

Internet of Things (IOT) technology and its role in the development of smart libraries

Israa S.Ahmed(1), Zainab W. Abdulateef(2)

Information institute for postgraduate studies, Iraqi commission for computers and informatic(1)(2)

Date of Submission: 01-10-2022

Date of Acceptance: 13-10-2022

ABSTRACT.

The term Internet of Things (IoT) is a broad term that falls under the umbrella of many devices and applications. It is a somewhat confusing term for Internet users in general and librarians in particular. The different types that can be used in libraries, and presented the most important difficulties and challenges that libraries face when applying this technology, and presented some models that applied the Internet of things in global libraries. The most notable results are that the technology of IoT still in most libraries just an idea, so it is necessary to investigate study, accuracy and prepare the technical, human and financial requirements before switching to smart libraries. Libraries, to clarify the importance of applying Internet of Things in libraries and to prepare them for the necessity of switching to smart libraries.

Keywords: Internet of things, smart libraries, information technology, libraries, information centers.

I. INTRODUCTION

The Internet of Things is the fourth-generation revolution after the computer, the Internet, and mobile networks. As many Arab and foreign countries seek to adopt the Internet of Things technology to be used in various educational sectors, especially in libraries and information centers. There is no doubt that it thrives on a huge range of technologies that can be utilized in libraries if properly planned and implemented. Libraries and information centers seek to keep pace with the developments in modern technologies and invest them to provide better services for their information to the beneficiaries. It is expected that the Internet of Things technology will push the shift from digital libraries to smart library with smarter services, so it has become necessary for libraries to employ Internet of Things technologies in the development of information

services in a way that contributes to meeting the needs of beneficiaries and benefiting from them.

II. RESEARCH PROBLEM.

The problem of research is focused on shedding light on modern technology and how to benefit from its applications in libraries and information centers in order to return the desired and satisfactory benefit to the beneficiaries. The problem of research seeks to answer questions about Internet of Things and its applications in facilitating library services. These can be summarized as follows:

- What is Internet of Things (IOT)?
- What is the role of the Internet of Things (IOT) in the development of smart libraries?
- What are the most important Internet of Things (IOT) applications in smart libraries?
- What are the difficulties and challenges faced by libraries when applying Internet of Things technology and how to overcome them?

III. RESEARCH OBJECTIVES.

This paper aims to meet the following objectives.

- Learn about IOT technology.
- Identify the role of IOT in the development of smart libraries.
- Identify IOT applications in smart libraries.
- Know the challenges facing libraries when applying IoT technology and find ways to overcome them.

IV. THE IMPORTANCE OF RESEARCH

The research focus on the following aims to show the importance of the research.

- Enriching the intellectual output in the field of information science and libraries with modern topics interested in the latest technological development, especially in the field of the Internet of Things.

2. Shed light on the role of IOT technology in transforming traditional and electronic libraries into smart libraries to provide their library services effectively and advanced by making their sources available to beneficiaries with minimal effort possible.

V. RESEARCH METHODOLOGY

To meet the requirements of the research, the researcher used the documentary approach and the descriptive approach, as the research relied on a review of a number of Arab and foreign studies in the subject for the purpose of presenting the most prominent study models available on the subject, building an intellectual framework and benefiting from similar experiences and expertise.

5-1. Search Limits

Objective limits: - The study addresses the topic of the Internet of Things and specify the future of smart libraries in the development of this technology.

5-2. Procedural terms for research

Internet of Things: "It is a platform that combines supported devices (electronically and programmatically), sensors, engines, smart devices, and is called objects; these things communicate with each other using existing means of communication such as the Internet (the primary means), mobile networks, Wi-Fi, Bluetooth... etc."

5-3. Smart Libraries: - "It is a set of concepts and practices for the sustainable development of the modern library based on digital information technology, networks and artificial intelligence, so that they are interconnected and integrated efficiently and effectively to provide digital and green services to beneficiaries."

VI. PREVIOUS STUDIES.

Through a review of the literature of the intellectual product that dealt with the subject of the Internet of Things, the research resulted in the existence of many Arab studies symmetrical foreign studies that dealt with this topic and highlight some library services in light of the development of this technology and the facilities provided to the library and the beneficiary if applied in libraries and these studies are as follows: 6-1. Foreign Studies:

First, the researchers (A Kaladha & Rao, 2017) argue that the information technology that exists at the moment is for the Internet of Things through which the components of the physical

library can be connected to each other and connect these components or objects to man without any human intervention. This study discusses library services through various technologies such as (RFID radio frequency identification, WSN wireless, and Wi-Fi-Wi) Wearable body sensors that can be adopted as new and sophisticated ways and directions to facilitate office services. The researchers concluded that the Internet of Things paved the way for the identification of sources of information and devices through Internet of Things technology if books were treated as objects. The office and its connection to the Internet so that it can exchange information and make decisions on its own to transform it, there will be a wider scope for libraries to become smart libraries with the help of this technology.

