Awareness and Satisfaction of Users towards RFID based Circulation System: a study

Dr. Udita Negi

Deputy Librarian, Doon University, Dehradun

Manoj Kumar Pant

Librarian, Uttarakhand Judicial and LegalAcademy, Bhowali, Nainital

Abstract

Radio Frequency Identification (RFID) technology has entirely transformed library management systems, providing effective and automated solutions for various operations-related activities. RFID technology has allowed libraries to increase security and enable high-speed inventory management by automating material handling, lowering data input errors, optimising customer service, and updating records more efficiently. As the use of RFID systems becomes prevalent, understanding user awareness and satisfaction has become crucial for libraries. This work attempts to understand the aspects of using Library circulation services in an RFID environment. The findings reveal that a considerable number of users are familiar with these technologies and their advantages while using the library circulation services. Nevertheless, there are still individuals who are hesitant to utilise services because they are not familiar with this technology. The findings also unveiled the need to organise training and user engagement programmes while implementing technology-assisted services, which is crucial in shaping user satisfaction and awareness.

Keywords: Library circulation, Library users, RFID technology, User awareness, User satisfaction

1. Introduction

Radio Frequency Identification Technology (RFID) technology has been utilised in libraries since the late 1990s, superseding barcode technology for identifying, managing, and tracking library resources and services. Its speed, accuracy, ability to handle large volumes of items, and integration with automated systems make it the favoured option for libraries seeking to increase efficiency, user experience, and circulation operations. The low cost of tags and ease of integrating RFID into the library management system make the library users and staff's tasks easy, smart, and convenient. Furthermore, self-service Kiosk and mobile apps integrated with RFID functionality have revolutionised the way library users interact with library services, enabling seamless and contactless interactions and accessibility of real-time data and information in the workplace and enabling users to perform circulation tasks independently, such as check-in, check-out, and renewing items quickly and easily (Kwok et al., 2008). The self-service feature improves convenience, reduces wait times at the circulation desk, empowers patrons to manage their library accounts autonomously, and decreases library staff reliance (Konoru, 2004). RFID systems

have reduced the staff required at the circulation desk, freeing them to provide more user-centric services (Singh and Mahajan, 2017). RFID systems in library circulation systems improve user experience by simplifying tasks, refining inventory control, and enhancing security measures, allowing staff to focus on engaging projects instead of scanning barcodes.

Doon University: library

Doon University was established by the Government of Uttarakhand by the Doon University Act of 2005, and the University Central Library was established in 2009. Within a decade, its circulation services transformed from using the Browne method to proprietary Libsys LMS software to open-source Koha, and finally to integrating RFID technology for all housekeeping and other activities. The library has implemented RFID technology such as self-checkout (Kiosk), RFID reader staff stations, smart card printers, smart cards for library membership, and a security gate for its services. However, to gain valuable insights into user experience for continuous improvement to ensure user satisfaction and enhance patron engagement, libraries must identify development opportunities and address users' issues and challenges.

2. Review of related literature

Tseng and Kuo (2009) opined that user apprehension and unfamiliarity are the main challenges in operating an automated library system despite its ability to meet the needs of technologically savvy patrons. Ward and Kranenburg (2006) noted that identifying and tracking book movement is one of libraries' most prevalent applications of RFID technology. Curran and Porter (2007) reported that RFID enhances customer book search and identification. Selamat and Majlis (2006) stated that self-issuing stations had reduced the number of staff required at the circulation counter to a minimum. Shahid (2005) emphasised that RFID speeds up library materials' borrowing and return procedures, freeing up staff to design and deliver more productive and value-added library services to users. Yenurkar and others (2017) and Madhusudan and Gupta (2014) suggested that an RFID-based library management system can facilitate fast transactions, reduce manual bookkeeping, and enhance traceability and security by eliminating manual intervention. Rahman and Islam (2019) advocated RFID to reduce staff stress, increase efficiency, track and locate items quickly, book drop support at any time, facilitate seamless circulation, promote self-check-in check-out activities, etc. Hasanand Saini (2017) asserted that implementing RFID in libraries allows users to use the circulation system 24/7. Kern (2004) acknowledged that self-checking and user satisfaction are two advantages of library RFID systems. Coyle (2005) stated that implementing RFID enhanced user satisfaction and reduced the average time for checking in and out of library books (Singh et al., 2006). Khanna (2014) demonstrated the positive effects of RFID on the circulation process, enhanced security measures, and efficient inventory management. Ahmed (2018) found that most users are satisfied with RFID systems after their implementation in libraries and that the transaction rate of library resources has increased. Kaur and Malhotra (2018) stated that kiosks have become an alternative to circulation/information services and have made services available beyond the library's physical boundaries.

