RFID in library

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ABSTRACT

RFID (Radio Frequency Identification) is the most talked about technology nowadays in almost all fields. This paper deals with the concept of RFID. It explains what RFID is and how RFID works. It provides five reasons for RFID in your library and should libraries use RFID. It will also provide the advantage and disadvantage of RFID.

Key words: Radio frequency identification (RFID), RFID works, Automatic Identification

INTRODUCTION

Radio frequency identification (RFID) is a general term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object wirelessly, using radio waves. RFID is evolving as a major technology enabler for tracking goods and assets around the world. A great deal of attention is being paid to RFID by the IT industry, media and analysts. According to a studies three quarters of manufacturing companies are now aware of RFID, of which a third are already using, piloting or investigating RFID applications for their organizations. As a result of the potential benefits of RFID, many of the world's major retailers have adopted RFID tagging for pallets and cases shipped into their distribution centres. The consequence of this RFID activity in the retail sector is likely to impact on around 200,000 manufacturers and suppliers globally, and will fuel the market for hardware and software to support RFID.

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APPLICATION

RFID has many applications outside of the retail supply chain including some surprisingly familiar ones such as car key-fobs, mass transit (such as the London Transport Oyster card), ski resort lift passes and security badges for access control into buildings. It is often described as a transformational technology in terms of its potential

impact on business processes and systems. However, in many ways it is a logical evolutionary step on from the barcode as a way of gaining increased labour productivity

through automation. When used in conjunction with allied technologies it can remotely sense objects to determine their identity track their position and detect properties such as pressure and temperature. RFID equipment has steadily fallen in price as volumes increase and microchip unit production costs fall. With the ability to store several k bytes of data in addition to the 'number plate' identifier it could be viewed as a form of 'mass

distributed database' that has the potential to become ubiquitous - billions of tags in daily use throughout the world on all objects that are produced, stored, moved, sold and maintained.

TECHNIQUE BEHIND RFID TECHNOLOGY

RFID stands for radio frequency identification. RFID systems use a chip or tag that emits a radio wave and a reader that reads the wave. The radio wave is called the electronic product code (EPC) and is associated with a single tag or chip. RFID provides real-time tracking and other information (location, destination, etc.) for items using it. EPC uses the EPC protocol, which tells the system how data on the tag is stored and determines how the tags and the readers communicate.

The tags also have an antenna to transmit to the reader. There are two types of tags: active and passive. Active tags use batteries to power communication with the reader. These tags in essense constantly emit signals. Passive tags only emit signals when within the interrogation zone of the reader. (The interrogation zone is the area that can be "read" by the reader.) The reader creates an electromagnetic field, which powers the tag and allows it to emit a signal to the reader.

Like bar codes, RFID tags identify items. However, unlike bar codes, which must be in close proximity and line of sight to the scanner for reading, RFID tags do not require line of sight and can be embedded within packages. Depending on the type of tag and application, they can be read at a varying range of distances. In addition, RFID-tagged cartons rolling on a conveyer belt can be read many times faster than bar-coded boxes.

The reader uses an antenna to pick up analog signals. When the reader's wave hits the tag, the tag emits a wave at a different frequency containing its information. That is how the reader "reads" the tag, similar to how a car stereo picks up radio stations (Sweeney 2005: 9-20).

USAGE IN LIBRARY

RFID technology allows libraries to insert passive, high frequency RFID tags onto their collections in what is called "item-level tagging" (Molnar 2004). This process expands the capability of standard bar coding. When an RFID tag comes into contact with a reader, a microchip on the tag is activated and read. Information is exchanged between tag and reader and stored onto a database. Like a bar code, a tag remains attached to an item as long as that item is catalogued.

THE DEVELOPMENT OF RFID

Over the years methods for capturing and storing information have evolved from paper and card systems, through keyboard data entry, bar code data capture and are now augmented by technological improvements such as touch screens on the shop floor. All of these initiatives have been aimed at improving accuracy, completeness and timeliness of information. However these all rely on access to a host computer system to make use of data collected.

So, how does RFID differ from other methods of identification and data capture? A typical RFID system is made up of three components: tags, readers and the host computer system.

TAGS

An RFID tag is a tiny radio device that is also referred to as a transponder, smart tag, smart label or radio barcode. The tag comprises a simple silicon microchip (typically less than half a millimeter in size) attached to a small flat aerial and mounted on a substrate. The whole device can then be encapsulated in different materials (such as plastic) dependent upon its intended usage. The finished tag can be attached to an object, typically an item, box or pallet and read remotely to ascertain its identity, position or state.

READERS

The reader, sometimes called an interrogator or scanner, sends and receives RF data to and from the tag via antennae.

