



A STUDY ON INTERNET OF THINGS APPLICATIONS AND RELATED ISSUES

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Abstract:

Day by day Internet of Things (IoT) has gained a great attention from research community because of the importance of IoT technology in human life. IoT is a smart system which consists of different type of sensors and real world application connected with each other through internet via wired or wireless network structure. The IoT makes the world smart in every aspects means IoT gives the information regarding the surrounding condition of things with the help of technology i.e. smart home, smart cities, smart transportation, smart industries, smart agriculture and smart environment etc. In this paper we study a different concept of IoT, various applications, Issues regarding IoT and Future Scope of IoT which will give the appropriate guidance and motivation to the research community to do the research in this field.

Key Words: IoT, Smart Cities, Smart Environment, Smart Industries & Smart Healthcare.

1. Introduction:

The IoT has the great potential to impact on our life how we live and also how we work i.e. IoT gives the smart life to the human beings [1]. Already researcher and common people know that the power and importance of internet, on the other hand IoT means Internet of Things is the latest technology to access the internet to make our life smart in every aspect [2-4]. The IoT creates an intelligent, invisible network that can be sensed, controlled and programmed. IoT based smart products based on embedded technology that allows them to communicate, directly or indirectly, with each other. The Internet means it is basically a rebranding of Human to Human communication to the Machine to Machine (M2M) communication of smart life as shown in Figure 1 [3, 4]. In the year of 1990s, Internet connectivity was reproduced in enterprise and consumer markets, but was still limited in its use because of the low performance of the network interconnect. In the year of 2000s, Internet connectivity became the norm for many applications and today it is expected an IoT as part of daily life to access the information. The true promise of the IoT is just at start to be realized – when invisible technology operates behind the scenes dynamically responding to how we want “things” to act.



Figure 1: Evolution of IoT

By the Internet of Things, smart systems recognize themselves and they can communicate information to the related person because smart systems obtain intelligence behavior [5-7]. With the help of Internet of Things, anything will be able to be communicated to the internet at any time from any place to provide any services by any network to anyone. This is the right time to connect with IoT and build our IoT systems in different areas because of more than 20 billion devices are connected in the world in 2017. The IoT is expecting 76 billion devices will be connected through internet by 2025 as shown in Figure 2 [8-9]. Innovative companies are adopting IoT strategy and technology to rethink their products and services to make this world smart and beautiful [10].

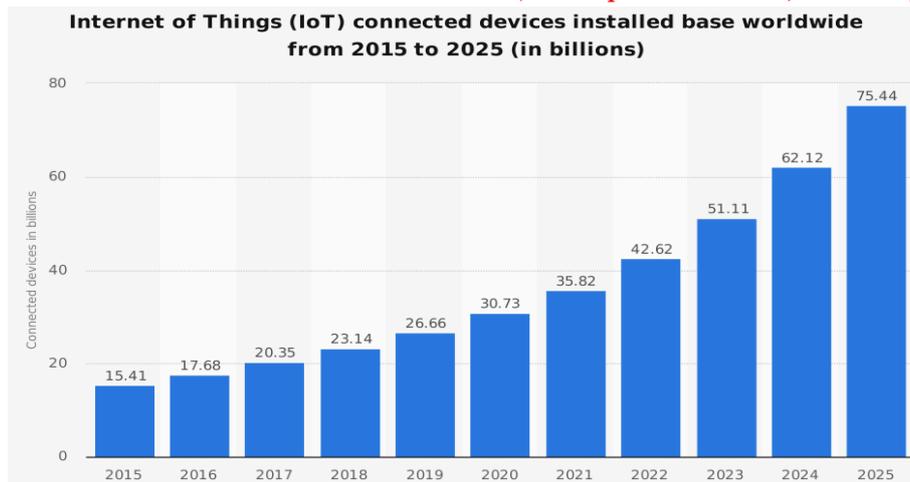


Figure 2: Internet of Things Growth from 2015-2025

By developing the IoT technology, testing and deploying products it will be much close to implementing smart environments by 2025 [11-14]. In the near future, storage and communication services will be highly in demand. The aim of this paper is to give the information regarding recent trends of Internet of Things. The paper is organized as follows: Section II presents the working of Internet of Things. Section III describes the applications of Internet of Things. Section IV Challenges and Various Issues on Internet of Things. Section V presents the conclusion based on the study carried out on Internet of Things.

