INTERNET OF THINGS APPLICATION, CHALLENGES AND FUTURE SCOPE

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Abstract - *IoT (Internet of Things) one of the most exiting trends and innovation in the recent history of technological advancement. Also the advances in computer hardware, embedded system devices, networking devices, display devices, control devices, software enhancements etc. has tremendously supported IoT to grow slowly and steadily from leaps to bounds. With computation, connectivity, and data storage becoming more advanced and universal there has been an explosion of IoT based application solutions in diversified domains from health care to public safety, from assembly line scheduling to manufacturing and various other technological domains. 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 IoT sensors can use various types of connections such as RFID, Wi-Fi, Bluetooth, and ZigBee, in addition to allowing wide area connectivity using many technologies such as GSM, GPRS, 3G, and LTE. IoT-enabled things will share information about the condition of things and the surrounding environment with people, software systems and other machines. by the technology of the IoT.*

1. INTRODUCTION

Internet of Things (IoT) is the network of physical, devices accessed through the Internet. These objects contain embedded technology to interact with internal states or the external environment. When these objects sense and communicate, it changes how and where decisions are made, and who makes them. It is a modern wireless communication technology having its application areas in various diversified domain areas. The basic idea of this concept is the pervasive presence around us of a variety of things or objects – such as Radio-Frequency Identification (RFID) tags, sensors, actuators, mobile phones, etc. – which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbors to reach common goals. It refers to the ever-growing network of physical objects that have an IP address associated with it for internet connectivity and addressing, and the communication that occurs between these objects and other Internet-enabled devices and systems that enables in some decision making process for applications in health care monitoring, assembly line scheduling, etc.

2. LITERATURE SURVEY

Papers we referred for literature survey,

- **Internet of Things (IoT) : Challenges and Future Directions** (Ms. Yogita Pundir, Ms. Nancy Sharma, Dr. Yaduvir Singh)

The growth potential for the embedded industry is enormous. And the path forward is becoming clearer every day. It's time that we start building IOT systems, and provide value to our customers. The IoT is expected to connect 28 billion —things to the internet by 2020, ranging from wearable devices such as smart watches to automobiles, appliances, and industrial equipment. In this paper, we will take a look at different IOT solutions developed so far, their functionalities and technology used and thus conclude the various challenges to be focused on to give way to better solutions that will help the community.

- **TECHNOLOGY ANALYSIS FOR INTERNET OF THINGS USING BIG DATA LEARNING"** (Sunghae Jun1)

The internet of things (IoT) is an internet among things through advanced communication protocols without human's operation. The main idea of IoT is to reach and improve the common goal by their intelligent networking. The IoT is an integrated technology of several sub technologies, such as wireless sensor or semantic. The technology of IoT has been evolved according to the environment based on information communication technology and social infrastructure. So we need to know the technological evolution of IoT in the future. In this paper, we analyze the IoT technology to find its technological relationship. We use patents and papers related to the IoT, and consider big data learning as tool for the IoT technology analysis. To verify the performance of our proposed methodology, we perform and show our case study using collected the patent and paper documents.

- **"A review paper on "IOT" & It‟s Smart Applications"** (Vandana Sharma1, Ravi Tiwari2)

We are entering in a new era of computing technology i.e. Internet of Things (IoT). IOT is a sort of "universal global neural network" in the cloud which connects various things. The IoT is a intelligently connected devices and systems which comprised of smart machines interacting and communicating with other machines, environments, objects and infrastructures and the Radio Frequency Identification (RFID) and sensor network technologies will rise to meet this new challenge. As a result, a enormous

amount of data are being generated, stored, and that data is being processed into useful actions that can "command and control" the things to make our lives much easier and safer—and to reduce our impact on the environment. Every organization such as companies and civil institutions needs up-to-date information about people. In this regard, most establishments either use websites, emails or notice boards. However, in most of countries internet access is available to people on systems and their mobile devices, so that the transferring of the information can be much easier and less costly through the internet

- "**Home Automation Using Internet of Things"** (Vinay sagar K N1, Kusuma S M)

With advancement of Automation technology, life is getting simpler and easier in all aspects. In today's world Automatic systems are being preferred over manual system. With the rapid increase in the number of users of internet over the past decade has made Internet a part and parcel of life, and IoT is the latest and emerging internet technology. Internet of things is a growing network of everyday object-from industrial machine to consumer goods that can share information and complete tasks while you are busy with other activities. Wireless Home Automation system(WHAS) using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home. It is meant to save the electric power and human energy. The home automation system differs from other system by allowing the user to operate the system from anywhere around the world through internet connection.

