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Challenges, Applications and Future Technologies in "Internet of Things"

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Abstract: Internet of Things (IoT) gained a great attention from researchers, it becomes an important technology that promises a smart human being life, by allowing a communications among objects, machines and every things together with peoples. IoT represents a system which consists a things in the real world, and sensors attached to or combined to these things, connected to the Internet via wired and wireless network structure. The sensors can use various types of connections such as RFID, Wi-Fi, Bluetooth, and ZigBee, in addition allowing wide area connectivity using technologies such as GSM, GPRS, 3G, and LTE.. by the technology of the IoT, the world will becomes smart in every aspects, the IoT will provides a means of smart cities, smart healthcare, smart homes and building, in addition to many important applications such as smart energy, grid, transportation, waste management and monitoring . In this paper a concept of IoT applications and future possibilities for related technologies in addition to the challenges that facing the implementation of the IoT.

Keywords: IoT Applications, Future Technologies, Smart Cities, Smart Environment, Smart Energy and Grid, Smart Manufacturing, Smart Healthcare

I. INTRODUCTION

The Internet of Things (IoT), referred to as the Internet of Objects, will change everything. The Internet has an impact on education, communication, business, science, government, and humanity [1]., the Internet is the important and powerful creations in all of human history and now with the concept of the internet of things, internet becomes more favorable to have a smart life in every aspects [2].Internet of Things is a latest technology of the Internet accessing. By the Internet of Things, objects recognize themselves and obtain intelligence behavior by making or enabling related decisions thinks to the fact that they can communicate information about themselves [3]. These objects can access information that has been aggregated by other things, or they can added to other services [3]. Figure 1 gives out that with the internet of things, anything's will able to communicate to the internet at any time from any place to provide services by network to anyone. this concept will create a new types of applications can involve such as smart vehicle and the smart home, to provide many services such as notifications, security, energy saving, automation, communication, computers and entertainment.

On developing the IoT technology, testing and deploying products it will be close to implementing smart environments by 2020 [6]. In the near future, storage and communication services will be highly pervasive and distributed: people, machines, smart objects, surrounding space and platforms connected with wireless/wired sensors, M2M devices, RFID tags will create a decentralized resources interconnected by a dynamic network of networks the communication language will be based on interoperable protocols, operating in heterogeneous environments and platforms [8]. IoT is a term and all objects can play an active role to their connection to the Internet by creating smart environments, where the role of the Internet has changed [9].

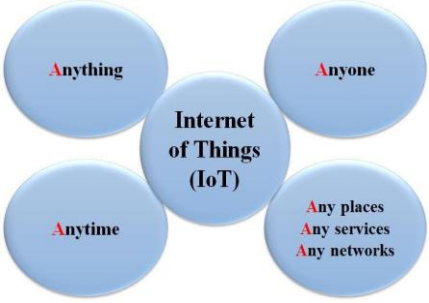

Figure.1. Internet of things Concept

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II. INTERNET OF THINGS STANDARDIZATIONS AND PROTOCOLS

By the 2020 approx 50 to 100 billion things will be connected electronically by the use of internet [10]. Figure 2 shows the growth connected to the internet from 1988 to forecast 2020. The Internet of Things (IoT) will provide a technology to creating the means of smart action for machines to communicate with one another and with many different types of information.The success of IoT depends on standardization, which provides interoperability, compatibility, reliability, and effective operations on a global scale. More than 60 companies for leading technology, in communications and energy, working with standards, such as IETF, IEEE and ITU to specify new IP based technologies for the Internet of Things [13].

III. INTERNET OF THINGS APPLICATIONS

Internet of things has many applications in human life, making life easier, safe and smart. There are many applications such as smart cities, homes, transportation, energy and smart environment.

