Internet of Things: An Overview of the Emerging Technology

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Abstract: The Internet of Things is an emerging phenomenon of today having great significance, technology, and global economy point of view. The extensive implementation of Internet of Things is ready to transform our life and lifestyle. Internet of Things offers huge potential due to unprecedented growth of smart devices, availability of low cost technologies, comprehensive connectivity and massive volumes of data collecting and processing ability in real time. Internet of Things is the next generation of the Internet connecting things and devices like sensors and cameras, results in generation of huge data that can infer useful insights for decision making. A world of interconnected smart devices is here in the form of Internet of Things. Internet of Things raises many issues and challenges like risk of surveillance, privacy and security violations. The present paper discusses the concept, definitions and application areas to gives an overview of the emerging technology Internet of Things.

Keywords: Devices, Ecosystem, Internet of Things, Network, Sensors, Things.

I.   INTRODUCTION

The next generation advancement of Internet is the Internet of Things. The Internet of Things combines Things with Internet connectivity and powerful data collection and data analysis capabilities. The Internet of Things is potentially beneficial, revolutionary and fully interconnected smart world of progress, efficiency, and opportunity. The term Internet of Things was first used by Kevin Ashton to describe a system in which objects in the physical world could be connected to the Internet by sensors to greatly reduce waste, loss, and cost. Convergence of ubiquitous connectivity, adoption of global standard Internet Protocol (IP), availability of greater computing power at lower price, miniaturization of sensor with greater computing power, advances in data analysis capabilities, rise of cloud computing are some of the factors responsible for rapid proliferation of Internet of Things. [4]

The Internet of Things is a fast emerging ecosystem with the tremendous potential to deliver significant benefits like cost efficiency, improved asset utilization, enhanced process efficiency and increased productivity. The Internet of Things enabled products employ embedded technology to communicate, directly or indirectly, with each other or with the Internet. The Internet of Things is a convergence of connected and communicating in an intelligent manner traditional devices like desktop and laptop and everyday things of diverse range with embedded technology, to become one big information system. Explosive growth in mobile devices and applications and the easy availability of wireless connectivity are the driving forces behind the emergence of Internet of Things. [11]

The ability of sensors to capture data on its surroundings at speed and in volume led to the phenomenon called Big Data. Big Data is the acquisition and analysis of extremely large data sets. Cost effective cloud storage and the rise of data acquisition and analysis capabilities to extract information from massive amounts of data have greatly contributed to Internet of Things. Rapidly developing Internet of Things technology is opening up multiple new opportunities and services in many industries including healthcare, transportation, manufacturing, energy, public safety, agriculture, insurance, smart cities etc. with the potential for significant benefits to citizens and consumers. Priority areas like spectrum, privacy, security and resilience support the growth of the Internet of Things. [12]

This ecosystem of connected objects forms the foundation of Internet of Things. All opportunity comes with some risks and Internet of Things is no exception. Every Internet connected object is another entry point for the cybercriminals. In a world where machines replace humans as the decision makers and sensors are continuously capturing data, liability and privacy are serious problems. To fully realize the great potential of Internet of Things, it is essential to address these security concerns. [1,8]

II.   DEFINITING INTERNET OF THINGS

Despite the global importance, technologically advanced, human life transformer, world economy driver, there is no single, universally accepted definition for the term Internet of Things. Different definitions of Internet of Things are available based on different considerations like global implications, applications, technology, and architecture. In its simplest form The Internet of Things is, extending Internet connectivity and computing capabilities to a variety of objects, devices, sensors, and everyday things. Internet of Things is the ability to connect, communicate, and remotely manage large number of networked, automated devices related to almost every walk of our life, using Internet. [5]

The Internet Architecture Board defines the term Internet of Things as it denotes a trend where a large number of embedded devices employ communication services offered by the Internet protocols. Many of these devices, often called smart objects, are not directly operated by humans, but exist as components in buildings or vehicles, or are spread out in the environment. Internet Engineering Task Force defines Internet of Things as smart object networking, where smart objects are devices that typically have limited power, memory, and processing resources, or bandwidth. International Telecommunication Union defines Internet of Things as 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. [10]

IEEE communications magazine defines the Internet of Things as it is a framework in which all things have a representation and a presence in the Internet that enables the interactions between Things and applications in the cloud. The Oxford Dictionaries defines Internet of things as the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data. The term Internet of Things can be seen as scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate exchange and consume data with minimal human intervention. Internet of Things represents the next step towards the digitization of our society and economy, where objects and people are interconnected through communication networks and report about their status and/or the surrounding environment. [13]

