

The New Emerging Technology in Libraries : RFID Technology

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Abstract

Now days the library and information professionals have tremendous opportunities due to the development of webs and new information technologies. Libraries and information centers are selecting, sorting, storing and disseminating the information. Radio Frequency Identification technology is the latest technology to make strong security and automatic identification surveillance system in the libraries. RFID provides the easier and faster circulation work, security of material, shelf check out and stock verification than Barcode technology. The authors provide the basic concept and components of RFID. In this article the authors provide the overview, basic structure, function, major standards, advantages & disadvantages of RFID. The literature review of RFID technology used in the libraries is narrated both world and Indian scenario.

Keywords: RFID, Tags, Theft Deduction, Security System, RFID standards

Introduction

In today's information society the librarians have a great responsibility to organize the knowledge centre due to the peak height of information explosion. Libraries are moving towards latest technological environment. RFID is a flexible technology, which was predicted to be one of the most convenient and well-suited automatic identification surveillance systems since 1980s¹. The library security has always been a key issue: such as material security, personal safety, personals comfort, financial liability, legal issues and problem patrons and RFID technology can be a solution to minimize such problems. RFID system is claimed to be one of the major time saving automatic identification and data capture technique, which replace barcode and EM system in recent years.

Historical Development

RFID was developed in 1948, but its implementations started in 1970s. The first U.S. patent for an active RFID tag with rewritable memory was obtained by Mario E. Cardullo on January 23, 1973. In 1973 Charles Walton, a Californian industrialist, received a patent for a passive transponder that was used to unlock a door without a key. Then Walton licensed

the technology to a lock making company called Schlage and RFID technology is another form of automated identification system, which is similar to bar codes. RFID in India was developed in the 1940's for defense applications. 1st time it was used for commercial purpose in 1980 for cattle tracking applications. Recent interest is in making RFID technology more ubiquitous in the global value chain. The first library suppliers started to market their systems in the mid 1990's. During the 1990's the proliferation of competing systems and radio frequencies employed created the need for standards and interoperability. Libraries need the higher frequency waves to allow for smaller, less powerful and portable readers. As complexities and uses increased, standards were developed to allow systems to work together. Development of standards is still going on with the latest standard being release late in 2004².

Components of RFID

An RFID system for library contain of eight components, i.e. RFID tags, a shelf check-out stations, a staff check -out station, a self-return book drop with an automatic check-in feature, a tagging station, a set of security gates, a shelf scanner for inventory and administrative station. The self check out station allows library member to borrow books

without the help of library staff: the book drop allows returning of books and updating the database; shelving station speed up the process of sorting return books for re-shelving. But mainly and basic components RFID system contains of three main components. The RFID system depends on these components, without these components we can not work and image these systems for modern library system.

RFID Tag Radio frequency tags which contain electronically programmed with unique information; and it past directly to library items. It can store information to identify in the collection.

Passive Tags need no internal power supply. The minute electrical current induced in the antenna by the incoming radio frequency signal provide just enough power for the CMOS integrated circuit in the tag to power up and transmit a response. These tags do not require batteries and have an unlimited life span.



Figure 1 : Tag

Active Tags have their own internal power source which is used to power any ICs that generates the outgoing signals. These are much more readable than passive tags.

Semi - Passive tags are similar to active tags as they have their own power supply but battery is used just to power the microchip and not broad cast a signal.

Antenna A conduit between RFID tags and the couple RFID antennas emit radio waves that activate RFID Tags. After a tag is activated, it can send the information or receive from the coupler.

Reader is also a component of RFID technology. This system includes different types of reader. Reader works in conversion station where library data is written to the tags.

Coupler the link between RFID tags and the PC, the coupler can send information in two directions; it can send the information from tag and send it to PC or it can read information from the PC and sent it to an RFID Tags

Server/PC is the link between the coupler and library automation system.

Security System benefits the latest design innovation to manage RFID and antitheft functions into a single device. A security system is composed of two pedestals: each pedestal is standalone and plug and play to the main power. New generation pedestals are based o a most efficient mechanical design.



