

## International Journal of Innovative Research in Science, Engineering and Technology

*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

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Vol. 7, Issue 1, January 2018

# Internet of Things – A Dynamic Global Network Infrastructure

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**ABSTRACT:** The Internet of Things (IoT) is the evolution of Internet, it's a new era in computing technology. It's imparting the world a digital nervous system such as tracking location using GPS sensors, eyes and ears using cameras and microphones, along with sensory organs that can measure everything from temperature to pressure changes. IoT is a system that promises smart life by allowing human – machine and machine – machine interactions. This paper focuses on the concept of IoT, it's features, architecture and future applications.

**KEYWORDS:** IoT, smart city, smart grid, smart health, smart transportation.

### I. INTRODUCTION

Internet of Things is a key element of global digital transformation. It was born between 2008 and 2009. Explosive growth of smartphones and tablet PC's brought the number of devices connected to the internet to 12.5 billion in 2010 while the world's human population increased to 6.8 billion making the number of connected devices per person to more than 1 for the first time in history. According to recent reports there are 8.4 billion connected things in 2017, setting the stage for 20.4 billion Internet of Things devices to be deployed by 2020. IoT is an advanced automation and analytics system which combines the connectivity with sensors, devices and people thereby enabling free flowing conversation between man and machine, software and hardware. It exploits networking, sensing and artificial technology to deliver complete systems for a product or service. It defines a new concept of how items in the physical world and sensors within or attached to these items are connected to the internet via wireless and wired internet connections. It also refers to the use of intelligently connected devices and systems to leverage data gathered by embedded sensors and actuators in machines and other physical objects. They use intelligent interfaces and are seamlessly integrated into the information network thereby providing a dynamic global network infrastructure.

