

Internet of Things: The beginning of the new era of Libraries

Abstract:

The main goal of IoT is to create a seamless and efficient system where devices can communicate and collaborate to automate tasks and provide valuable insights. In this context, this paper highlights the general applications of IoT. Further, the papers also discuss the applications of the Internet of Things (IoT) in libraries to enhance efficiency, improve services, and provide a better experience for both librarians and users. By incorporating IoT technologies, libraries can modernize their operations, improve resource management, and enhance the overall experience for users, contributing to the evolving landscape of smart and connected libraries.

Keywords: Internet of Things, Smart libraries, Smart home, Smart cities.

1. Introduction

With the advancement of ICT, the Internet has become an important tool for exchanging information and other resources. It provides online access to anything from anywhere (Kumar, 2023). The Internet itself is a global computer network that offers various communication and information services, such as e-mail, chatting, video conferencing, and social networking sites (Yusuf et al., 2019). The Internet is considered a remarkable technological achievement, often referred to as the “8th wonder of the earth”, as it has transformed the world into a global village by connecting people across the globe.

The term “Internet of Things” was first introduced by Kevin Ashton, MIT’s executive Director of Audio-ID labs in 1999 (Ashton, 2009). The Concept of IoT gained significant attention and popularity around 2010. The Internet of Things is not one thing, but it is a collection of technologies that have enabled things to be smart and communicate with one another. The network of physical objects, devices, vehicles, buildings, and other items embedded with sensors,

software, and connectivity, enabling them to collect and exchange data over the Internet is referred to as IoT.

In this context, this paper discusses the applications of the Internet of Things (IoT) in libraries to enhance efficiency, improve services, and provide a better experience for both librarians and users.

2. Literature review

Many researchers have explored the applications of IoT in libraries during the last couple of years. Some of the studies carried out by the earlier researchers are discussed in this section.

Pujar (2015) has explained the concept of IoT and how the technology has changed from the Internet of Communication to the Internet of Things and also projected the core areas of libraries such as collection management, access to libraries, location-based services, and information literacy where IoT would be implemented. The applications of IoT would be used in theft management, inventory control, and user identification (Bansal et al., 2018). Mondal (2021) provided comprehensive information about IoT and also suggested some of the core areas of IoT such as QR codes and RFID tags.

Li (2014) highlighted the applications of IoT in self-borrowing, self-returning, and a combination of information systems and books. Yusuf et al., (2019) studied the awareness of IoT applications in libraries among Librarians in Nigeria and they found that to deliver effective library services, Nigerian Librarians need to take conscious steps to understand the concept of the application of IoT.

In the year 2020, Liang & Chen (2020) study reviewed existing literature on IoT and its application in libraries. The study found that the IoT has the potential to improve library services. Sinha et al., (2022) studied the perception and awareness of Ph.D. students towards the execution of IoT in Library

services. The study found that students were aware of the applications of IoT in various areas of Library services such as user authentication and access control, remote monitoring of library resources, and self-issue/return books theft control management. Kumar (2023) investigated the perception of students from Kurukshetra University regarding the implementation of IoT in Libraries. It is evident from the study that 92.4% of the students agreed that IoT could help to manage energy and water consumption, and also they believe that time is reduced while issuing and returning the books.

3. Application of IoT

The various applications of IoT are discussed in this section.

3.1. Smart home

Smart home technology refers to the integration of devices and systems within a home that can be remotely controlled and automated. This technology allows homeowners to control various devices in their home, such as doors, lighting, fans, water management, and security management using the centralized system or mobile devices. It offers convenience energy efficiency and enhanced security by enabling remote access and automation of home functions to make life easier.

3.2. Smart cities

In the case of the smart city, the connectedness extends beyond a single home. IoT sensors can be installed on traffic lights, roadways, and vehicles to collect data on traffic patterns, congestion, and accidents. This data can be used to optimize traffic flow, reduce congestion, and improve road safety. These solutions utilize sensors and GPS data from the rider's smartphone to report the location and speed of a vehicle.

3.3. Health monitoring

Health monitoring refers to the process of tracking and monitoring vital signs and health parameters such as temperature, blood pressure, heart rate, and breathing. If there are sudden changes in these parameters, the system sends notifications to mobile devices, allowing one to take timely actions or seek appropriate medical attention.

