# INTERNET OF THINGS: APPLICATION TO THE LIBRARIES

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## ABSTRACT

*Web has taken a large discovery from 'Internet of communication' to 'Internet of Things', creating it potential to attach objects and transfer information with or while not human intervention. This is often seemingly to revolutionize the manner we have a tendency to live. Like other service industries, it's an enormous potential in betterment of library services. The Internet of Things (IoT) refers to a system of interconnected, internet-connected objects that area unit able to collect and transfer information over a wireless network while not human intervention. The private or business potentialities area unit is endless. In this article, researcher have focused on the concept of Internet of things, its process, lifecycle, the technology and its growth and also examples from service industries. It also covers potential impact of I oT on libraries and establish potential library areas wherever it may be enforced effectively.*

**Keywords:** *Internet of Things; libraries; RFID; Beacons*

## Introduction:

What is Internet of Things? In simple words, The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. According to Techopedia "The Internet of Things is a computing concept that describes a future where everyday physical objects will be connected to the Internet and be able to identify themselves to other devices". Another way we can say that "The Internet of Things is a scenario within which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Internet of Things has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS) and therefore the Internet". In straightforward terms , Internet of things permits, any natural or artificial objects to communicate each other and transfer knowledge using assigned scientific discipline address with or while not human interventions.

## Definition:

The most interesting part of this definition is that IoT is a complex of things (or mechanisms)

connected with each other over the Internet. They can "communicate" with each other and act without people's intervention

**Different Names of** Internet of Things (**I of T)**

Internet of Everything

• Smarter Planet

• Machine to Machine (M2M)

• The Fog

• Tsensors (Trillion Sensors)

• The Industrial Internet

• Industry 4.0/Economic Web

• Internet of Things (IoT)

**Internet of Things: Lifecycle**

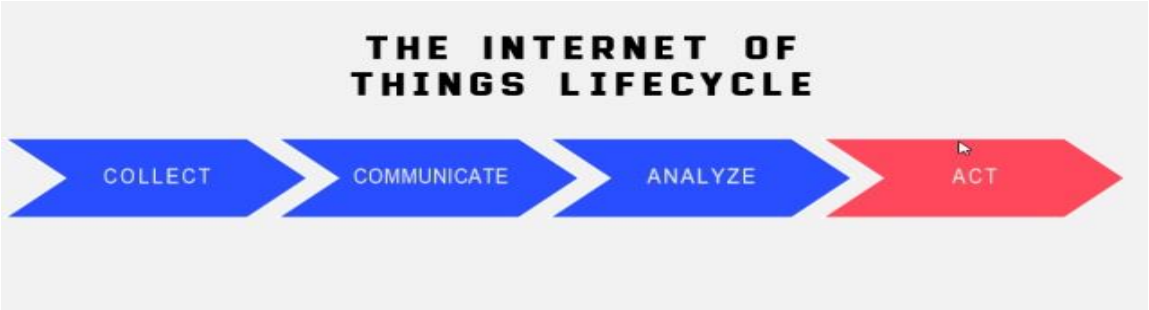


**Figure 1 ; Internet of Things; Lifecycle**

**Internet of Things: Lifecycle**

**Collect:** Device and Sensors are Collecting Data Everywhere

**Communicate:** Sending Data and Events Through Networks to some Destination

**Analyze:** Creating Information from Data

**Act:** Taking Actions based on the Information and data

**Internet of Things: How it Works**

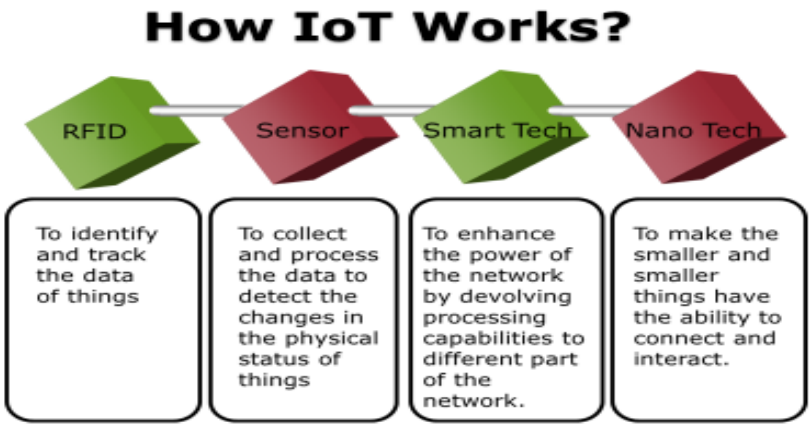


**Figure 2 : Internet of Things: How it Works**

**IoT Governance, Privacy and Security Challenges**

• The IoT's diversity in devices, services and protocols, gift challenges unseen and Unprecedented within the fashionable communication

• Governance and Privacy issues

• Security Challenges

• Autonomy

• process Constraints

• Discovery

• Trust Relationships

• It doesn't have any international compatibility customary.

• It may be extremely advanced leading to failure.

