Prospects of Internet of Things (IoTs) Technology Application for Library and Information Service delivery among Library Personnel in Academic Libraries in Osun State, Nigeria

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Olaronke O. Fagbola

Fareedah Olajide

Abstract
The Fourth Industrial Revolution (4IR) is gradually evolving, and the world of work is undergoing massive technological transformations and advancements due to the adoption of cutting-edge computing technologies such as artificial intelligence, cloud computing, big data analytics, blockchain technology and the Internet of Things (IoTs) in the day-to-day management of business operational activities in diverse sectors of the economy of which the library is not left out. Against this background, the study examined the prospects of Internet of Things technology application for library service delivery in academic libraries in Osun State, Nigeria. The study adopted a descriptive survey research design. A purposive sampling technique was used in selecting the five (5) university libraries used for the study. The total enumeration technique was used to cover all the 66 library personnel in the selected university libraries in Osun State, Nigeria. The validated questionnaire was used to collect data on 66 library personnel out of which 44 responded. The study found that online fine payment, e-library tour and shelf guide for new library users were identified as prospects of IoT technology application. Therefore, it is recommended the need for increase funding of libraries, improve infrastructural facilities to enable seamless usage of the Internet of Things and its related technologies in libraries and training and re-training of library personnel on the application of IoT and its related technologies for effective and better library service delivery that will improve the user experience.

Introduction

The Fourth Industrial Revolution (4IR) is gradually evolving, and the world of work is undergoing massive technological transformations and advancements due to the adoption of cutting-edge computing technologies such as artificial intelligence, cloud computing, big data analytics, blockchain technology and Internet of Things (IoTs) in the day-to-day management of business operations (Konappa 2014). Essentially, these significant developments in the field of computing technology created revolutionary changes in all fields of knowledge, fundamentally altered the way we live, work, and relate with one another; created opportunities and heralded the transformation of the entire systems of production, management, governance and information service delivery amongst others (Fagbola, Atulomah & Oladeji, 2021).

Libraries and most importantly, academic libraries being the reservoirs of knowledge are at the forefront of the massive deployment of modern information and communication technological (ICT) tools for a wide variety of tasks and activities (Konappa 2014). Moreover, Tella (2020) observed that Information and Communication Technology (ICT) is impacting significantly library operations and services, and disruptive technologies such as robotics, artificial Intelligence, augmented reality, virtual reality, 3D printers and the Internet of Things (IoT) amongst others are revolutionising information service delivery in libraries in diverse ways.

Library and information service delivery is fundamental to libraries. It is the totality of all library activities aimed at facilitating the use of the library and its resources (Oladipo, 2021). Library and information service delivery are library processes and activities deployed by academic libraries to deliver information services and resources to library users (Agoh & Omekwu, 2021). They explained that library and information service delivery encompass activities that store and disseminates knowledge, skills and artefacts; define new technologies, such as the Internet, cloud computing, robotics, and information and communication technologies. According to Alabi and Sani (2021), library and information services include current awareness services, reference and information services, selective dissemination of information, Internet services, circulation services, document delivery service, online reservation of books, online database services, information repackaging, email alerts, and instant messaging amongst others.

Unarguably, library and information services have gone through various stages of evolution and are witnessing a change that is greatly impacting humanity with the deployment of cutting-edge computing and information technologies which offer opportunities for knowledge and information dissemination to a wider audience regardless of time and location, and enhanced operational activities (Ogar & Dushu, 2018). This is premised on the various stages of human devotion and phases of the Industrial Revolution.

Internet of Things (IoT) is a sophisticated computerisation and analytics system that exploits sensing, big data, networking, and artificial intelligence technologies to provide complete systems for a product or service (Bharathi & Singh, 2019). IoT is an emerging paradigm that enables communication between electronic devices and sensors through the Internet to facilitate human lives (Kumar, Tiwari & Zymbler, 2019). Moreso, IoTs is about innovative functionality and better productivity by seamlessly connecting devices (Ebert & Weyrich, 2019). IoT enables objects to collect and transfer data over a network without human intervention using the Internet, sensors, and radio frequency identification (RFID) cards (Bansal, Arora & Suri, 2018). Thus, IoT technologies encompass not just one type of hardware but many kinds of hardware that have existed as unconnected devices (Fahn, 2017).

