RFID Technology for Libraries

By Richard W. Boss

RFID (Radio Frequency lDentification) is the latest technology to be used in library theft detection systems. Unlike EM (Electro-Mechanical) and RF (Radio Frequency) systems, which have been used in libraries for decades, the RFID-based systems that libraries began to install in the late 1990s not only detect the unauthorized removal of library materials, but speed staff charge and discharge, simplify and speed patron self-charge and self-discharge, support electronic inventorying and shelf searching, and interface with materials handling systems. The descriptive term “inventory tracking systems” has been applied to RFID systems, but it is not yet in widespread use in the library community. By mid-2007, an estimated 600 libraries with as many as 850 facilities worldwide were using RFID systems. Those numbers had at least quadrupled by mid-2011 according to representatives of several companies contacted by the author.

RFID is a combination of radio-frequency-based technology and microchip technology. The information contained on microchips in the tags affixed to library materials is read using radio frequency technology. A reader (aka sensor, scanner, or interrogator) looks for antennae on the tags and retrieves information from the microchips through them.

The tags used in RFID systems can replace both EM or RF theft detection tags or targets and barcodes, although the hybrid system that 3M introduced in 2000 replaced only barcodes and retained the EM strips in the belief that EM is superior to RFID for security. 3M did introduce a comprehensive RFID product that replaces both EM and barcodes in 2004 and now is one of the major suppliers of RFID technology for libraries. This change of position by 3M reflects how quickly RFID was accepted in industry and the library community.

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 fact that information can be read from RFID tags faster than from barcodes. That is due to the fact that the tags can be

read regardless of item orientation or alignment (i.e., the technology does not require line-of-sight or a fixed plane to read tags as do older technologies) 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. Finally, RFID tags can be read from distances of up to 24 inches—distances far greater than possible with lightpens and barcode wands. That is what makes RFID systems not only faster, but able to support electronic inventorying of materials on the shelves with handheld devices.

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, which can be achieved by installing readers in bookdrops or with self-discharge stations, shifts work from away from staff so that they can focus on service.

High reliability

The readers are highly reliable. Several vendors of RFID library systems claim an almost 100 percent detection rate using RFID tags. Anecdotal evidence suggests that is the case, but there appear to be no statistical data to support the claims.

There are fewer false alarms than with older technologies once an RFID system is properly tuned. The libraries contacted by the author that have experience with both EM and RFID security systems; report a 50 to 75 percent reduction in false alarms with RFID.

Some library RFID systems have an interface between the exit sensors (a term often used to describe readers that are used at exits) and the circulation module of an integrated library system to identify the items moving out of the facility. Were a patron to run out of the facility 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 North American library that has implemented this security feature.

Other RFID systems encode the circulation status on the RFID tag. 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. If material that has not been properly charged is taken past the exit sensors, an immediate alarm is triggered. Another option is to use both the “theft” bit and the online interface to an integrated library system, the first to signal an immediate alarm and the second to identify what has been taken.

High-speed electronic inventorying and item searching

A unique advantage of RFID systems is their ability to scan materials on the shelves without tipping them out or removing them to access the barcodes. A hand-held inventory reader can be moved across a shelf of books at a distance of up to six inches 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 that are out of proper order. When the tag numbers of missing items are entered into an inventory reader, it is possible to search for missing items on the shelves.

Interfaces with materials handling systems

Another application of RFID technology is an interface with a materials handling system, a system that consists of conveyors and sorting equipment that can move library materials and sort them mechanically 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, especially for systems with five or more bins or carts, this application has not been widely used. There were approximately 400 systems in use in North America's more than 90,000 libraries as of the second quarter of 2011, however, the number was increasing rapidly.

Long tag life

Finally, RFID tags last longer than barcodes because nothing comes into contact with them. Most RFID vendors claim a minimum of 100,000 transactions or ten years before a tag may need to be replaced. No library circulates an item that often. However, ten years is the typical guarantee. As of mid-2011, there were not enough libraries with tags as old as ten years to determine whether tag performance deteriorates before that time.

Disadvantages of RFID Systems

High cost

The major disadvantage of RFID technology is its cost. While the readers used to read the information are comparable in cost to the components of a typical EM or RF theft detection system, typically $1,000 to more than $10,500 each, the tags are far more expensive than barcodes, EM strips, or RF targets. However, tag prices dropped by 50 percent or more between mid-2009 and mid-2011 to a range of $.17-.25 each, with the price depending on the amount of memory and the quantity purchased. Media tags are substantially more expensive, typically $.50 to $.65 each.

