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IMPACT OF RFID (RADIO FREQUENCY IDENTIFICATION) TECHNOLOGY ON LIBRARIES.

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Abstract

Implementation of Radio Frequency Identification technology in libraries in a developing country like Nigeria has brought remarkable improvements in the services such as shelf charging-discharging, automated handling of materials, security, high-speed inventory and moved beyond security to become tracking systems that combine security with more efficient tracking of materials throughout the library, reduced the data entry errors, enhanced customer service, and records updates. The purpose is to identify common applications, potential benefits, and the challenges of implementing the RFID Technology in the Library. This paper seeks to offer quick assessment of RFID in libraries and provide guidance for researchers and practitioners in adopting RFID in libraries. It is hoped that the present study will help Librarians and Library professionals in improving the return on investment and proving the long-term security of the library, a better designed RFID system available at a low cost and that addresses privacy issues is needed to increase the adoption of RFID in libraries.

Keywords: RFID technology, components, benefits and implementation.

Introduction

RFID is a generic term, used to describe various technologies that use radio waves to automatically identify people or objects. (FAQ RFID, 2018) It is an automatic identification and data capture technology. "RFID is a combination of radio frequency based and microchip technology. The information contained on microchips in the tags affix to the library materials is read using radio frequency technology."(Boss, R. W. 2009). RFID technology is in use since the 1970s. RFID tags can be active, semi-passive and passive. It is a small device that can store information. Passive tags don't have internal batteries. RFID reader is a device that can receive and transmit a radio signal. It is built to encode data stored in the tag's microprocessor. Because of the higher cost, active and semi-passive RFID tags are used for valuable asset tracking. The passive RFID tags are used in RFID library management systems.

Now-a-days Libraries and Information Centers (LICs) are automating their functions and services to meet the users increasing demand. Radio Frequency Identification (RFID) technology plays a pivotal role in automating the various activities/functions of the LICs. Its application increases the speed and accuracy in operations. RFID based system move beyond security to become tracking systems that combine security with more efficient tracking of materials throughout the library. RFID systems can be integrated into existing library systems to improve the efficiency of the main processes, such as easier and faster charging and discharging, inventorying, material handling, etc. carried out in any library and increase the quality of services provided. RFID though relatively new to library and information centers, has been in existence for more than 60years, and it has been extensively used in different operations such as toll collection, access control, ticketing, etc.

OVERVIEW OF THE RFID TECHNOLOGY

RFID is one of the Automatic Identification and Data Capture (AIDC) technologies. The purpose of such technologies is to identify objects, automatically collect data about the objects and update the data into a computer system without human intervention (Potdar, Wu & Chang, 2010). RFID is an electronic information technology that utilizes wireless radio waves to transmit, identify, trace, sequence and confirm various objects (Liu & Chen, 2009; Roberts, 2006). It can be characterized as an electromagnetic proximity identification and data transaction system (Roberts, 2006). Two components in RFID are the tag and reader. RFID tags are used to tag objects or assets,

and an RFID reader gathers the tag information. RFID technology is a replacement for barcode technology in terms of non-optical proximity communication, information density and two-way communication. Compared to barcode technology, RFID technology possesses powerful properties which include being waterproof, having a magnetic scratch-resistant protection layer, being heat resistant, being long lasting, transmitting data transmission over long and short distances, data encryption, and relatively large memory capacity (Bi, Cao & Sheng, 2011). RFID technology is also more powerful than other AIDC technologies such as cameras, magnetic cards and identity card because of its data read and write functions, easy miniaturization and diversification of the shape, environmental resistance, reusability, data penetration, data memory capacity, system security and data security. RFID uses several common methods of identification, but the most common method is the association of the RFID tag unique identifier with an object or person. The basic concepts in RFID diagram typically comprise the following (Ramanathan, Ramanathan, Wan & Ko, 2014): 1. An RFID device (tag) 2. A tag reader with an antenna and transceiver 3. A host system or connection to an enterprise system. RFID devices can be divided into two categories: 1. RFID devices with power supply (battery) 2. RFID devices without power supply. RFID devices with power supply are known as transponders (transmitter/responder). Sometimes they are called “active tags.” RFID devices without power supply are known simply as “tags,” or “passive tags.” Active tags are more expensive than passive tags. Passive tags have an unlimited life and are lighter, smaller and cheaper. Tags can incorporate read-only memory (ROM), volatile read/write random access memory (RAM), or write once/read many memory (WORM). An antenna serves as a conduit between RFID tags and the RFID reader. RFID antennas emit radio waves that activate RFID tags as they pass through the activation field. The antenna sends or receives information from the RFID reader after a tag is activated.

COMPONENTS OF RFID

RFID has four major components which are;

- RFID tags / transponder that are electronically programmed with unique information
- Readers or Sensors to query the tags.
- Antenna.
- Server on which the software that interfaces with the integrated library software is loaded.

1. Tags: RFID tag is the heart of the system, which can be fixed inside a book's back cover or directly onto CDs and videos. This tag is equipped with a programmable chip and an antenna. Each paper thin tag contains an engraved antenna and a microchip with a capacity of at least 64 bits. These are three types of tags 'read only', 'WORM', and 'read/write'. Tags are read only if the identification is encoded at the time of manufacture and not rewritable 'WORM' (write once read many) tags are programmed by the using organization, but without the ability to rewrite them later 'Read/Write tags' which are chosen by most libraries, can have information changed or added. In libraries using RFID is common to have part of the read/write tag secured against rewriting e.g. the identification number of the item.