Second: The researchers (Pujar & K V Satyanarayana, 2015) believe in their study that the Internet has seen a huge leap from the "Internet of Communications" to the "Internet of Things". Making it possible to connect objects and transmit data with or without human intervention. It is hoped that this will revolutionize the improvement of library services, where the researchers reviewed an explanation of the "Internet of Things" and examples that will affect libraries and their services and identify effective areas in the library where Internet of Things technology can be applied. The researchers concluded that Internet technology if implemented in the right way will achieve the desired results and represent the added value to the library's resources. The researchers stressed that this technology is still in the stage of development and the librarian must recognize this technology and follow its development and the places that adopted this technology to transform into smart libraries that facilitate the provision of services to its beneficiaries.

6-2. Arab Studies.

The study (Pan and Mudhar, 2021) aimed to define the Internet of things, its applications and forms and to analyze its components, pros and cons. Content analysis to visualize the potential form of office services from an Internet of Things perspective to make digital resources available to beneficiaries. Author explained in detail the possibilities of this technology and provided a vision of smart libraries and their services under IoT and its impact on the transformation into high-level libraries. So that all devices become smart speaking Provides reports that contribute to the adoption of accurate and rapid actions. Also, provides facilities to beneficiaries in locating library resources in terms of controlling visits to the library for librarians in accomplishing their library

tasks and accessing them with the least possible effort and time. The study presented the most important features and challenges that can face Libraries under this technology being a double-edged sword. The study found that IoT is a technology that improves the environment of libraries and their services and allows the possibility of locating all physical entities in the library as information sources. Also, reducing their loss, but in return for these advantages, the security and privacy of library trustees and beneficiaries may be exposed to piracy and threat, in addition to the high material costs of providing new technical equipment and human resources.

The study (Bou Ghazaleh, 2019) discussed the historical development and concepts of the Internet of Things and touched on the structural components of its structure and the most important advantages, disadvantages and services it provides in various fields. He also touched on the topic of IoT in the Arab world in general and in Libya in particular through its application in libraries and some of the models that have been applied in libraries and information centers. The possibilities of this technology in libraries were presented. It concluded with several recommendations, the most important of which is that research and academic information institutions should participate in the dissemination of Internet of Things technologies to achieve research objectives, as well as the need for technology to support education, communication and knowledge. Information institutions can jointly encourage creativity and innovation through research and development.

VII. THE FIRST AXIS

7-1. Internet of Things (IOT) Concept.

There is no uniform definition of this technology, because no one actually controls it like the rest of the free Internet domains that carry a lot of definitions but all of them go in the same logical direction.

Internet of Things means that all the tools and devices we use have the ability to connect to the Internet and are managed through the computer, smartphone applications, or control devices connected to the World Wide Web.

This means that the tremendous development in the use of the Internet in our daily lives, has emerged a wide space for the use of the Internet as a medium that allows smart devices and electronic objects to communicate and interact via the Internet. The aim of "creating a better life for man" where communication and interaction with

tools and devices can be done according to his services and wishes.

Without having to be in a specific place or time, this is done by linking this stuff to cloud services and data warehouses within high-speed Hefina networks called the "Internet of Things" and is today called the "Everything Network" (Al-Hakim, 2018).

The Internet of Things can be defined as "the new generation of the Internet that allows understanding between devices interconnected via the Internet protocol (Addresses Internet) and includes tools, sensors, sensors, various artificial intelligence tools and others" (Odeh, 2019)

Author defined it (Aldowah, Ul Rehman, & Ghazal, 2017) as "a global network that connects devices and objects to the Internet to communicate and interact with the internal and external environment, for the purpose of exchanging information through information sensors according to specific protocols."

According to Al-Luwaihan, 2014, "The Internet of Things is a means of effectively and easily controlling things effectively and remotely, it is everything that the Internet can recognize through the known Internet protocols. In this case the human being is the beneficiary of all these understandings and object-related communications, and with various imaginations, man himself becomes something if he sticks to it and the surroundings of a certain Internet address, such as sticking to it a look, a headset, a watch, a device and equipment."

