Analysis of Internet of Things: IoT in human life

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Abstract

The digital universe emerged focusing replication of veritable universe with the enhancement of facilities and convenience including the beauty as same as the real universe. Numerous attempts were made to observe, detect and feel the universe with the practice of sensors and many equipment. To bring this digital universe to precision, it requires knowledge about the electronic equipment or device, simultaneous scrutiny techniques, communication procedures as well as the position or location of the equipment or device. The IoT which stands for Internet of Things is an enthusiastic universal network comprising internet linked things or equipment, for instance, sensors which highly sensitive and beneficial for tenuous applications, smart devices which affect for huge moderation of human life and actuators, etc. IoT technologies aids to connect things or objects which are located around a wider extent. Ubiquitous computing, communication, and robotics raised with different technical developments during the significant years in the past and even in present, along with the flow of IoT paradigm. This paper is based on IoT and evaluation of the information provided about the revolution of IoT. Further, different IoT applications specifically in the health sector, characteristics of IoT, issues and benefits of IoT and at last future of IoT.

Keywords: Type your keywords here, separated by semicolons ;

1. Introduction

IoT is a key influence that affects developing and discover an enormous number of internet applications. Numerous new technologies are arising which depicts the IoT expansion and innovations. In IoT, things (e.g. entities, objects, devices, machines, and wireless sensors) have to communicate with other things or humans and exchange information based on Internet wire/wireless connectivity[1]. IoT demonstrate the combination of hardware, software, information and network that arranged as a sequenced array of devices to control and manage the digital environment. The sensors of IoT support for al these activities especially in the health sector. IoT provide magnificent intelligent technique to minimize human effort while accomplishing smooth admittance to physical devices. IoT has enveloped the communication with a wide variety of devices, for instance, surveillance cameras, automotive vehicles, monitoring sensors, actuators, displays, home appliances, and so on [3]. With the sense of daily news, it seems the world devoted to magnify the IoT enhancing

different perspectives specifically, the efficiency and technology. Objects or devices of IoT consists of various formations and specifications which entangled with cloud technology, machine learning techniques, computation, networking as well as artificial intelligence. IoT comprises special characteristics like efficiency, internet connection, associated architecture, technology and updates, networks with nodes, a massive amount of data, etc. Since the industrial revolution, the area of manufacturing performed a major part in the economy in most of countries and industries. This revolution resulted in the automation, expansion, and mechanization of various abled robots and programmable logic controllers (PLCs). With the upward competition and globalization, new business models incorporated with IoT enable the organizations to develop innovative products with high productivity [4]. IoT enables to reshape the whole industries using advanced technological environment. It facilitates digitalized interior working procedures and customer experiences while allowing them to practice new business models. It seems the progressive growth of IoT in the fields, for instance, agriculture, health care, education, banking and finance, chemistry, geography, human day to day activities, etc. There are some specific reasons to use IoT in every field and they can be mentioned as dependency, memory, recording facility. One of the specific sectors of IoT is RFID which stands for Radio-Frequency Identification. In IoT, things (e.g. entities, objects, devices, machines, and wireless sensors) have to communicate with other things or humans and exchange information based on Internet wire/wireless connectivity [5]. In RFID, the information passed through wireless connections with the use of chip correlated to the object. RFID consists of the ability to renovate dump objects to moderately smart devices. RFID systems can be used wherever automated labeling, identification, registration, storage, monitoring, or transport is required to increase efficiency and effectiveness [6]. Cloud-based platforms are assigned to analyze and manage huge amount of data in IoT and FIWARE, OpenMTC, Google Cloud, AWS IoT are several examples for these platforms. For the case of the manufacturing industry, the Industries initiative prove a factor of immense pressure on all business companies to adopt IoT and IoTS as soon as possible, in order to keep pace with their challenging competitors [8]. When considering this statement, it depicts the IoT directly affect for economy and business of the world and the IoT device manufacturing companies are facing challenges with their competitors to develop the most technologically advanced devices at the very first.