2. How IoT Works:

Internet of Things is a technology through which life style of user will be changed means internet has changed the way we work & communicate with people through World Wide Web. The goal of the IoT is to take this connectivity to next level by connecting various devices to the internet [13-14]. The research community has also realized that this IoT ecosystem has vast scope in the areas of Home Automation, Automotive, Industries, Banking Sectors, Retail, Healthcare, Environment, Agriculture and Transportation [15]. To understand the IoT concepts as it would be the building blocks of different technologies, it is necessary to understand the steps involved in this process.

- ✓ Sensors & Actuators Technology: Sensors and Actuators is the first step of smart communication through which various types of information i.e. ranging from location, Weather/Environment conditions, soil parameters, Grid parameters, transformation information, and health information can transmit to IoT Gateway.

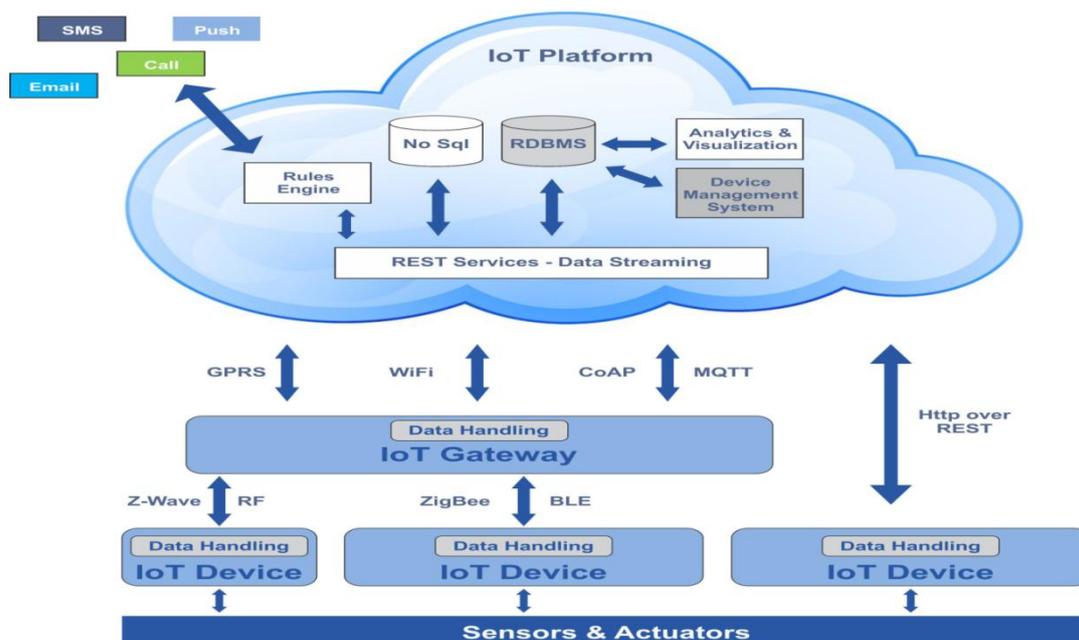


Figure 3: Building Blocks of Internet of Things

- ✓ IoT Gateways: IoT Gateways is working as bridge between the internal network of sensor nodes with the external Internet or World Wide Web. The IoT gateway is collecting the data from sensor nodes &

transmitting it to the internet infrastructure. IoT Gateway development defines the success of an IoT implementation.

- ✓ Cloud/Server infrastructure & Big Data: The data transmitted through gateway is stored & processed securely within the cloud infrastructure using Big Data analytics engine. This processed data is then used to perform intelligent actions that make all our devices 'Smart Devices'.
- ✓ End-User Mobile Apps: Final step of this communication is End-User Mobile Apps and these apps will help end users to control & monitor their devices from remote locations. These apps push the important information on your hand-held devices & help to send commands to your Smart Devices.

3. Internet of Things Applications:

Internet of things plays an important role to make life more smart, safe and easier. There are many applications such as smart cities, homes, transportation, agriculture, retails, banking, energy and smart environment etc as shown in Figure 4. However, the application of the Internet of Things (IoT) is not only restricted to these areas [17-18]. Other specialized use cases of the IoT may also exist. Based on the application domain, IoT products can be classified into different categories:

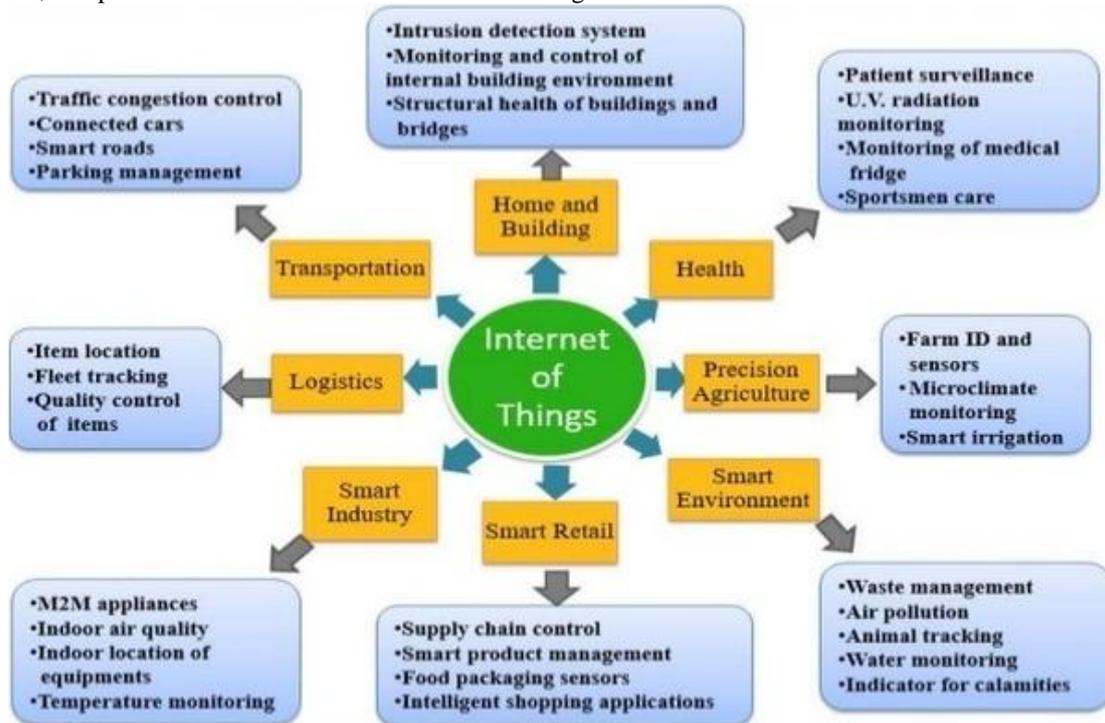


Figure 4: Various Applications of Internet of Things

- ✓ Home and Buildings: Smart Home is the integration of technology and services through home networking for a better quality of living. An IoT technology related to Smart Home are emerging. Home automation (also known as smart home devices) such as the control and automation of lighting, ventilation, air conditioning (HVAC), robotic vacuums, air purifiers, ovens or refrigerators that use Wi-Fi for remote monitoring as shown in Figure 5. Due to the large market potential, more and more smart home solutions are making their way into the market.

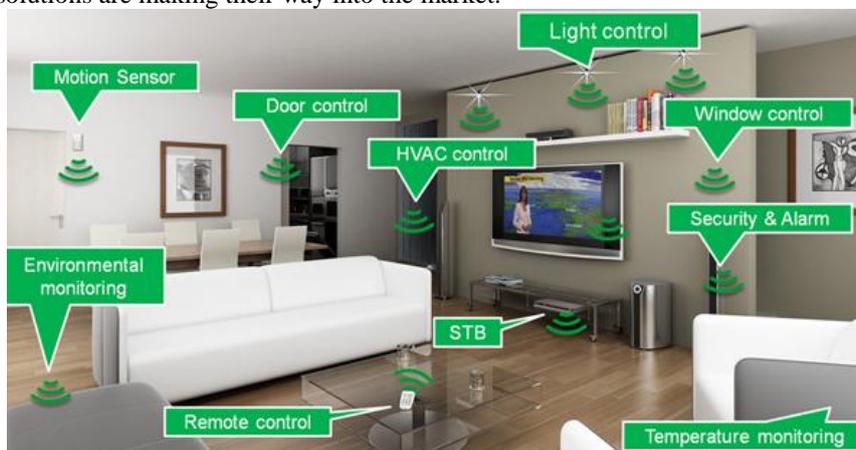


Figure 5: Smart Home with IoT

- ✓ Medical and Healthcare: The concept of connected healthcare system and smart medical devices bears enormous potential not just for companies, but also for the well-being of people in general [19]. The IoT devices can facilitate remote health monitoring and emergency notification systems such as blood pressure and heart rate monitors etc as shown in Figure 6. Research community shows IoT in healthcare will be massive in coming years.

