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Internet of Things, Future Applications and Challenges

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Abstract: *Internet of Things (IoT) is a network which consists of electronic devices that could be any appliance or vehicles, anything which has connectivity and can share data by interaction and exchanging data. It promises a smart human life, by making communications between electronic objects, machines and all things together with every one who can access it, possible. Use of Sensors (wireless and wired both) to connect smart things (mobile or stable) to the Internet network structure. These IoT sensors will need an energy efficient and effective method for connectivity in near future, present methods are as Wi-Fi, Bluetooth, GSM, GPRS, 3G, and LTE. IoT-enabled things will be made accessible from any part of the world using Internet, even machines which are non-Internet enable would be made part of this network structure because of this our World will becomes smart in every aspect. IoT will bring out the new era of technological revolution in the field of Smart Homes, Elderly care, Transportation, Governance, Agriculture, Healthcare, Manufacturing, Energy Management and Environment Monitoring. In this paper we review this concept IoT, it's applications and the challenges faced while the implementation of the IoT.*

Keywords: *Internet of Things, IoT Applications, Internet, Smart Homes, Environment, Monitoring, Energy Management, Smart Transportation, Healthcare.*

I. INTRODUCTION

The Internet of Things (IoT), will be responsible for changing everything majorly our lives. In current world scenario Internet has an impact on everything education, communication, business, science, government, humanity, environment and much more. And in the near future it is suppose to increase tremendously, the Internet is one of the most important inventions in all of human history and with the phenomenon of the Internet of Things, internet becomes even more larger part in the plan of having a smart life in future. Internet of Things is the future technology of accessing the web, the devices would be enabled with intelligence to communicate with each other. These Subjects would be able to access information that has been composite by other subjects which have internet access. Figure 1 discuss that with the internet of things, anything and all things would be able to communicate to the internet at any time from any place over network to anyone, this will involve such as smart home and vehicles, to provide many services.

By developing the IoT technology, testing and deploying products it will be much close to implementing smart environments in the near future, data storage and communication services will be highly spreading and distributed people, devices, smart machines, surrounding objects connected with wireless or wired sensors, devices, RFID tagging is an ID system that uses small radio frequency identification devices for identification and tracking purposes, will create a highly decentralised resources interconnected by a dynamic network of networks. In IoT network, communication language would be able to exchange and make use of information or interoperable protocols, operating in diverse environments and platforms. In IoT all objects could play an engaging role in their connection to the Internet by forming smart environments.

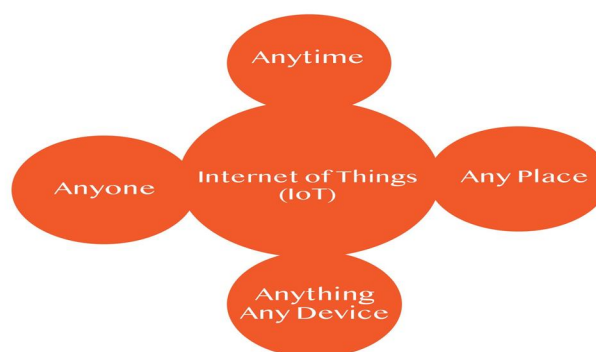


Figure 1: Internet of Things Basic Concept

II. INTERNET OF THINGS APPLICATIONS

Internet of things assures many exercises in human life, from making human life easier, fast, safe and smart. There are many ways in which IoT could benefit such as smart homes & cities, transportation, energy and smart environment.

- 1) *Smart Cities*: Seoul, New York, Tokyo, Shanghai, Singapore, Amsterdam, Dubai and many more major cities are supported by smart intelligent projects. These smart cities can be viewed as a cities of the future, and very soon, it will became possible to enter the IoT technology in these cities development. Smart cities require careful planning at every stage, with support of agreement from its governments and citizens to implement the internet of things technology in each and every aspect. By the IoT, cities could improvise at many levels, by improving infrastructure needs, enhancing better public transportation and reducing traffic congestion, and keeping cities citizen's safe, healthy and more engaged in the community as shown in Figure 2. By connecting all systems in the cities like administration, healthcare system, water, security monitoring systems, waste management systems and etc., in addition supporting people by access to the internet at every place so they could access the database of airports, railways, transportation, monitored under specified protocols, these cities will become smarter by introduction of the internet of things.



