Research Article

Rajender Kumar*

Students' Perspectives on the Application of Internet of Things for Redesigning Library Services at Kurukshetra University

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Abstract: The purpose of this study was to investigate students' perceptions regarding the implementation of the Internet of Things (IoT) at Kurukshetra University Library. A descriptive survey method was employed, utilizing a random sampling technique to survey 250 students from five different faculties: Arts & Linguistics, Social Science, Science, Engineering & Technology, and Law. A total of 237 completed questionnaires were received that were correctly filled out, resulting in a response rate of 94.8%. The analysis of data was done through the utilization of statistical software such as Statistical Package for the Social Sciences and Microsoft Excel. Statistical analysis was performed using percentages and analysis of variance to evaluate the significance of the findings at a 0.05% level. The findings indicate that a majority of students strongly support the use of IoT to replace outdated library processes and services. Furthermore, a significant difference was observed in the mean values of students' perceptions and the usefulness of employing IoT in the library across the five faculties. These results are presented in tabular format, accompanied by an appropriate explanation. The study offers insights into the potential benefits associated with implementing IoT in university libraries and underscores the importance of staying abreast of modern technological advancements in the field of libraries.

Keywords: internet of things, students, perceptions, IoT, libraries, wireless technologies, Kurukshetra University

1 Introduction

The emergence of 4.0 technologies, such as the Internet of Things (IoT), artificial intelligence (AI), and cloud computing, has proven to have profound effects on various aspects of education, information services, learning pedagogy, communication methods, and access to different resources. As we continue to embrace these advancements, the potential for further innovation and improvement within the library remains vast, promising an even more engaging and enriching future for library patrons worldwide (Wójcik, 2016). Among the many information and communication technologies, the Internet has become one of the most effective means for exchanging information, resources, and other things in various forms and formats with the help of people over the Internet. It provides online access to anything from anywhere, anytime, making it the most effective technology today. The IoT, which is an advanced form of the Internet, allows different objects to communicate with each other promptly using various methods such as sensors, radio frequency identification (RFID), near-field communication (NFC), Wi-Fi, Bluetooth, and strong networks. This technology has a wide range of applications, including cell phones, iPods, mobile devices, educational materials, services, people, and animals, making it pervasive.

Technology strengthens the bond between students and academic libraries by expanding access to digital resources, offering collaborative platforms, and providing personalized experiences. IoT integration enhances

* **Corresponding author: Rajender Kumar,** Librarian, DAV College Sadhaura, Yamuna Nagar, India, e-mail: rajkukphd@gmail.com

library services, providing digital resources and innovative tools for students. This enriches the learning experience, enabling research, collaboration, and easy access to information. Libraries are actively embracing the IoT and making efforts to utilize it effectively. The integration of modern technologies, such as data mining, AI, the IoT, and language-based search, is transforming traditional libraries into smart libraries (Jadhav & Shenoy, 2020). This global trend can be observed as numerous libraries around the world have adopted IoT technology in their operations. For instance, the Orlando Public Library has implemented Bluebeam technology to provide location-triggered information to library patrons (Qin, 2018). Similarly, the Somerset County Library and Half Hollow Hills Community Library have also integrated IoT systems into their operations (Pujar & Satyanarayana, 2015). Furthermore, renowned libraries like The Joe and Rika Mansueto Library, University of Chicago; Library of Congress in the United States; the Seattle Public Library in the United States, and the Birmingham Central Library in the United Kingdom deployed IoT-based systems such as smart door locks, video surveillance, automated retrieval, and self-checkout. These systems are utilized to enhance security, optimize energy consumption, efficiently manage library materials, and improve patron services. This involves the use of technology to deliver a remarkable experience for library users, especially tech-savvy users who need fast and real-time services. The study focuses on the perceptions of students regarding the application of the IoT in libraries. The Internet simplifies students' everyday lives by providing them with a variety of online platforms and services, as well as opportunities for people-to-people connections. Therefore, an attempt is made to conduct a study to understand how students perceive IoT technology and its application in libraries.

