Smart Technology Implementation in University Library: User Perception

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Abstract:

The purpose of this study was to investigate students' perceptions regarding the implementation of the Smart Technologies like IoT, AI, Robots, Drone Technology, and RFID at AbulKalam Library of NED University of Engineering & Technology. A descriptive survey method was applied and a structured questionnaire was formulated to collect data. The findings indicate that a majority of students strongly support the use of smart technology to replace outdated library processes and services.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 smart technologies 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 Smart Technologies in university library and underscores the importance of staying abreast of modern technological advancements in the field of libraries.

Keywords: Smart Technology, Internet of Things, IoT, libraries, Drone technology, NED University.

Introduction:

All aspects of human action, including library services, have been influenced by technology with an aim to provide better and more rapid services. The smart library is a concept arose from IoT that depends on some kind of data signal sensing and actions based on a radio frequency. Technologies connected with the smart library include machine learning, beacons (or iBeacons), mobile kiosks (tablet-based kiosks), mobile apps and RFID among others. Emphatically, the term 'smart library' appears in various contexts as a synonym for the concept of an 'intellectual library', 'digital library' or 'virtual library (Baryshev, Verkhovets&Babina, 2018). According to the Statement on Libraries and Development made by the International Federation of Library Associations and Institutions (IFLA, 2013), the library is the only place in many communities where required information are accessible that will bel helpful to improve their education, acquire new skills, find jobs, build businesses, health decisions, make informed agricultural or learn about environmental issues. Leicestershire County Council (2021) described a Smart Library is a library that should be able to be opened to library users without being staffed. Smart libraries' main objective is to manage their collection in a systematic manner to ensure users can use internet-based resources to benefit themselves. Smart Libraries uses digital technology in multiple applications with the help of the Internet and Intranet to offer its services to its users more efficiently, effectively, and intelligently. Artificial intelligence and technology are the driving forces behind smart libraries.

(Aittola et al., 2003) A smart library is a location-aware mobile library service, unconstrained by space, which helps users find books and related information.

(Miller et al., 2004) A smart library uses software quality engineering practices, with the aim to minimize the likelihood of making mistakes in using libraries and to maximize user ability to diagnose and correct mistakes when they occur

(Wang, 2011) smart library realizes the associations between books, the associations between books and people, and the associations between people

anywhere and at any time. Digitization, networking and intelligence are the information and technical basis of the smart library. In essence, the smart library is people-oriented. It has sustainable development and user convenience and its purpose to fulfill the growing information needs of library users.

(Yan, 2010) The smart library is a model of a smarter way to change the interactivity of users and library systems by using a new generation of information technology; to improve the clarity, flexibility and responsiveness of the interaction, smart service and management

(Wu, 2012) A smart library is a more advanced development of the hybrid library and digital library.In the surroundings of the IoT, the smart library depends on cloud computing technology and intelligent equipment; realizes the book-book, book people and people-people associations; and provides intelligent services for users.

Li and Dong (2016) Smart library refers to the smartness of the library building, through the integration of library building equipment, computer networks, communications technology and sensor monitoring.

Objective of the study:

1- To understand the demographic distribution of students of selected university

2-To examine the level of awareness and perceptions of students regarding applications of Smart Technologies in library services.

Literature Review

Libraries have a close relationship with the smart technologies as it allows for more efficient management and operation of library systems. By using smart technologies, libraries can provide users with a comprehensive range of reading services, such as self-checkout and self-return of books and library materials, long term storage and research on reading habit.The adoption of smart technologies have significantly transformed the way libraries operate and provide services, resulting in improved resource management and increased effectiveness (Ehsanian, TahmasebiLimooni, &Ghiasi, 2022), Xu (2022) proposed a solution to established a smart library at a university by implementing IoT based lending system, a book sorting system, a self-service system, and a text recommendation.. As such smart library paradigm has brought significant advances in service and its important development for library resource management (Bi et al., 2022). The recent findings of Wheatley and Hervieux (2019) affirm that incorporating the usage of AI into library services strategic plans of future is yet to be visible. Consequential to the arrival of new digital transformation technologies, institutions of higher learning must find novel means to get a competitive advantage (Hamidi and Jahanshaheefard, 2019).RFID can help locate resources without human assistance as it helps in knowing the actual destinations of a book in the library (Tim et al., 2018). Robots in libraries free up librarians' time to concentrate on other crucial information services that cater to the changing needs of the modern world. According to Harisanty et al. (2020). Cao et al. (2018) identified three elements of a smart library, namely, smart technology (such as Internet-of-Things, data mining, artificial intelligence and the like), smart services (providing user-centric services) and smart people (library users, staff and administrators). The survey on smart libraries carried out by Kulkarni and Dhanamjaya (2017) had questions related to infrastructure and physical space (smart building), services, and financial aspects (smart governance) of a smart library. Aithal (2016) has argued that libraries will