Lack of interoperability

The tags from one vendor are not interoperable with those of another vendor even if the same tag manufacturer has been used by both. That is because of the lack of a data model standard. A data model specifies what information can be stored on a tag and where it will be located on the tag. Until there is a widely adopted standard, a library risks the loss of its investment in tags should it change vendors after initial installation of its RFID system. However, such a standard was completed in the second quarter of 2011. It is described in a subsequent paragraph.

Vulnerability to compromise

It is possible to compromise 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, just as bringing a magnet into a library using EM technology would be.

It is also possible to compromise an RFID system by placing two items against one another so that one tag substantially overlays another. That may cancel out the signals. This requires knowledge of the technology and care in substantially aligning the tags.

Removal of exposed tags

RFID tags are typically affixed to the inside back cover and are exposed. The author found no evidence of removal in the libraries he visited, nor did any of the library administrators contacted by telephone report a problem. That does not mean that there won't be a problem when patrons become more familiar with the role of the tags. Recently, the technology of tags has been improved to make them much thinner and more difficult to detect when covered with a bookplate. The traditional manufacturing method, known as "solder and bond" created a detectable bump because the circuit on the chip attached to the antenna was raised; a latter method known as the "flip chip," fuses the chip onto the antenna, thus reducing the bump so that the tag is thin enough to conceal. A library can also imprint the RFID tags with its logo to make them appear to be bookplates. Disguising RFID tags as bookplates requires that they be inside the front cover and in multiple positions to overcome concern about alignment, not the back cover as that would raise suspicion.

Exit sensor problems

While the short-range readers used for circulation charge and discharge and inventorying may read the tags as much as 100 percent of the time, the performance of the exit sensors is more problematic. They must read tags at up to twice the distance of the other readers. The author knows of no library that has done a before and after inventory to determine the loss rate when RFID is used for security. Lacking data, one can only conjecture that the performance of exit sensors is better when the antennae on the tags are larger or when the exit lanes are 36 to 42 inches wide, rather than the 48 inches some libraries specify.

Perceived invasion of patron privacy

There is a perception among some that RFID is a threat to patron privacy. It is argued that the tags contain patron information and/or title information; and that the tags can be read from a distance after someone has taken the materials to home or office. However, 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 integrated library system, and—unless a library takes the step of retaining patron borrowing histories—is broken when the material is returned. When additional information is stored on an RFID tag, it is limited to information about the item, typically

holding location and call number, but rarely author and/or title. Some have suggested that interim locations such as sorting location also be included.

The RFID tags can only be read from a distance of 24 inches or less because the tags reflect a signal that comes from a reader or sensor and the readers that are available for the frequency range used in library tags are limited in their power by law to ten watts. It is, therefore, not possible for someone to read tags from the street or an office building hallway. In order to read tags from a distance of more than 24 inches, it would be necessary to greatly enlarge the tags or greatly increase the power of the readers. A library has no reason to purchase larger, more costly tags. An electrical engineer at N.V. Philips in the Netherlands told the author that it would require a high-wattage truck-mounted reader to read the tags used by libraries from a distance of ten feet. Such a reader would violate the maximum wattage permitted for readers on the bandwidth used for library tags.

One public library director has suggested that it would be easier to look at the book jackets on the materials a patron was carrying out of the library or down the street than to hack the integrated library system to tie a patron and a book together; and very much less expensive than constructing a high-powered reader to ascertain what library patrons had borrowed.

Perceptions, even when mistaken, may have real consequences. The Intellectual Freedom Committee of the American Library Association has responded to concerns about RFID raised by privacy advocates by drafting a set of principles:

- Implement and enforce an up-to-date organizational privacy policy that gives notice and full disclosure as to the use, terms of use, and any change in the terms of use for data collection via new technologies and processes, including RFID.
- Ensure that no personal information is recorded on RFID tags which, however, may contain a variety of transactional data.
- Protect data by reasonable security safeguards against interpretation by any unauthorized third party.
- Comply with relevant federal, state, and local laws as well as industry best practices and policies.
- Ensure that the four principles outlined above must be verifiable by an independent audit.
- The Council of the American Library Association adopted these principles on January 19, 2005. The Intellectual Freedom Committee continued its work and introduced a set of guidelines for RFID use in 2006. Among them, the following are the most significant:
- Libraries should not use RFID systems to track individual library users. Libraries should remove any personally identifiable information from statistical data collected by RFID systems.
- Due to the potential for eavesdropping, libraries should use hardwire connections and not wireless connections for all communications between RFID systems and the ILS involving personally identifiable information.
- Libraries should encrypt information on RFID tags.
- Libraries using “smart cards” should use an “opt-in” system that allows library users

to choose between “smart cards” and barcode-enabled cards.

