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Use of Internet of Things (IoT) Technologies in Indian Institutes of Management (I.I.M.) Libraries: A Study

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ABSTRACT:

Libraries as social institutions have always kept pace with the technological advancements in society to stay relevant. In recent years, the Internet of Things (IoT) is one such area that has opened enormous opportunities in almost all areas which have the intrusion of computers and the internet. IoT has not only helped Libraries to add value to traditional services but has also helped in collecting valuable data to supplement decision-making. This study examined the extent of use of the Indian Institute of Management (I.I.M.) Libraries are one of the premium brands of professional education in India. The study observed that the Libraries of I.I.M. have identified IoT as an important tool and have been using IoT at a moderate level.

Keywords: Internet, Internet of Things, IoT, Technology, Library

INTRODUCTION:

Computers, the internet and smartphones have become important aspects of everyone's life. Being connected is the buzzword as mobile devices, and broadband internet has become widespread and affordable. The internet has become an integral part of people's everyday life across professions and social diversity. The internet and connected devices have allowed people to seamlessly access and process information. At the same time, people, by carrying devices and accessing the information themselves, have become information producers. Technological developments have allowed the integration of human intellect and the physical and digital worlds.

Mogan (2014)¹ stated that IoT as a giant network of connected 'things' and people with relationship will be between people-people, people-things, and things-things. The cyber-physical

systems known as the Internet of Things (IoT) allow anything to be connected from anywhere at any time (Massis, 2016)²; Atzori, Iera, and Morabito, 2010)³. Corser, Fink and Bielby (2017)⁴ discussed IoT as a wired or wireless network of uniquely identifiable connected devices which can process data and communicate with each other with or without human involvement. IoT is based on the premise that everyday things with the right sensors and network access may communicate to carry out specific functions. There have been some worries about online snooping, breach of data privacy, legal objections, and human activities being controlled by devices (Ziegeldorf et al., (2014)⁵. Schmidt(2015)⁶ envisaged that IoT will be incorporated into everything around as the concept of the internet as a separate thing will disappear. The potentials of IoT have been quite favourable in academic and research information organisations; therefore, technology may no longer be regarded as a factor hindering access to knowledge (Makori, 2017)⁷.

The Indian Institutes of Management (I.I.M.s) are institutes of management education and research institutes of National Importance under the aegis of the Ministry of Education, Government of India, with the passage of the Indian Institutes of Management Act, 2017. There are currently twenty Indian Institutes of Management (I.I.M.) that provide educational opportunities at the undergraduate, graduate, and doctoral levels, in addition to executive education and a variety of other Business Administration-related programmes^{8, 9}. Alagumalai and Natarajan (2020)¹⁰ rightly stated that libraries are transforming from institutions of print management to knowledge management. Innovations in library service and the role of user participation in library service Innovations in academic libraries have produced a digital knowledge base that may be utilised to monitor online customer behaviour based on log files and other digital data (Scupola and Nicolajsen, 2010)¹¹.

REVIEW OF LITERATURE:

Pujar and Satynarayan (2015)¹² emphasised that IoT is the next big thing after the internet if implemented in libraries, adding value to library resources and services. Bansal, Arora, and Suri (2018)¹³ discussed IoT applications in libraries and advocated that using IoT and its associated technologies definitely help libraries and users in a big way. Massis (2016)² and Jadav(2019)¹⁴ pointed out the security and threat issues involved in using technology in libraries and showed concern about safeguarding user privacy. Mohamaddi and Yegane (2018)¹⁵ emphasise using new security protocols to save resources and users' information. Nag and Nikam

(2016)¹⁶ proposed an approach by using technologies such as cloud-based magic mirrors, and pressure sense pads through the wireless networks by which libraries not only improve library facilities but also increase user convenience. Upala and Wong (2019)¹⁷ discussed the implementation of face recognition as a security tool for user identification in library management. Bayani (2018)¹⁸ and others discussed that IoT tools can be used to implement online library supply chains and can be integrated with various technologies such as databases, data gathering and cloud systems. Dawes (2005)¹⁹ stated that the advantages of circulation speed and better inventory control sorting capability also come with drawbacks of cost, lack of standards, and privacy concerns.

OBJECTIVE: The objectives of this study are

1. To know the awareness about the use of IoT technologies in the I.I.M. libraries.
2. To find out the various IoT technologies and infrastructure available in I.I.M. Libraries.
3. To know the benefits and constraints they face in implementing IoT technologies in libraries.

