

Internet of Things (IOT)

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Abstract: The Internet of Things (IoT) is a system which is related to computing devices, mechanical, digital machines, objects, animals or people and having the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS), micro services and the internet. Internet of Things (IoT) used to create smart environments that make energy, transport, cities and many other areas more intelligent. The goal of the internet of things is new revolution of internet. According to industry analyst from IDC, the installed base for the internet of Things will be grow to approximately 212 billion devices by 2020, a number that includes 30 billion connected devices.

Keywords: Internet of Things (IoT), RFID, Big data, GPS.

I. Introduction

These paper includes the use of IoT (Internet of things), the IoT development in the every field that will make more smarter to the particular and make the future better using the smart devices like Internet-enabled appliances, home automation components, and energy management devices which are moving us toward a vision of the “smart home” offering more security and energy efficiency. Including some of other personal IoT devices like wearable fitness, health monitoring devices and network enabled medical devices which are transforming the way of healthcare services are delivered. This technology is more beneficial for improvement of day to day life more fastly, also improves the quality of life. Internet of Things continues to develop with the related technologies like Cloud computing, Future Internet, Big Data, Robotics and Semantic technologies.[1]

II. Internet of Things Vision

Internet of Things (IoT) is a concept that includes the active presence in the many variety of things/objects through which wireless, wired connections and unique addressing schemes are able to interact with each other and cooperate with other things /objects to create new applications/services and reach common goals and the more effective use of Internet of Things(IoT).The main goal using behind the Internet of Things is to enable things to be connected anytime, anyplace, with anything by using any one ideal path/network or any service which connects to Internet of Things(IoT). Internet of Things (IoT)is an new revolution of the Internet in the real world. Objects are used to make them more recognizable and for that they can communicate information about themselves and they can access information that has been aggregated by other things or they can be components of complex services.

In the future IoT becomes more useful in fact in the year 2020, Internet connected devices are expected to number between 26 billion and 50 billion. For every Internet-connected PC or handset there will be 5–10 other types of devices old with native Internet connectivity. Following figure shows the fast growing ratio of Internet of Things (IoT) and in future how much it will be used by on the planet. [1]

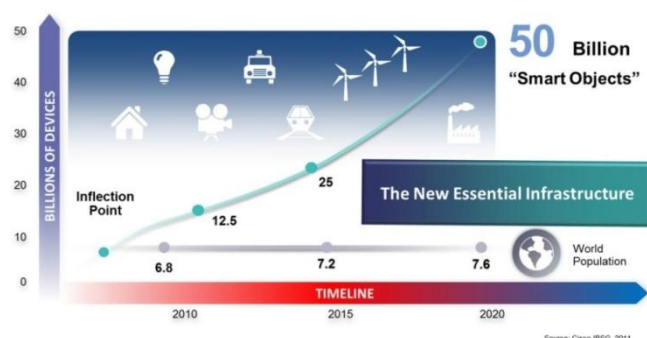


Figure: Internet-connected devices and the future evolution[1]

Basically Internet of Things (IoT) developed from convergence of wireless technology so that they will provides the access to information through the wireless and wired broadband connection. The Internet Consumer, Industrial Internet and Business make synergize of Internet of Things (IoT). The convergence of Internet of Things (IoT) creates the open, global network for connecting people, data, and things. The coverage of Internet of Thing (IoT) connect the cloud to intelligent things that sense and transmit a broad array of data, which helps creating services, level of connectivity and analytical intelligence.

The Internet of Things is much more useful in manufacturing which makes smart manufacturing area. The Internet of Things (IoT) and Services makes to create networks which are in the entire manufacturing process that convert factories into a smart environment. On the basis of the survey early adopters of IOT has revealed which devices are the customers more likely to use in the coming years. Following figure shows the Smart Appliances like thermostat, smart refrigerator to name a few are most liked by the customers and are seem to change the way we operate.

