



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 7, July 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

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IoT Technology: A Review on Internet of Things

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ABSTRACT: Today, everyone is using different kinds of electronic devices to communicate through the internet. It shows the dependency of human beings on electronic devices. Now we are operating these kinds of devices from anywhere and anytime because they are connected to each other through the internet. It's important to operate these devices from anywhere because people are too busy in their lives. As a result, IoT plays an important role in the internet, computer science, and information technology revolutions.

KEYWORDS: INTERNET of THINGS, IoT Characteristics, IoT Application, Dynamic Nature, Smart City and Home.

I. INTRODUCTION

IoT stands for "Internet of Things". We divide it into two parts. The first one is "INTERNET" and the second one is "THINGS". As we know, the Internet is a collection of networks. In this network, devices are connected to each other through the standard protocols and set of rules. Physical objects are coming under the heading "things." In physical devices, we consider sensors and actuators. So we can say that the Internet of Things is a collection of physical devices that are able to communicate through the internet using some standard protocol. In IoT sources, devices collect data from different sources and share this data with other devices through the internet. Now this shared data is used for some purposes.

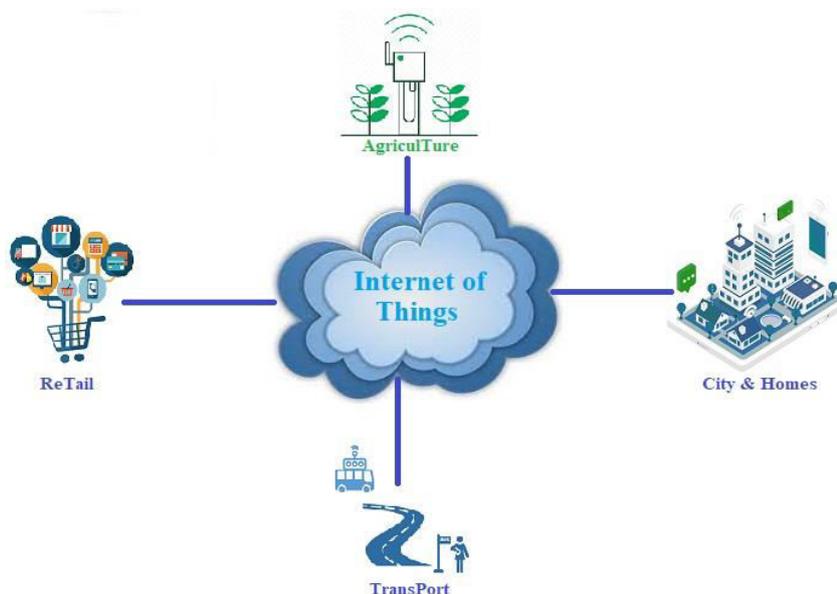


Fig. 1

Expeditious development in the field of Internet of Things and its ability to provide different kind of services make him fastest growing technology in Today's world. Internet of Thing is a concept of establishing connection/relationship in between the Physical objects without the interference of human being or less interference of human being. In IoT every devices have a unique Id (called identification number) through which they can be easily identified in the network and

they are able to receive/send data any- time, any-where without the interference of human. A “Thing” in Internet of Things can be a device implant in human body which read the pulse rate or body temperature, An injectable ID chip that is inserted under the skin of an animal to identify them, a built in sensor transport vehicle which provide information about the route. A system used to monitor the weather condition at a distinct place and make the information visible worldwide.

II. CHARACTERISTICS OF INTERNET OF THINGS

Some of the fundamental characteristics of IoT system are as follow –

- (a) Intelligence
- (b) Connectivity
- (c) Dynamic in nature
- (d) Enormous scale
- (e) Sensing
- (f) Heterogeneity
- (g) Security
- (h) Energy