2. Revolution of IoT

As the Internet evolution, there are main five eras

1. Internet of Documents (ex: documentary web folios, e-learning websites, and e-libraries)
2. Internet of Commerce (ex: e-transactions, e-finance, and banking)
3. Internet of Applications/ Rich Internet Applications (ex: web 2.0)

4. Internet of man (ex: Social networks)
5. Internet of Things (ex: Internet-connected accessories)

When the Internet was commercialized in the 1990s, this created new capabilities emerged that would start a ripple effect of technology growth [9]. In 1999, Kevin Ashton primarily proposed the impression of IoT. He revealed that IoT as peerless and advanced technology which combined with radio-frequency identification technology. 5G became the next target of entire mobile manufactures. The United States was able to gain the dominance of mobile world with the implementation of fourth-generation (4G). In the 2000s, Europe, Japan, and Korea led the third-generation (3G) world [9].The Netherland completely connected with IoT in the year of 2016. When the Netherland government initiates the system, nearly 15 lacks of accessories were connected with IoT for instance household devices, mobiles, televisions, radios, etc, and their internet network connection was speedy as well as smooth. Currently, Netherland was able to maintain the connection about 98% of homes with IoT and accessories. When the infrastructure is built it is an easier process to execute IoT. With 50 to 100 billion things expected to be connected to the Internet by 2020, we are now experiencing a paradigm shift in which everyday objects become interconnected and smart [10].

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3. IoT architecture

The emerging requirements of IoT call for an enhanced name service which is fundamental to the overall IoT architecture [2].

When it mentions some from these architectures,

1. Three-layer architecture
2. Four-layer architecture
3. Cloud-based architecture
4. Fog –based architecture
5. Five-layer architecture

Most specifically, four-layer architecture is the most common and popular scenario in IoT.The four-layer architecture contains four layers of technologies. These four layers depict the way each technologies communicate, data transfer and process the data and scalability, modularity and arrangements of IoT distribution layers.

1. Sensing layer

This layer contained the smart devices combined with sensors. The sensors allow to build the connection among digital and physical worlds providing the facility to gather the instant information and process those. The sensors have the capacity to take measurements such as temperature, air quality, speed, humidity, pressure, memory, and recording for certain number of measurements, flow, movement and electricity etc[11]. A Senor is capable to survey the exterior and physical possessions or movements and divert it to a signal which could recognize by a deice. Environment based sensors, household instrument sensors, vehicle sensors, Light sensors are some types of sensors which can be classified according to the inimitable intentions and examples for devices that contained these sensors are digital cameras, digital heartbeat calculators, digital voice recorders, touch-sensitive lights, etc.

2. Network layer

This layer act as the high performing and robust information transfer medium for wireless and weird connections that carry the large amount of data generated by sensors. Current networks, often tied with very different protocols, have been used to support machine-to-machine (M2M) networks and their applications [11].When considering the wider range of productive and effective service, high speed of data transform, the

IoT require numerous networks, different technologies, and access protocols. These networks consist of different forms or models, for instance, private, public or hybrid and they assigned to maintain the potential ability, network range and security requirements for communication.

3. Data processing layer

During this layer, the overall procedures are data management, access to the information, a combination of information and control. This layer responsible to mitigate the risk of private data and processing of needless data. Data filtering techniques such as data anonymization, data integration, and data synchronization, are utilizing to hide the ingredients of information while contributing only vital information which are utilizable for the appropriate applications [11]. This layer consists of the analytical part and numerous tools are using to abstract most related information form large raw data collection and process those lively. In-memory analytics stimulating the decision-making process and minimizing the query time of data. The security of information is one main aspect of this layer. The security system prevents hacking and unauthorized access by providing lesser risk.

4. Application layer

The core process of this layer is based on cloud or data center and it enables to deeper data processing, continue review and feedback. This layer is a combination of operational technology and Information technology skills which means of information carried from the data processing layer, will further process and manage to apply for the physical devices. A deeper analysis of data is one major role of this layer. When completing all the quality values and necessities, the information carries again to the physical world.

The IoT application covers “smart” environments/spaces in domains such as: Transportation, Building, City, Lifestyle, Retail, Agriculture, Factory, Supply chain, Emergency, Healthcare, User interaction, Culture and tourism, Environment and Energy [11]. Examples devices for this layer are mobile phones, smartwatches, etc.

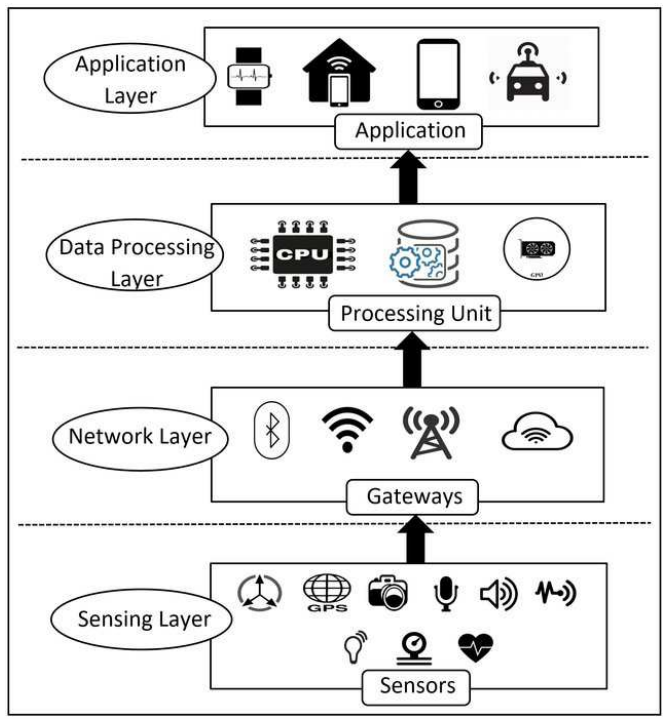

Figure 1. Four-layer architecture of IoT [15]

