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Use of Internet of Things (IoT) Applications in Modern Library Activities and Services

By

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Use of Internet of Things (IoT) Applications in Modern Library Activities and Services

Abstract:

Change is the law of the world and it can take a step towards development, be it in person, institution, or in thing. If the library is known as an institution that serves the community i.e. the university of the people then the library also needs to change over time. The most important inventions of the present time are computers and computer technology, if we talk about this technology in the context of libraries, a new age of computing technology that many people refer to as the Internet of Things (IoT). The present study was conducted with the main objectives of finding out how and how much the Internet of Things (IoT) is used in library functions, and how it helps in providing various library services to the user. What are current IoT applications and IoT examples? What is its future? In view of this, how it can be effective in the activity of the library, as well as how the five laws of Dr. Ranganathan can be fruitful in the present time is considered here. In short, this study provides the first overview of IoT and trends of computer technology as well as the modern library structure.

Keywords:

Library, Information User, Library Activities, Library Services, Information Technology, IoT applications

Introduction:

The library profession is at the forefront of various professions because the word 'service' is attached to this profession. It provides a neutral and balanced reading diet to the individual of the society. Today we know how important information is. Information is as important today as the importance of agriculture in the early days, the importance of industries in later times, and the information society that exists today. In our society, there are many professionals like doctors, lawyers, teachers, etc. who have become 'Kubera' just by circulating information. Libraries are the repository of information and these libraries are evolving more and more from generation to generation. If

we talk about the generation of libraries, then the time of Library 1.0, Library 2.0, Library 3.0, and today Library 4.0 is running. In this generation of libraries, the reading material is slowly changing from the traditional form to the ultra-modern form. With the help of this ultra-modern form, the library is today considered as an information center, information analysis center, documentation center, Referral center. Due to the radical change in the nature of the library, it has become known as a modern library, such as a digital library, virtual library, paperless library, library without a wall. What is meant here is that modern forms of information technology have been used in the collection and dissemination of information so that the user and the library staff get maximum satisfaction while saving time, energy, and money. The development of networks and the internet in the field of computer technology and also IoT i.e. Internet of Things which is a step towards smart systems in every field. The library is also not immune to the effects of the term IoT because it improves the library's functioning, service, and security. Things to consider here such as, Is the use of modern forms of information technology in the collection and dissemination of information really useful and necessary for the user and the library staff? Does it save time, energy, and money? Is it the demand of the time to come? This article tries to answer many such questions.

Review of Related literatures:

(Qin, 2018) seeks to show the potential scope and use of forms of Internet of Things technology in library services, clarifying the main purpose of the article. This research also suggests that Internet of Things technology may be used in library services and other activities in the same way that it is used in the commercial sector. He further said that Internet of Things technology can be useful in a variety of library activities.

(Bansal, Arora, and Suri, 2018) mentioned that libraries are always at the forefront when it comes to adopting and using new technology. This paper also helps in exploring the meaning and definition of the Internet of Things, its chronological background, its potential applications in libraries, and some of the challenges faced by the library professional while implementing it. It

clearly states that the Internet of Things technology can be used in a variety of ways in a library. Such as digitization technology, library management tools, library automation software, search and access tools, preservation tools, social media, internet, mobile application, SMS, e-mail, etc.

(Mondal, 2021) discussed in his article, that the libraries are changing and he talked about distinctive angles of IoT in the library. It was also discussed that libraries have to plan to keep pace with the flow of time in our society and adopt various technological innovations. One of the biggest changes in innovation is the move from the Internet of communication to the Internet of Things.

(Nag and Nikam, 2016) discussed the possible usage of the IoT in his paper. The Internet of Things is a new evolving technology as well as an ideal emerging technology to impress supporters by providing fast and convenient efficient services. The present study provides the concept of Internet of Things technology with a view to enhancing services in libraries. Using cloud computing, magic mirrors, and wireless sensor networks to take a step towards a smart library. Thus an approach has been proposed to improve the library facilities and provide a patron-friendly system. The proposed system is expected to enhance user convenience and will be used effectively in the near future.

(Abo-Seada, 2019) covers IoT and its applications in libraries by his article. He says libraries have been influenced by all the developments in IT and have benefited from IT tools. In recent years, new IT concepts have emerged, including digital transformation, cloud computing, and the Internet of Things (IoT). Libraries have to adopt new approaches to save a large portion of their IT budget. IT is useful not only for rationalizing costs but also for achieving efficiency.

