APPLICATION OF RFID TECHNOLOGY IN LIBRARIES

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Abstract

Radio Frequency Identification (RFID) is not a new system but the base of this was established way back in 1940s. The credit goes to commercial or business organizations who have explored and implemented RFID to acquire, manage and provide security to their products or items. Information and Communication Technology has transformed the format of information and work culture of libraries. Still libraries are trying to address various problems like qualitative information management, speedy acquisition and dissemination of information and security of information products. This paper gives brief idea about the RFID, its importance in the library system, how it works and describes different components of the RFID technology. It also briefs about tentative budget to establish RFID technology in the library and finally its future in Indian libraries.

Keywords : RFID/ Information and Communication Technology

1.   Introduction

Radio Frequency Identification, well know as RFID, was mainly used in the laboratory research in the 1940s for replicated communication systems. Later in 1980s it was prominently used by the business organizations to manage their commercial items. Recently, RFID technology has received attentions of library systems all around the world. It is basically a data acquisition and storage system which provides accurate and exact data without human intervention. It promises various benefits in management of circulation system, improved accuracy with speed, efficiency and full security of data sharing. Technically it is 'a technology that consists of a system and tiny tags, which uses radio waves to automatically identify people or objects'. It consists of a transponder with antenna and a chip and a reader which attached to a computer to identify the item. The complete set of these items is called a tag or a label. Data or information can be written on the chip (barcode etc.) and stored in the tag or label that is attached to the item to be identified and reader is non-movable (fixed at security gate or so).

2.   RFID Application in Libraries

RFID is the latest fast growing technology to be used in library for minimizing the theft of documents and as an access control systems. RFID-based systems move beyond

security to become tracking systems that combine security with more efficient tracking of materials throughout the library, including easier and faster charge and discharge, inventorying, and materials handling.

RFID is a combination of radio-frequency-based technology and microchip technology. The information contained on inbuilt microchips in the tags affixed to library materials is read using radio frequency technology regardless of item orientation or alignment and distance from the item. The tags can be read at a distance of up to two feet by each of two parallel exit sensors. The devices used for circulation are usually called "readers" while the ones used at building exits are usually called "sensors".

The technology used in RFID systems can replace both EM (Electro-Mechanical) or RF (Radio Frequency) and even the barcodes theft detection systems.

3. How RFID Works

As a part of technology implementation, an RFID tag is implanted in each and every book and reading material of the library and complete book information is entered into the software installed in server or workstation. Now whenever a library member brings the book for issue return purpose, the RFID reader from the tag reads the information pertaining to that book and transmits the data into the software and books is smoothly issued in a few seconds with a minimum of manual intervention. As the member takes the book outside the library, the antenna placed at the exit gate automatically read the information contained on the RFID tag to verify whether the book is properly issued or not. In case the book is not issued to the member as per library norms or it is being stolen from the library the antenna sense it and give an instant alert. Thus the technology resulted successful theft reduction of books.

The same RFID technology is also used for stock taking practice. Earlier, manual stocktaking was an exhausting exercise as each and every book's detail had been manually entered into the system or registers. Now with the introduction of new technology it is very easy for the library staff to just place a scanner on the top of the book; the scanner automatically passed on scanned information to the common database or server.

4. Advantages fo RFID Systems

Faster Circulation Transactions : The use of RFID definitely reduces the amount of time required to perform circulation operations. The most significant time saving fact is that information can be read from RFID tags much faster than from barcodes and that several items in a stack can be read at the same time. The time savings are less for charging than for discharging because the time required for charging usually is extended by social interaction with patrons.

The perfect tracker : An another feature of this technology in time savings and security aspect is that the RFID tags replace both the EM security strips or RF tags of older theft detection systems and the barcodes of the automated library 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 equipment. [3M has developed readers that can do both concurrently except for videotapes and audiotapes. These have to be desensitized and sensitized in a separate operation]. In either case, there can be as much as a 50 percent increase in throughput.

Simplified self-charging/discharging : For patrons using self-charging, there is a marked improvement because they do not have to carefully place materials within a designated template and they can charge several items at the same time.

Highly reliable : Several RFID library systems claim an almost 100 percent detection rate using RFID tags and there are very few false alarms than with older technologies once an RFID system is properly tuned.

Some RFID systems have an interface between the exit sensors and the circulation system to identify the items moving out of the library. Where a patron to run out of the library and not be intercepted, the library would at least know what had been stolen. If the patron card also has an RFID tag, the library will also be able to determine who removed the items without properly charging them. However, the author has not been able to identify a library that has implemented this security feature.

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. This feature of technology is very helpful in stock taking where much time was wasted in manual entries.

Automated Identification of materials : Another application of RFID technology is automated identification of materials. This includes conveyor and sorting systems that can move library materials and arrange them by category into separate bins or onto separate carts. This significantly reduces the amount of time required for reshelving the reading material.

