A review paper on Internet of Things: Applications & Challenges

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Abstract- **Nowadays Internet of Things (IoT) gained a good attention from researchers, since it becomes an essential technology that guarantees a rational human being life, by permitting a communications between objects, machines and each thing at the side of peoples. IoT represents a system that consist things within the globe, and sensors attached to or combined to those things, connected to the Internet via wired and wireless network structure. The IoT sensors will use numerous styles of connections like RFID, Wi-Fi, Bluetooth, and ZigBee, additionally to permitting wide area connectivity using several technologies like GSM, GPRS, 3G, and LTE. IoT enabled things can share facts regarding the condition of things and also the encompassing surroundings with individuals, software systems and different machines. By the technology of the IoT, the world can become smart in each aspects, since the IoT can provides a method of smart cities, smart healthcare, smart homes and building, additionally to several necessary applications like smart energy, grid, transportation, waste management and surveillance. In this paper we tend to review a concept of the many IoT applications and challenge 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), sometimes referred to as the Internet of Objects, can modify everything together with ourselves. The Internet has a bearing on education, communication, business, science, government, and humanity [6]. Clearly, the Internet is altogether the most important and powerful creations in all of human history and currently with the construct of the Internet of things, the Internet becomes favorable to possess a smart life in each facet [14].

Internet of Things is new technology of the internet accessing. By the internet of Things, objects acknowledge themselves and procure intelligence behavior by creating or enabling related decisions thinks to the actual fact that they'll communicate data regarding themselves [15]. These objects will access information that has been aggregate by different things, or they'll augment different services [15]. Figure 1 reviews that with the internet of things; anything's can able to communicate to the internet at any time from anyplace to provide any services by any network to anyone. This idea can produce an alternate kind of applications which will involve smart vehicle and the smart home, to provide several services like notifications, security, energy saving, automation, communication, computers and entertainment [11, 12].

Figure 1: Internet of things Concept

By developing the IoT technology, testing and deploying product will be a lot of about to implementing smart environments by 2020 [10]. in the near future, storage and communication services will be highly persistent and distributed: individuals, machines, smart objects, surrounding space and platforms connected with wireless/wired sensors, M2M devices, RFID tags can produce a extremely suburbanized resources interconnected by a dynamic network of networks [13].

In the IoT, the communication language will be based on interoperable protocols, operational in heterogeneous environments and platforms [16]. IoT during this context could be a generic term and every one objects will play a lively role to their association to the internet by making smart environments, where the role of the internet has customized [17].

.II. INTERNET OF THINGS STANDARDIZATIONS AND PROTOCOLS

By the 2020 around 50 to 100 billion things will be linked electronically by internet [5]. Figure 2 shows the escalation of the things connected to the internet from 1988 to forecast 2020. The accomplishment of IoT depends on standardization, which provides interoperability, compatibility, reliability, and effective operations on a global scale [6].

The design of the IoT standards is required to consider the proficient use of energy and network capacity, as well as with respect to other constraints such as frequency bands in addition to power levels for radio frequency communications [1, 18].

IEEE Standards Association (IEEE-SA) develops a number of standards that are related to environment need for an IoT. The key focus of the IEEE standardization activities are on the Physical and MAC layers [14].