What problem is being addressed? Libraries have not been using RFID systems to track individual library users. Patron loan information is stored only in the integrated library system. Therefore, the focus should be on the breaking of the link that exists within the integrated library

system as soon as an item is returned. Most libraries’ RFPs for integrated library systems contain that requirement. Many also specify other security requirements to protect against hacking.

Why limit the concern about wireless to RFID? A patron’s need for privacy is far greater when searching the patron access catalog or the Internet. A library that uses a local area network should require that the network in its entirety be as secure as possible. That can be done using a combination of encryption for the entire network and fiber optic cable for the wired portion of the network.

The area in which RFID represents the greatest potential threat to patron privacy is the use of the “smart card” as a patron ID card. A “smart card” is an RFID card with encryption. That would make it possible to have the ID card also function as a “debit” card, with value added upon pre-payment to the library and value subtracted when a patron used a photocopier, printer, or other fee-based device, or wished to pay fines or fees. Almost none of the score of RFPs the author has examined include a mandatory requirement for ‘smart cards.” The few that do, ask for that as an option. All stipulate encryption to protect patron privacy. While some encryption options require a great deal of tag capacity, experience in Europe with smart cards for banking and retail use suggests that an encrypted library patron card would be doable.

Because of the attention that has been focused on privacy issues, it is important to educate library staff and patrons about the RFID technology used in libraries before implementing a program. The best way to do that is to emphasize that RFID technology is not one technology, but several. E-Z pass is an RFID application that is designed to read large tags from a distance of up to 20 feet. It would be impractical to affix tags of that size and cost to library materials. The same is true of the tags used on pallets in warehouses.

In summary, the tag type and frequency of tags, and the readers used in libraries cannot be read from a distance.

Further, a library should stress that it does not store patron information on the tags in library materials, that it protects patron privacy by breaking the link between borrower and material after the material is returned, and it subscribes to the privacy guidelines in the American Library Association’s Code of Ethics.

Several states, most recently California, have been considering legislation that would pose restrictions on the use of RFID by retailers and libraries. It is, therefore, important to monitor legislative activity and to be prepared to inform legislators about the differences between retail and library applications, and how libraries protect the privacy of their patrons. Library administrators should be sure to keep their boards informed.

Components of an RFID System

All RFID systems have at least two components: tags and readers; some may also include a server.

Tags

Each razor-thin tag contains an etched antenna and a microchip with a capacity of at least 64 bits. The most common sizes are 50x50mm (millimeters) and 50x75mm. However, the tags may be included in a label that is substantially larger.

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. The tags usually have a capacity of at least 256 bits.

“Read/write tags,” which are chosen by an increasing number of libraries, can have information changed or added. For example, a library might add an identification code for each branch. That information could be changed were 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. In library RFID, it is common to have part of the read/write tag secured against rewriting, e.g., the identification number of the item. The tags usually have a capacity of at least 1024 bits. A minimum capacity of 1024 bits is essential if the tags are to be used in electronic inventorying and/or with a materials handling system. While vendors now almost always offer 1024 bit tags, larger capacity tags are available.

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 active tags that can be read at distances of ten or more feet. Warehouse pallet inventory and EZPass tags are examples of active tags.

Standard tags can be affixed to books, magazines, video cassettes, or media cases, but not to CDs and DVDs because the metallic content of these media may affect the signal of standard tags. These require circular tags with a donut hole that can be affixed to the inner circles of CDs and DVDs that have no metallic content. Some vendors offer two donut hole tags, including a larger one that covers more of the CD or DVD and has a

lower rate of failed reads. When looking at systems, librarians should ask for samples of all available tags.

The tags used by most vendors of library RFID are not compatible even when they conform to the same standards because the standards in existence through the first quarter of 2011 seek only electronic compatibility between tags and readers. The pattern of encoding information and the software that processes the information has differed from vendor to vendor; therefore, a change from one vendor's system to another would require modifying all of the software. To avoid this, 3M introduced its "Tag Data Manager" in mid-2008 to increase interoperability. It has the capability to read non-3M tags in non-standard formats. That allows libraries with RFID tags that conform to older standards the option of upgrading their systems to 3M hardware and software without having to retag their existing collections. 3M also made its own tag format available to its customers on request. ITG, now merged with Bibliotheca, and Tech Logic also agreed to make their vendor-specific encoding models available, and Bibliotheca can convert tags from other major vendors on the fly.

