Prospective Areas of Implementing IoT Applications in Libraries

Arumugam. J
PSG College of Technology
Coimbatore - 641004
Tamil nadu, India

ABSTRACT: *Internet of Things (IoT) is a system of physical objects that can be discovered, monitored, controlled or interacted with by electronic devices which communicate over various networking interfaces, and eventually can be connected to the wider Internet. This has become possible owing to increasing availability of broadband Internet connection at a reduced cost, availability of more devices with Wi-Fi capabilities, technology affordability at lower cost and high penetration of smart phones. This paper aims to explain the possible areas to implement the IoT applications in libraries. It also implies the merits, demerits and limitations of IoT applications in the libraries.*

1. Introduction

Internet of things (IoT), known as the Internet of objects, refers to the networked interconnection of every object, which is composed of all kinds of information sensing devices, such as radio frequency identification (RFID) devices, infrared sensors, global positioning systems, laser scanners and various other devices. When embedded with chips and sensors, these objects can "think", "feel", and "talk" with each other. Together with the infrastructure of the Internet and mobile networks, these objects can communicate with humans, and enable us to monitor and control them anytime anywhere. The components which are used in this technology called as SMART THINGS as mentioned below.

• **Sensors** (temperature, light, motion, etc.),

• **Actuators** (displays, sound, motors, etc.),

• **Computation** (can run programs and logic),

• **Communication interfaces** (wired or wireless).

Internet of things" is based on network technology, in which RFID (Radio Frequency Identification) tag technology is the key Technology. RFID system generally consists of the following two components: electronic tags and readers. Electronic tags can be attached to objects to be identified while readers can read or read/write, which depends on the memory structure and technology. Main modules are integrated into a single chip, complete communication with readers.

2. Technology Behind IoT

The basic set of technologies associated to enable IoT to happen, include RFID (Radio Frequency Identification Device), wireless communication devices (such as Beacons), sensors, energy harvesting technologies, cloud computing and advanced Internet protocol (IPv6). RFID helps to identify and track the data of things, sensors collect and process data to detect the changes in the physical status of objects, energy harvesting technologies help in low energy consumption of associated technologies such as Bluetooth, the collected data is stored on the cloud for further processing and wireless communication enable connection and interaction between objects to take further course of action. These smart technologies helps in enhancing the power of network and enable smallest objects with a capacity to connect and interact. Smart phones would act as the main connecting link between objects and humans in interacting and conveying the messages.
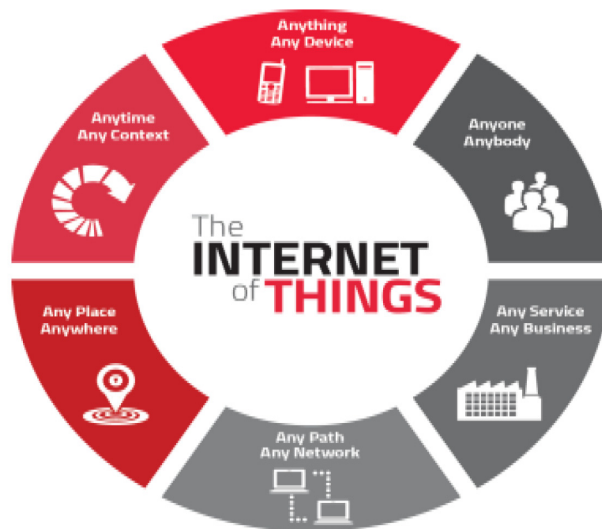
The basic working principle of RFID technology is not complicated. When the tag enters the magnetic field, it begins to accept the RF signal emitted from readers, and send out the product information stored in the chip by the energy obtained from induced current. Reader reads the information and decodes, then sent to the relevant central data processing information systems.

3. Potential Areas for Implementation IoT in Libraries

Access to library and its resources Libraries, using a mobile app, may provide a virtual library card to its members, which will enable members to gain access to library and use its resources. When a user accesses the library catalogue to locate the required resources, the library app stored on his or her mobile, will provide a map of the library guiding user to the location of resources. It can also provide additional information about a resource by connecting to a site so that user can get detailed information about a resource.

3.1 Collection Management

The library collection having RFID tags on each of the items enables their virtual representation, which can be identified using computers and RFID readers. Through integration of RFID tags in to member cards, circulation of items and fine collection can be streamlined. The IoT will be able to tell users about overdue books and how much fine they owe to the library, to enable them return the overdue books and pay the fine online without needing to stand in a queue in the library circulation desk.

Smart digital shelves may be able to promote the content based on patrons borrowing records and search history on the Internet. IoT will also help in better inventory management i.e. stock verification as it will be easy to locate misplaced books.

3.2 Information Literacy

Information literacy or orientation is offered to new patrons to educate them about a library, its resources and services. IoT may help libraries in providing self guided virtual tour of the library.

Libraries having setup wireless devices at various sections of the library, when users visit the particular section, their mobile phone will play a video or audio explaining more about that section and how one can get maximum benefit out of it. It may even able to provide enriched experience of special collections such as manuscripts by providing digital format of it on their mobile phones as physical access to such resources is restricted.

3.3 Patron-search Optimizing Service
IoT can use patron's data to suggest tailored recommendations, using real time data, based on the history of 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 the user. 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.

3.4 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 interested 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, 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.

3.5 Appliances Management
IoT may help libraries and their users in better management of available appliances to save energy and cost. IoT enabled mobile phones would be able to control the lighting, air conditioning, Wi-Fi etc.

4. Advantages of IoT Applications

• **Data:** The more the information, the easier it is to make the right decision.

• **Tracking:** The computers keep a track both on the quality and the viability of things .

• Time and Money

5. Disadvantages of IoT Applications

• **Compatibility:** As of now, there is no standard for tagging and monitoring with sensors. A uniform concept like the USB or Bluetooth is required which should not be that difficult to do.

• **Complexity:** There are several opportunities for failure with complex systems.

• **Privacy/Security:** Privacy is a big issue with IoT.

• **Safety:** There is a chance that the software can be hacked and your personal information misused.

6. Limitations of Implementing IoT in Libraries

Libraries need to take into consideration various issues before jumping into the bandwagon of IoT.

• Privacy and security of patron's data as there is a possibility of sharing this data with third parties, which may lead to hacking.

• Cost of investment in IoT technologies in terms of money, manpower and time.

• Staff training and finally the most important thing is decline in the use of physical library.

Libraries by taking their patrons into confidence, informing them about privacy and security of data and providing the requiredtraining and infrastructure would be able to implement IoT to enrich their services and patron's library experiences.

7. 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. The implementation strategy required the proper planning on technology and its basic requirements. It also requires the basic skill set on implementing the technologies for the purpose of advancement of the libraries.

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