IoTs is an ecosystem in which applications and services are driven by the data collected from devices that sense and interface with the physical world (Organisation of Economic Cooperation and Development (OECD), 2016). IoTs use smart devices and the Internet to provide innovative solutions to challenges and issues related to various business, governmental and public/private industries (Kumar, Tiwari & Zymbler, 2019). According to Qin (2018), the main idea of the IoTs assumes that everyday objects equipped with appropriate sensors and network access can communicate to fulfil certain tasks. Sarhan (2018) opined that the devices can generate and consume different types of data. Thereby, providing significant development of a various number of applications never found before.

Furthermore, IoT makes it possible to connect everyday objects, that are not themselves computers, by embedding sensors in them. Therefore, IoTs could be employed for consulting and guidance, tracing and tracking functions, retrieving, disseminating and steering information through virtual means, provide a global linking of a huge number of libraries and universities in real-time, thus, enabling libraries to fulfil its role more efficiently and smartly (Khan, Zhang, Chohan & Rafique, 2021). Given its benefits, the applications of IoTs have extended to a wide range of domains including homes, cities, environment, energy systems, retail, logistics, industry, agriculture, health, education and libraries amongst others (Sheeja & Karott, 2019). Thus, libraries have had to adapt in order to maintain a relevant presence in our society.

Libraries of today look more like community hubs and places full of activities and innovations with the use of new and emerging technologies such as cloud computing, artificial intelligence, robotics and social media to expand and enhance service delivery, thereby, adding more value to their services and making it attractive to users by focusing on maximising the effectiveness of shared resources for libraries to promote effective service delivery (Tella, 2020). Without doubt, the advancement in information and wireless communication technologies impacted greatly on library roles in the society and educational centres (Mohammadi & Yegane, 2021).

The IoT is comprised of billions of connected devices that usher in a new realm of possibility for library service development and innovation. Hence, its adoption for academic library operations would help to facilitate access to extensive range of information resources and services because it has the potential to remarkably boost service delivery, staff productivity, improve access to the library materials, radically re-engineer and regenerate library operations that support effective information and library service delivery; remotely monitor infrastructure, data transmission and control of the whole ecosystem intelligently (Cao, Liang & Li, 2018).

In addition, the 21st century academic libraries are home to massive and direct availability of information on the Internet without the mediation of librarians, couple with the challenges associated with curating and describing massive quantities of data, and the renewed challenges related to library as a place combined with perennial questions about the future of print resources (Fahn, 2017). Accordingly, the IoT which encompasses very small computers, directly or indirectly connected and interconnected with the Web and everyday objects to provide profoundly innovative levels of monitoring support, device control, service innovation, and, for many, business opportunities portend an unprecedented transformation in library and information service delivery. This development could be considered by library personnel as potential platforms to offer improved library services and provide flexible options for library users. It is on this premise that this study examined the prospects of IoTs technology application for library and information service delivery in academic libraries in Osun State, Nigeria.

Objectives of the study

The broad objective of this study was to explore the prospects of the IoT technology application for library service delivery among library personnel in academic libraries in Osun State, Nigeria. The specific objectives were to:

i. identify the prospect of IoT technology application for library and information service delivery among library personnel in academic libraries in Osun State, Nigeria;
ii. identify the potential benefits of IoT technology application for library and information service delivery among library personnel in academic libraries in Osun State, Nigeria; and
iii. identify the barriers to IoT technology application for library and information service delivery among library personnel in academic libraries in Osun State, Nigeria.

Literature Review

Concept of Internet of Things (IoT)

The Internet of Things (IoT) is a broad term that generally refers to the vast array of physical devices equipped with sensors and software that enable them to interact with little human intervention by collecting and exchanging data via a network (Greengard, 2024). It is a computing concept that describes the idea of everyday physical objects being connected to the Internet and being able to identify themselves to other devices, send and receive data (Rouse, 2023). IoTs is a valuable tool beneficial to millions globally and empowers diverse sectors to automate and minimise human intervention (Kumar, 2023). According to Kiran (2019), IoT is a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies. Wójcik (2016) observed that the basic notion of the IoT assumes that everyday objects with suitable sensors and network access can interact to perform certain activities. Therefore, IoT are simply objects or things where the infrastructure and technology involved are sensors, processors, cloud computing, and wireless connectivity.