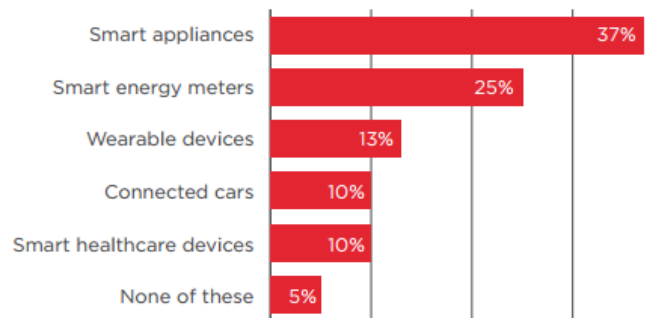


Figure: GSMA Report [2]

In future the there will be more impact of IoT on the economy and from the information as per the Cisco report IoT will generate \$14.4 trillion in value across all industries in the next decade. Yes, you are thinking correctly IoT will bring a wave, nobody can foresee.[2]

III. Architecture of Internet of Things

The IoT architecture consist of several layers and on the basis of that we can make the implementation of IoT from the edge technology layer at the bottom to the application layer at the top. The IoT layered architecture is basically designed in a way that can meet there requirements of various industries, enterprises, societies, institutes, governments etc. Following figure shows the generic layered architecture for IoT. The architecture having two distinct parts like network which indicates the services for the IoT and the another one is Edge-technology data capture and networks with the Internet layer in between to serve the purpose of a common media for communication. The two lower layers contribute to data capturing while the two layers at the top is responsible for data utilization in applications.

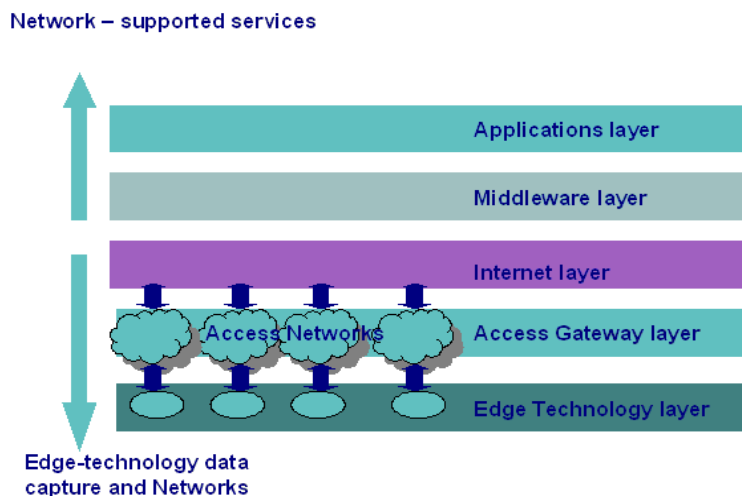


Fig. Layered architecture of Internet of Things

The use and functionalities of the various layers are discussed briefly in the following:

3.1 Edge layer:

This hardware layer of IoT architecture consists of RFID tags, embedded systems, sensor networks, and soft sensors in different forms. These all entities are the primary data sensors and which are useful in the field of IoT for different purposes. Such as ‘RFID tags’ are used for identification and information storage, sensor networks for the collection of information, embedded edge processors for information processing, communication, control and actuation.

3.2 Access gateway layer:

The first stage of data handling happens at this layer. It takes care of message routing, publishing and subscribing and also performs cross platform communication, if required.

3.3 Middleware layer:

This is one of the most critical layers that operate in bidirectional mode. It acts as an interface between the hardware layer at the bottom and the application layer at the top. It is responsible for critical functions such as device management and information management and also takes care of issues like data filtering, data aggregation, semantic analysis, access control, information discovery such as EPC (Electronic Product Code) in information service and ONS (Object Naming Service).

3.4 Application layer:

This layer at the top of the stack and it is responsible for delivery of various applications to different users in IoT. This layer includes the applications from different industries such as: manufacturing, logistics, retail, environment, public safety, healthcare, food and drug etc. With the increasing maturity of RFID technology, numerous applications are evolving which will be under the umbrella of IoT.[3]

IV. Applications of IOT

As we know the IoT is most useful in in different areas for different purposes. I listed some of the areas where IoT will make our lives more smart and some of the companies are preparing to surprise you with smart devices. The major objectives for IoT are the creation of smart environments/spaces and self-aware things (for example: smart transport, products, cities, buildings, rural areas, energy, health, living, etc.) for climate, food, energy, mobility, digital society and health applications”.

The IoT applications are used covers “smart” environments in the areas such as: Factory, Supply chain, Emergency, Healthcare, User interaction, Transportation, Building, City, Lifestyle, Retail, Agriculture, Culture and tourism, Environment and Energy.

