Application of Internet of Things: An Overview

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ABSTRACT

Purpose: This paper aims to present a comprehensive discussion on Internet of Things, its features and applications in various fields. The study also highlights the challenges of IoT.

Design/Methodology/Approach: The study is descriptive in nature and in order to explain the various aspects, various research papers from reputed journals were reviewed and information from various reports & online resources were gathered.

Findings: The study concludes that because of rapid growth in Internet and rise in data production, IoT is gaining a lot of importance and no major field is left untouched by IoT infrastructure. From education, travel, hospitality, industries to health every sector is being benefitted by IoT. It not only helps in gathering and analyzing data but also aids in increasing the security and increasing efficiency.

Originality/Value: The study provides valuable insights to understand the current state of research from both view points i.e. industry and academia.

Paper Type: Theme Based Paper

Introduction

The Internet of Things is the metaphor that has gained importance in the recent past because of the Digital revolution and it is changing every aspect of our lives. It is so much into everything that is now even known as "Internet of Everything".The term "Internet of Things" was first coined by Kevin Ashton who is an innovator and consumer sensor expert. According to him, IoT is the network connecting objects in the physical world to the Internet.In layman's terms, "The vast concept of Internet of Things refers the network of things which are implanted through sensors, software and various other technologies for the purpose of exchange of data over the internet."

Figure 1: IoT

Source: https://www.educba.com/introduction-to-iot/?source=leftnav

The basic idea is to connect the objects or things of real world with the internet thereby making them smarter by collecting real world data. It has become possible to extend the power of internet beyond the laptops and phones to a whole range of enormous things and processes only because of Internet of Things. Any device that can be connected to the internet, whether it is a smart television or a light bulb, is an IoT device.

There has been an exponential growth in the Internet of Things. Fortune Business Insights™ in its report, titled "Internet of Things (IoT) Market, 2020-2027" suggests that the Global Internet of Things market size is estimated to reach USD 1463.19 billion by 2027 while exhibiting a CAGR of 24.9% during the forecast period. It also mentioned that in 2019, the market stood at USD 250.72 billion.

Characteristics of IOT

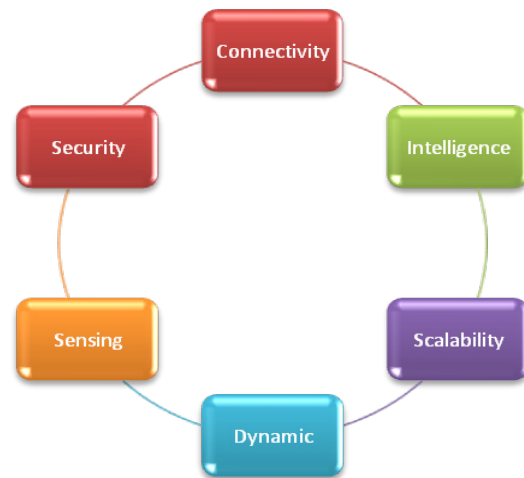There are few features or characteristics of IoT which are discussed below:

Figure 2: Characteristics of IoT

- **Connectivity:** Connectivity is the most basic and crucial characteristic of Internet of Things. There must be seamless connection among all the devices of the IoT ecosystem without which it would not be feasible to transfer data from one particular device to another. This simply means that all the IoT devices must be connected to the internet all the time.

- **Intelligence:** The amalgamation of algorithms and computation makes IoT intelligent or smart. Its intelligence enriches its competence of making the IoT devices act in a smarter way in any particular circumstance and carrying out the definite task.

- **Scalability:** IoT devices must be scalable i.e. they must be designed in a way that they are capable of scaling down and scaling up. The applications of IoT varies from smart home automation to enormous factories and workstations automation, which implies IoT infrastructure must be formulated on the basis of current and expected future scale.

- **Dynamic Nature:** The basis aim of IoT is to gather information from the environment and convert in a way through which decision could be made and in this entire process various dynamic changes take place in the components of IoT. Both the state of devices as well as number of devices changes dynamically.

- **Sensing:** IoT is impossible without sensors which make it possible to generate data on the basis of any changes in the environment and derive some meaningful insights from the same. The sensing information is nothing but just the analog signals which are capable of providing the rich understanding of the complex world.

- **Security:** Security is one of the important features of the IoT ecosystem. It is crucial to secure the endpoints, the network and the data transferred because in the entire flow of IoT ecosystem, sensitive information is passed from endpoints to the analytics layer through connectivity components.

Applications of Internet of Things

IoT has touched every aspect of our lives. Some major and most benefitted applications of IoT are discussed below:

- **Smart homes:** It is one of the most practical applications of IoT in the real life. In smart home, devices have the ability to connect and communicate with each other which has taken security, energy management and convenience to the another level. At present, there are numerous IoT devices available in the market for building smart homes for example, Philips Hue-Smart Home Lighting, Amazon Echo, Connected Surveillance Systems and others.

