

Use of RFID Technology in Panjab University Library: Users' Approach towards Circulation of Library Materials

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Abstract

RFID (Radio Frequency Identification) is a means of identifying any object or person using radio frequency transmission. RFID has been used in different sectors in terms of improving their existing services and performance. Before RFID, barcode technology is such technology which has been used in the libraries all over the world to improve its services. RFID is the same technology as barcode but offers a much more benefits as compare to barcode. The paper discuss about the brief overview of RFID, its components and implementation of RFID in the A C Joshi Library. In this paper author has conducted a user's study to know more about the awareness, use and their satisfaction about the RFID system implemented in the A C Joshi Library, Chandigarh.

Keywords: RFID Technology, Smart Library, Circulation, Panjab University.

1. Introduction

RFID (Radio Frequency Identification) is a means of identifying any object or person using radio frequency transmission. It is one of the several forms of auto identification technology like barcode, optical character recognition, magnetic ink, smart card, etc. that uses radio waves for identification. The RFID system works, using "smart" tags, with inbuilt silicon chips that store data, a reader that scans information from the tags, and the infrastructure to store and analyze the data. According to Automatic Identification and Data Capture (AIDC), "Radio Frequency identification is a technology that uses radio waves to transfer data between a reader and an electronic tag which is attached to a particular object. Typical uses are for object identification and tracking." RFID has been applied in many areas like supply chain management, warehouse management, toll collection, libraries, etc.

2. RFID System Components

An RFID system comprises of tags or transponders, reader, antenna, middleware and software application and a computer/ server. A comprehensive RFID system has the following key components:

- **RFID tags** also known as transponders, smart tag, or radio barcode, contains an electronic chip programmed with unique information and an antenna that sends and receives radio waves. The antenna consists of a flat, metallic conductive coil and the chip which is less than half a millimeter. Hitachi Limited. (2006). RFID systems tags are designed in various shapes, sizes and frequencies, depending on the application requirements and local radio-frequency regulations like Low frequency tags (125 kHz) ranges 0.3 meter, High

Frequency (13.56MHz) ranges 1 meter Ultra High Frequency (860-960 MHz) ranges 1-3 meters and Microwave (2.45 GHz) ranges 2+ meters.

- **Reader** is transceivers (i.e., a combination of transmitter and receiver) and their usual role is to query a tag and receive data from it. Reader use antennas to communicate with the RFID chip. It can read information stored in the RFID tags and also update RFID tags with the new information.
- An **antenna** connected to the reader by means of radio frequency signal. RFID reader antennas can be mounted into EAS gates, embedded into desktops and other furniture or integrated into conveyer or other material handling system.
- A **server** to receive and decode the information and to communicate with the automated library system. It receives the information from one or more readers and checks the information against its own database or exchanges information with the circulation database of the library integrated management system.

3. Application of RFID Technology in Libraries

The basic aim of any library is to provide opportunities to its readers for maximum utilization of its resources. To achieve this objective libraries are trying hard to implement new ICT tools and technologies time to time. Before RFID, barcode technology is such technology which has been used in the libraries all over the world to improve its services. RFID is the same technology as barcode but offers a much more benefits as compare to barcode. According to Chachra (2003) RFID technology is slated to replace barcodes in library applications. The following diagram depicts about the library RFID components and how it works in the libraries.

LibBest Library RFID Management System



The information contained on microchips in the tags affixed to library materials being read by using radio frequency technology regardless of item orientation and distance from the item is not a critical factor except in the case of extra-wide exit gates.

4. Implementation of RFID in the A C Joshi Library

4.1 Panjab University Library (PUL)

PU library was inaugurated in the year 1963. The Library has a collection of about 7 lakh publications which include books, bound volumes of journals, theses/dissertations, rare books, reports, government documents, back files of newspapers, and a collection of 1490 manuscripts. The Library is now fully computerized with an integrated system connected to the Campus Network providing Internet and e-mail facility to the University community. On-line Public Access Catalogue (OPAC) facility is available. It is available through the web also. The Library subscribes to about 600 current periodicals and has access to 225 Online full text journals as part of print journals subscription. It also has access to approximately 5000 online full text journals is available through INDEST- Consortium and UGC-INFONET. PUL can be accessed at the URL <http://library.puchd.ac.in/>.

