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ENHANCING LIBRARY AUTOMATION: THE ROLE OF RFID TECHNOLOGY IN MODERN LIBRARIES

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Abstract: *The paper describes the Role of Radio Frequency Identification (RFID) in modern Libraries and its application in library automation. RFID is a combination of radio, Frequency-based technology and microchip technology. A RFID technology offers a complete package from security, theft detection, tracking, monitoring, inventory control, and act as an expedient in books circulation or charging and discharging of books; and, lessens the burden of librarians, who could be better redeployed to other productive activities in the service of the readers. Stock verification through RFID system can be done efficiently and accurately, with the help of RFID handheld reader.*

Keywords**: RFID technology, microchip technology, library automation, stock verification, handheld reader.**

1. Introduction

Since the initialization of civilization men has made significant efforts to achieve or to know the unknown. The importance of the library is growing since the use of Information and Communication Technology (ICT) and modern technologies. The basic aim of any library is to provide maximum opportunities to its readers for optimum utilization of available resources. Libraries are central agencies for the dissemination of knowledge in the form of books, journals, audio-video tapes, CD-ROMs, and via digital information services to one and all. Library management software helps libraries to maintain library housekeeping operation easily but to do the same task quickly libraries needed some more advance technology. Automatic identification technology was the solution for this, so libraries have adopted barcode technology for automatic identification of library materials, for some times barcode has supported libraries to automatically identify the library materials but barcode was not sufficient for this, so libraries have adopted RFID technology to serve the purpose. A key thing to understand about RFID is that it is not a single technology; there are hundreds of different RFID products on the market today, and new ones appearing constantly. Radio Frequency Identification (RFID) has come a long way to provide basic components to create a degree of automation in libraries. It is an extended technology of barcodes. It is a combined technology of radio-wave and microchip. RFID was started using many years back in the 1940s for replicated communication system only. In 1980 many business organisations started using it for managing their commercial products. Later on places like- supermarkets, retailers, malls started using RFID for quick identity and also for security purpose. The RFID tag does not have to be visible for detection. Now a day RFID is using many organisations including libraries. RFID system allows item identification in addition to item security in the library. RFID technology not only helps in issue and return but also helps in other works, like library stock verification, arrange the return materials to the shelve more quickly, process newly acquired items more easily and quickly, prevent theft and most importantly security point of view RFID technology is the best solution for any library.

2. RFID Technology

RFID technology is a wireless sensor technology which is based on the detection of electromagnetic signals. It 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, regardless of item orientation or alignment. It is a hybrid system that uses electromagnetic for security and RFID for tracking, but handles both simultaneously with a single piece of equipment. RFID technology promises to change our world. It has the capability of making our personal lives and our professional lives in the library more convenient. RFID was developed in 1948, but its implementations started in the 1970's. RFID in India was introduced in the 1940's for defence applications. The first time it was used for commercial purpose in 1980 for cattle tracking applications. Recent interest is in making RFID technology more ubiquitous in the global value chain. The first library suppliers started to market their systems in the mid-1990. RFID technology has been also applied in a number of scientific and technical fields such as:

- **Medicine:** RFID tagging is used in blood transfusion and analysis. An RFID tag can be attached on a wristband which contains information about a specific patient.
- **Aeronautics:** Boeing ships tagged crates which are loaded with aeronautical equipment.
- **Automotive industry:** RFID technology is used in the assembly of new cars. Tags can be attached to parts of a car and track them during the assignably of new car and track them during the assembly process.
- **Retail industry:** Tags are used to identify and track products along the retail supply chain. The tags can be attached to physical items, such as pens or toothpastes, and transmit an identification signal allowing them to communicate with RFID readers or with each other.

3. RFID Technology in Modern Libraries

The idea of RFID can be simplified to that of a digital barcode and can be used to pick out, tune or locate library holdings on the move. It eases the desk and in the everyday stock renovation. This technology include smart RFID labels, hardware and software program. RFID provides libraries with extra powerful way of managing their collections at the same time as offering more customer support to their purchasers. Many academic and special libraries have adopted RFID technology for its special feature of security of library materials, inventorying functions and high speed circulation.