not need physical spaces in the future. Instead, they will be virtual repositories of content that users may access from anywhere.

Methodology:

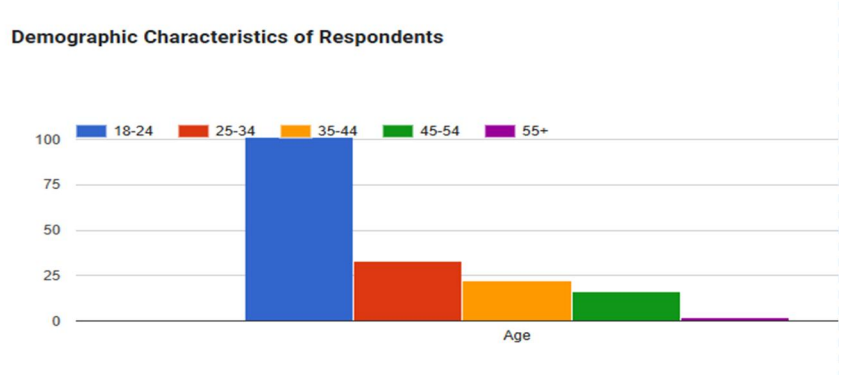
The collected data were analyzed using Microsoft Excel, with percentages used as the primary statistical measure. The main objective of the study centered on investigating students' perspectives on the implementation of smart technologies (AI, IoT, RFID, mobile technology, robotics, drone technology) prior to replacing the current library system. The research design was carefully crafted to ensure the sample represented the diverse user population of the university. To gain a comprehensive understanding of users' attitudes and opinions on the subject, a descriptive survey approach was selected. Questionnaires wereconsideredthe foremostreasonableinformation collection apparatus due to their ease of organization and effectiveinformation collection prepare.

Data Analysis and Interpretation:

Demographic distribution of respondents:

After determining the research question the next step was to collect and analyze the proportionate data based on lead-down objects. On observation of Figure 1, it represents the age group distribution of respondents. Figure 1 reveals that out of (N=174) respondents most of them were belonged to the age group of 18-24 years 58.04% respondents, followed by the age group of 25-34 18.96% and 35-44 years age group was 12.64%.

Figure 1



User Category:

The user category wise distribution of respondents represents the interest groups contributing to the data set and their responses can be concluded based on the working group of university staff and level of study of students. On observation of table 1, the survey responses revealed that most of the respondents belong to the Bachelors of Engineering (BE) group (44.82%), followed by the non-teaching staff (23.56%) and the least number of responses from alumni (2.29%).

Table 1

User category	Quantity	%Age	User category	Quantity	%Age
Non-Teaching Staff	41	23.56	ME Students	29	16.66
Faculty	11	6.32	BE	78	44.82

			Students		
Researchers (Ph.D.)	11	6.32	Alumni	04	2.29

Table 2

Gender	Male	102	58.62%
	Female	72	41.37%

Table 2 shows gender of respondents. The highest response rate 102(58.62%) are male followed by 72(41.3%) who are female.

Frequency of Library Visits:

Table 3 represents how often respondents visits library for various purposes. On examination, the results confer that most of the respondents visit library many times a week 33.33%, followed by other category of once a month 22.41% and others 35%.

