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INTERNET OF THINGS

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ABSTRACT

The Internet of things refers to a type of network to connect anything with the Internet based on stipulated protocols through information sensing equipment to conduct information exchange and communications in order to achieve smart recognitions, positioning, tracing, monitoring, and administration. In this paper we briefly discussed about what IOT is, how IOT enables different technologies, about its architecture, characteristics & applications, IOT functional view & what are the future challenges for IOT.

KEY TERMS

IOT (Internet of Things), IOT definitions, IOT functional view, architecture, characteristics, future challenges.

INTRODUCTION

The IOT concept was coined by a member of the Radio Frequency Identification (RFID) development community in 1999, and it has recently become more relevant to the practical world largely because of the growth of mobile devices, embedded and ubiquitous communication, cloud computing and data analytics. Imagine a world where billions of objects can sense, communicate and share information, all interconnected over public or private Internet Protocol (IP) networks. These interconnected objects have data regularly collected, analyzed and used to initiate action, providing a wealth of intelligence for planning, management and decision making. This is the world of the Internet of Things (IOT). Internet of things common definition is defining as: Internet of things (IOT) is a network of physical objects. The internet is not only a network of computers, but it has evolved into a network of device of all type and sizes , vehicles, smart phones, home appliances, toys, cameras, medical instruments and industrial systems, animals, people, buildings, all connected ,all communicating & sharing information based on stipulated protocols in order to achieve smart reorganizations, positioning, tracing, safe & control & even personal real time online monitoring , online upgrade, process control & administration. We define IOT into three categories as below:

Internet of things is an internet of three things: (1) People to people, (2) People to machine /things, (3) Things /machine to things /machine, Interacting through internet. Internet of Things Vision:

Internet of Things (IoT) is a concept and a paradigm that considers pervasive presence in the environment of a variety of things/objects that through wireless and wired connections and unique addressing schemes are able to interact with each other and cooperate with other things/objects to create new applications/services and reach common goals. In this context the research and development challenges to create a smart world are enormous. A world where the real, digital and the virtual are converging to create smart environments that make energy, transport, cities and many other areas more intelligent. Internet of things Internet of Things is refer to the general idea of things, especially everyday objects, that are readable, recognizable, locatable, addressable through information sensing device and/or controllable via the Internet, irrespective of the communication means (whether via RFID, wireless LAN, wide area networks, or other means). Everyday objects include not only the electronic devices we encounter or the products of higher technological development such as vehicles and equipment but things that we do not ordinarily think of as electronic at all - such as food , clothing ,chair, animal, tree, water etc. Internet of Things is a new revolution of the Internet. Objects make themselves recognizable and they obtain intelligence by making or enabling context related decisions thanks to the fact that they can communicate information about themselves. They can access information that has been aggregated by other things, or they can be components of complex services. This transformation is concomitant with the emergence of cloud computing capabilities and the transition of the Internet towards IPv6 with an almost unlimited addressing capacity.

The goal of the Internet of Things is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service. Research Article Volume 6 Issue No. 5 International Journal of Engineering Science and Computing, May 2016 Internet of things .

ENABLING TECHNOLOGIES FOR IOT

Internet of things (IoT) is a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies. With the Internet of Things the communication is extended via Internet to all the things that surround us. The Internet of Things is much more than machine to machine communication, wireless sensor networks, sensor networks microcontroller, microprocessor etc. These are considered as being the enabling technologies that make “Internet of Things” applications possible. Enabling technologies for the Internet of Things are considered in and can be grouped into three categories: (1) technologies that enable “things” to acquire contextual information, (2) technologies that enable “things” to process contextual information, and (3) technologies to improve security and privacy. The first two categories can be jointly understood as functional building blocks required building “intelligence” into “things”, which are indeed the features that differentiate the IoT from the usual Internet. The third category is not a functional but rather a de facto requirement, without which the penetration of the IoT would be severely reduced.

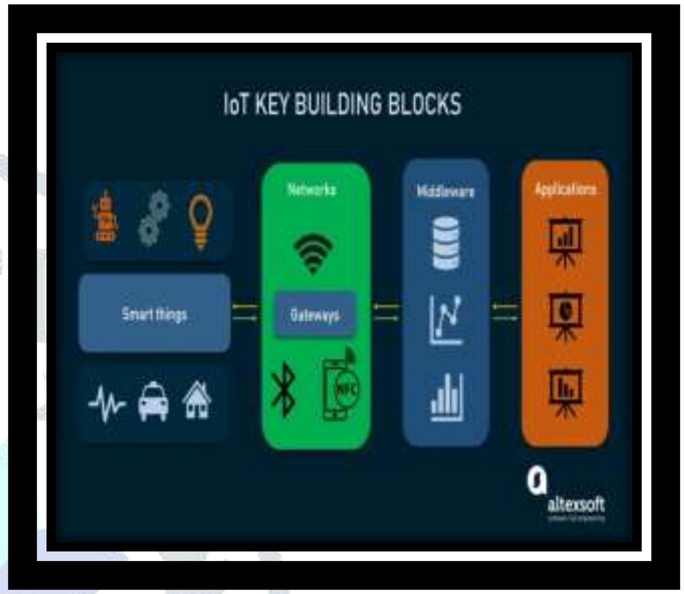
The Internet of Things is not a single technology, but it is a mixture of different hardware & software technology. The Internet of Things provides solutions based on the integration of information technology, which refers to hardware and software used to store, retrieve, and process data and communications technology which includes electronic systems used for communication between individuals or groups. There is a heterogeneous mix of communication technologies, which need to be adapted in order to address the needs of IoT applications such as energy efficiency, speed, security, and reliability. In this context, it is possible that the level of diversity will be scaled to a number a manageable connectivity technologies that address the needs of the IoT applications, are adopted by the market, they have already proved to be serviceable, supported by a strong technology alliance. Examples of standards in these categories include wired and wireless technologies like Ethernet, WI-FI, Bluetooth, ZigBee, GSM, and GPRS.

