

# Application of Radio Frequency Identification (RFID) in Engineering College Library: An Experience.

\*Vinayagamoorthy P., \*\*Shanthi J.

\*Librarian (Selection Grade), Velammal Engineering College, Ambattur Redhills Road Chennai 600 066, \*\*Librarian, SOKA IKEDA College for Women, Madhanangkuppam Chennai- 600 099 (Tamil Nadu)

## Introduction

Various systems have been used such as Bar-Coding, Electro-magnetic strips, Radio Frequency Identification (RFID) with the intention of improving the quality of service to the users. RFID has many applications in libraries that can be highly beneficial, particularly for circulation staff. Since RFID tags can be read through an item, there is no need to open a book cover or CD/DVD case to scan an item. This would help alleviate injuries such as repetitive strain injury that can occur over many years. Since RFID tags can also be read while an item is moving, using RFID readers to check-in returned items while on a conveyor belt reduces staff time. Furthermore, inventories of materials could be done on the shelf within seconds. RFID helps a librarian in providing the users with optimum utilization of available resources.

## Concept of RFID

Radio Frequency Identification Technology was primarily used to identify the aircraft during the Second World War, to distinguish friendly aircraft from enemies' aircrafts. Large powered RFID tags or transponders were placed on the aircrafts for correct identification of radar signals. This was the first usage of RFID and since then the same is used in present day aviation traffic control. The development of microchip and later on the technological advances have led to the design and use of passive RFID tags. Today, the RFID technology

is used as an integral part of business systems by many business houses, including Libraries and Information Systems.

RFID is a data collection technology that uses electronic tags for storing data. The tag, also known as an "electronic label," "transponder" or "code plate," is made up of an RFID chip attached to an antenna, transmitting in the kilohertz, megahertz and gigahertz ranges. Tags may be battery-powered or derive their power from the Radio Frequency waves coming from the reader.<sup>1</sup>

Radio Frequency Identification tag(s) uses wireless technology to transmit product serial numbers from tags to a scanner, without human intervention. It is regarded as a likely successor to barcode inventory tracking systems.<sup>2</sup>

## Components of RFID

A comprehensive RFID system has the following components:

- \* RFID Tag.
- \* RFID Reader & Antenna.
- \* Server on which the software that interfaces with the integrated library software is loaded.
- \* Electronic Security Gate.

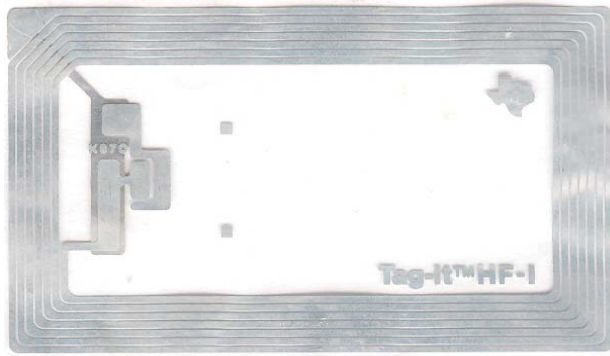
## RFID Tag

Normally three different kinds of RFID tags are used based on the requirement of the application. The details are follows:

- \* Passive tag - Operates from reader.
- \* Active tag - Integrating a battery.
- \* Semi-passive tag - No battery required.

---

**Reprint requests: Dr. P. Vinayagamoorthy**  
Librarian (Selection Grade)  
Velammal Engineering College  
Ambattur Redhills Road, Chennai 600 066  
E-mail: vinumoorthy@yahoo.com



**Figure 1: RFID Tag**

### **RFID Reader and Antenna**

RFID reader can be fixed or handheld and is usually connected to computer. The RFID reader handles the communication between the information system and the RFID tag. RFID antenna connects to the RFID reader, can be of varying size and structure, depending on the communication distance required for a given system's performance. The antenna activates the RFID tag and transfers data by emitting wireless pulses.