- (a) Intelligence :- An IoT system is the combination of coding/programming and computational software and hardware components that make it intelligent. From the intelligence point of view, the extraction of data is very important. Now the extracted data is interpreted properly. In the present world, this data is used intelligently by using the IoT system to make their business important and for important business decisions.
- (b) Connectivity :-For transformation of data, connectivity is required, so connectivity is an important requirement of the IoT system. The main goal of connectivity is to provide network accessibility and compatibility. Accessibility means getting on the network, and compatibility means the ability to consume and generate data.
- (c) Dynamic in nature :- Dynamic in nature, this means devices can join and leave the network at any time and any place. We can say that the state of devices changes dynamically. For example, sleeping and waking up, connection and disconnection. In the sleeping state, devices are saving their power.
- (d) Enormous scale :-Any number of devices can added at the same time, at any place.
- (e) Sensing :-The IoT system uses sensors. Sensors are used to detect or measure changes in the environment. They can generate data and share that data with others to take action.
- (f) Heterogeneity:- Internet of Things devices are based on different hardware and networks and can communicate with other IoT devices or services through their distinct networks. This shows that the IoT system architecture should support diversity.
- (g) Security :- Security is the major challenge in the IoT system as we do not know every piece of data/information that is shared between the devices through the distinct network. So it is important to secure the endpoints. Not only the data/information needs to be secure, but also the devices need to be secure because in an IoT system, every device has a unique identification number to connect to each other.
- (h) Energy :- In the IoT system, devices are based on energy. which demands lots of energy to make a strong connection between the devices. And also, if they are not sharing information, they go into the sleeping mode to save energy.

III.APPLICATION OF INTERNET OF THINGS

Some important application of internet of things are :-

- a. Smart City and Home.
- b. Smart Transports.

- c. Smart Traffic monitoring.
 - d. Smart agriculture.
 - e. Smart Retail Industry.
 - f. Industrial Automation.
 - g. Health & wearable.
- A) Smart City and Home → Smart cities and homes are one of the powerful applications of IoT, generating curiosity among the people. IoT will solve daily life problems faced by people living in cities. They can make their city clean by using IoT. The IoT helps them monitor their homes and pets from anywhere and anytime. IoT will make their everyday appliances smart.
- B) Smart Transport → Smart transportation is the next step of emerging technology. With the help of IoT now transport is available on one single fingertip at their door step. People can trace vehicle easily from anyplace and anytime through the internet. Smart transportation is very useful to manage the traffic in city by using sensors, advanced communication technologies, automation and high-speed networks. We can say that this is the art and science of moving from one place to another. According to the US Department of Transportation, "Intelligent Transportation Systems (ITS) apply a variety of technologies to monitor, evaluate, and manage transportation systems to enhance efficiency and safety."
- C) Smart Traffic monitoring → A smart traffic monitoring system is used to monitor real-time traffic situations and provide congestion-free traffic. Overspeed vehicles are monitored by the speed sensor and an e-challan is sent to the owner of the vehicle. It offers safe and punctual public transportation facilities. Smart traffic monitoring systems at crossroads and narrow road ends use GPS and GIS to provide accurate traffic direction. By optimising road networking technologies, the IoT enables rapid and better communication systems.
- D) Smart agriculture → Smart agriculture is a new term that refers to managing farms using the Internet of Things (IoT), robotics, drones, and artificial intelligence (AI) to increase the number and quality of goods while reducing the amount of human work required. We can easily monitor and maintain the quality of soil by using IoT system like moisture, acidity and other nutrients.
- E) Smart Retail Industry → Retailers have begun to implement IoT solutions and IoT embedded systems in a variety of applications to improve store operations, including raising sales, reducing theft, enabling inventory management, and improving the shopping experience for customers. Physical retailers can compete more effectively against internet adversaries thanks to the Internet of Things. They can regain lost market share by attracting customers into the store, allowing them to buy more while saving money. The IoT has huge promise in the retail sector. IoT allows merchants to interact with their customers in order to improve the in-store experience. Smartphones will allow shops to stay in touch with their customers even when they are not in the store. Using smartphones and beacon technology to interact with customers can help retailers better serve their customers. They can also track a customer's movement through a store, enhance the layout, and position high-value items in high-traffic areas.
- F) Industrial Automation → At present, it's important for every organisation that they can increase their production at a low cost. Automation means working without the intervention of human beings. In any industry, making the task automated will increase the quality of service. Improving operator safety is one of the greatest benefits of industrial automation, as it eliminates the need for operators to perform dangerous tasks such as, for example, handling dangerous chemicals, lifting heavy objects, working in adverse conditions such as high temperatures, or performing tasks that involve repetitive movements. Operators are more secure when these types of tasks are performed by robots and other automated solutions.
- G) Health & Wearables → The Internet of Things helps improve patient care and prevent fatal events in high-risk patients. IoT system help to reduce emergency room waiting time. The IoT has also introduced some wearables and devices that make patients' lives more convenient. Wearables or sensors attached to the patient allow doctors to monitor the patient's condition in real time outside the hospital.

