification tags. These tags provide benefits of electronic article surveillance (EAS) as well as barcodes presented in RFID4U, (2005). RFID characteristics are: uniquely identifies items, cases; no line of sight required; simultaneous identification; read/write capability; can be used in harsher environments; more data storage capacity; low sensitive to orientation; require a separate process to create tags and attach them.

The implementation of RFID needs to connect to a system for monitoring the movement of the book, namely the Integrated Library System, a system that manages the database of the library. In this way all the statistical data (number of users, number of loans, etc.) are available almost in real time, eliminating human errors such as the collation and infernal work, to organize such random data.

Fig. 1. Mechatronic library integrate system.

The mechatronic system used in a modern library consists of: books with tags, readers, central management unit- server and library integrated system (Fig. 1). With RFID applications in libraries, all the library assets, namely books, manuscripts, CDs, DVDs, videos, audio cassettes, etc. have to be embedded with RFID tags. The RFID readers and antennas are placed conveniently where library users will have maximum access. In addition there has to be computers that...
are managing and controlling all the library activities presented in RFID4U, (2005).

RFID tags must be devoted according to the types of documents that are fitted; to allow saving, storing, modifying or deleting information; to include anti-theft security; to give the possibility of working with integrated library systems; to store information about the document; to store information related to the loan, to comply with ISO18000-3 standard; to have longer life than that of the document, to have more memory than 2048 bits and to be built with multi protective layers.

RFID cards (permits) to identify the readers, must comply with ISO18000-3 standard, must run at frequencies of 13.56 MHz, be of read/write, be programmed with a unique identification number that cannot be amended, allow storage, saving and deleting information, have more memory than 2048 bits and work in an integrated library system.

A server is the heart of an RFID application system. It is the communications gateway among the various components of the system. It receives the information from one or more of the readers and exchanges information with the library databases presented in RFID4U, (2005).

2. OPEN SOURCE LIBRARY INTEGRATED SYSTEMS

Integrated library management systems can cut costs and enhance the efficiency of library services and therefore are absolutely necessary for the management of housekeeping operations. But small and medium- size libraries face a difficult situation due to the high cost of commercial library management systems, available in the market.

For at least the last two decades, libraries have overwhelmingly obtained their core automation systems from specialized vendors who offer the software through licenses that allow the company to retain exclusive access to the underlying source code. In recent years, open source software has become an increasingly popular alternative. The underlying program code is made available for anyone to inspect, repair, or improve.

The open source software movement has entered the library automation industry, introducing a new set of integrated library systems and a clique of companies offering a business model based on service and support rather than software license fees (American Library Association, 2008).

The library integrated systems that are used in the Romanian university libraries are software products that were acquired from different suppliers.

We aim at computerizing the department library which is in a developing process but will not exceed 10,000 volumes in the near future; such an investment is useless now when we have at our disposal open sources library integrated systems that are used by libraries worldwide.

Naturally libraries without much financial resources need a cost effective way to automate their services. Free/Open source software was a revolutionary concept among computer programmers and users. To a certain extent free/ open source solutions could provide an alternative solution to costly commercial application software. Free/Open source software is software that users have the ability to run, copy, distribute, study, change, share and improve for any purpose (Vimal Kumar, 2005).

3. KOHA- LIBRARY INTEGRATED MANAGEMENT SYSTEM

Koha is an integrated library management system that was originally developed by Katipo Communications Limited of Wellington, New Zealand for the Horowhenua Library Trust (HLT), a regional library system located in Levin, some 100 kilometres north of Wellington. In 1999, HLT was looking for a new system to replace its DOS-based one, and found that commercially-available options would incur substantially increased communications charges.

Katipo proposed developing a new system using open source tools (Perl, MySQL, and Apache) that would run under Linux and use Telnet to communicate with the branches. The software was in production on 3 January 2000, and released under the GPL for other people to use in July 2000. There has been a high level of interest in Koha internationally, and it is currently being used in New Zealand, Australia, Canada, the United States, India, Thailand, the United Kingdom, and France. Many of the libraries using Koha are small, mainly school and special libraries. Koha has just been implemented at the Nelsonville Public Library in Ohio.

The initial Koha release was an early version, with functionality for circulation, simple cataloguing and acquisitions, and OPAC searching. New versions have been released by the Koha developers irregularly, and the system is gradually gaining enhanced functionality.

In most cases, Koha users either undertake the development themselves and contribute with changes to the project or they commission a developer to undertake specific enhancements. Libraries considering implementing Koha have an option to hire Katipo staff to help with the implementation, and there is also a list of other organisations which could be hired at http://koha.org/installation/support.html.

The Koha project uses a number of channels to allow members of its community to communicate with each other — there is a general mailing list, as well as separate ones for developers, Windows users, French-speaking Koha users/developers, and German-speaking Koha users/developers. In addition, the developers use Internet Relay Chat (IRC), a real-time message facility for scheduled meetings and less formal conversations. (Chawner, 2004) Koha 3.0 was selected because the GNU licence (open source) was considered more future-proof than proprietary products, and more open to customisation to meet the special needs of the library (Bissels, 2008).