### **Server**

The server is the heart of the comprehensive RFID system. It is the communication gateway among the various components. It receives the information from one or more of the readers and exchanges information with the circulation database. The server typically includes a transaction database so that reports can be produced.

### **Electronic Security Gates**

EAS is an anti-theft system used by the libraries. Pre RFID systems utilized metallic security strips that needed to be desensitized a separate action during a normal checkout in order for patrons to exit the library without setting off an alarm. The security feature is incorporated by RFID technology in the tag itself and is much more conveniently activated or deactivated during the check in or check out operation, security gates, which play a crucial role in preventing loss of library property, typically set an alarm when an unauthorized or improper checkout item is detected.



**Figure 2: Electronic Security Gate**

### **Areas of Application of RFID**

RFID has been successfully applied in the following areas:

- \* Issuing of Passports: RFID tags are being used in passport issued by many countries. The first RFID passports were issued by Malaysia in 1998.
- \* RFID tags are used for public transport systems for transport payment.
- \* It is used by farmers for product tracking : Candian Cattle Identification Agency, using RFID tags to identify their cattles.
- \* Microwave RFID tags are used in long range access control for vehicle : since the 1990s RFID tags have been used in car keys. Without the correct RFID, the car will not start.
- \* Implantable RFID tags or transponders can be used for animal identification. The transponders are more well-known as passive RFID technology on microchip implant (animal).
- \* RFID is used in inventory systems: An advanced automatic identification technology such as the Auto-ID system based on the Radio Frequency Identification (RFID) technology has two values for inventory systems. First, the visibility provided by this technology allows an accurate knowledge on the inventory level by eliminating the discrepancy between inventory record and physical inventory.
- \* Human implants: some of the western countries are using RFID tag for identifying their personnel.

- \* Libraries: In the recent years a sizeable number of libraries are introducing this technology.

#### **Need for RFID Technology in Libraries**

The rising cost of books and other print materials, the restriction on library budgets and the heterogeneous user community are posing problems to the library management. RFID technology helps the library management to overcome these problems and offer more secure and foolproof library services to their users. Some of the factors that necessitate the use of the RFID in libraries are:

- \* To increase collection accuracy with accurate reshelving of material, thus avoiding the problems of wrong shelving.
- \* To decrease document injuries caused at the time of charging and discharging.
- \* To provide great help and accuracy in library books stock taking
- \* Provide more value added future service with same number of staff
- \* Increase the overall proficiency in the library.
- \* Facilitates the readers to take and make use of the personal books into the library along with the library books, which is not possible at present; and
- \* To minimize losses of library materials.

#### **Literature Review on Application of RFID in Libraries**

Butters (2007)<sup>3</sup> described the perceived threats of radio frequency identification (RFID) systems in libraries, in order to probe their technical feasibility. A study that measures performance of RFID library system at a university library by examining factors, namely tag placement, reader orientation sensitivity, read rate, reading distance, and metal and electromagnetic interference were reported by Golding and Tennant (2007)<sup>4</sup>. Rodriguez-Silva (2007)<sup>5</sup> examined the quantitative assessment of the benefits of RFID technology for libraries in the European countries. Sujatha (2007)<sup>6</sup> outlined the brief introduction to RFID, its components, need, usage, advantages and disadvantages and also highlighted the experience on account of the implement of RFID

technology in Dr. B.R. Ambedkar Open University Library. The feasibility study regarding the structure and application of the RFID system, an evaluation and a model for implementing RFID solutions in libraries was provided by Yu (2007)<sup>7</sup>. The application of RFID Technology for Libraries with its advantages and disadvantages and draft related expenditure of RFID application in libraries was stated by Boss (2006)<sup>8</sup>. Jay Singh and Navjit Brar and Fong (2006)<sup>9</sup> highlighted the state of RFID applications in libraries and explained the basic requirements and components needed to implement the RFID technology in the libraries. An actual implementation of RFID tagging system in one local University library in Malaysia was examined by Selamat and Majlis (2006)<sup>10</sup>. It focuses on three main challenges during the implementation which relates to system integration, parallel operation with existing system and procedure changes. The implementation of RFID technology in a library faced many challenges, as experienced by Shahid (2005)<sup>11</sup> and he explained the use of RFID technology in libraries and how the technology is used in circulation, tracking, inventorying, and security of library materials.