RESEARCH METHODOLOGY: To ascertain the use of IoT technologies in I.I.M. libraries survey method was used for collecting data. A questionnaire was created on the 'google forms' platform consisting of 19 questions. The link to the google form questionnaires covering both closed and open-ended questions was circulated amongst I.I.M. Libraries on their official e-mail addresses in February 2022. Out of the total 20 respondents, a total of 14(70%) responses were received. Descriptive statistics such as frequency and percentage tabulation were used to analyse the data.

DATA ANALYSIS AND INTERPRETATION:

1. FAMILIARITY WITH THE CONCEPT OF IoT IN THE LIBRARY

While examining the familiarity with the concept of the Internet of Things (IoT) in the Library, 57 % of the libraries are familiar with the concept and are professionally working with IoT, a considerable number of Libraries have theoretical knowledge about IoT.

SN	OPINION	Total Response
1	Yes, very familiar and have professionally worked on it	8(57.1%)
2	Yes, have extensively read about it	3(21.4%)
3	Only heard about it	3(21.4%)
4	Not familiar	0(0)

2. AVAILABILITY OF RFID BASED ISSUE/RETURN FACILITY VIA CIRCULATION /KIOSK

The use of RFID-based circulation kiosks shows the commitment of the Library to adopt the high end infrastructure to facilitate the users with self-service facilities and extends the sense of ownership and choice to them, which considerably reduces the staff workload and saves precious time and energy of the library users. (Kaur & Malhotra)²⁰.

The question was asked to the I.I.M. libraries regarding the availability of RFID-based Issue/return facility via Kiosk. Data revealed that 57.1% (8) libraries have kiosk facilities made available for their users, while 14.3 % (2) have these facilities but still need to be functional. A total of 28.6% (4) libraries have RFID based circulation but do not have circulation desks.

SN	OPINION	Total Response
1	Yes, have fully functional system	8(57.1%)
2	Yes have but not functional	2(14.3%)
3	Yes have RFID based circulation but have no circulation desk	0(0)
4	No have plans to install RFID based self-circulation in the future	4(28.6%)

3. RFID-BASED DOCUMENT LOCATOR IN THE LIBRARY

RFID significantly saves the time of both Library staff and users in saving processing time and costs, improving client service, minimising book theft, and maintaining continuous updates of new books collections. Hand-held RFID readers promise the ability to sweep a shelf once and obtain a list of all books on the shelf (Mohammed et al., 2019)²¹.

About the RFID document locator 50% (7) libraries responded that they have not yet implemented it; however, they have plans to install RFID based document locator in their libraries in the future. Only 28.6 % (4) libraries responded that they have a fully functional system, and 14.3% (2) libraries have RFID-based document locators in their libraries. In comparison, 7.1% (1) libraries have installed RFID-based locator, but it is not functional.

SN	OPINION	Total Response
1	Yes, have fully functional system	4(28.6%)
2	Yes have but not functional	1(7.1%)
3	Yes, have RFID based Document Locator	2(14.3 %)
4	No, have plans to install RFID based Document Locator in the future	7(50%)

4. RFID-BASED INVENTORY MANAGEMENT SYSTEM IN LIBRARY

IoT offers libraries great opportunities to smartly manage their collection of books, periodicals and other documents. IoT helps Libraries add value to their traditional document service and information management tasks and offers a rich library experience to the users.

SN	OPINION	Total Response
1	Yes, Have a Fully Functional System	7(50%)
2	Yes have a system but yet to be functional due to administrative issue	0(0)
3	Yes have but not been made operational due to technical issues	1(7.1%)
4	No have plans to install an RFID inventory Management system in the future	6(42.9%)

Out of the 14 respondents (libraries), 42.9% (6) still need to install an RFID inventory Management system in their respective Libraries but have plans in the future. Only 50% (7) libraries stated that they have a fully functional system. 7.1 % (1) responded that they have a system but could not make it operational due to technical issues.

5. LIBRARY APPLICATION (APP)

Recent developments in communication technology, reachability of high-speed internet and accessibility of smartphones to every stratum of society have paved the way for the use of mobile phones to browse the internet (Adrakatti and Mulla(2017)²²; Sarasa-Cabezuelo(2022)²³. Accessing services on the mobile app has become an indispensable part of young millennial. Mobile applications hold great promise to enable libraries to provide enhanced services and handle users' increased information needs (Adrakatti & Mulla (2017)²².