IoT is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment (Fahn, 2017). It exists as part of an emerging technology ecosystem with cloud and big data analytics; simplifies and automates tasks that are complicated and sometimes beyond the scope of human capabilities (OECD, 2016). No doubt, IoTs operate in a network with millions of sensors and smart devices to generate massive amounts of real-time data; which necessitates massive amounts of bandwidth, energy, and storage consumption (Ketu & Mishra, 2021; Shammar & Zahary, 2020). Therefore, IoT has the ability to efficiently manage resources, enhance security, improve user experience, optimise network management, and make data-driven decisions (Zhou, 2024).

Furthermore, IoT is innovative. Its applications are made to eliminate central control conditions of analysis and produce real-time decision-making processes (Hadi, 2022). On their part, Pujar and Satyanarayana (2015) averred that the basic set of technologies needed for IoT to happen include radio frequency identification devices (RFID), wireless communication devices (such as beacons), sensors, energy harvesting technologies, cloud computing and advanced Internet protocol (IPv6). Equally, Wójcik (2016) pointed out that IoTs is a system that enables any natural or man-made object to communicate with each other and transfer data using assigned Internet protocol (IP) addresses with or without human intervention. As such, IoT requires a set of technologies to promote connectivity and interaction among objects and each object requires a unique identification, sensors, Internet and a central server among others (Sharma, 2015). Arguably, IoTs has a great potential in libraries, and can enable several library services including self-borrowing and self-returning, smart inventory, intelligent querying, and the merging of books and information systems (Asim, Arif, & Rafiq, 2022).

Awareness of IoT technology among library personnel in Academic Libraries

Awareness is a relative concept; the state or quality of being aware of something; a common knowledge about a phenomenon, social, scientific or political issue. Awareness of IoT is the most comprehensive and important phenomena today, since it connects many things through the Internet (Shashidhara, 2023). Awareness is the act of having basic knowledge or being conscious of something happening around an individual (Okonoko & Eruvwe, 2020). Awareness refers to human perception and cognitive reaction to a condition/event (Gallotto, Sack, Schuhmann & de Graaf,2017). Thus, awareness of IoT technology is important and the first step in the adoption and implementation of the technology.

Unarguably, certain level of awareness about IoT technologies exist among the library personnel in developing countries (Wojcik, 2016). For instance, Lippincott (2021) noted that IoT can transform the academic library into a living-learning lab that senses and studies human dynamics, human computer interactions, and human-building interactions. In India, Gupta and Singh (2018) reported that the majority of the Indian librarians learnt about IoT through conferences, seminars, and discussion forum. In Nigeria, Yusuf, Ifijeh, and Owolabi (2019) reported that there is a low level of awareness of IoT among library personnel. They suggested that librarians need to take conscious steps to understand the concept and application of the Internet of Things (IoT) to effectively enhance library service delivery. Consequently, awareness of, application and adoption of IoT technology in academic library operations will change the landscape of librarianship positively, enable library personnel to initiate smart library services, assist in service efficiency, provide tracking facilities and promote effective and reliable management of the library system.

Prospects of IoTs technology application for library and information service delivery

IoT refers to the collective network of connected devices and the technology that facilitates communication between devices and the cloud, as well as between the devices themselves. Studies have reported the versatility and attested to the prospect of IoTs technology application in academic libraries for service delivery. For example, Shahzad, Khan and Iqbal (2024) averred that IoT can support library professionals to initiate smart library services, assist in service efficiency, offer context-based library services, provided tracking facilities and deliver effective management of library systems. Wójcik (2016) pointed out that IoT has a great deal of potential and can be used to track collections, advertise traditional library resources online, provide users with consolation services, and preserve archival collections. To Fu (2021), the IoTs can provide intelligent management reader behaviour analysis, intelligent self-borrowing and returning books and materials, long-term preservation, and other conveniences for the smart library, which helps with intelligent library management.

Rahman and Islam (2019) revealed that IoT-enabled libraries could aid in the efficient management of library infrastructure in a variety of ways such as automatic book renewal, penalty for excessive resource use, and book tagging using borrowers' fingerprints. According to Khan et al. (2021), IoT adoption in libraries can help reduce inefficiencies by continuously tracking the usage of appliances and resources, thereby resulting in a more efficient library operation with reduced manual labour and increased focus on more complex tasks. Bayani, Segura, Alvarado and Loaiza (2018) stated that with ability of IoTs to automate routine operations, it has the potential to make the job of library staff easier and that the circulation system in libraries can be made as simple as sliding off with the application self-check-in/check-out system and the discovery of the book at its position. While Qin (2018) opined that IoT technology could be useful in library curating, characterising, maintaining, analysing, and selecting collections, as well as marketing and promotion. Gupta and Singh (2018) revealed that IoT application can be used for virtual library tours, shelf guides, user orientation, online payment, occupancy, and other library service availability; promote users' perception of the library by offering a strong reader circle, a real-time resource monitoring system, an easy location, and a service-oriented experience.