#### **Value/Utility of RFID in Libraries**

RFID can provide economic and cost effective solutions to many key issues faced by the librarians today.

- \* Stock verification: RFID assists in checking very quickly, whether the books are located in their proper shelf space or not in the library. It saves a lot of time and human effort.
- \* Locating a specific resource: Using the scanner / reader in conjunction with the library information system, a specific volume can be immediately located. It would identify if the book was on loan. If the volume is within the library, it would identify its correct location.
- \* Check-in and Check-out: with the use of the RFID System, a user can check-out and check-in of library resources without the help of library personnel.
- \* Self Return of Books: The RFID system enables self return of books by the users.

This saves time, is convenient and allows crucial manpower to be available for other duties.

- \* Security: The RFID monitors provide security to the resources of a library. Smart electronic gates would alert the library staff if a patron, intentionally or by mistake, was about to remove a volume from the library without a proper check out. Even the volume being removed would be identified. Earlier systems like bar codes and electro magnetic systems can be duplicated at low cost and enable some unscrupulous users to devastate the resources of a library.
- \* Library Membership Cards: The RFID cards can eliminate the necessity of elaborate library membership cards and the record keeping involved with it. Smart cards similar to Bank Credit Cards and ATM cards can be used with swap machines. However, these cards used in the context of libraries would store several bytes of relevant data.
- \* DATA Analysis: With the RFID system in place, a librarian can at any point of time draw data analysis from the library information system. It would help in analyzing the borrowing patterns of individual users as well as that of the entire lot. Patterns related to the movement of specific documents can also be derived. These would help in making important decisions such as purchase decisions, budgetary decisions and inter-library loans etc, which are very important in the management of a library.

#### **Velammal Educational Trust, Chennai: An Overview.**

Velammal Educational Trust is a registered non-minority service organization established in the year 1986 to inculcate among the youth a sense of discipline which is important to mould them into useful and capable citizens. The watch words of the Trust are Dedication, Determination and Distinction. The Trust which proved its mettle in school administration entered in the field of Technical Education in 1995 by starting two institutions, namely, Velammal Engineering College and Velammal

College of Management and Computer Studies. The Trust is currently managing with eleven educational institutions including schools, engineering colleges, arts and science colleges.

#### **Velammal Engineering College, Chennai**

Velammal Engineering College was established in the year 1995. It is one among the few engineering colleges located very near to Chennai city. College is approved by All India Council for Technical Education (A.I.C.T.E) and is affiliated to Anna University and also this institution was ISO certified and Accredited by National Board of Accreditation (NBA). It offers various under graduate, post graduate and research level courses.

A separate library building named after Dr. S.R. Ranganathan, the father of Library Science, in an area of 25,500 square feet under the estimated cost of Rs. 5 crores with modern facilities like centralized air-condition, digital library unit with rich collection of subject CD's, modern reading room with well furnished furniture, digital photo copying unit, internet browsing unit, video conference room, conference hall, discussion rooms to create R&D skills, audio and video section.

The central library serves more than 3600 students, teachers, non teaching staff and research scholars. At present, the library has 53,000 books and non book materials, 273 periodicals both national and international and subscribing more than 500 e-journals and 3500 CD collection, video conferencing facility and separate section for digital library.

All the library in-house transactions are computerized and it is connected to intranet. Barcode technology has been used since the year 2000. The library also provides internet browsing facility and it has more than 800 students' project reports and previous question papers are in e-form. The library has offers the following services to it members:

- \* Lending services.
- \* Online Public Access Cataloguing Service (OPAC).
- \* On line database services.
- \* Internet browsing.
- \* Photocopying services.

