

Internet of Things: An Overview

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Abstract:

Internet of things (IOT) is the most evolving technology among all the technologies that are currently in trend in the researchers' world, researchers have ranked this technology above AI and robotics. The meaning of Internet of things is itself a clear term. Although this is very evolving technology but there is critical shortage of research articles on this very topic. In this paper it's been tried to elaborate the important aspect of internet of things, how things that are remotely connected or have sensor can facilitate our lives.

Keywords: OCR, Map, Segmentation, RLSA, Projection Profile

1. Introduction:

Internet of things (IOT) is the most emerging technology among all the technologies that are currently evolving in the researchers' search; they have ranked *IoT* above *AI* and robotics. The meaning of Internet of things is itself a clear term. Although this is very evolving technology but there is critical shortage of research articles and related literature review. This new technology has drastically changed the style how we live, travel, jobs and entrepreneurship also. Even the industry is changing its form to from a term i.e. Industry 4.0 and all the information in this era is being stored in digital form. The Internet of Things enables us to connect 'things' to the Internet. These objects (items) can share information with one another and transmit data to other devices and systems. The information they share can be to other things as well as the environment they are in. Smart devices and machines can also share information about their internal state.

Why Is IoT so Important?

Over the past few years, IoT has become one of the most important technologies of the 21st century. Now that we can connect everyday objects—kitchen appliances, cars, thermostats, baby monitors—to the internet via embedded devices, seamless communication is possible between people, processes, and things. So, Internet of Things (IOT) can be called as network of related things that can share data through network without any human assistance. Thing can be anything from a solar panel to a small circuit, from an automobile to biochip livestock.

Nowadays, every business is motivated by IoT with hope of prospects of increasing profits and reduction in operating costs. In business IoT device implementation can provide the data and insights necessary to regulate workflows, visualize patterns, automation of processes, meet compliance requirements, and most importantly to fit in competitive business environment.

Types of network connections through which devices can connect can include Wi-Fi connections, Bluetooth connections etc. The internet connected device can also be called smart devices like refrigerators, washing machines, home security systems, webcams and printers, routers and smart

speaker devices. To transfer information devices use some protocols like IP that also used for web sharing over the internet.

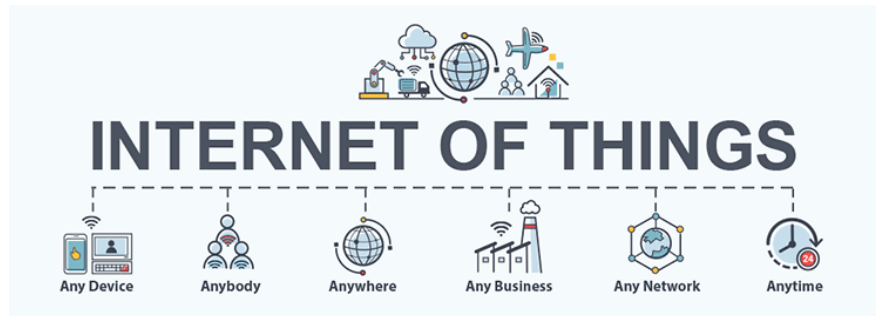


Figure 1: representing various applications of Internet of things (IOT)(source:[2])

Deployment of smart devices can enhance competitive advantage for businesses if used strategically. For example, by mining data about inventory level and financial issues and examine the consumer's behaviour. By tracking consumer's interests, a retailer can sell more products. Once a product is at consumer's place, this product can be used to alert the owner about upcoming service.

2. Literature Review:

Li et al. [3] have explained in their paper that from past few years IoT has evolved rapidly and its been trend of internet in coming years. In the article authors have surveyed the enabled technologies in internet from time to time. In particle role of SoA has been explored in IOT. Also internet things have been classified into various categories. Xia et al. [4] have admitted that they have witnessed new era of Internet of Things. According to authors radio frequency identification is a dispensable technology. It is concluded by Atzori et al. [5] that IoT should be considered as part of the overall Internet of the future. In the papers authors have explained that data is self-re-routed and every device is assigned an IPv6 to each IoT element that make it possible to reach from one node to other node. Another term that is coined in this paper is web squared that aimed at integrating web and sensing technologies.

From technical perspectives Wartmann et al. [6] have discussed the deployment of an Internet of Things (IoT) application needs the combination of a range of information and communication technologies in the form of hardware and software. Some of the most crucial hurdles for IoT innovators are currently experiencing in this context relate to device level energy supply, identification and addressing, Internet scalability, security and personal privacy, as well as standardization and harmonization.