Moreover, IoT has the ability to efficiently manage resources, enhance security, improve user experience, optimise network management, and make data-driven decisions (Zhou, 2024). Bansal, Arora and Suri (2018) pointed out that some of the applications of IoTs in library services include inventory control, theft management, circulation, user identification, book reservation, and mobile references. Muthumari, Kulkarni and Kulkarni (2021) opined that the IoTs could assist libraries in providing self-contained virtual journeys through their locations and with the strategic placing of library beacons, throughout the building, they can easily communicate with mobile devices, enhancing the virtual tour experience. To Igbinovia and Okuonghae (2021), IoTs can produce excellent results in library security systems with the use of local binary pattern histograms. Similarly, Xie, Liu, Fu and Liang (2019) averred that with modern libraries that are prone to public safety incidents due to their many functions, sophisticated layouts, and large number of users, the intelligent evacuation protocol is a viable application of IoT technology in library safety management.

Arguably, IoTs are emerging technologies that can provide several benefits to libraries in terms of the management of routine operations. However, the relevance of IoTs applications in library services would depend on the speed of delivery, the platform for distribution, the expectations of users, and the perception that connected devices are safe and information is kept a secret (Asim, Arif, & Rafiq, 2022).

Benefits of IoT technologies application for library and information service delivery

The IoT is a novel, innovative and one of the most notable disruptive technologies of this century that can be applied in library services in several ways. For instance, Asim, Arif and Rafiq (2022) stated that IoTs are emerging technologies that can provide several benefits to libraries in terms of the management of routine operations. Zhou (2024) noted that IoT technologies in libraries could help improve security measures and personal experiences, including self-checkout systems and real-time book localisation. To Wójcik (2016), IoT can be used to market traditional library resources online, track collections, provide users with consolation services, and preserve archival collections. On their part, Shahzad, Khan, and Iqbal (2024) pointed out that IoT could assists in improving library systems and services. While Kumar (2023) opined that IoT integration will enhance library services, provide digital resources and innovative tools for students, thereby enriching their learning experience, enabling research, collaboration, and easy access to information.

Additionally, IoT can help libraries in optimising use of space, enhancing the users' experience, preserve valuable collections through smart room management, provide self-guided, virtual tour of the library; aid libraries in delivering location-based services, as well as the provision of information literacy (Mohammadi &Yegane, 2018; Xie, Liu, Fu, & Liang, 2019). IoT allows librarians to manage facilities and equipment in better way

(Kaba, & Ramaiah, 2019). IoT reduces the staff requirement for doing odd tasks, as majority of the tasks would be carried out by machine (Pandey, Kazmi, Hayat, & Ahmed, 2018). Yusuf, Ifijeh and Owolabi (2019) claimed that IoT has the potential to improve routine tasks and provide personalised services to library users. And to Dongare (2022), one of the key benefits of IoT for libraries is the ability to monitor and track various aspects of library operations, such as temperature and air quality, ensure a safe and comfortable environment for users and staff.

The IoT technologies are emerging technologies that can provide several benefits to libraries in terms of the management of routine operations. According to Echedom, Kakiri and Oyadonghan (2020), IoTs technology adoption for the library and information service delivery guarantee access to library and its resources, collection management, inventory, theft management, user identification, reservation of information material, mobile reference services, information literacy and library orientation services, amongst others. However, Yusuf et al. (2019) advised that to maximise the benefits of IoT application in the libraries, librarians need to receive training and support to build their knowledge and skills in this area. Thus, by adopting IoT, libraries can offer quality services resulting from technology adoption, which may lead to an increase in user satisfaction and usage.