IOT ARCHITECTURE

IOT architecture consists of different layers of technologies supporting IOT. It serves to illustrate how various technologies relate to each other and to communicate the scalability, modularity and configuration of IOT deployments in different scenarios. Figure 4 shows detailed architecture of IOT. The functionality of each layer is described below : **A. smart device / sensor layer:**

The lowest layer is made up of smart objects integrated with sensors. The sensors enable the interconnection of the physical and digital worlds allowing real-time information to be collected and processed. There are various types of sensors for different purposes. The sensors have the capacity to take measurements such as temperature, air quality, speed, humidity, pressure, flow, movement and electricity etc. In some cases, they may also have a degree of memory, enabling them to record a certain number of measurements. A sensor can measure the physical property and convert it into signal that can be understood by an instrument. Sensors are grouped according to their unique purpose such as environmental sensors, body sensors, home appliance sensors and vehicle telematics sensors, etc. Most sensors require connectivity to the sensor gateways. This can be in the form of a Local Area Network (LAN) such as Ethernet and Wi-Fi connections or Personal Area Network (PAN) such as ZigBee, Bluetooth and Ultra Wideband (UWB). For sensors that do not require connectivity to sensor aggregators, their connectivity to backend servers/applications can be provided using Wide Area Network (WAN) such as GSM, GPRS and LTE. Sensors that use low power and low data rate connectivity, they typically form networks commonly known as wireless sensor networks (WSNs). WSNs are gaining popularity as they can accommodate far more sensor nodes while retaining adequate battery life and covering large areas.

SENSOR NETWORK IDENTIFICATION DATA & SIGNAL PROCESSING NETWORK MANAGMENT FUTURE INTERNET NANOELECTRONICS CLOUD COMPUTING COMMUNICATION EMBEDDED SYSTEM SECURITY & PRIVACY SOFTWARE DISCOVERY SERVICES SYSTEM INTEGRATION HARDWARE NETWORK TECHNOLOGY POWER & ENERGY STORAGE INTEROPERABILITY COST EFFECTIVE DATA MANAGMENT PROTOCOL/ STANDARDS SEMICODUCTOR ELECTRONICS



International Journal of Engineering Science and Computing, May 2016 6125 http://ijesc.org/ B. Gateways and Networks Massive volume of data will be produced by these tiny sensors and this requires a robust and high performance wired or wireless network infrastructure as a transport medium.

Current networks, often tied with very different protocols, have been used to support machine-to-machine (M2M) networks and their applications. With demand needed to serve a wider range of IOT services and applications such as high speed transactional services, context-aware applications, etc, multiple networks with various technologies and access protocols are needed to work with each other in a heterogeneous configuration. These networks can be in the form of a private, public or hybrid models and are built to support the communication requirements for latency, bandwidth or security. Various gateways (microcontroller, microprocessor...) & gateway networks (WI-FI, GSM, GPRS…) are shown in figure 3. C. Management Service Layer The management service renders the processing of information possible through analytics, security controls, process modeling and management of devices. One of the important features of the management service layer is the business and process rule engines. IOT brings connection and interaction of objects and systems together providing information in the form of events or contextual data such as temperature of goods, current location and traffic data. Some of these events require filtering or routing to postprocessing systems such as capturing of periodic sensory data, while others require response to the immediate situations such as reacting to emergencies on patient's health conditions.. In the area of analytics, various analytics tools are used to extract relevant information from massive amount of raw data and to be processed at a much faster rate. Analytics such as inmemory analytics allows large volumes of data to be cached in random access memory (RAM) rather than stored in physical disks. In-memory analytics reduces data query time and augments the speed of decision making. Streaming analytics is another form of analytics where analysis of data, considered as data-in-motion, is required to be carried out in real time so that decisions can be made in a matter of seconds. Data management is the ability to manage data information flow. With data management in the management service layer, information can be accessed, integrated and controlled. Higher layer applications can be shielded from the need to process unnecessary data and reduce the risk of privacy disclosure of the data source. Data filtering techniques such as data anonymisation, data integration and data synchronization, are used to hide the details of the information while providing only essential information that is usable for the relevant applications. With the use of data abstraction, information can be extracted to provide a common business view of data to gain greater agility and reuse across domains.