2 Literature Review

Libraries have a close relationship with the IoT as it allows for more efficient management and operation of library systems. By using IoT, libraries can provide users with a comprehensive range of reading services, such as self-checkout and self-return of books and materials, long-term storage, and research on reading habits. The adoption of IoT technology has significantly transformed the way libraries operate and provide services, resulting in improved resource management and increased effectiveness (Ehsanian, Tahmasebi Limooni, & Ghiasi, 2022). Xu (2022) proposed a solution to establish a smart library at a university by implementing an IoT-based lending system, a book sorting system, a self-service system, and a text recommendation. Such a system can improve library management efficiency, borrowing rates, and reduce the cost of day-to-day library maintenance. With the implementation of AI and IoT, the smart lending service is more realistic and tangible than traditional human-based librarianship. As such, the smart library paradigm has brought significant advances in service and is an important development for library resource management (Bi et al., 2022). According to Dongare (2022), IoT intelligent technology can be successfully applied in library routines and services with Internet and cloud computing, including automatic gate entry devices, reference services, collection development, notification services, mobile technology, location-based services, fire alarms, electronics, drones, automated polls, and displays for programs and events. According to Chintan (2022), Blockchain technology can combine various cards, such as credit/debit, library, office, parking, and hospital cards, into one smart card that stores all biometric information of a user and has a built-in RFID. Sinha, Panja, and Brar (2022) investigated the opinions of research scholars at IIT Madras regarding IoT applications in library services and found that most scholars support the use of IoT technology in libraries due to its potential benefits, including user authentication, remote monitoring of library resources, improved service delivery, and reduced book issue/returns time. Another study by Sinha and Brar (2022) found that most postgraduate students at IIT Madras are receptive to new technologies in the library and gather information about them from various sources such as YouTube, web searches, social discussions, articles, magazines, newspapers, courses, and webinars. Deshpande (2022) suggested that RFID and online public access catalogue (OPAC) based on IoT technology can improve resource utilization and profitability in academic libraries through wireless sensor networks. Harati, Shekofteh, Valizadeh-Haghi, and Kazerani (2021) examined IoT infrastructures in 15 academic libraries in Iran and found that 60.53% of the libraries had the required infrastructures to a

moderate extent for IoT use, including technical, financial, legal, and human resources. Overall, libraries are becoming more intelligent systems through the integration of IoT devices, which capture real-time data and optimize various processes for increased efficiency and improved resource management (Sungkur, Ozeer, & Nagowah, 2021). As IoT technology advances, it is increasingly being used to connect and interact with other devices through sensors and small computers. Algarni, Alkhelaiwi, and Karrar (2021) noted that as this technology evolves, it not only increases productivity, reduces costs, and improves quality of life, but also protects the security of data generated by smart devices. Modern libraries are also adopting IoT applications to maximize resource utilization while saving time, energy, and money (Makwana, 2021). According to Ukamaka and Kakiri (2021), information communication technology (ICT) literacy should be incorporated into library and information science (LIS) programs at the graduate and postgraduate levels to equip professionals with the necessary skills to operate in the IoT-enabled environment. The implementation of IoT in library automation software, management tools, digitization technology, search and access tools, retention tools, web, social media, mobile applications, SMS, and email is changing the library environment (Mondal, 2021). The IoT can enhance the customer experience by offering a range of options such as self-contained virtual journeys through library locations, as well as real-time notifications in the event of theft or system bypass through strategically positioned proximity sensors (Igbinovia & Okuonghae, 2021). Muthumari, Kulkarni, and Kulkarni (2021) noted that remote devices known as reference points can be set up in various library locations to play videos or sounds on customers' phones, providing them with more information about the location and how to make the most of it. However, the adoption of new technology requires an assessment of its advantages, return on investment, and application disadvantages. The IoT is still a relatively new concept in the developing world, but governments in countries such as South Africa and Nigeria, which are open to adopting new technologies, should take steps to promote IoT adoption while also considering privacy and security concerns (Igbinovia, 2021). By automating regular processes, the IoT has the potential to make library staff's jobs easier, making libraries more efficient and progressive (Khan, Zhang, Chohan, & Rafique, 2021). Alagumalai and Natarajan (2020) noted that IoT technology can be applied to various functions and services of libraries, such as collection management, recommendation services, location-based services, appliance management, usage statistics, information literacy, online learning portals, resource access, user queries, self-check-in/out, overdue reminders, online fine payment, and locating misplaced books on shelves. Muhamed and Darwesh (2020) proposed an RFID-based reference positioning system design that allows for fast reference search and improved security in library halls. Yi, Dhakshyani, and Abdulla (2020) developed a smart book return and sorting system using IoT technology that enables faster book return and sorting processes. Maceli (2020) suggests that IoT technology can effectively monitor and manage archival collections. However, Kaushik's (2019) study showed that IoT is not commonly used in library staff workplaces due to a lack of understanding and training. The integration of many functions into one interface or device, as offered by the IoT, has proven useful.