Barriers to IoT Technologies application for Library and Information Services

The IoT, no doubt is a potent technology that will change the service structure and pattern of libraries in the coming years. Its implementation in libraries is essential for optimising library operations, activities and for interconnecting available resources and systems in order to redefine and render interactive and innovative services to large number of users wherever they are most needed (Shashidhara, 2023). However, researchers have identified several issues as possible barriers that libraries may face in adopting this novel technology. For instance, Shahzad, Khan and Iqbal (2024) observed that lack of technical infrastructure, security and privacy concerns, lack of technological skills and unavailability of policy and strategic planning could serve as barriers to the successful adoption of IoT applications in university libraries. Bi, Wang, Zhang, Huang, Wu, Gong and Ni (2022) averred that the large-scale data generated by massive IoT devices emphasises the importance of privacy protection, and particularly in smart library scenarios, the heterogeneous and multi-source collected data includes a significant amount of personal and privacy data (e.g., facial image data), and the leakage of such critical data may have a significant impact on people's lives.

Echedom et al.(2020) pointed out that with the attendant problem of budget cost confronting several libraries, the increase in the price of ICT-enabled devices and network services, most libraries may not be able to provide adequate funds to cater for the establishment of IoT-enabled library services, and since IoT is a progressive innovation, most libraries may not be able to cope with the evolving trends in the IoT infrastructure, given that IoT requires time and technically competent manpower. And according to Algarni, Alkhelaiwi and Karrar (2021), IoT systems are typically resource-constrained, with limited power and capacity. Therefore, attacks on IoT networks may increase energy consumption by compromising the network and consuming IoT properties through redundant or bogus service demands

Without doubt, libraries, have a close relationship with the IoT as it allows for more efficient management and operation of library systems (Kumar, 2023). Hence, adopting and using IoTs technology in academic libraries would enable the library to monitor and control various library resources, optimise energy consumption and create a comfortable environment for users.

Methodology

The population of this study consisted of all the sixty-six (66) library personnel (25 librarians and 35 library officers) in the five (5) selected university libraries in Osun State, Nigeria. The descriptive survey research design was used for the study. Total enumeration technique (census method) was used to cover all the 66 library personnel in the five selected university in Osun State. A questionnaire titled prospect of IoT technology application for library and information service delivery among library personnel scale was used for data collection.

The questionnaire was divided into four sections A – D. Section A elicited information on the demographic characteristics of the respondents such as gender, age, educational qualification and years of work experience. Section B comprised of six (6) item-statements on the prospects of IoTs technology application for library and information service delivery. The response format range from 1- strongly disagree (SD) to 4 = strongly agree, Section C comprised four (4) item-statements on the benefits of IoTs technology adoption. The response format range from 1- strongly disagree (SD) to 4 = strongly agree. Section D comprised of seven (7) item-statements on barriers to the use of IoTs technology for library and information service delivery of the respondents. The response format range from 1- strongly disagree (SD) to 4 = strongly agree. The instrument has reliability co-efficient of 0.80 Cronbach's α.

The questionnaire for the study was administered to the library personnel in all the five selected university libraries in Osun State, Nigeria (see Table 1) through direct contact by the three research assistants. A total of sixty-six (66) copies of the questionnaire were distributed to the respondents. Out of this, 44 copies were returned, giving a response rate of 67%. The entire returned questionnaire were found usable for analysis. The questionnaire distribution and respondents across the selected universities in Osun State are presented in Table 1. The Statistical Product Service Solution (SPSS) version 27 was used for data analysis.

Table 1: Questionnaire distribution and response rate across selected universities in Osun State, Nigeria

S/N	Name of institutions	Questionnaire			
		Distributed	**Returned**	**Usable**	**Response Rate (%)**
1	University A	24	19	19	79
2	University B	3	2	2	67
3.	University C	6	4	4	67
4	University D	6	15	15	58
5.	University E	26	4	4	15
Total		**66**	**44**	**44**	

Results

Table 2 presents the demographic profiles of the respondents.

Table 2: Demographic characteristics of the respondents

Demographics	Frequency	Percent (%)
Gender		
Male.	14	32
Female.	30	68
Total	44	100
Age range		
21 - 30 years.	8	18
31 - 40 years.	26	60
41 - 50 years.	5	11
51 years and above.	5	11
Total		
Professional status		
Professional Librarian.	18	41
Para-professional.	26	59
Total		
Academic qualifications		
NCE/HND.	4	9
BA/BLIS/B.Sc.	22	51
MLIS.	18	40
Ph.D.	--	--
Total	44	100
Years of work experience		
1 - 5 years.	15	34
6 - 10 years.	25	57
11 - 15 years.	4	9
16 years and above.	--	--
Total	**44**	**44**

The demographic profile of the respondents as presented in Table 2 showed that of the 44 library personnel surveyed, 30(68%) were females, while 14(32%) were males. This implies that there are more female library personnel in the sampled universities, confirming the age long believe that the Library and Information Science profession is a female-dominated one in Nigeria. The age distribution of the respondents range from 21 to above 51 years ($\bar{x}$ = 35.02 years). The retirement age for academic staff on professorial grade and non-academic staff in universities in Nigeria are 70 and 65 years, respectively. This means the university libraries in Osun State, Nigeria are blessed with young personnel having more active years to spend in the employment of these universities.