Figure2. Shows the IoT enabled smart city basic with benefits and sectors that would be affected

- 2) *Smart Home and Campus*: Wi-Fi's technologies in home automation has been used primarily due to electronic devices such as TVs, mobile devices, etc are usually supported by Wi-Fi. Many companies are considering developing platforms that integrate the building automation with entertainment, healthcare monitoring, energy monitoring and wireless sensor monitoring in the home and building environments. By the concept of the internet of things, homes and buildings may operate many devices and objects smartly, of the most interesting application of IoT in smart homes and buildings are smart lighting, smart environmental and media, air control and central heating, energy management and security as shown in Figure 3 below.



Figure 3. Smart Home Aspects

Figure3. Represents the idealistic Basic Smart Home with every function and service regulated by Iot

- 3) *Smart Energy Management*: Smart energy management is related to the information control and will be developed to have a smart grid. A smart grid that will integrate the information and communications technologies (ICTs) to the electricity network enabling a real time, two way communication channel between suppliers and consumers, which will create more progressive interaction on energy flow, which will help deliver electricity more efficiently and sustainably. The technology will be used for sensing and monitoring for power flows; digital communications and coordination with smart meters, creating a highly interactive, responsive electricity as shown in Figure 4 below.

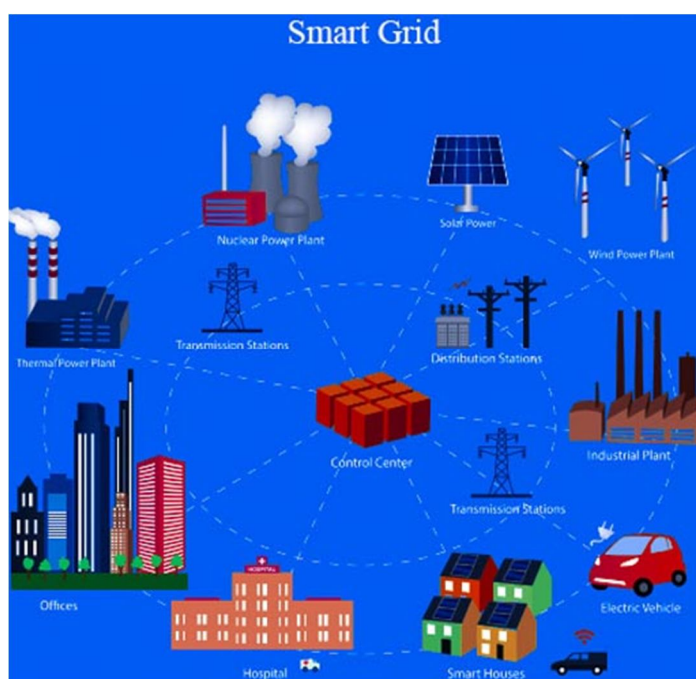


Figure4. Smart Energy Grid controlling the supply and consumption in all sectors through IoT

- 4) *Smart Health:* Hospitalised patients whose physiological status needs to be monitored continuously can be constantly monitored by using IoT technology. Using smart health sensors to collect complete physiological information and using cloud computing to store, analyse the information and then process the analysed data wirelessly for further review. Replacing the process of having a healthcare professional come by to check the patient's vital signs on regular intervals, instead providing an automated continuous flow of patient's information. Simultaneously improving the quality of care via constant attention and hence lowering the cost of care in addition to data collection and analysis as shown in Figure 5 below.



Figure 5

Figure5. Smart Health helping by storing your and analyzing in with respect to professional health cate advisors.