The main purpose of this article is to find answers to the following research questions (RQs) based on existing studies, evaluate student perceptions, analyze and synthesize data, and report the evidence in a way that will allow library professionals to thoroughly understand the findings.

RQ 1) What are the sources of awareness of IoT technology of students at Kurukshetra University?
RQ 2) What are students' opinion level replacing the library and their perception of the application of IoT in the library service area?
RQ 3) What are the opinions of students regarding the usefulness of IoT in library services?

3 Kurukshetra University, Kurukshetra

Kurukshetra University, situated in the city of Kurukshetra, Haryana, is a prestigious state government university in India. It was founded in 1956 and derives its name from the historical and mythological importance of the sacred city of Kurukshetra. Nestled along the western shore of Brahm Sarover, a revered holy tank, the university's campus spans over 400 acres of land. It is a premier institution known for its academic excellence, research contributions, and cultural heritage. The university offers a wide range of undergraduate,

postgraduate, and doctoral programs across various disciplines, including arts, science, commerce, management, social sciences, law, and technology. With a focus on quality education and holistic development, Kurukshetra University strives to impart knowledge, promote critical thinking, and nurture the talents and skills of its students. The university campus spans a vast area and is equipped with modern infrastructure, state-of-the-art facilities, and well-equipped laboratories. It houses libraries, auditoriums, sports facilities, hostels, and other amenities, creating an environment conducive to academic pursuits and extracurricular activities.

Kurukshetra University boasts of a well-maintained Central Library spanning 114,205 square feet, serving as a beacon of knowledge and academic support. It houses an extensive collection of resources, including 407,744 books/bound volumes/theses, 8,533 e-books, 15,324 manuscripts, 196 journals, 12 full-text resources subscribed through the E-Shodh Sindhu consortium, and 5 self-subscribed e-resources. The library is equipped with upgraded ICT infrastructure, including 45 computers, 4 laptops, 4 multi-functional printers, 2 barcode readers, 15 printers, 1 kiosk Libsys – 4.0, and 200 internet nodes connected to the campus-wide network. The computer lab has four 5 KVA Online UPS units for uninterrupted power supply, while other sections have one 2 KVA Online UPS and four 5 KVA Online UPS units. The Library, automated and comprehensive, serves as a gateway to e-resources, circulation, in-house databases, OPAC, and electronic communication, accessible through the university website to its 7,725 registered users. With diverse resources, comfortable reading areas, quiet study spaces, and internet-equipped computer terminals, it fosters effective learning and supports research and cultural knowledge dissemination. With a knowledgeable staff and collaborative environment, the Central Library acts as a vital intellectual hub, promoting holistic student development and academic achievements (https://www.kuk.ac.in/).

3.1 Objectives of Study

- To know the students' source of awareness of IoT technology at Kurukshetra University.
- To know students' opinions on replacing the library and their perception of the application of IoT in the library service area.
- To know students' opinions on the usefulness of IoT in library services.

4 Methodology

The present study employed a descriptive survey approach to investigate students' perspectives on the application of the IoT at Kurukshetra University Library. The participants were selected from five faculties including Arts & Languages (FAL), Social Sciences (FSS), Science (FS), Engineering & Technology (FET), and Law (FL), was selected using the random sampling sample of 250 students. The questionnaire was structured and used as a tool for data collection to fulfil the survey objective. Fifty print questionnaires were distributed among each faculty student with personal physical visits to the respective departments, data were collected from students of only one faculty in a day and the average time taken to complete the questionnaire was around 10–15 min. Therefore, the questionnaire was handed over to the potential respondents only after obtaining their verbal consent and the questionnaire was collected after 15 min. The data collection process was completed within 5 days in the month of January 2023. Forty eight questionnaires were received from Arts and Language, 45 from Social Sciences, 48 from Science, 50 from Engineering and Technology, and 46 from Law. The survey yielded a total of 237 correctly completed responses, with a response rate of 94.8%.