In this paper we present a Home Automation system(HAS) using Intel Galileo that employs the integration of cloud networking, wireless communication, to provide the user with remote control of various lights, fans, and appliances within their home and storing the data in the cloud. The system will automatically change on the basis of sensors' data. This system is designed to be low cost and expandable allowing a variety of devices to be controlled.

3. IoT ELEMENTS

In this section we have listed and discussed on some key elements for IoT and IoT based applications. If we classify IoT elements/components into few basic categories that aids seamless connectivity then it can be as followed: (i) Hardware (ii) Middleware (iii) User End Visualization Hardwareconstitutes of various sensors, actuators, embedded devices and other communication devices.Middleware constitutes of various tools used for on demand storage of data collected by sensor devices and processed by embedded devices and various computing tools used for data analytics.User End Visualization consists of various data visualization and interpretation tools which can be accessed on various diverse platforms which aids the end user to keep a track of various events driven by those data collected by various sensory hardware's. We have highlighted few breakthrough and enabling technologies in the above mentioned categories which will provide a clear conscience for the three components listed above.

Wireless Sensor Network (WSN): The advances in low power integrated circuits and wireless communications has made it a possibility of making available efficient, low cost, low power miniature devices for use in remote sensing applications. These factors has improved the viability and feasibility of utilizing a sensor network consisting of a large number of intelligent sensors, enabling the collection, processing, analysis and dissemination of valuable information, gathered in a variety of environments. The data collected by various sensor nodes are sent to either distributed systems or centralized systems (based on need) for further processing and analysis that helps in various decision making processes and for automation processes decision making. The breakthrough advances achieved in optimizing hardware components to a greater extent has increased the life time of sensor nodes with optimization at hardware level and at protocol level.

Radio Frequency Identification (RFID): A major breakthrough advancement in the embedded communication paradigm which enables design of microchips for wireless data communication. They help us in automatic identification of anything they are attached to acting as an electronic barcode that can be used in various IoT based applications. There are two types of RFID tags: Active Tags and Passive Tags. Passive RFID tags are not battery powered and they use the power of the reader's interrogation signal to communicate the ID to the RFID reader. This has resulted in many applications particularly in retail and supply chain management. The applications can be found in transportation (replacement of tickets, registration stickers) and access control applications as well.

Near Field Communication (NFC): It is a set of communication protocols that enable two electronic devices, one of which is usually a portable device such as a smartphone, to establish communication by bringing them within 4 cm (2 inches) of each other. In other words NFC, is a form of contactless communication between devices like smartphones or tablets. Near Field Communication (NFC): It is a set of communication protocols that enable two electronic devices, one of which is usually a portable device such as a smartphone, to establish communication by bringing them within 4 cm (2 inches) of each other. In other words NFC, is a form of contactless communication between devices like smartphones or tablets. Manufacturers must meet when designing NFC compatible devices. This ensures that NFC is secure and remains easy-

to-use with different versions of the technology. Compatibility is the key to the growth of NFC as a popular payment and data communication method.

Data Storage after gathering and Data Analytics: IoT has led to creation of huge amount of data. So effectively managing the collected data and deciding upon the ownership of storage of data and time frame for maintaining the unprecedented amount of collected is a vital issue to be considered. Data centres are to be such that they will ensure reliability for data stored and efficient energy efficient technologies to be entertained. Use of stored data should be smart and be intelligently used for smart monitoring and actuation enabling various decision making processes. Artificial Intelligence and computational algorithms should be developed to aid these requirements. Efficient Data Analysis techniques are to be incorporated for extracting useful information from collected raw data from across various sensor devices.

Data visualization: To ensure a user to effectively interact with IOT based system proper data visualization techniques are required to be incorporated. Advances in touch screen technologies, display device technologies, and advances in smart phone technologies have surely aided IoT based applications. 2D and 3D technologies have made data visualization for end users more interactive and efficient.Extraction of meaningful information from raw data is non-trivial. This encompasses both event detection and visualization of the associated raw and modelled data, with information represented according to the needs of the end-user.

4. INTERNET OF THINGS APPLICATIONS

Internet of things promises 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.

A. Smart Cities: Many major cities were supported by smart projects, like Seoul, 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 very feasible to enter the IoT technology in cities development. Smart cities demand require careful planning in every stage, with support of agreement from governments, citizens to implement the internet of things technology in every aspects. By the 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 . 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.