A reader may have multiple antennae that are responsible for sending and receiving radio waves. The readers can be fixed or mobile, can read information stored on the tags and write information to them. This can be achieved without direct line of sight and in environments where traditional data collection could not operate. A major advantage is that information can be written to the tag multiple times so storing a history that travels with the article.

HOST COMPUTER

The data acquired by the readers is then passed to a host computer, which may run specialist RFID software or middleware to filter the data and route it to the correct application, to be processed into useful information.

RFID is not a new technology, in fact it was first used by the US military during WWII, but wider deployment chain was slow due to the high costs of equipment and its limited reliability in volume environments. RFID equipment has steadily fallen in price as volumes increase and microchip unit production costs fall. With the ability to store several kilobytes of data in addition to the 'number plate' identifier it could be viewed as a form of 'mass distributed database' that has the potential to become ubiquitous - billions of tags in daily use throughout the world on all objects that are produced, stored, moved, sold and maintained.

AUTOMATIC IDENTIFICATION

In recent years automatic identification procedures (Auto ID) have become very popular in many service industries, purchasing and distribution logistics, industry, manufacturing companies and material flow systems. Automatic identification procedures exist to provide information about people, animals, goods and products.

The omnipresent barcode labels that triggered a revolution in identification systems some considerable time ago, are being found to be inadequate in an increasing number of cases. Barcodes may be extremely cheap, but their

stumbling block is their low storage capacity and the fact that they cannot be reprogrammed.

The technically optimal solution would be the storage of data in a silicon chip. The most common form of electronic data carrying device in use in everyday life is the chip card based upon a contact field (telephone chip card, bank cards). However, the mechanical contact used in the chip card is often impractical. A contactless transfer of data between the data carrying device and its reader is far more flexible. In the ideal case, the power required to operate the electronic data carrying device would also be transferred from the reader using contactless technology. Because of the procedures used for the transfer of power and data, contactless ID systems are called RFID systems (Radio Frequency Identification).

HOW RFID WORKS

How does RFID work? A Radio-Frequency Identification system has three parts:

* A scanning antenna.
* A transceiver with a decoder to interpret the data.
* A transponder - the RFID tag - that has been programmed with information.
* The scanning antenna puts out radio-frequency signals in a relatively short range. The RF radiation does two things:
* It provides a means of communicating with the transponder (the RFID tag) AND
* It provides the RFID tag with the energy to communicate (in the case of passive RFID tags).

This is an absolutely key part of the technology; RFID tags do not need to contain batteries, and can therefore remain usable for very long periods of time (maybe decades). The scanning antennas can be permanently affixed to a surface; handheld antennas are also available. They can take whatever shape you need; for example, you could build them into a door frame to accept data from persons or objects passing through.

When an RFID tag passes through the field of the scanning antenna, it detects the activation signal from the antenna. That "wakes up" the RFID chip, and it transmits the information on its microchip to be picked up by the scanning antenna.

1. The tag need not be on the surface of the object (and is therefore not subject to wear).

2. The read time is typically less than 100 milliseconds.

3. Large numbers of tags can be read at once rather than item by item.

In essence, that's how RFID works.

WHY USING RFID IN THE LIBRARY EASY TAGGING

One of the most daunting experience in introducing RFID system in a library is tagging. The possibility of tagging millions of collections manually by hand is unimaginable. Fortunately, there have been several working solutions for this issue, from the one that tackles the issue of migration from barcode system to full-fledge RFID implementation to the one with automatic tagging and decoding. However, it is no longer a problem with the newest RFID technology. Library should not buy an old RFID technology, which has a severe readability problem with special type of collections, such as DVDs and CDs.

AUTOMATED SORTING

Once a library collection is dropped at a specific place, the collection will be automatically scanned by one or more RFID readers. The system will then send a unique identification data read from the returned collection to the backend system in miliseconds and subsequently produce an acknowledgement of returned collection. Either using conveyor belt or any other means, the collection can later be transported to another spot for a sorting process. Using RFID technology, unsupervised automatic sorting is also possible.

MANAGING COLLECTIONS AND STORAGE

Most libraries organise their collections using Dewey Decimal Classification system. When librarians put collections away, they need to put them in a specific place according to Dewey Decimal Classification system. The idea of having the classification system is to have a unique location where they can locate each collection easily. While the classification system is very helpful to locate the collections when they are in the right spot every time, in daily practice, the collections may not be in the place where they are supposed to be. Patrons who are not familiar with the classification system may take a collection away from a shelf and return it in an unknown spot somewhere else, for example. Librarians need to gather the collections which are scattered in different places and put them back in their right location. Thanks to RFID, it is now possible for librarians and patrons to locate and return the collections in the right place where they belong effectively and efficiently.

SECURE AND AUTOMATED RESERVATION AND BORROWING

In library patron's use cases, reservation and borrowing are the most useful features of Integrated RFID Library Management System. The vision of 24/7 library is already possible with the use of RFID technology. No more dispute on whether a patron returns a collection in time or late. No more hassle of returning during library opening hours. Beyond a single library, RFID can provide real time information when interlibrary loan collections arrive or leave a specific library.

