

# Investigation and Implementation of Internet of Things (IoT) for Different Applications in Library Services

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## Abstract

*The purpose of this study is to explore the uses of the Internet of Things (IoT) and to identify the obstacles associated with deploying IoT in libraries. The most of the libraries are using limited IoT-based services. IoTs have enormous promise for libraries, since they may provide various services such as self-checkout and self-return, intelligent querying, smart inventory, and more. In this paper, we have examined the areas where IoT can be implemented in academic libraries also various expected difficulties during implementation of IoT in libraries. Further research is done on the various advantages of IoT for library administrations. This study explains the extent of IoTs applications and the challenges to adopt and implement IoTs in libraries. The research findings would be useful for library and administrators who are interested to implement IoTs applications in their libraries for the satisfaction of all concerned stakeholders.*

**Keywords:** Internet of Things, Applications of IoT, Library Services, Smart Libraries, return.

## INTRODUCTION

The Internet is essential to working in today's environment. Information technology involves in all fields of the world. Application of Information Technology has a great impact on all aspects of people's social life. Library is also one of them. Libraries are facing many challenges in maintaining a continuous flow of information in real time system. We know the importance of information in today's world and libraries are the repositories of information. The reading selection in libraries nowadays is gradually shifting from traditional to ultramodern formats. A step toward smart systems in every industry is the growth of networks, the internet, and the Internet of Things. We can transform our library into a smart library by implementing IoT. ry. IoT improves the libraries functioning, service & security. Internet of Things (IoT) is a new revolution of the internet that is rapidly gathering momentum driven by the advancement in sensor networks, mobile devices, wireless communications, networking and cloud technologies IoT is defined as "a dynamic global networks infrastructure with self configuring capabilities based on standard and interoperable communication protocols where

physical and virtual things have identities, physical attributes and virtual personalities and use intelligent interfaces and are seamlessly integrated into the information network [1–8]. This paper reviews the available literature on this topic related to libraries to investigate different applications of IoT in academic libraries and library services.

## SIGNIFICANCE OF THE STUDY

The main objective of the study is to ascertain the present condition of IoT implementation in libraries and investigate diverse aspects of IoT in library services to aid academic libraries in augmenting students' involvement in information retrieval. The application of the Internet of Things

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in libraries is a useful subject for academics, particularly those working in the fields of information science and libraries.

### OBJECTIVES OF THE STUDY

- To comprehend the fundamentals of the Internet of Things (IoT) and how it operates.
- To investigate the different areas of IoT implementation in Libraries.

### INTERNET OF THINGS (IOT): DEFINITION

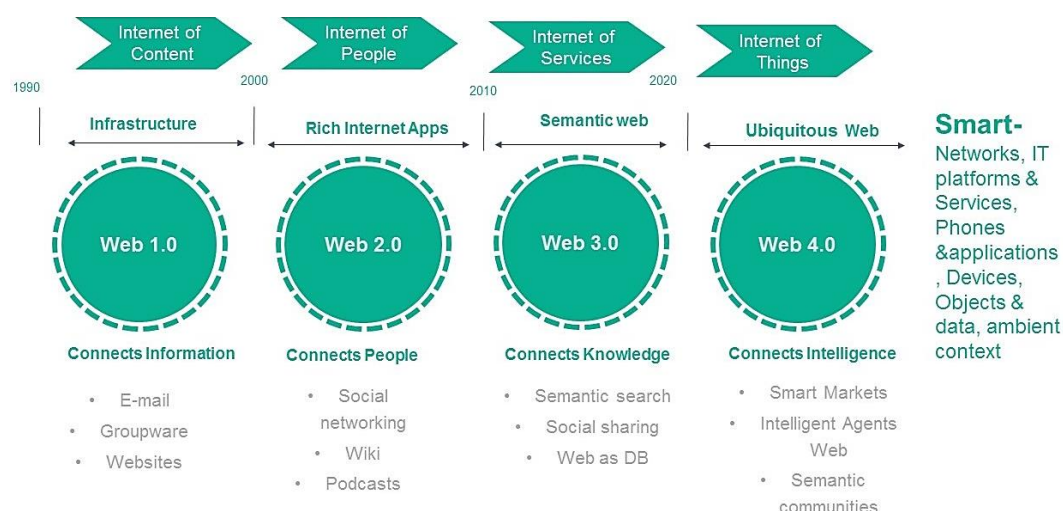
The phrase "Internet of things" and its concept originated with a lecture given by Peter T. Lewis in September 1985 at the Congressional Black Caucus Foundation's 15th Annual Legislative Weekend in Washington, D.C. Lewis states that the Internet of Things, or IoT, is the fusion of technology, people, and processes with connected devices and sensors to allow remote status, control, trend analysis, and observation of these devices [9].