Ali al-Aklabi (2019) has defined "the Internet of Things as the continuous networks of growth between physical objects that contain an IP address to connect to the Internet on the one hand, and the communication that occurs between those objects and other devices and systems that are also connected to the Internet to make the necessary responses and reactions."

We conclude from the previous definitions that the Internet of Things (IOT) is a concept that denotes objects equipped with sensors that can be connected and controlled through the "Internet" to accomplish certain tasks as quickly as possible.

7-2. About the historical development of the Internet of Things

This term was first used in 1999 by a British salesman (Kevin Ashton) who proposed the term "Things of the Internet" through his work at Proctor & Gamble, he came up with the idea of tracking down "RFID radawi tracking signals" on a cosmetic and connecting it with a wireless receiver to be able to monitor the sales list. Giving a signal

when additional inventory is needed, I assume such data will help solve many problems in the world and by the Korean electronics company LG it was announced the manufacture of the first refrigerator with Internet of Things technology (Dahshan, 2019). In 2005, the International Telecommunication Union (ITU) adopted research to develop Internet of Things technology, which was published in an annual report, In 2008, the International Internet of Things (IPU) was formed, the sixth version of the Internet Protocol (IPSO) was launched in 2012, which recognized that it is possible to specify a special address for everything without any obstacles or restrictions and thus ensure that millions of devices can be connected (Bou Ghazaleh, 2019).

7-3. Structural components of the Internet of Things

(Sharma, 2014) has listed three categories of technical requirements that must be available to activate the Internet of Things system in the management of information centers and revolves around:

1. Identity verification: Many devices connected to global networks share, requires that each device have a unique identifier that does not duplicate with other devices. This can be achieved with the empowerment of Internet protocols, and also the use of radio frequency identification techniques and other mechanisms used in identifying, tracking and distinguishing entities and objects.
2. Sensors: Devices associated with the Internet of Things need to contain components that enable them to interact and send data about their status, or any changes that occur to them. This is achieved by installing sensors on them to measure dimensions and disparate aspects, where sensors collect and process data by exploring any possible change in the physical state of entities.
3. Central server: The central server performs the tasks of collecting data from all entities saved in the cloud for the purpose of processing it in the future. There may be a device or application that performs the task of uploading data to enable the human element to detect, control and analyze what is happening, for example the use of smartphone applications

It has been mentioned (Irena, 2015) that are complementary to the general components of the Internet of Things mentioned the most prominent elements of which are the following:

a. Physical entities: - which are represented in things.

b. Motors or actuators: - Components that affect the physical environment.

c. Sensor devices: - are the ones that work to sense the entities of the physical environment.

d. Virtual entities: - These are electronic tickets, information sources and personal paper folders on which sensors can be installed.

e. People: - It is represented in activating the ability of the human element to control the environment, through the application of smartphones and other devices

VIII. ADVANTAGES AND EQUALS OF INTERNET OF THINGS TECHNOLOGY

(Keyur & P G Scholar, 2016, p. 6130) mentions many of the advantages offered by the Internet of Things to individuals and companies in general can be summarized as follows:

First: - Individuals: - Individuals benefit from the technology of the Internet of Things many areas including (safety, health, security, financial matters, daily planning, savings systems and home security systems.... and others)

- Data: - This technique provides a lot of information that helps in making the right decision at the right time.
- Tracking: - This technology helps in tracking and monitoring physical objects which in turn saves a lot of time, effort and money in research.
- Time: - This technology helps to provide accurate information in the fastest time and effort to individuals

Second: - For companies: - This technology provides a great benefit to companies, where it can monitor shipping, inventory, security, track individuals and conserve energy, in addition to that companies can target the customer through smart devices and provide advertising for products and provide them with them in order to achieve huge profits and increase the number of customers. (Bou Ghazaleh, 2019, p. 186). As for the equality of Internet of Things technology

Although there are many advantages, there are three equals related to this technology, including:

1. Excessive dependence on technology: - As users rely on this technology completely day after day as a decision making based on the data provided by it, and that with the increasing development of its technologies, this will lead to total destruction and represented by the pixelation of individuals from carrying out daily tasks, due to dependence on this technology, and produces catastrophic problems if

a certain system in this technology collapses, or provides wrong data

2. Security and Privacy Infringement: - Data circulating on the Internet is always subject to security breach, despite taking all the security measures that are done to protect it. Whatever the system based on the Internet for users such as (bank account numbers, smart cards for direct payment... and others) where hackers are working to look for a vulnerability to penetrate and steal data, and this has happened recently the hacking of some government websites in some developed countries by a group of people who call anonymous Despite the fact that these sites are characterized by the highest levels of security, protection, security and confidentiality. There are also some companies that monopolize the use of the Internet of Things, which will harm consumers and businesses. (Kumar, 2018, p. 103)

3. Job loss: One of the disadvantages of the Internet of Things is the loss of jobs, as the Industrial Revolution previously led to the replacement of workers with machinery and led to high rates of unemployment. Today, under this technology, it will lead to the loss of many workers to their jobs and to a significant rise in unemployment rates, which will lead to disastrous consequences for societies as a whole (Keyur & P G Scholar, 2016, p. 6130).