Better than bar-code : RFID tags are far better than bar codes, as these are not required to be scanned through some reader or recorder, as required in bar-code.

Finally, the RFID tags last longer than barcodes because nothing comes into contact with them. Most RFID vendors claim a minimum of 1,00,000 transactions before a tag may need to be replaced.

5. Disadvantages of RFID Systmes

High cost : The major disadvantage of RFID technology is its cost. The readers and sensors used to read the information are costing between Rs.100,000/- to Rs.1,50,000/ a server costing as much as Rs.5,00,000/- to 600,000/- and the tags cost Rs.30 to Rs. 45 each.

Easy to deceive the technology : It is possible to deceive an RFID system by wrapping the protected material in two to three layers of ordinary household foil to block the radio signal. Clearly, bringing household foil into a library using RFID would represent premeditated theft. It is also possible to create a fault in an RFID system by placing two items against one another so that one tag overlays another. That may cancel out the signals. Although this requires knowledge of the technology and careful alignment.

Removal of tags : The RFID tags are typically affixed to the inside back cover of the book and are exposed for removal. This is a rare case but that does not mean that there won't be problems when patrons become more familiar with the role of the tags. If a library wishes, it can insert the RFID tags in the spines of all except thin books, however, not all RFID tags are flexible enough. A library can also imprint the RFID tags with its logo and make them appear to be bookplates, or it can put a printed cover label over each tag.

Exit sensor problems : The performance of the exit sensors is problematic. They must read tags at up to twice the distance of the other readers. If the library install a smaller antenna at checkpoint than there can be problem for sensor to check every patron, because it will not work properly. The performance of exist sensors is better when the antennae on the tags are larger

Fear to invade Patron Privacy : There is a perception among some that RFID is a threat to patron privacy. That perception is based on two misconceptions: (1) that the tags contain patron information and (2) that they can be read after someone has taken the materials to home or office.

The vast majority of the tags installed in library materials contain only the item ID, usually the same number that previously has been stored on a barcode. The link between borrower and the borrowed material is maintained in the circulation module of the automated library system, and is broken when the material is returned. When additional information is stored on the tag, it consists of information about the item, including holding location, call number, and rarely author/title. The RFID tags can only be read from a distance of two feet or less because the tags reflect a signal that comes from a reader or sensor. It is, therefore, not possible for someone to read tags from the street or an office-building hallway.It is, therefore, important to educate library staff and patrons about the RFID technology used in libraries before implementing a program.

6.   Components of An RFID System

A comprehensive RFID system has three components: (1) RFID tags that are electronically programmed with unique information; (2) readers or sensors to interrogate the tags; and (3) a server or docking station on which the software that interfaces with the automated library system is loaded. It is also possible to distribute the software among the readers and sensors.

Tags : Each paper-thin tag contains an etched antenna and a microchip with a capacity of at least 64 bits. There are three types: "read only", "WORM," and "read/write." Tags are "read only" if the identification is encoded at the time of manufacture and not rewritable. This type of tag contains nothing more than item identification. It can be used for items acquired after the initial implementation of RFID and by libraries that have collections without barcodes. Such tags need not contain any more than 96 bits.

"WORM" (Write-Once-Read-Many)" tags are programmed by the using organization, but without the ability of rewriting them later. They can be used when a retrospective conversion of a collection that is already barcoded is undertaken. The main advantage over read only tags is that information in addition to the identification number can be added. However, it must be information that won't need to be changed. That could be an author and/or truncated title if the tag has enough capacity, but not library location or circulation status.

"Read/write tags," which are chosen by most libraries, can have information changed or added. For example, a library might add an identification code for each branch. That information could be changed where the holding location subsequently changed. When a vendor includes a "theft" bit that can be turned on and off, the RFID tag can function much like an EM or RF tag.

All of the tags used in RFID technology for libraries are "passive." The power to read the tags comes from the reader or exit sensor, rather than from a battery within the tag. "Active" tags, which have their own power supply, are substantially larger and more expensive than the tags used in library RFID applications. It is these tags that can be read at distances of up to ten feet.

6.1   Tagging materials

A library planning on doing its own tagging should consider using volunteers in addition to its regular staff. That both reduces the time and cost of tagging. Only limited training is required, typically 15 to 20 minutes. There are many options for tagging books. It is important to select a consistent location for book tags. The inside of the back cover is the recommended location because it is the fastest for right-handed tag installers to reach. Most libraries are not able to tag their entire collections at one time. They must, therefore, plan a phased implementation.

The Retrospective conversion of existing barcoded items, including affixing the tags to library materials, takes 15-30 seconds per item depending on the amount of information added to the tag and the skill of the person doing the tagging.

Pre-programmed tags, which are used for new acquisitions in libraries that want only identification numbers on the tags, take even less time because they do not involve scanning existing barcodes.