Thanks to the efforts of the open-source community, any library can now enjoy a serious ILS at no licence cost; the saved money can hence be allocated to the extension of the collection.
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Koha satisfies all the functional requirements of a library management system. In addition to the functional modules (acquisition, cataloguing, OPAC, circulation, and serial control), Koha can provide some features that are only available with costly ILS: web OPAC, document status inquiry, reservation and holds of documents through OPAC, customization of user and graphical interface, import and export of MARC data etc. (Fig. 2).

KOHA - OPAC Module offer a lot of opportunities:
- Koha offers a public catalogue (OPAC) with complete functions.
- OPAC users can search in ten fields (topics, authors, titles, publishers, barcodes etc).
- The OPAC users who are authentified as members can make online reservations for the library documents.
- "Biblio basket": the members who are logged can select various enrolments which they can send and find in the email afterwards; these can be saved in a usual form, text or in ISO 2709 format, and subsequently read with the help of End Note-type software.
- OPAC users can send suggestions concerning acquisitions; they will automatically be announced through email by any action taken in accordance to their suggestions.

KOHA - Circulation Module
- The reader can borrow a book from any branch.
- He or she can return a document to any branch, not necessarily to the one from where he or she borrowed it.
- The reader can make a reservation from any branch.
- Rules for borrowing can be defined very clearly by the library: for each category of membership, for each category of documents, the branch which the document belongs to, the borrowing period of time, the maximum number of books that can be borrowed.
- Borrowing and returning books as well are very simple to make, just by scanning the barcodes on the reader’s permit and also the inventory number of the document.

KOHA - Cataloguing Module
- Cataloguing module is one of Koha’s main strengths. There can be defined some forms in order to catalogue different types of publications: monographs, electronical resources, periodical magazines, etc.
- Export / Import: it allows the export and import of some enrolments in MARC format; they can be found in the catalogues of some other libraries that use Koha and, with the help of Z39.50 protocol, they can be brought in the library own catalogue, thus achieving a quick cataloguing, subsequently only the local data will be filled in.
- Searching: it allows doing various searching, which can be done on any MARC field of the registration.

4. TRANSILVANIA UNIVERSITY CASE STUDY
For our small research department library we integrated Koha library open source integrated system. This decision was chosen taking into consideration the Koha facility to generate every registered item’s barcode.

We implemented Koha, library integrated system which generates barcodes for every recorded item. Koha has all modules needed to computerize a small library activity. We can choose the type of barcode (Fig. 3 and Fig. 4).

Fig. 2. Koha modules.

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Fig. 5. Selecting item to print barcode.

One very important activity is setting up labels for printing. We can set up spine labels in 4 easy steps:
1. Select the label layout;
2. Select the label template;
3. Select a group of added items, or "batch", we wish to print;
4. Print labels from the "Add Items to Print" page by selecting the "Generate PDF for batch" button next to the batch (or group of added items) we wish to print labels for. (Fig. 5) (Koha, 2009).

Fig. 6. Items to be printed.

Fig. 7. Barcode for printing.

We choose a layout type from the "Choose Layout Type" dropdown menu. From every barcode we choose digit representation. Koha integrated system is suitable for automation and computerization of both big and small libraries. It can be implemented in libraries based on bar codes or RFID technology. In the proposed application, RFID technology has been chosen. Designed system combines the advantages of the Koha integrated system with RFID technology. The automatic conversion machine automatically converts bar-code marked books into RFID. The machine automatically adds an RFID tag, reads the bar code on the medium and then programs the RFID tag according to the chosen data model, presented in Vision (2011). At that moment 248 documents were recorded from the research department library. This is a real benefit for the documentation process.

On the tags, stored data have to include at least: the Item ID, theft bit, shelving information and date of circulation. RFID applications in libraries may encounter some technological problems:
- RFID tags are attached to the inside of the book, which made them exposed to damage and vandalism.
- Some metallic material in book covers, CDs and DVDs influence the correct reading of the tag.
- RFID tags can be covered with aluminium foil and lose their anti-theft sensor function.
- The RFID reader range depends on its power and antenna size.
- The reading accuracy decreases if there are too many items to read simultaneously.

There are some problems regarding the implementation of RFID technology in library: privacy issues; inter-library operations due to differences in tags or software; readers and sensors influenced by metal shelves; RFID technologies are more expensive than barcodes and security strips, fact that introduces financial restrictions. We are during a testing experiment and RFID system will be a further approach.

5. CONCLUSIONS

The proposed solution, that of an integrate mechatronic system for libraries automation, offers the model with a minimum cost using open sources software and it offers a useful instrument for the university researchers, opening new opportunities for master students and PhD students.

REFERENCES