Overall, the literature suggests that RFID technology has several potential benefits for libraries, including improved efficiency, security, and user satisfaction. However, more research is needed to understand user perceptions of RFID systems better and identify potential challenges or drawbacks.

3. Objectives of the study

i. To assess users' awareness of implementing RFID technology in the library

ii. To determine users' understanding of the different components of the RFID system

iii. To investigate the purposes of using RFID in the library

iv. To check the efficiency of library circulation services after implementing the RFID system

v. To identify the benefits and problems experienced by users in using RFID systems

vi. To measure users' satisfaction with the existing RFID technology.

4. Methodology

This study investigated the awareness and satisfaction of users towards the applications of RFID technology in library circulation services. The survey method was used to collect data from undergraduate and postgraduate students, research scholars, faculty, and the central library of Doon University staff. A structured questionnaire containing open and closed-ended questions was circulated to 200 university users. Out of these, 181 filled questionnaires were returned. The response rate was 90.5%. The collected data was analysed using percentage analysis.

5. Analysis and interpretation

5.1 *Awareness of RFID applications in circulation services*

The library's user status is determined by their understanding of new technology, such as the RFID-assisted circulation system, which respondents were asked to confirm. It is evident that 56.4% of the users are well aware of the new technology implemented in the library, while 10.5% of users are somewhat aware that this system is being used in the library, and 21% of users are not aware, and 12.2% users have only heard about this technology. A sizable portion of library patrons still need to be acquainted with the RFID-assisted circulation service despite the library's attempts to promote their library orientation programmes.

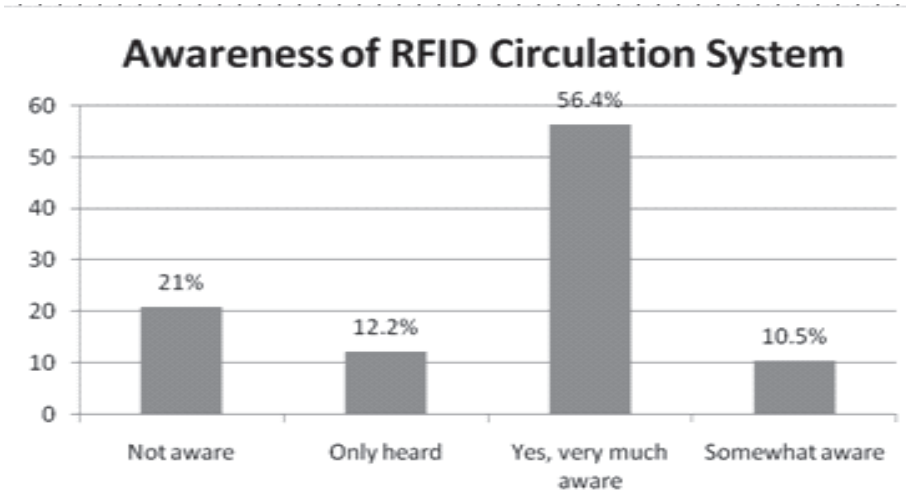

Figure 1: Awareness of RFID applications

5.2 *Awareness of RFID components in the library circulation services*

RFID-assisted library circulation improves services by automating material handling, reducing data entry errors, enhancing customer service, and updating records more efficiently. In response to the query regarding awareness of the users of the various RFID components, the results indicate that many users know of RFID smart cards, RFID tags, RFID scanners and readers, self-service (Kiosk), and security gates.