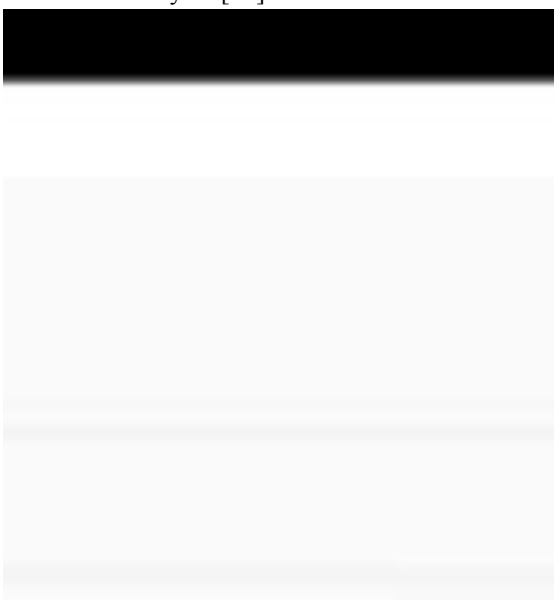

Figure 2: Internet of Things Growth

The IEEE provides an early basis for the IoT with the IEEE802.15.4 standard for short range low power radios, typically working in the industrial, scientific and medical band in addition to use ZigBee technology [7].

ETSI produces globally applicable standards for information and communications technologies (ICT), including fixed, mobile, radio, converged, broadcast and Internet technologies, discusses a similar idea under the label of "machine to machine (M2M) communication.

Internet Engineering Task Force (IETF) is concerned with the advancement of the Internet architecture and the smooth operation of the Internet and known as large, open to international community of network designers, operators, vendors and researchers [16]. IETF provides its own depiction of IoT which provides a most recognizable enhancement to support IPv6, with the 6LoWPAN [4, 20, 21].

III. INTERNET OF THINGS APPLICATIONS

The wide set of applications for IoT devices are often divided into consumer, commercial, industrial, and infrastructure spaces.

3.1 Consumer applications

A growing portion of IoT devices are formed for consumer use, including connected vehicles, home automation/smart home, wearable technology, connected health, and appliances with remote monitoring capabilities.

3.1.1 Smart home

IoT devices are the part of higher concept of home automation, which can contain lighting, heating and air conditioning, media and security systems. Long term benefits could include energy savings by automatically ensuring lights and electronics are turned off.

3.1.2 Elder care

One key application of smart home is to provide assistance for those with disabilities and elderly individuals. These home systems utilize assistive technology to accommodate an owner's specific disabilities. Voice control can support users with sight and mobility limitations while alert systems can be connected straight to Cochlear implants worn by hearing impaired users. They can also equipped with extra safety features. These features can comprise sensors that monitor for medical emergencies such as, falls or seizures. Smart home technology applied in this way can provide users with more freedom and the higher quality of life.

3.2 Commercial Applications

3.2.1 Medical and healthcare

IoT devices can be used to permit remote health monitoring and emergency notification systems. These health monitoring devices can range from blood pressure and heart rate monitors to advanced devices capable of monitoring specialized implants, such as pacemakers, Fitbit electronic wristbands, or advanced hearing aids. Some of the hospitals have begun implementing "smart beds" that can detect when they are occupied and when a patient is attempting to get up. It can adjust itself to ensure appropriate pressure and support is applied to the patient without the manual interaction of nurses.

3.2.2 Transportation

The IoT can support in the integration of communications, control, and information processing across various transportation systems. Application of the IoT covers to all aspects of transportation systems (i.e. the vehicle, the infrastructure, and the driver or user). Dynamic interaction between these components of a transport system enables inter and intra vehicular communication, smart traffic control, smart parking, electronic toll collection systems, logistic and fleet management, vehicle control, and safety and the road assistance.

3.2.3 Building and home automation

IoT devices can be used to monitor and control the mechanical, electrical and electronic systems which are used in various types of buildings (e.g., public and private, industrial, institutions, or residential) in home automation and building automation systems. In this context, there are three main areas are being covered in literature:

- The integration of the Internet with building energy management systems in order to produce energy efficient and IOT driven "smart buildings".
- The possible means of real-time monitoring for reducing the energy consumption and monitoring occupant behaviors.
- The integration of smart devices in the environment and how they might to know who to be used in future applications.

