EXPLORING RFID TECHNOLOGY APPLICATION FOR MANAGING LIBRARY AND INFORMATION SERVICES IN UNIVERSITY AND INSTITUTIONAL LIBRARIES OF NORTH EAST INDIA: AN OVERVIEW

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Abstract

The first part of paper describes about the concept, historical development, components of RFID Technology. The paper discusses about the proposal to study the status of RFID implementation in University and Institutional Libraries of North East India. As the RFID Technology application in libraries and other business organizations are gaining momentum, there is an urgent need for exploring the possibility for using RFID Technology in Library and Information Centres of North East India and discuss many issues and challenges to implement RFID Technology and University and Institutional Libraries of North East India. The second part of paper highlights the application of RFID Technology for managing housekeeping operations of university and institutional library services effectively. A brief outline of Research Project for Implementing RFID Technology in University and Institutional Libraries of North East India has also been described in brief.

Key Words : RFID Technology, University Libraries , Institutional Libraries, North east India , Library and Information Services

1.0 INTRODUCTION

In today's information society the librarians have a great responsibility to organize and manage the knowledge center due to exponential increase the volume of information which

leads to the information explosion. Libraries are moving towards adopting latest technological environment. Libraries are regarded as the 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. The basic aim of any library is to provide maximum opportunities to its readers/end-users for optimum utilization of available resources. So, libraries have been seeking technological support to improve their organizational setup for providing effective customer services and also manage various services. Previously Barcode technology was one such tool, which has been used to improve the efficiency of libraries all over the world. Now libraries and information centers have started using Radio Frequency Identification (RFID) systems to replace their electro-magnetic and barcode systems in the late 1990s.

As its name implies, the term RFID is generally used to describe any technology that uses radio signals to identify specific objects. RFID technology is primarily intended to reveal a current change in the library user service from the semi-automated to the fully-automated mode (Chan and Ying, 2005). It is a fast growing technology used in libraries for enhanced circulation capabilities, better inventory control, reliability (Ayre, 2006), minimizing theft of documents (Goldingand Tennant, 2008; Sumi and Kumar, 2007; Makhdumi and Verma, 2007), and provides batch access and storage of mass data. The implementation of RFID technology certainly improves service efficiency for libraries and enables more diversified applications and service modes. However, as stated by Yu (2008)*"regulating necessary standards, processes, and interfaces to fit in with current information systems and extend automatic library operations requires continuous effort"*. 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. At present, when libraries of all kinds are facing economic hardship the overwhelming reason for considering RFID technologies is the most beneficial one, not only for improving the quality of service also for promising to relieve repetitive strain injury, speed patron self-checkout, and make possible comprehensive inventory. (Madhusudhan, 2010).

RFID tag implementation can be a time-consuming, distracting, and expensive process for any library system. Simply stated, the commitment required is greater than most libraries can successfully support. RFID 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 (i.e., the technology does not require line-of-sight or a fixed plane to read tags as do traditional theft detection systems). The RFID gates at the library exit(s) can be as wide as four feet because the tags can be read at a distance of up to two feet by each of two parallel exit gate sensors.

1.1 NORTH EAST INDIA

North Eastern Region (N E Region) of India has attracted attention of the government of India since two decades for overall development of the region which comprises of seven states which is popularly known as seven sisters and recently in 2001 the eight States "Sikkim' has been included in the North Eastern Region. These states are viz., Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. North Eastern Region is bestowed with eight Central Universities, (Assam University, Silchar; Tezpur

University, Tezpur; NEHU, Shillong; Nagaland University, Kohima; Mizoram University, Aizawl; and Manipur University, Imphal and Rajiv Gandhi University, Arunanchal Pradesh Tripura University, Agartalla and Sikkim University, Gangtok), two State Universities (Gauhati University and Dibrugarh University), two Agricultural Universities (Agricultural University, Jorhat and Central Agricultural University, Imphal,), seven Medical Colleges, three Engineering Colleges, one each Medical Research Institute, ICAR Laboratories, Advanced Studies in Science &Technologies, Centre of Plasma Physics, Agricultural University, Forest Research Institute and NERIST and 247 Colleges supporting under-graduate and graduate level courses. Besides these institutions , few institutions of national importance like IIT, Guwahati, IIM , Shillong, Sikkim Manipal Institution of Medical Science, North Eastern Regional Institute of Technology, Ita Nagar, National Institute of Technology, Silchar , Aizwal, Nagaland , Imphal and Agartalla and North Eastern Regional Institute of Medical Sciences, Shillong have been established for the faster growth and the development of the backward and remote area of the North Eastern States for spreading the benefits of higher education and research (Sinha,2012).

