

RFID TECHNOLOGY: A CHANGING SCENARIO AND NEW PILGRIM FOR LIBRARY

MAHENDRA MAHETA

JAY JANI

Abstract

There is nothing new in RFID for whom where inventory control and distribution work is more important than anything else. But it is defiantly new for the people working in the library and information science field. Ever more sophisticated functionality and new applications characterize this dynamic technology. All communities such as publishers, booksellers, libraries have a stake in identifying new standards that will support continued innovation and interoperability and allow maximum flexibility in developing new applications for both customers and vendors. In this paper authors have explored how RFID tags in libraries offer the possibility of increasing in productivity greatly and hold a promise of better service for the patrons.

Keywords : RFID/ Inventory Control System/ Library Security System

1. Introduction

Ironically, it has a long and relatively stable history behind it, originating in the late 60's, but it is only in the last few years that cost declines combined with improved technology has really enabled widespread use. Radio Frequency Identification (RFID) is currently one of technology's hot focus areas. Now these improvements are enabling applications beyond the physical supply chain processes of manufacturing, distribution and retail and into services applications such as security and access control, tracking, and monitoring /management where location knowledge is critical to the success of those applications, and where the location professional can assume a leadership position.

It is even becoming more popular in the library. Library can replace its old barcode system with brand new RFID System. It is a form of identification that is contact-less and does not require line of sight. The technology, though new to libraries, has been in use in other sectors for more than 20 years. The RFID tags are placed in books and generally covered with a property sticker. Antennas of different sizes, based on application, are used to read the tags and manage the various library functions.

More or less it works like barcode system only. While automatically identifying RFID takes help of automatic identification and data capture (AIDC) technology. In libraries RFID can be useful in daily issue return, circulation, transaction, inventory control

etc. because it is far more powerful than traditional barcode reading it can be a very good option for the libraries. It is far more secure and with latest technology.

The problem with technical acronyms, like RFID, is that they tend to make all products or solutions that use the technology sound alike. In this paper we will discuss both the similarities and differences among different RFID solutions. We will also share some experiences in implementing these systems in multi-vendor environments.

2. Essential Components for RFID

RFID Tags RFID “tag” (essentially a microchip for information storage) flexible, paper-thin smart labels that are applied directly to library items. Each RFID tag contains a tiny chip, which is both readable and writable and can store information to identify items in your collection. In library applications, it also stores a security bit and if needed, information to support sorting systems.



Figure-1: RFID Tags

Antenna: A conduit between RFID tags and the coupler. RFID antennas emit radio waves that activate RFID tags as they pass through the activation field. After a tag is activated, it can send information to or receive information from the coupler.

Coupler: The link between RFID tags and the PC. The coupler can send information in two directions: It can read information from a tag and send it to the PC (read mode), or it can read information from the PC and send it to an RFID tag (write mode).

PC: The link between the coupler and library automation system. VTLS has developed software that runs on your PC to provide an interface between the RFID hardware and your library automation system.



Figure-2: How it works?

Comparison of RFID with Traditional Barcode

Competitive Chart: RFID - Bar Code		
Particular	Bar Code	RFID
Direct Contact	Required	Not required
Material Handling	More	Less
Power Consumption	More	Less
Circulation Activity	Slow	Fast
Tag Scanning Speed	Slow	Fast
Hardware Space Required	More	Less

RFID tags can be read without contact, line-of-sight, or a particular orientation. This reduces materials handling, speeds inventory control tasks, and makes circulation activities fast, easy and accurate. Several RFID tags can be read at one time, further accelerating all scanning activities. This means that you scan multiple items simultaneously when performing check-ins or taking inventory. In addition to the space required to store the item-ID, RFID tags contain re-writable space for additional data. In the VTLS RFID Solution, this additional space is used to store a security setting. This means that your library can manage circulation AND theft deterrence with a single technology.

3. Limitations with RFID

- Power - Does the tag contain a built-in power source or can it only be “passively” activated by the field emitted by the reader. Most systems currently are passive (inductive) in nature - both for historical cost considerations and due to passive systems being sufficient for many of the most traditional applications.