S	OPINION	Total
N		Response
1	Yes, Have a Fully Functional System	3(21.4%)
2	Yes have an application but yet to be functional	0(0)
3	Yes have a library app but not been made operational due to technical issues	1(7.1%)
4	No, have plans to develop library app in the future	10(71.4%)

The table shows that fewer libraries, 21.4 % (3), have library apps for all services. In contrast, 71.4% (10) of libraries have not used library apps but are interested in developing them in the future. The data shows that 7.1% (1) library has a library app, but it has yet to be made operational due to technical issues.

6. SEND /NOTIFICATION TO USERS REGARDING NEWLY ADDED DOCUMENTS (BOTH PHYSICAL/ ELECTRONIC) TO THE USER VIA MAIL/MESSAGE/LIBRARY APP

Most Libraries provide services along with traditional services, extending Library services through mobile applications. The previous studies registered satisfaction of users with mobile library services as they consider these services and the associated technologies necessary and helpful (Wang et al. (2012)²⁴

S	OPINION	Total
N		Response
1	Via mail	14(100%)

2	Via sms	1(7.1%)
3	Customised WhatsApp group	0(0)
4	Telegram groups	0(0)
5	Social media update	1(7.1%)
6	Goodreads	1(7.1%)

In response to the question of sending notifications to the users regarding new documents received by the Library in printed or electronic form via mail/sms or social media. The majority of libraries use mail 100 % (14) for sending notifications to their users in place of SMS 7.1% (1), social media 7.1% (1) and Goodreads (a private website for book reviews and suggestions) 7.1%(1).

7. AUTOMATED QUERY HANDLING: CHATBOT

A chatbot (Allison, 2011)²⁵ is interactive, responding in sentences that answer common directional and predictable questions in a way that is meaningful to humans. Chatbots are artificial intelligence (A.I.) applications that produce responses to questions based on a computer program's current knowledge (O'Brien, 2019²⁶; Pickell, 2019²⁷). Ehrenpreis and DeLooper (2022)²⁸ explained that a chatbot could serve as another access point to the website for simple questions about library services. They further expressed that if a chatbot could successfully answer simple questions, it could allow librarians who performed chat references to focus on more in-depth research questions.

S	OPINION	Total
N		Response
1	Yes have a fully functional chatbot facility to address	0(0)
2	Yes, but not fully functional	2(14.3%)
3	No such service is being made available	12(85.7%)

In response to the question of having a chatbot facility majority, 85.7% (12) libraries responded that no such facility is made available in their libraries. Only 14.3 % (2) libraries say yes but are not fully functional.

8. NOTIFICATIONS AND READING LISTS

Krol (2019)²⁹ suggested that reading lists extend students' knowledge of class lectures and stimulate students to read, and act as a 'tool to signpost' students to relevant and specific material. Recent technological advancements like resource discovery and digital engagement have covered various subjective aspects of meaningful engagement of users with Library resources, including the evidence-based acquisition of library resources (Cameron & Siddall, 2015)³⁰.

The study shows that a fraction of institutes sends users with reading lists to the new collection, and sending reading lists to the students and users does not seem popular amongst Libraries of the Indian Institute of Management.

S	OPINION	Total
N		Response
1	Yes, regularly send details of lists/ personal suggestions etc.	5(35.7%)
2	Only to specific to users enrolling/ opting for the service	0(0)
3	No, have yet to make plans to implement the service due to administrative/ technical reasons.	1(7.1%)
4	No, but have plans to enable this service	8(57.1%)

9. IOT AS PROSPECTS FOR LIBRARIES

Due to the potential impact on society, the environment, and the economy, institutions and industry have offered considerable attention to IoT (Liang and Chen 2018)³¹. Despite data security challenges, IoT offers an encouraging future for libraries “to improve workflow and service, integrate existing resource and system to achieve service innovation, connect library resources and services to more people than before (OCLC, 2015)³².

S	OPINION	Total
N		Response
1	Strongly disagree	1(7.1%)
2	Fully disagree	0(0)

3	agree	1(7.1%)
4	Fully agree	5(35.7%)
5	Strongly agree	7(50%)

Libraries were asked whether they consider IoT a prospect, and it was found that 50% (7) libraries strongly agreed that this is the need of the hour. In comparison, 35.7% (5) fully agreed, followed by 7.1% (1) agreed, and one of the libraries strongly disagreed 7.1%(1). The data received recertifies that IoT will be an essential technological opportunity for the Libraries.