Out of the 44 library personnel, 26(59%) were library officers, and 18(41%) were librarians. This implies that there are more library officers than librarians in the survey ed universities in Osun State. Perhaps, the lean annual budget of the universities could not permit the employment of more librarians. The job tenure (years of work experience) of the respondents in their various universities range between 1 and 15 years ($\bar{x}$ = 8.00 years). The educational qualifications of the respondents varied between diploma and Master degree in Library and Information Science.

Table 3 presents the mean and standard deviation scores of prospects of IoT technology application for library and information service delivery of the respondents.

Table 3: Mean and standard deviation scores of the prospects of Internet of Things technology application for library and information service delivery of the respondents'

s/n	Prospects of IoTs applications	$\bar{x}$	SD
1	Shelf guide for new library users.	1. 27	0.59
2	Online fine payments.	1.30	0.59
3	Alerting services.	1.25	0.44
4	E-library virtual tour.	1.27	0.45
5	Library orientation for patrons.	1.23	0.42
6	Help direct users to vacant reading areas.	1.18	0.39
	Weighed mean =	**1.25**	

Results in Table 3 revealed that online fine payments ($\bar{x}$ = 1.30, SD = 0.59), E-library virtual tour ($\bar{x}$ = 1.27, SD = 0.45), shelf guide for new library users ($\bar{x}$ = 1.27, SD = 0.59), and alerting services ($\bar{x}$ = 1.25, SD = 0.44) among others were some of the prospects of IoT technology application in academic libraries in Osun State, Nigeria.

Table 4 presents the mean and standard deviation scores of the benefits of IoT technology application for library and information service delivery among library personnel in Osun State, Nigeria.

Table 4: Mean and standard deviation scores of the potential benefits of IoTs technology application for library and information service delivery of the respondents

S/N	Benefits of IoTs Technology applications	x	SD
1.	Help in providing detailed delivery of information.	1.18	0.39
2.	Streamline book-office processes - inventory processes and monitoring of collection storage.	1.16	0.37
3.	Self-guided tours for users.	1.18	0.39
4.	A promotional tool for building positive image for the library.	1.23	0.42
	Weighed mean =		**1.19**

Results from Table 4 revealed that some of the benefits of IoTs technology application for library and information services delivery in academic libraries in Osun State, Nigeria include as a promotional tool for building positive image for the library ($\bar{x}$ = 1.23, SD = 0.42); help in providing detailed delivery of information ($\bar{x}$ = 1.18, SD = 0.39); self-guided tours for users ($\bar{x}$ = 1.18, SD = 0.39); and to streamline book-office processes (inventory processes and monitoring of collection storage ($\bar{x}$ = 1.18, SD = 0.39).

Table 5 presents the mean and standard deviation scores of barriers to IoTs technology application for library and information service in university libraries in Osun State, Nigeria.

Table 5: Mean and standard deviation scores of the barriers to IoTs Technology application for library service and information delivery of the respondents

S/N	Barriers to IoTs applications	x	SD
1.	Lack of standards for IoTs collection and storage.	1.43	0.63
2.	IoTs can cause a digital divide between the users and non-users of the technology.	1.52	0.10
3.	Adoption of IoTs is expensive and libraries may not be able to shoulder the expenses all alone.	1.45	0.66
4.	Inadequate infrastructural facilities to enable the implementation of IoTs.	1.48	0.64
5.	Organisational barrier.	1.41	0.66
6.	Data security issue (safety and security of users' data).	1.41	0.66
7.	Data privacy (legal aspect of data collection and processing).	1.45	0.10
	Weighted mean =		**1.45**

The results in Table 5 revealed some of the identified barriers against IoTs technology application for library and information service delivery in university libraries in Osun State to include IoTs technology can cause a digital divide between the users and non-users of the technology ($\bar{x}$ = 1.52, SD = 0.10), inadequate infrastructural facilities to enable the implementation of IoTs technology ($\bar{x}$ = 1.48 SD = 0.63), adoption of IoTs is expensive and libraries may not be able to shoulder the expenses all alone ($\bar{x}$ = 1.45, SD = 0.66); and data privacy (legal aspect of data collection and processing) ($\bar{x}$ = 1.45, SD = 0.10) among others.

