Iot: Issues and applications

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Abstract

The internet of Things (IoT) is a new paradigm that has changed the traditional way of living into a high tech life style. Smart city, smart homes, pollution control, energy saving, smart transportation, smart industries are such transformations due to IoT. A lot of crucial research studies and investigations have been done in order to enhance the technology through IoT. However, there are still a lot of challenges and issues that need to be addressed to achieve the full potential of IoT. These challenges and issues must be considered from various aspects of IoT such as applications, challenges, enabling technologies, social and environmental impacts etc. The main goal of this review article is to provide a detailed discussion from both technological and social perspective. The article discusses different challenges and key issues of IoT, architecture and important application domains. Also, the article bring into light the existing literature and illustrated their contribution in different aspects of IoT. Moreover, the importance of big data and its analysis with respect to IoT has been discussed. This article would help the readers and researcher to understand the IoT and its applicability to the real world.

I.   Introduction

The Internet of Things (IoT) is an emerging paradigm that enables the communication between electronic devices and sensors through the internet in order to facilitate our lives. IoT use smart devices and internet to provide innovative solutions to various challenges and issues related to various business, governmental and public/private industries across the world [1]. IoT is progressively becoming an important aspect of our life that can be sensed everywhere around us. In whole, IoT is an innovation that puts together extensive variety of smart systems, frameworks and intelligent devices and sensors (Fig. 1). Moreover, it takes advantage of quantum and nanotechnology in terms of storage, sensing and processing speed which were not conceivable beforehand [2]. Extensive research studies have been done and available in terms of scientific articles, press reports both on internet and in the form of printed materials to illustrate the potential effectiveness and applicability of IoT transformations. It could be utilized as a preparatory work before making novel innovative business plans while considering the security, assurance and interoperability.

General architecture of IoT

A great transformation can be observed in our daily routine life along with the increasing involvement of IoT devices and technology. One such development of IoT is the concept of Smart Home Systems (SHS) and appliances that consist of internet based devices, automation system for homes and reliable energy management system [3]. Besides, another important achievement of IoT is Smart Health Sensing system (SHSS). SHSS incorporates small intelligent equipment and devices to support the health of the human being. These devices can be used both indoors and outdoors to check and monitor the different health issues and fitness level or the amount of calories burned in the fitness center etc. Also, it is being used to monitor the critical health conditions in the hospitals and trauma centers as well. Hence, it has changed the entire scenario of the medical domain by facilitating it with high technology and smart devices [4, 5]. Moreover, IoT developers and researchers are actively involved to uplift the life style of the disabled and senior age group people. IoT has shown a drastic performance in this area and has provided a new direction for the normal life of such people. As these devices and equipment are very cost effective in terms of development cost and easily available within a normal price range, hence most of the people are availing them [6]. Thanks to IoT, as they can live a normal life. Another important aspect of our life is transportation. IoT has brought up some new advancements to make it more efficient, comfortable and reliable. Intelligent sensors, drone devices are now controlling the traffic at different signalized intersections across

major cities. In addition, vehicles are being launched in markets with pre-installed sensing devices that are able to sense the upcoming heavy traffic congestions on the map and may suggest you another route with low traffic congestion [7]. Therefore IoT has a lot to serve in various aspects of life and technology. We may conclude that IoT has a lot of scope both in terms of technology enhancement and facilitate the humankind.

IoT has also shown its importance and potential in the economic and industrial growth of a developing region. Also, in trade and stock exchange market, it is being considered as a revolutionary step. However, security of data and information is an important concern and highly desirable, which is a major challenging issue to deal with [5]. Internet being a largest source of security threats and cyber-attacks has opened the various doors for hackers and thus made the data and information insecure. However, IoT is committed to provide the best possible solutions to deal with security issues of data and information. Hence, the most important concern of IoT in trade and economy is security. Therefore, the development of a secure path for collaboration between social networks and privacy concerns is a hot topic in IoT and IoT developers are working hard for this.

II. Literature survey

IoT has a multidisciplinary vision to provide its benefit to several domains such as environmental, industrial, public/private, medical, transportation etc. Different researchers have explained the IoT differently with respect to specific interests and aspects. The potential and power of IoT can be seen in several application domains.

Some of the potential application domains of IoT
Various important IoT projects have taken charge over the market in last few years. It can be seen that American continent are contributing more in the health care and smart supply chain projects whereas contribution of European continent is more in the smart city projects [8].
Global distribution of IoT projects among America (USA, South America and Canada), Europe and APAC (Asia and Pacific region) [8]
Industry, smart city, smart energy and smart vehicle based IoT projects have a big market share in comparison to others.

Global share of IoT projects across the world [8]
Smart city is one of the trendy application areas of IoT that incorporates smart homes as well. Smart home consists of IoT enabled home

appliances, air-conditioning/heating system, television, audio/video streaming devices, and security systems which are communicating with each other in order to provide best comfort, security and reduced energy consumption. All this communication takes place through IoT based central control unit using Internet. The concept of smart city gained popularity in the last decade and attracted a lot of research activities [9]. The smart home business economy is about to cross the 100 billion dollars by 2022 [10]. Smart home does not only provide the in-house comfort but also benefits the house owner in cost cutting in several aspects i.e. low energy consumption will results in comparatively lower electricity bill. Besides smart homes, another category that comes within smart city is smart vehicles. Modern cars are equipped with intelligent devices and sensors that control most of the components from the headlights of the car to the engine [11]. The IoT is committed towards developing a new smart car systems that incorporates wireless communication between car-to-car and car-to-driver to ensure predictive maintenance with comfortable and safe driving experience [12].

Khajenasiri et al. [10] performed a survey on the IoT solutions for smart energy control to benefit the smart city applications. They stated that at present IoT has been deployed in very few application areas to serve the technology and people. The scope of IoT is very wide and in near future IoT is able to capture almost all application areas. They mentioned that energy saving is one of the important part of the society and IoT can assist in developing a smart energy control system that will save both energy and money. They described an IoT architecture with respect to smart city concept. The authors also discussed that one of the challenging task in achieving this is the immaturity of IoT hardware and software. They suggested that these issues must be resolved to ensure a reliable, efficient and user friendly IoT system.

Alavi et al. [13] addressed the urbanization issue in the cities. The movement of people from rural to urban atmosphere resulting in growing population of the cities. Therefore, there is a need to provide smart solutions for mobility, energy, healthcare and infrastructure. Smart city is one of the important application areas for IoT developers. It explores several issues such as traffic management, air quality management, public safety solutions, smart parking, smart lightning and smart waste collection (Fig. 5). They mentioned that IoT is working hard to tackle these challenging issues. The need for improved smart city infrastructure with

growing urbanization has opened the doors for entrepreneurs in the field of smart city technologies. The authors concluded that IoT enabled technology is very important for the development of sustainable smart cities.

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