4.1.2 Need for RFID

The basic purpose of implementing RFID is to provide better and efficient library services such as self checkout/Check-in of library materials, security of the library books and efficient tracking of library materials throughout the library. RFID Make self checkout faster and easier for library users and RFID scanners can take inventory by just being passed slowly along the library shelves, without having to handle each item individually. To save the time and long queues after the circulation section for check in and checkout of books and to provide the circulation timing for extended hours (from 9:00am-4.30 pm to 9:00am to 9:00 pm), Panjab University Library, RFID was implemented in the year 2010 and the reasons for the implementation of it include Check-in & Check-out of books, theft control and stock verification. Before RFID implementation PUL was using bar code technology and after the implementation of RFID, the library still continued with that technology also for those items that have not been yet tagged.

4.1.3 RFID @PU: Present Status

Table – 1: Different components of RFID technology @PUL

Components	Quantity
RFID Tag	4 lakhs
User self check-out	2
Automatic book return(Drop Box)	1
Security system	2
Conversion station	1
Staff service station	1
Inventory system (<i>Digital Library Assistant</i>)	2

Table 1 gives details of the various components, which are presently used in PUL. It is clear from the above table that PUL is having two self checkout systems, for users within library premises. Library establishes a conversion station to make the tagging a continuous process. PUL installed an automatic book return or Drop Box just outside the library which gives the book return facility 24*7. At the time of the study Panjab University Library has tagged approximately 2.9 lakh books from its total collection of about 7 lakh items. The tagged items represent the items that are available for loan (issuing) and the remaining ones including theses, bound journals, rare books, reports and reference books, etc. are not yet tagged.

4.2 Need for the Present Study

The basic purpose of implementing RFID is to provide enhanced library services by means of self checkout/check-in of library materials, security of library books and efficient tracking of library materials throughout the library. There was a need to examine the extent to which the needs of the users are being met with the application of RFID components and to identify the importance of RFID technology amongst the users. The purpose of this study was to create a substantial body of knowledge about the factors that will influence the success of RFID in libraries, and to share this knowledge with that in order to help facilitate change.

4.3 Objectives of the Study

The main objectives of this study are as under:

- To study the users awareness about RFID technology and its usage.
- To study the satisfaction level of users for RFID facilities provided by the library.
- To find out the hindrances and problems faced by the users while using the RFID technology.
- To suggest ways and means for better utilization of RFID technology in libraries.

4.4 Research Methodology

The investigator used the survey method for the said research. A well structured questionnaire was prepared keeping in view the objectives of the study. A pilot study was also done with 50 users before final data collection to validate and authenticate the questionnaire prepared.

4.5 Sampling

Panjab University has total no of 13, 530 users out of which post graduate 5624 under graduate 4746 Research Scholar 2077. The survey population included the undergraduate, post graduate and the research scholars of the Panjab University. For sampling stratified random sampling method has been used 5% data from each category has been taken for this study. Nearly 95% of the questions were provided with alternative choices. Of course, provision was also made to give them the opportunity to express their views by leaving some questions open-ended. The structured questionnaire was distributed to 5% of total number of registered members of academic session of 2015-16 i.e. 621 in order to get information on various aspects of usage of RFID technology. The investigator received 480 (77.29%) responses from users. This included 140 undergraduate 250 Postgraduate and 90 research scholars.

Table – 2: Class wise population

Class	Total Population	Sample data (5% of total population~)	Response received
Under Graduate	4746	237	140
Post Graduate	5624	281	250
Research Scholar	2077	103	90
Total	12447	621	480

4.6 Data Analysis and Interpretation

The analysis and interpretation of the data collected through questionnaires by the sampled population is provided below.

Table - 3: Learn to use RFID technology

Methods	Number	Percentage
Through orientation by library staff	161	33.54
Through friends	242	50.42
Through printed instructions placed nearby	83	17.29
Visual Instructions displaying on screen	11	2.29
Through hit and trial method	32	6.67

There are various sources through which users came across to learn about RFID technology, which are given in Table 3. It is seen that a large number of respondents (50.42 per cent) said that they learn about RFID technology through friends. Orientation through library staff is found to be an important source (33.54 per cent), followed by printed instructions nearby workstations (17.29 per cent) and through hit and trial method (6.67 per cent). Only 2.29 per cent responded regarding the following of visual instructions display on screen.