- \* Conducting book exhibition.
- \* Electronic document delivery service.
- \* Conducting technical film shows.
- \* Arranging of inter library loan.
- \* Book bank scheme for SC/ST students.
- \* General book bank scheme for economically weaker students.

The library is run by qualified, well experienced and user friendly library staff (One Librarian, three Asst. Librarians, 7 Library Asst. and 2 administrative staff).

#### Users' Feed Back on RFID Application

A survey was conducted among the engineering students of various branches at undergraduate and post graduate level and need for RFID technology.

faculty members of the college to study their satisfaction level about the library resources, services and introduction of new technology like RFID etc, in the library. A structured questionnaire has been designed and circulated to the students and faculty members, The questionnaire consists of the following questions related to satisfaction level of institution's library resources like collection of books, journals/ periodicals, CD ROM, internet facility, e-journals access provision, video conferencing etc. and library services like loan of books, journals/ periodicals, CD ROM, reference services, inter-library loan, reprography, internet service, e-journals and online database services and also users' satisfaction level of computers and software availability and the

**Table 1**

S. No	Description	Questionnaire distributed	Questionnaire received	Percentage
1	Students -UG	250	237	39.5
2	Students PG	250	224	37.3
3	Faculty	100	81	13.5
	Total	600	542	90.3

#### Distribution of Questionnaire and Responses Received

It is seen from the Table 1 that the response rate is 90.3%. A majority (237) of the respondents (39.5%) belong to under graduate students and 224 respondents belong to post graduate students and remaining are faculty members (13.5%).

**Table 2**

S. No	Sex	No.of Respondents	Percentage
1.	Male	329	60.7
2.	Female	213	39.3
	<b>Total</b>	<b>542</b>	<b>100</b>

#### Classification of Respondents by Sex

The data in the Table 2 presents the gender of the respondents. It is found that a majority (60.7%) of the respondents belongs to male community and 213 (39.3%) respondents belong to female community.

**Table 3**  
**Classification of Respondents - Department Wise**

S. No	Name of the Department	No.of Respondents	Percentage
1.	Electronics & Communication Engineering	85	15.7
2.	Information Technology	82	15.1
3.	Mechanical Engineering	87	16.1
4.	Electrical & Electronics Engineering	89	16.4
5.	Computer Science and Engineering	86	15.9
6	Civil Engineering	55	10.1
7	Business Administration	58	10.7
	Total	542	100

It is seen from the Table 3 that the response are classified the department wise, the percentage of the responses more or less equal from 15.1% to 16.4% Except department of Business Administration(10.5%) and Civil Engineering (10.1%).

**Table 4**  
**Users' Satisfaction on the Institution's Library Sources**

From Table 4, the satisfaction level of the users in the institution's library sources can be

S. No.	Sources	Satisfied	Not Satisfied	RANK
1	Books	428 (78.9)	114 (21.1)	1
2	Journals/ periodicals	401 (73.9)	141 (26.1)	2
4	Project reports	348 (64.2)	194 (35.8)	6
5	CD ROM collections	367 (67.7)	175 (32.3)	4
6	Internet facility	382 (70.5)	160 (29.5)	3
7	e-journals access provision	351 (64.8)	191 (35.2)	5
8	Video Conferencing (AnnaEduSat)	332 (61.3)	210 (38.7)	7

(Figures in brackets indicate the percentage)

understood. Books, Journals/ Periodicals and Internet facility are ranked first, second and third respectively, CD ROM products and

e- journal access are ranked subsequently.