- **Read Range** - Since most RFID tags are passive, the range of most tags is very limited (usually just a few feet, and often just a few inches). This in turn limits the utility of applications to those where the assets, merchandise, person, or animal must be in close proximity to a reader. Some newer technologies have ranges as high as 20 to 30 feet but have tradeoffs in size and cost. Key factors determining range include antenna size (both tag and reader) and reader output power.
- **Storage Capacity** - The lowest cost chips have a limited amount of storage capacity and that is read-only. However, RFID technology advancements have increased the capacity and enabled the ability to read/write numerous times in the equivalent amount of space, with storage capabilities now reaching up to 64K, opening up RFID to a variety of more dynamic applications.
- **Privacy** - The movement of RFID technology into applications serving or targeted at the individual consumer has alarmed many privacy advocates, both with respect to the potential of eavesdropping but more particularly that many of these applications collect or generate data that could be used to abuse an individual's privacy. A lack of technology standards increases these concerns.
- **High cost**. The major disadvantage of RFID technology is its cost. While the readers and gate sensors used to read the information typically cost around \$2,000 to \$3,500 each; and the tags cost \$.40 to \$.75 each.
- **Chances of Removal of exposed tags**. RFID tags are typically affixed to the inside back cover and are exposed for removal. This means that there would be problems when users become more familiar with the role of the tags (Boss 2004). In Indian libraries, it is a major challenge to keep the tags intact.
- **Tag collision**. Another problem readers have is reading a lot of chips in the same field. Tag clash occurs when more than one chip reflects back a signal at the same time, confusing the reader. Different vendors have developed different systems for having the tags respond to the reader one at a time. Since they can be read in milliseconds, it appears that all the tags are being read simultaneously

4. **RFID Applications**

In a basic RFID system, RFID antennas and couplers are used to read the tags affixed to each item in your collection. At various administrative points within your library, you can implement specific read/write stations, each of which uses an RFID reader. Virtual offers the following components in its RFID Solution:

Technical Services Workstation - Serves as a central RFID workstation, where staff members attach RFID tags to items in your collection, program the tags with the RFID item-ID, and activates the security bit for the theft detection system.

Patron Self-Checkout Station - Allows patrons to check out items without assistance from the library staff. Complete with a touch screen and receipt printer, the Patron Self-Checkout Station helps you reduce staff workload and improve customer service.

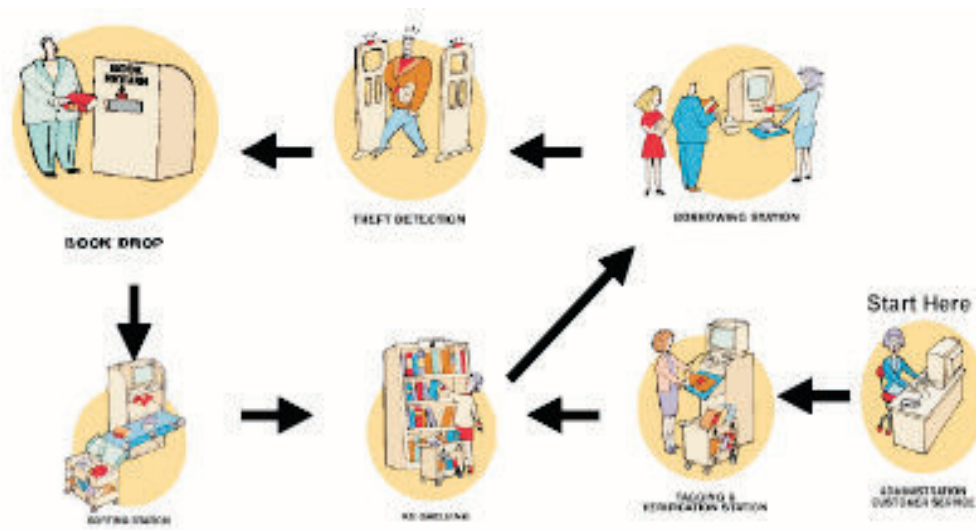
Security Gates - Positioned at library exits, they read the security setting that is stored in RFID tags and determine whether or not items should be permitted to leave the library. If items have not been properly checked out, an alarm sounds to alert library staff.

Staff Circulation Station - Provides seamless integration with your ILS while reducing materials handling and streamlining workflows.

Self-return Book Drop - Provides a return chute that interfaces with your library automation system so that the loan status of returned items is reset as soon as the items are returned.

Sorting Station - Provides a workstation where staff can reactivate the security bits of checked-in items and scan items to determine their shelving locations.

Inventory Control System - Lets you take inventory and locate missing items. The RFID Inventory Control System consists of two parts: 1) a hand-held RFID reader that you can use to scan items on your shelves and 2) software will allow you to generate inventory reports about the collected data. The RFID Inventory Control System speeds up the inventory process, locates misshelved items, and improves inventory accuracy.