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## The Internet of Things

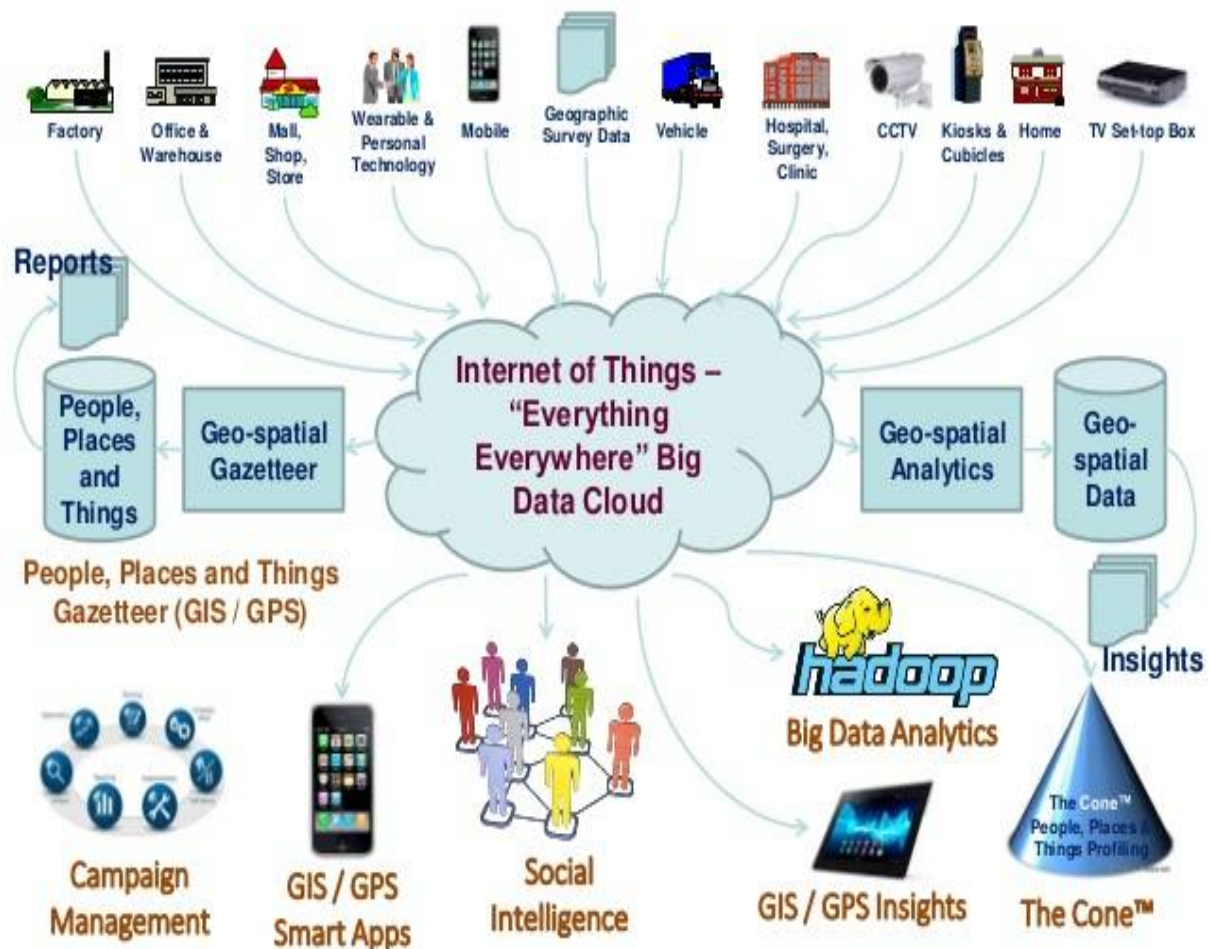


Fig 1 Internet of Things

### II. KEY FEATURES

- **Complex environment sensing capability:** The sensors in IoT act as defining instruments which transform IoT from a standard passive network of devices into an active system capable of real world integration. IoT provides innovative ways to sense and deliver information from the physical world to cloud.
- **Connectivity:** A wide variety of wired and wireless connectivity standards are required to enable different application needs.

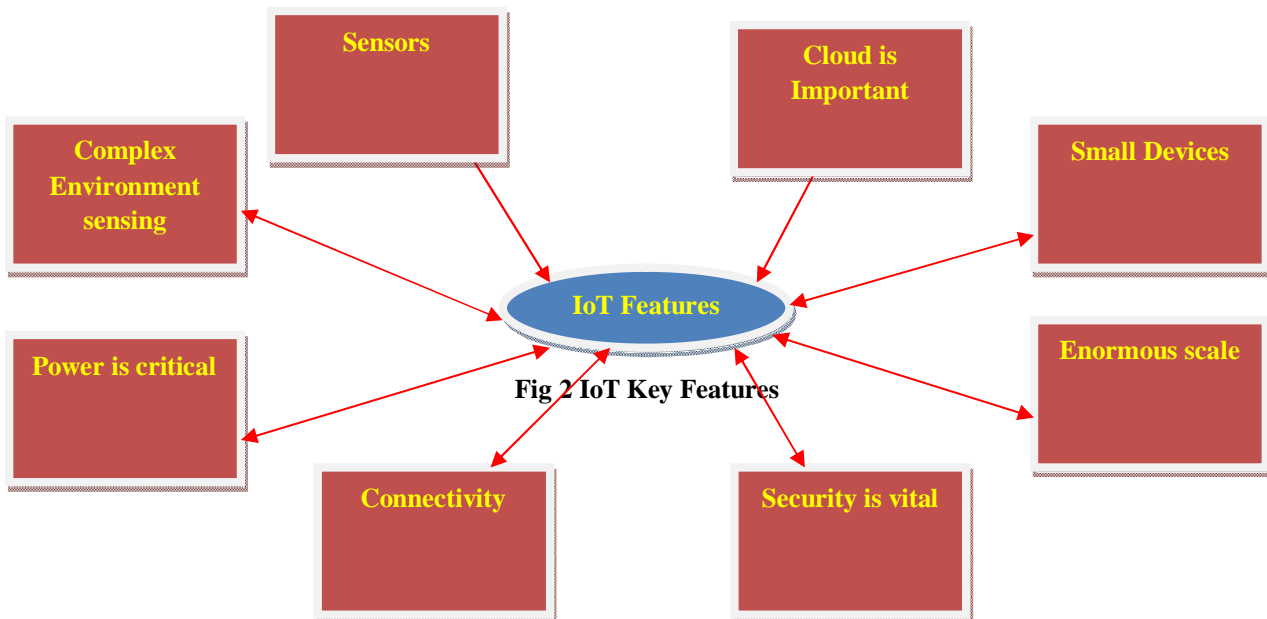
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- **Changes what type of item communicates over an IP network:** The objects enabled via IoT share information about their condition and the surrounding environment with people, software systems and other machines. This information can be shared on real time basis and shared at defined intervals.
- **IoT Technologies:** The IoT enabled technologies include sensors, RFID, multi agent systems, event driven architectures, web services.
- **IoT applications:** IoT applications require end to end (E2E) solutions including cloud services.
- **Research Domain:** IoT has a well established and continuously expanding research domain.
- **No. of integrated devices:** The number of devices that needs to be managed and those which communicate with each other will be an order of magnitude larger than the devices connected to the current internet.



### III. IoT ARCHITECTURE

The IoT architecture can be divided into 3 and 5 layer models. It consists of the following layers:

- The Perception layer,
- The Network layer,
- The Middleware layer,
- The Application layer,
- The Business layer.

The perception, network and application layers are considered as the main layers of IoT whereas the rest of the layers are used for management of services and the IoT systems.

