

Applicability and Usability of RFID Technology in Library

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Abstract

Technology makes all kind of business functions perform better. To survive in a highly competitive business environment, companies should resign their structure by new technologies. On the other hand, sectors which are not so competitive like public library services, need to use new technologies to serve better. One of new technology applications that has been used in various sectors for 2000 years, is RFID technology. In this context, it was investigated whether RFID technology was useful for library services with a case study in a concept of qualitative research method. It is thought to be useful and pioneer for library services to develop their function system with RFID technology.

Keywords: RFID, features, objectives, components, implementation of RFID

Radio frequency identification (RFID) is one of many products falling under the umbrella name automatic identification, or auto-ID. These technologies are used to help machines identify objects. Other auto-ID technologies include barcodes, smart cards, voice recognition and optical character recognition.

RFID technology has been around for about 60 years. During World War II, the Allied Forces used it to identify friendly aircraft in an effort known as IFF (Identify Friend or Foe). In the 1980s, the technology went public and was used for everything from tracking cows and pets to triggering equipment down oil wells. The most common applications include tracking goods, assets and production-line moving parts; security, such as controlling access to buildings and networks; and automated payment systems that let customers pay for items without using cash (RFID Journal LLC, 2005).

Current uses of the technology suggest its flexibility in diverse situations. Dog owners have used RFID tags to identify their pets rather than the traditional tattoo. Hewlett Packard used RFID tags to track runners at the Boston Marathon. An amusement park in Denmark uses RFID technology to help parents keep track of their children while at the park. The Vatican is currently tagging its 1.6-million-volume book and manuscript collection with RFID microchips. RFID technology is used to combat counterfeiting in sports memorabilia and to track baggage at airports (Landt, J. 2005).

The world's largest retailer, Wal-Mart, requested that its top 300 suppliers tag all their pallets and cases in 2005. In a similar move, Target, third largest retailer in the United States, set a 2007 deadline for its top vendors to implement RFID. The Department of Defence required its 45,000 suppliers to be tagged in 2005. Libraries are the largest institutions using item level RFID tagging and, as such, are on the cutting edge of the developing technology for this unique application of RFID (Mark Roberti, 2002-2011).

Objectives

Library management includes areas such as borrowing and returning of books, classification of materials, cataloguing and barcoding. Many of these areas, including the aforementioned, have direct effects on customer satisfaction. As an example, even in small libraries, where the collection size is small, items can often be misplaced which can cause discontent in patrons.

RFID technology had its first commercial applications introduced in the late 1980's. Since then technologies in different fields have advanced causing the cost of RFID tags and readers to go down, thus making it available to a broader market. For example, libraries have slowly started to adopt this technology as RFID tags have become cheaper. The goal of this thesis is to find out whether RFID technology offers any significant benefits for library management and how do these benefits reflect to customer satisfaction. Also, in order for a library to get the best possible benefit from using RFID they need to take into account certain factors well before making any investment decisions. These factors will also be discussed about.

RFID components and the principle of operation

A basic RFID system consists of three modules: Tags, Readers and Antennas. An RFID Tag is made up of a coupling element and a chip; each tag has a unique electronic code, attached to the object used to identify the target. RFID readers are devices that are used to retrieve and write the information on RFID tags. There are handheld readers and fixed readers. Handheld readers designed that act like handheld bar code scanners and fixed readers are mounted to read tags automatically as items pass nearby them. The antenna emits radio signals to activate the tag and to read and write data to it (Wang Guang Hui, 2008, 6).

In practical applications of using RFID technology, a tag is attached to an object used to identify the target, when the target object pass through the area that the reader can read, the tag and the reader builds up the radio signal connections, the tag sends its information to the reader, such as unique code and other data stored on, the reader receives those information and decodes them, and then sends to a host computer so as to complete the whole information processing.

RFID and Barcode

The Barcode Recognition Technology is not new to the library. But RFID technology may still be unfamiliar to most people in this field though its application in certain areas is widely used. The biggest

difference between Barcode and RFID is that bar coding scans a printed label with optical laser to identify the object whereas RFID interrogates a tag using radio frequency signals (ZEBRA technologies).

Applying RFID technology in a library, a micro-chip will be embedded into the items. Micro-chip will automatically send data such as serial number to the scanner, which will not require as much manual scanning as in the bar code technology. In contrast, RFID can reduce the production costs and improve retail efficiency; hence more and more people think that RFID technology will be a replacement for bar code technology (Wang Guang Hui, 2008, 7).

The Issues of Security and Privacy

RFID data security means protecting the data on the tag and the data transmitted between the tag and the reader to ensure it is accurate and safe from unauthorized access. RFID tag can be read from a long distance and its contents can be read by anyone with an appropriately equipped scanner, because RFID tags cannot tell the differences between one reader to another (Mr Tan Jin Soon, Dr Li Tiejian, 2008).

Assume that a third party intercepted a message between tag T72 and the reader E8, and assume also that the third party can determine that the message was "788A54B68" but can't know what this message means. It would be considered as a breach of security. Furthermore, if the tag T72 was affixed to an article purchased by Lisa with its contents "Item: Prescription Drug; Brand: PharCo; Drug: Cancergone; ProdDate: RFID vs. Barcodes RFID Barcodes Data Stored EEPROM Paper Line of sight requirement Not Required Required Tag's Capabilities Read/Write Capable Read Only Number of items that can be scanned Multiple One Reusable Yes No Durability High Low Harsh Environment Yes No Event Triggering Capable Not capable Security High Low ISO Standard Incomplete Yes Cost of Tag Expensive Inexpensive. It would be considered as a breach of privacy (Banks, J., Pachano, M., Thompson, L. & Hanny, D. 2007).