B. Smart Home and Buildings: Wi-Fi's technologies in home automation has been used primarily due to the networked nature of deployed electronics where electronic devices such as TVs, mobile devices, etc are usually supported by Wi-Fi. Wi-Fi have started becoming part of the home IP network and due the increasing rate of adoption of mobile computing devices like smart phones, tablets, etc. For example a networking to provide online streaming services or network at homes, may provide a mean to control of the device functionality over the network. At the same time mobile devices ensure that consumers have access to a portable 'controller' for the electronics connected to the network. Both types of devices can be used as gateways for IoT applications. Many companies are considering developing platforms that integrate the building automation with entertainment, healthcare monitoring, energy monitoring and wireless sensor monitoring in the home and building environments.

C. Smart Energy and the Smart Grid: A smart grid is related to the information and control and developed to have a smart energy management. A smart grid that integrate the information and communications technologies (ICTs) to the electricity network will enable a real time, two way communication between suppliers and consumers, creating more dynamic interaction on energy flow, which will help deliver electricity more efficiently and sustainably. The Key elements of information and communications technologies will include sensing and monitoring technologies for power flows; digital communications infrastructure to transmit data across the grid; smart meters with in home display to inform energy usage; coordination, control and automation systems to aggregate and process various data, and to create a highly interactive, responsive electricity. Many applications can be handling due to the internet of things for smart grids, such as industrial, solar power, nuclear power, vehicles, hospitals and cities power control.

D. Smart Health: A close attention that required to hospitalized patients whose physiological status should be monitored continuously can be constantly done by using IoT monitoring technologies. For smart health sensors are used to collect comprehensive physiological information and uses gateways and the cloud to analyze and store the information and then send the analyzed data wirelessly to caregivers for further analysis and review. It replaces the process of having a health professional come by at regular intervals to check the patient's vital signs, instead providing a continuous automated flow of information. In this way, it simultaneously improves the quality of care through constant attention and lowers the cost of care by reduces the cost of traditional ways of care in addition to data collection and analysis.

E. Smart Transportation and Mobility: The development in transportation is one of the factors to indicate the wellbeing of the country. A road condition monitoring and alert application is one of the most important of IoT transformation application. The main idea of the concept of smart transportation and mobility is to apply the principles of crowd sourcing and participatory sensing. The process began with user identified the route wishes and marked some points as pothole in the smart phone's application. The smart transportation is deal with three main conceptions, they are transportation analytic, transportation control, and vehicle connectivity. The transportation analytic represents the analysis of demand prediction and anomaly detection. The routing of vehicles and speed control in addition to traffic management are all known as transportation control which they actually tightly related to the way of the vehicles connectivity (V2X communication), and overall governed by multi-technology dissemination.

F. Smart Factory and Smart Manufacturing: Smart factory added a new values in manufacturing revolution by integrates artificial intelligence, machine learning, and automation of knowledge work and M2M communication with the manufacturing process. The smart factory will fundamentally change how products are invented, manufactured and shipped. At the same time it will improve worker safety and protect the environment by enabling low emissions and low incident manufacturing. These advances in the way machines and other objects communicate and the resulting way in which decision-making moves from humans to technical systems means that manufacturing becomes “smarter”. new technologies such ; Automation, robotics, and autonomous mobility are all provides a means of smart manufacturing but M2M communications enabled by the “industrial” internet of things will provides a full meaning of smart factory and smart manufacturing by the way of Big Data concept which in this context, refers to the analytical possibilities offered by the volume and variety of data that is generated by a networked economy to optimize the industrial processes to implying less maintenance downtime, fewer outages and much reduced energy consumption.

5. INTERNET OF THINGS CHALLENGES

The fact that Internet of things applications and scenarios outlined above are very interesting which provides technologies for smart every things. , but 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 such as:

Scalability: Internet of Things has a big concept than the conventional Internet of computers, because of things are cooperated within an open environment. Basic functionality such as communication and service discovery 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 gain an efficient operation for scalability.

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

Data volumes: Some application scenarios of the internet of things will involve to infrequent communication, and gathering information’s form sensor networks, or form logistics and large scale networks, will collect a huge volumes of data on central network nodes or servers. The term represent this phenomena is big data which is requires many operational mechanism in addition to new technologies for storing, processing and management.

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

Interoperability: Each type of smart objects in Internet of Things have different information, processing and communication capabilities. Different smart objects would also be subjected to different conditions such as the energy availability and the communications bandwidth requirements. To facilitate communication and cooperation of these objects, common standards are required.

Power supply: Things typically move around and are not connected to a power supply, so their smartness needs to be powered from a self-sufficient energy source. Although passive RFID transponders do not need their own energy source, their functionality and communications range are very limited. Hopes are pinned on future low power processors and communications units for embedded systems that can function with significantly 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 justify its existence.