IX. THE CONCEPT OF SMART LIBRARIES.

This concept is the result of modern technological development in various technologies, software and devices characterized by artificial intelligence. The characteristics of self-management, at a time when traditional libraries were affected by the first secretions of technology such as the Internet and computers to be called "computerized libraries" and carried the characteristics of the computerized system. As a result of the development of modern technology and its addition to the property of intelligence is reflection on the nature of the system to be called "smart system". We can say on the library that applies such systems "smart library" and can be considered the latest generation after the previous four generations. The last of which was the semantic generation, the smart library comes as a new generation, if it is no longer focuses on computer and network technology only, but has been associated with several dimensions. The most important of which is the adoption of the idea of sustainable development, and dependence on

modern technology in various fields. (Al-Ajal and Muwaffak, 2019, p. 170).

The process of transformation into a smart library is only the result of the digital maturation of digital and electronic libraries, artificial intelligence, social information networks, multiculturalism and their interaction to form a smart library. The concept of smart libraries is intertwined with the concept of both electronic and digital libraries, but each library has its own concept, significance and characteristics. Although these concepts are based on the use of digitalization, they are taken into account in their concept, along with those basics and networks. However, smart libraries are a term that encompasses the characteristics of society, while electronic and digital libraries focus on the effective management of electronic information sources such as images, audio, text and video (Pan and Mudhar, 2021, page 71).

Accordingly, Author asserted (Wang, 2013, p. 2) that the smart library is an electronic and digital library focused on providing the best library services with high-quality management and efficiency using the latest information technologies. Smart libraries themselves are a scientific development and if compared to traditional, electronic and digital libraries, they are considered a comprehensive solution for the development of these libraries to suit technological variables, and to prove their services and effectiveness for the permanence of their existence.

X. PILLARS OF INTERNET OF THINGS TECHNOLOGY AND THEIR APPLICATION IN SMART LIBRARIES

There is a set of techniques and tools that underpin the Internet of Things that contributed a lot to its excellence and helped to apply them in the field of libraries and information centers if applied in them in particular, namely:

a. Radio Frequency Identification (RFID) Technology: - "It is an abbreviation of the term Radio Frequency Identification Radio, which is a general expression of technologies that use radio waves to automatically identify or to track the tracing of different cultural entities and vessels automatically. It is defined as automatic identification based on a device called (tags RFID). This device is a small chip that can be inserted into cultural materials, products or humans containing a chip made of silicon and an antenna so that it can receive data and send it through radio waves" (Zubaidi, 2013, p. 420).

b. Sensors: - are devices that receive physical quantities such as (heat, pressure, speed, distance) Usually the output is a signal that is converted into a screen that can be read by a human at the sensor site or is sent electronically via a network for reading or processing. (IVY, 2013).

c. Beacon "The technology that sends and receives information to beneficiaries, which is based on Bluetooth transmission technology without the need for a network connection or antennas to complete the process, and works to save time and effort, and guide the beneficiaries on the location of information and the way to access it easily and accurately, while providing protection crisis information security" (Abdul Aziz, 2021, page 15)

d. Computed clouds: "It is one of the methods of computing, in which computer resources are presented as services, and users are allowed to access them over the Internet without the need to possess knowledge, experience or even control the infrastructures that support these services. Cloud computing can be seen as a general concept that includes Service as Software. The web and other modern trends in the world of technology that share the idea of relying on the Internet to meet the computer needs of users" (Taha, 2016, page 12).

e. Augmented Reality Applications: "It is the addition, synthesis and imaging of digital data and the use of digital methods of real reality of the human environment, and from a technical perspective augmented reality is often associated with wearable computers, or smart devices that can be carried" (Larsen, Buchholz, & Brosda, 2011, p. 41).

(Iman, 2018) mentioned the most important services that can be provided through augmented reality technology in:

- Set up virtual tours within the library, as it gives researchers information about each corner within the library.
- Help researchers read the heels of books and get the recall numbers of each book in addition to detecting errors about the place of the book on the shelf, and indicate its correct place.
- Get additional information about books such as (price - summary - competing publishing houses in the publication and distribution of the book ... etc).
- Assist in reading texts from the book or from the book's front and back covers or citations, through the use of OCR technology.
- Use augmented reality in training courses within the library, connect beneficiaries between the virtual and real world, and enhance the reading of scientific materials with additional information such as videos, photos, models ... etc.