- **Wearables:** IoT for Wearables have a very large domain which comprises of various devices. They are sensor equipped energy efficient devices which are u used for fitness, wellness, and health and entertainment purposes. Examples include Fitbit, Amazefit, Motorola Moto 360 Sport and others.

- **Retail:** Application of IoT in retail is in tracking the goods, automated delivery of the goods, exchanging real time information between the suppliers and the retailers. Till now, IoT in retail has a limited reach but it has huge potential in the upcoming future.

- **Smart Cities:** For smart cities, IoT is applied for smart surveillance, smart waste and recycling system, electricity management, automated transportation, smarter energy management systems, smart street lighting and others. These all are aimed to eliminate the challenges and bringing convenience to people.

- **Healthcare:** Healthcare has the potential to be one of the most benefitted sectors from IoT. Sensors and Wearables can be used by the doctors for monitoring the condition of the connected patients and get the real-time access to patients' medical data. Also IoT aids in proving smart beds equipped with sensors to observe the patient and provide necessary data.

- **Education:** IoT is modernizing the education sector by connecting people all across the world, simplifying the process of knowledge sharing, reducing the barriers in accessing any information or data and in introducing the security in education system.

- **Agriculture:** IoT is being used for development of tools for Drip irrigation, drones for farm surveillance and others. Also IoT sensors can be implemented for obtaining data about the soil such as soil moisture, nutrients, level of acidity and others which will aid the farmers to plan accordingly.

- **Transportation:** IoT is being in self-driven cars by Google, Tesla, Uber etc. Sensors and embedded systems in these cars are connected to cloud for informed decision-making through Machine Learning.

- **Industrial Automation:** IoT is revolutionizing infrastructure backed with advanced sensor networks, wireless connectivity, innovative hardware and machine-to-machine communication and conventional automation process of industries.

- **Energy management:** The notion of smart grid is highly reliable and efficient as it gathers the data in automated manner and examines the behavior of consumers and suppliers of electricity which thereby aids in the improvement of economics of electricity use and reduction of electricity waste & costs.

- **Hospitality:** Sending electronic keys directly to the mobile phones of the guests which enables in automating the check-out process and deactivating the operations of the rooms, conveying data related to activities of interests of the guests, allocating the housekeeping tasks to maintenance personnel, receiving request of personal hygiene supplies and others are examples of IoT footprints on Hotel industry.

- **Telehealth:** Digital communications of Medical Imaging, Video Consultations with Specialists, Remote Medical Diagnosis & Evaluations, etc. are the popular examples of Telehealth or Telemedicine.

- **Smart Supply-chain Management:** IoT devices are transforming the supply chain management and they are certain to be in the market for long run. From tracking goods while they are in rest or transit to identifying the issues of goods lost or delayed, all the aspects of supply chain are untouched by IoT.

- **Water Supply:** Just like electricity, water meters can also be connected with internet and necessary software for collecting, processing and analyzing data of the consumers. This will aid in the understanding the consumers' behavior and detecting frauds if any. Also it will facilitate the consumers in tracking their consumption data on real time basis.

- **Travel:** Through IoT, travel agencies are adding convenience and ease to the customers experience by delivering them real time information, sending electronic key cards to guest and automating most of the processes.

- **Traffic Management:** Traffic can also be managed by IoT devices. Drivers can use their smartphones in collecting and sharing information about various routes and thereby improving their route for the same distance and destination.

- **Business houses:** Corporates are using IoT infrastructure in revenue generation, smoothening the logistics, data generation for framing strategies & plans, improvising customer service & support, proving better consumer experience, reducing maintenance costs, and others.

- **Real Estate:** Development of smart space, offering energy efficient opportunities, speeding up decision making process and others are all the examples of how IoT is reshaping the real estate.

Challeneges of Internet of Things

Internet of Things has become a huge part of people and corporation's day to day activities. But with its uses some major challenges are also arising, which are:

- **Security:** Major issue related to any device or services which are linked to Internet is security. Users are sensitive to their private information and data and it has to be secured from cyber attackers.

- **Data extraction from complex environment:** In a country like India, it is huge challenge for IoT devices to perform at their best in harsh and complex environment and it's a challenge for the software developers to upgrade the devices which cater to the needs of the users according to its environment. For example, IoT devices for vegetable quality, it is easy to get the data of quality of vegetable in urban areas with good connectivity but it will not be possible to get data at every place of the country.

- **Connectivity:** As we discussed above about the data extraction we could sense the key role of connectivity in IoT and its devices. With poor connectivity IoT will certain to be a failure.