4. Characteristics of IoT

1. Interconnectivity: IoT devices could interrelate with the world contains information transformations and communication procedures.
2. Connectivity: Connectivity allows fast access to the relevant network accordingly.
3. Continues services: The ability to accommodate associated services like secrecy, continuous data access and accordance consistency between physical and potential things.
4. Safety: Responsible for the safety of personal data and transforming information is the is an important security standard when designing IoT devices.
5. Massive network range: Ability to connect with a greater number of devices at the same time through the internet and the possibility to manage and control the services and operations effectively and efficiently.
6. Intense changes and adoption: The ability to speed up changes of the device status, for instance, connect, disconnect, shutdown, restart, etc.

7. Heterogeneity: IoT devices are diverse according to hardware components and according to the requirement various networks could cooperate with those devices.
8. Artificial Intelligence: The IoT devices that consist of an AI algorithm to maintain functions and operations of equipment in developed countries. (ex: recognizing dues of the refrigerator by its sensors)

5. Applications of IoT

IoT application could recognize from various sectors of the world. Smart industries are the most prominent area of IoT applications, next to this, IoT application areas include smart home, security systems, intelligent thermostats, smart city applications, so they can adjust flight and school schedules and can find the optimal route around the accidents and send those instructions to city digital signage system to guide drivers around the accident[12]. When considering all the details, it could categorize the applications into four application domains: (1) Personal and Home; (2) Enterprise; (3) Utilities; and (4) Mobile Personal and Home [13].

IoT that use for personal and home is mostly using Wi-Fi connection and it enabling more data bandwidth. For instance, a Smartphone can be used for communication along with several interfaces like Bluetooth for interfacing sensors measuring physiological parameters [13]. An expanded personal network building a home monitoring system which enabling health care facilities, delivery facilities, home daily stock maintaining facilities, entertainment facilities, etc with the help of air conditioners, refrigerators, tv, video games, etc. Through the sensors of these equipment, the users could notify the changes, dues, and conditions and easily fulfil without much effort through online delivery and services. IoT support for well and proper management of home hold activities and energy.

1. Enterprise

Environmental monitoring is a basic aspect of enterprise and IoT support to maintain the connection with all the buildings and all the employers with the help of wireless and wired networks. Wi Fi, Wired internet connections, lighting systems, CCTV camera systems are examples of IoT in enterprises. Sensors have always been an integral part of factory setup for security, automation, climate control, etc [13]. Through the sensors of water supply systems traffic management systems and emergency services IoT support to alarm about the current condition and risks and get the precautions or necessary actions immediately.

2. Utilities

IoT support for resource management to adjust cost and profit. The efficiency of energy consumption could control with the help of IoT and water management systems could measure the quality of water according to the location, water ingredients with the use of sensors. According to the sensor type, these could avoid

accidental contamination among storm water drains, drinking water, and sewage disposal [13]. This quality measuring procedures could use to both agriculture and irrigation sectors to recognize soil parameters and water management. The satellite technologies, use of sensory devices to understand environmental hazards and the system of marine creature recognition are count under this.

3. Mobile

Mobile IoT demonstrate a wide range, low power and more secure network-based things supported by sensors. These things are easy to install, approximately low cost, present better coverage, support for low power consumption, etc. Smart transportation and smart logistics are placed in a separate domain due to the nature of data sharing and backbone implementation required [13]. Bluetooth technology is one specific aspect of mobile IoT and this technology can be seen in mobile phones, laptops, vehicles, etc. It is basic sensor-based technology that producing Media Access Identification (MAC-ID) over the exposure area. Efficient logistic management is one major session of mobile IoT. Mobile IoT are applicable for health monitoring technology, smart waste management, smart homes, traffic light systems tec.