3.3 Industrial Applications

3.3.1 Agriculture

There are several IoT applications in farming such as collecting data on temperature, rainfall, humidity, wind speed, pest infestation, and soil content. This data can use to automate farming techniques, take informed decisions to develop quality and quantity, minimize risk and waste, and reduce effort to manage crops. Like example, farmers can now monitor soil temperature and moisture from afar, and even apply IoT-acquired data to precision fertilization programs.

3.3.2 Infrastructure applications

Monitoring and controlling operations of sustainable urban and rural infrastructures like bridges, railway tracks, on- and offshore- windfarms is a key application of the IoT. The IoT infrastructure can be used for monitoring any events or changes in structural conditions that can be compromise safety and increase risk. IoT can help the construction industry by cost saving, time reduction, better quality workday, paperless workflow and increase in productivity. It can benefit in taking faster decisions and save money with Real-Time Data Analytics.

3.3.3 Energy management

Major numbers of energy-consuming devices (e.g. switches, power outlets, bulbs, televisions, etc.) already integrate Internet connectivity, which can allow them to communicate with advantages to balance power generation and energy usage and optimize energy consumption as a whole. These devices allows remote control by users, or central management via a cloud-based interface, and enable functions like scheduling (e.g., remotely powering on or off heating systems, controlling ovens, changing lighting conditions etc.).The Smart grid is a utility-side IoT application; systems gather and act on energy and power-related information to increase the efficiency of the production and distribution of the electricity [22].

IV. INTERNET OF THINGS CHALLENGES

There are some 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 [2,9], such as:

4.1 Scalability:

Internet of Things has a huge concept than the conventional Internet of computers, because of things are cooperated within an open background. Basic functionality such as message and service detection therefore need to function equally efficiently in both small scale and large scale environments. The IoT requires a new functions and methods in order to get an efficient operation for scalability.

4.2 Data interpretation:

To support the users of smart things, there is a need to interpret the local situation determined by sensors as accurately as possible. For service providers to profit from the dissimilar data that will be generated, needs to be able to draw some generalizable conclusions from the interpreted sensor information.

4.3 Interoperability:

Each type of smart objects in Internet of Things has different information, processing and communication capabilities. Different smart objects would also be subjected to different situation such as the energy accessibility and the communications bandwidth requirements. To facilitate

communication and cooperation of these objects, general standards are required.

4.4 Software complexity:
A more general software infrastructure will be needed on the network and on background servers in order to manage the smart objects and provide services to support them. Because the software systems in smart objects will have to function with minimum assets, as in conventional embed systems.

4.5 Security and privacy:
In addition to the security and protection aspects of the Internet such in communications confidentiality, the authenticity and responsibility of communication partners, and message integrity, other requirements would also be important in an Internet of Things. There is a need to access certain services or prevent from communicating with other things in IoT and also business dealings involving smart objects would need to be protected from competitors' prying eyes.

4.6 Fault tolerance:
Objects in internet of things is much more dynamic and mobile than the internet computers, and they are in changing fast in unexpected ways
Structuring an Internet of Things in a robust and responsible manner would require redundancy on a number of levels and an ability to automatically adjust to changed situation.

4.7 Power supply:
Things typically move around and are not connected to a power supply, so their smartness needs to be powered from a independent energy source. Although passive RFID transponders do not need their own energy source, their functionality and communications range are very incomplete.
Hopes are pinned on future low power processors and communications units for embedded systems that can function with extensively less energy. Energy saving is a factor not only in hardware and system architecture, but also in software, for example the implementation of protocol stacks, where every single transmission byte will have to substantiate its existence.

IV. CONCLUSION

The IoT promises to bring a step change in individuals "quality of life and enterprises" productivity. Through a widely distributed, locally intelligent network of smart devices, the IoT has the potential to facilitate extensions and enhancements to fundamental services in transportation, logistics, security, utilities, education, healthcare and other areas, while providing a new ecology for application development. A rigorous effort is required to move the industry beyond the early stages of market development towards maturity, driven by common understanding of the discrete nature of the opportunity.

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