RFID Technology and Its Applications With Reference To Academic Libraries

Dr. L. Santhi[1], S. Lakshmi[2], R.Sakthivel[3]

[1](Librarian, PSGR Krishnammal College for Women, Coimbatore)
[2](Asst. Librarian, M.Kumarasamy College of Engineering, Karur)
[3](Asst Librarian, M.Kumarasamy College of Engineering, Karur)

Abstract: *Information is indispensable for human development as air is essential for the survival of living being. The rate of change brought about by information technologies has a key effect on the way we live, work worldwide. The Library services are also actively changing according to the changing digital environment. Today Libraries use current trends in all activities including, selection, sorting and dissemination of information. Today everyone is looking out for ease of access of information and services from libraries. Internet of things which is now the talk of the world is playing a vital role in all aspects of life. Today we can see that there are more than 15 million interconnected and electronic devices in operation globally. The most common example of internet of things tools that is used is the RFID technology This paper is written in order to provide an overview of the RFID technology, its history, RFID technology components and how it works and also pros and cons of the RFID technology is also discussed. This study will also give an idea for the Libraries that are planning to implement automated Library Management System using RFID Technology in future.*
Keywords: *Libraries, RFID Tags, RFID Technology, RFID Reader, Radio Waves*

I. The Promise Of The Internet Of Things

The internet of things is multiple networks of devices or technology platforms that communicate via wireless protocols i.e. without direct human interaction. This enables rapid and efficient transfer of data supporting a wide range of activities and operations. The application of internet of things can also lead to significant improvements in the operation of day to day activities carried out in Libraries with increased efficiency, better performance and enhanced safety.

Library staff handle a tedious task involving sorting, lending, returning, tagging, eyeing of books. In addition to this users also encounter problems in finding, borrowing, renewing, queuing and so forth, To overcome these obstacle, a smart library management system based on an RFID technology is now on the peak. Using low-cost passive tags in libraries reduces the cost of modernization significantly. As such, integrating RFID technology management system makes both the library users and staff's task easy, smart, convenient, and practical.

II. RFID???

RFID stands for Radio Frequency Identification which was invented basically for defense and war purposes. It claims to have patented by Mario W. Cardullo for an active rewritable RFID tag on January 23, 1973. It helps in automatically tracking and identifying objects.
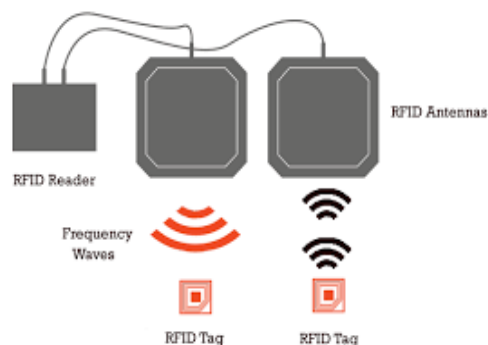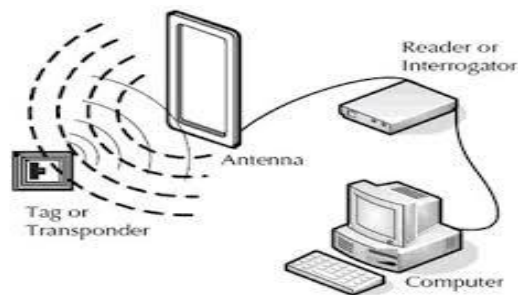

Figure 1

It actually works on the principle of exchange of radio signals between the identification medium and a RFID reader with a combination of microchip and radio frequency technologies.

Basic Components of RFID

Figure 2

III. Libraries and RFID

In today's society librarians have a greater responsibility to organize the Library not only as a store of books but as a knowledge centre due to information explosion. Many Libraries across the globe have already adopted the RFID technology and successfully running the activities. RFID technology is a flexible technology and most convenient to use it as well. As the father of Library Science Dr. S.R. Ranganathan mentioned the fifth law "Library is a growing organism" Librarians are adopting latest technologies to provide better and efficient services to the patrons.