6. IoT in Health Sector

When considering the smart health care system, numerous portable sensors and communication modules are taking by the people (when they are walking, driving or taking the public transport system) to check their blood oxygen saturation, body temperature, blood pressure and then communicate with the remote doctor or hospital server, in order to diagnosis the conditions as it required [2]. Remote health monitoring techniques are usually exploit by homecare, clinicians, and hospitals environments to distantly monitor the crucial signals of an personal communication in real-time among the patients, parents and physician with the intension of allowing the communication during possible abnormality, minimizing the clinician time, diminishing hospital costs, and enhancing the quality of care [7]. This technology mainly require user interface (smartphone, tablet, laptop etc), a data accumulator (biosensor) and network or internet connection. One popular IoT solution that use for health sectoris smartphone. Smart phones help for equinoctial communication, provide health education and medical references etc. Its mission is to create a link between the sensors, smart phones and the health care team. A clear and gainful answer is given by Costa et al. [16] to assist for medical checks in the form of alarm or reminder. An auto-generated text message will deliver to the patient's phone. The “health brain” is another interesting scenario introduced by Shellington et al. [17]. It enabling the older people to take square steps without cognitive impairment in their living space. Glucometer, sphygmomanometer, accelerometer, stethoscope are some IoT devices that use for the purposes like bio Electrocardiograms, nursing cardiac (crucial) signs,galvanic skin response, pulse beat calculation, measuring body temperature, measuring blood oxygen and sugar amount. Sensors capable to gather patient’s input data and process with

the specific applications that made for the procedure. The results of processed data could deliver to the patient through user interfaces like computer, smartphone, smart watch, tablet or by specific attached IoT object. U-Health carries a healthcare system under a mobile platform and it allows to collect data, process and store in the cloud.

7. Advantages and Disadvantages of IoT

7.1 Advantages

Advanced connection, easy communication, automation, and control (ability to communicate without human interaction) are some advantages of IoT. IoT is a considerably large technological network which supports to complete human day today activities save both time and money. Effective resource management using IoT help to waste management and efficient services could gain through the internet. The major benefits of IoT are information and easy access to that information.

7.2 Disadvantages

Security measures of IoT effect for user dissatisfaction and possible attacks can be observed by different ecosystems. Privacy is one disadvantage or limitation that could lose with a huge amount of data transmissions. Complexity and compliance are another two disadvantages of IoT with the means of complex network designs, regulations, strict standards, distribution of devices, maintenance using

8. Future of IoT:

Gartner (2014), which is a top research and advisory company of the world, has predicted a 30 percent growth in IoT enabled objects from 2014 to 2015 with over 25 billion IoT enable things by 2020 [9]. Gartner mentioned that manufactures of IoT products and service will gain more than us$263 billion successive earnings in 2020 and the majority through the services. It will result in US$1.9 trillion in global economic value-add through sales into diverse end markets [9]. There is a possibility to change these numbers due to the COVID-19 infection, if that will badly affect for manufacturing and innovations of IoT and it is pleasure to expect that 2021 will be somewhat advanced than 2020, in IoT manufacturing. Telecommunication technology recognized the egregiousness of GSMA and provided several parameters under 85 aspects advising the way to join with the internet and the devices that allow to join with the internet etc. By 2020, there will be 50 to 100 billion devices connected to the Internet, ranging from smartphones, PCs, and ATMs (Automated Teller Machine) to manufacturing equipment in factories and products in shipping containers [14]. It is a remarkable statement when considering the manufacturing of IoT and future developments. And

as technological news, GPS will replace by VPS with the terms of more accurate and three-dimensional representations near the future. International Data Corporation (IDC) predicts that IoT will reach about a US$ 1.7 trillion marketby2020 [7].According to the situation of the world which can be named as COVID-19 infection, development IoT can pay more attention to the health care sector. Devices that could easily recognize the diseases, instruments with artificial intelligence to help the mankind, smaller size devices to do a lot of activities are some things that seem to be generated in the future using IoT. Every field or sector, for instance, health, education, agriculture, technology, etc should enhance productivity with the use of IoT.

Conclusion

New research areas and technologies are arising with innovations of IoT. According to the above-mentioned data, it can evaluate that future manufacturers should highly consider the limitations or disadvantages of IoT to develop solutions and reduce the complexity of the devices. This article provides information about IoT revolution, IoT architecture, Applications of IoT including advantages and disadvantages. The next-generation IoT things will be subject to creativity, technical protocols and application requirement, and moderate designs. Providing the required flexibility and security will affect for dynamic use of IoT in the future. The shared environment and ecosystem of IoT should comprise of higher storage, proper and speedy networking facilities, simplicity and proper management. Visualization ability is a major ability of the devices connect with IoT and a three-dimensional view taking the first place. Advanced and new frameworks and platforms are creating to solve issues of IoT like security, data management, and complexity, etc.

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