APPLICATION AREAS

Potential applications of the IoT are numerous and diverse, permeating into practically all areas of every-day life of individuals, enterprises, and society as a whole. 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. Below are some of the IOT applications.

A. IOSL (Internet of smart living):

Remote Control Appliances: Switching on and off remotely appliances to avoid accidents and save energy, Weather: Displays outdoor weather conditions such as humidity, temperature, pressure, wind speed and rain levels with ability to transmit data over long distances, Smart Home Appliances: Refrigerators with LCD screen telling what's inside, food that's about to expire, ingredients you need to buy and with all the information available on a Smartphone app. Washing machines allowing you to monitor the laundry remotely, and. Kitchen ranges with interface to a Smartphone app allowing remotely adjustable temperature control and monitoring the oven's self-cleaning feature, Safety Monitoring: cameras, and home alarm systems making people feel safe in their daily life at home, Intrusion Detection Systems: Detection of window and door openings and violations to prevent intruders, Energy and Water Use: Energy and water supply consumption monitoring to obtain advice on how to save cost and resources, & many more…

B. IOSC (Internet of smart cities):

Structural Health: Monitoring of vibrations and material conditions in buildings, bridges and historical monuments, Lightning: intelligent and weather adaptive lighting in street lights, Safety: Digital video monitoring, fire control management, public announcement systems, Transportation: Smart Roads and Intelligent High-ways with warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams, Smart Parking: Real-time monitoring of parking spaces availability in the city making residents able to identify and reserve the closest available spaces, Waste Management: Detection of rubbish levels in containers to optimize the trash collection routes. Garbage cans and recycle bins with RFID tags allow the sanitation staff to see when garbage has been put out.

C. IOSE (Internet of smart environment):

Air Pollution monitoring: Control of CO_2 emissions of factories, pollution emitted by cars and toxic gases generated in farms, Forest Fire Detection: Monitoring of combustion gases and preemptive fire conditions to define alert zones, Weather monitoring: weather conditions monitoring such as humidity, temperature, pressure, wind speed and rain, Earthquake Early Detection, Water Quality.

MATERIALS AND METHODS:

Manufacturing technology currently in use exploits standard technology along with modern distribution and analytics. IOT introduces deeper integration and more powerful analytics. This opens the world of manufacturing in a way never seen before, as organizations become fully developed for product delivery rather than a global network of suppliers, makers, and distributors loosely tied together.

Intelligent Product Enhancements:

Much like IOT in content delivery, IOT in manufacturing allows richer insight in real-time. This dramatically reduces the time and resources devoted to this one area, which traditionally requires heavy market research before, during, and well after the products hit the market. IOT also reduces the risks associated with launching new or modified products because it provides more reliable and detailed information. The information comes directly from market use and buyers rather than assorted sources of varied credibility.

Dynamic Response to Market Demands:

Supplying the market requires maintaining a certain balance impacted by a number of factors such as economy state, sales performance, season, supplier status, manufacturing facility status, distribution status, and more. The expenses associated with supply present unique challenges given today's global partners. The associated potential or real losses can dramatically impact business and future decisions.

Advancements in material technologies become critical for the varied applications of smart manufacturing systems which include sensors for the Internet of Things (IOT), cyber-physical systems(CPS), and robot-human interactions. In most sensors used for sensing of stimuli such as forces, temperature, humidity, one type of material is not enough for all applications. Hence multi-material sensors become necessary. With shrinking volume of sensing systems, and reducing costs and energy required for running the sensors and collecting data – making compact, highly efficient sensor systems would require innovative materials.

SENSOR:

A sensor is a device that produces an output signal for the purpose of sensing of a physical phenomenon. In the broadest definition, a sensor is a device, module, machine, or subsystem that detects events or changes in its environment and sends the information to other electronics, frequently a computer processor.

RESULT AND DISCUSSION:

The future of IOT has the potential to be limitless. Advances to the industrial internet will be accelerated through increased network agility, integrated artificial intelligence (AI) and the capacity to deploy, automate, orchestrate and secure diverse use cases at hyper scale. The potential is not just in enabling billions of devices simultaneously but leveraging the huge volumes of actionable data which can automate diverse business processes. As networks and IOT platforms evolve to overcome these challenges, through increased capacity and AI, service providers will edge furthermore into IT and web scale markets – opening entire new streams of revenue.

Internet of things is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system.

IOT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. They enhance data collection, automation, operations, and much more through smart devices and powerful enabling technology.

This tutorial aims to provide you with a thorough introduction to IOT. It introduces the key concepts of IOT, necessary in using and deploying IOT systems.

CONCLUSION:

Internet of Things is a new revolution of the Internet & it is a key research topics for researcher in embedded ,computer science & information technology are due to its very diverse area of application &heterogeneous mixture of various communication and embedded technology in its architecture.

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