2.0 REVIEW OF LITERATURE ON RFID TECHNOLOGY APPLICATION

In order to know the latest development in the area of RFID Technology and its applications in Indian University and Institutional Libraries , the literature available in primary and secondary sources of information have been meticulously scanned and summary of some of the studies have been enumerated here. As market for RFID Technology is still at a nascent stage in India, not many studies have been done research on this topic in Indian context .However, some available literatures are reviewed which revealed information about the preliminary information about the RFID Technology highlights various components and challenges for the adoption and implementation in Indian libraries (Bhavanishankar and Galagali (2013; Somvir and Kaushik (2011) . Tilwani and Agrawal (2011) in their paper discussed about RFID applications and its benefit for managing libraries.

Most of the articles discussed about the RFID technology, its components , its usage in managing library activities which are still at initial stage of implementation at many libraries in India (Vasishta ,2009; Anjaiah and Lingaiah ,2008; Asghar and Vaidyanathan ,2008; Kumar, ,2008; and Rajasekar, Dhanakar, Pandian and Malliga , 2008; Maheta and Jani , 2007 ; Pattanaik, 2007; Sumi and Kumar, 2007; Doraswamy, Sreenivasulu and Rani,2006; Nisha, Bakhshi, and Ali,2006; Varma and Ahmed,2006;).

Yu (2005) and Yu (2011) has conducted a case study on Implementation of RFID Technology in Library Systems in Turku City Library and discusses about the key role played by the RFID technology in patron satisfaction and it can effectively improve the self-service and the collection management, which correspondingly leads to improving the patrons' satisfaction with using the library.

Ghosh (2010) describes the RFID (Radio Frequency Identification) as a latest technology which has been used in different industries for security and theft detection. He discussed about the usage of RFID technology with special reference to SVNIT library, Surat. The author mentioned the cost –effectiveness of the RFID technology for modernisation of libraries which involves more cost at initial stage and then it is cost effective which is accurate, cost saving and minimize the manpower.

Nagalakshmi (2010) describes about the implementation of RFID Technology in academic libraries of India and discussed about various feature of the technology. Madhusudhan (2010) in his paper examined the usage of RFID technology in libraries located at Delhi which highlights that the efficiency of library services has increased after the implementation of RFID technology in libraries. Bansode and Desale (2009) also discussed about the Implementation of RFID technology in University of Pune Library and highlighted the improvement in the library services in university library of Pune University.

At International level also Butters (2008) , Engel (2006) and Kotecha (2008) , and Koneru (2004) has discussed about the implementation of RFID technology in Australian Academic libraries and highlights the barriers in implementing it in the libraries and using RFID for library automation respectively. Mulla and Chandrashekara (2006); Waddenkeri, (2006), and Shahid (2005) have discussed the role of RFID in libraries for Physical Information Security , Circulation, Tracking, Inventorying, and Security of Library Materials

3.0 RFID TECHNOLOGY: AN OVERVIEW

The origin of RFID Technology has been understood since 1930s emerged out from the concept of "mirror-sunlight-reflection". For centuries we have known how to communicate message with just a mirror by flashing the sun's reflection in the direction of recipient, so that message can be sent through air, simply by reflecting radiated sunlight. The basic theory behind RFID is same, but difference is here, it reflects "radio-wave". The first application of RFID had shown during 2nd world war (used with Radar). However, its commercial application started to be realized from1980s onwards. The most common application are tracking person and objects, identifying goods in supply chain, reusable container, high value tools and other assets, is also used for security including controlling access to building and networks and payment systems. So now it has become a part of everyday life. (Pattanaik, 2007).

According to Chachra (2003) Radio Frequency Identification (RFID) is the technology that is slated to replace barcodes in library applications. It is a form of identification that is contact-less and does not require line of sight. The technology, though new to libraries has been in use in other sectors for more than 20 years. The RFID tags are placed in books and generally covered with a property sticker. Antennas of different sizes, based on application, are used to read the tags and manage the various library functions.

3.1 Components of RFID Technology

An RFID system for library contain of six components, i.e. RFID tags, a staff check-out station, a self-return book drop with an automatic check-in feature, a tagging station, a set of security gates, a shelf scanner for inventory and administrative station. The self-check-out station allows library member to borrow books without the help of library staff: the book drop allows returning of books and updating the database; shelving station speed up the process of sorting return books for re-shelving. But mainly and basic components RFID system contains of three main components.

3.11 A comprehensive RFID system has following components:

3.111 RFID Tags

The tags are electronically programmed with unique information. The tag is paper thin, flexible and approximately 2"x 2" in size which allows it to be placed inconspicuously on the inside cover of each book in a library's collection. It consists of an etched antenna and a tiny chip which stores vital bibliographic data including a unique ID number to identify each item. This contrasts with a barcode label, which does not store any information, but merely points to a database.