Furthermore, while the libraries must take care of the user community, they must apply the concepts of the Internet of Things, digital transformation, and cloud computing to provide the best modern services. The goal can only be

achieved if all the libraries and library associations here make the best efforts to work together.

(Pujar and Satyanarayana, 2015) states that, the Internet has taken a huge leap in the concept of technology so we must know that what is the Internet of Things? This article covers its definition and various issues, such as technology and its growth, examples of service industries, and its potential impact on libraries. It further explains that IoT can turn library buildings into smart buildings, allowing patrons to interact with a variety of library objects and access virtually all types of information using devices with communication capabilities. It is also stated here that this stage of development is going on and it means that the library professionals should wait to know about this new technology as well as to make the technology widely accepted, adopted, and made available for systematic implementation because IoT will be the next big thing after the Internet. It will bring more and more changes in the field of libraries, especially the way the library connects and communicates with its patrons.

(Wojcik, 2016) mentions that the use of the Internet of Things in libraries is a new issue that has not been further studied. The potential use of this technology for the needs of libraries has been raised at international conferences in recent years, which has become a topic of interest for library organizations. Research shows that IoT technology may have the potential to be used for library services and other activities. The use of new technologies in libraries can help improve the image of these organizations in the eyes of users, especially the younger generation. The article here also explores the potential scope of Internet of Things technology for libraries and the forms of its use in its services.

(Vandana, Bhattacharjee, and Gupta, 2017) explained that the Internet of Things is an emerging technology where maximum efficiency can be achieved with minimal effort. All library devices can be managed from one place by implementing the Internet of Things. Further, it can be said that you are allowed to tap into high-tech functionality and luxury and that was not

possible in RFID in the past. In short, a better and more efficient library system can be developed with the help of existing technology, however, keep in mind that it should be achieved without harming humans and the environment. Such state-of-the-art technology leads to a library system that is not only user-friendly but also staff-friendly.

Statement of the Problem:

The topic of a current research article is given below

Use of Internet of Things (IoT) applications in modern library activities and services

Objectives of the Study:

1. To identify the basics of the Internet of Things (IoT) and its structure.
2. To identify the different names and enablers of the IoT.
3. To identify the various possibilities of IoT applications in the library.
4. To identify other potential areas of IoT implementation for libraries, and their risks.
5. To identify the future applications of IoT which is useful in the field of the library.

Scope and Limitation of the Study:

There are many types of the library such as public libraries, academic libraries, special libraries, and other types of libraries. There are also sub-types of these major libraries. Depending on the types of libraries it has also many users. In a nutshell, every person in society is a library user, whose main objective is to get information tailored to his scope with precision, speed, and low cost. It is no exaggeration to say that this task is very difficult or almost impossible for a traditional library, whereas a modern library that uses a computer, network, and internet technology can do this task very easily. That is why in the present article the activity and service of the modern library are mentioned as a scope.

The limitation of the present article is that only the use of Internet of Things (IoT) applications in the library has been taken into consideration.

Signification of the Study:

In the present times, everyone can agree with this specific statement that 'information is a commodity that can be sold. It can also be said that in a farming-based society farming was a means of livelihood. The industry was the means of livelihood in an industry-based society, whereas today it is an information-based society in which information is the only means of livelihood. Many professionals like doctors, lawyers, teachers, engineers, etc. can work satisfactorily in their profession only through information. Since information is very important in today's world, every user of society should have uninterrupted, up-to-date, and accurate information on its subject. For that, the library is the only option that is a unique organization for the collection and dissemination of information. These libraries have taken on the ultra-modern form of information center today. Knowing what modern technology tools are used in this library is an essential task as it is constantly working on the creation, collection, dissemination, and retrieval of information. The significance of the study thus presented is clear.

Internet of Things (IoT) and Library:

1. Primary Information:

IoT is the 'Internet of Things' for which everyone has something to say today. If we try to say in very simple words then it is a vast network of connected objects, capturing data about how to use it and the environment around it. In addition, the IoT platform is used to gather information, to find patterns.