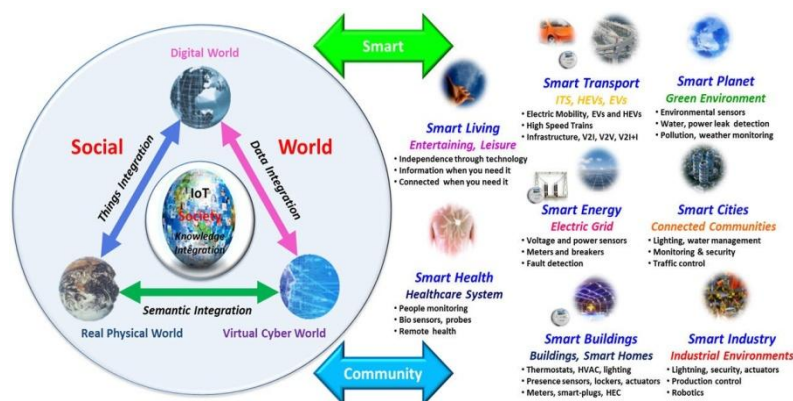


Figure: Internet of Things (IoT) in the context of Smart Environments and Applications [1]

4.1 Smart Cities:

A smart city is the city which will monitors and integrates conditions of critical infrastructure including roads, bridges, tunnels, rail/subways, airports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens. With the help of IoT we can manage natural challenges as well as man-made challenges to the system can be focused. With advanced monitoring systems and built-in smart sensors, data can be collected and evaluated in real time.

For smart city implementation IoT plays an important role with the help of IoT we can make easily connection between communities. For example, resources can be committed prior to a water main break, salt spreading crews dispatched only when a specific bridge has icing conditions, and use of inspectors reduced by knowing condition of life of all structures.

If we implemented IoT for smart city project it will be more beneficial and time saving. If we think about in the long term Smart cities vision, systems and structures will monitor their own conditions and carry out self-repair, as needed. The physical environment, air, water, and surrounding green spaces will be monitored in non-obtrusive ways for optimal quality, thus creating an enhanced living and working Environment that is clean, efficient, and secure and that offers these advantages within the framework of the most effective use of all resources. A smart city is a developed urban area that creates sustainable economic development and high quality of life by excelling in multiple key areas: economy, mobility, environment, people, living, and government [1]

4.2 Smart Energy and the Smart Grid:

Now days we must need to save our energy resources for future use because as we noticed that future energy supply should no longer be based on fossil resources. The smart grid concept is becoming more popular in all over the world and also more useful. Energy supply needs to be based largely on various renewable resources. Increasingly focus must be directed to our energy consumption behaviour.

Future energy grids are characterized by a high number of distributed small and medium sized energy sources and power plants which may be combined virtually ad hoc to virtual power plants; moreover in the case of energy outages or disasters certain areas may be isolated from the grid and supplied from within by internal energy sources such as photo voltaic on the roofs, block heat and power plants or energy storages of a residential area (“islanding”).

The developing Smart Grid is expected to implement a new concept of transmission network which is able to efficiently route the energy which is produced from both concentrated and distributed plants to the final user with high security and quality of supply standards. Therefore the Smart Grid is expected to be the implementation of a kind of “Internet” in which the energy packet is managed similarly to the data packet - across routers and gateways which autonomously can decide the best pathway for the packet to reach its destination with the best integrity levels. [1]

4.3 Smart Mobility and Transport:

With the connection of internet to the vehicles gives rise to a wealth of new possibilities and applications which bring new functionalities to the individuals and the making of transport easier and safer. Now days self-driving vehicles are in the prototype phase it will make a new revolution in the smart transportation industry. With the IoT we can apply the concept of connected cars which is able to optimize it’s own operation, maintenance as well as comfort of passengers using on board sensors and internet connectivity. Automotive visions chips are also useful concept in smart transportation which will help to understand the environment around them by detecting traffic lights, collisions, drowsy drivers, and road lane markings.

Those tasks initially are more the sort of thing that would help a driver in unusual circumstances rather than take over full time. The concept of Internet of Vehicles (IoV) is the next step for future smart transportation and mobility applications and requires creating new mobile ecosystems based on trust, security and convenience to mobile/contactless services and transportation applications in order to ensure security, mobility and convenience to consumer-centric transactions and services.[1]

4.4 Smart Home, Smart Buildings and Infrastructure

In the home automation Wi-Fi plays an important role and it will connect peoples with the help of smart devices (smart phones, tablets, etc.). The use of energy in home can be produced with the help of IoT. IoT applications using sensors to collect information about operating conditions combined with cloud hosted analytics software that analyse disparate data points will help facility managers become far more proactive about managing buildings at peak efficiency.