3.112 Readers or Sensors

These components are available in various shapes and sizes to suit respective applications within the library, and are often integrated into one enclosure for that specific purpose i.e. patron self-check-out machines and inventory readers. The reader powers the antenna to generate an RF field. When a tag passes through this RF field, the information stored on the chip is decoded by the reader, and sent to the computer system or Central Server which in turn, communicates to the Library Information System.

3.113 Server/Docking Station

The server is the heart of some comprehensive RFID systems. It is the communications 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.

4.0 RFID Technology used for other kinds of Applications

The RFID tag can be affixed to an object and used to track and manage inventory, assets, people, etc. For example, it can be affixed to cars, computer equipment, books, mobile phones, etc. RFID can be used in a variety of applications, such as:

- Access management;
- Tracking of goods;
- Tracking of persons and animals;
- Toll collection and contactless payment;
- Machine readable travel documents;
- Smart dust (for massively distributed sensor networks);
- Tracking sports memorabilia to verify authenticity;
- Airport baggage tracking logistics.

5.0 RFID TECHNOLOGY APPLICATIONS IN UNIVERSITY AND INSTITUTIONAL LIBRARIES

Radio Frequency Identification (RFID) Technology has changed the concept of security all over the world by giving smart cards for an individual's identification. The use of RFID has now been extended to libraries, so as to keep them efficient and competitive in an ever-changing environment. The technology is applied to a variety of activities in libraries nowadays like totally automated check in / check- out (without the intervention of the library staff), theft detection, stock verification etc. and comprises many components including RFID tags/labels, library staff station, security gate, self-service units, shelf management etc. and it can be extended to many more areas in future. Being a new technology its potential is to be elaborated a little.

RFID tags are flexible and paper-thin with an electronic chip. When placed into books of other media, theses tags /labels can be read and written to using radio frequency, that operate without contact and line of sight. It has in-built EAS function, to detect thefts and is designed to last for the lifetime of the item they identify. The library staff station facilitates handling of material shaving RFID tags. Through a modern graphical user interface, many functions can be run on this station. Once the label is placed in the document, its identification such as accession number/shelf location is registered in the chip of the label. This information is either to be taken form the library database or it is directly taken from the book by scanning the barcode on the book. Thus, these ID tags are used for check in/check- out purposes.

After establishing the validity of the member through the smart card, the documents to be checked out are placed on the deck of the station. Library database is updated automatically by putting the book in the borrower's account and theft detection system of the label is deactivated. When the document is to be returned, the borrower has to place it on the deck and it gets checked in and the theft detection mechanism is activated. Fine, if any would be calculated and a slip maybe printed at this time. If the document is to be renewed, it is to be placed on the deck and can be renewed after checking the validity of renewal and a new due date is to be confirmed (Nagalakshmi, 2010)

5.1 Implementations of RFID Technology used by Indian Higher Educational Libraries in India

Recently, many Indian institutions and corporate libraries have started deploying RFID in their libraries. Following libraries have already started implementing RFID Technology in India: (Nagalakshmi, 2010) List of universities and institutions might be more and many are looking for adopting RFID Technology for their library housekeeping operations. In North East India also few libraries have already started implementing RFID Technology application for their library activities and some libraries are in the process of finalization of the project. As the cost of implementing RFID Technology is huge , so many libraries have been facing financial problems despite their willingness to adopt this technology. Many hurdles are there but LIS professionals working in different libraries have positive attitude for applying RFID Technology in their libraries.

Table-2: Implementation of RFID Technology in University and Institutions of Higher Learning in India

Sr. No.	Name of the Institution	City	State
1	Indian Institute of Technology	Chennai	Tamil Nadu
2.	Indian Institute of Technology	Kharagpur	West Bengal
3.	Indian Institute of Management	Shillong	Meghalaya
4.	Indian Institute of Management	Indore	Madhya Pradesh
5.	Indian Institute of Management	Lacknow	Uttar Pradesh
6.	Indian Institute of Management	Kozhikode	Kerala
7.	Great lakes Institute of Management	Chennai	Tamil Nadu
8.	National Institute of Technology	Surat	Gujarat
9.	National Institute of Technology	Silchar	Assam
10	Chandragupt Institute of Management Patna	Patna	Bihar
11.	Pandit Deendayal Petroleum University	Ahmedabad	Gujarat
12	Sandip Institute of Technology and Research	Nashik	Maharastra
13.	Marwadi Education Foundation Group of Institutions	Rajkot	Gujarat
14.	BCL	Delhi	New Delhi
15.	Mizoram University	Aizawl	, Mizoram
16.	North Eastern Hill University (NEHU)	Shillong	Meghalaya
17.	Nirma University	Ahmadabad	Gujarat
18.	Anna University	Chennai	Tamil Nadu
19.	Jaykar Library, Pune University	Pune	Maharashtra
20.	Punjab University	Chandigarh	Chnadigarh
21.	IISC	Bangalore	Karnataka
22.	IGCAR	Chennai	Tamil Nadu
23.	PRL	Ahmedabad	Gujarat
24.	IMSC	Chennai	Tamil Nadu
25.	Babaria Institute	Vadodra	Gujarat
26.	Parliament Library	Delhi	Delhi
27.	Kerala State Library	Trianathapuram	Kerala
28.	Bank of Baroda	Mumbai	Maharashtra