Shelf Management and Inventory Control

Figure-3

Perhaps the most difficult and disliked function in libraries is inventory control and shelf management. This function becomes extremely simple with RFID technology and associated software from the ILS system.



Figure-4: Shelf Management and Inventory Control

The components necessary for inventory management consist of a Reader and a Wand with an IPAQ (hand-held personal digital assistant) at the end. The Reader weighs only 607 grams (1.34 lbs) and the Wand 435 grams (0.96 lbs), making the weight of the entire unit approximately one kilogram. A shelf can be inventoried in a matter of a few minutes as the units can read up to 20 tags a second. The system allows for two different methods for taking inventory.

The first method for taking inventory is to run the Wand across the shelf. This process captures the RFID data to the IPAQ unit, which can store data for more than 6 million books. This data is uploaded, through wired or wireless connections, to the ILS system, where the software program performs the inventory management functions.

The second method involves a pre-processing step where data is downloaded from the ILS system to the Reader. This method is more effective when there is a need to search for specific books or to identify misshelved or missing books. The unit comes with an audible alarm to provide appropriate feedback to the user. All in all, this technology converts the otherwise tedious task of managing inventory to a convenient technique for helping libraries gain control over their collections.

5. RFID Interface

The simplest situation for interfacing the RFID system with the ILS system is when the RFID system supplier is also the ILS system supplier. At present, the only ILS system vendor that also provides the RFID solution is VTLIS Inc. unless your library is already a VTLIS customer; it is likely that the RFID solution and the ILS solution for your library will come from different vendors. The two systems will therefore need to be interfaced. This interfacing is done using the SIP (SIP, SIP- 2 and NCIP) protocol. Libraries using the 3M self-checkout stations with barcode technology may already be familiar with the SIP protocol.

When the RFID system supplier is not the ILS system supplier, things get more complicated. First, whenever there is a failure of any sort, there is the possibility of the usual finger pointing among the vendors involved, but more on this later.

Second, the SIP protocol is sequential in nature and has no “trial” transactions. For example you cannot do a “bulk” check-out in one step using the SIP protocol. The RFID

system may read six books at the self-checkout station and immediately check them out in a “bulk” mode, but internally it must process these six books one at a time with the ILS system. Further, there are no “trial” transactions in the SIP protocol. You cannot ask the ILS a question like, “If I were to try and check out this book (these books), am I allowed doing so?” The ILS system either checks out the book or denies the request. This poses special problems for “bulk” check-outs that the RFID system has to deal with.

Our early experience showed that the typical problems in self-checkout stations in the field were:

1. Network failure or power failure.
2. ILS system not responding or responding incorrectly.
3. Slow response times.
4. System disconnects requiring logons by staff.

To address these problems, VTLS developed a “test” suite for the SIP protocol. This test suite consists of about 30 different test situations. Prior to installation of the RFID system, VTLS works with the ILS system supplier to see if their SIP protocol responds correctly to these tests. These tests are convenient in two ways. First, prior to installation, we can tell if the ILS will work correctly in the various conditions. Second, each time the ILS vendor updates its software; the same tests can be run again to insure the integrity of the system.