Readers/Sensors : A typical system includes several different kinds of readers, also known as sensors when installed at library exits. These are radio frequency devices designed to detect and read tags to obtain the information stored thereon. The reader powers an antenna to generate an RF field. When a tag passes through the field, the information stored on the chip in the tag is decoded by the reader and sent to the server, which, in turn, communicates with the automated library system when the RFID system is interfaced with it. While there is software in each reader to facilitate communication with the server and/or with library staff, most of the software supplied by the RFID system vendor is on the server when one is included in the system. When there is no server, most of the software is on the readers, although some may be on a docking station.

The types of readers include staff workstations for circulation desk charging and discharging, patron self-charging stations, and longer-range walk-through exit sensors to detect and read an RFID tag passage for purposes of determining whether it is a charged (authorized/no alarm) or discharged (non-authorized/alarm) event. The exit sensors are sometimes called "antennae," but that is not correct because an antenna is only one component of an exit sensor. It is also possible to install a reader in a book drop to discharge materials as they pass the reader. Finally, there is a portable device that consists of a scanning gun attachment to read a group of items on the shelves for purposes of locating missing and misplaced items.

Readers for use at the circulation desk typically cost Rs. 1,00,000/- or more each. They can be placed on the circulation counter or built-in. Discharging can be done on the same units, or on one or more dedicated units away from the service counter. Check-in is particularly rapid because the materials can be moved over the unit without regard to the orientation of the material and no conversation with patrons is involved.

RFID exit sensors at exits look much like those installed in libraries for the last several decades, however, the insides are very different. One type reads the information on the tag(s) going by and communicates that information to a server. The server, after checking against the circulation database, activates an alarm if the material is not properly checked-out.

A bookdrop reader can automatically discharge library materials and reactivate security. Since they have already been checked-in, they can go directly back onto the shelves. These units can also be used with sorter and conveyor systems.

The portable scanner or inventory wand can be moved along the items on the shelves without touching them.

Server/Docking Station : The server is the heart of some comprehensive RFID systems. It is the communications gateway among the various components. It receives the information from one or more of the readers and exchanges information with the circulation database. Its software includes the APIs (Applications Programming Interface) necessary to interface it with the automated library system. The server typically includes a transaction database so that reports can be produced.

7. Budgeting for RFID

A small library of 40,000 items should plan on a minimum budget of Rupees 16 lakhs for an RFID system. The shopping list would consists of:

40,000 tags @.Rs.34/-	**=**	**Rs. 13,60,000/=**
1 programmer/converter rental (3 weeks) =		Rs. 25,000/=
2 staff stations @ Rs. 1,00,000	=	Rs. 1,00,000/=
2 exit sensors @ Rs. 1,60,000	=	Rs. 3,20,000/=
1 wireless portable scanner	=	Rs. 1,80,000/=
1 server	=	Rs. 6,00,000/=
222 hours of labor @ Rs. 300	=	Rs. 6,66,000/=
Carpentry and electrical	=	Rs. 39,000/=

The labor cost assumes a conversion rate of three tags per minute.

A library with 100,000 items interested in patron self-charging and a book drop unit should plan on a minimum budget of Rs.65,00,000 for an RFID system.

A library with a collection of 250,000 items interested in patron self-charging and a book drop unit should plan on a minimum budget of Rs1.5 crores for an RFID system.

8. Edarly Adopters of RFID

While there are over 500,000 RFID systems installed in warehouses and retail establishments worldwide, RFID systems are still relatively new in libraries.

Most installations are found in American and European libraries. In India The University of Pune Library has installed this system and successfully preventing pilferage of books and doing stock taking with great ease.

The other RFID libraries are, 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 the only sites that appear to have tagged more than 500,000 items each.

The most ambitious RFID program is that of the 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.

9.   Future of RFID in India

In a move expected to kick-start RFID adoption among Indian companies, regulators in India recently designated UHF RFID (Ultra-High-Frequency Radio-Frequency-Identification)spectrum in accordance with the frequencies used by Europe and United States.

The Wireless Planning and Coordination (WPC) wing of India's Ministry of Communication assigned the 865-867 MHz UHF band for use by radio frequency identification devices.

Electronic Product Code Global India is also hoping to see an Indian university become one of the Auto-ID Labs, which will be dedicated to researching and developing new technologies and applications for revolutionizing global commerce for RFID technology.

10. Conclusion

Although, the RFID technology is quite expensive, still it has yielded excellent results for the all the organization. The technology is set to become more popular in India with more deployment in the coming time in different sectors. It has been proved that this technology reduces the labour, costs and provides efficient results, which leads to foolproof security and access control. The only barrier in the journey is high cost of it, but it is expected that in coming days the cost will come down further and very early we will see mass adoption of this technology in various libraries and in Indian and World.

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