4. Six viewpoints about RFID technology for Library

- RFID tags replace both the EM security strips and Barcode.
- Simplify Patron self check-in/check-out.
- Ability to handle material without exception for video and audio tapes.
- Radio Frequency anti-theft detection is innovative and safe.
- High-speed inventory and identify items which are out of proper oder.
- Long-term development guarantee when using Open Standard.

5. How RFID technology works in the Library

As a part of technology implementation, the RFID technology works through flexible, paper-thin RFID tags, which can be placed inside the cover of each and every book/study materials. Complete information about each book/study materials is entered in the Library Management Software (LMS). Whenever a user brings a book/ study material for issue-return purpose, the RFID reader from the tags reads the information pertaining to that book and transmits the data into the software and book is issued in a few seconds without the assistance of the library staff. As the user takes the document outside the library, the antenna placed at the exit gate automatically reads the information contained on the RFID tag to verify whether the document is properly issued or not. In case, it is not issued to the user as per the library norms or it is stolen from the library, the antenna senses it and gives an instant alert. Thus, it results in successful theft reduction of documents. RFID technology is not only being used for circulation purpose in the libraries, it is also used for stock taking purpose. The following figure shows the System follow of RFID technology in libraries:

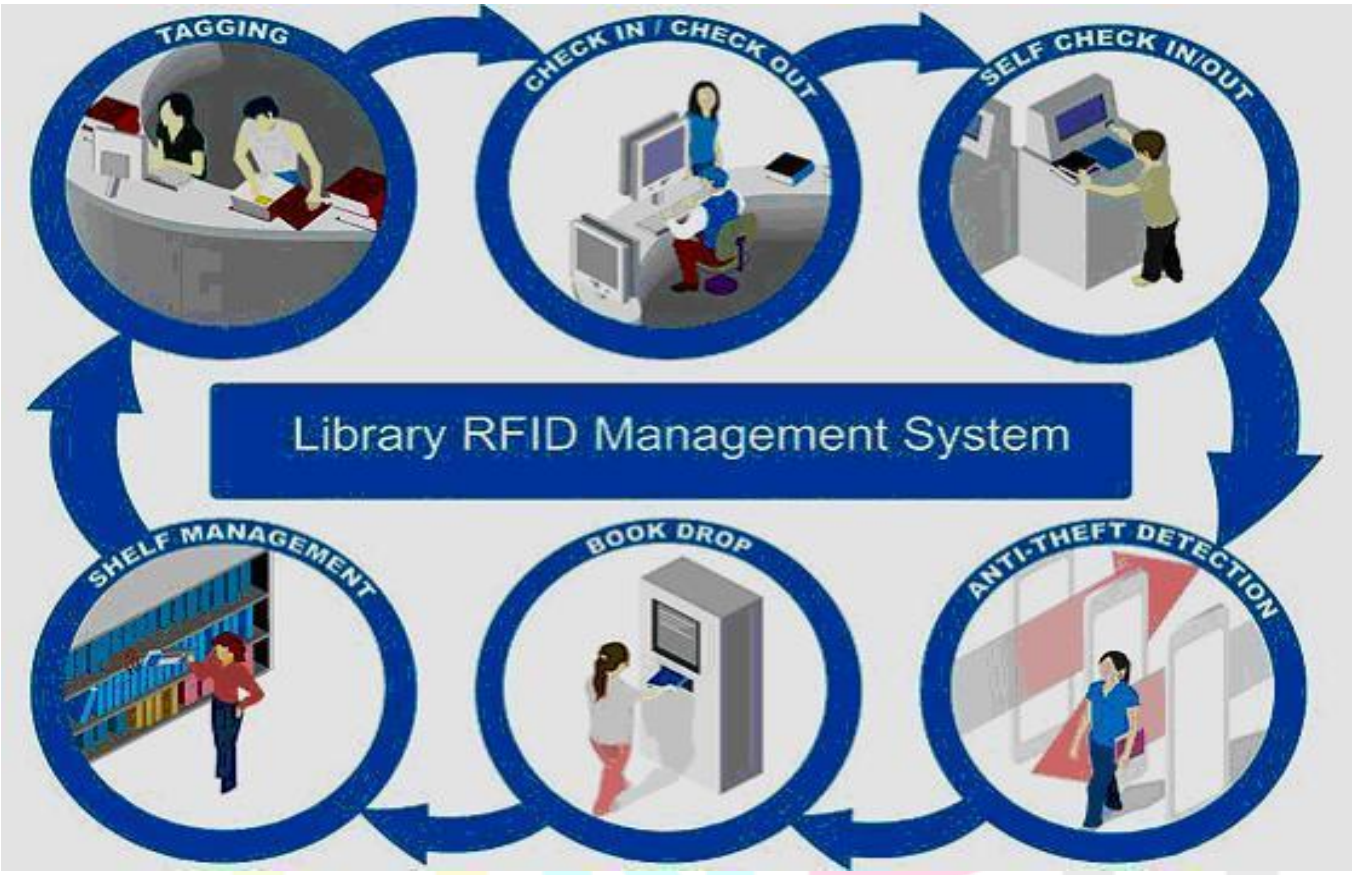

Fig: 1 System flow of RFID technology

6. Components of RFID technology for library

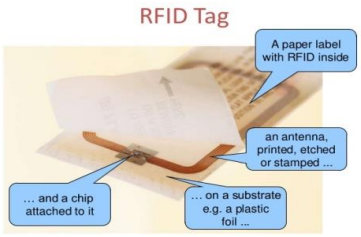

Fig 2: RFID tag

Fig 3: Sticker

Fig 4: RFID smart card

Fig 5: RFID multipurpose staff station

Fig 6: RFID smart card reader

Fig 7: RFID self check-in/check-out station

Fig 8: RFID security gate

Fig 9: RFID handheld reader

An RFID system for library containing the following basic components:

- **RFID tags-**RFID tags are electronically programmed with unique information. There are three types of tags: Read only, WORM (Write Once Read Many) and read/ written. Most of the libraries prefer read/written tags as information can be added or edited as per requirement. Tags are affixed to books, usually at the back side of library books and to read them, reader or exit sensor is used. The life of tags is longer than barcodes. In order to maintain more security magnetic strips can be also used. They are pasted inside the book and difficult to remove; their main function is to detect unauthorized movement of books/study materials.
- **RFID sticker-**It has to be put on the RFID tag in the book, and we can design the cover of the sticker as per our need, it may contain the name of the institution, name of the library users ID and other relevant information.