10. IMPLEMENTATION OF BIG DATA: TOOLS TO KEEP TRACK OF BOOKS READ/SEARCHED / DOWNLOAD BY THE LIBRARY USERS

Through big data technology (Zhang, 2022)³³, users' browsing process and content can be tracked, based on which the Library can ascertain their potential needs. Further, users' requirements can be proactively resolved to improve the overall experience and achieve usage efficiency.

S	OPINION	Total Response
1	Yes, have a functional system but not been implemented yet due to privacy issues	1(7.1%)
2	Yes, have a functional system for it	3(21.4%)
3	Not implemented due to technical issues	8(57.1%)
4	Not implemented due to administrative issues	2(14.3%)

Data analysis of the above table revealed that only 21.4% (3) libraries have implemented and have functional systems. Whereas 57.1% (8) libraries show their inability to implement due to technical issues, followed by administrative issues at 21.4 % (3) .7.1%(1) library has not been implemented due to privacy issues.

11. IMPLEMENTATION OF IOT-BASED ENERGY CONVERSION MECHANISM

Galvao et al. (2017)³⁴ suggested that since the Library building is attended mainly by young adults, Library as a role model may help disseminate the concept and importance of energy conservation using technology to the young generation.

The economic benefit is one of the foremost reasons institutions explore IoT's energy efficiency capabilities. Smart metering, real-time energy consumption monitoring, and data-driven forecasts enable all supply chain members to manage expenditures and investments better and eliminate waste^{35,36}.

SN	OPINION	Total Response
1	Yes, have a fully functional system	1(7.1%)
2	Yes have a system which is yet to be made functional	3(21.4%)
3	No plans for implementation due to technical and financial issues	10(71.4%)

Data in the above table reveals that the majority of libraries, 71.4% (10), have yet to make plans to implement energy conversion mechanisms due to technical and financial reasons. Only 7.1% (1) Libraries have fully utilised this tool to conserve energy, while 21.4% (3) libraries still need to be functional.

12. TRAINING FOR STAFF IN ORDER TO HANDLE IOT TOOLS FOR STAFF

By gathering real-time data, libraries can benefit from IoT by saving staff time, enhancing patron assistance, giving personalised service, and providing recommendations (Liang, 2018)³¹. The Library staff may have the basic skills to handle IoT technology. However, for optimal implementation of technology, some training and the creation of demonstration tools are necessary. The Libraries affirmed the same when questions were asked for this study.

SN	OPINION	Total Response
1	Strongly disagree	1(7.1%)

2	Fully disagree	0(0)
3	Agree	1(7.1%)
4	Fully agree	5(35.7%)
4	Strongly agree	7(50%)

13. IOT AWARENESS AMONGST USERS

Library awareness not only provides opportunities to 'share information about the resources that the library has to offer' but also provides an opportunity for users to provide feedback on their needs and expectations (Fraser-Arnott, 2020)³⁷. Ideally, a new user/freshman is not expected to be accustomed to Library services augmented with IoT technology. In this context, Libraries can develop library orientation strategies, including Library services augmented with IoT technology, through orientation programs, workshops/training/conferences and Online-Virtual Tours.

SN	OPINION	Total Response
1	Orientation Programs for the Freshers	13(92.9%)
2	Workshop/Training/Conferences	8(57.1%)
3	Online-Virtual Tours	7(50%)
4	Any other, please specify	1(7.1%)

Data in the above table reveals that for creating awareness among users regarding using IoT technologies in the library 92% (13) I.I.M. libraries responded that they organise orientation programs for the newly enrolled students, whereas 57.1% (8) libraries organise workshops/training/conferences for their users from time to time.50%(7) libraries provides online virtual tours to create awareness of new technologies.

14. BENEFITS OF IOT

IoT is a promising technology that can be applied to inventory management, access and authentication, and monitoring of collection storage (OCLC, 2015)³². IoT may also be used in specific areas to improve organisation, management, and planning that aids logistics and process and workflow organisation in various sectors with an aim to improve library services by

providing users with tools that allow easy use of libraries, constant contextual help, and personalisation processes (Wójcik, 2016)³⁸. The users were requested to provide feedback to determine the specific logistics and processes that can be enhanced with IoT in libraries.