The Internet of Things is the concept of everyday objects from industrial machines to wearable devices using built in sensors to gather data and take action on that data across a network. The Internet of Things is the future of technology that can make our lives more efficient. The future for telecommunications and the world economy lies with the Internet of Things. The Internet of Things is a label for an increasingly connected future in which regular, everyday items from household appliances to cars to medical devices are outfitted with sensors and connected to the Internet to share their data. The Internet of Things will give rise to an entire ecosystem for interconnected devices, objects, systems, and data all working together. Internet of Things is wearable technology and smart appliances, autonomous machines and equipment with sensors, Big Data and data analysis capabilities. [2]

III.   INTERNET OF THINGS APPLICATION SECTORS

The Internet of Things refers to the ability of everyday objects to connect to the Internet and to send and receive data. Emerging applications of Internet of Things falls in two broad categories information analysis and automation control. Information and analysis of data generated in Internet of Things can be automated in enhanced decision making to control operations significantly without human interventions. Products embedded with sensors can be tracked and monitored for collection of their behavioral data. This data can give enlarged awareness of real time events using visualization technologies to decision makers. Longer range and complex human planning and decision making is possible with advanced data analysis software's, huge storage and computing recourses. Improved instrumentation can optimize process and consumption of scarce resources resulting in reduced waste, energy, and human intervention. Complex autonomous

system ensures major benefits in safety, risk, and costs due to its ability of rapid, real time sensing of unpredictable hazards conditions for humans and instantaneous responses. Applications of Internet of Things are widespread and possess the potential to deliver significant benefits to citizens and consumers across a range of areas include healthcare, manufacturing, transportation, and energy.[6]

Wearable remote patient monitoring healthcare devices, monitor fitness exercise, sleep and other health habits allowing patients and their doctors to obtain real time access to health data of patients. Internet of Things in healthcare is expected to lead to vast improvements in the quality of care, better health outcomes, and at significantly lower costs. Healthcare industry is extensively employing IoT technology. IoT enabled wearable's allow doctors to capture health data of patients that helps to know patients with troubling health signs that might not show any symptoms before it lead to more severe problems. Doctors can use this data to better understand the health of the individual patient, and prepare detailed data sets of patient groups for treating and preventing long time chronic diseases. Hospitals collect and hold massive amounts of data can use IoT technology to infer actionable intelligence for patient's treatments. IoT enabled scanners give hospital stock shortages information eliminating need to intentionally overstock inventories. IoT devices can considerably improve the treatment in emergency situations in hospitals. Even before the patient arrives in hospital in critical condition IoT device can provide all details about patient's vital signs and other statistics so that doctor understands patient's condition and can start treatment without wasting time once patient arrives.[9]

Data collecting sensors embedded in machinery or warehouse can communicate problems or track resources in real time, and real time data processing software's takes decisions and makes it easy to work more efficiently and keeps costs down. Sensor networks and smart devices are driving major improvements such as increased visibility, improved automation, improved energy management, increased ability for proactive maintenance, and a better connected supply chain. IoT possess the ability to reduce workplace related injuries, deaths and keep employees safe, especially those working in hazardous areas. Wearable technology can be equipped with embedded sensors to determine when a worker might be in danger maneuvering unsafely. The sensors can monitor extreme temperatures and the presence of toxic substances like hazardous environmental conditions. Behavioral data collected by IoT devices from wearable sensors can predict possibility of accident. This predictive ability is a potentially exciting feature of IoT. Manufacturers can use IoT products to ensure the integrity, quality, safety, and security. IoT devices promise to revolutionize design, security, and maintenance in sensitive area of manufacturing. [7]

Internet of Things impacts transportation on a large scale. Driverless and connected cars are about to arrive. Roadways can be monitored via sensors to keep them as safe as possible. Collecting information from vehicles can help improve traffic flow, allow drivers to avoid traffic accidents and provide information for better vehicle design and develop intelligent transportation infrastructure. Goods can be tracked while it is on the way for delivery. The rise of safety focused sensors on automobiles, promises to considerably reduce the global death rate from motor vehicle accidents. Because a vast majority of motor vehicle accidents are the result of human error, replacing the human decision making component in driving is the object of autonomous vehicles. These decision making components come in the form of safety sensors protecting the car without direct driver action. Auto companies also use the data these sensors acquire to help them produce safer, more efficient cars.[14]