- **RFID smart card-**After successful completion of tagging all the library books/study materials, the next step is to print the RFID enabled library ID card and then activate the ID cards through the RFID smart card reader, without ID card books cannot be issued to the users. The activation process is same like tagging of books. One message "Card Issued Successfully" will display on the screen after successful activation of the card.
- **Tagging/multipurpose staff station-** Tagging of books and other study materials can be done through the multipurpose staff station. We need open the tagging station application and then put the book/study material in which RFID tag has been pasted on the RFID tagging station, after that we have to enter the accession number of the book/study material in the box displayed in the screen, then click on show, it

will display the bibliographic information of the book/study material after that we have to click on scan and write one after another. After successful completion of tagging "Item Tagged Successful" message will display on the screen.

- **Self check-in/check out station-** The self check-out station allows library member to borrow books without the help of library staffs. It also allows returning of books and updating the database. The Self check-in/check out station is basically a computer with a touch screen and a built–in RFID reader, plus special software for personal identification, books and other media handling and circulation. After identifying the patron with a library ID card, a barcode card, or his/her personal ID number.
- **RFID Security gate-**Theft detection is one of the most valuable features of RFID system, if any user takes a book without checkout the book properly, the security gate will automatically detect the book and buzz an alarm, it will help the library staff to identify the user who is taking the books without proper permission. Because of theft, every year the library faces a huge loss, so after the installation of RFID system, the problem has solved.
- **Handheld reader for inventory and administrative station-** Stock verification through RFID system can be done easily and accurately, with the help of RFID handheld reader we can be done stock verification within a few hours, depends on the collection of the books. The process is like we need to take a tour with the handheld reader in the shelves, the reader automatically collect the accession number of every books available in the shelves, after collection all the data we can export it into an excel file, later we can download the accession register from our library management software with the list of accession number which we found absent earlier. After the final comparison we can conclude with the result, the number of missing books in the library, so it will take hardly one day to complete the entire process, means it saves lots of time of the library staff.