Identify the face of the beneficiary and a tracking technique through the identification number or survey of the researcher's parkour and his photo and match them to the library database.

Specify additional information about the library building such as opening hours, closing times of the library, services provided, technology available in it, and the number of current seats in it at the moment.

f. Blue Beam App: -" This app serves as a virtual or beneficiary mentor based on Beacon-I technology which is commonly used in augmented reality initiatives. This app sends location tracking information to mobile devices to help beneficiaries search for sources of information and provide them with contextual hints about those sources" (Pan and Mudhar, 2021, p. 73).

G. Capira Technologies: - This technology provides a competitive idea for the use of the Internet of Things in libraries. This technology provides solutions to the reality of integration between the applications of devices and library systems used. The application can suit the individual needs of the library, and then the beneficiary can receive notification about the status of his/her personal account, surround him/her with events and office activities, search for indexes, and receive notifications from librarians. This application is used in more than a hundred libraries in the United States of America (Subhi, 2017, p. 22).

H. Bibliotenna Computers - "Library sources are browsed in them and contain a library database management system that allows the process of borrowing Ccheck out and the process of checking in for information sources and contains tablet screens that read the sources to be borrowed and the sources returned as well as a reader for the electronic identification cards of the beneficiary. The returned books are received in them and collected in a basket in preparation for their return on the shelves by the librarian or a robot using the sensors from which the source data was received and then sensed the security of their correct presence on the shelf" (Pan & Mudhar, 2021, p. 73).

XI. AREAS OF UTILIZATION OF THE INTERNET OF THINGS IN SMART LIBRARIES

Internet of Things technology is one of the promising technologies that will contribute significantly to the access of beneficiaries to the information and services provided by libraries and

information centers, which can generally benefit from its commonly used applications as follows:

1) Library access service and its resources.

Libraries can benefit from the Internet of Things technologies represented by positioning technology (GBS) and wireless guide technology (ibeacon), in the development of information source search services, by directing the researcher to the container as there are the required sources of information according to the research requirements entered by the researcher. For example, when researchers enter the library indexes the library application stored on mobile phones provides a guide map to determine the topics of the required information sources. Additional information on the source may also be provided by contacting other sites such as Amazon, and so detailed information on the source of the information can be obtained before borrowing it (Abdul Mokhtar, 2021, p. 229).

2) Management of library holdings and collections.

One of the most important activities that can be used from this technology in doing it, where this process can be inscribed through pressure panels, through which it is possible to know the number of beneficiaries who frequent certain departments and know which departments are the most visited or which sections need to be developed for their holdings. By linking motion sensors to the application of libraries and then analyzing data, also benefit from "RFID radio frequency" identification cards. Within the library collection, in addition to including an identification in the cards, sensing the beneficiaries of the sources that are about to end the period of loan and fines, and paying those fines through the application of the library without the need to go to the library. (Ahmed, 2019, page 10).

3) Conduct inventories.

One of the most common IoT services for librarians and information specialists are those designed for inventory purposes. These services require the use of tags on information sources using RFID. The sensor is placed on the shelves to detect the removal of any element for circulation which makes the shelves smart and active. Also, facilitates the library trustee from conducting the inventory and statistical analysis, as well as the ease of inventory of collections of libraries, which are usually difficult to inventory by traditional methods. Library collections with RFID tags on each of their elements that can be identified using

computers and RFID readers, and by integrating RFID cards into library member cards make it possible to simplify the circulation, collection, and inventory of collection items quickly and well (Pan and Mudhar, 2021, p. 74).

4) Information Marketing Activities

One of the most important areas in which Internet of Things technology can be used efficiently in library and information center services is marketing and promotion activities, the benefits of which in this direction are unlimited, making information sources more marketing and distributed (Al-Subhi, 2017, page 20).

5) Self-reliance in borrowing and retrieving sources of information

Using the "RFID" technology, beneficiaries no longer need to open the title page of each book to borrow, retrieve sources of information, complete the process automatically, or simplify the loan procedure. The RFID self-service can work (24) hours without an employee because this technology will significantly enhance library services and efficiently the circulation of books and other sources of information (Al-Tayeb, 2019, page 429).

6) Control of thefts.