Smart energy meters can collect data from a wider range of household, office and industrial equipment automatically, they apply analytics that can track, monitor and potentially manage energy use for cost saving. Sensors in devices can track data and use predictive modeling to schedule downtime for more efficient energy use. Smart grid technologies drive greater efficiencies in both energy production and consumption. Advanced appliances and smart devices are in use today to cut energy usage and costs. An office building or a large business house may use IoT device to capture and monitor energy usages from each section to identify areas of wasteful energy use and cut costs. The energy industry with machine to machine service provider is at the forefront of IoT technology, mainly utility companies innovating ways to read energy usage of commercial, industrial, and residential customers remotely. Energy IoT devices can range from meters, grid sensors and actuators to energy boxes and electrical appliances can be used for applications such as grid monitoring and control, metering, asset management and tracking, and field force communication.[3]

IV. CONCLUSION

The Internet of Things is connecting things to the Internet to create an intelligent, invisible network that can be used to provide useful remote monitoring and control services. Internet of Things possess robust ability of massive data collection, data analysis and data management capabilities to infer valuable insights from the data generated by the transactions and interactions for exploring its full potential. The Internet of Things is comprehensive and self organizing network of connected, identifiable and addressable physical objects with embedded chips, sensors, actuators and low cost miniaturization. Though the Internet of Things is emerging and potentially beneficial to world community there exits several definitions based on different factors like underlying technology and application areas. Applications of Internet of Things are encompasses to very large sectors to deliver significant benefits, the present paper discusses some of the important areas like healthcare, manufacturing, transportation, and energy. Patient monitoring devices, electronic records and other smart accessories are taking care of patient's health and encourage a healthy lifestyle. IoT ensures products integrity, quality, safety, and security in manufacturing sector. In transportation sector IoT attempts to replace human decision making component to make motor vehicle movement safe and secure. In energy sector adoption of smart grid technologies bring about greater efficiencies in energy production and consumption.

REFERENCES

[1] "The Internet of Things: An Overview-Understanding the Issues and Challenges in More Connected World", (2015), https://www.internetsociety.org/sites/default/files/ISOC-IoT-Overview-20151014_0.pdf

[2] Essential Guide, "IoT analytics guide: Understanding Internet of Things data", http://searchbusinessanalytics. techtarget.com/essentialguide/IoT-analytics-guide-Understanding-Internet-of-Things-data

[3] Techopedia, "Internet of Things", https://www.techopedia.com/definition/28247/internet-of-things-iot

[4] Daniel Castro & Jordan Misra,"The Internet of Things", (2013), www2.datainnovation.org/2013-internet-of-things.pdf

[5] "Reaping the Benefits of the Internet of Things", (2014), http://www.cognizant.com/InsightsWhitepapers/Reaping-the-Benefits-of-the-Internet-of-Things.pdf

[6] White Paper on "Security in the Internet of Things-Lessons from the Past for the Connected Future", (2015), http://www.windriver.com/whitepapers/security-in-the-internet-of-things/wr_security-in-the-internet-of-things.pdf

[7] "Internet of Things-Privacy & Security in a Connected World", (2015), https://www.ftc.gov/system/files/documents/ reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf

[8] "The Internet of Things: Evolution or Revolution?", http://www.aig.com/Chartis/internet/US/en/AIG%20 White%20 Paper%20-%20IoT%20English%20DIGITAL_tcm3171-677828_tcm3171-698578.pdf

[9] White paper on "Realizing the Potential of The Internet of Things: Recommendations to Policy Makers", (2015), https://www.tiaonline.org/sites/default/files/pages/TIA-White-Paper-Realizing_the_Potential_of_the_Internet_of_ Things. pdf

[10] "The Working Party on the Protection of Individuals With Regard to the Processing of Personal Data", 2014, http://ec.europa.eu/justice/data-protection/article-29/files/tasks-art-29_en.pdf

[11] White Paper on, "The Internet of Things: Security Research Study",(2015), https://www.veracode.com/ sites/default/ files/Resources/Whitepapers/internet-of-things-whitepaper.pdf

[12] "The Internet of Things-Research Study", http://www8.hp.com/h20195/V2/GetPDF.aspx/4AA5-4759ENW.pdf

[13] Jim Chase, The White Paper on, "The Evolution of the Internet of Things", (2013), http://www.ti.com/lit/ml/ swrb028/swrb028.pdf

[14] Pew Research Center, "The Internet of Things Will Thrive by 2025", (2014), http://www.pewinternet. org/2014/05/14/internet-of-things/A. Vetro, H. Sun, P. DaGraca, and T. Poon, "Minimum drift architectures for three-layer scalable DTV decoding," IEEE Transaction on Consumer Electronics, Vol. 44, No. 3, pp. 527-536, Aug. 1998.