Regulation and Standardization

At present, RFID has not formed the unified globalized standard, the market has coexistence of multiple standards, and three representative standards include: Europe's and America's EPC Global, Japan's Ubiquitous ID Center and ISO/IEC18000. Different standards made significant differences in wireless frequencies bands and data formats etc, and resulted in incompatibility of products from various manufacturers. This has brought difficulties to the widespread application of RFID and created the enormous hindrance for RFID products to be intercommunicated and developed in the use of the library (Wikipedia, 2010).

Every country can set its own standards for the frequencies used for RFID (Wikipedia, 2010).

Need for implementing rfid technology in library management system

Overview of barcode based library systems

Use of barcodes in library management is still very common. Each item in a library is labelled with a barcode which is used for circulation management. This type of management system always requires

a line-of-sight, meaning that when items are borrowed and returned, each item needs to be processed separately. As barcodes are nothing more than 2d-images other means are needed for security measures. This is where electromagnetic (EM) tags come into play. These tags work by creating an electromagnetic field to which the security gate system will react to when an active tag comes close enough to the gate. This is why when an item is borrowed the tag is desensitized and when returned the tag is activated again. Barcodes do not offer any benefits for collection management. Even though check-in units can be barcode based the returned items still need to be sorted by hand before returning them back to their shelves. It can be said that the defining characteristic of barcode based library management is the lack of efficiency (Wikipedia, 2011).

Values of using RFID technology in libraries

In libraries there are tasks, such as check-in and check-out that can be further automated by use of this technology. This will enable better allocation of workforce and funds when library staff can concentrate better e.g. in customer service instead of spending their time on mundane tasks. By keeping this in mind, it is clear that the main values of RFID based systems lie in better efficiency, which in turn leads to reduced costs. Then, in what ways does RFID help to increase efficiency? (Pandian, 2010, 50).

Though self-service check-in units can also be based on barcodes, RFID offers better functionality. RFID readers can recognize several books at once whereas with bar codes each book needs to be read separately. By installing a separate sorting machine, which will read the tag information from the returned items and sort them into corresponding carts, it is possible to make the check-in unit even smarter. This will save time as the library staff can straight deliver the books back to their shelves without first spending time on sorting the items. With RFID it is also possible to make it so that the library patrons return their items straight back to the shelves by themselves instead of using the self-service check-in. Of course this method works best if a patron only has a few items to return. (Pandian, 2010, 50-51).

Misplaced and missing items are very common problem in libraries. This is also an issue where RFID can be used to make things easier. By using handheld readers a librarian can easily check if a shelf has missing or misplaced items, thus making controlling the inventory much quicker. This could also be made so that the shelves themselves contain a RFID reader which will automatically update the information to the staff. This way it becomes possible to quickly check the state of each shelf from the computer without having the need to separately check every shelf (Pandian, 2010, 51).

With barcode based systems, when a new book arrives to a library it needs to be labelled with a barcode and also with an electromagnetic tag that is used for anti-theft purposes. On the other hand, a single RFID tag can be utilized for both circulation management and for anti-theft purposes. This makes processing new books and making them ready for circulation much faster. Thus, RFID also makes security more efficient (Pandian, 2010, 50).

RFID applied situations in the world library

RFID system applied in a library has more than 10 years of history. The first application of radio frequency identification technology was fully deployed in Bukit Batok Community Library in Singapore

in 1998, afterward e.g. the United States, Australia, the Netherlands, Malaysia (in this order), started using this technology to construct the automated library system. According to the Checkpoint statistics, over 440 libraries worldwide used of RFID technology as of 2005, and this figure rose to 2,000 in 2007 and 3,000 by the end of 2009. Moreover, the speed of growth for those worldwide large libraries using RFID technology is at 30% of annual rate (Zhou Wenhao, 2008, 2).

RFID Standards in Library

Finnish Data Model sets the national standard and regulations for Finland. HF band are now widely adopted for library applications in Finland. The benefits of HF for the library application are:

- Excellent immunity to environmental noise and electrical interference
- Reliability of bulk tag reading, of tags in various orientations
- Unaffected by human body shielding, making it the most suitable for EAS security functionality
- Small tag size
- Appropriate Reading range
- Low cost tags and readers
- Easier for Global applications due to harmonized regulatory environment
- Ideal for item-level tracking
- Supported by many suppliers of RFID tags and readers (Finnish Libraries' RFID Working Group, 2005).

Challenges of using RFID in libraries

It's become clear that RFID offers many benefits in library use but every technology has its problems. From patrons point of view the most troubling one is the privacy issue. Though a RFID tag doesn't contain any personal information the tag itself makes "tracking" and "hot listing" possible. Tracking, as the name implies, means tracking the movements of a RFID embedded item by using tag readers. This coupled with "hot listing", a way to create a database of items and their corresponding tag identification numbers, creates a rather serious privacy issue (Pandian, 2010, p.70).

When viewed from the financial point the greatest obstacle is the cost. Though costs are coming down, the cost of an RFID based library management system is still more than a system based on barcodes and electromagnetic tags. As the amount of money needed to update to RFID is high there is uncertainty whether the return on investment is high enough to cover the costs (Pandian, 2010 p.70).

Though RFID makes implementing security measures easier when compared to electromagnetic tags there are issues that undermine this benefit. Depending on the strength of a RFID reader it is possible to either greatly hinder or completely block the tag signal by wrapping an item, embedded with a

RFID tag, with several layers of aluminium or tin foil. This, combined with the not always so well performing gate sensors, makes risk of items getting stolen quite high. Also if the RFID tags are not embedded inside the book covers it is easy to just remove them, remove the tag (Pandian, 2010, p.70).

Conclusion

RFID is still a relatively new technology. So far, several libraries in India 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.

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