Redefining Libraries with Technology: Radio Frequency Identification (RFID)

Dr. Mamatha N

Librarian, Government First Grade College, Channapatna Ramanagara Karnataka, India

mungaru17@gmail.com

ABSTRACT

The applicability of the Radio Frequency Identification (RFID) system which is a new generation of Auto Identification and Data collection technology in a future Smart Library Management System (SLMS) is introduced in this paper. It assists with automated business measures and permits the ID of an enormous number of labeled articles like books, utilizing radio waves. The proposed Smart RFID system is a wireless non-contact system that utilizations radio frequency to transfer data from a tag appended to an item, with the end goal of automatic identification and tracking. RFID needn't bother line of sight, it eliminates manual accounting of records, and improves the use of assets like labor, foundation and so forth likewise, less time utilization as the line of sight and manual cooperation are not required for RFID Tag reading. RFID-based Library Management System (LMS) would assist with permitting a quick exchange stream for the library and will demonstrate prompt and long-term advantages to the library in recognizability and security. In the ever-evolving landscape of academia, technology stands as a driving force, shaping how knowledge is accessed, disseminated, and created. As we celebrate the continuous pursuit of excellence within academic Libraries, it is imperative to explore the dynamic role that RFID technology plays in reshaping the traditional contours of Libraries. This article delves into the nuanced impact of RFID on academic libraries, examining both the advantages and potential drawbacks associated with the integration of these cutting-edge technologies.

KEYWORDS: Academic Libraries, RFID, Digital tools, Data collection, Book Drop, Library Management and Services, Library Security, Theft detection.

INTRODUCTION

Libraries of all types and sizes are working to increase engagement, spearhead robust outreach, add programs, and develop and maintain other key services to their communities—all without adding staff. Implementing RFID is a logical, reliable, and fast way for libraries to work smarter and reap the benefits of cutting-edge technology.

RFID technology scans bulk items at once, relieving staff of time spent processing individual items. The borrow and return experience is enjoyable for patrons, and they are delighted to see materials checked in and removed from their accounts instantaneously, allowing them to borrow more without delay. By markedly improving the speed and accuracy of circulation functions, RFID lets staff quickly get materials back onto shelves and into patrons' hands. As

a result, staff can focus on more enriching patron interactions, spend more time developing and enhancing library initiatives and programs, and not be stuck behind the desk. Libraries using RFID report that job satisfaction improves and painful and costly repetitive stress injuries decrease when staff spend more time helping patrons and less time processing materials.

Radio Frequency Identification (RFID)

It is a wireless a non-contact system that uses radio frequency Electro-Magnetic (EM) waves to transfer data from a tag attached to an object, for automatic identification and tracking.

An RFID system has three sections that are a scanning antenna, a transceiver with a decoder to interpret the data, and a transponder the RFID tag that has been modified with data. The scanning antenna puts out radiofrequency signals in a moderately short reach. The RF radiation furnishes a method of communicating with the transponder (the RFID tag) and furnishes the RFID tag with the energy to communicate (on account of passive RFID tags). The scanning antennas can be permanently affixed to a surface, handheld antennas are also available. They can take uses radio frequency electromagnetic (EM) waves to transfer data from a tag attached to an object, for automatic identification and tracking.

RFID has significant advantages over barcode technology. When barcoded items are checked in or out, every single barcode must be carefully aligned with and presented to an electronic reader, a time-consuming process. RFID technology, on the other hand, allows numerous items to be processed immediately, without requiring individual alignments. Barcodes are frequently sensitive, requiring multiple scans before they are successfully read, and they typically end up scratched or otherwise rendered unreadable due to normal wear and tear plus placement on the outside of library items.

RFID can help to protect library materials from theft or inadvertent loss and allows library staff to keep track of individual items at every stage in their circulation life cycles. Like most technology, the constant evolution and modern-day ubiquity of RFID has resulted in far lower costs than when it initially emerged. These days, tags only cost around twelve cents apiece (a far cry from the decades-old, original industry pricing of a dollar per tag). The return on investment with RFID technology is quick and long-lasting, and the saved expenditures can be applied to other areas of library need.

Many libraries use RFID technology in conjunction with automated material handing (AMH) systems to rapidly process returns and other materials, including brand-new library materials received directly from vendors. Productivity is further enhanced through hand-held mobile inventory readers, which library staff uses to scan materials to pull items for holds, transit materials between branches, scan shelves for missing or mids-shelved materials, and take inventory of the entire collection.