The collected data were analyzed using Statistical Package for the Social Sciences software and Microsoft Excel, with percentages used as the primary statistical measure. The mean differences in students' perceptions and opinions regarding the application of IoT in different library areas were determined using analysis of

variance (ANOVA) statistical test at a significance level of 0.05%. The results of the analysis are presented in tabular form, along with a suitable description.

The main objective of the study centered around investigating students' perspectives on the implementation of IoT prior to replacing the current library system. The research design was carefully crafted to ensure the sample represented the diverse student population of the university. To gain a comprehensive understanding of students' attitudes and opinions on the subject, a descriptive survey approach was selected. Questionnaires were deemed the most suitable data collection tool due to their ease of administration and efficient data collection process.

The research methodology employed in this study provides a robust and reliable means of investigating students' perspectives on the application of IoT at Kurukshetra University Library, with the results providing valuable insights into potential areas of improvement and development in the field of LIS.

5 Data Analysis

To properly appreciate the value of integrating new technologies into the institute, it is important to thoroughly understand the user's awareness. To achieve this objective, students were asked about their sources of awareness of the IoT. Table 1 shows the sources of IoT awareness among students. The results of the study indicated that all students were familiar with the IoT concept, with the majority learning about it via social media platforms such as YouTube, Facebook, and WhatsApp (29.1%). Other common sources of awareness were articles in magazines and newspapers (21.5%), research projects (14.3%), conferences and webinars (13.9%), workshops (9.7%), and colleagues (11.8%). The student's awareness of IoT has the potential to enhance the utilization of library resources, enrich their learning experiences, facilitate efficient space management, and provide personalized services. Moreover, it can contribute to strengthening their understanding of security and privacy measures, thereby fostering trust in IoT (Koohang, Sargent, Nord, & Paliszkiewicz, 2022).

It is important to assess the people's acceptance of the application of new technologies in the organization's operation and make informed judgments about their acceptance. Table 2 presents the viewpoints of students regarding the replacement of the current library system with new technology. The results indicated that a majority of students (54.4%) – including 56.3% from the Arts and Language faculty, 48.9% from Social Sciences, 47.9% from Science, 64% from Engineering and Technology, and 54.4% from the Law faculty – strongly agreed with the implementation of new technology in replacing exiting library operation area. Furthermore, 34.2% of the students agreed with the replacement, while only 10.5% remained neutral. A negligible percentage of students disagreed (0.4%) or strongly disagreed (0.4%) with the implementation of new technology in libraries.

The utilization of the IoT within libraries presents an opportunity to enhance user service, experience, and engagement, as well as foster interaction between library staff and students. As part of this exploration, the study aimed to investigate students' perceptions regarding the implementation of IoT in library-related areas. Table 3 displays the results that the majority of students are in favor of integrating IoT in various library services such as book reservations (97%), virtual library tours (96.6%), mobile reference services (94.9%),

Table 1: Source of IoT awareness

Source of awareness	Response = *N* (%)
Colleagues	28 (11.8)
Research project	34 (14.3)
Article/magazine/newspaper	51 (21.5)
Conference/webinar	32 (13.5)
Workshop	23 (9.7)
YouTube/Facebook/WhatsApp	69 (29.1)

Table 2: Replace the present Library system with a new application

Faculties	Strongly agree *N* (%)	Agree *N* (%)	Neutral *N* (%)	Disagree *N* (%)	Strongly disagree *N* (%)	Total *N* (%)
Arts & Languages	27 (56.3)	12 (25)	8 (16.7)	1 (2.1)	0 (0)	48 (100)
Social Sciences	22 (48.9)	14 (31.1)	9 (20)	0 (0)	0 (0)	45 (100)
Science	23 (47.9)	17 (35.4)	8 (16.7)	0 (0)	0 (0)	48 (100)
Engg. & Technology	32 (64)	18 (36)	0 (0)	0 (0)	0 (0)	50 (100)
Law	25 (54.3)	20 (43.5)	0 (0)	0 (0)	1 (2.2)	46 (100)
Total	129 (54.4)	81 (34.2)	25 (10.5)	1 (0.4)	1 (0.4)	237 (100)