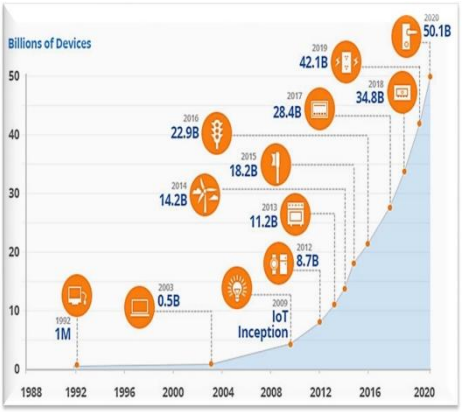

Figure 2. Internet of Things Growth

A. Smart Cities

Major cities were supported by smart projects, like New York, Tokyo, Shanghai, Singapore, Amsterdam, and Dubai. Smart cities may still be viewed as a cities of the future and smart life, and by the innovation rate of creating smart cities today's, it will became feasible to enter the IoT technology in cities development. Smart cities demand requires careful planning in every stage, with support of agreement from governments, citizens to implement the internet of things technology in every aspects. IoT, cities can be improved in many levels, by improving infrastructure, enhancing public transportation reducing traffic congestion, and keeping citizens safe, healthy and more engaged in the community as shown in Figure 3. By connection all systems in the cities like transportation system, healthcare system, weather monitoring systems and etc., in addition to support people by the internet in every place to accessing the database of airports, railways, transportation tracking operating under specified protocols, cities will become smarter by means of the internet of things.

Figure 3. Smart Cities Aspects

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B. Smart house and buildings

Wi-Fi technologies in home automation have mainly used because of the network nature of the deployed electronics where electronic devices such as mobile devices, etc. are generally supported by Wi-Fi have started to become part of the network Domestic IP and because of the increasing rate of adoption of mobile computing devices such as smart phones, tablets, etc. For example, a network for providing online broadcast or home network services may be a means of controlling the functionality of the device on the network. At the same time, mobile devices ensure that consumers have access to a portable "controller" for network connected electronics. Both types of devices can be used as gateways for IoT applications. Many companies plan to develop platforms that integrate building automation with entertainment, health care monitoring, energy monitoring, and wireless sensor monitoring in home and building environments. . By the concept of the Internet of Things, houses and buildings can intelligently manage many devices and objects, 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 4 below.

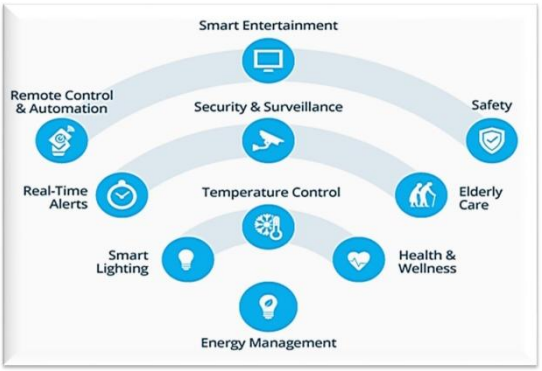

Figure 4. Smart Home & building applications

IV. INTERNET OF THINGS CHALLENGES

The fact that Internet of things applications and scenarios outlined are very interesting which provides technologies for smart every things. , but there are some more challenges to the application of the Internet of Things concept in cost of implementation. The expectation that the technology must be available at low cost with a large number of objects. IoT are also faced with many other challenges such as

Scalability: Internet of Things has a big concept than the conventional Internet of computers, because of availability and communication bandwidth requirements. To facilitate communication and cooperation of these objects, common standards are required things are cooperated in an open environment. Basic functionality such as communication and service discovery must therefore work equally well in both small and large scale environments. IoT requires new features and methods to achieve efficient operation for scalability.

– **Self-organization**: Smart things should not be managed as computers that require their users to configure and adapt them to particular situations. Mobile objects, which are often used only sporadically, need to establish spontaneous connections and to organize and configure themselves to adapt to their particular environment.

– **Data volumes**: Some Internet of Things application scenarios will involve infrequent communication, and the collection of form sensor networks, or large scale logistics and networks, will bring together huge amounts of data on the Internet of Things. nodes or central servers. The term represents this phenomenon is big data that requires many operational mechanisms in addition to new technologies of storage, processing and management.

– **Interpretation of data**: To support users of intelligent objects, it is necessary to interpret as precisely as possible the local context determined by the sensors. For service providers to benefit from the disparate data that will be generated, it is necessary to draw generalizable conclusions from the interpreted sensor data.