OBJECTIVES OF THE STUDY

- ✓ RFID: Understanding the Technology
- ✓ RFID: Library management perspective
- ✓ RFID: Advantages
- ✓ RFID: Limitations
- ✓ RFID: Role of Librarian to Implement

Related Works

Selvakamal etal (2022) in study concludes that RFID is a new breed of auto-identification and data collection technology that helps in the transaction process of the library, automates business processes, and allows the radio wave identification of numerous tagged objects such as books. They propose an RFID-based library a management system that allows for quick transaction flow and makes problem-solving easy. It also adds properties of traceability, security, and benefits in preventing book missing and stock verification of the library books without manual bookkeeping intervention. The proposed system is built around active RFID readers, and passive RFID tags that can electrically store information that can be read by an RFID reader. The system will utilize GSM, or Global System for Mobile Communication, to convey information about the status of a book in the account and its fine associated with its absence from the library database.

Khanna (2014) said the library is an ever-evolving entity. Librarians have always been interested in using new technologies to improve the quality and efficiency of their operations. Today, RFID has revolutionized the working practices of librarians by improving efficiency. RFID has individual serial numbers at a distance. Khan discusses RFID, RFID tags/labels, RFID security gates, RFID Self Service Units, RFID Shelf Management, RFID Automated Check-in/Checkout, RFID Theft Detection, RFID Stock Verification, and many more. He also provides information on RFID technology, how it works, and how it can be used in the library. He will also share with you the implementation of the RFID technology at A.K. Joshi Library, Panjab University.

Suhaimi, Mohamed and Khusaini (2023) accomplished, to augment library use and administration, a radio frequency identification and detection (RFID)-based library management system is necessary. It will use the RFID reader to easily identify and manage the books. Because the database shows whether a book is available at the library, students can use it to search for it and, if it is, pick it up there. The project's primary benefits for libraries are the reduction of manual errors, speedy book access, and time savings.

In a study by Singh (2022), The use of Radio Frequency Identification (RFID) technology in library services and service providers is having a significant impact on various aspects of the library, such as self-checkout, material theft prevention, reading material divide, and much more. The use of RFID in Indian libraries is increasing with the growing awareness of the technology. RFID plays an important role in the essential aspects of libraries, especially for the users and the library professionals, as it saves manual labour and provides quick access to resources. RFID is a long-lasting system that offers software innovation in libraries and enhances the trustworthiness of organizations all over the country. RFID impacts the main component of the library, especially for the user and the library professional, as it reduces labor work and provides quick access of the resources. In this paper, we discuss the impact, benefits, components, and use of RFID within Indian institutions.

HOW RFID WORKS IN LIBRARIES

A RFID system utilizes labels, or tags appended to the items to be distinguished. Two-way radio transmitters-receivers called cross-examiners or readers convey a signal to the tag and read its reaction. The readers generally send their perceptions to a computer system running RFID software or RFID middleware. RFID labels can be either passive, active or battery helped uninvolved. An active tag has an onboard battery and occasionally sends its ID

(Identity) signal. A semi-passive tag has a little battery ready and is initiated when within the sight of an RFID reader. The label's data is put away electronically in a non-unpredictable memory. The RFID tag incorporates a little RF transmitter and recipient. An RFID reader sends an encoded radio signal to interrogate the tag. The tag gets the message and reacts with its identification data. This might be just an exceptional tag serial number, or might be item-related data, for example, a book number, student number, or other explicit data. RFID tags contain in any event two sections: an integrated circuit for putting away and handling data, adjusting and demodulating rat RF signal, gathering DC (Direct Current) power from the incident reader signal, and other particular capacities; and an antenna for getting and sending the signal Fixed readers are set up to make a particular interrogation zone that can be firmly controlled. This permits a profoundly characterized reader region for when tags go all through the interrogation Zone. Mobile readers might be hand-held or mounted on trucks or vehicles. Information is moved between a tag and a reader through low-power radio waves, which are tuned to a similar frequency. To get data from a tag, a transceiver should convey a signal to the RFID tag, making the tag communicate its data to the transceiver. The transceiver then reads the signal, converts it to a digital format, and transmits it to a designated application such as a Library management system. Tagging Tag is the utmost significant link in any RFID system. It can store information relating to the specific item to which they are attached, and rewrite again without any requirement for contact or line of sight. The information inside a tag may give identification to a thing, evidence of ownership, original storage area, credit status and history. RFID tags have been specifically designed to be affixed to library media, including books, CDs (Compact Disc), DVDs (Digital Versatile Disc) and tapes. The part of the librarian is to characterize the books into gatherings and glue the RFID tags on them. These paper-like tags help in following the books inside the scope of the reader.