**Table 5**  
**Users' Satisfaction on the Institution's Library Services**

S.No.	Description	Satisfied	Not Satisfied	RANK
1	Loan of books	491 (90.6)	51 (9.4)	1
2	Journals/ periodicals circulations	472 (87.1)	70 (12.9)	2
3	CD ROM loan & print outs	431 (79.5)	111 (20.5)	4
4	Reference service	458 (84.5)	84 (15.5)	3
5	Reservation service	376 (69.4)	166 (30.6)	7
6	Inter library loan	294 (54.2)	248 (45.8)	9
7	Reprography service	361 (66.6)	181 (33.4)	8
8	Internet service	422 (77.9)	120 (22.1)	5
9	e-journals and online database services	415 (76.6)	127 (23.4)	6

Velammal Engineering College library provides a number of services to the user communities, as listed in the table. Based on the users' opinion (Table 5), it is observed that traditional services are ranked first, loan of books, journals/periodicals circulation and reference service are ranked second and third respectively. The modern services such as "CD ROM loan and print outs", "Internet service" and "e-journals and online database services" are ranked as fourth, fifth and sixth respectively.

**Table 6**  
**Users' Satisfaction Level on Computers and Software Availability**

S. No.	Description	Satisfied	Not Satisfied	Rank
1	Adequacy of computer	381 (70.3)	161 (29.7)	2
2	Configuration of computers	359 (66.2)	183 (33.8)	3
3	Queries search/OPAC	473 (87.3)	69 (12.7)	1
4	LAN	312 (57.6)	230 (42.4)	4
5	Adequacy of bandwidth	289 (53.3)	253 (46.7)	5

It is evident from Table 6 that 87.3 % of the users are satisfied with their library “Queries search/OPAC” and 70.3 % of the respondents showed their satisfaction with their library having adequate number of computer and 66.2% of the users are satisfied with their institutional library having high configuration computers.

**Table 7**  
**A Need for RFID Applications**

S.No.	Description	Yes	No	RANK
1	Are you satisfied with existing barcode technology applications in your library?	468 (86.3)	74 (13.7)	1
2	Are you facing difficulties in locating of books in the book shelves?	341 (62.9)	201 (37.1)	5
3	Are you finding any problems at the time of borrow/return of books (wait for long time to return and issue)?	379 (69.9)	163 (30.1)	3
4	Do you want to use your own books inside of the library?	409 (75.5)	133 (24.5)	2
5	Are you feeling very inconvenient during the stock verification (normally no transaction at the time of stock taking)?	296 (54.6)	246 (45.4)	7
6	Are you aware of RFID Technology?	372 (68.6)	170 (31.4)	4
7	Is RFID technology needed for your library management?	331 (61.2)	211 (38.8)	6

It is evident from the Table 7 that 86.3 % of the users are satisfied with existing barcode technology /applications in their library. Even though 69.9% of the respondents are facing problems at the time of borrow/return of books. 62.9 % of the users are facing difficulties in locating of books in the book shelves and above 61.2% of the respondents mentioned RFID technology is needed for their library management. Based on the opinion of the users, it is clearly indicated that the implementation of RFID technology is unavoidable in Velammal Engineering College library in order to avoid the problems in future.

**Implementation of RFID Technology in Velammal Engineering College: An Experience.**

**Present Status of RFID in Velammal Engineering College.**

To implement the RFID technology in our

college on the phased manner, we have divided into three areas; first is issuing of RFID card to the library members to avoid to carry manual cards, second, one is to paste RFID tag in the books and other library resources for easy transaction and proper shelving, third one is to put electronic security gate for anti-theft system.

At present RFID membership cards are issued to the students and faculty members; they are using this card to borrow books from library. The card contains memory of 2K bits. Two RFID Reader have been purchased to read and write the information on the RFID membership cards.

At present we are using Barcode technology as well as RFID technology; we are using existing barcode label to get information from the books and other documents and RFID membership cards are used to get/load information about user. The key features and specifications of the components of the RFID



card and Mid Range Reader which we are using, are highlighted as follows.