Libraries currently follow the open access system due to which books are lost or misplaced when they are returned. Stock verification process is also not done on a frequent basis to find the lost or misplaced books on time. Bar coding system has been followed in many libraries which is slowly replaced by RFID technology which is more advanced than the bar coding system. The RFID tag contains the indentifying information of a particular document which helps I identifying and avoiding theft or misplacement of the documents in the Library.

IV. RFID And Library Functions

A Library is a collection of information, sources, resources, books, services and the building in which it is housed. Many Libraries now not only act as a resources giver but also a generator where IR is developed and acts as a access point to various resources in multiple storage media like microform, audio tapes, CDs, LPs, Cassettes, DVDs, video tapes etc. Different Libraries use different methods of arranging their materials following different classification systems, so that items can be located easily by the Library users. Basic tasks in Library management includes the planning of acquisition of books & other materials, arranging them according to the classification system in use, preservation of materials, developing and administering the library computer systems. The main problem faced by traditional libraries theft of Library books and materials, non-returns ad misfiled items.

RFID technology here helps in tracking the books and materials, reducing management costs and increases the time the library staffs spend with patrons in accessing the Library resources more effectively and efficiently. RFID technology, during the past few decades have been playing a vital role in redefining library processes in all aspects and increased users satisfaction.

Here are some of the major advantages of implementing RFID technology in Libraries

- RFID tags replace both EM security chips and Barcode
- Simplifies patron self check-out and check-in
- Radio Frequency and anti theft detection is innovative and safe
- Helps in verifying stock with high speed and accuracy
- Long term development guaranteed when using open standards.

V. RFID Components And Its Functions

RFID technology for Libraries include RFID tags, a self check out station, self return book drop with an automatic check in feature, a tagging station, a set of security gates, and shelf scanner for stock verification and administrative reasons. Let us see how these above mentioned components actually work for Libraries.

5.1 RFID TAGS
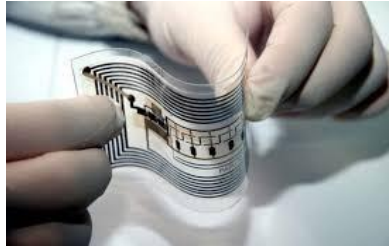
Figure 3

It is considered the heart of the RFID technology and can fixed inside of the Library Books or directly for CDs, DVDs, and other Materials. It works with a microchip that consists of integrated circuits (silicon chip) that are programmed to store unique identification number of the particular book or the materials in Library. The size of the tags depends on the on the antenna, which increases with range of tag and decreases with frequency

5.2 RFID SELF CHECK OUT STATION

Figure 4

Self Check out was first used in groceries and big super markets in the western countries. Now it is been introduced in the Libraries and functioning successfully. Patron needs to just put in their smart id cards in the slot provided and enter their pin. Then they place their books on the scanner, and the books get issued in their account. Here they can get multiple books issued at once as the check out station can scan multiple copies together. These are usually touch screen.

5.3 READERS/SENSOR GATES

Figure 5

RFID reader is a device used to gather information from an RFID tag, which is used to track Library books. Radio waves are used to transfer data from the RFID tag to the reader. It is also called as n interrogator.

Sensor gates alerts the Library staff members in the Library if any Books or other materials are taken outside without having checked out. It works as an enhanced security for Library. These gates are basically of two types. One is that the unique identification number is communicated to the server which in turn checks with the circulation database as to whether is checked out properly or not and then alarms. The next type is that the theft byte is in the RFID tag is already inserted and turned on or off to show if the Library materials are checked out or not. Here there is no communication with the circulation database. Basically it acts as a link between the RFID tags and the server.

5.4 STAFF STATION WITH ANTENNA

Figure 6

RFID staff station is a staff assisted station to tag and register the Library Materials into web based Library Software Stock Management System. Here the Books are inserted with the RFID Tags and the Anti theft Sticker which protects the Tags from exploited. It is loaded with arming and disarming module, tagging and sorting module. The Arming/disarming module inside the RFID tag of the Library materials to be set to trigger or not triggers the alarm of the EAS gate. The staff puts the Library Book or Material on the reader and assigns the unique identification numbers (accession number) which is then stored in the server as well.

