

A Case Study of User Satisfaction of RFID Technology in University Library of Bodoland Territorial Region

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ABSTRACT

This study examines the user satisfaction with Radio Frequency Identification (RFID) technology in the academic environment of Bodoland University Central Library through a case study approach. RFID technology has transformed modern library operations by improving circulation services, security systems, inventory management, and self-service facilities. The primary objective of this study is to evaluate library users' satisfaction with the implementation and use of RFID-based services at the Central Library of Bodoland University, Assam. The research focuses on various aspects of user experience, including ease of access, speed of borrowing and returning materials, accuracy of transactions, reduction of waiting time, and overall convenience. Data were collected through questionnaires, interviews, and observations from 60 students, faculty members, and library staff. The findings reveal that the majority of users are satisfied with RFID-enabled services due to their efficiency, time-saving features, and user-friendly operations. Users particularly appreciate self-checkout systems and enhanced security measures that contribute to smoother library functioning. However, the study also identifies certain challenges, such as occasional technical issues, lack of user awareness, and the need for proper guidance during the initial stages of implementation. The study concludes that RFID technology significantly enhances the quality of Central Library services and user satisfaction when supported by adequate infrastructure, technical maintenance, and user education programs. The findings may help in the central library and information professionals in planning and improving RFID-based library services for better user engagement and operational efficiency

KEYWORDS: RFID, University Library, User Satisfaction, Smart Library, Information Technology, Survey Analysis.

INTRODUCTION

The rapid rise of information and communication technology has remarkably brought a change on how academic libraries operate and serve communities in the present day. In today's digital era, libraries are no longer the old quiet places which are just filled with books. Rather they have evolved into vibrant, technology-driven centres of information. Nowadays, modern academic libraries offer fast, efficient, and user-oriented services in order to meet the varied needs of students along with researchers, faculties and also the wider academic communities. This type of transformation is based largely in fitting response to the growing expectations to immediate access to vast range of resources, streamlined circulation systems, stronger security, and more effective management of library collections. For meeting these demands libraries around the world have adopted automation and new technologies. One of the innovations which is greatly influenced library management is the Radio Frequency Identification (RFID) technology. Brian King and Xiaolan Zhang defines about the RFID, *"RFID technology stands for Radio Frequency Identification. RFID tags are small integrated circuits connected to an antenna, which can respond to an interrogating RF signal with simple identifying information, or with more complex signals depending on the size of the IC."* RFID has grown into a key tool for improving how libraries track, manage and further secure their resources. Bodoland University, which is located in Assam, India demonstrates an institution embracing such technological progress. Being established to promote higher education, research, innovation, and cultural development in its region, the university offers a wide range of programs across science, arts, commerce, social sciences, languages, management, and professional studies. It is engaged to continuous improvement by upgrading its infrastructure, expanding research capabilities, and integrating new technologies to keep up the pace with modern educational needs. At the heart of Bodoland University is its Central Library, which provides supports to academic activities by giving access to books, journals, thesis, reference materials, newspapers, electronic resources, and digital databases. With the increment in library's collection and user base, it has gradually shifted from being traditional manual operations to automated, technology-based services. This rapid shift is essential for improving the operational efficiency, ease of staff workload management, managing information resources effectively, and enhance user satisfaction. One of the major mile stone in this regard is the adaptation of RFID technology.

2. RFID TECHNOLOGY: A CONCEPTUAL OVERVIEW

Radio Frequency Identification (RFID) technology is an advanced system which uses radio waves to automatically identify and manage tagged items. RFID consists of small electronic tags attached to library items. Miodrag Bolic, Akshay Athalye, and Tzu Hao Li mention about the RFID, *"RFID is a wireless technology that allows for automated remote identification of objects."* The main components of RFID system include tags, readers, antennas, middleware, and library management system. In libraries, RFID tags are being attached securely to materials, allowing them to be wirelessly tracked and processed without the need for physical contact or in other words direct scanning. Albert Lozano-Nieto mentions about the functions of RFID, *"The basic function of an RFID system is to automatically retrieve the information that has been previously inserted into specific integrated circuits."* This makes the library transactions faster and more efficient in comparison to traditional barcode systems. The use of RFID has greatly transformed library management by automating key processes including circulation and security. For example, RFID-based service kiosks let users check out and return items independently, thereby reducing the need for staff assistance and thus speeding up transactions. This further helps ease out congestion at service counters, especially at during the busy times, and also enhances administrative efficiency. Security gates are often