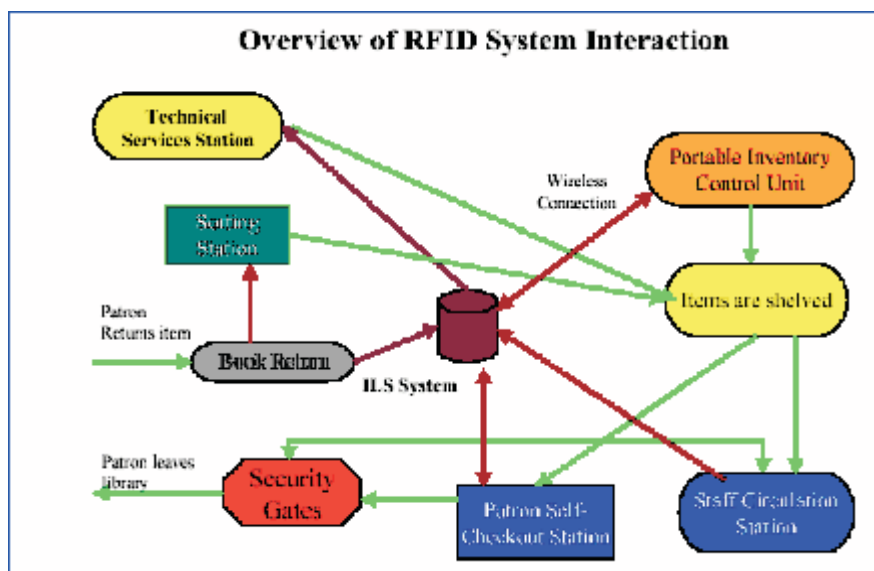


Figure-5

The ILS vendor reaction has been mixed. Some ILS vendors have taken the enlightened approach and use the test suite to insure that their system interoperates with the RFID systems correctly. Other ILS vendors are dragging their feet on this. And one vendor insists on being paid each year to run these tests. It is important for libraries to recognize this situation and open a dialogue with the ILS suppliers and insist upon interoperability.

Finally, in order to permit quick resolution of any perceived or real problems, VTLS Inc. has built some intelligence into the self-check units. The units are designed to be self-monitoring. Periodically, the unit polls itself to determine 1) if the network is still functioning, 2) if the ILS system is still responding and 3) what the time delays are in each of the processes. This problem resolution is accomplished in two ways. The system is designed to automatically re-connect if a connection is lost. The system also has extensive logging capability, which logs not only the transactions that are performed, but also the status of the system and the events that are generated as a result of the changing status. This extensive information is extremely valuable in pinpointing the exact problem so that the responsible parties can address the issues at hand.

6. Installing RFID Tags

The use of volunteers is the least expensive way to install tags on books. The process is simple and requires less than 10 minutes of instruction. In some cases it is necessary to go to an outside source for this task. For new libraries and for new branches that have a first day collection to be processed, it makes more sense to have the book supplier do this processing as this minimizes the book handling.

Experience with this multi-vendor situation has been very positive. Book jobbers are usually eager to handle this additional task. VTLS now has experience with several book suppliers. In each case, the book supplier acquired the administrative station from VTLS and attached the RFID tags to the required specifications with few problems.

There are two important steps in the installation of tags. First, it is essential that the tag supplier (manufacturer or distributor) do 100 percent QC on the tags. RFID tags may work at close proximity to the antenna, but they may not work in the field when the distances between the tag and antenna are greater in the field. Second, after the tag is installed in the book, there should be an immediate quality control check to make sure that the tag works correctly. The additional cost of doing this check at the time of installation is very low whereas a later discovery can be very frustrating to the users. Our experience on this has been very positive. The volunteers and the book jobbers are doing this task without any concerns about quality.

6.1 Installing RFID Hardware

The easiest option for installing the RFID hardware is to have the RFID system vendor install it. However, there are times when the installation has to be performed by the construction contractor under the supervision of an architect. Since a third party has to do the installation, it is necessary to produce good equipment specifications. At the

very least these specifications should include dimensions, weight, color options, power requirements and thermal load generated. In addition, complete step-by-step installation instructions need to be a part of this package. This package should also include a performance test that ensures that all equipment is operating at the required levels.

There are environmental conditions such as metal or aluminum doors or other materials that can act as antennas, thereby interfering with the proper operation of the RFID antennas. The equipment, therefore, needs to be isolated from these environmental conditions. This can be done by re-orienting the equipment, creating RF shields or fine-tuning the antennas.

7. Conclusion

The RFID industry for libraries is still very new. Several libraries have successfully installed the RFID solution. Since traditional security systems have proved to be less effective than libraries desire them to be, and RFID is more effective in material management, one can safely conclude that the RFID solution is here to stay. As more libraries install these systems vendors will gain greater experience in the field and use this experience to refine the solutions.

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BIOGRAPHY OF AUTHORS

Mahendra Maheta (B com, MLISc, M Phil) is working with Vivekananda Institute of Hotel and Tourism Management, Rajkot the hospitality industry, and catering as a Chief Librarian of a reputed 5 star, ISO 9002:2000 certified institute having placement cell in many countries like Australia, United Kingdom and United States of America. Working on the digitalization of the resources and information of hospitality industry. He has presented several national and state level papers and attended many workshops. His goal is to achieve Ph D on current technological trend.

Email: librarian007@rediffmail.com

Jay Jani holds BSc(Bio-chemistry), MLISc and he He is working as a librarian in Christ College, Rajkot-Gujarat. He participated in many national and international level seminars, conferences and workshops. His area of interest is wireless communication and networking. He is presently working on a project of RNet with Saurashtra University.

E-mail: librarian007@rediffmail.com