The state-of-the-art has been presented by Akpakwu et al. [7] about IoT application requirements along with their associated communication technologies. The third generation collaborative project cellular-based low-power wide area plausible solutions for supporting and enabling the new service needs for Massive to Critical IoT use cases are explored in detail. What's next, 5G new radio advancements for new service needs and enabling technologies for the IoT are introduced.

According to Chui et al. [8] Internet of Things has great future, yet organizations, policies, and technical issues must be handled before these systems are widely embraced. Earlier adopters will require proving that the new sensor driven business models create superior value. Jing at al. [9] have compared traditional network, and concluded that IoT system stays in a more crucial environment with less number of resources and less network guards, thus lightweight solutions would always be our first choices for IoT security. Authors have also discussed security issues of IoT as an indivisible entity, and give some plausible solutions for these issues.

Roman et al. [10] have reviewed the current research state-of-the-art of 5G IoT, related technologies, and current research trends in IOT and challenges. This paper former elaborated the background and current trends on 5G and IoT. Later authors have analyzed the needs in 5G enabled IoT. Ray et al. [11] have contributed in research with survey that it summarized the current state-of-the-art of Internet of Things architectures in various domains systematically.

Alaa et al. [12] have conducted a search on different aspects like smart homes, related IoT apps. Authors have also surveyed on smart home apps using IoT, framework architectures to develop and process IoT smart home applications.

3. Architecture of IOT

Architecture is not much different or unique in terms of Internet of Things; the major difference is in their functional areas, performance and applications. However architecture consists of main four areas as mentioned following points and Figure 2.

- Sensors/Devices
- Gateways and Networks
- Cloud/Management Service Layer
- Application Layer

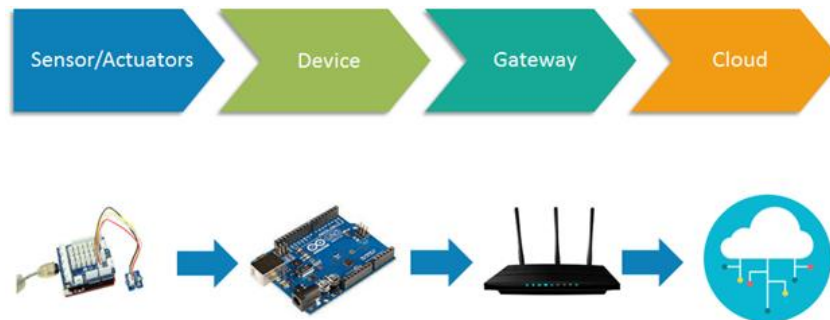


Figure 2: Architectural components of IOT

There are many layers of IoT architecture that provide functional capabilities and best alternatives to business organizations and other users. It is the basic architecture nowadays that leads to development and deliver the services over the network and is hope of future.

1. **Sensors/Actuators:** Sensors are the instruments that could generate, receive, deliver and execute the data over the communication network. To simplify, a sensor is device that could receive the input from external environment and could response according to that. Best examples are humidity control sensors, temperature sensors, IR sensors, RFID etc. Most of the sensors need connectivity through Gateways and sensors use LAN or PAN for connecting. Another inseparable part of sensors is actuators that convert data generated by smart devices to some action. Sensors are embedded in the internet of connection enabled devices.
2. **Gateways:** IoT need fast network like WiFi etc. (Local area network), GSM or 4G network etc. (Wide area networks) to transfer data as sensors and converter actuator generate huge amount of data. Gateways work in close connection with sensors, so these are crucial part of IoT architecture because massive volume of data must be handled for proper functioning. Gateways not only facilitate connections but also conversion of data generated by sensor to easily transferable usable format.

Security is the main concern in any type of data transfer. Gateways bear responsibility of two-way information flow with encryption algorithms and security tools. These tools help in reducing malware attacks.

3. **Devices:** These are the hardware and software devices that receive and transmit data to the cloud. Data is first captured by the devices embedded in the device. IoTs can provide significant benefits to huge Internet of Things (IoT). During the limited access and speed of cloud service, installing edge system can enhance the throughput and flexibility and even the response time.
4. **Data center/ Cloud:** clouds are the third party services that provide infrastructure for the analysis of data, controlling the devices and also for providing security. Through cloud service information is delivered to the end applications like healthcare systems, GPS systems, house held devices etc. we can consider cloud as brain of IoT.

