Radio Frequency Identification (RFID) System In Libraries

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ABSTRACT In the recent past as well as in present a series of modern technology such as Bar- Coding Electromagnetic strips, etc have been used in the libraries. With the intention of improving the quality of services to the users RFID is the latest technology to be used in library theft detection systems and circulation operations. This system consist of smart RFID Labels, Hardware and Software provider libraries with more effective way of managing their collection while providing greater customer service to their patrons

1. Introduction

RFID means Radio Frequency Identification invented in 1970s. This technology uses radio waves to identify people or objects. This technology is one of the fastest growing Automatic Data Collection (ADC). There are several methods of identification. RFID systems carry data in suitable transponders, generally known as tags and retrieve data by machine readable means, at a suitable time and place to satisfy particular application needs.

2. RFID use in libraries

RFID is the latest technology to be used in Library theft detection systems and circulation operations. This system consist of smart RFID Labels, hardware and software provides libraries with more effective way of managing their collections while providing greater customer service to their patrons. RFID in libraries saves library staff's time by automatizing their tasks. This technology saves readers precious time that he would have been spent, waiting for his turn in a queue for issuing and returning a book. Charging and Discharging of books can be fully automatized with the help of self check in/out systems. It directly provides the book information and library member information to the library management system and does not need the manual typing. It also provides monitoring and searching systems.

This technology works through flexible paper- thin smart labels, approximately 2"X2" in size, which allows it to be placed inconspicuously on the inside cover of each book in a library's collection. The tag consists of an etched antenna and a chip which stores vital bibliographic data including a unique Accession number to identify each item. These smart labels are applied directly on library books and can be read with RFID Scanner, line of sight is not essential for reading the tags with the scanner, therefore the books require much less human handling to be read and processed.

3. Components of RFID System

3.1. Tags: The heart of the system is the RFID Tags, which can be fixed inside a book's back cover or directly on to CDs and videos. Each tag has a certain amount of Internal memory (EEPROM) (Electrically Erasable Programmable Read-Only Memory) in which it stores information about the object, such as its unique ID, or in some cases more details of bibliographic data and product composition. An RFID Tag consists of an integrated circuit and an antenna combined to form a transponder. RFID Tags collect the energy to operate from a radio frequency field emitted by a reader device; therefore they do not need a battery. When energized by a radio signal from a fixed position reader or handheld scanner, the tag returns the stored information in order that the item to which it is attached can be easily located

There are three types of tags

Read Only

WORM (Write-Once-Read-Many)

Read Write

Active and passive Tags:

Active tags: active tag contains in built power source (battery) within the tags.

Passive tags: 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.

Readers: A receiver device called as reader. These are radio frequency devices designed to detect and read tags to obtain the information stored. 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 sent to the server a host computer. The devices used within the building are usually called readers while the one used at building exits are usually called sensors.

Antenna: An Antenna is connected to the reader to help to process identification of the items and Activate/deactivate the tag antitheft function simultaneously. Antennas are the channels between the tag and the reader, which controls the system's data acquisitions and communication so the antenna enables the chip to transmit the identification information to a reader.

Server: The server is the heart of some comprehensive RFID systems. It is the communication gateway among the various components. It receives the information from one or more of the readers and exchanges information with the circulation database. Its software includes the APIs (Applications programming Interface) necessary to interface it with the automated library system.

RFID Label Printer: An RFID printer is used to print the labels with an individual barcode, library logo, etc.

Handheld reader: It can be moved along the items on the shelves without touching them. It used in Stock Verification, used in search for book misshelved, search for individual book on request.

Shelf Check Unit: Users identification is done with an RFID- ID Card. Users can put item onto the reader surface in front of the shelf check unit to be registered under particular user's name.

Book Drop Station: Libraries can offer a distinct service that is very useful for users, such as the ability to return books when the library is closed. The book drop system can be useful for this activity. In this system user inserts the book/items into the slot. The RFID reader captures the electronic signature and sends to backend system for loan cancellation. User's record is updated immediately.