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equipped with RFID at library entrances and exits which help prevent unauthorized removal or theft, protecting the valuable resources. It also offers multiple benefits for both staff and users. It reduces repetitive tasks, increases the pinpoint accuracy, simplifies record-keeping of books and e-books, and also speeds up daily operations for library management. And for users, RFID brings greater convenience, independence, and quick access to materials thus making library a more satisfying experience. The self-service feature of RFID is that it inspires the users to confidently interact with technology, promoting a sense of empowerment. Additionally, RFID also supports the vision of “smart libraries” by combining automation, digital resource management, and effective information retrieval.

Nevertheless, the success of RFID technology in library depends more on the technology itself. It is quite crucial that users are aware of the technology, understand it and are satisfied with the system. Research in library science often focuses on how users perceive RFID in terms of how easy it is to use, efficiency, convenience, reliability, satisfaction, security and also awareness. At central library of Bodoland University, RFID has been introduced in order to modernize services, improve management of resources and enhance the experience of user. Yet, in order to truly understand how effectively the RFID system works it is very important to understand and take note on how users interact with RFID and what they think of its advantages and potential drawbacks. The major considerations which can be focused on inclusion of user’s opinion on self service reduced waiting times, ease of borrowing and returning items, personal data security, and system reliability.

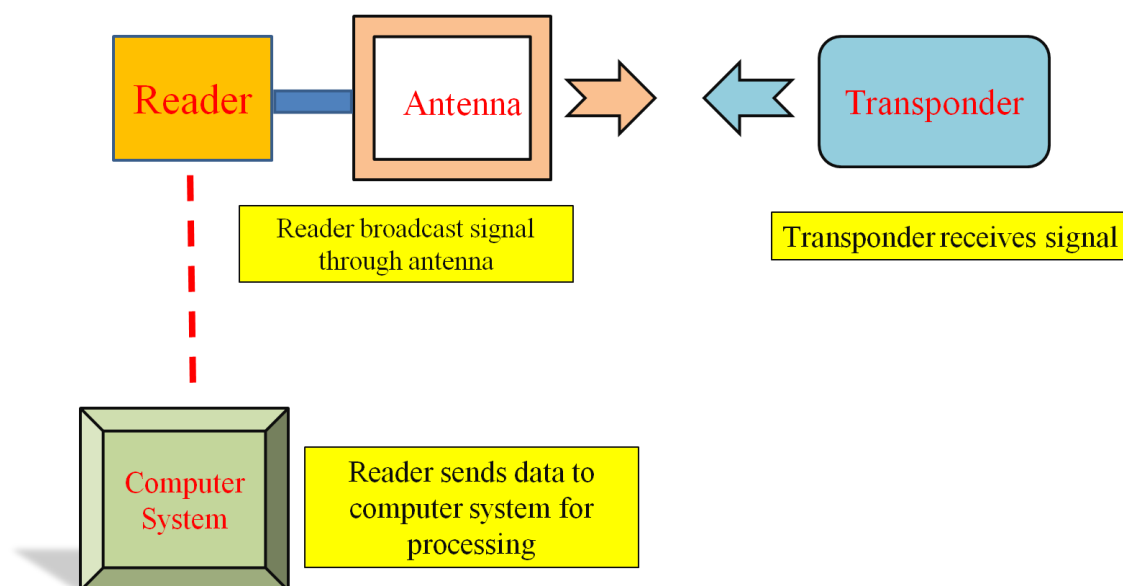


Figure 1: Working principle of RFID system

3. RFID TECHNOLOGY AND ITS ROLE IN ACADEMIC LIBRARY MANAGEMENT

The rapid growth of information and communication technologies has greatly changed how in academic libraries and university information systems to operate. Traditionally, libraries relied on manual processes and barcode systems, which led to common issues like slow check-out procedures, poor inventory management, and a heavy reliance on staff. To tackle these challenges, many academic institutions have started using Radio Frequency Identification (RFID) technology, which is a smart way to automate library functions and manage information

