



RFID technology implementation in libraries

Rajneesh Kumar

Assistant Librarian, Central Library, IET, Bhaddal Ropar, Punjab, India

Abstract

Information is indispensable for human development as air is essential for the survival of living being. The rate of change brought about by information technologies has a key effect on the way we live, work worldwide. The Library services are also actively changing according to the changing digital environment. Today Libraries use current trends in all activities including, selection, sorting and dissemination of information. Internet of things which is now the talk of the world is playing a vital role in all aspects of life. Today we can see that there are more than 15 million interconnected and electronic devices in operation globally. The most common example of internet of things tools that is used is the RFID technology This paper is written in order to provide an overview of the RFID technology, its history, RFID technology components and how it works and also advantages and disadvantages of the RFID technology is also discussed. This study will also give an idea for the Libraries that are planning to implement automated Library Management System using RFID Technology in future.

Keywords: RFID technology, RFID tags, RFID reader, library security, security system

Introduction

Introduction RFID means Radio frequency identification i.e. the technology that uses radio waves to automatically identify individual items. The objective of any RFID system is to carry data in suitable transponders, generally known as tags and to retrieve data, by machine readable means, at a suitable time and place and to satisfy particular application needs. RFID is one of the most technologies being adopted by both industry and academic world. Modern academic library is a place where millions of books advanced; periodicals, CDs, DVDs and other electronic reading materials are contained. It is a challenge to manage for librarians, managing such type of huge collection.

When you hear the term RFID used today it most commonly refers to the burgeoning business application for managing and tracking supply chains, especially in the materials, manufacturing, and retail industries. The supply chain business objective is to use RFID technology to not only take the just-in-time inventory concept to its next performance level but to support additional information functions from streamlining the product recall process and reducing theft and fraud, to further improving the type and quantity of product marketing information.

Brief history of RFID

RFID technology was invented in 1948, but it was not mainstreamed for commercial applications until the 1980s. One of its first known applications was during World War II, when it was used by the British radar system to differentiate between German aircraft and their own aircraft with attached radio transponders. Only recently, due to technology advances, have the price points dropped to where RFID is now feasible for companies to adopt. Wal-Mart was among the first commercial enterprises to select RFID technology to achieve

improvements in the inventory supply process and theft control. Wal-Mart started the process of implementing RFID throughout its retail distribution chain by requiring its top 100 suppliers to use RFID tags by year-end 2004 on the pallets and cases they shipped to Wal-Mart.

However, in 2004 due to the status of standards and limited tag production capabilities, manufacturers of RFID tags were unable to meet the volume of demand within Wal-Mart's desired time frame. As the standards further evolved, production capabilities expanded and price points kept dropping, Wal-Mart's implementation is now in full swing with most of their top suppliers delivering RFID tagged pallets and crates to all of Wal-Mart's distributions centers. RFID use has started to penetrate other corporate supply chains, but in many cases these implementations are closed loop systems. In other words, the RFID is deployed within a particular corporation's supply chain, but not between them and their business trading partners. There are other applications which are also limited to deployment withing a single organization, such as tracking tools so they aren't left behind in the airplane after maintenance.

Objective of the study

- To explain the concept and implementation of RFID technologies in the libraries.
- To discover the library services that are clubbing with RFID technology.
- To investigate present situation of Indian libraries in order to adopt RFID technology into their library services.

Components of RFID system

1. **Tags:** RFID tag is the heart of the system is the RFID tag, which can be fixed inside a book's back cover or directly onto CDs etc. This tag is equipped with a programmable

chip and an antenna. Each paper thin tag contains an engraved antenna and a microchip with a capacity of at least 64 bits. These are three types of tags 'read only', 'WORM', and 'read/write'. Tags are read only if the identification is encoded at the time of manufacture and not rewritable 'WORM' (write once read many) tags are programmed by the using organization, but without the ability to rewrite them later 'Read/Write tags' which are chosen by most libraries, can have information changed or added. In libraries using RFID is common to have part of the read/write tag secured against rewriting e.g. the identification number of the item.

2. **Readers/Sensor Gates:** A receiver device called as reader detects the signal as soon it enters into its radio range and decodes the number for interpretation; Reader interrogates the tags and offers optimum reading performance enabling instant data capture when passed alongside the items in a continuance movement. The devices used within the building are usually called 'readers' while the ones used at building exits are usually called 'sensors'.
3. **Antenna:** An antenna is connected to the reader to help to process identification of the items and activate/deactivate the tag antitheft function simultaneously. Additional antenna can be added to increase the number of item processed in case of larger transactions.
4. **Server:** The server is the heart of some comprehensive RFID systems. It is the communication gateway among the various components. It receives the information from one or more of the readers and exchange information with the circulation database. Its software include the SIP/SIP2 (session initiation protocol), APIs (Application Programming Interface) NCIP or SLNP necessary to interface it with the integrated library software.
5. **Smart ID/Access Cards:** Smart ID cards provide an optimal technology for secure and accurate identity verification. SMART ID cards/access cards are provided to the Library users which enable the users to access the Library like check in or check out the Library materials, access RFID gates at the entrance of the Libraries or many other purposes like attendance, transport, mess and even for tracking the students. User's information like their names, address, contact information, etc are printed on their ID cards. The data provided are completely protected.
6. **RFID Label Printer:** It is used to print the labels that can be further used for labeling.
7. **Hand held Reader:** It can be moved along the items on the shelves without touching them. It used in stock verification, used in search for book-missed, search for individual book on request.
8. **Shelf Check out Station:** Users identification is done with an RFID-ID card. Users can put item onto the reader surface in front of the self check unit to be registered under particular user's name. Multiple items can be checked out at the same time.
9. **Book Drop Stations:** Libraries can offer a distinct service, such as ability to return the books when library is closed. It is machine with a slot with a chip RFID Reader integrated into a wall. User identifies him or her then puts the Books into the Slot. Upon Completion of return, user gets a Receipt showing how many and which books are returned.