Discussion of the findings

IoTs is regarded as the most comprehensive and important phenomena today, since it connects many things through the Internet. It enables digital or physical objects/devices which are embedded with software, electronics, sensors and other forms of hardware to behave smart and provides the capability to collect and exchange data to make independent decisions with or without human intervention with the help of Internet connectivity. The study revealed that library personnel perceived that the prospects of Internet of Things (IoTs) application for library and information service delivery were for online fine payments, shelf guide for new library users, alerting services and e-library virtual tour among others. This finding is in tandem with Gupta and Singh (2018) who reported that IoT application can be used for virtual library tours, shelf guides, user orientation, online payment, and occupancy amongst others.

This study revealed that potential benefits of IoTs technology applications to academic libraries service were as a promotional tool to build a positive image for the library, self-guided tours for users, and providing detailed delivery of information amongst other. This agree with Mohammadi and Yegane (2021) who reported that IoTs helps libraries in optimising use of space, enhancing the users experience, preserving valuable collections through smart room management, providing self-guided, virtual tour of the library. Kumar (2023) who pointed out that IoT integration will enhance library services, provide digital resources and innovative tools for students, thereby enriching their learning experience, enabling research, collaboration, and easy access to information. Zhou (2024) who stated that IoT has the ability to efficiently manage resources, enhance security, improve user experience, optimise network management, and make data-driven decisions.

In addition, findings revealed that barriers to IoTs technology application for library and information services delivery were that IoTs can cause a digital divide between the users and non-users of the technology, inadequate infrastructural facilities to enable the implementation of IoT, data privacy and adoption of IoTs is expensive and libraries may not be able to shoulder the expenses all alone amongst others. This finding corroborate

Shahzad, Khan and Iqbal (2024) who reported that lack of technical infrastructure, security and privacy concerns, lack of technological skills and unavailability of policy and strategic planning could serve as barriers to the successful adoption of IoT applications in university libraries. Equally, Echedom et al.(2020) who reported that the attendant problem of budget cost confronting several libraries, with increase in the price of ICT- enabled devices and network services, most libraries may not be able to provide adequate funds to cater for the establishment of IoT-enabled library services, and since IoTs is a progressive innovation, most libraries may not be able to cope with the evolving trends in the IoTs infrastructure, given that IoTs requires time and technically competent manpower.

Conclusion and Recommendations

Most libraries in the Third world countries are managed traditionally because of lack of adequate technological infrastructure due to dwindling of funds in the library space. IoTs as an emerging paradigm enables communication between electronic devices and sensors through the Internet to facilitate human lives. IoTs is a sophisticated computerisation and analytics system that exploits sensing, big data, networking, and artificial intelligence technologies to provide complete systems for a product or service. The study examined the prospects of Internet of Things (IoTs) technology application for library and information service delivery among library personnel in academic libraries in Osun State, Nigeria. Without doubt, the library environment is a complex ecosystem in terms of the high volume of elements, patrons, attending quickness, continuous growing of the objects and demands and a sufficient supply chain management system.

The IoTs can enable connectivity of a physical item such as a book to the real-time communication technology via the Internet, thereby initiating an online library supply chain integration with different forms of technologies like database, data acquisition and clouding system. Through this integration, many online services can be initiated. In conclusion, therefore, the adoption and application of the IoTs technologies into the academic library system could serve as a pathway to global data access and knowledge propagation in a fast, efficient, effective and smart manner as it is expected of the 21st century library space. Based on the findings from this study, the authors recommended the need for increase funding of libraries, improve infrastructural facilities to enable seamless usage of the Internet of Things and its related technologies in libraries and the training and re-training of library personnel on the application of IoTs and its related technologies for effective library service delivery.

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Authors' Biodata

[a]Dr. Olaronke O. Fagbola is a senior lecturer in the Department of Library and Information Science, University of Ilorin, Ilorin, Nigeria. Her research focus is information management, users' studies, and use of technology in academic libraries. Email: fagbola.oo@unilorin.edu.ng)

Fareedah Olajide is of the Department of Library and Information Science, University of Ilorin, Ilorin, Nigeria.

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