"Devices with sensors, processing power, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks" are referred to as "Internet of things" (IoT) according to Wikipedia. Electronics, communication, and computer science and engineering are all included in the Internet of things. The term "internet of things" has been deemed misleading since gadgets merely need to be individually addressable and connected to a network, not the whole internet.

An ecosystem known as the Internet of Things (IoT) is one in which things, including humans and animals, are given unique identifiers and the capacity to transmit data across a network without the need for human-to-human or human-to-computer interaction. Micro electro mechanical systems (MEMS), the Internet, and wireless technologies have come together to form the Internet of Things [10].

### HISTORY OF INTERNET OF THINGS (IOT):

Since its inception, the Internet of Things has grown quickly, revolutionizing entire industries in addition to connecting individual products to the internet. When we connected commonplace items to the internet, such thermostats and refrigerators, the Internet of Things was born. The Toaster, created in 1990 by John Romkey, was the first Internet of Things device. An illustration of the "Evolution of Internet of Things" is provided below in Figure 1



**Figure 1.** Evolution of Internet of Things.

Diagram Source: [https://www.google.com/search?sca\\_esv=568085247&q=evolution+of+IOT+from+the+internet&tbm=isch&source=lnms&sa=X&ved=2ahUKEwjmsyq8sSBAXX2ZfUHHcCBBzEQ0pQJegQIDBAB&biw=1366&bih=657&dpr=1#imgrc=aJER8WBkzIrUjM](https://www.google.com/search?sca_esv=568085247&q=evolution+of+IOT+from+the+internet&tbm=isch&source=lnms&sa=X&ved=2ahUKEwjmsyq8sSBAXX2ZfUHHcCBBzEQ0pQJegQIDBAB&biw=1366&bih=657&dpr=1#imgrc=aJER8WBkzIrUjM)

### **NEED OF INTERNET OF THINGS (IOT)**

IoT connects all objects to internet, makes us connected together. IoT tries to establish advance connectivity with all areas in the world. Internet of Things can be used for environmental monitoring, for example tsunami warning system can be prevent less damage. Internet of Things is also helpful for infrastructure management by tracking infrastructure in urban and rural areas such as bridge, railway tracks and can reduce risk of danger situations ahead. IoT is useful for industrial applications as well. It is also helpful for energy management. IoT reduces human effort for many activities and provides huge amount of information. IoT gives humans a better quality life. If smart device will remind you of your appointments, that means you can dedicate your time to rest of other important work and become more productive.

We can save our time by using IoT, our mind releases from unnecessary workloads and we can focus on some other important tasks. Some day to day activities can also be automated using IoT like turning on the lights, ordering medicines, open the garage door from the car when you are arriving home and so on. In summary, the internet of things aims to link all possible items so they can communicate with one another online and lead safe, comfortable lives for people [11–15].

### **FEATURES OF THE INTERNET OF THINGS (IOT):**

The phrase "Internet of Things" refers to a network of real-world items, such as vehicles, appliances, and home appliances, that are integrated with electronics, software, sensors, and network connectivity to facilitate data exchange and gathering. These devices can interact with one another, the environment, and other devices to create intelligent systems and services thanks to the Internet of Things (IoT).

IoT has the following characteristics:

- (a) *Connectivity*: The most important aspect of the IoT infrastructure is connectivity. IoT devices need to be linked to the IoT network. It should always be guaranteed that anyone can connect, anywhere, at any time. For instance, a connection between people and other Internet-connected devices, such as smart phones and other gadgets, as well as a connection between routers, gateways, sensors, and other Internet-connected devices.
- (b) *Intelligence & Identity*: It is important to extract knowledge from the generated data. A sensor, for instance, produces data, but that data is only valuable if it is correctly interpreted. Every IoT gadget has a distinct identity. This identification helps with equipment tracking and occasionally allows for status inquiries.
- (c) *Scalability*: The number of items being linked to the Internet of Things is increasing daily. Therefore, an IoT system ought to be able to handle the significant growth. As a result, enormous amounts of data are generated, which must be managed carefully.
- (d) *Architecture*: It is not possible for the IoT architecture to be uniform. It ought to be hybrid, enabling products from various manufacturers to work with the Internet of Things. The Internet of Things is owned by no engineering division. When several domains come together, IoT becomes a reality.