6.0 SERVICES PROVIDED BY RFID TECHNOLOGY IN LIBRARIES

6.1 Self Service

Right now by far the most popular use of RFID is in providing or enhancing self-service operations. There are two main reasons for this. Firstly self-service is seen as the "quickest win" available and offers significant cost savings on circulating stock (Figure-1, 2, 3).

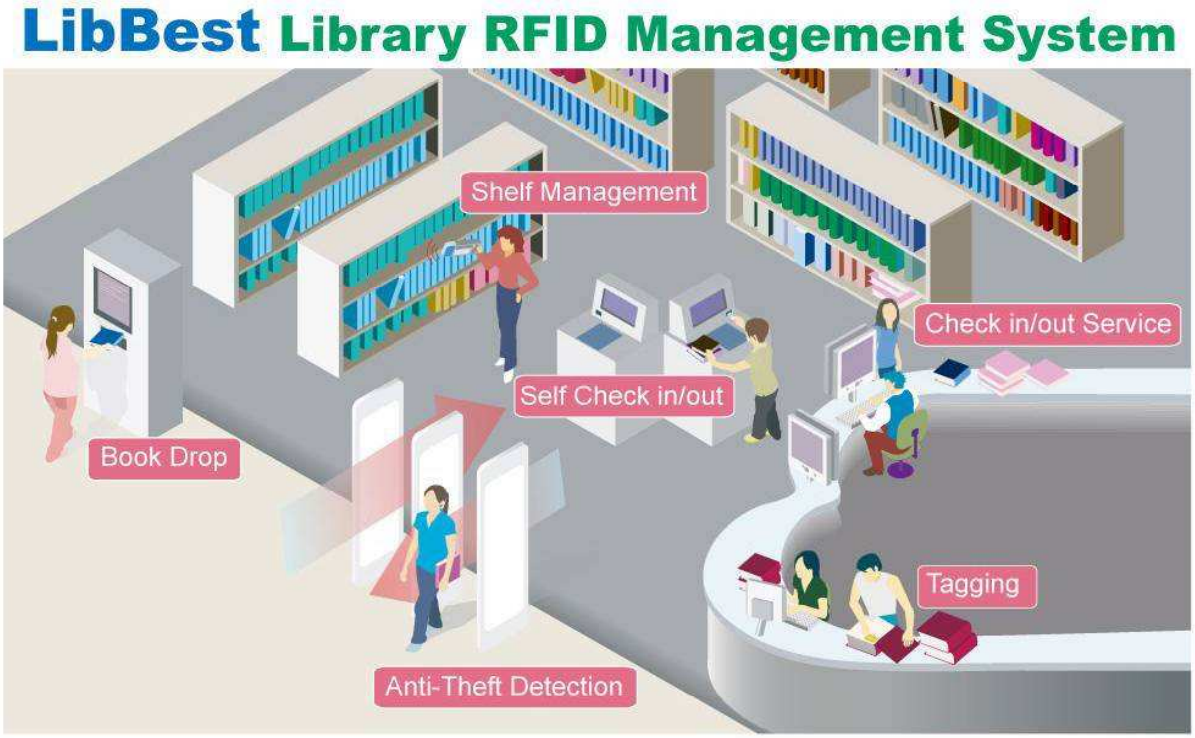

Figure-1 : Photograph Showing the Library Using RFID Technology

(Source : http://www.libbest.com/rfid.html)

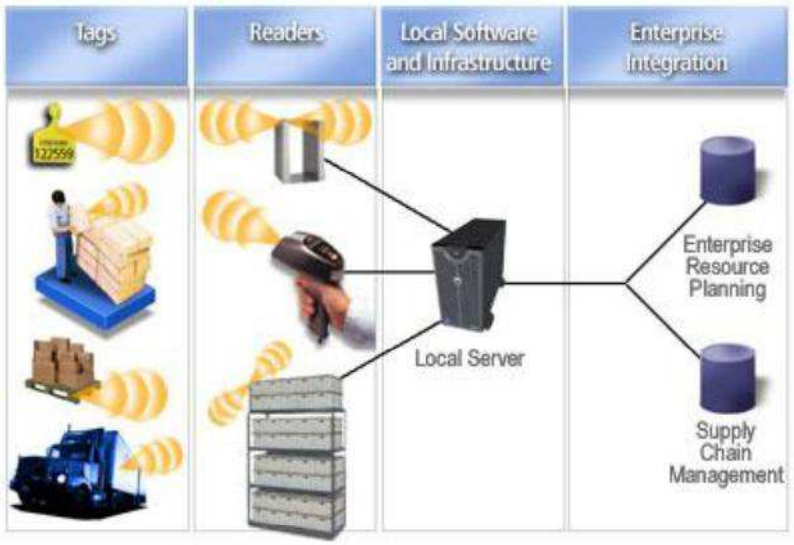

Fig- 2(How Does RFID Works ?)