- 5) *Smart Transportation Aspects:* Smart transportation will deal with transportation analytics, transportation control, and vehicle connectivity. This represents the analysis of demand prediction and anomaly detection with the routing of vehicles, speed control in traffic management as shown in Figure 6. IoT would also be used in electric vehicles, which is an important way to reduce the fuel consumption, cost and the impact of global warming by decrease in pollution.

Figure6. Shows the smart Transportation using anormaly detection routing of vehicles and connpctivity with different vehicles

Smart Transportation



- 6) *Smart Environment Aspects:* IoT in Environment plays a major effect in human life, human beings, animals, birds, fishes and plants all are affected by unhealthy environment. Many research efforts has been made to solve the problems of environmental pollution and waste management. Creation of a healthy environment is not easily possible as of industries and transportation pollution, irresponsible human activities are the factors for this environmental damage. We need smart ways and new technologies for monitoring and managing our activities in order to assess the current condition of the environment. Collected data and management is needed to have an efficient resource consumption and in addition to decrease the industrial, transportation wastes.



Figure 7

Figure6. Shows a smart Balanced Environment For Everyone will prove beneficial Everywhere.

III. SOME INTERNET OF THINGS CHALLENGES

The fact that IoT applications and scenarios stated above sound very interesting, but there are some major challenges that need to overcome before the implementation of application of the Internet of Things. The expectation of technology at low cost with different number of regularly changing scenarios and smart objects challenges, are such as:

- 1) *Scalability:* Internet of Things has a bigger picture of implementation than the conventional Internet of computers, because of things are to communicate and cooperate within an open environment. Basic functionalities therefore need to function equally effectively in both small and huge scale network environments. The requirement of new functions and methods is in order to gain an efficient scalability operation.
- 2) *Self-Organizing:* Smart things need to establish connections at high speeds, and should be able to self organise and self configure themselves to suit their changing network environment.
- 3) *Data volumes:* Some scenarios of the IoT will involve collection of huge volumes of data on central network nodes or servers. This phenomena known as “big data” which requires many new technologies for storing, processing and management.
- 4) *Interoperability:* Conducting communication of different smart objects, common standards are necessary. As each type of smart objects in IoT will collect different information, data processing and communication capabilities that is technology to send and receive. Different smart objects would also have difference in energy storage and communicating bandwidth.
- 5) *Software complexity:* An immeasurable software infrastructure would be needed on the IoT structure and other backend servers in order to manage the smart objects and provide services to support them with minimal resources.
- 6) *Security and privacy:* Communications confidentiality, the authenticity, encryption of data, non-false message, other requirements would also be important in an IoT. The need to access or prevention of some private documentation from communicating with other things in IoT and the financial transactions involving mobile smart objects would need to be protected from hacking.
- 7) *Fault tolerance:* Objects in IoT are much more dynamic and mobile than the conventional internet computers, and they are updating rapidly in unexpected ways. Structuring an IoT in a work efficient manner would require dismissal on different steps and an ability to adapt automatically to regular changing real time conditions.

- 8) *Power supply*: Most of the smart things will tend to move around and will not have a connected power supply, so need of power from a self-sustaining energy source. Hopes are on future low power consuming processors, communicating embedded units that can perform with very less energy.
- 9) *Wireless communications*: Keeping mind the energy consumption, planted wireless communication methodologies such as GSM, Wi-Fi and Bluetooth devices are far less suitable for purpose; some new WPAN such as ZigBee (an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios) have narrower bandwidth, but they have very less power consumption.

IV. CONCLUSION

Web/Internet is updating and constantly changing the way of our lives, from interactions at virtual level in professional life and social relationships. The Internet of Things is the possible answer towards a communication dimension of another level. It will prove right the notion of “anytime, anyone, anyplace, anything” in the field of digital interactions. I have surveyed about different aspects of the IoT with its applications and the challenges IoT faces before being fully implemented, in this paper. Current Technologies give us the Idea for the possibilities in future as we lack the energy, technology and resources for IoT.

In the coming years as with the changing technology we can expect the IoT is not far behind.

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