– **Interoperability:** Each type of intelligent object in the Internet of Things has different capabilities in information, processing and communication. Different smart objects would also be subject to different conditions such as energy implementing applications and services that exploit the things or the data produced by them .On the other hand, cloud can benefit from IoT by extending its scope to deal with real world things in a more distributed and dynamic manner, and for delivering new services in a large number of real life scenarios. In many cases, Cloud can provide the intermediate layer between the things and the applications, hiding all the complexity and functionalities necessary to

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implement the latter. This will impact future application development, where information gathering, processing, and transmission will generate new challenges, especially in a multi cloud environment or in fog cloud [72]. Cloud facilitates for IoT application to enabling data collection and data processing, in addition to rapid setup and integration of new things, while maintaining low costs for deployment and for complex data processing [73]. Cloud is the most convenient and cost effective solution to deal with data produced by IoT and, in this respect, it generates new opportunities for data aggregation, integration, and sharing with third parties. Once into Cloud, data can be treated as homogeneous through well-defined APIs, can be protected by applying top level security, and can be directly accessed and visualized from any place [74].

B. Big Data

Due to the rapid expansion of networks nowadays, the number of devices and sensors in networks is increasing in the physical environments that will change the networks, services and applications of information communication in different fields. [75]. Next year's forecast shows that approximately 50 billion devices will generate large amounts of data from many applications and services in various areas such as smart grids, smart homes, health, automotive, transportation , logistics and environmental monitoring. The technologies and associated solutions that allow the integration of real data and services in today's information networking technologies are often described as the Internet of Things (IoT) [76]. The volume of data on the Internet and the web is growing, and every day, about 2.5 billion bytes of data are created and it is estimated that 90% of the data has been generated in the last two years. Data collected from sensors related to different events and events can be analyzed and transformed into real information to give us a better understanding of our physical world and create more value-added products and services. These sensory data such as predicted and balanced power consumption data in smart grids, analyzed pollution data, weather conditions and congestion, recorded sensory data to improve traffic control and management, better care services health care [77]. In addition, the information available on social media such as Facebook, tweeter, WhatsApp and observations and measurements of the physical world submitted by users also provide a huge amount of data (Big Data) [78]. Integrating data from various physical, virtual and social resources into IoT enables applications and services to be developed that can integrate situational and contextual knowledge into decision-making mechanisms and create more applications. intelligent and improved services. With large volumes of distributed and heterogeneous IoT data, issues related to interoperability, automation, and data analysis will require common descriptions and data representation frameworks in addition to legible and interpretable data descriptions. by machine [79].

C. Security and confidentiality

Due to the fact that IoT applications can access multiple administrative domains and involve multiple ownership regimes, a framework of trust is needed to enable system users are confident that the information and services exchanged can actually be used [80].The trust framework must be able to deal with humans and machines as users, because it must transmit trust to humans and must be robust enough to be used by machines without denial of service. The development of trusted frameworks that meet this requirement will require advances in areas such as Light Public Key Infrastructure (PKI) as a basis for trust management [81]. Lightweight key management systems are used to activate trusted encryption materials using communications and processing resources, as is consistent with the resource constrained nature of many IoT devices [82].IoT based systems require a quality of information for metadata which can be used to provide an assessment of their liability of IoT data. A novel methods is required for IoT based systems for assessing trust in people, devices and data. One of the most methods used are trust negotiation that allows two parties to automatically negotiate, on the basis of a chain of trust policies, the minimum level of trust required to grant access to a service or to a piece of information. Internet of things uses a methods for access control to prevent untrusted data breaches by control the process of ensuring the correct usage of certain information according to a predefined policy after access to information

V. CONCLUSIONS

The Internet of Things is a new technology that provides many applications to connect things to things and people to things via the Internet. Every object in the world can be identified, connected to each other through the Internet making decisions independently. All networks and communication technologies are used to build the concept of the Internet of things such as mobile computing, RFID, wireless sensor networks and embedded systems, in addition to many algorithms and methodologies for obtaining business processes , store data and security problems. The IoT requires a standardized approach for architectures, identification schemes, protocols and frequencies will occur in parallel, each targeted for a particular and specific use. Through the Internet of Things many smart applications become real in our lives, allowing us to reach out and contact everything that is important for human life such as smart care, smart homes, smart energy, smart cities and smart environments.

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