Table 3: Students' perception of the application of IoT in the Library area

IoT application areas	FAL *N* (%)	FSS *N* (%)	FS *N* (%)	FET *N* (%)	FL *N* (%)	Total *N* (%)
Self-issue/return of books	40 (83.3)	42 (93.3)	44 (91.7)	50 (100)	40 (87)	216 (91.1)
Books delivered by drones	20 (41.7)	28 (62.2)	24 (50)	50 (100)	18 (39.1)	140 (59.1)
Reservation of books	45 (93.8)	45 (100)	48 (100)	50 (100)	42 (91.3)	230 (97)
Collection development	16 (33.3)	28 (62.2)	30 (62.5)	42 (84)	25 (54.3)	141 (59.5)
To check book theft	32 (66.7)	28 (62.2)	38 (79.2)	45 (90)	32 (69.6)	175 (73.8)
RFID/NFC application	26 (54.2)	30 (66.7)	40 (83.3)	50 (100)	28 (60.9)	174 (73.4)
Self-sorting of books	32 (66.7)	38 (84.4)	44 (91.7)	45 (90)	32 (69.6)	191 (80.6)
Remote monitoring of resources	12 (25)	20 (44.4)	30 (62.5)	42 (84)	30 (65.2)	134 (56.5)
Text-to-speech for visually impaired	42 (87.5)	38 (84.4)	42 (87.5)	48 (96)	45 (97.8)	215 (90.7)
Smart inventory/bookshelves	38 (79.2)	42 (93.3)	44 (91.7)	46 (92)	40 (87)	210 (88.6)
Live virtual library tour	42 (87.5)	45 (100)	48 (100)	48 (96)	46 (100)	229 (96.6)
Mobile reference services	44 (91.7)	40 (88.9)	45 (93.8)	50 (100)	46 (100)	225 (94.9)
Google glass (newspaper clippings)	12 (25)	25 (55.6)	48 (100)	48 (96)	35 (76.1)	168 (70.9)
Notification of programs/events	38 (79.2)	40 (88.9)	46 (95.8)	50 (100)	46 (100)	220 (92.8)
3-D printers	5 (10.4)	20 (44.4)	30 (62.5)	25 (50)	15 (32.6)	95 (40.1)
Smart student tracking systems	11 (22.9)	18 (40)	28 (58.3)	38 (76)	20 (43.5)	115 (48.5)
Multi-purpose student card	36 (75)	40 (88.9)	48 (100)	50 (100)	46 (100)	220 (92.8)
Automatically survey	7 (14.6)	20 (44.4)	32 (66.7)	42 (84)	22 (47.8)	123 (51.9)
Self-booking seat in the library	24 (50)	38 (84.4)	48 (100)	50 (100)	42 (91.3)	202 (85.2)
Location-based services	22 (45.8)	32 (71.1)	40 (83.3)	46 (92)	38 (82.6)	178 (75.1)
Sensors: Fire alarm/Lights/Gate entry/temperature/locks/ Water consumption	35 (72.9)	40 (88.9)	48 (100)	50 (100)	46 (100)	219 (92.4)
Surveillance system	18 (37.5)	28 (62.2)	42 (87.5	48(96)	38 (82.6)	174 (73.4)

notification of programs/events, multi-purpose student cards (92.8%), sensors for fire alarm/lights/gate entry/temperature/locks/water consumption (92.4%), self-issue/return of books (91.1%), text-to-speech for visually impaired individuals (90.7%), and smart inventory/bookshelves (88.6%). Additionally, 85.2% of the students expressed their approval for self-booking seats in the library, while 80.6% supported the self-sorting of books, 75.1% favored location-based services, and 73.8% agreed that IoT could help prevent book theft. Other IoT applications that received students' support included RFID/NFC applications and surveillance systems (73.4%) and Google glass (newspaper clippings) (70.9%). The table also indicated that the average number of students who supported the use of IoT in library collection development was 59.5%, with 59.1% of the students supporting books delivered by drones, 56.5% supporting remote monitoring of resources, 51.9% agreeing to automatically survey, 48.5% in favor of smart student tracking systems, and 40.1% approving the use of 3D printers. Khan et al. (2021) and Hadianto, Hindarto, and Santoso (2023) support the student's perception that libraries worldwide are embracing IoT technology. Pakistani university libraries exemplify this trend, utilizing IoT-based appliances for enhanced services such as smart climate control and advanced security measures.

Table 4: ANOVA statistics of students' perceptions of IoT application in the library

Source of variation	SS	df	MS	Mean					*F*	*P*-value	*F* crit
Between groups	4570.4	4	1142.6	FAL	FSS	FS	FET	FL	12.9	0.00	2.45
Within groups	9299.091	105	88.6	27.1	33	40.3	46	35.1			
Total	13869.49	109									

They also employ RFID tags for secure check-out and check-in, alongside user card recognition, and streamlining operations (Asim, Arif, & Rafiq, 2022).