Only recently have standards been developed that facilitate interoperability. These are discussed in the following section on standards.

Readers

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 stored, sent to a server, or communicated to an integrated library system when the RFID system is interfaced with it. When there is no server, most of the software is on the readers.

The types of readers include conversion stations, staff workstations for circulation desk charging and discharging, patron self-charging and discharging stations, book drop readers, 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. Finally, there is a portable device that consists of a scanning gun or wand attachment to read a group of items on the shelves for inventorying, shelf order, or locating missing items.

Conversion stations range in price from as little as $2,000 to as much as $4,000. The more expensive are mounted on mobile carts so that items can be converted one at a time at the shelves rather than bringing them to a workroom on book carts. Readers for use at the circulation desk typically cost $1,000 to $1,500 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 more rapid than check-out because the materials can be processed without having to talk with patrons as is desirable with staff check-out.

Patron self-charging stations are similar to those which have been available for years and are similar in cost, approximately $18,000-22,000. A number of models can support not only conventional barcoded library cards, but also magnetic strip cards and smart cards. Some models can also be used for patron self-discharging. That increases the cost of the unit by at least $2,500. A patron self-charging station can handle a minimum of 100,000 transactions per month, but some libraries have peak loads that may make it necessary to have more than one reader per 100,000 monthly circulations.

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 stores that information, communicates it to a server, or sends it to the library's integrated library system. If there is a "theft bit," an alarm will be activated. As an option, a library may choose to automatically lock the turnstile gate if one or more items have not been properly charged. This option is rarely exercised. If a server is used, the server, after checking against the circulation database, activates an alarm if the material is not properly checked-out. A set of two exit sensors typically costs at least $7,000 and as much as $10,500.

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 unless a library wants to check for holds, returns to the wrong location, and interlibrary loans. These units can also be used with a materials handling system, including conveyors and sorters. The sorters then separate out the holds, returns to the wrong location, and interlibrary loans. Bookdrop readers usually are similar to circulation desk readers and cost $2,500 or more, plus the cost of installation into a desk or wall.

ATM-type patron charge/discharge stations cost at least $30,000. When combined with a conveyor and sorter with three or more bins into a materials handling system, the cost rises to a minimum of $75,000. Some large libraries have spent well in excess of $1 million for a materials handling system that includes many bins and many feet of conveyers.

The portable scanner or inventory wand, which is priced at $1,000 or more, can be moved along the items on the shelves without touching them for inventorying, looking for holds and missing items, and finding incorrectly shelved items. The data can be stored and downloaded to the server of the integrated library system later on, or it can be transmitted to the server using wireless technology.

Server

A server may be configured with an RFID system. It is the communications gateway among the various components. It receives the information from one or more of the readers and checks the information against its own database or exchanges information with the circulation database of the library's integrated library system. The server typically includes a transaction database so that reports can be produced. A server costs a minimum of $3,500, including software. A vendor may choose not to use a server by substituting a less expensive docking station and increasing the amount of software in the readers.

Standards

Standards for RFID in libraries are essential because library materials are not only used by the owning library, but also by others via interlibrary loan. Common standards would make it possible to circulate borrowed items without entering information manually.

If RFID hardware and software vendors can deliver standardized products internationally, their cost is reduced.

Finally, standards can avoid libraries being dependent upon specific vendors as is the case when vendors use proprietary protocols. When there is conformity to the relevant standards, it is possible to change vendors in case of poor performance or a business failure.

The relevant RFID standards for libraries are ISO 15693, ISO 18000-3, SIP2, NCIP, and ISO 28560.

ISO 15693, an international standard, defines the physical characteristics, air interface, and communication protocol for RFID tags. It deals with the interface between the tags and the software in the readers. ISO 15693 operates at 13.56 MHz frequency and offers a maximum read distance of 1.5 meters (approximately 59 inches). Almost all RFID products, including all those used for library RFID applications conform to this standard. However, the standard was designed for container level tracking, not the item-level tracking sought by libraries.

Compliance to ISO-18000-3, an international standard, means that a read/write passive tag operates at 13.56 MHZ, but limited to a range of 24 inches. All library RFID tags conform to this standard. Each vendor decides on the number and function of the data blocks on its tags. While this facilitates item level tracking, it does not provide interoperability among the tags of different vendors.