Together with circulation module this station is also used for other services like, editing and updating of patron's record, generate loan history for a particular patrons, program of new Library material etc.

5.5 SHELF MANAGEMENT SOLUTION

The shelf Management solution makes locating and identifying items on the shelves an easy task for the library staff members. It consists or a portable scanner and a base station. It helps in search for books requested by the users, during stock verification and to find out any misplaced books as well. These functions are performed by sweeping the portable scanner across the spines of the books on the book shelves. After Stock verification a discrepancy report could also be generated.

Figure 7

5.6 SERVERS

A Server is configured with RFID system and acts as a communication gateway among various components. It received information from the readers and checks the information from with the circulation database of the integrated Library Management System.

5.7 RFID SMART ID/ACCESS CARDS

Figure 8

Smart ID cards provide an optimal technology for secure and accurate identity verification. SMART ID cards/access cards are provided to the Library users which enable the users to access the Library like check in or check out the Library materials, access RFID gates at the entrance of the Libraries or many other purposes like attendance, transport, mess and even for tracking the students. User's information like their names, address, contact information, etc are printed on their ID cards. The data provided are completely protected.

VI. Major Pros And Cons Of Rfid Technology

6.1 Pros
- Speedy and easy access to the users in getting books charged and discharged.
- Reliable and accurate high speed stock taking.
- Long life of RFID Tags
- Materials handling in Libraries are fully automated.
- Library Stock Management is really helpful using RFID technology
- Reduced Staff Management in Libraries.
- Circulation Process needs less time.
- Liberty to have access to Library 365 days(24*7)
- Automatic counter(RFID gate) helps in generating reports of footprints inside the library 6.2 Cons
- The Cost for implementing RFID technology is high in academic Libraries due to budget constraint.
- Users Privacy tends to get assaulted
- Collision problem in Readers and Tags.
- Lack of international Standard for RFID technology
- Personal relationship between the staff and the Library users may be reducing.
- Totally dependent on electricity and during power cuts Library activities may get stuck.

RFID AND BARCODE TECHNOLOGY
1. Barcodes uses a senson and light to read the data on the tag while RFID uses radio signals and no need of line of sight to get data Barcode scanners can only process tags one at a time while RFID scanners can process many at a time
2. Barcodes are simple and can be easily replicated while RFID is more complex and secure
3. RFID tags can be hidden to protect against the environment while barcodes need to be exposed
4. Barcodes are cheaper and RFID tags are relatively higher.

RIFD- THE DRIVING FORCES IN LIBRARIES
1. Costs are reducing,
2. Evolving global standards,
3. Improving technology,
4. NFC Tags,
5. Increasing success stories

CHALLENGES IN RFID IMPLEMENTATION
1. Need ICT infrastructure
2. Requirement of internet/Wi-Fi facilities
3. Resource generation and funding
4. Skilled manpower
5. Standardization
6. Security in Digital Libraries
7. Sustainability and Maintenance
8. Taking initiative and Budget constraint

MAJOR VENDORS OF RFID SOLUTIONS ACROSS INDIA

Table 1

S. No.	Company Name	Contact Details
1	Daphne Systems	New Delhi / 099584 70793
2	Gyantech software Solutions Pvt.Ltd.	Mumbai / 022 2590 0003
3	EduTech	Pune / 098908 98348
4	Ecole Solutions	Bengaluru / 080 2657 1555
5	Avid Software Soultions	Telangana / 098490 07614
6	Greenfuturz	Chennai / 044 4352 0740
7	2cqr	Chennai / 044 4201 9491

VII. Conclusion

It is quite clear from the above discussion that an RFID system would help Libraries serve in a more efficient and effective manner that addresses both the security and materials tracking needs of a Library. It is also important that the staff and library users about RFID technology before actually implementing it. If your Library is thinking of automating it, RFID is on the go option and cannot ignore the fact. In future the technology is still in the rise with the implementation of NFC tags that are more effective than RFID tags.

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