7. Advantages of RFID Technology in Modern Libraries.

- It is very fast.
- Rapid charging/discharging.
- Simplified patron self-charging/discharging.
- Nobody is required for issue/ return process.
- We can get the data less than a second by using RFID technology.
- Increase the security level.
- Setting up the system is one – time job.
- Handling is very easy.
- High –speed inventorying.
- High reliability.
- Long tag life.
- Self-check-in/out can be done using RFID system by the users.
- Library staff can be deployed for other works instead of circulation.
- Time-saving technology for both users and librarians.
- Best tracking system for library theft control.
- Easy to find the misplaced books.
- Fast and exact stock verification can be done using RFID.
- Maintenance is fully automated and easy.

8. Disadvantages of RFID Technology in Libraries.

Some disadvantages are also there while using RFID technology-

- It is very costly to implement as well as maintain.
- Systems fail down problem.
- Less skilled staff for maintenance.
- Vulnerability to compromise
- Removal of exposed tags.

- Exit sensor problems.
- Frequency block.
- User Privacy concern.
- Reader collision.
- Tag collision.
- Interoperability.
- Invalid/damage tag problem.

9. System Requirements for RFID technology

For RFID technology, following hardware and software are required-

- **Tag-** It contains a silicon chip which holds a unique identification number and connected to the database for data transmit/receiving.
- **Reader-** It holds the database and connected to the chip and transmit/receive data through radio wave technology.
- **Computer-**A computer is required for interface and deal with the users'. It may be connected to a server for maintaining the bigger amount of data.
- **Library Management Software-**It is required for maintaining the databases of materials as well as users'.

10. Steps to be followed for Adoption of RFID Technology in Modern Libraries

The major issues on RFID while implementing are the below; librarians should take care of this point before adapting to the new technology.

- Library should have proper planning for budget/timeline of implementation.
- Clear requirement analysis is very important for any technology change, so the librarians should have an appropriate requirement for the library.
- Librarian should be very careful in selecting vendor and the required components.
- Tuning of the antennas on the RFID tags;
- Width between security gates need to be checked for reading and accuracy;
- Size and frequency of RFID tags;
- Check that the tags are suitable for all the library materials (like books, CD, DVDs, etc.);
- Transmitting power generator by the reader and collision issue;
- LMS and RFID integration is essential for successful implementation;
- Vendors' service and response is one of the significant activities in installation;
- Cost involved vs. Returns on Investment;
- Tearing RFID tags by the users;
- Ensure the replacement of damaged tags by the vendors;
- Annual Maintenance Cost (AMC) related issue;
- Power back up is a significant issue nowadays;
- Programmed to not read of tags of other libraries;
- Training the library staff and users of new technology are required.
- Accurate anti-theft alarm should work;
- Users are prohibiting using devices like laptops and electronic devices that may deactivate the alarm.

11. Role of Librarian

The key challenge for librarians today is to improve user services and provide Patrons with a pleasant experience when searching and browsing books. RFID technology significantly reduces management costs and increases the time that Librarians spend with patrons by enabling automated book handling at check-ins, check-outs, collections inventories, book sorting and theft deterrence. RFID plays vital role in redefining the library process to make everyone's job easier right from patron to library staff. RFID technology introduces

an ethical dilemma for librarians. Libraries have traditionally acted to protect and defend the privacy of their patrons and yet some are implementing a technology before proper safeguards have been developed.

Conclusion

RFID system brought the revolution in library and information centres, libraries have become a driving force in the development of RFID for the mass market, RFID system is a prevalent technology that addresses both the security and library materials tracking needs of a library. The RFID technology has become an innate part of all modern libraries, information centres and knowledge centres, and has proved that it is efficient, effective, and user friendly, and expedient. It is much better and improved technology over conventional barcodes system. It provides more effective and efficient circulation services as well as for security of library collections. Today many libraries are using the technology for the prevention of theft in the library. It is essential to educate library staff and library users about RFID technology before implementing it in the library. RFID technology in a library reduces the time needed for circulation duties since multiple tags can be read at a time. Error-free circulation is one of the essential features of RFID technology. Patron self-issue/return kiosk can additionally free up staff from duties in the circulation section. And not only books, but also the membership cards could be fitted with an RFID tag.

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