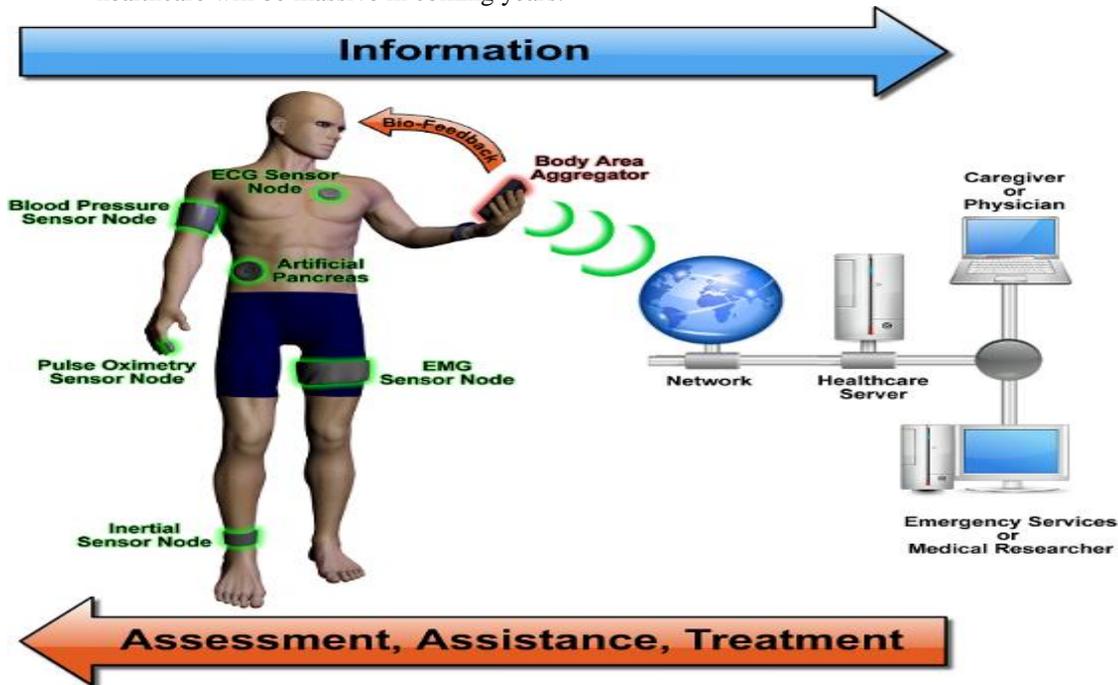


Figure 6: Medical and Healthcare with IoT

- ✓ Agriculture: With the continuous increase in world's population, demand for food supply is extremely raised. Governments are helping farmers to use advanced techniques and research to increase food production [2, 6, 9, 20]. Smart farming is one of the fastest growing fields in IoT. Farmers are using meaningful insights from the data to yield better return on investment. According to Figure 7, Sensing for soil moisture and nutrients, controlling water usage for plant growth and determining custom fertilizer are some simple applications of IoT.



Figure 7: Smart Agriculture with IoT

- ✓ Environment: The Smart Environment in a city comprises of Smart Governance, Smart Mobility, Smart Utilities, and Smart Buildings. Services enabled by the IoT paradigm in smart city environment might range from Monitoring health building, Management of waste, Monitoring air quality, Monitoring noise, Traffic congestion ,smart parking , smart lightning, water quality monitoring, natural disaster monitoring [3,6,21] ,smart farming and many more as shown in Figure 8.



Figure 8: Smart Environment Monitoring with IoT

- ✓ Retail: The growth and future of IoT in the retail sector is enormous. IoT provides an opportunity to retailers to connect with the customers to enhance the in-store experience as shown in Figure 9. Smart phones will be the way for retailers to remain connected with their consumers even out of store [4, 7, 13]. Interacting through Smart phones, retailers serve their consumers better. They can also track consumer's path through a store and improve store layout and place premium products in high traffic areas.



Figure 9: Smart Retail Sector with IoT

- ✓ Industries: Industrial Internet is the future scope of the world because it is empowering industrial engineering with sensors, software and big data analytics to create brilliant machines [5,9,17]. Smart machines are more accurate and consistent than humans in communicating through data hence inefficiencies and problems will be avoided easily. According to Jeff Immelt, CEO, GE Electric the improvement industry productivity will generate \$10 trillion to \$15 trillion in GDP worldwide over next 15 years.