Table 3

Frequency of Library Visits	Many times a week	58	33.33%	Once a month	39	22.41%	
	Once a week	28	16.09%	Daily	35	20.11%	
	Once every 2 weeks	14	8.04%				

Replace the present Library system with a smart technology:

In response to the view on contribution of users to Replace the present Library system with a smart technology, as observed in Table 4, most of the respondents (54%) were strongly agreed with this opinion and (31.6%) agreed on other hand very low number of respondents were neutral, disagree or strongly disagree on this opinion as it was expected that they were not aware that smart technologies can be used in library setup based on their observation on its commercial application and required specific training program.

TABLE 4

Scale	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Total**
Qty.	95	55	18	05	02	174
%Age	54%	31.6%	10.3%	2.9%	1.1%	99.9%

User opinions about the usefulness of Smart Technology Application in the Library:

Table 5 presents the opinions of library users regarding the benefits of implementing smart technologies in library. The results indicate that a majority of

library users 61.49%strongly agreed that access to collections and resources should be improved by implementing smart technology in library. Smart Technology can help to save time and money (57.47%) followed by Navigating books will be easy (56.32%) followed closely by Students can learn remotely (54.59%). The study also shows that 53.44% users believes that smart technology can be useful in remote monitoring followed by The library will be more convenient and manageable (53.44%). Additionally, users believe that Smart Technology implementation in library can enhance user experience (51.14%) and increase the efficiency of library workers (49.42%), Other benefits identified by library users to use the smart technology will be beneficial to keep track of day-to-day operations (48.85%) followed by reduce the delivery time of the issue/return process (48.27%). Additionally, (44.82%) respondents reveal thatIt uses a different attendance system automatically, (44.25%) of users believes that the smart technology usage in library will be helpful to keep the low cost of maintenance. 43.67% users shows that it will be effortless to track students in the library, 40.80% strongly believes that Library users can find parking more easily after implementing smart technologies in library.

TABLE 5

S.No.	Smart Technology application areas	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	Reduce the delivery time of the issue/return process	84 48.27%	69 39.65%	18 10.34%	02 1.14%	01 0.57%
2	Navigating books will be easy	98 56.32%	61 35.05	14 8.04%	00 0%	01 0.57%
3	Improved access to collections and resources	107 61.49%	57 32.75%	07 4.02	02 1.14%	01 0.57%
4	Students can learn remotely	95 54.59%	63 36.20%	13 7.47%	03 1.72	00 0%
5	Enhance user experience	89 51.14	66 37.93%	19 10.91%	00 0%	00 %
6	It will be effortless to track students in the library	76 43.67%	71 40.80%	22 12.64%	04 2.29%	01 0.57%
7	It uses a different attendance system automatically	78 44.82%	74 42.52%	16 9.19%	05 2.87%	01 0.57%
8	Increase the efficiency of library workers	86 49.42%	59 33.90%	23 13.21%	04 2.29	02 1.14%
9	Keep track of day-to-day operations	85 48.85%	73 41.95%	16 9.19%	00 0%	00 0%
10	Low cost of maintenance	77 44.25%	52 29.88%	32 18.39%	10 5.74%	03 1.72%
11	Remote monitoring	93 53.44%	60 34.48%	20 11.49%	00 0%	01 0.57%
12	Library users can find parking more easily	71 40.80%	61 35.05%	34 19.54%	06 3.44%	02 1.14%
13	The library will be more convenient and manageable	93 53.44%	65 37.35%	12 6.89%	04 2.29%	00 0%
14	Save both time and money	100 57.47%	54 31.03%	17 9.77%	03 1.72%	00 0%

Awareness and Appreciation for the use of Smart Technology-Based Library Services.

From the table 6 it has been inferred that 43.10% of library users, are aware to a very large extent about the library services can be accessed on library website. 37.93% of library users are aware to very large extent about that library services can be accessed on library website through online public access catalogue (OPAC). 36.78% respondents of library users are lagging behind in awareness about library services can be accessed on mobile devices. On other hand 30.45% of respondents are aware to very large extent the library services can be accessed on IoT devices followed by 23.56% of users are aware to very large extent the library services can be accessed on RFID.