better. In academic libraries, RFID technology makes routine tasks easier and faster. Brian King and Xiaolan Zhang mention about the RFID, “*RFID computing system is a technology whose use has become more and more diverse and has become pervasively applied in many environments.*” This includes checking books in and out, organizing shelves, verifying stock, and managing security. Unlike barcode systems that need a direct line of sight, RFID can read multiple tagged items at once from a distance, speeding up the entire process and making it more convenient. With RFID systems, borrowers can use self-service kiosks to check out and return books, which reduces waiting times and lessens the burden on staff. RFID security gates also help protect library materials from theft. The use of RFID technology in universities is part of creating smart, digital campuses. Modern libraries are adopting these automated tools to meet the growing needs of students, researchers, faculty, and administrative staff who want quick access to information. RFID helps keep track of inventory accurately, quickly find misplaced books, and monitor collections in real time. Furthermore, it boosts user satisfaction by providing faster services and a more enjoyable library experience. As universities continue to go digital, RFID technology is becoming an essential part of improving library management and supporting high-quality academic services.

4. IMPLEMENTATION OF RFID IN THE UNIVERSITY LIBRARY

Introducing RFID technology in university libraries is a major step toward modernizing and automating library services. With the growing need for quick, accurate, and user-friendly information management systems, many universities have started using RFID-equipped library setups to boost efficiency and improve the overall experience for users. An RFID system in a university library usually includes RFID tags on library materials, RFID readers, antennas, self-service kiosks, security gates, and library management software. All these parts work together to automate book lending, manage inventory effectively, and securely monitor library resources. In university libraries, RFID technology mainly helps streamline everyday tasks like checking books in and out. Users can borrow or return books at self-service stations without needing help from library staff. This not only cuts down on crowding at circulation desks but also makes the process faster and contactless. RFID readers at entry and exit points help track the movement of library items and sound alarms if something is taken without permission. Additionally, librarians can use handheld RFID scanners for quick stock checks and shelf organization, greatly reducing the time and effort needed for manual inventory checks. For RFID systems to succeed in university libraries, it's important to have user knowledge, proper technical setups, and support from the institution. Schools often provide training and orientation to help students and faculty understand how to use RFID services and self-service options. Adopting RFID technology leads to better access to resources, improved security, better collection management, and greater user satisfaction. Moreover, implementing RFID supports the wider goals of digital transformation and creating smart campuses in higher education. As universities keep bringing advanced technologies into academic management and library services, RFID systems are expected to play an increasingly important role in maintaining efficient and sustainable information management practices.

4.1 Advantages and Applications of RFID Systems

RFID technology has many benefits compared to traditional library management and identification systems, making it a popular choice in schools and information centers. One of the biggest advantages of RFID is its ability to quickly and contactlessly identify multiple items at once. Unlike barcodes, RFID doesn't need direct line-of-sight scanning, which saves time and makes operations run more smoothly. This feature speeds up processes like

borrowing, returning, and renewing library materials, so users spend less time waiting and find it easier to access library services. Andreas Hagl and Konstantin Aslanidis mention about the advantage of RFID, “*Radio Frequency Identification (RFID) is the most reliable way to electronically identify, data capture, control, track, and inventory items using RF communication.*” Another key benefit of RFID is its ability to improve inventory management and tracking of resources. RFID tags embedded in books and other items allow librarians to quickly check stock and find misplaced items more accurately. This reduces the loss of materials and cuts down on the time spent searching manually or keeping records. Plus, RFID enhances security through electronic gates that can automatically detect if tagged items are being moved without permission. The automation that RFID brings also decreases the need for manual labor, reduces human error, and lets library staff focus more on supporting students and academic activities. RFID technology is not just limited to library management; it has a wide range of uses in educational institutions and other fields. In universities, it can be used for tracking student attendance, controlling access to buildings, managing assets, and keeping track of lab equipment, all of which contribute to campus security. Outside of academia, RFID is also used in transportation, healthcare, supply chains, retail, and industrial automation. Specifically in libraries, RFID systems support self-check-in and check-out, automate book sorting, manage shelves, control digital inventories, and prevent theft. The versatility and efficiency of RFID technology have made it an essential part of today’s smart campus environments and automated information management systems.

A survey was conducted among the users of the Central Library, Bodoland University with the well-structured questionnaires to gather information regarding the user awareness, usage patterns, satisfaction levels, perceptions of efficiency and security associated with RFID-based library services. All total 100 questionnaires were distributed to the users including students, research scholars and faculty members and 60 users were responded with filled questionnaires. The collected responses were analyzed and interpreted to evaluate user perceptions and the effectiveness of RFID implementation in enhancing library services.