Check In/Out Service

The counter station is a staff-helped station on administrations like loans, returns, tagging, sorting and so on. The benefactor moves toward the counter to get or return the book. First, the supporters should recognize themselves by utilizing the tags given to them. The staff at the counter at that point utilizes a reader to peruse the tags to make a passage in the central database. If there should arise an occurrence of a book return, the staff gathers the book and reads the tag. On the off chance that the book is returned past the due date, the fine is gathered from the benefactor.

Self-Check In/Out Service

The system fundamentally comprises of a computer interfaced with an RFID reader, in addition to unique software for individual recognizable proof, book and other media taking care of and circulation. In the wake of recognizing the benefactor with a library ID card, an RFID card containing the patron's details and their ID the patron is asked to choose the next action (check-out or check-in of one or more books). After choosing check-out, the patron puts the book(s) in front of the RFID reader and the display will show the book title, author name and its ID number (other optional data can appear whenever wanted) which have been checked out. It shows the date before which the book is to be returned. Whereas within proper limits in, the patron shows the book(s) before the RFID reader and a similar will be shown as under checkout. Plus, if there are delays in the return of book(s), the fine sum will be shown.

Anti-Theft Detection

RFID EAS Gates is the anti-theft part of the Library RFID Management System utilizing a similar RFID tag installed in the library things. Each lane can follow things of around 1 meter and would trigger the alert system when things went through them. The caution will sound and lights on the gate will streak as the supporter goes through with the un-borrowed library material.

Book Drop

The Book Drops can be found anyplace, inside or outside the library. Conceivable remote areas outside the library incorporate MRT/train stations, malls, schools, and so on. This offers phenomenal adaptability and comfort of returning library things at whenever of the day, in any event, when the library is shut. Patron has to place the book on the trays available for book drop. The reader reads the tags and acknowledges the patron of the successful return. The reader updates the backend system and allows loan cancellation.

RFID IN INDIAN LIBRARIES

List of more than 250 libraries comprises leading public, private, academic, medical and research libraries like;

- IIT Delhi
- NLU Delhi
- British council Delhi
- American center Library
- Sapru House Delhi
- NASSDOC New Delhi
- IIM Indoor
- IIM Lucknow
- IIM Ahmedabad

- IISc Bangalore
- IIT Madras
- IIT Kharagpur
- IIT Patna
- IIT Roorkee
- NCL Pune
- NIT Rourkela
- NIT Surat
- University of Pune
- Public Libraries of seven states of India
- IIT Jodhpur
- NIT Srinagar
- IISER Bhopal
- AIIMS Libraries
- North Bengal University, Darjeeling
- Aarupadai Veedu Institute of Technology, Chennai
- Aarupadai Veedu Medical College, Pondicherry
- Datta Meghe Institute Of Medical Sciences, Wardha
- Patna Women's College, Patna
- Maulana Azad Central Library, Bhopal
- Birchandra State Central Library-Tripura
- GCET Safapora, Srinagar
- MGSU Bikaner
- St Aloysius College Mangalore
- NIFT Chennai

MAJOR ADVANTAGES

- RFID improves library workflow by reducing non-value-added work processes
- Hassle free issue/return/renewal
- Improves staff productivity and customer Service
- Increases the security function in library
- Flexible library timings by use of self-charging and book Drop Kiosk
- Quick Inventorying, Shelf Reading, Re shelving, Sorting, Searching, Weeding and exception finding
- Enhanced Customer services and improved process efficiency
- Highly reliable, claims an almost 99.9% detection rate
- RFID tags last longer than barcodes
- EAS Exit gates have option to keep record of incoming and outgoing library users with recording
- Fingerprint or picture may also be integrated with the RFID
- Assist inventory check with ease

- Easy book identification for shelving process

- Assist traceability of book allocation

- Enhance book return processes by full automation of check-in, EAS activation and system updates completed simultaneously in the self-return chute

- 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.