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### IV. THREE LAYER ARCHITECTURE

The three layer architecture of IoT consists of the layers:

- 1) **The Perception Layer:** The perception layer is the last layer of the IoT architecture. This layer is used to collect information from environment. It uses the data gathered from RFID tags and sensors. The sensors collect information about temperature, motion etc and pass this information to the network layer.
- 2) **The Network Layer:** It is the most important layer of IoT architecture. It's function is to collect the data sent by perception layer and transmit it to application layer using wired or wireless media. It also comprises of information and management centres.
- 3) **The Application Layer:** It caters to application specific demands of the users by acting as a bridge linking the industrial technology with needs of humans. The three layer architecture of IoT is as shown in Fig 3.

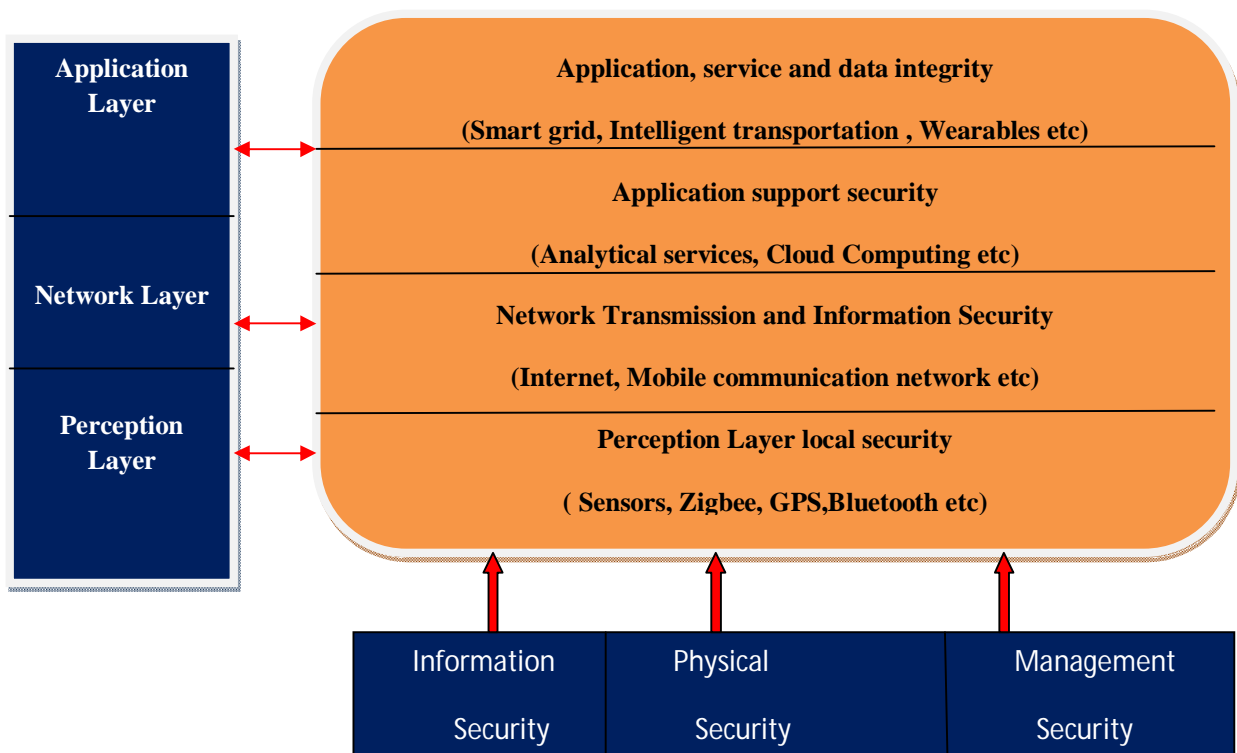


Fig 3 Three Layer Architecture

### V. FIVE LAYER ARCHITECTURE

Since billions of devices are connected to IoT architecture so in order to ensure privacy and security for the huge amount of data a five layered architecture is proposed as follows:

- 1) **The Business Layer:** This is the first layer of the five layered architecture whose main function is to ensure the confidentiality of data and creates business models and graphs according to the information acquired from the application layer.

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- 2) **The Application Layer:** It is the second layer and defines the type of applications in IoT. It's functionality is the same as specified in the three layer architecture.
- 3) **The Processing Layer:** This layer performs the function of storing and analyzing huge amount of data sent by the perception layer. In order to manage such huge amount of data this layer uses techniques such as database software, cloud computing etc. This layer is linked to the database where it stores the information received from transport layer.
- 4) **The Transport Layer:** It's functionality is similar to the network layer in the three layer architecture. This layer is responsible for the safe and secure transmission of data between perception layer and processing layer. It uses many technologies such as Wi-Fi, Bluetooth etc.
- 5) **The Perception Layer:** This layer uses technologies such as RFID, GPRS etc to collect information about each and every object in the IoT system such as temperature, location etc and transmits the collected data into signals.