Wireless communications: From an energy point of view, established wireless technologies such as GSM, UMTS, Wi-Fi and Bluetooth are far less suitable; more recent WPAN standards such as ZigBee and others still under development may have a narrower bandwidth, but they do use significantly less power.

6. INTERNET OF THINGS AND RELATED FUTURE TECHNOLOGIES

Many new technologies are related to IoT to prove the integration of wired as well as wireless control, communication and IT technologies together which are responsible for connecting several subsystems and things which operate under a unified platform controlled and managed smartly.

A. Cloud Computing

The two worlds of Cloud and IoT have seen a rapid and independent evolution. These worlds are very different from each other, but their characteristics are often complementary in general, in which IoT can benefit from the virtually unlimited capabilities and resources of cloud to compensate its technological constraints for example storage, processing, and communication. Cloud can offer an effective solution for IoT service management and composition as well as for 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 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. 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.

B. Big Data

Due to the rapid expansion in the networks nowadays, the number of devices and sensors in networks are increased more and more in the physical environments which will change the information communication networks, services and applications in various domains. The expectations in the next year's show that around 50 billion devices will generate large volumes of data from many applications and services in a variety of areas such as smart grids, smart homes, healthcare, automotive, transport, logistics and environmental monitoring. The related technologies and solutions that enable integration of real world data and services into the current information networking technologies are often described under the term of the Internet of Things (IoT).

The volume of data on the Internet and the Web is still growing, and everyday around 2.5 quintillion bytes of data is created and it is estimated that 90% of the data today was generated in the past two years. Collected data from sensors related to different events and occurrences can be analyzed and turned into real information to give us better understanding about our physical world and to create more value added products and services. Such these sensory data like data of predicted and balanced power consumption in smart grids, analyzed data of pollution, weather and congestion , sensory data recorded to provide better traffic control and management, and monitoring and processing health signals data that collected by sensory devices to provide better healthcare services.

C. Security and Privacy

Due the fact that IoT applications able to access the multiple administrative domains and involve to multiple ownership regimes , there is a need for a trust framework to enable the users of the system to have confidence that the information and services being exchanged can indeed be relied upon. The trust framework needs to be able to deal with humans and machines as users, for it needs to convey trust to humans and needs to be robust enough to be used by machines without denial of service. The development of trust frameworks that address this requirement will require advances in areas such as lightweight public key infrastructures (PKI) as a basis for trust management. Lightweight key management systems is used to enable trust encryption materials using minimum communications and processing resources, as is consistent with the resource constrained nature of many IoT devices .

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 the access to information is granted.

D. Distributed Computing

Distributed computing uses groups of networked computers for the same computational goal. Distributed Computing has several common issues with concurrent and parallel computing, as all these three fall in the scientific computing field. Nowadays, a large amount of distributed computing technologies coupled with hardware virtualization, service oriented architecture, and autonomic and utility computing have led to cloud computing. Internet of Things with distributed computing represents a vision in which the Internet extends into the

real world embracing everyday objects. Physical items are no longer disconnected from the virtual world, but can be remotely controlled and can act as physical access points to Internet services.

7. CONCLUSIONS

Internet of things is a new technology which provides many applications to connect the things to things and human to things through the internet. Each objects in the world can be identified, connected to each other through internet taking decisions independently. All networks and technologies of communication are used in building the concept of the internet of things such technologies are mobile computing, RFID, wireless sensors networks, and embedded systems, in addition to many algorithms and methodologies to get management processes, storing data, and security issues. IoT requires standardized approach for architectures, identification schemes, protocols and frequencies will happen parallels, each one targeted for a particular and specific use. by the internet of things many smart applications becomes real in our life , which enable us to reach and contact with every things in addition to facilities many important aspects for human life such as smart healthcare, smart homes, smart energy , smart cities and smart environments.

Internet of things may facing two major challenges in order to guarantee seamless network access; the first issue relates to the fact that today different networks coexist and the other issue is related to the big data size of the IoT. Other current issues, such as address restriction, automatic address setup, security functions such as authentication and encryption, and functions to deliver voice and video signals efficiently will probably be affected in implementing the concept of the internet of things but by ongoing in technological developments these challenges will be overcome. The internet of things promises future new technologies when related to cloud, fog and distributed computing, big data, and security issues. By integrating all these issues with the internet of things, smarter applications will be developed as soon. This paper surveyed some of the most important applications of IoT with particular focus on what is being actually done in addition to the challenges that facing the implementation the internet of things concept, and the other future technologies make the concept of IoT feasible.

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