Table 4 presents the results of an ANOVA conducted to assess the perceptions of five faculty students regarding the implementation of IoT in different library areas. The findings indicate a strong preference among students for incorporating IoT applications in various library areas, emphasizing the importance of advanced technology in modern libraries. The statistical analysis conducted on the data reveals that the *F*-value of 12.9 exceeds the critical *F*-value of 2.45 at a significance level of 0.05. This indicates a statistically significant difference in the mean scores of students' perceptions regarding the use of IoT in different library areas across the five faculties. The result highlights the enthusiasm of students in the science and engineering faculties toward the application of IoT in various library areas. This finding suggests a potential for technology-driven innovation in these fields, reflecting the relevance of IoT in advancing library services and resources. The ANOVA provides valuable insights into students' perceptions regarding the implementation of IoT in library areas. The statistically significant difference in mean scores and the enthusiasm expressed by science and engineering students underscore the significance of incorporating advanced technology, such as IoT, in modern libraries to enhance their effectiveness and meet the evolving needs of users.

The primary goal of introducing any new technology is to maximize its benefits and make them accessible to a wide range of people. Table 5 presents the opinions of students regarding the benefits of implementing IoT in libraries. The results indicate that a majority of students (92.4%) believe that IoT can help manage energy and water consumption, followed closely by reducing the time required for book issues and return, and facilitating smart and easy management of library buildings (91.6%). Additionally, students believe that IoT can support remote learning (90.7%), save time and money (88.2%), increase the efficiency of library workers (87.3%), and enable tracking of day-to-day library operations (82.7%). The study also shows that 79.7% of the students believe that IoT can be useful in book navigation, followed by remote monitoring (78.9%), tracking students in the library (78.1%), and improving the convenience and manageability of the library (77.6%). Other

Table 5: Students' opinion about the usefulness of IoT applications in the library

The usefulness of IoT application	FAL *N* (%)	FSS *N* (%)	FS *N* (%)	FET *N* (%)	FL *N* (%)	Total *N* (%)
Reduce the delivery time of the issue/return process	40 (83.3)	40 (88.9)	45 (93.8)	50 (100)	42 (91.3)	217 (91.6)
Navigating books will be easy	32 (66.7)	35 (77.8)	40 (83.3)	50 (100)	32 (69.6)	189 (79.7)
Improved access to collections and resources	38 (79.2)	30 (66.7)	42 (87.5)	45 (90)	28 (60.9)	183 (77.2)
Students can learn remotely	40 (83.3)	42 (93.3)	45 (93.8)	48 (96)	40 (87)	215 (90.7)
Enhance user experience	12 (25)	35 (77.8)	40 (83.3)	48 (96)	38 (82.6)	173 (73.0)
It will be effortless to track students in the library	20 (41.7)	40 (88.9)	38 (79.2)	45 (90)	42 (91.3)	185 (78.1)
It uses a different attendance system automatically	18 (37.5)	30 (66.7)	38 (79.2)	42 (84)	32 (69.6)	160 (67.5)
Increase the efficiency of library workers	32 (66.7)	42 (93.3)	45 (93.8)	48 (96)	40 (87)	207 (87.3)
Keep track of day-to-day operations	25 (52.1)	38 (84.4)	44 (91.7)	50 (100)	40 (87)	197 (83.1)
Low cost of maintenance	16 (33.3)	30 (66.7)	40 (83.3)	50 (100)	35 (76.1)	171 (72.2)
Remote monitoring	28 (58.3)	35 (77.8)	42 (87.5)	50 (100)	32 (69.6)	187 (78.9)
Smart and easy to manage the buildings	40 (83.3)	42 (93.3)	45 (93.8)	50 (100)	40 (87)	217 (91.6)
Easy to manage energy/water consumption	32 (66.7)	45 (100)	48 (100)	50 (100)	44 (95.7)	219 (92.4)
Library users can find parking more easily	25 (52.1)	40 (88.9)	48 (100)	45 (90)	38 (82.6)	196 (82.7)
The library will be more convenient and manageable	14 (29.2)	42 (93.3)	46 (95.8)	42 (84)	40 (87)	184 (77.6)
Save both time and money	20 (41.7)	45 (100)	48 (100)	50 (100)	46 (100)	209 (88.2)