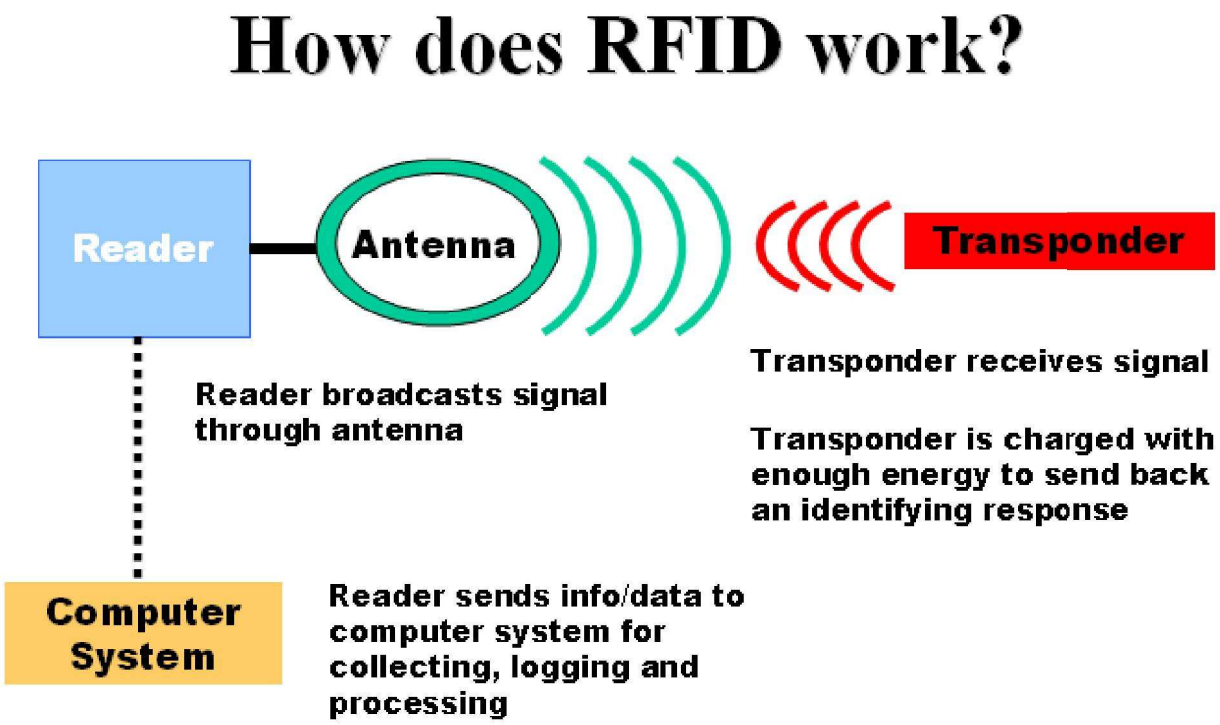

Figure -3 : How Does RFID Works

(Source : http://hotcaketechnologies.com/technology.php)

6.2 Self-Return

6.21 Combined Issue/Return

In many instances Issue and Return functions may operate on the same unit. Most suppliers will offer the flexibility to operate units selectively as "Issue only", "Return only", or "Issue and Return".

6.3 Fine/Charge Payment

6.4 Automatic Sorting

6.5 Security

6.6 Stock Management

6.7 Accessioning

7.0 PROSPECTS OF APPLICATION OF RFID TECHNOLOGY IN UNIVERSITY /INSTITUTIONAL LIBRARIES OF NORTH EAST INDIA

7.1 Gaps in research area

RFID technology is an emerging area of research and still is in its initial phase of adoption facing a number of issues; therefore, several research gaps exist between the performance of RFID systems and its associated issues. Due to various real time ambiguity constraints in such systems, soft computing techniques like fuzzy logic (to map the real-world uncertainty), genetic algorithms (to solve problems of high complexity), advanced techniques like CDMA (Code Division Multiple Access) techniques are yet to be applied to such systems in order to effectively address the problems in existing RFID systems leading to enhanced performance. Moreover, the technical and precise research gaps in relation with RFID systems are identified during the literature survey.