4. Applications of IoT

A number of applications are designed based on sensor and IoT. Some of the applications in different field have been tried to explore in the following points and elaborated also in Table 1:

1. **Households and Wearable:** IoT is embedded in almost all the products like bands to wear on wrist to measure the calories burning rate and keeping record of health credentials. GPS tracker is the good example of IoT. Many companies like Samsung, Apple, and Google are inventing many devices that we can be wear to assist us in daily life.
There are many household devices that are based on temperature sensing like ACs, refrigerators, food processing devices. Many people instruct IoT through internet connection to set up the soothing environment before entering the home.
2. **Health:** IoT have helped tremendously in guiding patients and helping doctors to maintain a good health record of patients. Monitoring can be done in real time and even outside the hospital though devices connected to internet. These devices can put alarm in patient’s emergency conditions that can prevent any dangerous risk of life. Even in the hospitals IoT give many technically enabled instruments like hospital beds, special devices like oximeter, BP machines and body monitoring systems.
3. **Traffic monitoring systems:** The Internet of things (IoT) is very useful in the managing traffic of vehicles in metro cities which leads these cities to become smart cities. Through IoT enabled sensors huge data can be collected which help in managing traffic like traffic jams can be informed to drivers so they could take alternative way or preventing cohesion of vehicles by sensing the distance in two vehicles etc. Also various routes can be advised according to distance, time taken and measure of traffic on that particular road.
4. **Communication management in vehicles:** IoT help in installing sensors in different vehicles helps in interconnectivity between vehicle/driver and managers. Manager as well as driver can know about each other status and manager can guide about geographical position of the vehicle. Even alarms can ring by sensing any vital condition that could be faced by vehicle.

Table 1: Applications of Internet of Things (IoT)

Type	Application	location
Wearable	Health monitoring, help disable people, maintain body	Belts, shoes, bands to wear on wrist

	temperature	
Mobile devices	Sensor devices connected to internet like mobile health detection, step counting devices, monitor daily activities	PDAs, carry in hands or pockets
Robotics	Helps in households, carry daily activities, manage processing tasks	Robotics labs, homes
Smart homes/cities	Centralized home task that can be scheduled from outside also, Manage city's basic amenities like water supply etc.	Devices linked to centralised system
Environment	Monitoring og natural resources, protection of animal, livestock, disaster emergency alerts	Smart metering system, animal husbandries, mines etc.
industry	Many applications related to financial, business transaction over the internet and debit credit log files.	Within or outside the organisation
Traffic management	managing vehicle jams, traffic on roads, hurdles on different routes	On paths, traffic lights, through staellites

- 1. Agriculture:** Technology enabled farming is another example of Internet of Things. There are devices that assist farmers to know about quality and condition of soil to produce good and variety of crops. Many metrics that are crucial for farming e.g. Acidity level in soil, measure of required nutrients, moisture in soil and chemicals present in ground can be determined from by sensor enabled devices.
- 2. Hospitality:** Tourism is main occupation in any cities and countries. Visitors need a comfy place to live in and enjoy. So, hotel industry tries to provide some leisure experience to the tourist by providing some quality infrastructure enable by IoT like digital keys, AC systems, room ordering services etc. even roaming out can also be facilitated by sending key maps of locations.
- 3. Smart grid and energy saving:** The deployment of devices equipped with sensors that go from production points to different strategic points permit for good monitoring and control over communication network. If connections are being established between destination client and service provide, a huge amount of information can be fetched to make strategies, detect errors and recovery. These devices can also provide suggestions to clients about consumption of energy and provide solution to reduce its consumption.
- 4. Water supply:** One of the major advancement has been made in basic amenities using IoT. One example is of water meters that are equipped with come software and connected to internet for data sharing. The software help in collection analyze and understand the behavior of data. Also the consumers can check their usability metrics though portal in real time. Clients can even receive alerts about overflow, over-usage and presence of any leakage.
- 5. Maintenance management:** The area where installing and using of IoT technology is mostly used is maintenance management. A CMMS enabled tool that helps in manufacturing is obtained using

combinations of software and sensors. This tool can be used for extending life of assets in possession, increases its reliability also. Their applications can go unlimited if sensors got designed on particular maintenance of devices. These sensors also determine if metrics are out of range and need based maintenance is compulsory to run.

5. Conclusion

In this paper we have surveyed various aspects from understanding IoT to its deployment in various applications. The aim of this paper was not only to define internet of things but role of these instruments in many fields that may of us may unaware. From the above study we can conclude that internet of Things is most essential technology to deploy in today's life to assist in many ways. It can be explored more to reap maximum benefit in field of health system and mobility. In households although its matter of debate that it is making humans lazy but other ways its very helpful in managing many household work inside and outside which are time consuming and almost impossible to di in busy schedule. If Internet could be combined with block chain, some deep learning concept results can be par excellent. As RFID and WSN have become base of these technologies, people see very promising results out of these instruments. Also the fusion of the Nanotechnology to the Internet of Things have ellaboarted the 'Things' concept in the IoT higher range. As mentioned above, many IoT applications of people, organizations, basic amenities and versatile life have embedded. Nowadays IoT is hot topic of research that need much more experiments because it has wide perspectives.

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