IV. TECHNOLOGY USED in INTERNET OF THINGS

There are some common type of wireless technology used in IoT :-

1. LPWANs
2. Cellular
3. Zigbee
4. Bluetooth
5. Wi-fi
6. RFID

1. LPWANs :- LPWANs is stands for low power wide area network. This is a wireless network technology. It provide interconnection in between low-bandwidth and fully battery operated devices with low bit rates over long ranges. In LPWANs, we can connect to any type of IoT sensor. Asset tracking, environmental monitoring, building management, occupancy detection, and consumables monitoring are all possible with this technology. Still, LPWAN can only send small chunks of data at low rates, making it suitable for use cases that do not require high bandwidth and are not time-sensitive.
2. Cellular :- Cellular (3g/4g/5g) network provide reliable broadband communication that supports various voice call and video streaming applications but they require high operational cost and power. Cellular networks cannot be run in most IoT applications with battery-powered sensor networks, but they are well suited for specific use cases such as connected cars, transportation and logistics fleet management. For example, in-vehicle infotainment, traffic management, advanced driver assistance systems (ADAS), fleet telematics, and location-based services may all rely on ubiquitous, high-bandwidth cellular connectivity.
3. Zigbee :- Zigbee is an IEEE 802.15.4-based specification to enable low-cost, low-power wireless machine-to-machine (M2M) and internet of things (IoT) networks. Zigbee supports lower data rates, low power applications and uses a mesh networking protocol to avoid hub devices and create a self-healing architecture.
4. Bluetooth :- Defined in the category of wireless personal area networks, Bluetooth is a well-positioned short-range communication technology in the consumer market. Bluetooth Classic was originally intended for point-to-point or point-to-multipoint data exchange (up to 7 slave nodes) between consumer devices. Bluetooth Low Energy was optimized for power consumption and later introduced for smaller consumer IoT applications. BLE-enabled devices are primarily used in combination with electronic devices (usually smartphones) that act as hubs for transferring data to the cloud. Today, BLE is widely integrated into fitness and medical wearables (smartwatches, glucoses, pulse oximeters, etc.) and smart home devices (door locks, etc.), and data is conveniently transmitted and visualized to smartphones. increase. The release of the Bluetooth mesh specification in 2017 is aimed at enabling more scalable deployment of BLE devices, especially in retail stores. The BLE Beacon Network has been used to provide versatile indoor localization capabilities and unleash new service innovations such as in-store navigation, personalised promotions, and content delivery.
5. Wi-Fi :- Wi-fi is the wireless technology used to connect different electronic devices through the internet so they can exchange information. WiFi is uniquely deployed to support broadband and narrowband IoT applications from a common platform that can operate with different power consumption and signal range. WiFi is often not a viable solution for large networks of battery-powered IoT sensors, especially in industrial IoT and smart building scenarios. Rather, it's about connecting devices that can be easily plugged into electrical outlets, such as smart home gadgets, appliances, digital signage, and security cameras.
6. RFID :- RFID stands for "Radio Frequency Identification". It is a wireless technology which uses radio waves to transfer data from one source to another source. In this technology RFID tags and readers are used which allow you to identify users automatically and uniquely and track inventory and assets and reader gets signal back from the RFID tag.



V. ADVANTAGES OF INTERNET OF THINGS

1. In IoT system IoT devices needed minimum human intervention.
2. Because of minimum human intervention it saves lots of time.
3. Provide accessibility from anywhere and anytime.
4. They are dynamic in nature, so they can leave and rejoin the network at any time.
5. In the IoT system, IoT devices have unique identification number so it provide improved security option also.

VI. CONCLUSION

This review provided a basic introduction to the Internet of Things, the features of the IoT, the applications of the IoT, the technologies used in the IoT, and some of the benefits of the IoT. The Internet of Things is a term that has been used a lot in recent years. Today, everyone uses the services of IoT systems in their daily lives. For example, portable self-driving cars, lights, home appliances, etc. In the future, the IoT will be a fundamental need for all industries.

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