• Reduced safety for users.

• Internet of Things device could lead of life in due course of your time with increasing AI Technology.

**IOT and its impact on Libraries**

Even though IoT remains in its infancy, it has an enormous potential for libraries. Libraries are ready to add a lot of price addition to their services and provide valuable library expertise for patrons. IoT is all regarding connecting objects one another on-line as they're unambiguously placeable.The IOT may be wont to improved library services. Librarians area unit already at home with this in libraries because of the utilization of RFID, that will the similar issue of interacting with machines, tags and updates library management system with entries of books issued to a user, however just in case of IOT, solely the distinction is, it's the web interacting with a issue or object like book. Libraries have books, journals, CDs/DVDs, theses and lots of a lot of physical objects and IoT may be a blessing in disguise to beat a number of the perennial library issues like spatial relation of objects and their usage. It will even facilitate in strengthening the ties between the books and readers thereby realizing Dr S.R. Ranganathan's ordinal law of humanities "Every Reader his or her Book." Since most of the patrons in gift days have sensible phones, employing a mobile app, libraries will change them to access and use library resources through virtual borrower's card. it's the nice potential for libraries to plug their services.

Library specialists and designers additionally face advanced challenges, worries and opportunities for development in respect to the aborting technologies like the IOT .The Internet of Things and new technologies will improve libraries, each on grouping information and user services.

The lay communication between objects in IOT technologies will create easier higher cognitive {process} and management process in libraries. In keeping with the concept of sensible building, libraries may be equipped by IOT devices.

IOT can change libraries to attenuate loss and introduce safety techniques. Libraries are ready to add a lot of price addition to their services. Librarians area unit those specialists that already at home with this technology in their libraries because of the user of RFID, that will the similar issue of interacting with machines, tags software package, and updates library management system with entries of books issued to a user, but in IOT, solely the distinction is" it's the web interaction with a issue or object like books .

**Potential Areas of IoT in Libraries**

• software for Library automation – LMS
• Library management tools – all the applications
• Digitalization technology – digital libraries and virtual platforms
• Tools for search- Discovery and united Search provided
• Access to e-resources and publisher content
• Preservation and digitization platforms
• Net and Wi-Fi of Libraries
• Library websites and different electronic tools for marketing together with social media
• Mobile Applications utilized by Libraries
• different digital suggests that of communications like SMS, emails etc

The potential areas of Io T implementation for libraries:

1. Improved access to collections and resources – There is a potential in IoT to put in RFID on all library shelves therefore patrons can quickly notice wherever a book is traced . Patrons might then be directed right to its location with the use of special app.

2. Collection management and Stock Checking – Library material are often controlled by applying sensors on them. By connecting the sensing element to the net, the movements of every item are often monitored. This will give real time data, thereby providing proper internal control furthermore it will facilitate patrons to notice the item they are searching for. This might be done with the help of special app on their smart phones.

3. Recommendation & Notification service- Smart phones may well be detected within the library, via Wi-Fi or Bluetooth, and send targeted communications to patrons. For example, IoT imbedded in patron borrower's card can trigger a notification to readers who owe a fine to the library once they enter the building. This notification with a link directs patrons to the payment page. IoT

might even be accustomed to send a notification of a couple of new fiction book within the library whereas the patron is searching for books within the fiction aisle.

4. Mobile Technology and location based services – track IoT devices to work out traffic patterns of patrons to enhance space available or to pinpoint mostly used library areas. Patrons can connect their phones to sensors and receive notifications to find library resources from their favorites list. This information might facilitate in optimizing library staff, find out genre patterns and spot opportunities.

5. Safety – By installing internet-connected fire sensors, accidental fire can be often handled easily and safely from outside the library

6. value Savings & Appliances monitoring – by using lighting that's controlled by the net to sense on or off position of lights or by implementing energy system that controls energy consumption as per need.

7. Drones – As Amazon is testing presently, there are implications for libraries also .furthermore. It'd become helpful to get library resources to homebound patrons or folks living in remote service areas.

8. Survey Patrons – IoT sensors will recognize when patrons are leaving the library premises and immediately send a survey to the patron. The information can be collected to find out if the patron was happy with their experience.

9. Direct patrons to special displays, programs and events –In addition to storing books, Most libraries, organize events, like storytelling, book discussion etc, and academic programs for kids, teens and adults. With beacons deployed within the library, information concerning these events and special displays is easily available.

Now we are going to discuss a number of the potential areas in detail for implementation of IoT in libraries

**Access to library and its resources**

Libraries, employing a mobile app, could issue a virtual borrower's card to its members. With the use of this card members can get access to library and use its resources. Once a user accesses the library catalog to find the desired resource/s, the library app installed on his or her mobile, can display a map of the library on his /her mobile the location of resource/s. It can even give extra information about the resources by connecting to a web site like Amazon, as such the user has elaborate information of the resource, before he/she borrows it.