SIP2 (Standard Interchange Protocol) is the de facto standard developed by 3M that makes it possible for a patron self-charging station or RFID system to communicate with an integrated library system. It makes it possible to verify that patron is a valid borrower and has not exceeded any of the library defined limits on borrowing. The checkout/check-in information is then passed between the RFID and integrated library systems. SIP2 is gradually being replaced by NCIP, a standard developed by the National Information Standards Organization (NISO Circulation Interchange Protocol Z39.83). However, 3M was working on SIP3 as late as the second quarter of 2011.

ISO 28560, a three-part international standard that was published in the second quarter of 2011, is essential to interoperability among RFID systems. The standard spells out the format for library RFID tags. Specifically, Part 1 describes the data models and date elements, while Parts 2 and 3 provide for two options for encoding the data on the tags. The United States will have to choose between the two options. ISO 28560 requires conformity to ISO 18000-3.

Before the completion of ISO 28560, Denmark, Finland, France, and the Netherlands

established national standards to insure interoperability among their libraries. A number of libraries in other countries have chosen to adopt one of these national standards in order to assure interoperability among at least a few vendors' tags. The most widely supported national standard is that of Denmark. Known as the Danish Data Model (DS INF 163), the open encoding standard is in use in several countries and supported by at least three vendors of RFID systems for libraries. With only minor changes, the Danish Data Model conforms to Parts 1 and 3 of ISO 28560.

As ISO 28560 offers options, it is essential that the National Information Standards Organization (NISO) provide U.S. implementers with guidance on how to provide RFID in a way that adheres to the international standard. As of mid-2011, NISO had circulated a draft of its "Recommended Practices" (NISO RF-6-201x) and collected comments. Publication was scheduled for the third quarter of 2011. The published standard was expected to recommend conformity to ISO 28560, Parts 1 and 2. See www.niso.org for current information about RFID standards and best practices.

The adoption of ISO 26580 will not guarantee interoperability as vendors may incompletely or incorrectly implement a standard, add proprietary security functions, and/or include software or firmware that is system dependent and can only be used with specific tags.

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. While there is little choice with regard to the placement of tags on CD/DVDs and videotapes, there are many options for tagging books. It is important to select a limited number of tagging locations to avoid slowing down the tagging process. The inside of the back cover is often recommended because it is the fastest for right-handed tag installers to reach. However, a library may want to consider placing the tags inside the front cover under a bookplate or with a logo printed on the tag. That may make the function of the tag less obvious and, therefore, improve security. .

One vendor recommends that tags be positioned at least three inches above the bottom. That avoids possible interference from metal shelves when inventorying.

There is an argument about uniform positioning of the tags. One vendor suggests that three locations should be selected to reduce the possibility that the tags of two books will align substantially on top of one another and cancel one another out. Another vendor and several librarians who are using RFID say that they have not encountered problems with uniform positioning of tags as neither staff now patrons are very carefully about creating the stacks.

Many libraries are not able to tag their entire collection at one time. They must, therefore, plan a phased implementation. A common approach is to convert materials not already tagged when they are being discharged from circulation. While it might seem desirable to do the conversion at the time of charging, that may create a bottleneck during busy

periods. Regardless of whether it is done after discharge or as part of the charging process, it will only be a few months before the large majority of circulating items will have RFID tags. If this approach is used, the equipment at the circulation points may have to read both barcodes and RFID tags.

Retrospective conversion requires a “conversion station.” Rather than purchasing a number of units, a library may want to purchase some and rent additional units for use during the most active conversion period. The conversion of existing barcoded items using a team of three averages six to ten seconds per item depending on the amount of information added to the tag and the number and skill of the persons doing the tagging. Pre-programmed tags, which can be 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.

It is essential that the tagging tasks be rotated so that no one repeats the same motions over an extended period of time.

Almost all libraries tag new acquisitions as part of the cataloging process, however, libraries that have experienced losses of unprocessed library materials from technical services, might consider doing the tagging at the time of receipt in acquisitions. While inadvertent duplicates cannot then be returned, it should significantly reduce losses and facilitate tracking of items in technical services.