From the above matter, it is clear that IoT and libraries are directly related to each other and if we do not take the above matter in brief, there are many other special uses of IoT in today's modern libraries. What is the requirement of IoT in libraries? It can be said that in a real sense IoT can provide global connectivity to a large number of libraries and thus enable IoT libraries to fulfill their role in a more efficient and smart way. For that, we should keep the following points in mind.

- Data of social media which is used in libraries.

- Various E-platforms like e-resources subscriptions, purchase of e-books are used by the users.
- Laptops, tablets, smartphones, scanners, printers, etc. devices used by the users of the libraries.
- Gates of various sections of the libraries can be enabled with high-end sensors and are providers of IoT.
- IoT is used for online connectivity to the circulation module of the library.
- Catalogues and OPACs are the potential IoTs for the libraries.
- Prevention devices, Fire detection are also potential IoTs of the libraries.
- Mobile apps and mobile referencing are also based on IoT.
- Tracking the movement of resources and inventory in Libraries.
- Assistive technologies used in libraries.
- Modern forms of libraries like virtual and digital libraries are based on IoT.

2. Meaning:

The most common and comprehensive meaning of the Internet of Things (IoT) can be given in this way that the Internet of Things enables an object to collect and transfer data over a network without human intervention using the Internet, sensors, and RFID.

3. Definition:

The Internet of things (IoT) describes physical objects (or groups of such objects) that are embedded with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks.

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals, or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

4. Different names of IoT and IoT enablers :

We all know that the Internet of Things is a full form of IoT but most of us don't know the various names of the Internet of things. It is known by various names depending on its characteristics. These various names are introduced here as follows.

- Internet of Things (also known as IoT and it is the common name)
- Internet of Everything (Internet for Devices)
- Smarter Planet
- Machine to Machine (M2M communication)
- The Industrial Internet
- Industry 4.0 (Internet for Non-Human)
- The Fog
- Trillion Sensors (also known as Tsensors)

Many of the above words can be explained in a simple sentence in such a way that platforms of IoT are used to gather the pinpointed information and detect patterns It helps in asset utilization, reducing cost, and productivity.

5. Characteristic of IoT:

Internet of things (IoT) is a wonderful invention of the modern age that has entered human life and created accuracy, speed, and consistency in every task beyond the reach of human resources. Which is possible to understand from its characteristics and it is as follows.

- Energy
- Intelligence
- Communication
- Integration
- Interoperability
- Standards

6. History:

The term Internet of Things is 16 years old. But the actual idea of connected devices had been around longer, at least since the 70s. Back then, the idea was often called "embedded internet" or "pervasive computing". But the actual

term “Internet of Things” was coined by Kevin Ashton in 1999 during his work at Procter & Gamble.

Kevin Ashton (one of the founders of the original Auto-ID Center) first coined the phrase IoT while working for Procter and Gamble to improve supply chain management. He linked Radiofrequency identification (RFID) as a prerequisite to connecting to the Internet. He found if all the objects and people in daily life were equipped with identifiers, then computers could easily manage and inventory them and apart from using RFID, barcodes, QR codes and digital watermarking can also be used for tagging the machines. In 2000, LG announce its first Internet-connected Refrigerator. In November 2005, International Telecommunications Union (ITU) published its report on IoT and concludes it can create a plethora of innovative applications and services. It will serve to enhance the quality of life and reduce inequalities and also will provide new revenue opportunities. The telecommunication industry will get an opportunity to capitalize on mobile and wireless communications to explore new frontiers. Fig 1 shows how the IoT evolved from the internet. Starting from the hands of scientists, engineers, and or technical persons, it passed from various phases and is moving towards IoT.

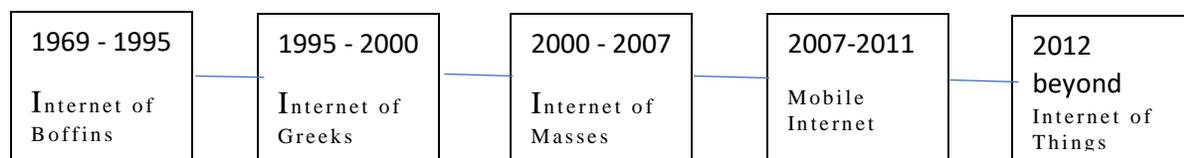


Figure 1. Evolution of Internet of Things from internet.