5. ANALYSIS ON RFID USAGE AND USER AWARENESS

The study on RFID usage and user awareness in the Central Library of Bodoland University discloses the growing integration of Radio Frequency Identification (RFID) technology into modern library operations and highlights the perceptions and awareness levels of library users regarding this technological advancement. The questionnaires were designed for collecting information related to demographic features, patterns of library usage, familiarity with RFID technology, and the extent to which users interact with RFID-based self service systems. The respondents were from different educational background such as undergraduate, graduate and postgraduate levels as well as different age groups. This diversity of respondents reflects broad participation which gives us a comprehensive understanding of RFID awareness among users with varying academic backgrounds. Findings from the survey tells us about the frequency of library visit, including daily, weekly, monthly, rarely, and it shows that the library continues to play an important role in supporting teaching, learning, and research activities within the university. Users who have been regularly visiting the library interact more frequently with RFID-enabled service systems for borrowing and returning books. The survey classified responses into Always, Frequently, Sometimes, Rarely which helped us evaluate the level of adoption of RFID technology in routine library activities. The findings discloses that many users actively use RFID enabled self service kiosks and circulation systems, indicating that RFID technology has become one of the integral part and component of library management infrastructure. The survey categorized

responses into five levels: Always, Frequently, Sometimes, Rarely, and Never. This helped to assess how well RFID technology is embraced in everyday library activities. The results indicate that many users are actively engaging with RFID-enabled self-service kiosks and circulation systems, showing that RFID technology has become a vital part of library management. Frequent interaction with these systems is playing a significant role in enhancing users' technological awareness and fostering positive attitudes toward digital library services. Additionally, the study looked into how familiar users are with RFID technology by asking whether they felt Very Familiar, Familiar, Slightly Familiar, Neutral, or Not Familiar with RFID systems. The findings suggest that a considerable number of users have at least a moderate understanding of how RFID works and its applications in the library setting. Users view RFID technology as a modern, efficient tool tied to self-checkout, self-return, inventory management, and theft prevention. Regular exposure to RFID services has thus improved users' technological literacy and their comprehension of automated information management systems.

Another key takeaway from the study is that users generally find RFID systems to be easy to operate and user-friendly. Respondents expressed positive views about the clarity of instructions for using RFID kiosks and appreciated the ability to handle circulation tasks independently without needing heavy assistance from library staff. This straightforward operation has bolstered user confidence and encouraged broader acceptance of new library technologies. The self-service aspect of RFID systems has also empowered users to become more technologically self-sufficient and comfortable with automated processes. The findings highlight the importance of awareness-building programs, orientation sessions, and proper guidance regarding RFID operations to improve user engagement with these automated systems. Since acceptance of technology is closely tied to user familiarity and hands-on experience, the library's commitment to providing clear instructions and accessible self-service options is crucial for the success of RFID implementation. Some respondents even recognized that RFID technology is utilized in various sectors beyond libraries, such as healthcare, transportation, retail, manufacturing, and asset tracking, reflecting a wider understanding of technology among users. Overall, the study demonstrates that RFID technology has become a significant and well-accepted feature of library services at Bodoland University Central Library. Users appear to be increasingly aware of RFID-based offerings and are gradually incorporating these technologies into their academic routines. The positive feedback regarding familiarity, ease of use, regular interaction, and technological awareness signals a successful adoption of RFID technology and highlights its growing relevance in contemporary academic library management.

Table 1: Summary of RFID User Awareness, Satisfaction, Efficiency, and Security Findings

Dimension	Survey Aspect	Major Findings
Respondent Profile.	Educational and age diversity	Participants represented different educational levels and age groups, ensuring broad user representation
Library Usage Pattern	Frequency of library visits	Users visited the library at varying frequencies (daily, weekly, monthly, etc.), indicating active engagement with library services.
RFID Awareness	Familiarity with RFID technology	Most respondents demonstrated moderate to high familiarity with RFID-based systems and

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		their applications.
RFID Usage	Use of self-service systems	Users regularly interacted with RFID-enabled borrowing and return services, showing substantial adoption.
Ease of Use	User-friendliness of RFID systems	RFID systems were perceived as simple, convenient, and easy to operate.
Service Efficiency	Speed and waiting time	RFID technology reduced queues and minimized waiting time during circulation activities.
Accuracy and Reliability	Transaction performance	Users believed RFID services maintained accurate and reliable issue-return records.
Technical Performance	System stability	Most respondents experienced minimal technical difficulties, indicating satisfactory system reliability.
User Satisfaction	Overall perception	Users expressed positive attitudes and high satisfaction with RFID services.