3.4. Agriculture

IoT plays a vital role in the agriculture field for soil and crop monitoring. Smart farming helps farmers to reduce waste generation and increase productivity. Helps in Drones for field monitoring, Sensor for soil monitoring, Water pumps for water supply, Machines for routine operation, livestock tracking,

3.5. Application of IoT in Libraries

Today, libraries rely more on ICT to meet the needs of the users and to meet the challenges associated with these changes (Makwana, 2021). The applications of IoT are not new to Libraries, because libraries are already using RFID which helps to identify and track the data with wireless networks (Li, 2014).

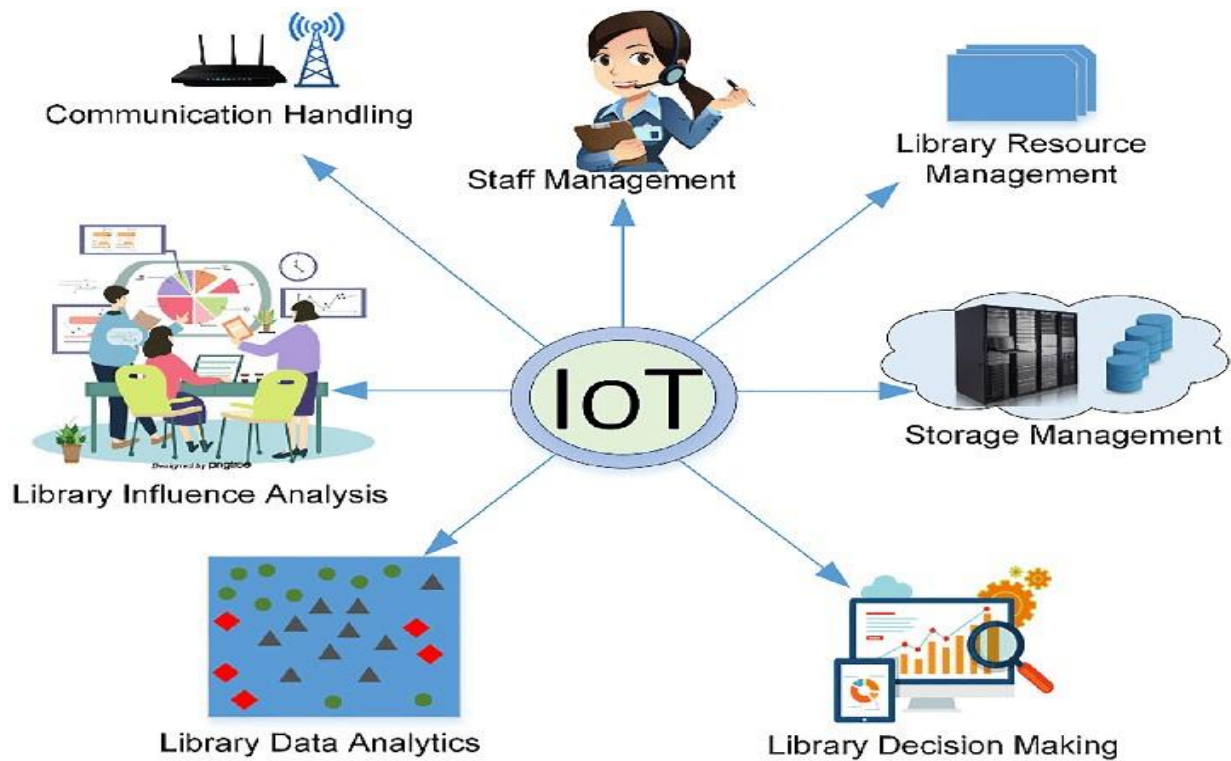


Figure 3: Application areas of IoT in libraries

a) Misplacement of books

Misplacement of books refers to the problem of books being misplaced or not returned to their designated locations. By utilizing IoT technology, sensors can be installed on all books, enabling students to easily locate them. Additionally, a special smartphone app can guide students to the correct location of the book they are searching for, enhancing efficiency and reducing the time spent searching for misplaced books (Pujar, 2015)

b) Theft detection system and Unauthorized students' identification.

Theft management refers to a system or process implemented to prevent and address theft incidents. In this specific context, the use of tags on each book item enables the system to notify the librarian if a theft occurs. This helps in monitoring and maintaining the security of the library collection (Bansal et al., 2018).