Budgeting for RFID

A small library of 40,000 items should plan on a budget of $27,000 to $30,500 for an RFID system without bookdrop readers, or patron self-charge/discharge. The shopping list would consist of:

RFID Shopping List for Small Library

Item	Cost
37,000 book tags @ $.20	$7,400
3,000 media tags @ $.65	$1,950
1 programmer/converter rental (3 weeks)	$750
2 staff stations @ $1,500	$3,000
1 set exit sensors	$7,000–10,500
1 portable scanner	$1,500
111 hours of labor @ $8	$888
Carpentry and electrical	$1,000
Shipping, installation and training	$3,500
Round-off adjustment	$12

The foregoing costs assume competitive bidding and awarding the contract to other than the high bidder. A library should adjust the staff cost based on its local wage for its employees and the percentage of volunteers used.

A library with 100,000 items interested in patron self-charging and a book drop unit should plan on a minimum budget of $90,000–100,000 for an RFID system.

Prices for library RFID are volatile, therefore, it is a good idea to informally gather information before submitting a tentative budget to the library's funding authority.

Installations

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 made in existing buildings are small, primarily in branch libraries. The Las Vegas-Clark County Library District, Multnomah County Library, Queensborough Public Library, Salt Lake County Public Library. Seattle Public Library, 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 among the few sites that that appear to have tagged more than 500,000 items each. Some of these libraries will have tagged several million items when their collection conversion is completed.

A common means of funding a large RFID project is to include it in the construction cost of a new library facility or major addition and renovation.

The most ambitious multi-library RFID program is that of the Nederlandse Bibliothek Dienst (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. A pilot system was installed at the public library in the city of Eindhoven in 2002, and the first operational system two years later in the public library in the city of Heimlo. The vendor, Nedap N.V. of the Netherlands, uses Tagsys tags that conform to the Dutch standard format, but the equipment is also able to read the tags produced by Philips and Texas Instruments per the Dutch standard. The deployment of RFID throughout the country was virtually complete in mid-2011. Major Dutch jobbers are now including RFID tags in all library materials purchased from them. Approximately 85 percent of recent acquisitions by Dutch public libraries arrived with RFID tags.

Vendors

Eight vendors were offering comprehensive RFID solutions for libraries as of mid-2011: Bibliotheca (www.bibliotheca-rfid.com), EnvisonWare (www.envisionware.com), Libramation (www.libramation.com), MK Sorting Systems (www.mk-sorting-systems.com) Sentry Technology Corporation (www.sentrytechnology.com), Tagsys (www.tagsysrfid.com) Tech Logic (www.Tech-Logic.com), and 3M (www.3M.com/us/library).

ITG, formerly a division of Vernon Library Supplies, is now part of Biblioteca. EnvisionWare is a distribution partner of P.V. Supa (www.pv-supa.com) of Finland. P.V. Supa is the world's largest manufacturer of materials handling systems for libraries and a major supplier of RFID readers and tags. Tagsys sells directly only to very large libraries. MK Sorting Systems and Tech Logic are major suppliers of materials handling systems that use RFID. Several vendors of integrated library systems and materials handling systems for libraries were also offering RFID solutions. There are several other companies that provide products that work with RFID, especially patron self-charging stations and materials handling equipment.

Differentiation Among RFID Systems

While library RFID systems have a great deal in common with one another, including the use of high-frequency (13.56 MHz), passive, read-write tags, there are some significant differences:

1. An RFID system may manage security by using a "theft" bit on the tag that can be turned on or off, or it may interface with an integrated library system and query that system to determine the security status. It may even do both.
2. The RFID tags may contain only item identification numbers or they may contain considerable additional information, some of which may be permanent and some capable of being rewritten. A 74 or 95 bit tag can accommodate only item identification, a 256 bit tag can accommodate a small amount of additional information such as location, and a 1024 or 2048 bit tag can also accommodate limited bibliographic information for an item.
3. Some tags have a noticeable bump because they have been produced using "solder and bond" technology, while others have almost no bump because they use the "flip chip" technology that fuses the chip to the antenna. The latter type is less obvious.
4. Some vendors offer only proprietary tags while others offer tags that conform to a national standard supported by multiple vendors. However, almost all vendors are expected to support the new ISO 28560 standard and the parallel NISO standard that spells out the options to be used by U.S. libraries.

Other Sources

For a more detailed discussion of RFID in U.S. libraries see the report of the NISO RFID Working Group downloadable as NISO RP-6-201x from www.niso.org.

A useful British blog can be found at http://www.mickfortune.com/Wordpress/.

RFID Journal (www.rfidjournal.com) is a useful source of current information about the RFID industry as a whole.

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