- Items can be placed on reader without careful placement that it is required for line of sight system (bar code scanner)

- Faster inventory process

- Ability to locate specific items

LIMITATIONS

- High cost Interoperability and standardization issues Integration problem of RFID solution with the software/hardware

- RFID system may be compromised with certain devices/conditions

- Moisture,metal,mist,distance and incorrect positioning of antennas may affect functioning

- Physical damage to the tags/removal by the library users

- Documents like magazines,Pamplets may not have good location for bulky RFID tags and tag cost is also significant in their case

- Transition phase may lead to a choos

- Privacy and Ethical issues Vendor support and technology compatibility issues

- Annual maintenance charges of post warranty period are very high

- Training /adoption by the staff and Users

- Frequency Block

- Chances of removal of exposed tags exit gate sensor problems

- User Privacy concern

- Reader collision

- Tag collision

- Interoperability

ROLE OF LIBRARIAN

RFID technology introduces an ethical dilemma for librarians. The technology allows for greatly improved services for patrons, especially in the area of self-checkout, it allows for more efficient use of professional staff and may reduce repetitive stress injuries for library workers. And yet, the technology introduces the threat of hot listing and tracking library patrons. Librarians have taken extra steps to ensure that laws such as the USA PATRIOT Act cannot be used by government entities to invade the privacy of their patrons, and yet many of those same libraries are placing traceable chips on their patron's books.

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. Library use of RFID technology serves to legitimize the technology in the eyes of the community. Therefore, it is incumbent on the library community to ensure that the technology is developed in concert with established privacy principles and that any library use of RFID follows best practices guidelines consistent with library values.

CONCLUSIONS & FUTURE WORK

In library speeds up every one of the cycles like issuing, reissuing returning books, observing books concerning hostility to robbery, books looking through measures. Execution of a system relies upon the data upon the tag, adequacy of RFID reader position, and tag position. Also, they all rely on the expense. Advancements in RFID innovation keep on yielding bigger memory limits, more extensive understanding reaches, and quicker preparation. Updating of manual bookkeeping, books are now more easily traceable, Improved utilization of resources like manpower, infrastructure, etc., Less time consumed as no line of sight is mandatory, limited manual intervention, limited manual blunders, accessibility of the long-lasting tags, quick access to books, are the primary benefits after execution of RFID based LMS. Automated RFID-based library the management system will speed up exchange as giving and returning is presently computerized. In the future, the tag system can be implemented in any type of asset tracking, especially in multi-national offices to keep track of their office files, often DVDs. It can also be used in laboratories for tracking equipment. RFID can be implemented in public transit to avoid unauthorized travel.

RFID-based libraries have a high initial cost, but they also have lower maintenance costs and require less time to operate. RFID adoption is anticipated to happen in libraries at an ever-accelerating rate.

REFERENCES

[1] Khanna, S. (2017). Impact of RFID technology on library services: A case study of AC Joshi Library, Punjab University, Chandigarh. Int. J. Digit. Libr. Serv, 4(2), 117-126.

[2] Malipatil, B., & Nagaraj, J. (2017). Automation of Engineering College Libraries in Kalaburagi and Bidar District of Karnataka State. PESQUISA Online Journal, 2(02), 77- 86.

[3] Patil, A. A. (2022). Rfid Tags and Security Mechanism in Library. International Journal of Advance and Applied Research, 10(1), 350-355.

[4] Selvakamal, P., Rajasekaran, S., Mohan, M., & Ganesamoorthy, M. (2022). RFID-Based Library Management System used in Library. Journal of Remote Sensing GIS & Technology, 8(3), 26-32.

[5] Singh, D. (2022). Use of RFID System and Improvement in Library Services. IJR, 8, 283.

[6] Suhaimi, M. M., Mohamed, Z., & Khusaini, N. S. (2023). Effectiveness of RFID Smart Library Management System. Journal of Mechanical Engineering (JMechE), 12(1), 133-152.

[7] The data is retrieved from http://en.wikipedia/orf/wiki/RFID

[8] The data is retrieved from https://2cqr.in/implementing-rfid-technology

[0] The data is retrieved from www.libsuite.com/lib_rfid.htmlIJARR, 8(12), 2023; 43-48

[10] Wang, J., Alroobaea, R., Baqasah, A. M., Althobaiti, A., & Kansal, L. (2023). Study on library management system based on data mining and clustering algorithm. Informatica, 46(9).

[11] Yusuf, M., Akintunde, A., Habeeb, S., & Quadri, A. (2023). Radio Frequency Identification (RFID) Based Library Management System. International Journal of Technology and Systems, 8(2), 21-35.