During literature survey the researcher found that in India a very less number of libraries have implemented RFID technology, and in North-East India the number of implementation is very much poor. The libraries should have provided RFID awareness programme, it may aware some libraries and they may implement the RFID technology. Cost is another major factor for not implementing this technology; if the vendor minimizes their cost some more libraries may implement this RFID technology. Government should take some steps for implementing the RFID technology. Govt. may provide some subsidies for private institutions and universities for implementing RFID technology. The researcher here tries to focuses the application of RFID technology for this purpose the researcher chooses a research topic ***"RFID Technology and its Application in University and Institutional Libraries of North-East India."***There were no such studies has been conducted by any other researcher earlier.

Following gaps have been identified where research studies may be conducted. These areas are:

1. No such studies has been conducted on implementation of RFID Technology in University and Institutional Libraries of North-East India;
2. Most of the studies are based on theoretical concept about RFID Technology and its application in libraries;

Out of above mentioned area, research project proposal can be submitted on the topic ***"Implementation of RFID Technology in University and Institutional Libraries of North-East India."*** which is under preparation stage.

8.0 CONCLUSION

The RFID Technology is very new for library community and the use of RFID in libraries is very essential part of upcoming years. The major characteristics of RFID technology is to provide high-speed inventory and identify items which are out of proper order. It is the responsibility of library community to conduct a comprehensive technology assessment of RFID as soon as possible to make the best possible decisions involving the implementing this technology. The implementation of this technology will change our personal and work lives in library and adorns the conventional library management with a new idea and usher for a

future. Libraries that choose to implement RFID technologies in advance of policy safeguard being put in place should take extra precautions to follow evolving best practices guidelines. Librarians and Information managers are the leaders in protection and managing the intellectual freedom &user privacy, and it needs to have some responsive & strong determination in implementing RFID Technology.

RFID refers to the process of grabbing and retrieving data from integrated circuits using 'radio frequency' transmission. RFID seen as the next generation of the barcode offers libraries marvelous opportunities by contributing to saving time and manpower and creating cost efficient and total quality services. Embedding books and other library items with radio frequency identification chips, widely known as RFID tags, would improve efficiency by helping staff track materials better, deter theft and allow patrons to check out books faster.

An Integrated Library System harnessing RFID Technology, convert a traditional library into a 'Book smart Library' by reducing queue times at circulation desk, quick inventory control without handling books, trouble-free identification of misplaced books, automatic book sorting and theft prevention and more time for library staff to assist the patrons. However, careful analysis of potential implications relating to" individual privacy" is global imperative, since privacy advocates worry about what happens when the RFIDs leave the library.

Although, the RFID Technology is quite expensive, still it has yielded excellent results for the all the organization. The technology is set to become more popular in India with more deployment in the coming time in different sectors. It has been proved that this technology reduces the labour, costs and provides efficient results, which leads to fool proof security and access control. The only barrier in the journey is high cost of it, but it is expected that in coming days the cost will come down further and very early we will witness the mass adoption of this technology in various libraries across India and other parts of the World.

REFERENCES

1. Anjaiah, M. and Lingaiah, Vuppala. (n.d.). Application, Implementation & Development of RFID (Radio Frequency Identification) Technology in Modern Libraries. (Retrieved on 04/04/2014: http://libsys.co.in/download/rfid_in_libraries.pdf).
2. B, Bhavanishankar, and Galagali, Rajani. M. (2013). RFID: An Overview. Indian Journal of Information, Library & Society, 26, N3-4, Pp.173-178.
3. Butters, Alan. (2008). RFID in Australian Academic Libraries: Exploring the Barriers to Implementation. Australian Academic & Research Libraries, 39(3), Pp.198-206. (Retrieved on 18/03/2014: http://www.sybis.com.au/Sybis/AARL39(3)Butters.pdf).
4. Coyle, K. (2005), Management of RFID in Libraries. Journal of Academic Librarianship, 31(5), Pp.486-489.
5. Dabas, Chetna. (2011). Design of Accelerating Techniques for Performance Issues In RFID Systems. PhD thesis, Department of Computer Science Engineering and Technology, JAYPEE Institute of Information Technology. (Retrieved on 28/02/2014: http://shodhganga.inflibnet.ac.in/handle/10603/3353).
6. Dowaswami, M., Sreenivasulu, R. and Usha Rani, K. (2006). RFID Technology in library: An overview. In 4th International Convention CALIBER-2006, Gulbarga, 2-4

February, 2006, INFLIBNET Centre, Ahmadabad, Pp.519-521. (Retrieved on 30/01/2014: http://ir.inflibnet.ac.in/bitstream/1944/1105/1/60.pdf).