5.1 Analysis on User Satisfaction, Efficiency, and Security of RFID

The study on user satisfaction, efficiency, and security of RFID technology at the Central Library of Bodoland University offers valuable insights into how RFID systems have improved library operations and enhanced the overall experience for users. The survey included a variety of questions designed to gauge users' opinions on ease of use, service efficiency, accuracy, reliability, convenience, independence, and security related to RFID technology. One of the key findings relates to how easy RFID systems are to use. Respondents indicated their level of agreement with statements about the user-friendliness of RFID services, with options ranging from Strongly Agree to Strongly Disagree. The results show that users generally find RFID systems simple, convenient, and easy to navigate for regular library tasks like borrowing and returning books. The self-service features of RFID kiosks allow users to complete circulation activities independently, which increases convenience and satisfaction. The study also emphasizes how RFID systems improve efficiency by reducing queues and waiting times at the circulation desk. Traditional manual circulation processes can be slow, especially during busy times, but RFID self-service systems make transactions faster and help streamline library operations. Users strongly agreed that RFID technology speeds up the borrowing process, simplifies returning books, and enhances the overall quality of library services. This automation significantly boosts operational efficiency. Another important aspect the study highlighted is the accuracy and reliability of RFID check-in and check-out services. Many respondents felt that RFID systems accurately handle transactions, keep user accounts up to date, and minimize the errors often seen with manual methods. Efficient account management is crucial; incorrect handling of borrowed or returned books can lead to

confusion and dissatisfaction. The findings indicate that RFID has positively contributed to maintaining accurate transaction records and smooth circulation management.

Technical reliability was also examined, focusing on whether users encounter technical issues with RFID systems. Most respondents expressed satisfaction with how well RFID services perform, but the study acknowledges that ongoing system maintenance and technical support are essential to ensure smooth operations. A dependable technological setup is key to maintaining user confidence and satisfaction with automated library systems. Security and privacy are also central to this study. Respondents were asked if their personal information is safe when using RFID services and if RFID helps prevent theft of library items. The findings show that users generally trust the security features that come with RFID technology. RFID security gates and tagging systems are seen as effective in protecting library collections and detecting any unauthorized removal of materials. Therefore, users perceive RFID technology as a significant contributor to both information security and resource protection in the library. The study further highlights how RFID technology improves users' overall library experience. Many respondents expressed satisfaction with the independence RFID self-service systems provide, especially the ability to check out and return books without needing staff assistance. Users appreciated the reduced manual effort, faster service, and greater convenience linked to RFID operations. Most users also said they would recommend RFID services to others due to the efficiency, speed, reliability, and security it offers. Another important finding is that clear instructions on how to use RFID kiosks have positively impacted user satisfaction. Clear guidance reduces confusion, encourages users to operate independently, and helps them feel more comfortable engaging with automated systems. The study suggests that educational initiatives and awareness programs are critical for maximizing the effectiveness of RFID in academic libraries.