TABLE 6

S. No	Items	To a very large extent	To a large extent	To some extent	To little extent	To no extent
1	I am aware that library services can be accessed on mobile devices	64 36.78%	55 31.06%	39 22.41%	12 6.89%	04 2.29%
2	I am aware that library services can be accessed on RFID	41 23.56%	56 32.18%	42 24.13%	16 9.19%	19 10.19%
3	I am aware that library services can be accessed on IoT devices	53 30.45%	56 32.18%	38 21.83%	10 5.74%	17 9.77%
4	I am aware that library services can be accessed on library website through online databases.	75 43.10%	55 31.60%	28 16.09%	10 5.74%	06 3.44%
5	I am aware that library services can be accessed on library website through online public access catalogue (OPAC)	66 37.93%	43 24.71%	34 19.54%	15 8.62%	16 9.19%

User perceptions about the following services implementing Smart technologies in library:

The utilization of the smart technology 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 user perceptions regarding the implementation of smart technology in library-related areas. Table 7 displays the results that the majority of library users are in favor of integrating smart technology in various library services such as Sensors: Fire alarm/Lights/Gate entry/ temperature/ locks/ Water consumption (81.60%) followed by Surveillance system 79.31%, Smart inventory/bookshelves 79.88%, live virtual library tour and Multi-purpose student card equally shared the response of 77.58%. Additionally, 77.01% of the library users expressed their response in favor of Text-to-speech for visually impaired in the library, Notification of programs/events and Smart student tracking systems while 75.86% supported the Reservation of books.

75.28% favored Mobile reference services, and 74.13% agreed that smart technology could help remote monitoring of resources. Other applications that received students' support included 3-D printers 73.56% and automatically survey 70.68% and Self-booking seat in the library 69.54%. The table also indicated that the average number of students who supported the use of smart technology in Self-

sorting of books was 64.94% with 64.36%of the users supporting the check book theft, 63.79% respondents supports Collection development, 59.77% supporting Self-issue/return of books, 55.17% in favor of RFID/NFC application, 53.44% approving the use of Google glass (newspaper clippings) and 50% supports the books delivered by drones. . 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. They also employ RFID tags for secure check-out and check-in, alongside user card recognition, and streamlining operations (Asim, Arif, &Rafiq, 2022).

TABLE 7

Sno.	Items	Yes	%Age	No	%Age
1	Self-issue/return of books	104	59.77%	70	40.22%
2	Books delivered by drones	87	50%	87	50%
3	Reservation of books	132	75.86%	42	24.13%
4	Collection development	111	63.79%	63	36.20%
5	To check book theft	112	64.36%	62	35.63%
6	RFID/NFC application	96	55.17%	78	44.82%
7	Self-sorting of books	113	64.94%	61	35.05%
8	Remote monitoring of resources	129	74.13%	45	25.86%
9	Text-to-speech for visually impaired	134	77.01%	40	22.98%
10	Smart inventory/bookshelves	139	79.88%	35	20.11%
11	Live virtual library tour	135	77.58%	39	22.41%
12	Mobile reference services	131	75.28%	43	24.71%
13	Google glass (newspaper clippings)	93	53.44%	81	46.55%
14	Notification of programs/events	134	77.01%	40	22.98%
15	3-D printers	128	73.56%	46	26.43%
16	Smart student tracking systems	134	77.01%	40	22.98%
17	Multi-purpose student card	135	77.58%	39	22.41%
18	Automatically survey	123	70.68%	51	29.31%
19	Self-booking seat in the library	121	69.54%	53	30.45%
20	Location-based services	125	71.83%	49	28.16%
21	Sensors: Fire alarm/Lights/Gate entry/ temperature/ locks/ Water consumption	142	81.60%	32	18.39%
22	Surveillance system	138	79.31%	36	20.68%

Conclusion:

Our empirical study's findings show that, in general, participants who are potential users have an accepting attitude toward ambient smart technologies used in library services. The result reveals that the majority of library users are in favor of integrating smart technology in various library services. It is also concluded that the majority of library users strongly agreed that access to collections and resources should be improved by implementing smart technology in library. The study also reveals that the library users are aware to a very large extent about the library services can be accessed on library website on other hand very low number of users is aware that library services can be accessed on RFID. The study concluded that the large number of library users is in favor to implementing smart technologies in fire alarm/Lights/Gate entry/ temperature/ locks/ Water consumption.

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