If we talk in terms of libraries then we can say that libraries are changing today - this is an accepted fact. Today's libraries don't look like old libraries at all but today's libraries seem increasingly like a community hub as well as full of activity, innovation, and technology. In the current context of the library, it can be said that they have taken a positive approach in adopting new technologies to meet the needs of the users and to meet the challenges associated with these changes. Computers, networks, the internet,

telecommunication equipment, RFID, -resources such as e-book, e-journal are becoming commonplace in libraries today. Nowadays the need for library cooperation, resource sharing, library consortia is increasing and libraries are accepting this opportunity properly and easily.

Have we ever imagined in the past that we would be able to trade with the world at our fingertips? Trying to understand in the context of a library, does it mean that we can sit in a small building or office and collect or disseminate information from all over the world? But nowadays this is possible and this matter is nothing short of magic. That is to say, the current form of information technology has made this a reality. Instead of keeping a record of how many users are coming to the library nowadays, it is being considered how much of the library's resources are being used as this work is being done very accurately with time, energy, and money savings.

7. Need of IoT:

Traveling in bullock carts in earlier times and air travel in present times. Education through school in the past and online education in the present. Information through the traditional libraries in earlier times and information through e-resource in present times. The above examples have taken the world far (the world in my hands). The need for information technology is evident from this, IoT is an advanced form of information technology. That is to say, the exchange of information by human beings has never stopped and will never stop. Thus the need for information technology is indispensable to facilitate the direction of progress. IoT is a modern form of information technology and its requirements can be presented here as follows.

- Data deluge
- Miniaturization of devices
- Autonomic management
- IPv6 as an integration layer
- widely adopted in the commercial sector
- Spread across a wide range including agriculture, industry, homes, cities, environment, health, energy systems, retail, logistics

- It achieves a sustainable environment
- It is using AI and machine learning to add intelligence to devices.

If we talk about the library field and profession then IoT can provide a global linking of a huge number of these kinds of institutions in real-time. In this way, IoT enables libraries to fulfill their role in a more efficient and smarter manner.

8. Uses of IoT in various areas of the library:

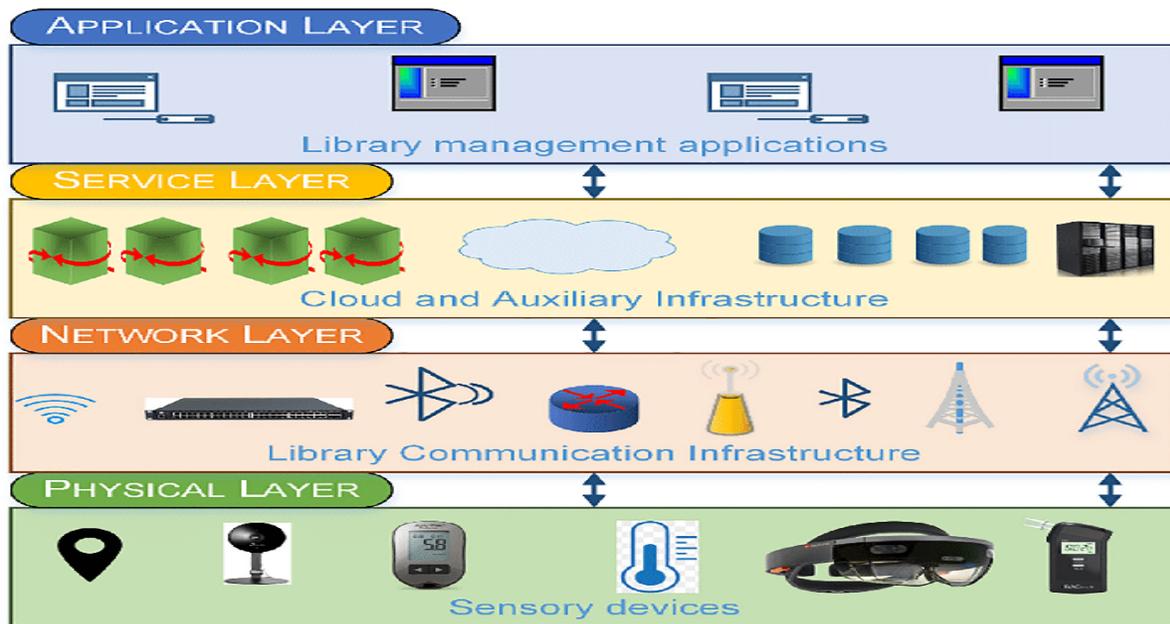
The work that is done in the libraries is mainly technical works. In other words, it is called housekeeping functions of the library i.e. all the work that is done before the book reaches the library and reaches the hands of the reader is included here. Thus, it is easy to say that book rental, inventory, tagging, and access control are all part of an intelligent library management system. which we can understand with the help of the below image.