Table 1: Awareness of RFID components

S.N.	Opinion	Response
1	RFID tag	147(81.2%)
2	RFID smart card	167(92.3%)
3	RFID scanner reader	138(76.2%)
4	Self-service (Kiosk)	141(77.9%)
5	Security gate	139(76.8%)

(Note: *Multiple answers are permitted)

5.3 *Use of self-service (Kiosk) in the Library by patrons*

RFID-enabled self-service kiosk minimises library personnel's workload; improve inventory management accuracy and user experience independently without staff intervention, reduce waiting times and allow the staff to add value to other services. They also save the library and its patron's time and money.

Table 2: Use of self-service (Kiosk)

S.N.	Opinion	Response
1	Check-in/check-out of books	111(61.3%)
2	Book details	22(12.2%)
3	Reservation of books	18(9.94%)
4	Patrons details	17(9.39%)
5	Purchase suggestions	13(7.8%)

An attempt was made to look at various uses of RFID integration in the library circulation services by the patrons. Table 2 indicates that 61.3% of users use the Self-service facility (Kiosk) for check-in/check-out of books. While 12.2% of users used this tool to see the book's details, followed by patron details (9.39%). Furthermore, 9.94% of users reveal that they use this technology to reserve books and requisition books and journals (7.8%).

5.4 ***User's preference in check-in/check-out in the library***

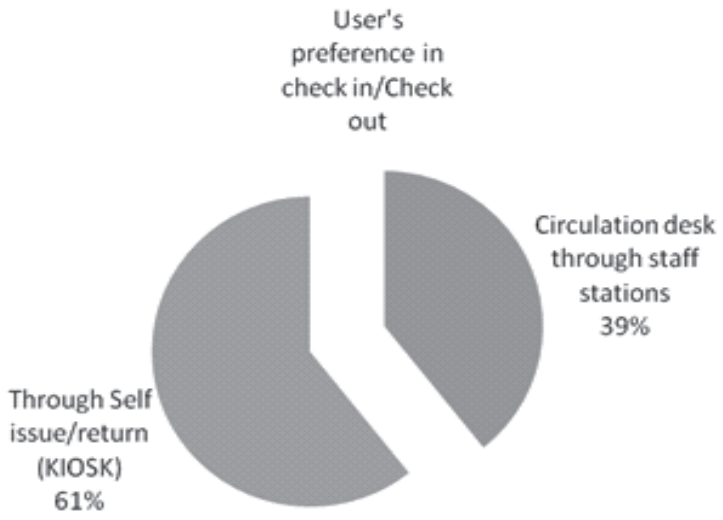

Figure 2: User's preference

Users prefer library self-service kiosks for book issuance/returning, demonstrating the efficient and engaging patron experience achieved through RFID-based circulation, allowing convenient check-in and check-out of materials. Significantly, 39% of patrons are still reluctant and avoid using library self-service, preferring to rely on staff support to check out and return materials. This calls for campaigns emphasising the advantages of utilising library self-service, including quicker transactions, round-the-clock accessibility, and shorter line-ups at circulation counters. Furthermore, the library might provide reluctant consumers with individualised support by manning library staff near kiosks to assist users with the procedure and resolve their concerns.

5.5 ***Reason for preferences***

Open-ended questions were asked to the users to comprehend patrons' preference in opting for the library self-service (Kiosk) instead of the circulation desk. A majority of users prefer the self-issue/return facility for faster and easier transactions, as this facility requires no help from staff other than the circulation desk from the staff stations.

5.6 ***Awareness programme for Library self-service (Kiosk)***

To perceive the awareness of the library self-service (Kiosk) in the library, respondents were asked whether they have been provided orientation about its functioning, and the responses are shown below in figure 3