Figure 10: Smart Industry with IoT

- ✓ Smart Wearable: Smart wearable are networked devices that can collect data, track activities, and customize experiences to user's needs and desires [6, 8]. Wearable solutions are designed for a variety of functions as well as to be worn on a different of part of body such as the head, eyes, wrist, waist, hands, fingers, legs or embedded into different element of attire as shown in Figure 11.



Figure 11: Smart Wearable with IoT

Transportations: The automotive digital technology has focused on optimizing vehicles internal functions. But now, this attention is growing towards enhancing the Transport experience [2,3]. A connected car or any transportation is a vehicle which is able to optimize it's own operation, maintenance as well as comfort of passengers using onboard sensors and internet connectivity. Most large auto makers as well as some brave startups are working on transportation solutions. Major brands like Tesla, BMW, Apple, Google are working on bringing the next revolution in automobiles.

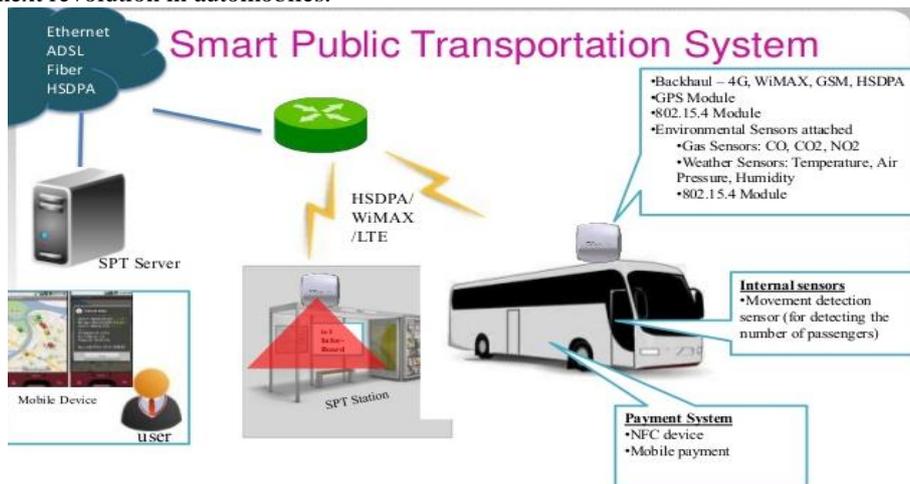


Figure 12: Smart Transpotations with IoT

4. Challenges in Developing IOT:

This section describes the some of the major challenges as shown in Figure 13 that need to be resolved in order to build the IoT [17-21]. The solutions for these issues need to come from technological, social, legal, financial, and business backgrounds in order to receive wide acceptance by the IoT community.



Figure 13: Various Challenges and Issues with IoT

- ✓ Security: As the IoT connects more devices together, it provides more decentralized entry points for malware. Less expensive devices that are in physically compromised locales are more subject to tampering. More layers of software, integration middleware, APIs, machine-to-machine communication, etc. create more complexity and new security risks. Expect to see many different techniques and vendors addressing these issues with policy-driven approaches to security and provisioning.
- ✓ Trust and Privacy: With remote sensors and monitoring a core use case for the IoT, there will be heightened sensitivity to controlling access and ownership of data. Compliance will continue to be a major issue in medical and assisted-living applications, which could have life and death ramifications. New compliance frameworks to address the IoT's unique issues will evolve.
- ✓ Standards and interoperability: Standards are important in creating markets for new technologies. If devices from different manufacturers do not use the same standards, interoperability will be more difficult, requiring extra gateways to translate from one standard to another.
- ✓ Complexity, Confusion and Integration Issues: With multiple platforms, numerous protocols and large numbers of APIs, IoT systems integration and testing will be a challenge to say the least. The confusion around evolving standards is almost sure to slow adoption.
- ✓ Evolving Architectures, Protocol Wars and Competing Standards: With so many players involved with the IoT, there are bound to be ongoing turf wars as legacy companies seek to protect their proprietary systems advantages and open systems proponents try to set new standards. There may be multiple standards that evolve based on different requirements determined by device class, power requirements, capabilities and uses. This presents opportunities for platform vendors and open source advocates to contribute and influence future standards.

7. Conclusion:

The scope and potential of the IoT appears to be enormous, despite the range of issues that need to be addressed. Based on the various application and various challenges in IOT it can be considered that new research problems arise due to the large scale of devices, the connection of the physical and internet worlds, the openness of the systems of systems, and continuing problems of privacy and security.

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