Internet of Things (IO) technology can detect the security of information sources through software installed on the computer, which includes RFID devices, light and sound alarm (usually up to 2 meters), rapid identification, voice alarm, and false error report (Al-Tayeb, 2019, page 430).

7) Device Management

Internet of Things technologies can be invested in the management of all its electronic devices, as it allows library workers to control through their mobile phones the air conditioners, lighting, temperatures, Wi-Fi technology and others. (Abdel Mokhtar, 2021, p. 229). Based on the above, libraries and information centers, with their actual orientation to employ the Internet of Things, will move their current traditional systems to smart library systems, which are based on the interaction between employees, beneficiaries, services and the library building, as it is a large-scale interactive technology. Table 1 below illustrates and summarizes the conception of the areas of application of Internet of Things technology in libraries and the possibilities that will facilitate library services and their beneficiaries.

Table No. (1) shows the conceptualization of the areas of application of Internet of Things technology in libraries (Magdalena, 2016)

| Domain | Internet of Things Capabilities |
|---------------------------------|--|
| Financial Management Resources | .1Track the movement of sources in the shelves and inside the library .2Track the status of sources (loan, return, technical operations) .3Track the status of furniture |
| Human Resource Management | .1Monitor the behavior of the beneficiary within the library .2Calculate the number of visitors to the library .3Guiding the beneficiary through applications for the facilities they need |
| Operations Management | .1Reservation of meeting rooms and reading .2Availability of reading tables as the number of beneficiaries increases |
| Monitor the library environment | .1Automatically sense the presence of fires .2Activate cooling and ventilation according to the heat sensor .3Activate lighting in case of beneficiaries |
| Financial Management Resources | .1Automatically sense the presence of fires .2Activate cooling and ventilation according to the heat sensor .3Activate lighting in case of beneficiaries |
| External Services | .1Use of different applications for library services .2Providing loan and return service by regions |

XII. THE MOST IMPORTANT CHALLENGES AND DIFFICULTIES THAT PREVENT IOT APPLICATIONS IN LIBRARIES AND INFORMATION CENTERS.

Despite many advantages and benefits that result from the use of Internet of Things technology, this type of technology may be subject to obstacles and problems, these problems vary from one side to the other according to it. For the varying factors of possibilities and objectives available for each library, we can list them as follows:

1. Weak technological and technical design: It is necessary to prepare the appropriate technical design to adopt these applications, with the need to provide excellent infrastructure.
 2. Lack of experience and skills: in terms of the low level of qualified cadres' management and follow-up of this modern technology.
 3. Difficulty in implementing training programs for beneficiaries: For the library to succeed in adopting these applications, it must provide guidance services. This task may become a problem if there is not enough time available to the library staff, there is a low level of use of modern technology by beneficiaries, or a poor professional level of those conducting the training process (Bou Ghazaleh, 2019, page 193).
- Ali al-Aklabi (2019, p. 113) points to several factors that he sees as a concern about the consequences of the use of Internet of Things

technology that will affect work in libraries and information centers.

1. The use of the Internet of Things may cause a rise in cyberattacks, exploit any possible loopholes to disrupt the Services as well as the possession of information about beneficiaries.
2. The possibility of penetrating the huge number of networks connected to things over the Internet.
3. The use of IoT technology may cause the availability or disclosure of certain personal information, so concern about the ability to maintain privacy increases.
4. The level of security in the continuation of services, and not to be affected by any circumstances that may lead to interruption or poor connection of objects to each other.

XIII. THE MOST IMPORTANT INTERNATIONAL LIBRARIES THAT HAVE IMPLEMENTED INTERNET OF THINGS TECHNOLOGY

The opportunities available for the application of the Internet of Things are great, and many developed countries have benefited from them, below is a presentation of the most important experiences, namely:

1. The experience of the National Library of Malaysia: Samsung Electronics has concluded a cooperation agreement with the National Library of Malaysia, where it has built a modern and advanced library. The Samsung Smart Library, which uses

smart screens and advanced smart devices connected to the Internet, which has made special applications for the library for services such as (loan, collection management, reading and library activities), and the investment of Internet of Things applications in tablets and screens. (Ahmed Mohammed, 2022, p. 193).

2. Orlando Public Library Experience: - In November 2014, the library implemented iBeacon wireless beacons based on the iBeacon technology application where users are sent via mobile phones on geographic locations within the library with notifications about the library such as events, presentations, assistance in navigating within the library... Etc.