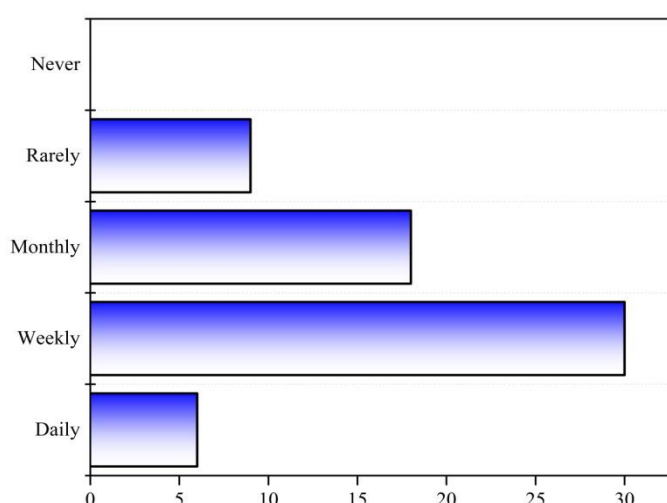


Figure 2: Frequency of library visit by respondents

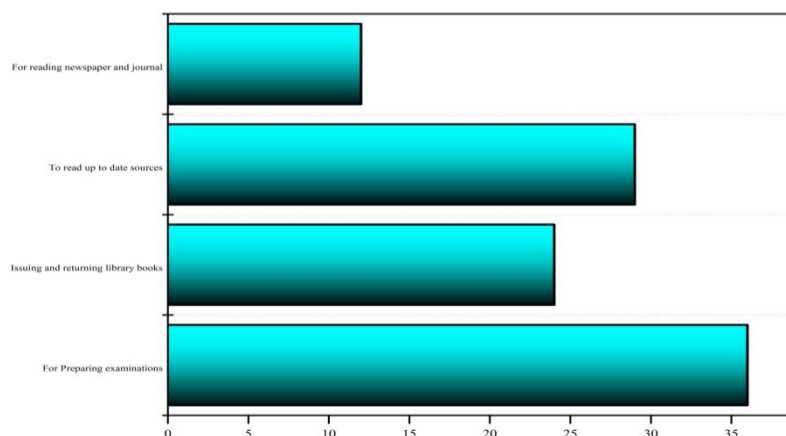


Figure 3: Purpose of Library visit by Respondents

SUMMARY AND CONCLUSION

The study concludes that RFID technology has notably improved user satisfaction, operational efficiency, and security at the Bodoland University Central Library. Users generally view RFID systems as efficient, accurate, secure, and easy to use. This technology has effectively reduced waiting times, simplified circulation tasks, improved record management, enhanced protection against theft and loss, and fostered greater convenience and independence among users. The findings strongly support RFID as a valuable technological solution for modern academic library management, illustrating its significance in enhancing the quality of library services.

The study on user satisfaction with Radio Frequency Identification (RFID) technology in the central library of Bodoland University of Assam reveals that RFID has significantly improved the efficiency, accuracy, and quality of library services. Most users expressed positive opinions regarding the speed of circulation services, ease of self-check-in and self-check-out, improved security of library materials, and reduced waiting time. The technology has also enhanced overall user convenience by enabling faster access to information resources and better management of library collections. The findings indicate that students, faculty members, and library staff generally perceive RFID technology as a modern and user-friendly system that contributes to a better library experience. Users appreciated the automation of routine processes, which allows library staff to focus more on user support and information services. Additionally, RFID has helped to minimize issues such as misplaced books, manual errors, and unauthorized removal of materials.

However, the study also highlights certain challenges affecting user satisfaction. Some respondents reported occasional technical problems, lack of awareness about the proper use of RFID-enabled services, and concerns regarding privacy and system maintenance. These issues suggest the need for continuous technical support, regular system upgrades, and user orientation programs to maximize the benefits of RFID technology. Overall, the case

study concludes that RFID technology has had a positive impact on college library services and user satisfaction. The successful implementation of RFID not only modernizes library operations but also improves service delivery and user engagement. For sustained effectiveness, college libraries should continue investing in staff training, user education, and technological improvements to ensure that RFID systems remain reliable, secure, and responsive to users' needs.

REFERENCES

- [1] Bolic, Miodrag. Simplot-ryl. Stojmenovic, Ivan. Rfid systems research trends and challenges. First Published., A John Wiley and Sons, Ltd., West Sussex, United Kingdom, 2010.
 - [2] Finkenzeller, Klaus. RFID Handbook Fundamentals and Application in Contactless Smart Cards, Radio Frequency Identification and Near-Field Communication. Third Edition., A John Wiley and Sons, Ltd., West Sussex, United Kingdom, 2010.
 - [3] House of Representatives, Committee on Energy and Commerce U.S.. RFID Technology What the Future Holds for Commerce, Security, and the Consumer. Reprinted Edition., University Press of the Pacific, Honolulu, Hawaii, 2005.
 - [4] Kitsos, Paris. Zhang, Yan. *RFID Security Techniques, Protocols and System-on-Chip Design*. First Edition., Springer., 233 Spring Street, New York, 2008.
 - [5] Lozano-Nieto, Albert. *RFID Design Fundamentals and Applications*. First Edition., Taylor and Francis Group., Boca Raton London New York, 2011.
 - [6] Sing, Neeraj Kumar. *RFID FOR LIBRARIES A Practical Approach*. First Published., Ess Ess Publication., Darya Ganj, New Delhi, 2019.
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