IoT- A Technology to reconnect the world

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Abstract – *Internet of Things is the next big thing that will connect more than 2 billion objects. The technology will help building smart homes, smart cities, smart agriculture, smart healthcare. The technology will require many sensors to be fabricated and the data from the sensors to be processed to make some decisions. This will generate a huge volume and size of data.   Many statistical models and analysis will be required to analyse the data generated. There are number of challenges to make these systems work on a real time.This paper highlights the overview of application of IoT for smart city and healthcare applications.*

Key Words: **Internet of Things, Sensors, Actuators, Data Analytics,**

1. INTRODUCTION

Internet based services refers to the connection of different computers and computing devices. It is global network inter connecting different computing devices. The scope of internet is getting expanded through the concept of Internet of Things (IoT). The Internet of Things will connect all the objects around us such as lighting system, air conditioners, internet based businesses etc..The vision of Internet of things is to connect all the equipment we see around us at home or at work to provide advanced level of service to the society and to the business. All the objects around us like the table, lighting system, watch etc.. will be fitted with embedded systems so that we can create a basic computing platform in them. These different objects can be used as different nodes of that Internet of Things. They will help in connecting different other things around them and depending on the application requirements a larger network will be formed. IoT is one of the building blocks that is considered to be of use for developing smart solutions to problems. IoT is one of the enabling technologies for to make the city smart.

1.1 Sensors and Actuator

Sensors and actuators are the essential building blocks of IoT[2]. The **sensors** basically sense the physical phenomenon that is occurring around them and the actuators perform certain actions based what is sensed. Based on the parameter that is sensed by the sensor, different types of sensors may be used. For example the physical parameters that the sensor senses are Temperature, Pressure, Humidity, lighting conditions etc. The sensed information in the form of voltage, current or light intensity is sent to the connected system. This information will effect some physical action performed by the actuator. The sensor basically detects the changes in the ambient conditions or can sense the state of another device. For example, a passive Infrared sensor is used for detecting the presence of any obstacle.

Sensors are sensitive to the physical property that is being measured. Also, they are sensitive only to that physical parameter and insensitive to other changes. The sensor output may be converted into analog or a digital signal. Accordingly, further processing can be done.

An **actuator** is a component of a machine or a system that is responsible for moving and controlling a mechanism of system. An actuator requires some kind of a control signal and a source of energy for their functioning. When actuators receive a control signal, they respond by converting that energy into mechanical motion. Actuators may be classified as hydraulic, pneumatic, electrical, thermal, magnetic or mechanical.

1.2 Smart City

IOT can be of great help to build a smart city. A smart city uses information and communication technologies (ICT) to increase operational efficiency, share information with the public and improve both the quality of government services and citizen welfare. A city should have a proper transport system like railways and roadways, hospitals, schools, traffic management, waste management, banks, police, water management. To make the city smart, we need to make all the components of the city smart. With the help of sensors, sensor networks, actuators and other communication technologies like RFID, NFC etc. we can transform a city into a smart city. There has to be connectivity between all these different blocks for offering various services to the citizens in a smart way. Many things will be done automatically and the services would be offered to those who have subscribed for the service.

First of all, there is an ever growing urban population throughout the world. The natural resources in the urban areas are depleting in a fast rate. Also, there are climatic and environmental changes. To make smart cities, the buildings, transportation, police, banks, schools etc.. should be embedded with ICT, digital communication networks, sensors, actuators, RFID tags, software that drive these components in a smart way. Another aspect of smart city is smart governance. The government officials will get connected to all the government agencies and the citizens of the city. They will also be connected to the public services, emergency services, banking services, health care, transportation services and so on.

1.3 Challenges

To achieve these services, there are certain challenges that need to be overcome. Security and privacies of the citizens are vulnerable to different security attacks since all citizens have access to all infrastructures. These type of vulnerabilities have to be taken into consideration while building smart cities. Integration of different hardware components having different specifications is also an important challenge. Integration of various software platforms and accommodation of user requirements can be a huge challenge. There are number of legal and social issues are to be taken care of since it will deal with huge volumes of data associated with human beings. The task of filtering the requisite data and analyzing the data on a real time and actuating a system based on that data is a huge challenge to the technologists. The choice of different sensors for sensing is also critical since the energy consumed by the sensors has to be taken in to consideration.

1.4 Data Handling and Data Analysis

IoT is highly data intensive. These data need to be handled properly and should be analyzed to make sense out of the data. Data handling ensures that the data is stored properly and disposed off in a safe and secure manner after the conclusion of the project. We need to develop policies and procedures for handling of data that is created electronically and non- electronically. The data generated by the sensors is huge and such huge data continuously flow through the network. Storage and processing of this data has to be taken into consideration while planning and designing of IoT systems. Big data is a new generation of technologies and architectures designed to economically extract value from very large volumes of very wide varieties of data. This data which is unstructured has to be handled in real time. In IoT world, the sensors that are embedded to different devices and the machines that generate huge data transmit this data to remote servers through internet and this data has to be handled back end. Sufficient network infrastructure needs to be developed in order to handle this data. The process of data handling comprises of data generation and acquisition, data storage, data processing and analysis. Data analytics is the process of examining the data sets in order to draw conclusions about the information they contain with the help of specialized systems and software. The data can be analyzed quantitatively or qualitatively. Qualitative analysis refers to the process of analyzing data that is categorical in nature; Quantitative analysis refers to process by which numerical methods are used for analysis. Statistical models can be adopted for performing quantitative analysis[1].

1.5 IoT in Healthcare

There are different sensors that have been fabricated to monitor the physiological condition of human beings. There are sensors to sense body temperatures, blood pressure, ECG sensor, pulse oxymeter sensor and many more. These sensors can be fitted to the human body for measuring the physiological parameters and can be sent to a sensor node. The data derived from various sensor nodes can be compiled and processed for further analysis. The patient data can be collected over a period of time and after analysis a preventive care can be advised to the patient. There are many people who do not have access for effective healthcare. Wireless IoT driven solutions bring healthcare to patients rather than bring patients to healthcare. It is possible to securely capture a variety of medical data through IoT based sensors, process the data with smart algorithms and share the data wirelessly with medical professionals for appropriate medical recommendations [3].

2. Conclusion

The scope of internet is expanding. There is unification of different technologies like embedded system, cloud computing, big data, machine learning, mobile computing and networking[4]. IoT is attractive in different spheres of applications like manufacturing, retail, healthcare, agriculture, security. In manufacturing, the overall supply chain, the different equipment, sensors, actuators, robotic machinery used need attention to improve the business processes. In healthcare, we can have portable healthcare and telemedicine in a much bigger way. Processes like inventory tracking, consumer choices can be efficiently managed. This technology will bring a drastic change in our lives.

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