Capira Technologies has launched an application for iBeacon technology supported for libraries that has CapiraMobile applications as a service to interact with beneficiaries via Bluetooth technology and the technologies are represented in

- Lending service: It informs beneficiaries to send notifications about the books returned and the dates of return, as well as renewal dates, books booked, and any other data related to the lending of books.
- Follow-up of events: Send notifications about events held within the library.
- Shelves: Send notifications to beneficiaries of the vessels on the shelf, as soon as you pass in front of a certain shelf of books, and then can be used to view the recent versions received by the library.
- Tracking: Library staff can track the beneficiary throughout the library, the places they visit, and the amount of time they spend inside the library. (Unified Arab Index, 2018).

3. Application of Wireless Girl Guides (Beacon) technology in museums: This application has been adopted globally in many museums, and has also been applied in libraries with the same capabilities and level as well. The beneficiary or visitor to the museum no longer needs to scan the code or code of the QR code of the painting, artifact, or to obtain special information about it. As it is done by downloading this application on the mobile phone of the beneficiaries Using the technology of locating, the application sends him a notification of all the detailed data about any painting or piece he wants to know about as soon as he passes through it in the museum and can be provided with a set of audio and visual files related to that painting or piece. In addition, through the application itself, the beneficiary can receive a range of other services (Pan and Mudhar, 2021, p. 79).

4. Hillsboro Public Library Experience: - The Hillsboro Library in Orrego showcased Book-O-Mat in 2016, a kiosk located in Hillsboro University's central square and equipped with best-selling books as well as a collection of new films. Located in a public pedestrian traffic area, this kiosk is monitored from the main library a few miles away to track use and alert the library when books need to be identified or restocked for continuous collection. (Hayek, 2018)

5. D.H. Hill Library Experience: The D.H. Hill Library at North Carolina State University has implemented the Internet of Things (IoT) to implement library procedures. It monitors the movement of furniture, the number of visitors to the library, provides access to the card, controls digital signage. The Internet of Things encourages the library to practically explore embedded technologies, connecting students with relatively low-cost materials to develop practical applications of their curriculum. Librarians in this environment facilitate learning and enable students to test, select, and improve their initial practical models, learn from others, and then showcase their models and work. (Bou Ghazaleh, 2019, p. 192)

XIV. RESULTS

1. Internet of Things technology in most libraries is still just an idea, and it is still a perception of what will happen in the future, so accuracy must be investigated, studied and technical, human and financial requirements prepared before switching to smart libraries.

2. The investment of Internet of Things technology needs libraries and information centers to work on training their professionals on this emerging technology so that they can apply this technology and use it efficiently to develop smarter information services and provide them better to the beneficiaries.

3. Internet of Things technology is replete with many technical capabilities that can be utilized in libraries and information centers, if properly planned and implemented.

4. The study showed the most famous experiences of international libraries towards their application of Internet of Things technology, which can be used and invested in the development of Arab libraries.

XV. RECOMMENDATIONS

1. Increase research and studies on Internet of Things technology and subject it in the field of

information science and libraries because of its impact on the service and enrichment of intellectual production.

2. Attention to holding workshops and training courses by specialists in the application of Internet of Things technology for library trustees and staff, and clarifying the importance of applying the Internet of Things in libraries and to prepare them for the need to turn into smart libraries, so the traditional library cannot be dispensed with in any way but at the same time it is not possible to stay on the actual libraries in their old traditional reality in providing their services and resources

3. Benefit from global experiences in the application of Internet of Things technology to avoid obstacles and problems, develop library infrastructure and provide Internet communication lines when switching to the Internet of Things

4. Study the concerns that threaten the investment of Internet of Things technology in libraries and information centers and try to find appropriate solutions to them.