Unauthorized student identification refers to the process of using sensors at the gate to perform face recognition on all students and compare their faces with the available databases. This enables the gate to only allow entry to authorized guests, denying access to those who are not authorized.

c) Tracking the movement of resources

Tracking movements of resources refers to the tracking of resources, especially books, using mobile devices. The library items are often sent outside the library for repair or binding, and with the use of IoT, it becomes possible to track the location of these items even when they are outside the library premises (Mondal, 2021).

d) Virtual tour and searching for books

A virtual tour is a digital experience that allows users to explore a location, in the library, remotely. With the help of IoT technology, libraries can provide self-guided virtual tours where users can access videos or audio on their smartphones to learn more about the different sections of the library. Also, they can search the books on the respective shelves or check the resource availability despite the placement wherever they are (Mondal, 2021).

f) QR code

A QR code is a type of barcode that can be scanned using a smartphone's camera. The QR code provides a convenient way for users to access a brief introduction or information about the book they are interested in. By scanning the QR code with their smartphone and using internet connectivity, users can quickly retrieve relevant details about the book before making a borrowing decision.

g) Smart circulation section

The smart circulation section refers to a system that utilizes the IoT to enhance the borrowing process in a library. With this system, users no longer have to wait in line as they can access information such as the number of books they have borrowed, any fines or reminders they may have, and the number of books they have reserved. This technology streamlines the circulation process and provides users with convenient access to their library account details (Susan Mathew, 2019).

h) Notification about new arrivals

A notification service refers to a system that sends alerts or messages to users. With the help of IoT, notifications will be sent to library users about new books who are searching for similar books. This allows users to stay updated and informed about the availability of relevant books while they are actively looking for them (Mondal, 2021)

i) Smart doors and smart lock

A smart door lock is a technology-advanced lock system that provides real-time updates on the status of the door, indicating whether it is properly closed or not. Additionally, it can send notifications if an unauthorized user attempts to enter the library enhancing security measures. Smart locks can be opened using a passcode instead of a physical key, eliminating concerns about losing keys or theft (Gupta et al., 2022)

j) Maintenance of Infrastructure

It refers to the activities involved in ensuring the proper functioning and upkeep of various components within a system. Here sensors play a role in controlling the usage of lights, fans, and air conditioners based on their usage, which can help optimize energy consumption and enhance the efficiency of the infrastructure (Pujar, 2015; Mondal, 2021).

k) Fire detection and safety

It refers to measures taken to prevent the risks associated with fires. By installing fire sensors connected to the Internet, the sensors can send signals to a smartphone during emergencies. The IoT enables automatic response at an early stage, helping to prevent further damage (Bansal et al., 2018).

l) Protecting special and rare collections

Protecting special and rare collections in libraries refers to safeguarding valuable and unique such as rare books, manuscripts, papers, and clothing that hold significant historical, cultural, and academic importance. IoT can be utilized to enhance the protection of these collections by monitoring and controlling the environmental conditions in which they are stored, ensuring optimal preservation and preventing damage (Mondal, 2021).

4. Advantages of the Internet of Things

Some of the advantages of the Internet of Things are discussed here

- It saves a lot of time and minimizes human efforts.
- IoT helps to save more money by reducing manual tasks and time.
- Automating daily life tasks makes good monitoring of devices.
- Increased efficiency and time-saving.
- With good features IoT makes a better quality of life.
- It can assist in the smarter control of libraries via smartphones.
- It enhances security and offers personal protection.
- Information is easily accessible, even if we are far away from our actual location, and it is updated frequently in real-time.
- IoT devices connect and communicate with one another and perform a variety of tasks without the need for human intervention

5. Disadvantages

The IoT has also some disadvantages. They are:

- Hackers may gain access to the system and steal personal information.
- The people rely heavily on the Internet and are unable to function effectively without it.
- Overuse of the Internet and technology makes people unintelligent because they rely on smart devices instead of doing physical work, causing them to become lazy.

6. Conclusion

The management of collections, maintenance of library space, furnishings, and appliances, user education, and access to resources and services are all positively and successfully impacted by the use of IoT in libraries. It helps librarians make wise decisions, improve staff efficiency and effectiveness, productively interact with users, and enhance user pleasure (Kaba et al., 2019). By resolving current issues with technology, the industry will release more of these IoT devices, enabling all libraries to utilize them to provide their patrons with greater services.

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