

Internet of Things/ Everything: An Overview

Neha Nidhi¹, Deepak Prasad², VijayNath³

^{1, 2, 3}Department of Electronics and Communication Engineering
Birla Institute of Technology, Mesra, Ranchi, India

Corresponding author: nehanidhi199@gmail.com

Abstract: Internet has proved to be the greatest boon for our lives since its innovation. Its effectiveness and utility has touched every aspect of human life ranging from education, communication, business, science, technology, etc. Today, with a single click, one can virtually travel around the world. The ease with which transfer of data from one system to another system takes place through internet has been the biggest time rescuer for us. The achievements accomplished so far, using a variety of gadgets available to be in sync with internet, has made humans to work more ruthlessly towards making a new smart digital world where everything could be connected on the network and opening a new door for our visualization. And this is what we call it as Internet of things (IoT). This means we are slowly entering into a phase where various things around us could

virtually be on-net. This step by step transformation of Internet into “Internet of Things” is going to be the gateway to our new modernized digital world. According to CISCO, the leading giant around the world in networking, connectivity and communication of all sorts, IoT is going to connect an estimated number of 25 billion devices by 2015, and 50 billion by 2020¹. The present discussion is an effort to explore the basic concepts of IoT, its application in daily life, its safety purpose and various other prospects.

The foundation of IoT had been laid down long back in 1999 by Kevin Ashton. He is known for coining the term “Internet of things” and described it as a system where internet was used to hook up the physical devices together. He was working with Procter & Gamble (P&G) where he became interested in using Radio Frequency

Identification (RFID) ² to help manage P&G's supply chain³. The popularity of this technology was carried forward to the world by the introduction and simultaneous development of Smartphone. Smartphone provided something that was not well known to the people i.e. wireless transmission of data. It provides the wireless connection to the devices to communicate, exchange, control and monitor their respective data/information using different sensors, switches around it and with other mobile interfaces as well.

With IoT, it might be possible today to have solutions to connect sensors to the internet. The architecture of IoT system is shown in Fig. 1. The model has five layers⁴. The edge layer at the bottom consists of sensor networks, embedded system, RFID tags and readers or other types of sensors. These hardware elements provide information as

well as help in identification, processing, collection, communication, control and actuation of the data. The next layer called the access gateway layer is the initial stage of data handling unit. It takes care of publishing, subscribing and message routing to other communication devices. The middle layer operates in bidirectional mode. It also acts as an interface between the hardware layer at the bottom and application layer at the top. This layer is responsible for device and information management.

It also takes care of data filtering, data aggregation, access control, information discovery such as Electronic Product Code (EPC) and Object Naming Service (ONS). The application layer is responsible for providing access to various applications to different users.

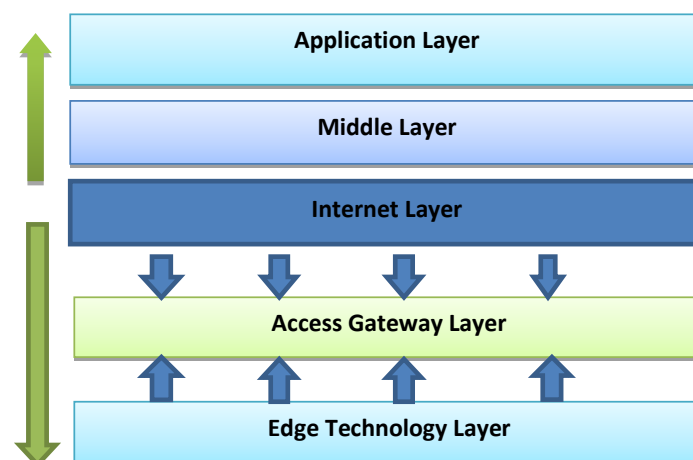


Fig 1: Architecture of IoT system

The application layer is responsible for providing access to various applications to different users. In the present scenario, IoT not only uses RFID technology which was projected by Kevin Ashton but also Wi-Fi IEEE 802.11⁵, Barcode, Quick Response (QR) code⁶, Zigbee IEEE 802.15.4⁷, Smartphones⁸ etc. RFID technology is widely used in transportation and logistics for localization of the materials/vehicles/men. It has RFID tags which can be easily deployed in the goods to be transported. Wi-Fi is a general purpose, low cost, highly interoperable technology and widely used in indoor and outdoor environment which allows the connection of multiple devices to transmit data. Barcode and QR code are low cost technologies which can be detected by compatible and appropriate devices. This technology has been mainly adopted by retail sector for monitoring of goods. Zigbee is a secure network topology which can

allow up to 64770 nodes to be shared. It can be used globally for Wireless Personal Area Network (WPAN) and mesh networks. Earlier, the uses of IoT were mainly restricted to the industrial or retail sector, but now-a-days IoT is becoming prominent around us almost in every field. Fundamentally, IoT brings the physical world and virtual world together by blending different concepts and technologies. IoT is a network that allows the connection of a huge number of things to the internet so that information can be exchanged without human interruption. IoT model cannot be called a revolution over the existing technologies but is the comprehensive arrangement of all the existing technologies in a single unit. For example, Smoke alarms which are generally installed in offices, shopping malls, towers, museums etc, could enlist the nearby ordinary light bulbs to flash and give audio alert.