INTERACTIVE INFORMATION, HELP AND GUIDE

A number of museums in Europe, America and Northern Asia have started to implement trials on RFID technology to enhance the experience of their visitors. In The Osaka Science Museum, Japan, researchers have tried to use the information obtained from RFID bracelets worn by museum visitors for directing some robots to guide them around several exhibits. Libraries around the world can enhance and empower their visitors and patrons with RFID technology.

SHOULD LIBRARIES USE RFID

Because of the privacy issues, some librarians and library users question whether libraries should consider using RFID at all. In considering the introduction of any technology into the library we need to ask ourselves "why?" What is the motivation for libraries to embrace new technologies? The answer to this question may be fairly simple: libraries use new technologies because the conditions in the general environment that led to the development of the technology are also the conditions in which the library operates. In the case of RFID, anyone managing an inventory of physical objects needs to do item-level functions, such as sales or lending, more efficiently and with less human intervention.

RFID is a highly advantageous technology for a wide variety of inventory tracking situations. It is also coming into its own for payment systems, including the ever elusive "micro-payment," the holy grail of non-cash transactions. Whether or not libraries embrace RFID, it will probably continue to replace barcodes in the retail supply chain. And it will contribute to the general speeding up of our world, which affects libraries as well as other institutions. A key fact is that library circulation, the primary function where RFID can be used, is increasing while library budgets and purchasing power are losing ground.

RFID AND LIBRARY FUNCTIONS

In libraries, items are taken out and returned many times. This makes the library function an even better use of RFID than in retail because the same RFID tag is re-used many times. Second only to circulation, libraries look to RFID as a security mechanism. The RFID tags can facilitate security in a variety of ways. In one method, the tag that is used has a special "security bit" that can be switched from "checked-in" to "checked-out." The exit gates at the library read each tag as the user passes out of the library and sounds an alarm if the bit is not in the "checked-out" state. The check-in function resets the bit. Another method is for the tags themselves to remain the same; as the user passes through the exit gate the system reads the tags in the books in the user's arms or bag and queries the library database to be sure that the items have been checked out.

Although RFID can be used in library anti-theft systems, this doesn't mean that it is a highly secure technology. What libraries don't tell their users, and none of us should probably say very loudly, is that RFID tags can be shielded by a thick layer of Mylar, a few sheets of aluminum foil, or even an aluminum gum wrapper, so they won't be detected by the reading device. In addition, today's tags are not hidden in the spine of the book, like security tape, but are often found on the inside of the book cover, barely concealed by a library label, and can be removed. This is not a condemnation of the technology nor even a reason not to use it in the library security system; the reality is that library security has never provided more than a modicum of security for library items. The gates and their alarms are as much social deterrent as they are actual prevention. The reason to use RFID for security is not because it is especially good for it, but because it is no worse than other security technologies. There is, however, some potential savings because a single tag serves many different functions. The library saves some time in processing new items because it only has to affix one technology to the item. It may also save some money due to the integration of circulation and security with a single vendor and into a single system. Some future-positive

thinkers in the library world see the potential to have a combined exit-gate/check-out station that allows patrons to walk about of the library with their books in hand and their library card in their pocket. That brings up other questions, especially privacy ones, but the notion is intriguing.

RFID systems can read multiple tags at once, allowing you to check out a stack of books with a single transaction .RFID can provide great advantages because the tags can be read while the books sit on the shelf. Not only does the cost of doing an inventory of the library go down, the odds of actually completing regular inventories go up. This is one of those areas where a new technology will allow the library to do more rather than just doing the same functions with greater efficiency. Library experience with RFID is still in its early stages, but already some librarians are getting ideas for additional uses of this technology. RFID could be used to gather statistics on the re-shelving of books in the stacks area, by equipping shelvers with hand-held readers. Vendors of RFID systems for libraries are already offering automated sorting of returned books into a handful of bins that facilitate the re-shelving of books that are checked in. A fully automated library could potentially know exactly where an item is, down to the very book truck or bin, during the return process.

KEY ATTRIBUTES OF RFID

Unlike barcodes, RFID tags can be read;

1. through desktops and book covers (no line of sight is required).

2. in any orientation to the reader/antenna

3. while moving (i.e. while being deposited through a return chute)

4. several at a time

5. from distances of several inches to the antenna

RFID improves library workflow, staff productivity and customer service with these attributes. However, the ability to conduct inventory counts without removing a single book from the shelf is what really separates RFID from preceding technologies such as barcodes.

EVALUATING RFID FROM DIFFERENT VENDORS

It is potentially overwhelming to evaluate competitive offerings of a new technology; hence the following guide lists some of the characteristics to be considered.