2. Readers: A receiver device called as reader detects the signal as soon it enters into its radio range and decodes the number for interpretation; Reader interrogates the tags and offers optimum reading performance enabling instant data capture when passed alongside the items in a continuance movement. The devices used within the building are usually called 'readers' while the ones used at building exits are usually called 'sensors'.

3. Antenna: An antenna is connected to the reader to help to process identification of the items and activate/deactivate the tag antitheft function simultaneously. Additional antenna can be added to increase the number of item processed in case of larger transactions.

4. 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 exchange information with the circulation database. Its software include the SIP/SIP2 (session initiation protocol), APIs (Application Programming Interface) NCIP or SLNP necessary to interface it with the integrated library software.

RFID TECHNOLOGY AND LIBRARY

Using RFID in libraries saves library staff's time by automatizing their tasks. An establishment that uses RFID library management saves a book reader, precious time that he would have spent, waiting for his turn in a queue for borrowing or returning a book. Taking care of books and making them available to the book readers are important tasks. Most of the library staff's time is spent in recording information of incoming and outgoing books. Borrowing and returning of books can be fully automatized with the help of self-check-in/out systems. This system involves installation of

special software. A person using this system to borrow books, is presented with options on a computer screen. The person has to identify himself with a code, which is preferably a personal identification number, or any form of unique identity code. Books selected by the person are identified by the system's built-in RFID reader. And, the surveillance bit in the book's tag is deactivated by the system. When a book is returned, the check-in/out system activates the surveillance bit.

APPLICATION OF RFID TECHNOLOGY TO LIBRARY SERVICES

Libraries use RFID tags on book and other item to provide identification during check-out, check-in, inventory, shelf management and for theft deterrence.

1. **Check-Out:** Check-out or charging of books is a time consuming process. Users can check-out book on their own with the help of self-check-out station. Self-checkout station is composed of a proprietary touch-screen device along with an RFID reader plus special software for personal identification, book and other media handling and circulation. [4] This kind of system allows the Library to speed up book charging process i.e. checkout several books/items simultaneously, frees staff for deploying them on other activities, reducing queuing time, provides user privacy.
2. **Check-In:** It is also a time consuming process. Manual discharging can be significantly easier, faster, and more ergonomically friendly with RFID. More books/items can be checked in at one time. The Book Drops system can be useful for this activity. In this system, user inserts the Library books/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. [5] It offers unprecedented flexibility and convenience of returning LIC items at any time of the day, even when the LIC is closed.
3. **Stock Verification and other inventory control:** An RFID library system would speed up the finding of books and also improves the stock control of the library. [6] It comprises basically a portable scanner and a base station. High-speed inventory and identify documents which are out of order can be done through the proper use of RFID technology i.e. scan documents on the shelves without removing them.
4. **Security at the gate:** 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 stand-alone 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 LIC items. In addition to the above application, RFID technology can play an important role in case of retrospective conversion process and inter library loan process.

5. **Shelf Management:** This solution makes locating and identifying items on the shelves an easy task for librarians. It comprises basically of a portable scanner and a base station.

The solution is designed to cover three main requirements:

- Search for individual books requested
- Inventory check of the whole library stock
- Search for books which are mis-shelved

6. **RFID Transponder or Tagging:** It is the most important link in any RFID system. It has the ability to store information relating to the specific item to which they are attached, rewrite again without any requirement for contact or line of sight. Data within a tag may provide identification for an item, proof of ownership, original storage location, loan status and history. RFID tags have been specifically designed to be affixed into library media, including books, CDs, DVDs and tapes.

BENEFITS OF USING RFID IN LIBRARIES

The use of RFID technology increases efficiency and eliminates human error due to fatigue and psychological reasons. The major advantages can be summarized as follows:

- Improves-efficiency of the staff and quality of services;
- Increases the speed of operations i.e. reduces the amount of time required to perform circulation operation, stock verification, etc.
- Enhances accuracy;
- Increased user satisfaction and hence improves the image of the LICs;
- Provide reliable statistics for management information system(MIS) and management control;

- Saves the time of the users;
- Improves information availability.
- reducing non-value added work processes
- Improves staff productivity
- Improves customer service
- Assist inventory check with ease.
- Easy book identification for shelving process
- Assist traceability of book allocation
- Allow better accuracy in book collection management, resulting in reduced book purchase
- More than one item can be checked out or checked in at the same time.

CHALLENGES OF IMPLEMENTING RFID IN LIBRARIES

- High Cost
- Frequency Block
- Chances of removal of exposed tags exit gate sensor problems
- User Privacy concern
- Reader collision
- Tag collision
- Interoperability

Conclusion

Whether we realize it or not day-by-day RFID technology become an integral part of Libraries. The magnitudes of expected improvement of the introduction of this technology in Libraries have opened doors to serve users in better ways. RFID technology is not only emerging but also more effective, convenient and cost efficient technology in library security. Still it has yielded excellent results for all the organization. The decreasing price of tags and other equipment's in near future will encourage more Libraries to adopt this technology for various applications in an effective ways. Application of this technology will definitely improve the image of the Libraries and develop a positive attitude of users towards Libraries. Therefore now is the time to embrace this flexible and beneficial technology to reap the rewards of improved efficiency, better inventory control, increased quality of services and employee and customer convenience. Finally it is concluded that the librarians in 21st century should go ahead and compromise with the development of advanced technology.

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