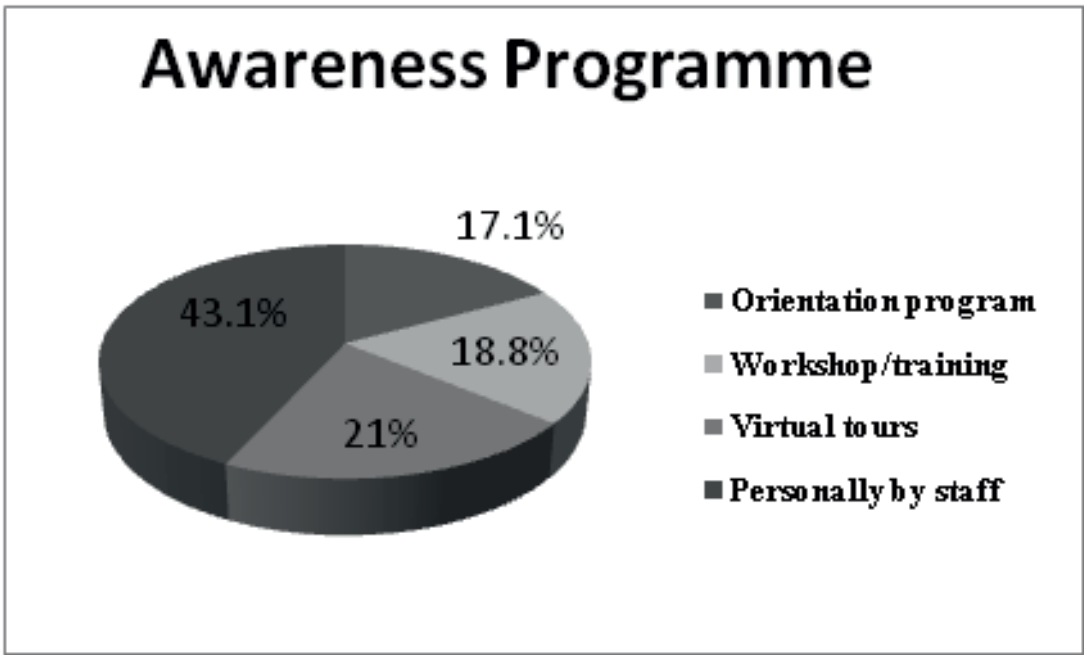

Figure 3: Awareness programme

The survey result described in figure 3 reveals that 43.1% of users get information about the self-issue/return facility through personal interaction with staff. The findings show that staff is actively involved in the awareness programme. 21% of users are aware of this technology through virtual tours. While 17.1% of users responded that they received an orientation programme for using the self-issue/return facility, 18.8% of users revealed that they get training for using this technology from the library. The findings suggest that the library should organise extensive patron orientation and training initiatives. These initiatives will assist users in navigating through the new circulation processes and using technology efficiently.

5.7 *Benefits of using RFID-based circulation services*

RFID technologies enhance efficiency in operation processing, eliminating the need for librarians to scan individual barcodes and allowing simultaneous check-in/out, verification, and entrance guard control (Yu, 2007).

Table 3: Benefits

SN	Opinion	Response
1	Reduce the time of the check-in/check-out process	153(84.5%)
2	Multiple books issued/returned	142(78.5%)
3	No dependency on staff	137(75.7%)
4	Fast transaction	132(72.9%)
5	Online reservation of books	143(79%)
6	User privacy reliable	151(83.4%)
7	Decrease latency	152(84%)

(Note: *Multiple answers are permitted)

The survey findings in table 3 show that a considerable number of respondents agree that RFID-assisted circulation has reduced the time of the check-in/check-out process in comparison to the staff-assisted barcode-based circulation process. The study found that RFID-assisted circulation reduced latency periods and waiting times by eliminating the need for library staff assistance, thereby reducing the overall efficiency of the circulation process.

5.8 *Problems faced by users while using RFID-assisted circulation*

Table 4: Problems faced

SN	Opinion	Response
1	No awareness program	106(58.6%)
2	Security gate collision	5(2.76%)
3	Upgradation of computers	6(3.31%)
4	Lack of assistance from staff	35(19.3%)
5	Slow speed	7(3.87%)
6	Return/issue slip receipt not working	8(4.42%)
7	RFID tag missing/not working	9(4.97%)
8	Book not returned showing in their account	5(2.76%)

Table 4 shows the problems users face when using RFID-based circulation systems. A staggering 58.6% of users revealed that the library organized no awareness programme, while 19.3% responded for lack of assistance from staff. 4.97% of users reveal that sometimes the RFID tag is missing/ not working while issuing books from the library. The other problems users face are return/issue slip receipts not working (4.42%), computer upgrades (3.31%), and slow speeds (3.37%). To ensure maximum utilisation of RFID-based systems, it is important to ascertain the problems they face using this technology. Frequent orientation of users can help levitate the use of RFID systems, thereby ensuring optimum use of library assets (Sahid, 2005).