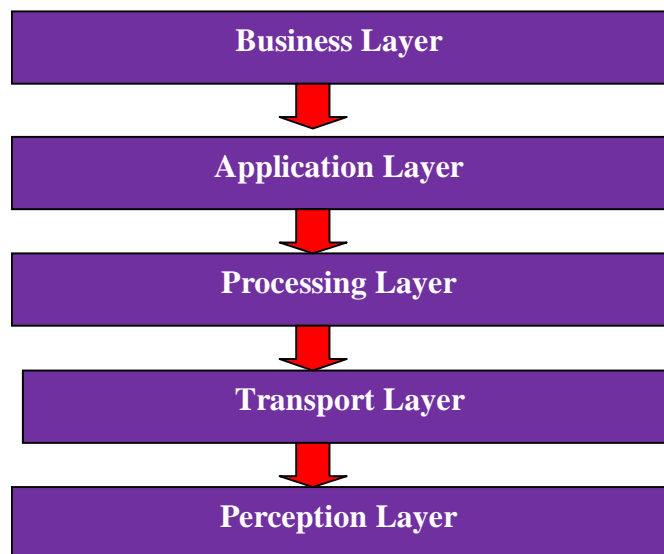


Fig 4 Five Layer Architecture

### VI. ADVANTAGES AND DISADVANTAGES OF IoT

#### Advantages:

- 1) The delivery mechanism is relatively fast and accurate with minimum utilization of energy which improves the quality of life.
- 2) Allows machine to machine interactions thus providing connectivity of physical devices thereby ensuring greater transparency.
- 3) Provides technology optimization as the same technology is used by both the customer and the device.
- 4) Ensures optimum utilization of energy and resources.
- 5) Automation of daily tasks leads to better monitoring of devices.

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## Disadvantages:

- 1) Since all the devices, public sector services, machinery, appliances etc are all connected to the internet a huge amount of information is available on it which may be prone to attack by the hackers .
- 2) Complex network of IoT makes the detection of failure and bugs in software/hardware a difficult task which can have serious implications.
- 3) With the advent of IoT highly automated machines/devices will replace the unskilled workers in industries leading to large scale unemployment.
- 4) All the devices must be made compatible with the current IoT technology. Since no standard has been set for compatibility tagging and monitoring equipment, this would result in compatibility issues, resulting in people buying appliances from a certain manufacturer leading to monopoly in the market.
- 5) The over reliance on technology on a day to day basis and making decisions on the basis of the information that it gives up could lead to wrecked system.

## VII. IOT APPLICATIONS

- **Smart Homes:** More than 60,000 people currently search for the term smart home each month. Smart homes are automated buildings that include many interesting applications of IoT such as smart media, smart lighting, security etc.
- **Smart Cities:** With the use of IoT a lot of things such as infrastructure, transportation, citizen safety etc can be improved in cities, thus alleviating the problem of traffic congestion.
- **Smart Grid:** A smart energy management system can be incorporated with the use of smart grid that promises to use information about the nature of electricity suppliers and consumers in automated fashion to improve the efficiency, reliability and economics of electricity.
- **Smart Health:** An ailing person living alone can be monitored continuously with the help of IoT. Wireless sensors throughout the house, help measure healthy activity levels, sleeping patterns and medication schedules. Alerts are automatically sent to health care services and authorized family members if any abnormal activity is detected.
- **Smart Transportations:** Smart transportation encompasses three major areas, transportation analytic, transportation control, vehicle connectivity. Transportation analytic gives an estimate of the number of vehicles or people that will use a specific transportation facility in future. Transportation control deals with the issues of traffic management such as speed control etc which in turn is directly related to vehicle connectivity. Most of the large automobile manufacturers as well as some as some startups are working on connected car solutions.
- **Wearables:** These are hands free devices that can sense their environment which comprises of the user's body, the area right around the user's body or the other things the user passes by. They can communicate with other sensors, wearables, smartphones, machines and even with the whole network. On combining them with cognitive analytics, they can anticipate user's information needs.

## VIII. CONCLUSION

In the not too distant future, hundreds of millions, then billions of individuals and business with exponential growth of smart, communicating devices will stretch the boundaries of current systems thus, creating the potential to change the way we work, learn, entertain and innovate. The Internet gave us the opportunity to connect in ways we could never have possibly dreamt. The Internet of Things will take us beyond connection to become part of a living, moving, global nervous system thereby stretching the boundaries of today's systems.

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