SECURITY FEATURE

The same RFID tag used to manage inventory can also be used to protect it from theft. Current offerings provide the choice between a purely RFID solution, or RFID with an EM (electro-magnetic) add-on for theft.

TAG MEMORY CAPACITY

More memory is not necessarily better than less - it often correlates with price, and data transmission speed. As a first step, consider what information you need to program into each tag, and then discuss with vendors.

TAG FUNCTIONALITY

Read/Write vs. Read Only

1. Some vendors offer tags which can only be "written to" once. That is, once the tag is programmed, the information stored in the tag's memory cannot be changed. Alternatively, information stored in the memory of read/write tags can be updated as required.

Anti-collision

2. All RFID vendors in the library market offer a product with anti-collision (the ability to read several tags simultaneously). However, the speed at which this can be performed, and the total number of tags that can be read, will vary. This relates specifically to inventory

management with a hand-held reader, and check-in processes.

EAS (Electronic Article Surveillance) mechanism

3. As mentioned above, RFID can be used to prevent theft in the library. This approach varies from vendor to vendor – the security mechanism may be integrated into the chip itself, or security gates may be linked to a separate server which interrogates the database to conclude whether an alarm needs to be triggered.

ADVANTAGE OF RFID

Whether you are concerned with tracking inventory in a warehouse or maintaining a fleet of vehicles, there is a clear need for a fully automated data capture and analysis system that will help you keep track of your valuable assets and equipment. Active Wave RFID technologies provide unique solutions to difficult logistical tracking of inventory or equipment- particularly in applications where optically based systems fail and when read/ write capabilities are required. The technology is stable, and evolving, with open architectures becoming increasingly available.

RFID BENEFITS VS. BARCODE

The optical nature of barcode requires labels to be "seen" by lasers. That line-of-sight between label and reader is often difficult, impractical, or even impossible to achieve in industrial environments. In order to function properly, a barcode reader must have clean, clear optics, the label must be clean and free of abrasion, and the reader and label must be properly oriented with respect to each other. RFID technology enables tag reading from a greater distance, even in harsh environments.

In addition, the information imprinted on a barcode is fixed and cannot be changed. ActiveWave RFID tags, on the other hand, have electronic memory similar to what is in your computer or digital camera to store information

about the inventory or equipment. This information can be dynamically updated.

The Advantages of RFID vs. barcode technology:

1. No line of sight requirement.

2. The tag can stand a harsh environment.

3. Long read range.

4. Portable database

5. Multiple tag read/write.

6. Tracking people, items, and equipment in realtime.

DISADVANTAGES OF RFID TECHNOLOGY

The RFID technology, though very beneficial, is expensive to install. Small and medium scale enterprises find it costly to use it in their firms and offices.

1. It is difficult for an RFID reader to read the information in case of RFID tags installed in liquids and metal products. The problem is that the liquid and metal surfaces tend to reflect the radio waves, which makes the tags unreadable. The tags have to be placed in various alignments and angles for taking proper reading. This is a tedious task when the work involves big firms.

2. Interference has been observed if devices such as forklifts and walkie-talkies are in the vicinity of the distribution centers. The presence of mobile phone towers has been found to interfere with RFID radio waves. Wal-Mart, the retail sector giant, has installed billions of RFID tags in their products throughout the world and they have encountered such problems.

3. The USA and Europe, for instance, have different range of frequencies that allow RFID tags to function. This makes it mandatory for international shipping companies and other organizations to be aware of the working pattern of other nations also, which can be very time-consuming.

4. RFID technology has been referred to as invasive technology. Consumers are

apprehensive about their privacy when they purchase products with RFID tags. Once the radio chips are installed in the product, the customer can be tracked and his personal information can be collected by the RFID reader. However, many stores have a facility that deactivates the RFID tags after the product has been purchased.

RFID technology can be the next tool for success and management of various businesses. With more research, the flaws and limitations of this technology can be removed. This will make RFID technology very useful for diverse sectors like retail, transport and jewelry businesses.

CONCLUSION

Today, RFID is used in enterprise supply chain management to improve the efficiency of inventory tracking and management. Whether your library is using RFID today, is thinking of using it in the future, or has pre-determined that RFID is not suitable for libraries, we cannot ignore this technology. It is going to be incorporated into products that libraries purchase and into items that users bring into the library, such as smart cards and hand-held electronics. It is being considered for passports and is already in use as a payment system. Now is the time to develop both policies, such as the American Library Association's statement on RFID in libraries, as well as sets of best practices

that give the library some clearly stated goals for the decisions that will inevitably have to be made as RFID becomes a common, if not ubiquitous, technology. The bottom line is that the synergy between the latest technology like RFID and libraries can create wonders resulting in empowerment of both users as well as librarians. In future, we can see many more libraries adopting this technology.

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