Staff and Conversion Station: Staff Station consists of antenna, electronic module and power supply. There are additional Software windows Integrated into Library Management System.

4. RFID Vs Barcode

S.No	RFID	Barcode
4. 1	RFID involves a tag affixed to a product which identifies and tracks the product via radio waves.	A barcode is a visual representation of data that is scanned and interpreted for information.
4.2	RFID tags don't need to be positioned in a line of sight with the scanner.	Barcode scanners need a direct line of sight to the barcode to be able to read.
4.33	RFID tags are more reusable and rugged as they are protected by a plastic cover.	Barcode are more easily damaged as the line of sight is needed to scan, the printed barcode has to be exposed on the outside of the product.
4.4	RFID can be read and write.	Barcode can read only.
4.5 5	RFID contain high levels of security, data can be encrypted, and password protected or set to include a 'kill' feature to remove data permanently.	Barcode have less security than RFID as they can be more easily reproduced or forged.
4.6	RFID can be run with minimal human participation.	Barcode are very labour intensive as they must be scanned individually.
4.7	RFID multiple items can be read simultaneously.As approximately 40 RFID tags can be read at the same time	Barcode can be scan single item only.
4.8	Stock verification made easier as no need of taking the books out from shelf. You can read multiple books from the shelf at a time.	Stock verification takes time because of the fact that each book has to take out from shelf and then scanned with the scanner.

5. Advantages of RFID:
Self Charging/Discharging: The use of RFID technology in a library decrease the time needed for circulation duties. This technology helps librarians eliminate valuable staff time spent scanning barcodes while checking out and checking in borrowed items. Patrons self charging/discharging shift that work from staff to patrons.

Reliability: The readers are highly reliable. Since the tags and sensors communicate with the integrated library system it is possible to know exactly which items are moving out of the library.

Streamlined Inventory Management: A unique advantage of RFID System is their ability to scan books on the shelves without tipping them out or removing them. A handheld inventory reader can be moved rapidly across a shelf of books to read all of the unique identification Information.

Longitivity of tag life: RFID tags last longer than barcodes because the technology does not require line-of-sight. Most RFID vendors claim that the tag life can be at least 100,000 transactions or at least 10 years. These tags do not interface with the appearance of the book and can even be made to appear as a bookplate.

Automated Materials handling: RFID technology is automated materials handling. This includes conveyor and sorting systems that can move library material and sort them by category into separate bins or onto separate carts. This significantly reduces the amount of staff time required to ready materials for re-shelving.

Theft reduction: When a user leaves the library with the issued document these are checked at the exit gate. For this purpose RFID technology can be efficiently used and a terminal/ lane installed on the gate. Theft detection is an integral feature of the chip/ circuit within the RFID tag. It is a standalone technology. Each lane is able to track items of about 1 meter. When an unissued document passed through the gate, the terminal/lane will give an alarm. In this way RFID system can minimize theft of library items.

DISADVANTAGES:
High Cost: The major disadvantage of RFID technology is its cost. The RFID tags are very costly. Besides tags, the reader exit censor, circulation station, scanner etc are also quit expensive. These situations discourage many libraries to adopt this technology.

Modification of security tags: In this case, any could use the RFID reader to permanently turn off security by looking the security data. This could also include programming random data, erasing data. Any of these situation cause great difficulty to the library.

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.

Tag Collision: Tag collision is also the disadvantages of RFID. Tag collision can occur when numerous tags in the same time confusing the reader.

Reader Collision: Reader Collision can occur where two signals from different reader overlap and the tag is unable to respond to both.

Conclusion: RFID technology is not emerging but also more effective, convenient and cost efficient technology in library security. This technology has slowly begun to replace the traditional barcode on library items. RFID is the latest technology to be used in library theft detection system and circulation operations. RFID in libraries saves library staff's time by automatizing their tasks. This technol-

ogy is quite expensive; still it has yielded excellent results for all the organization. The decreasing price of tags and other equipments in future will encourage more libraries to adopt this technology for various applications in an effective ways.

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