Figure 2: RFID & Library Management³

Advantages of RFID Systems

The advantages of RDID system for libraries are as follows:

Rapid check-out / check-in: The amount of time for performing circulation work, is reduced by using the RFID technology, because the information can be read much faster than barcode technology due to the capability of reading several items in a stack at the same time. While initially unreliable, the anti-collision algorithm that allows an entire stack to be check-out or check-in now appears to be working well. The other time savings realized by circulation staff are modest unless the RFID tags replace both the EM security strips or RF tags of older theft detection systems and the barcodes of the library management system - i.e., the system is a comprehensive RFID system that combines RFID security and the tracking of materials throughout the library; or it is a hybrid system that uses EM for security and RFID for tracking, but handles both simultaneously with a single piece of equipment⁴. Fifty percent throughput can be increased. During the circulation the social interaction with patron, the time is extended for check-out and the time savings are less for check-out than for check-in.

Simplified patron self check-out / check-in: For patrons using self check out, there is a marked improvement because they do not have to carefully place materials within a designated template and they can check out several items at the same time. Patron self check-in shifts that work from staff to patrons. Staff is relieved further when readers are installed in book-drops⁵.

High Reliability

1. The readers are highly reliable. RFID library systems claim an almost 100 percent detection rate using RFID tags.
2. There is no false alarm than with older technologies once an RFID system is properly tuned.
3. RFID systems encode the circulation status on the RFID tag. This is done by designating a bit as the "theft" (EAS) bit and turning it off at time of check-out and on at time of check-in. If the material that has not been properly check-out is taken past the exit sensors, an immediate alarm is triggered.

High-speed inventorying: A unique advantage of RFID systems is their ability to scan books on the shelves without tipping them out or removing them. A hand-held inventory reader can be moved rapidly across a shelf of books to read all of the unique identification information. Using wireless technology, it is possible not only to update the inventory, but also to identify items which are out of proper order.

Automated materials handling: Another application of RFID technology is automated materials handling. This includes conveyer and sorting systems that can move library materials and sort them by category into separate bins or onto separate carts. This significantly reduces the amount of staff time required to ready materials for re-shelving.

Long tag life: Finally, RFID tags last longer than barcodes because nothing comes into contact with them. Most RFID vendors claim a minimum of 100,000 transactions before a tag may need to be replaced.

† Chip is user-friendly and multi-purpose

- Media is re-writable
- More ergonomic for staff
- Theft control more efficient
- Stack check out (more than one book at a time)

Fig. 2: RFID & Library Management[3]
Efficient self-check

- Use fewer resources for that repetitive work
- No waiting lines
- 24 hours return (automatic book return)
- Privacy

† Inventory control

- Faster
- Done more frequently
- Shelf order function

Limitations

There are some limitations also in the RFID. Some of these are as follows:

- Tags and readers are still too expensive
- Licensing and maintenance costs for using hardware and software are high and integration option limited.
- The RFID tags are typical affixed to the inside back cover of the book, which can be easily removed and threaten the security gates.
- Lack of standards and protocols
- Blocking the RF wave is easily done by anybody through ordinary aluminum foil/Mylar.
- It is also possible to compromise the RFID system by placing two books against one another so that tags overlays another that may cancel out the signal.
- Item with odd shapes and metal components, such as CDs, DVDs, are stretching the creativity of vendors of RFID systems for libraries.
- RFID system alternatively reduces staff and patron interaction, so that proper interaction cannot be maintained among them.

Barcode vs RFID

Barcode	RFID
Read only	It read and write
Only one item read at a time	Multiple items can be read at a time
It is time consuming in stock verification	It is time saver in stock verification
Each book has to taken out from their places	There is no need of taking books out from shelf
Needs direct contact to reader	No direct contact to reader
Limited life span due to printing	Long life span
Automated sorting of library material is not	It is easily possible
Misplaced books have to search manually	Search misplaced books
Theft prevent in the library is not possible	Theft prevent in the library
Self check in/out counter can not work	Self check in/out
Tracking is not possible	Tracking is possible

Table 1: Basic Comparison of Barcode and RFID

Best Practices For Libraries

Now libraries are implementing RFID system and it is important to develop best practices guidelines to utilize the technology in the best way. The following guideline for library may be concerned:

- The library should be open its use of RFID technology including providing publicity available documents starting the rational for using RFID, objectives of its use and associated policies and procedure and who to contact with questions.
- Only authorize personnel should have access to the RFID system.
- No personal information should be stored on the RFID Tag. Information describing the tagged item should be encrypted on the tag even if the data is limited to a serial number.
- No static information should be contained on the tag that can be read by unauthorized readers.
- All communication between tag and reader should be encrypted via a unique encryption key.

RFID Standard For Library

The international organization for standardization and EPC Global has been very active in developing RFID standards. The AutoID center and their commercial offshoot EPC Global have also defined specifications and standards⁶. Because most commercial application, utilize the HF, the discussion of standards will be limited to HF standards. There are two ISO standards pertinent to library RFID systems:

- ISO 15693 Standards.
- ISO 18000-3 Standards.