7. Engel, Elena. (2006). RFID Implementations in California Libraries: Costs and Benefits. U.S. Institute of Museum and Library Services. (Retrieved on 18/03/2014: http://www.kcoyle.net/RFIDCostsBenefits.pdf).
8. Ghosh, T.B. (2010). Application of RFID Technology in Sardar Vallabhbhai National Institute of Technology (SVNIT). (Retrieved On 04/04/2104: Http://Eprints.Rclis.Org/11357/1/RFID_Paper_Alahabad%5B1%5D.Pdf).
9. Givens, Beth. (2004). RFID Implementation in Libraries. American Library Association. (Retrieved on 18/03/2014: https://www.privacyrights.org/ar/RFID-ALA.htm).
10. Kern, C. (2004). Radio-frequency-identification for security and media circulation in libraries. The Electronic Library, 22 (4), 317-24.
11. Koneru, Indira. (2004). RFID Technology: A Revolution in Library Management. In 2nd International CALIBER-2004, New Delhi, 11-13 February, 2004, INFLIBNET Centre, Ahmadabad, Pp.412-418. (Retrieved on 30/01/2014: http://ir.inflibnet.ac.in/bitstream/1944/362/1/04cali_54.pdf).
12. Kotecha, Dhaval H. (2008). Automation in Library using RFID Technology. In 6th Convention PLANNER - 2008, Nagaland University, Nagaland, November 06-07, 2008, INFLIBNET Centre, Ahmadabad, Pp.76-83. (Retrieved on 18/02/2014: http://ir.inflibnet.ac.in/bitstream/1944/1106/1/3.pdf).
13. Kumar, Rakesh. (2008). Role of RFID in Academic Libraries. In 6th Convention PLANNER - 2008, Nagaland University, Nagaland, November 06-07, 2008, INFLIBNET Centre, Ahmadabad, Pp.120-126. (Retrieved on 28/01/2014: http://ir.inflibnet.ac.in/bitstream/1944/1245/1/11.pdf).
14. Maheta, M. and Jani, J. (2007). RFID Technology: A Changing Scenario and New Pilgrim for Library. In In 5th International CALIBER -2007,Panjab University ,Chandigarh,08-10 February,2007, INFLIBNET Centre, Ahmadabad, Pp.468-476. (Retrieved on 30/01/2014: http://ir.inflibnet.ac.in/bitstream/1944/1423/1/468-476.pdf).
15. Margam, Madhusudhan. (2010). RFID Technology Implementation in two Libraries in New Delhi Program: Electronic Library and Information systems. 44(2), Pp.149-157. (Retrieved on 04/04/2014: www.emeraldinsight.com/journals.htm?articleid=1858344).
16. Mulla, .K R. and Chandrashekara, M. (2006). Application of RFID in Libraries for Physical Information Security - A View. In 4th International Convention CALIBER-2006, Gulbarga, 2-4 February, 2006, INFLIBNET Centre, Ahmadabad, Pp.500-506. (Retrieved on 18/02/2014: http://ir.inflibnet.ac.in/bitstream/1944/1100/1/56.pdf).
17. Nagalakshmi, L. Radha Alias. (2011). Deployment of RFID (Radio Frequency Identification) at Indian academic libraries: Issues and best practice. International Journal of Library and Information Science, 3(2), Pp.34-37. (Retrieved on 04/04/2104: http://academicjournals.org/article/article1379512040_Radha.pdf).
18. Naure, M. and Kern, C. (n.d.). Implementing RFID in Libraries for Automation – Experiences from over 20 current installations. (Retrieved on 18/03/2014: web.zhbluzern.ch/LIBER-LAG/PP.../M.../Praesentation_Bozen_03.pdf).
19. Nisha, F., Bakshi, S I. and Ali, P M Naushad. (2006). RFID System: A Boon for Librarians. In 4th International Convention CALIBER-2006, Gulbarga, 2-4 February, 2006, INFLIBNET Centre, Ahmadabad, Pp.549-557. (Retrieved on 30/01/2014: http://ir.inflibnet.ac.in/bitstream/1944/1112/1/64.pdf).