Table - 4: Advantages of RFID technology

Advantages	Number	Percentage
Time saving	451	93.96
Security	164	34.17
Simple	243	50.62
Speed	252	52.5
New technology	246	51.25
Time limit less	105	21.87

In table 4 the advantages of applicability of RFID technology were indicated by the users. The above table shows that 93.96 percent users found RFID technology is time saving. More than half (52.5 percent) users indicated that the speed in handling operations is very advantageous. RFID technology is simple and secure, this quality is preferred by 50.62 percent users and 34.17 percent users respectively.

Table - 5: Disadvantages of RFID technology

Disadvantages	Number	Percentage
Difficult to use	13	2.7
Trouble some	52	10.83
Hang-ups of workstations	113	23.54
Issuing of wrong books	60	13.33
Security	10	2.29
Electricity backup	26	5.42
No Disadvantage	201	41.87

Most interestingly, 41.87 percent respondents found no disadvantage of RFID technology, whereas hang-ups of workstations and issuing of wrong books were the major disadvantages as indicated by 23.54 percent and 13.33 percent users respectively in table 5, 10.83 percent respondents found RFID technology, quite troublesome.

Table - 6: Frequency of problem facing while getting the book issued and returned

Frequency	While getting the book issued		While returning the book	
	Number	Percentage	Number	Percentage
Usually	54	11.25	22	4.58
Sometimes	217	45.21	182	37.92
Never	209	43.54	276	57.5

It is essential to know how many times on an average the target user is facing problems while utilizing the RFID technology. When enquired about the frequency, 45.83 percent respondents faced problems sometimes while getting the books issued and a large number of respondents (58.33 percent) have never faced any problems while returning the books through drop boxes. (Table 6). While 43.75 percent respondents did not find it problematic while getting the books issued and 37.5 percent respondents faced problems sometimes while returning the book. A very less percent of respondents (10.42 and 4.17) faced problems usually while issuing and returning the books respectively.

Table - 7: Problems faced while issuing the book

Problems	Number	Percentage
No problems	132	27.5
Problem in entering password	48	10
Reading in book tags by workstations	108	22.5
Books not properly tagged	65	13.54
Workstations not working properly	76	15.83
Data of books not entered properly	74	15.42

Even though RFID technology is easy to use as well as the time saving, still there are some issues bothering the users. Table 7 indicates that. Almost one third of respondents found no problems while using the RFID technology. Reading of wrong book tags by the workstations was the problem indicated by the 22.5 percent respondents. Workstations were not working properly and data of books were not entered properly, indicates some problems being faced by 15.83 percent users and 15.42 percent respondents respectively.

Table - 8: Problems faced while returning or dropping the book

Problems	Number	Percentage
No problems	171	35.62
Workstations not working properly	62	12.92
Not proper backup of electricity	73	15.21
Less Book Drop boxes	156	32.5
Reading in book tags by workstations	28	5.83

The users were requested to furnish details regarding the problems faced while returning the books through drop boxes. Table 8 reveals that more than one third of respondents (35.62 percent) do not having any problem. Another one third of respondents (32.5 percent) faced problems because of a limited number of drop boxes. At the same time, 15.21 percent of users found that there is no proper backup of electricity followed by workstations not working properly by 12.92 percent respondents and Non reading of the book tags properly by workstations by 5.83 percent.

Table - 9: Satisfaction with the RFID infrastructure available in the library

Satisfaction Level	Number	Percentage
Fully satisfied	305	63.54
Somehow satisfied	165	34.38
Unsatisfied	10	2.08

Users were asked about their satisfaction level with the RFID infrastructure available in the library. More than half (63.54%) of respondents were fully satisfied with the RFID infrastructure available in the library to provide services (Table 9). Whereas one third of the users were partially satisfied and only 2.08% respondents were not satisfied with the available RFID infrastructure.

Table - 10: Assistance from Library staff

Behavior	Number	Percentage
Cooperative	436	90.83
Neutral	44	9.17
Not Helpful	0	0
Ignorant	0	0

Library staff played a very important role in successfulness of any activity or services provided to the users. Users were asked whether the staff of the library is co-operative, neutral or the ignorant towards them. In response most of the respondents (90.83%) indicated towards the co-operative behavior of the library staff and only 9.17% users felt the neutral behaviour of the library staff.