5.9 Opinion

The implementation of RFID (Radio Frequency Identification) technology has substantially transformed library operations by improving efficiency and security, offering patrons convenience, allowing library staff to showcase the application of the latest technological advancements, and improving

user experience. The users were requested to give feedback and suggestions on how to improve the existing RFID-based circulation system rendered by the library and enhance the library circulation services in the future.

Table 5: Opinion

Opinion	Response				
Effectiveness of the RFID system in speeding up the borrowing process	**Ineffective**	**Effective**	**Moderate**	**Somewhat effective**	**Highly effective**
	0 (0)	1 (.55%)	29 (16.02%)	91(50.28%)	60 (33.15%)
Satisfaction with the self-checkout stations (KIOSK) provided by the RFID system	**Very dissatisfied**	**Dissatisfied**	**Moderate**	**Somewhat satisfied**	**Highly satisfied**
	0 (0)	2 (1.1%)	26 (14.36%)	96 (53.04%)	57 (31.49%)
Overall convenience of using the RFID system compared to previous methods in circulation services	**Much less convenient**	**Convenient**	**Moderate**	**Somewhat convenient**	**Much more convenient**
	0 (0)	1 (.55%)	27 (14.92%)	90 (49.72%)	63 (34.81%)
Overall experience with the RFID-based circulation system		**Poor**	**Moderate**	**Good**	**Excellent**
	0 (0)	0 (0)	25 (13.81%)	95 (52.49%)	61 (33.70%)

The analysis of table 5 reveals that the adoption of Radio-Frequency Identification (RFID) technology in the library has significantly enhanced the borrowing process speed, with 33.15% of users reporting successful borrowing speeds and 50.28% finding it fairly effective. User satisfaction with self-checkout stations is also notable, with 31.49% highly satisfied and 53.04% reasonably satisfied. The data underscores the overall convenience of the RFID system compared to the previous barcode-based method, with 49.72% of users finding it somewhat convenient and 34.81% rating it much more convenient. This indicates an improvement in user experience, likely due to increased efficiency, speed, and user-friendliness. Additionally, users rated their overall experience with RFID-based circulation systems as 52.49% good and 33.70% excellent, demonstrating the system's convenience and time-saving benefits for daily transactions.

6. Discussion

The present study discusses the implementation of RFID technology in library circulation services, highlighting various aspects of its awareness, benefits, challenges, and the importance of user education and feedback. Despite efforts to promote RFID-assisted circulation services, there is a need to raise awareness among library users about its full extent of benefits. RFID-enabled self-service kiosks are preferred to minimise staff workload, improve inventory management, and provide users with a convenient and efficient experience, particularly for book issuance and returns. The study emphasises the significance of extensive patron orientation and training initiatives to help users navigate new circulation processes and utilise RFID technology effectively. RFID technologies are noted for enhancing operational efficiency by eliminating individual barcode scanning, reducing check-in/check-out times, and

improving overall circulation process efficiency. However, challenges in implementation are acknowledged, suggesting the importance of addressing user problems through frequent orientation sessions and inviting user feedback for further system enhancements. Overall, the study's results underscore the comprehensive overview of RFID technology in library circulation services, emphasising the need for increased awareness, user education, and continuous improvement efforts to optimise library RFID system utilisation.