World Scenario

While there is some debate as to when and where RFID in libraries first began, it was first proposed in the late 1990s as a technology that would enhance workflow in the library setting. Singapore was certainly one of the first to introduce RFID in libraries and Rockefeller University in New York may have been the first academic library in the United States to utilize this technology, whereas Farmington Community Library in Michigan may have been the first public institution, both of which began using RFID 1999. In Europe, the first public library to use RFID was the one in Hoogezaand-Sappemeer, the Netherlands, in 2001, where borrowers were given an option. To their surprise, 70% used RFID option and quickly adapted, including elderly people. Approximately 600 contracts had been signed by the middle of 2007. there were approximately 850 facilities using RFID.

Most installations are small, primarily in branch libraries. The University of Connecticut Library; University of Nevada/Las Vegas Library, the Vienna Public Library in Austria, the Catholic University of Leuven in Belgium, and the National University of Singapore Library are among the few sites that appear to have tagged more than 500,000 items each. The most ambitious RFID program is that of the Nederlandse Bibliotheek Dienst (Netherlands Library Service). It envisions implementing RFID in all of the public libraries of the country, with an item able to travel among libraries that are equipped to read the tags of all of the books, not just their own. A pilot system was installed at the public library in the city of Eindhoven in 2002, and the first operational system two years later in the public library in the city of Heimo. The vendor, Nedap N.V. of the Netherlands, uses Tagsys tags, but the equipment is also able to read the tags produced by Philips and Texas Instruments when the appropriate software is used. The deployment of RFID throughout the country is expected to take a minimum of five years. Major Dutch jobbers are now including RFID tags in all library materials purchased from them. Approximately 80% of recent acquisitions by Dutch Public Libraries arrived with RFID tags.[7]

Indian Scenario

Indian Institute of Management's deployed RFID system in their libraries for automated charging and discharging the books. IIT's implementing RFID technology for library theft detection systems. CSIR Labs and DRDO are using this new technology. ICAR Labs are also equipped with RFID technology. Recently in indigenous bases study (Margam Madhusudhan, 2010) found that after implementation of RFID in Indian Law Institute Library and NASSDOC Library at New Delhi the check-in and check-out time is reduced to less than 20 seconds per item, and use of the libraries has also increased. Neither library had calculated the saving of staff time by performing multiple check-out and check-in of items. In both institutions the RFID implementation is integrated with the library management systems, which is the Indian, developed ILS, LIBSYS. LIBSYS also supply the RFID system for ILI, but at NASSDOC the RFID vendor was LIBMAN. Both libraries also issued RFID based library smart cards for their users. RFID tags are often seen as a replacement for barcodes, having a number of important advantages over the older barcode technology. NASSDOC had not used any barcode technology before the introduction of RFID whereas ILI had - and it continued their use after RFID implementation for those items that were not yet tagged. The emerging market of an unprecedented growth in RFID technology is likely to provide a fillip to the Indian IT industry. The range of Infosys services



are range from analyzing the potential consequences and payback of an RFID deployment to overseeing initial pilots and final deployment. The company will also prove low-cost services to develop the custom software; its clients will need to link their RFID networks to existing enterprise systems. Since the amount of software development required to link RFID networks to enterprise systems is significant, India will be immensely benefited from these new opportunities of RFID. The Wipro technologies is launching an RFID concept store at its corporate campus in Bangalore in hopes of building expertise in the hot supply chain technology. The store will be equipped with RFID technology, including tags, readers, and related software, according to a statement issued by the company during the launching of a radiofrequency ID concept store at its corporate campus in Bangalore in July 2004.

Summing Up

The RFID technology is very new for library community and the use of RFID in libraries is very essential part of upcoming years. The major characteristics of RFID technology is to provide high-speed inventory and identify items which are out of proper order. It is the responsibility of library community to conduct a comprehensive technology assessment of RFID as soon as possible to make the best possible decisions involving the implementing this technology. The implementation of this technology will change our personal and work lives in library and adorns the conventional library management with a new idea and usher for a future. Libraries that choose to implement RFID technologies in advance of policy safeguard being put in place should take extra precautions to follow evolving best practices guidelines. Librarians and Information managers are the leaders in protection and managing the intellectual freedom & user privacy, and it needs to have some responsive & strong determination in implementing RFID technology.

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