10. Staff and Conversion Station: Staff station consists of antenna, electronic Module and power supply. There are additional software windows Integrated into library management Systems.



Fig 1: Components of RFID system

Applications of RFID in Libraries

RFID techniques were complex and devices were unsuitable for general industry during this primary stage. Techniques were developed enabling the integration of various circuits and radio transistors into single chips. In this era the major applications of RFID extended to various fields, including farm produce tracing, vehicle identification, entrance guards, and trade control. RFID tags were flexible and could be pasted onto curved surfaces; however, Radio Frequency Identification (RFID) is an automated identification. Technology that uses tags to transmit data upon RFID reader queries. Compared to barcodes identification technology, RFID tags provide a unique identifier, which raises concerns over user privacy, such as clandestine tracking and inventorying at present, the major applications of RFID implementation in libraries are limited to information management, circulation, and inventory.

Information management

Barcodes, book cards, and magnetic strips can all be integrated into one RFID tag (Chachra, 2003). This type of RFID tag provides memory to record information and to supply the system. The memory not only stores bibliographic records and circulation status, but the system also traces the location of the specific collection material. Depending on this service, the system can offer assistance in tracing service when looking for particular material in libraries.

Circulation

RFID reduces the amount of time required to perform circulation operations. The most significant time savings are attributable to the facts 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. 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 equipment. There can be as much as a 50 percent increase

in throughput. The time savings are less for check-out than for check-in because the time required for check-out usually is extended by social interaction with patrons.

Inventory

Batch processing can also apply to libraries to perform inventory or shelf-reading. Take hand-held readers to sweep shelves, for instance – readers can immediately detect all of the collection within this range, including abnormal situations such as books put on the wrong shelf. To conclude from the above discussion, libraries can use RFID to replace barcodes and obtain several advantages (Kern, 2004). They can:

Reduce queues at the front desk

- Decrease repeatable tasks; increase interaction with patrons;
- Extend internal security;
- Lower the cost of manipulating and managing collections;
- Procure collections, checking and accepting automation; and
- Raise the efficiency of inventory and arrangement.

Advantages of RFID systems

- **Rapid charging/discharging:** The use of RFID reduces the amount of time required to perform circulation operations. The most significant time savings are attributable to the facts 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. While initially unreliable, the anti-collision algorithm that allows an entire stack to be charged or discharged now appears to be working well.
- **High-speed inventorying:** 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.
- **High reliability:** The readers are highly reliable. Some RFID systems have an interface between the exit sensors and the circulation system to identify the items moving out of the library. Were 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. This is done by designating a bit as the "theft" bit and turning it off at time of charge and on at time of discharge.
- **Simplified patron 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. Patron self-discharging shifts that work from staff to patrons. Staff is relieved further when readers are installed in bookdrops.
- **Long tag life:** 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.

- **Automated materials handling:** Another application of RFID technology is automated materials handling. This includes conveyor 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 reshelving. Given the high cost of the equipment, this application has not been widely used.
- **Fast Track Circulation Operation:** The use of RFID reduces the amount of time required to perform circulation operations. The most significant time savings are attributable to the facts 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. While initially unreliable, the anti-collision algorithm that allows an entire stack to be charged or discharged now appears to be working well.

Disadvantages of RFID Systems

- **Privacy:** The privacy issue is also a subject of debate in the application of RFID technology. All patron activities such as reading, browsing, and action behavior will be detected by readers which are installed in libraries. These observing operations are similar to surveillance and may be a privacy problem for the patron. Such issues and concerns about privacy may prevent the application of active services in libraries.
- **High Cost:** The cost is one of the major factors influencing acceptance of RFID, although the production costs of RFID have reduced and Alien Technology has cut the tag prices. However, the retail price is far higher than this price. For library collections with over 100,000 items, it will be hugely expensive to implement RFID completely. Plus, the costs for the reader, peripheral equipment and application software will be even more of a burden. This will stretch the budget and the schedule for implementation of an RFID solution will be hard because libraries hold enormous collections.
- **Security:** The structure of RFID chips is the same as IC smart cards made with complementary metal-oxide semiconductors (CMOS). Therefore, methods of cracking smart cards also apply to RFID chips. Moreover, the character of RFID wireless communication can also catch transmitted data through intercepted wireless signals. For this reason, RFID must encrypt information to prevent eavesdropping, modification/replacement, and misuse
- **Vulnerability to compromise:** It is possible to compromise an RFID system by wrapping the household foil to block the radio signal. It is also possible to compromise an RFID system by placing two items against one another so that one tag overlays another. That may cancel out the signals. This requires knowledge of the technology and careful alignment.
- **Removal of exposed tags:** The RFID Tags can not be concealed in either spine or gutter of the books and are exposed for removal. 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.

Conclusion

RFID is still a relatively new technology. So far, several hundred libraries have implemented RFID, mostly for self-service and the vast majority of these libraries are positive about their RFID investment and its benefits. However, it is not been completely straightforward to research, purchase, implement and exploit RFID technology. There are some important concerns which libraries should be aware of. This guide has spelt out all these known issues so that libraries starting to invest in RFID can go into the process with their eyes open, having learned about the main pitfalls from the experiences of others. Broadly libraries believes that RFID is a beneficial technology and encourages libraries to make the commitment to RFID. The key is to take care in the purchase process to follow the advice contained in this guide and to focus on maximising the availability benefits.

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