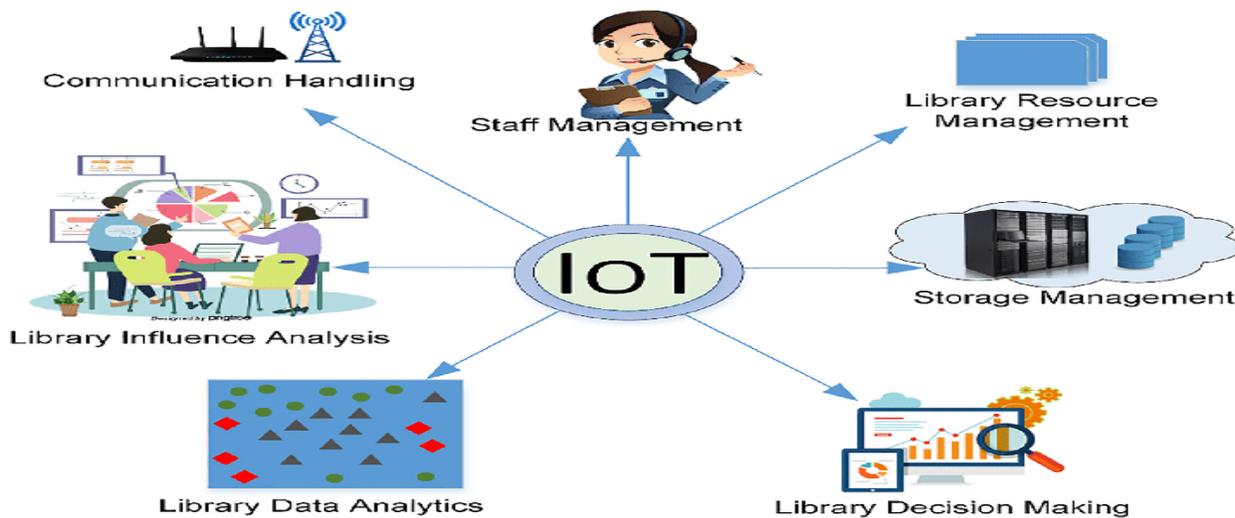
(Source: <https://princh.com/iot-technologies-in-libraries/#.YZsfedDMLIU>)

9. Infrastructure of IoT based library:

Libraries are already incorporating IoT technology in their sections such as Smart building technology, RFID, Library classes, People counters, etc. Below are two figures that provide information on the use of IoT in the library. In other words, we can say that layered architecture for IoT implementation in libraries and application areas for IoT in libraries are given below.



(Source: https://www.researchgate.net/figure/Layer-architecture-for-IoT-implementation-in-academic-libraries_fig1_355380026)



(Source: https://www.researchgate.net/figure/Application-areas-for-IoT-in-libraries_fig2_355380026)

If we try to understand by various points then we must keep below mentioned 10 elements in our mind. The elements of the IT infrastructure that most libraries should have are as follows:

- Hardware: computers, and accessories

- Software: all the programs and applications which are used in running the library and providing services to the users
- LAN: including the library's internal communications network and its devices
- WAN: This includes Internet services, virtual private networks (VPNs), and other networks
- ILS: it helps to manage the collections, library services, and user accounts
- Library websites and other electronic marketing tools, including social media
- Databases
- Electronic or digital media: known as paperless information resources
- Training resources to help staffers and users develop technology skills
- Administration: including IT department management and contract managers.

In other words, it is known as a potential area of IoT implementation for libraries and it is also mentioned here.