REFERENCES

- 1) A Kaladha, & Rao, K. (2017). Internet of Things: A Route to Smart Libraries. *Journal of Advancements in Library Sciences*.
- 2) Ahmed Abdullah. (2019). Internet of Things in Libraries and Information Institutions. *Advanced working papers for the 25th Conference of the Association of Specialized Libraries*.
- 3) Ahmed Mohamed Ali Abdel Mokhtar. (2021). Employing Internet of Things Technologies in the Development of Academic Library Services: A Prospective Study. *Bibliophilia Library and Information Studies*, 3(236-216).
- 4) Al-Ajal Hamza, and Muwaffaq Abdul Malik. (April, 2019). The Trend Towards Smart Libraries is a forward-looking study of the library systems of the future. *Journal of Pleophilia for the Study of Libraries and Information* (2661-7781).
- 5) Aldowah, H., Ul Rehman, S., & Ghazal, S. (2017). Internet of Things in Higher Education: A Study on Future Learning. *Journal of Physics: Conference Series*.
- 6) Ali al-Kalbi. (2019). Framework of the Internet Proposal for the Application of the Internet of Things in Educational Institutions. *Journal of Educational and Human Studies*, 4(6).
- 7) Ban Ahmed, and Mudhar Ahmed. (2021). Smart Future Libraries under the Internet of Things: Opportunities and Challenges. *Arab Journal of Literary and Humanistic Research*, Volume I, Issue Three,
- 8) Hayam Hayek. (10 9, 2018). How libraries can adapt to the Internet of Things tsunami. Recovered from Textile Academy: <https://blog.naseej.com/%D8%A7%D9%84%D9%85%D9%83%D8%AA%D8%A8%D8%A7%D8%AA-%D9%88-%D8%A5%D9%86%D8%AA%D8%B1%D9%86%D8%AA-%D8%A7%D9%84%D8%A3%D8%B4%D9%8A%D8%A7%D8%A>
- 9) Hussein Ali Bu Ghazaleh. (2019). Internet of Things (IOT) applications in libraries and information centers. *Journal of Sabratha Scientific University*.
- 10) I. w. (2013, July). Retrieved from WhatIs.com: <https://www.techtarget.com/whatis/definition/sensor>
- 11) Irena, B. (2015). "What Makes Up the Internet of Things". Retrieved from <https://www.computer.org/web/sensingiot/content?g=53926943&type=article&urlTi>
- 12) Keyur, P. K., & P G Scholar. (2016). Internet of Things-IOT: Definition, Characteristics, Architecture, Enabling Technologies, Application & Future Challenges. *researchgate*. Retrieved from https://www.researchgate.net/publication/330425585_Internet_of_Things-IOT_Definition_Characteristics_Architecture_Enabling_Technologies_Application_Future_Challenge
- 13) Kumar, D. V. (2018, JULY). APPLICATIONS OF INTERNET OF THINGS FOR SMART LIBRARIES: AN OVERVIEW. 7(2).
- 14) Larsen, Y. C., Buchholz, H., & Brosda, C. (2011). Evaluation of a portable and interactive augmented reality learning system by teachers and students. *researchgate*.
- 15) M. W. (2016). Internet of Things: potential for libraries. *researchgate*, 34(2).
- 16) Mazen Samir al-Hakim. (2018). Definition of stuff to the Internet of Things. *ReaearchGate*. Recovered from https://www.researchgate.net/publication/328612307_2-tryf_alashya_aly_shbkt_antrnt_alashya
- 17) Mohammed Ibrahim Hassan Al-Subhi. (2017). Employing the Internet of Things in Libraries: An Overview of Potential

- Prospects for Application. Maghreb Journal of Documentation and Information, 26.
- 18) Mona Abdul Hussein Jawad Al-Zubaidi. (March, 2013). The use of radio wave (RFID) technology in the field of lending. Journal of the Faculty of Basic Education / University of Babylon, 11.
 - 19) Omar Ghassan Taha. (2016). Improving the performance of an organization's information system using cloud computing. Tishreen University: Syrian Arab Republic.
 - 20) Pujar, S. m., & K V Satyanarayana. (2015). Internet of Things and libraries. Annals of Library and Information Studies, Vol. 62, September, pp.186-190.
 - 21) Raghad Muhammad al-Luwaihan. (October 16, 2014). Internet of Things. Saudi Academy website. Retrieved from the Saudi Academy website.
 - 22) Sanaa Kazim Odeh. (2019). Things of Internet (IoT). H TE-CH Conference on the Launch of the Dome Initiative for the Development of the Telecommunications and Technology Sector in Iraq, p. 32.
 - 23) Sharma, A. (2014, MAY 20). PCQUEST Magazine. Retrieved from <https://www.pcquest.com/the-tech-behind-internet-things>
 - 24) Tarfa bint Abdul Aziz. (2021). Application of the Wired Guide I Beacon Technique in the King's University Library: An Exploratory Study. King Abdulaziz University: A comprehensive interdisciplinary electronic journal.
 - 25) Unified Arabic Index. (2018). Internet of Things and Libraries. Recovered from <http://blogaruc.blogspot.com/2018/04/blog-post.html>
 - 26) Wang, S. (2013). The Resource Sharing and Cooperative Development of Smart Libraries in Asia. (1023-2125). Retrieved from https://web.archive.org/web/20180423043535id_/http://blis.lib.nccu.edu.tw/fulltext/82/82_1.pdf
 - 27) Zainab Al-Tayeb. (2019). Internet of Things and Information Organizations: Towards an Innovative Generation of Smart Information Services. Working papers submitted to the 25th Conference of the Association of Specialized Libraries.