### RFID Membership Card

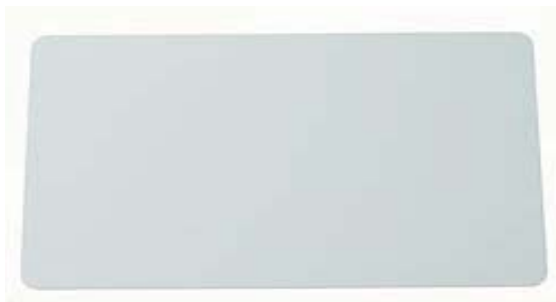


Figure 4 : RFID Membership Card

### Technical Specification

Operating Frequency : 13.56 MHz, Supported Standards: ISO 15693-Vicinity Cards, Factory Programmed Read only Number: 64 bits, Memory(User Programmable): Minimum 256 bits Organised into 64x32 bit blocks, Simultaneous Identification of Tags: Upto 50 tags per Second (Reader/Antenna dependent), Data Retention time (at 25C): 10 Years, Case Material: PVC (Polyvinyl Chloride), White Surface Finish: Glossy, Dimensions: 85.6 (L) x 54 (W) x 0.76 (Thickness) mm (ISO 7810), Weight: 5 gms, Printability: Thermal transfer (Dye Sublimation preferred), Silk screen Tamp on (Pad on).

### RFID Mid Range Reader



Figure 4: RFID Mid Range Reader

### Technical Specifications

Operating Frequency : 13.56 MHz, Supported Standards : ISO/IEC 15693, ICODE , Supported Protocol : RS232/ USB/Ethernet, Read Range : Upto 45 cm for 300 x 300 mm, Baud Rate : 57600 b/s (fixed) and Flash : 64 kb.

### Areas of Application

To implement the RFID technology in Engineering college we can divide the process into four areas, first issuing of RFID card to the library members to avoid to carry manual cards, second one is to paste RFID tag in the books and other library resources for easy transaction and proper shelving, third one is to put electronic security gate for anti-theft system. Fourth one is automatic Book Drop systems. The books are returned through the Book Drop facility located at a suitable place in the library; the RFID tags are automatically read and it will immediately update both patron record and library database. The Book Drop allows patrons to return the items 24 hours a day. Optionally, a conveyor sorting system for books that are returned through the Book Drop can be installed.

### Proposed Application

To improve the library service, we have proposed to implement to stick the RFID tag in the library books and other resources and put electronic security gate to avoid theft of books. For this, we have called for quotations from various RFID solution companies and the quotations are analysed based on this a proposal has been submitted to the higher authority for sanction.

### Probable Benefits

The implementation of RFID cards to the users is very useful to the students/staff for easy handling. It also reduces the burden of the borrowers to submit borrowers' cards at the time of borrowing books from the library. It reduces the time of the transaction and increases the reliability. It reduces the useable space and human power at the circulation counter (previously we kept several drawers to store the borrowers' cards).

### Estimation

For improving the quality of service to the users, Velammal Engineering College has a proposal to implement RFID technology in all areas in the library. For this purpose a detailed study has been conducted and the requirements of components and estimate cost are given in the Table 8.

**Table 8**  
**Cost Estimation**

S.No	Components Requirements	Required Quantity	Approximate rate per item in Rs.	Total Cost in Rs.
1.	<b>RFID Tags:</b>			
	RFID Label which is to be stuck on the books and others resources.	60000	24	14,40,000
	RFID plan cards for patrons (to be used for identification card for members/patrons)	4000	45	01,80,000
2.	<b>RFID Reader</b>			
	Middle Range Reader / Antenna (For issue/return of books and writing programme on the tags with SDK)	01	34800	34,800
	Long Range Reader with walk through antenna (up to 1 meter read range with Buzzer and EAS along with SDK)	02	265000	5,30,000
	RFID Handheld Reader for stock verification	01	33500	33,500
3.	<b>Computers</b> at present our library has 20 computers + 2 numbers of high end servers	-	-	-
4.	<b>Software</b> Our institutions have RFID research centre, actually it is funded by Government of India using this centre we have made in-house software for RFID applications.	-	-	-
	Total in Rs.		22,18,300	

### Conclusion

In spite of the overwhelming advantages and benefits with the use of RFID technologies in Engineering College library, the main drawback is very high initial cost. Newly established institutions can not introduce RFID technology in their institutions and the maintenance also incurs a considerable amount. The RFID technology in libraries can thus eliminate significantly manual labour by optimizing the handling, processing and security of materials.