Table 6: ANOVA statistics of students' opinions on the usefulness of IoT applications in the library

Source of variation	SS	df	MS	Mean					*F*	*P*-value	*F* crit
Between groups	3840.9	4	960.23	FAL	FSS	FS	FET	FL	29.1	0.00	2.5
Within groups	2474.6	75	32.99	27.1	38.2	43.4	47.7	38.1			
Total	6315.49	79									

benefits identified by students include improved access to collections and resources (77.2%), enhanced user experience (73%), and the use of different automatic attendance systems facilitated by IoT (67.5%). These findings suggest that the implementation of IoT in libraries has the potential to significantly improve various aspects of library operations. Igbinovia's study (2021) promotes the integration of IoT in libraries, taking into account technological, organizational, environmental, and security/privacy considerations, while emphasizing effective management and resource utilization (Khan et al., 2022). Hazinji (2022) highlights IoT's benefits in remote experiments, e-learning, smart classrooms, inclusive education, and security threats. Panigrahi, Sethy, and Dadhich (2022) stress IoT's impact on library services: creation, archive management, instruction, data protection, and information literacy.

In the ANOVA results presented in Table 6, the statistical analysis examined the opinions of five faculty students regarding the value of IoT applications in different library areas. The analysis revealed a significant difference in mean values among the five faculty students. The *F*-value of 29.1 exceeded the critical *F*-value of 2.5 at a significance level of 0.05. This indicates that there is a notable variation in the students' opinions regarding the usefulness of IoT applications across different library areas. Furthermore, the results indicate that students from the science and engineering faculties hold a stronger belief in the usefulness of IoT applications in various library areas. This suggests that these students perceive IoT technology to have greater value and potential benefits of library management. The findings align with the current technological landscape, where advanced technology, such as the IoT, is becoming increasingly prevalent. It is evident that a majority of students share the belief that IoT applications offer more advantages in different library areas. This highlights the recognition and acceptance of the benefits that IoT technology can bring to enhance library services and experiences.

6 Conclusion

The internet's shift from solitary to interconnected has birthed a backup system for evolving libraries. The IoT empowers sectors to automate and minimize human intervention, benefiting millions globally. Libraries can also leverage this valuable tool, but user and staff feedback must guide its integration with thoughtful consideration. This article presents the collective views of students on the application of IoT in libraries. The results show that most students are in favor of the acceptance of new technology to replace old library processes and services. Students perceive various IoT applications in the library positively including book reservations, live virtual library tours, mobile reference services program/event notifications, and multi-purpose student cards. Additionally, self-issue/return of books, text-to-speech for the visually impaired, smart inventory/bookshelves, self-booking seats in the library, self-sorting of books, location-based services, RFID/NFC, and Google glass (newspaper clippings) are some of the services that can be integrated with IoT to libraries. Furthermore, students also recognize the usefulness of IoT applications in the library, particularly in sensors for fire alarm/lights/gate entry/temperature/locks/managing energy and water consumption, improving efficiency, and facilitating smart and easy management of library buildings with surveillance systems. The benefits identified by students include remote learning support, time and cost savings, enhanced user experience, and improved access to resources. The results also highlight significant differences in students' perceptions and opinions across different faculties, regarding the application of IoT in various library operations and services. However, the majority of students agree that IoT can help manage all library areas and services.

The IoT is a sensor-based system that requires minimal or no human intervention. It offers personalized care to users, along with cost-effective maintenance and a user-friendly navigation system. However, it is essential to ensure proper planning, review of the existing infrastructure of operation and services, and staff training for a successful IoT implementation. The library needs to invest in powerful networking, security measures, and data management systems to protect user privacy and information. Additionally, continuous monitoring, evaluation, and user feedback will be essential to address any challenges or issues that may arise during the implementation process. Overall, integrating IoT into the Kurukshetra University library has the potential to revolutionize its operations, enhance user satisfaction, and support the growing needs of students. By adopting this technological advancement, the library can position itself as a cutting-edge institution and deliver resourceful services to its users. These considerations create an opportunity for new research in the field and highlight the importance of developing effective strategies for implementing IoT in library redesign. It can be believed that studying the perception of IoT applications for library redesign is a step in the right direction and will assist other libraries and information centers in discovering and implementing the usefulness of IoT in the future.

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