*Autonomous Operations*: The ability of Internet of Things (IoT) systems and devices to function autonomously and make decisions without human input is known as autonomous operation. This is an essential feature of the Internet of Things (IoT) that opens up a plethora of new services and applications.

### **USES OF IOT IN THE LIBRARY**

IoT platform is used to gather the information which is the main role of library. Thus, it is possible to argue that libraries and IoT are intimately related. IoT can provide the global connectivity to all libraries and its users too. So by applying IoT in libraries, librarians can work more efficiently and smart way. It holds great potential for libraries.

Pujar and Satyanarayana (2015) have pointed out the various applications of IoT in libraries which includes energy management, improved access to the library and its resources, virtual library card, location based services and so on. IoT can help the better management of library services.

Bansal, Arora & Suri (2018) discussed the areas in the library where IoT can be applied such as inventory control, theft management, circulation desk, virtual library and book reservation.

There are various types of resources available in each library and by applying IoT librarians can overcome some of the problems like loss of books. Application of IoT in library can act as a value addition to library services.

### **IMPLICATIONS OF IOT IN DIFFERENT AREAS OF LIBRARY**

IoT integration could enhance library services like self-check-in and check-out, stock verification, activity tracking, access control, theft prevention, and information management and analysis. Numerous cutting-edge solutions that boost library services and increase operational effectiveness are made possible by IoT. To safeguard sensitive information belonging to library patrons, IoT integration must also prioritize data privacy.

#### **Smart Library Management**

IoT can be used for creating and managing smart library. Internet of Things is a system for collecting data gathered by interconnected devices, frameworks, sensors and other monitoring devices. We can use Internet of Things to resolve issues such as disturbed shelving, thefts in library etc. The students can easily search for books by using their smart phones. They can use library computers for searching other library resources available in libraries by using OPAC. Using IoT or Smart Library Management System library users can be guided to the shelves directly. An internet of things (IoT) is a system for collecting data gathered by interconnected devices and frameworks sensors and other monitoring devices.

#### **Space Utilization and Resource Allocation**

By offering insights into library space utilization, IoT-based occupancy tracking systems assist libraries in making the most of seating arrangements, resource allocation, and facility management. By anonymizing occupancy data and getting user agreement before collecting personal data, privacy issues are addressed.

#### **Security & Surveillance**

IoT-based security devices keep an eye on restricted areas, entrances, and exits to improve library security. Unauthorized access is detected by surveillance cameras and sensors, guaranteeing the security of library materials and users. Encrypting data transfer, limiting access to surveillance footage, and adhering to legal requirements are all factors that affect data privacy.

#### **Environmental Monitoring**

IoT sensors screen natural circumstances in libraries, like temperature, dampness, and air quality. This information assists libraries with keeping up with ideal circumstances for saving fragile materials and safeguarding against harm. Protection shields guarantee that the sensors don't coincidentally gather individual data and that information is anonymised and put away safely.

#### **Personalized Services**

IoT uses user data to create customized library experiences. Personalized recommendations, alerts, and help are provided by beacons and location-based services according to the location and preferences of library users. In order to ensure privacy, data collecting must have consent, stringent data access rules must be put in place, and openness regarding data handling procedures must be maintained.

### Enhanced Accessibility

Users of libraries can benefit from increased accessibility thanks to the Internet of Things. Location based services can be provided by smart devices and beacons, for example, providing assistance to patrons with disabilities, guiding them to accessible locations.

While IoT offers various benefits in libraries, it is pivotal to carry out powerful information protection measures. Libraries should focus on the assurance of supporter data, get assent for information assortment and utilization, and lay out secure information stockpiling and transmission conventions. By coordinating IoT advancements with solid information protection rehearses, libraries can saddle the advantages of IoT while defending supporter security.

### CONCLUSION

The current demand is for libraries to use IoT and other technologies. Use of technology in the library can save the time, money, energy and makes it possible to maximize the use of library resources. IoT could offer value to the library's materials and services if it can be deployed there. Many of the libraries in the country are now working to make their content fully digital. By using technology in the library, one can preserve the rare collection of library. IoT may be the next big thing for the library. IoT will definitely help the libraries and their clients amazingly.

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