**Collection Management**

The library resources having RFID tags on every item allows their virtual existence, which may be known by use of computers and RFID readers. Through integration of RFID tags in to users

cards, circulation of books and collection of fine are often regularized. The IoT will be in a position to information users if the book is overdue and the fine they owe to the library, it will enable the users to return the overdue books and pay the fine on-line without attending the library circulation desk .Smart digital shelves will be ready to promote the content as per patrons borrowing records and search history on the net. As with the help of IoT it is simple to find misplaced books. It will facilitate in smooth inventory management.

**Information literacy**

Information literacy or orientation helps new patrons to guide about the library, its resources and services. Now days, Libraries use Magic Mirror consisting of camera, Wi-Fi enabled sensors that provides interaction between user and computers to record the information of the users. Mobile apps facilitate virtual tour of the library. Libraries having setup beacons like wireless devices at numerous sections of the library, once users visit the actual section, their mobile app play video or audio explaining details of that section. Information about special collections like manuscripts will be provided in digital format on their mobile phones as physical access to such resources is restricted .This will enrich the experience of the user.

**Recommendation service**

IoT can use patron's data to suggest tailored recommendations, using real time data, based on the history of their borrowings. When a researcher searching a database for resources on topic of his or her research, it will be possible to suggest other resources, which would be of interest to them. Even when a user, while visiting library next time or is he or she is close to the library, IoT would be able to inform the user about new arrivals in his or her area of work or about availability of borrowed book, which he or she was looking for during his/her earlier visit

**Location based services**

IoT would help libraries in providing location based services. If a user having created his favorite list in library catalogue using his or her account from home or office, walking in to the library with IoT enabled mobile device, would be able to get directions for stacks, where favorite books have been shelved and also would be able to help him or her to know interesting titles available on the topic and status of checked out books. It may also enable libraries to provide status of availability of reading rooms, discussion rooms online mobile apps are used to keep and track the availability of the book on the respective shelves or check the other resource availability despite the location wherever they are. These are also connected to IoTs to provide the data, printers, scanners, computers etc, by displaying the peak and non peak hours of their usage on library website or users can check it using their library mobile app

**Appliances management**

IoT may help libraries and their users in better management of available appliances thus saving the energy costs. Even though some of such things are in place in some libraries, but it may extend the control not only to library staff but also to users. Imagine, a user walking into library, using a cubicle or reading table using their IoT enabled mobile phones would be able to control the lighting, air conditioning, Wi-Fi etc. One another advancement is Pressure pad sensor consisting of a thin sheet sensor pad enabled with Wi-Fi technology is connected to processing unit which records and controls the systems and users activities.

**Some library and museum examples**

In November 2014, Orlando Public Library implemented Bluubeam technology to send location triggered information to patrons. Patrons using the library app will get alert about library offers and events. For example, if the user is searching for a cookbook, they also receive library's cuisine corner program having local chef demos.

Neue Galerie in New York and Boston Atheneuam worked with a technology company called Spotzer to provide enriched information about work of an art. Once a museum visitor downloads the app, it tracks the person movements to art and learns the person's preference and provides personalized experience as he/she moves to other art.

More than 30 libraries in USA have signed up Bluubeam technology for implementation. One library is using this technology to push alert of new movies released that day. Another library has advertised free computer workshops and book sales. Another technology company Capira has 100 library clients. Two of their libraries sends user reminder about overdue books and items available for pick up as soon as they enter the library**.**

**Future of IoT in libraries**

The future of IoT in libraries seems to be robust looking in to the developments in this sector. IoT once fully evolved, may bring in sea change in a way how libraries function and provide services to their patrons. It may turn library buildings in to smart buildings, wherein patron can interact with various things in the library and get virtually all kinds of information using devices having communication capabilities.

Over the years, apart from the possible areas of implementation mentioned above, IoT may enter deeper into various areas of libraries and may be able to give statistics on usage of library resources, map indicating areas of library most used, satisfaction level of users' experience and when students get frustrated with library resources and resort back to Google

Libraries need to take into consideration various issues before jumping into the bandwagon of IoT. First is privacy and security of patron's data as there is a possibility of sharing this data with third

parties, which may lead to hacking. Secondly, cost of investment in IoT technologies in terms of money, manpower and time. Thirdly, staff training and finally the most important thing is decline in the use of physical library21. Libraries by taking their patrons into confidence, inform them about privacy and security of data and providing the required training and infrastructure would be able to implement IoT to enrich their services and patron's library experiences.

**Conclusion:**

IOT has a great potential for libraries. If implemented in the desired lines, may bring in desired results and make value addition to library resources and services. It is still in evolving stage and it makes sense for librarians to learn about this new technology and wait until the technology is more widely accepted, adopted and available for better implementation in libraries. At the same time, it would be also interesting to learn from early adopters and devise better ways to maximize the benefit of IoT adoption in libraries. Libraries are prone for change and it has been witnessed over a period of history, hence IoT would be the next big thing after Internet, which is going to bring in plethora of changes to the library arena particularly the way library connects and communicates with its patrons

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