- **Power requirement:** In India not every region has power supply or adequate power supply to use IoT efficiently. Still with some long lasting batteries in IoT devices it can work but a better and green energy source for IoT should be motivated.

- **Regulation:** IoT technologies are upgrading continuously and there are also so many devices that connect to it which have different quality level. Without a proper government regulation many severe scenarios can be created of potential attackers, low grade quality supply in the market etc. regulation procedure should be at pace with IoT innovation. It will also help businesses to get crucial information in decision making.

- **User Expectations:** In today's highly competitive market user does not settle for single upgrade and average performance. They always want better from others and what they had experienced before. Their expectations and result should be matched. IoT technology for a user should be smooth, uncomplicated and productive to use.

- **Scalability:** So many devices now a day are connected to IoT technology. Itcreates ahuge network of database and if not handle correctly and on time it effect the performances. The system needs to be regularly checked and upgraded to enhance he scalability. It's a challenge in recent times to continuously enhance the size of cloud storage for analyzing big raw data.

Conclusion

Internet of Things is the new paradigm that facilitates communication between the connected devices through internet and sensors. Because of rising demand for smart sensors and security aspects, IoT has become the need of the hour. No major sector has remained untouched by it. IoT is successfully helping in collecting, processing and analyzing of the gathered data. IoT is beneficial for industrial automation, hospitality, travel, business houses, energy management, water supply and others. IoT is As every coin has two sides, apart from benefits, the Internet of Things have few challenges also relating to security, privacy, connection, scalability, regulations and others.

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GJEIS Prevent Plagiarism in Publication

The Editorial Board had used the Ouriginal – a Swedish anti-plagiarism software tool which is a fully-automatic machine learning text-recognition system made for detecting, preventing and handling plagiarism and trusted by thousands of institutions across worldwide. Ouriginal by Turnitin is an award-winning software that helps detect and prevent plagiarism regardless of language. Combining text-matching with writing-style analysis to promote academic integrity and prevent plagiarism, Ouriginal is simple, reliable and easy to use. Ouriginal was acquired by Turnitin in 2021. As part of a larger global organization GJEIS and Turnitin better equipped to anticipate the foster an environment of academic integrity for educators and students around the globe. Ouriginal is GDPR compliant with privacy by design and an uptime of 99.9% and have trust to be the partner in academic integrity (https://www.ouriginal.com/) tool to check the originality and further affixed the similarity index which is {9%} in this case (See below Annexure-I). Thus, the reviewers and editors are of view to find it suitable to publish in this Volume-14, Issue-2, Apr-June 2022.

Annexure 14.8

Submission Date	Submission Id	Word Count	Character Count
30-Apr-2022	D110516231 (Ouriginal)	2250	14955

Analyzed Document	Submitter email	Submitted by	Similarity
2.1 TBP1_Madhulika_ GJEIS Apr to Jun 2022. docx (D110516231)	madhulikap.sarkar@ignou.ac.in	Madhulika P. Sarkar	9%

Sources included in the report

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W	URL: https://www.researchgate.net/publication/227172798_A_Study_on_Internet_of_Things_based _Applications Fetched: 1/7/2020 10:07:59 AM	1

Reviewers Memorandum

Reviewer's Comment 1: Internet of Things is the new paradigm that facilitates communication between the connected devices through internet and sensors. The study presents a comprehensive discussion on the Internet of Things, its features and applications in various fields. The study also highlights the challenges of IoT.

Reviewer's Comment 2: The findings of the study are valuable to understand the current state of research in the area from both academia and industries point of view as well as associated challenges and opportunities.

Reviewer's Comment 3: The study is presented very strategically, also the choice of topic is very appropriate. Yet a more strengthened and updated review of the literature could be conducted to further improve the quality of the work done.

Editorial Excerpt

The article has 9% of plagiarism which is the accepted percentage as per the norms and standards of the journal for publication. As per the editorial board's observations and blind reviewers' remarks the paper had some minor revisions which were communicated on a timely basis to the authors (Madhulika and Shailza), and accordingly, all the corrections had been incorporated as and when directed and required to do so. The comments related to this manuscript are noticeably related to the theme "**Application of Internet of Things**" both subject-wise and research-wise. The Internet of Things is the metaphor that has gained importance in the recent past because of the Digital revolution and it is changing every aspect of our lives. This paper aims to present a comprehensive discussion on the Internet of Things, its features and applications in various fields. The study also highlights the challenges of IoT. Overall, the paper promises to provide a strong base for further studies in the area. After comprehensive reviews and the editorial board's remarks, the manuscript has been categorized and decided to publish under the "**Theme Based Paper**" category.

Acknowledgement

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