Table - 11: Preference of method for issuing/ return of books

Methods	For Issuing of Books		For Returning of books	
	Number	Percentage	Number	Percentage
RFID	360	75	282	58.75
Manual	44	9.17	148	30.83
Both	76	15.83	50	10.42
Total	480	100	480	100

An attempt was made to determine the methods that users wanted to use in the near future, such as Manual only or RFID only, or whether they want to access both types of methods for issuing and returning of books. Table 11 reveals that 75 per cent and 58.75 percent of users preferred the RFID system respectively for issuing and returning, 8.33 per cent and 30.83 per cent of users preferred manual system for both the services respectively. 16.67 per cent and 10.42 percent wish to utilize manual as well as RFID system. It can be determined that users are interested in making use RFID technology.

Table - 12: Scope for improvement

Options	Number	Percentage
Change in software	82	17.08
More Book Drop Boxes	175	36.46
More Self-Issue Systems	114	23.75
More assistance from Library staff near systems	131	27.29
More and clear printed guidelines near workstations	140	29.17

The users were asked to rate suggestions that how the RFID services can be improved. One third of users indicate that there is a need of more drop boxes to improve the RFID service. 27.29 percent respondents want more assistance of staff near workstations. Implementation of more issuing workstations was suggested by 23.75 percent respondents and 29.17 percent suggested about the more and clear printed guidelines near the workstations.

Table - 13: Preferred location of drop boxes in campus

Locations	Number	Percentage
Hostel	145	30.20
Department	264	55
Student centre/Coffee house/Canteen	70	14.58
Library	238	49.58

Users were asked to mark the preferred locations where the more drop boxes can be placed. Table 13 reveals that 56.25 per cent of respondents preferred the concerned departments for the drop boxes. The next most selected location was Library (50 per cent). This is followed by hostel (29.17 per cent) and student centre/coffee house/canteen (14.58 per cent).

5. Findings and Suggestions

The analyses of the data collected through survey have been revealed a number of findings which are as follows:

- Almost half (50.42 percent) of the user population surveyed learns RFID usage through their friends.
- The advantage of RFID as indicated by the respondents revealed that time saving was the top most advantage of the RFID technology.
- Almost half (41.87 percent) from the population studied, found no disadvantage of the RFID technology.
- 45.21 percent from the population under study revealed that they face problem while getting the book issued.
- 27.5 percent users did not face any problems while issuing the book while 22.5 percent users found the difficulty as the wrong reading of book tags by workstations.
- More than half users (57.5 percent) do not faced any problem while returning the books through the drop-box and almost one third of total population surveyed having the problem related to less drop-boxes.
- More than half (63.54 percent) users were fully satisfied with the RFID infrastructure available in the library.
- Majority of users surveyed, sought the help of the library staff and indicated that staff is cooperative.
- Majority of users (75 percent) preferred the RFID technology for issuing the books in comparison to manual system on the other hand more than half (58.75 percent) users preferred the RFID system for returning the books of the library.
- Users were asked about the improvements of the RFID system, more than one third (36.46 percent) of the total population suggested the placement of more drop-boxes followed by the more and clear printed guidelines near workstations by 29.17 percent users.
- More than half (55 percent) users preferred to place more drop-box in the different departments.

5.1. Suggestions

- It is strongly recommended that library need to organize more awareness programmes to make the users familiarize with the RFID technology
- It is suggested that staff members should be deputed at or near the self-check system/book drop system to provide user assistance to users.
- It is also suggested that library should provide SMS alert service to their users whenever they issue/return books through RFID system.

6. Conclusions

Implementing RFID technology has provided major benefits for Panjab University Library. RFID is used to improve the efficiency of inventory tracking and management. In future, we can see many more libraries adopting this technology as it saves time of the users, indicated as the top most advantage by the users in the study. The results of the present study also clearly showed that the users sought the help of the library staff if they suffer from any problem so it is important to educate library staff and library users about RFID technology to make it a successful venture. The conclusion is that the versatility between the technology like RFID and libraries can create miracles resulting in endorse both users as well as librarians.

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