20. Pattanaik, Bibhutibhusan. (2007). RFID an issue for Indian Library. (Retrieved on 18/03/2014: http://bibhutipattanaik.blogspot.in/2007/05/rfid-issue-for-indian-library.html)
21. Rajasekar, V., Dhankar, M Arul., Pandian, R. and Malliga R. (2008). RFID Technology in Anna University Library Management: A Study. In 6th Convention PLANNER - 2008, Nagaland University, Nagaland, November 06-07, 2008, INFLIBNET Centre, Ahmadabad, Pp.169-173. (Retrieved on 30/01/2014: http://ir.inflibnet.ac.in/bitstream/1944/1129/1/14.pdf).
22. RFID for Library Applications NEW REVISION PUBLISHED: NISO RP-6-2012, RFID in U.S. Libraries. (2012). (Retrieved on 18/03/2014: http://www.niso.org/workrooms/rfid).
23. RFID Implementation Services (n.d.). (Retrieved on 18/03/2014: http://www.lssi.com/services/library-data-services/rfid-services/).
24. RFID in Libraries: Privacy and Confidentiality Guidelines. (2006). (Retrieved on 18/03/2014: (https://www.ala.org/Template.cfm?Section=otherpolicies&Template=/ContentManagement/ContentDisplay.cfm&ContentID=130851).
25. Sadanand Y. Bansode, and Sanjay K.Desale, (2009). Implementation of RFID Technology in University of Pune Library. Program: Electronic Library and Information systems. 43(2), Pp.202 – 214. (Retrieved on 04/04/2014: www.emeraldinsight.com/journals.htm?articleid=1789421).
26. Schneider, Karen G. (2002). RFID and Libraries: Both Sides of the Chip. American Library Association. (Retrieved on 18/03/2014: http://www.ala.org/offices/sites/ala.org.offices/files/content/oif/ifissues/rfidbothsideschip.pdf).
27. Shahid, S.M. (2005). Use of RFID Technology in Libraries: A New Approach to Circulation, Tracking, Inventorying, and Security of Library Materials. Library Philosophy and Practice, 8(1). (Retrieved on 02/02/2014: http:// www.webpages.uidaho.edu/~mbolin/shahid.pdf)
28. Shahid, Syed Md. (2005). Use of RFID Technology in Libraries: a New Approach to Circulation, Tracking, Inventorying, and Security of Library Materials. Library Philosophy and Practice, 8(1). (Retrieved on 18/03/2014: http://unllib.unl.edu/LPP/shahid.htm).
29. Singh, Rohit and Sultana Shahana (2010). RFID: A System for Library & Information Centre Proceeding of 55th ILA National Conference on Library and Information Science in the Digital Era, January 21-24, 2010, Pp.174-184.
30. Somvir, and Kaushik, Sudha. (2011). The New Emerging Technology in Libraries: RFID Technology. International Journal of Information Dissemination and Technology, 1(2), Pp.96-100. (Retrieved on 04/04/2014: http://www.ijidt.com/index.php/ijidt/article/viewFile/24/22).
31. Suman, S. and Kumar, J. (2007). Application of RFID Technology in Libraries. In 5th International CALIBER -2007,Panjab University ,Chandigarh,08-10 February,2007, INFLIBNET Centre, Ahmadabad, Pp.459-467. (Retrieved on 18/02/2014: http://ir.inflibnet.ac.in/bitstream/1944/575/1/459-467(cal%2007).pdf).
32. Tilwani, T. and Agarwal, Anil. (2011). RFID Applications and Benefits in Libraries. Indian Journal of Information, Library & Society, 24, N3-4, Pp.213-221.

33. Varma, A.K. and Ahmed, M Imtiaz. (2006). RFID Applications in Libraries. In 4th International Convention CALIBER-2006, Gulbarga, 2-4 February, 2006, INFLIBNET Centre, Ahmadabad, Pp.739-746. (Retrieved on 30/01/2014: http://ir.inflibnet.ac.in/bitstream/1944/1176/1/87.pdf).
34. Vasishta, Seema. (2009). Roadmap for RFID Implementation in Central Library, PEC University of Technology. Pp.300-306. (Retrieved on 18/03/2014: http://eprints.rclis.org/17693/1/ical-49_196_414_1_RV.pdf).
35. Waddenkeri, Mallikarjun. (2006). RFID Technology in Library and Information Centers: Relevance and Prospects. In 4th International Convention CALIBER-2006, Gulbarga, 2-4 February, 2006, INFLIBNET Centre, Ahmadabad, Pp.558-561. (Retrieved on 30/01/2014: http://ir.inflibnet.ac.in/bitstream/1944/1114/1/65.pdf).
36. Yu, Dai. (2011). Implementation of RFID Technology in Library Systems Case Study: Turku City Library. PhD thesis, Lahti University of Applied Sciences. (Retrieved on: 18/03/2014: www.theseus.fi/bitstream/handle/10024/28534/Dai_Yu.pdf)
37. Yu, Shien-Chiang. (2006). RFID implementation and benefits in libraries. The Electronic Library, 25(1), Pp.54-64. DOI 10.1108/02640470710729119. (Retrieved on 18/03/2014: http://front.cc.nctu.edu.tw/Richfiles/18368-ViewContentServlet.pdf).

Website Visited

1. http://www.rapidradio.co.in
2. http://en.wikipedia.org/wiki/Radio-frequency_identification
3. http://ir.inflibnet.ac.in