RFID technology has several advantages over the current barcode systems being used at libraries worldwide. The libraries that use RFID, promises to save time and operate more efficiently and effectively than the barcode systems. Some of the compensations of RFID over a barcode systems are that RFID tag can be used for security as well as for status control, thereby eliminating the need to attach security strips to library items; RFID systems make self –

checkout faster and easier for library patrons; and RFID portable scanners can take inventory by just being passed slowly along the library shelves, without having to handle each item individually. RFID vendors, however, need to resolve some issues before libraries feel confident in adopting them and forefront the issues such as cost, lack of standardization amongst vendors and privacy.

### References

1. Wikipedia, the free encyclopedia (<http://en.wikipedia.org/wiki/RFID>).
2. Brian Cryer's Glossary of IT Terms with Links. (<http://www.cryer.co.uk/glossary/r/rfid.htm>).
3. Butters, Alan (2007) RFID Systems, Standards and Privacy within Libraries. *The Electronic Library*, 25(2); 430-439.
4. Golding, Paul and Tennant, Vanesa (2007). Work in Progress: Performance and Reliability of Radio Frequency Identification (RFID) Library System. In *International Conference on Multimedia and Ubiquitous Engineering* held at Seoul (Korea) April 2007, pp.1143-1146.

5. Rodriguez-Silva, D.A et al (2007) Quantitative Assessment of the Benefits of RFID Technology for Libraries: A trans-European Study. In IEEE Workshop on Automatic Identification Advanced Technologies held at Alghero, Italy 1-8 June 2007, pp.128-133.
6. Sujatha, G (2007) Radio Frequency Identification (RFID) Technology in Library Management. *Pearl : A Journal of Library and Information Science*. 1(2): 22-29.
7. Yu, S. C. (2007). RFID Implementation and Benefits in Libraries. *Electronic Library*. 25, (1): 54-64.
8. Boss, Richard W. RFID Technology for Libraries (2006), Available on <http://www.ala.org/ala/pla/plapubs/technotes/rfid technoteupdate.doc>.
9. Jay Singh, Navjit Brar and Fong, Carmen (2006). The State of RFID Applications in Libraries. *Information Technology and Libraries* 25, (1): 24-32.
10. Selamat, Mohd Suhaimi and Majlis, Burhaniddin Yeop (2006). Challenges in Implementing RFID Tag in a Conventional Library. In IEEE International Conference on Semiconductor Electronics, held Kuala Lumpur Oct 2006, pp.258-262.
11. Shahid, Syde 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).
12. Lindquist, Mats G (2003). RFID in Libraries-Introduction to the Issues. Available on <http://www.ifla.org/IV/ifla69/papers/161e--Lindquist.pdf>.
13. McArthur, Alastair (2003), Integrating RFID into Library Systems - Myths and Realities. In World Library and Information Congress:69th IFLA General Conference and Council held at Berlin, Germany, 1-9 August 2003. Available at: <http://www.ifla.org>.
14. Coyle, K. (2005) Management of RFID in Libraries. *Journal of Academic Librarianship* 31, (5): 486-489.
15. Sue, Kuen-Liang and LO, Yi-min (2007) BLOCS: A Smart Book-Locating System Based on RFID in Libraries. In International Conference on Service Systems and Service Management held Changdu, China, 9-11 June 2006, pp.1-6. Klaus Finkenzeller, "RFID Handbook: Fundamentals and Applications in Contactless Smart Cards and Identification", Second Edition, 2003.