SN	OPINION	Total Response
1	Have time to interact with the users to provide specialised services	11(78.6%)
2	Have time to evaluate the present Library services	11(78.6%)
3	Have time to Rectify old collections in the Library	8(57.1%)
4	Have to collaborate with other Libraries to Develop/ Re-design	7(50%)
5	Have time to develop Library outreach programs	8(57.1%)
6	Increase more value addition to their services	8(57.1%)
7	Helps in better inventory management	8(57.1%)

Regarding the potential benefit of IoT tools implementation in library services, the majority of libraries, 78.6% (11), revealed that they would get time to interact with their users and would have time to evaluate their services for users. While 57.1% (8) libraries responded that they would have time to develop an outreach program for their users, can do better inventory management, have time to rectify old collections of the libraries and can provide value addition to their services.

15. CHALLENGES WITH IOT

Every new technology that brings paradigm shifts also provides extensive operational, behavioural and managerial challenges to professionals and institutions. Libraries have long been considered social institutions reflecting social and cultural inclinations. Utilising library orientation, reference service, circulation services and feedback, Library staff always find ways to engage with library patrons. There are perceptions among library staff that the IoT might limit their associations with patrons. Keeping this in mind, the libraries were asked for their response.

SN	OPINION	Total Response

1	Have no time to design/create new in-house Library services	4(28.6%)
2	The Library services become mechanical, with fewer human contacts	0(0)
3	Have no opportunity to develop Library outreach programs	3(21.4%)
4	Have fewer opportunities to interact with the users	3(21.4%)
5	The Library services become mechanical, with fewer human contacts	7(50%)

It was found that the majority of libraries, 50% (7), are concerned that after using technologies, library services become mechanical with less human contact. Whereas 28.6% (4) libraries responded that they would have no time to design/create new in-house library services. While 21.4% (3) libraries reveal that they would have fewer opportunities to interact with the users and to develop outreach programs respectively.

16. CONSTRAINTS FOR LIBRARIES TO IMPLEMENT IOT BASED SERVICES

Operating amidst declining budgets, increasing costs, and a resource-scarce environment, academic libraries' leaders must make insightful decisions regarding how innovations are adopted and implemented in their institutions. (Brundy, 2015)³⁹. Library Administration's focus on digitising, archiving, and providing access to unique and rare collections would be a significant objective for the Library and may become the leading way to demonstrate the Library's significance, relevance and contributions (Soehner, 2014)⁴⁰. Evidently, people in organisations tend to resist dynamic change due to behavioural and psychological factors. In this context, Library Administration may play an important role by being open to employees' concerns and communicating to employees the need for change (Al-Jaradat et al, 2013)⁴¹. Library staffs are trained in their traditional domain of resource management. A relatively new concept of IoT may challenge them to adapt to new operational changes, which sounds familiar because 'technology changes faster than we can adapt'. With this in mind, libraries were asked for their opinion on various factors concerning services, operations and managerial obstacles they think they are/may be facing with adopting IoT in Libraries.

S. No	OPINION	Total Response
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1	Financial constraints on Budget	9(64.3%)
2	Have a dependency on technology	2(14.3%)
3	More Pressure on staff to keep up with the technological changes	6(42.9%)
4	Privacy and Security of Users	6(42.9%)
5	Management Support	4(28.6%)
6	Lack of Appropriate Technological Expertise	7(50%)
7	Fewer personal/emotional connections with the Library services	1(7.1%)
8	Hampering opportunity to develop Library outreach programs	0(0)

It is found that majority of I.I.M. Libraries 64.3% (9) have revealed that financial constraint on Budget is a severe issue in implementing IoT based services in their respective libraries, whereas 50% (7) libraries expressed a Lack of Appropriate Technological Expertise is a challenge. Apart from it, the privacy and security of users 42.9 % (6) and the Pressure on staff to keep up with the technological changes are the constraints faced by libraries 42.9% (6).

CONCLUSION

This survey attempted to evaluate the application of IoT among the Libraries of one of the premium brands of institutions in India that have been conferred the status of 'Institutes of National Importance'. These institutes have greater autonomy and a reasonable amount of funds. By being at the core of information and knowledge activities, the Library of I.I.M. should position itself as a champion of innovative technological and intelligent systems. Across the academic fraternity, implementing IoT and intelligent systems significantly impacts information and knowledge management in academic and research institutions. The explosive growth of high-speed internet clubbed with IoT has leverage to attract patrons to traditional information sources and to smartly utilise user-generated data for expeditious information flow and enriched learning experience. Beyond technology, sensors and data security IoT have great potential for Libraries if implemented in the desired manner. The study concluded that the Libraries of I.I.M. are at the moderate stage of implementing IoT infrastructure. It is suggested that I.I.M. Libraries must grab the advantages of available technology and IoT by precedence over other academic Libraries.

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