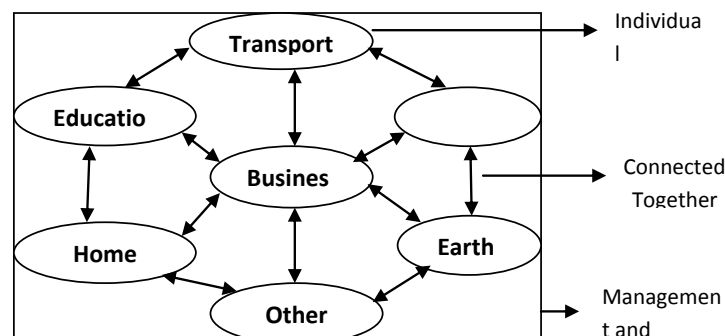


Fig 2: Internet of Things

A warning about the smoke's location could appear on a television and door locks would be automatically opened.

IoT provides a communication link between the things which can communicate. We can't imagine a projector talking to a chair. But it would be more sensible for a projector talking to a smart phone. Thus IoT can now be called as Internet of Everything or Network of anything which means connecting people, animals, objects and literally everything which is uniquely identifiable. Now, there is more emphasis on objects which can communicate and have an active participation in the information network and take smart decisions. For example, in case of an air-conditioning unit, say, the smartwatch could control the airflow and the air conditioner could also display temperature information on watch's screen. With these many applications, IoT has successfully been able to accomplish the tasks of automatic identification of items, automatic positioning, process tracing, online tracking, online scheduling, etc. The advancement of IoT can trim down crime to some extent. For example, in present time, most of the cities are not safe enough for working women while returning home after office hours at late night. Though, a lot of

efforts have been carried out to make a dream city but still crimes have not been reduced. With the application of IoT i.e. by connecting the hidden cameras installed at bus-stands, subways, over bridges etc.; different sensors in streetcars, buses, auto-rickshaws to trace their path, Smartphone carried by people, nearest police station and district administrative offices together, the number of crimes may be reduced.

Establishing communication between millions of interconnected objects is as easy as building Rome in a day. The "internet of things" promises a technological revolution in days to come, but for this to turn out into a huge sensation, the interconnected objects need to articulate the same language and translate the solutions which can be incorporated in all other IoT devices that have either been developed so far or are yet to come. A number of industrial organizations across the world are working constantly to adopt a common standard language to bring IoT closer to their customers. The possible applications of IoT have been pictorially shown in Fig. 3.

In this scenario the advent of nanotechnology has proved to be a great facilitation for IoT technology. The expansion in the sector of tiny wireless

sensors which are capable of being operated on ultra-low power with an average life

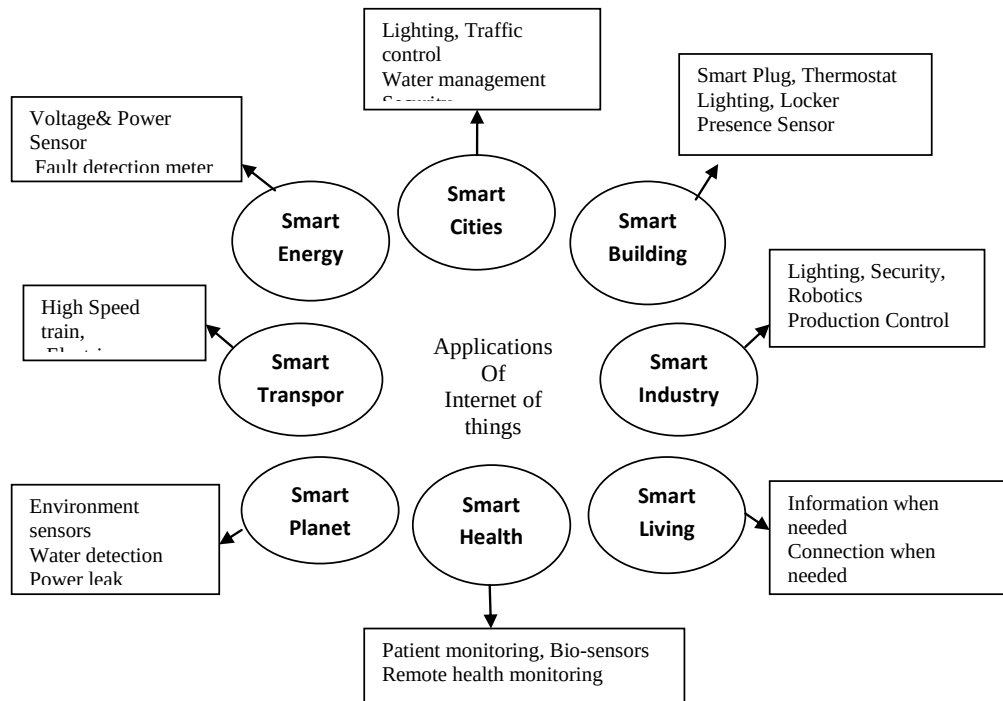


Fig 3: Application of Internet of Things

expectancy makes IoT superior than any other system that have been worked upon till date. The nanotechnology is wrapped up so proficiently with IoT that it has offered our lives in a very profound and fascinating manner.

The whole concept of working with the complex web of devices on internet seems wise on paper but has various hidden issues involved that necessitate to be looked upon very methodically. Security is a very

important facet in this segment. There are certain applications of IoT where security might not be an issue, say exchanging data intended for a game however, if defense matter comes into picture the same might pose a risk. Thus, everyone needs to be cognizant and alert regarding their liabilities and exposure to the threat of using the system.

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