7. Conclusion

The present research conducted on the application of RFID-based circulation system has shed light on how to administer libraries in a more organised, effective, and user-friendly way. It was evident that users and staff take time to get aquatinted at the outset. However, with frequent usage, RFID technology will become an invaluable tool for library management, providing several benefits like automated inventory control, expedited checkout and circulation processes, increased security, and improved patron pleasure. It is relevant to note that implementing an RFID library management system would necessitate careful planning, funding, employee training, and continuous maintenance. The case study's conclusions will assist other libraries planning to introduce RFID-based circulation in identifying specific RFID circulation system components and effectively addressing common challenges users and staff face.

References

Ahmed, H.(2018).RFID technology inlibraries: a case study of Allama Iqbal library, University of Kashmir. *Journal of Indian Library Association,* 52(4), 109-120.

Coyle, K. (2005). Management of RFID in libraries. *Journal of Academic Librarianship,* 31(5), 486-489.

Curran, K. & Porter, M. A. (2007). Premier onradio frequency identification for libraries. *Library HiTech,* 25(4), 595-611.

Doon University (2024). Retrieved from https://doonuniversity.ac.in/index.php/about_us.

Doon University Central Library. (2024). Retrieved from https://www.doonuniversity.ac.in/library

Hasan, N. & Saini, S. (2007). Survey of use and impact of RFID: a case study of IIT Delhi. In *Curation and management of cultural heritage through libraries* (pp. 563-577)

Kaur, H & Malhotra, S. (2018). Use of "Kiosks" as a self-service tools in libraries. Retrieved fromhttps://www.researchgate.net/publication/328245991_Use_of_Kiosks_asaSelf_Service_Tools_in_Libraries.

Kern, C. (2004). Radio frequency identification for security and media circulation in libraries. *The Electronic Library,* 22(4), 317-324.

Khanna, S. (2014).Impact of RFID technology on library services: a case study of A.C. Joshi Library, Panjab University, Chandigarh. *International Journal of Digital Library Services,* 4(2).

Koneru, I. (2004). RFID technology: a revolution in library management. Retrieved from https://ir.inflibnet.ac.in/handle/1944/362

Kwok, S. K., Cheung, C. F., Lee, W. B.,Tsang, Albert H. C. & Tang, M. C. (2018). Development of an RFID-enabled mobile smart library system. *International Journal of Enterprise Network Management,* 2(2), 185-97.

Madhusudan, M. & Gupta, P. (2014). Use of RFID technology by students in Indian Institute of Technology, Delhi and Indian Law Institute, Delhi: a survey. *World Digital Libraries: an International Journal,* l7 (2), 145-156.

Rahman, M. H. & Islam, M. S. (2019). Implementation of RFID in university libraries of Bangladesh. *Global Knowledge, Memory and Communication,* 68 (½), 112-124.

Selamat, M., & Majlis, B. Y. (2006). Challenges in implementing RFID tags in a conventional library. Retrieved from https://www.researchgate.net /publication/259131_Challenges_in_Implementing_RFID_Tag_in_a_Conventional_Library.

Shahid, S. Md. (2005). Use of RFID technology in libraries: a new approach to circulation, tracking, inventorying, and security of library materials. *Library Philosophy and Practice (e-journal)*. 62.

Singh, J, Brar, N. & Fong, C. (2006). The state of RFID application in Libraries. *Information Technology and Libraries,* 25(1):24-32.

Singh, N. K. & Mahajan, P. (2017). Application of Radio Frequency Identification Technology in libraries and information centres: an Indian perspective. *Library Philosophy and Practice(e-journal)*. 1614.

Tseng, S. & Kuo, Pin-dar (2009). A study on the patronage of intelligent library: the Ximen intelligent library of the Taipei public library system. *New Library World,* 10(9/10), 410-429.

Yenurkar, G. K., Nasare, R. K. & Chavhan, S. S. (2017). RFID based transaction and searching of library books. Retrieved from https://www.researchgate.net/publication/325984252_RFID_based_transaction_and_searching_of_library_books.

Yu, S. C. (2007). RFID implementation and benefits in libraries. *The Electronic Library,* 25(1), 54-64.

Ward, M. & Kranenburg, R. V. (2006). RFID: frequency, standards adoption and innovation. *JISC Technology and Standards Watch*. Retrieved from https://www.academia.edu/2619982/RFID_frequency_standards_adoption_and_innovation.