Using the Internet together with energy management systems also offers an opportunity to access a buildings’ energy information and control systems from a laptop or a Smartphone placed anywhere in the world. This has a huge potential for providing the managers, owners and inhabitants of buildings with energy consumption feedback and the ability to act on that information.

In the future ‘Internet of Things’ in the Intelligent Building Management Systems can be considered part of a much larger information system.

This system is used in buildings to manage energy use and energy utilization to maintain the building systems. It is based on the infrastructure of the existing Intranets and the Internet, and therefore utilises the same standards as other IT devices.[1]

4.5 Smart Factory and Smart Manufacturing

The role of Internet of Things (IoT) will become more important to access devices and machines in manufacturing industry for making smart industry. The IoT will connect the factory to a whole new range of applications, which run around the production. This could range from connecting the factory to the smart grid, sharing the production facility as a service or allowing more agility and flexibility within the production systems themselves. In this sense, the production system could be considered one of the many Internets of Things (IoT), where a new ecosystem for smarter and more efficient production could be defined.

Enterprises are making use of the huge amount of data available, business analytics, cloud services, enterprise mobility and many others to improve the way businesses are being conducted. These technologies include big data and business analytics software, cloud services, embedded technology, sensor networks / sensing technology, RFID, GPS, M2M, mobility, security and ID recognition technology, wireless network and standardisation.

4.6 Smart Health:

IoT is useful in medical field. When any patient is hospitalized whose status requires close attention can be constantly monitor educing IoT-driven, non-invasive monitoring. This requires sensors to collect comprehensive physiological information and uses gateways and the cloud to analyse and store the information and then send the analysed data wirelessly to caregivers for further analysis and review. These techniques help to improve the quality of care through constant attention and lower the cost of care by eliminating the need for a care giver to actively engage in data collection and analysis. In addition the technology can be used for remote monitoring using small, wireless solutions connected through the IoT. These solutions can be used to securely capture patient health data from a variety of sensors, apply complex algorithms to analyse the data and then share it through wireless connectivity with medical professionals who can make appropriate health recommendations.

The main objective is to enhance life quality for people and to provide them better services and for that the medical field will connect to IT field using the technique IoT. Using IoT we can reduces unnecessary cost. Using IoT we can provide the right medical support at the right time. The IoT plays an important role in healthcare applications, from managing chronic diseases at one end of the spectrum to preventing disease at the other.

4.7 Smart Logistics and Retail

The Internet of Things creates more opportunities to the people who want to achieve more benefits in their sector. It will give the efficient solutions in the retail sector by addressing the right person, right content at the right time and right place. Retailers are also uses more technical devices to optimize internally. The Big data is also an evolution in IoT which helps retailer to manage their business. [1]

V. Challenges of IOT

5.1 Security Concerns:

Now days so many interconnected devices out there in market and more to come in the near future, for that security concern matters more. If we poorly secured our IOT devices then the cyber attackers will use them as entry points to cause harm to other devices in the network. This will lose our personal data to the public and the entire trust factor between internet connected devices and people using them will deteriorate. For that we need to provide more security for our IoT devices and then trust factor between internet and connected devices will be maintained.

5.2 Privacy issues:

The connected devices to the internet increased constantly. These devices collect user data without their permission, analyse them for purposes only known to the parent company. The IOT devices lead people to trust these devices with collection of their personal data without understanding the future implications.

5.3 Inter-operability standard issues:

Basically the information exchange should take place between all interconnected IoT devices. But the actual process of that is more complex and it will depend on the various levels of communication protocol.

VI. Conclusion

In short we can say that in the upcoming years IoT will cover more areas and more useful in our day-to-day lives and it will help to improve our lifestyle through various technologies and applications. IoT will become the utility with increased communication, sophistication in sensing and it may create the knowledge from vast amount of data. There are so many usefulness of IoT applications into all the domains including education, governance, mining, medical, manufacturing, industrial, transportation etc.

IoT is the very ideal technology to influence on such domain which is going to develop new technologies and the some revolutionary apps, the apps may be created in the mobile system so that IoT may become the evolution in the next generation of mobile system.

Sometime the security issues may arrives but if we properly work on it then there may be not challenge for us and it will be a revolutionary step in the development of IoT.

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