- Inventory Control
- Improved access to collections and resources
- QR codes and RFID tags
- Collection management
- Protecting rare collections
- Recommendation & Notification service
- Mobile Technology and placement based services
- Mobile Reference
- Tracking movement of Resources and Inventory with IoT
- Virtual Library and Book Tracking
- Safety
- Theft Management
- Cost Savings & Appliances Monitoring

- Drones
- Automatically Survey Patrons
- Direct patrons to special displays, programs, and events
- Information literacy or orientation
- Assistive Technology
- Community activities supported your interests

10. IoT environments and five laws of library science:

Dr. S. R. Ranganathan (a father of library science) has given five basic laws of library science, which are connected with every function and activity of the library, and they can be easily implemented. These five laws were given by Ranganathan a century ago, even though they are still implemented today but nowadays It has been presented differently due to the IT environment. These five formulas are outlined below:

Five Laws of Library Science (Original)

- Books are for use
- Every reader his or her book
- Every book its reader
- Save the time of the reader
- The library is a growing organism

Lennart Bjerneborn, an assistant professor at the Royal School of Library and Information Science, has presented these five laws separately in the form of hypertext links which,

- Links are for use
- Every surfer his or her link
- Every links its surfer
- Save the time of the surfer
- The web is a growing organism

The above five laws are similar to the five laws of the web, and the original five laws of library science are inspired. These laws are presented as follows

- Web resources are for use

- Every user his or her web resource
- Every web resource its user
- Save the time of the user
- The web is a growing organism.

Thus knowledge and information which was earlier available in printed form but today are also available in other formats such as Floppy, CD, DVD, Audio, Video Cassette, E-book, E-Journals, E-files. However, all library services are information-centric and consumer-centric.

Advantages of IoT:

There are many advantages of IoT which is given below

- Access to high-quality data

Information is easily accessible, even if we are far away from our actual location, and it is updated frequently in real-time.

- Better tracking and management

Whatever the institution is, IoT makes tracking and management a breeze for organizations. it is now also about smart offices, smart warehouses, and smart anything else.

- Efficient resource utilization

Electric Devices are directly connected and communicate with a controller computer, such as a cell phone, resulting in efficient electricity use. As a result, there will be no unnecessary use of electrical equipment.

- Automation and control

IoT devices are connected with each other through a wireless infrastructure, they are able to operate on their own with little or no manual intervention. It is useful for safety because it senses any potential danger and warns users.

- Comfort and convenience

Personal assistance can be provided by IoT apps, which can alert you to your regular plans.

- Saves time and money

By automating activities, it saves us a lot of time and money.

- Reducing human labor

Internet of Things devices performs a variety of functions without the need for human intervention, thus greatly reducing human labor.

- Better customer service

You no longer need to ask anyone because they will automatically inform you through their mobile app or website. So, whenever anything happens, you will always be informed.

- Improve security

It enhances security and offers personal protection in the comparison of humans.

Disadvantages of IoT:

Despite the many advantages of IoT mentioned above, there are also disadvantages that cannot be ignored. These disadvantages are as follows

- Privacy concerns

Hackers may gain access to the system and steal personal information. There is a risk of information can be misused. A lot of people feel uncomfortable sharing private information online. They worry about who might see them and misuse their data.

- Complexity

With the complexity of systems, there are many ways to fail.

- Requirements skilled workers

Unskilled workers are at a high risk of losing their jobs, which could lead to unemployment.

- Dependable

It relies heavily on the internet and is unable to function effectively without it.

- Makes people unintelligent

Yes, it is true because people rely on smart devices instead of doing physical work, causing them to become lazy.

- Lack of standardization

There are no common standards for data collection or transmission across different devices.

Hence, it makes things difficult for consumers to choose between various options available.

Conclusion:

The main theme of the article, 'Use of Internet of Things (IoT) Applications in Modern Library Activities and Services', simply states that the use of technology in libraries is the demand of the day. It also saves the library time, energy, and money and makes it possible to maximum use resources. In support of this, In the "Mann Ki Baat" program on November 29, 2020, Prime Minister Shri Narendra Modiji has said that today many museums and libraries in the country are working to make their collections fully digital. Our National Museum New Delhi has made some commendable efforts in this regard. The National Museum is in the process of launching about ten virtual galleries - it's a pleasure! Now one can visit the galleries of the National Museums of Delhi from the comforts of home, where on the one hand the cultural heritage is to reach more and more people mainly through technology and on the other hand, the use of technology is also important for the preservation of this legacy.

In short, it is no exaggeration to say that the above matter is appropriate for the review of the present article.

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