Internet of Things
IOT Structure and Advancements with Applications

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ABSTRACT

Internet of Things symbolizes an idea in which the Internet encompasses into the real world implementing routine objects. In this paper the idea, the challenges, possible usage situations and technical architectural blocks of the "Internet of Things" have been discussed. Many technical organizations are vigorously following research topics that contribute to the Internet of Things (IoT). Today, as sensing, actuation, communication, and control becomes even more intelligent and universal, there is momentous overlap in these communities, sometimes from slightly different perspectives. More cooperation between communities is encouraged. The increase of these devices in a communicating–activating network creates the Internet of Things (IoT), in which sensors and actuators merge effortlessly in our surroundings, and the information is shared across levels in order to develop a common operating picture (COP). The paper concludes with solutions to the issues that are likely to arise as the idea of the Internet of Things becomes a reality.

Keywords: IOT (Internet of Things), RFID, Cloud computing, Internet.

I. INTRODUCTION

Many people hold the view that cities and the world itself will be overlapped with sensing and activation, many implanted in "things" creating a world referred to a smart world.

The ideas of smart devices, smart cars, smart phones, smart homes, smart cities; a smart world have been supported for ages. Accomplishing these goals has been examined, till now by many diverse research communities.There are five prominent research communities among which one is: Internet of Things (IoT). In the Internet of Things (IoT) model, many of the objects around us will be on the network on some form. Radio Frequency Identification (RFID) and sensor network technologies will grow to meet this new challenge, in which information and Communication systems are implanted in our surroundings invisibly. Intelligent connectivity with existing networks and context-aware computing using network resources is a vital part of IoT. With the growth in Wi-Fi for Internet access, the evolution towards universal information and communication networks is already obvious. However, for the idea of Internet of Things to successfully arise, the computing model will need to go beyond traditional mobile computing setting that use smart phones and portables, and evolve into connecting everyday existing objects and implanting intelligence into our environment.

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The concept Internet of Things was first defined by Kevin Ashton in 1999. Even so, in the past decade, the definition has been more comprehensive covering wide extent of applications like health care, utilities, transport, etc. Although the definition of 'Things' has changed as technology developed, the main aim of making a computer sense information without the help of human engagement remains the same.

An ultra-evolution of the current Internet has took place which has become a Network of interconnected objects that not only mines information from the environment (sensing) but also interacts with the physical world i.e. through actuation, command and control. It uses existing Internet standards to provide services for information transfer, analytics, communications and applications. Fueled by the large number of devices enabled by open wireless technology like

Blue-tooth, Radio Frequency Identification (RFID), Wi-Fi, and telephonic data services as well as embedded sensor and activating nodes, IoT has developed and is on the edge of transforming today's inactive Internet into a fully unified Future Internet.

II. IOT ARCHITECTURAL COMPONENTS

2.1 Radio Frequency Identification (RFID)

RFID technology is a major discovery in the implanted communication model which allows design of microchips for wireless data communication. They help in the self-identification of anything. They act as an electronic bar-code. The inactive RFID tags are not battery powered and they use the power of the reader's transmission signal to communicate the ID to the RFID reader. This mechanism is used in many applications particularly in retail and supply chain management. It is also used in transportation i.e. in replacement of tickets, registration stickers etc., and applications that involve access control as well. These passive tags are currently being used in many bank cards and road toll tags which are among the first global deployments. Active RFID readers have their own battery supply and can represent the communication. The main application of active RFID tags is for monitoring cargo in port containers.

2.2 Wireless *Sensor Networks (WSN)*

Technological advances in wireless communications and low power integrated circuits have made available cost-effective, low power mini devices for use in remote sensing applications. The aggregation of these factors has improved the practicality of using a sensor network containing a large number of intelligent sensors, enabling the collection, processing, analysis and spread of valuable information, gathered in a variety of environments. Active RFID is almost the same as the lower end WSN nodes and has limited storage and processing capability. The scientific challenges that must be overcome in order to realize the large potential of WSNs are significant and multidisciplinary in existence. Sensor data are shared among sensor nodes and sent to a distributed or centralized system for analytics.

2.3 Data storage and analytics

One of the most important outcomes of this rising field is the creation of an unprecedented amount of data. Storage, expiry and ownership of the data become complex issues. Today the internet consumes up to 5% of the total energy generated. With these types of needs, it is sure to go up even further. Hence, data centers that are centralized and run on mined energy will ensure reliability as well as energy efficiency. The data have to be stored and used intelligently for smart monitoring and activation. It is vital to develop artificial intelligence algorithms which could be centralized or distributed based on the need. New merger algorithms need to be developed to make sense of the data collected. Progressive, non-linear, temporal machine learning methods based on evolutionary algorithms, genetic algorithms, neural networks, and other artificial intelligence techniques are important to achieve automated decision making. The properties such as interoperability, integration and adaptive communications are shown by the systems. They also consist of a standard architecture very well-suited for IoT applications that are usually in terms of hardware system design as well as software development. More importantly, a centralized architecture to support storage and analytics is required. As of 2012, Cloud based storage is becoming increasingly popular and in the years ahead and Cloud based analytics and visualization platforms are predicted.

III. CLOUD CENTRIC INTERNET OF THINGS

The idea of IoT can be envisioned in two ways 'Internet' centric and 'Object' centric. In the object centric architecture, the smart objects take the center stage. The Internet centric architecture involves focusing on internet services while data is contributed by the objects. For the vision of IoT to become a success, we develop an Internet centric approach. An abstract framework integrating the universal sensing devices and the applications is shown in the figure 1. In order to realize the full potential of cloud computing as well as universal sensing, a composed model which has a cloud at the center seems to be most executable. This not only gives the malleability of dividing related costs in the most analytic manner but is also highly scalable. After joining the network sensing service can offer their data using a storage cloud providers; analytic tool developers can provide their software tools; artificial intelligence experts can give access to their data mining and machine learning tools which are useful in conversion of information to knowledge and also computer graphics designers can provide a range of visualization tools. Cloud computing can offer these services as Architectures, Platforms or Software where the full potential of human creativity can be harvested using them as services. The tools used, data yielded and the visualization created disappears into the background, harvesting the full potential of the Internet of Things in various application domains. In figure 1 given below, the Cloud integrates all ends of universal computing by providing computation time, scalable storage and other tools to build new businesses.

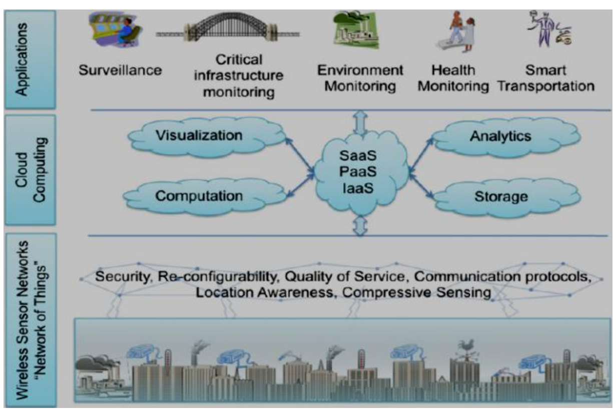

Fig 1: IOT Framework

IV. APPLICATIONS

4.1 *Personal and Home*

For the past two decades the idea of Universal health care has been envisioned. IoT gives a perfect platform to bring this idea into a reality using body area sensors and IoT rear end to upload the data to servers. For example, a Smartphone can be used for communication along with several interfaces like Bluetooth for interfacing sensors measuring physical parameters. Creating a home monitoring system for elderly care can be an extension of the personal body area network is which allows the doctor to monitor patients and the elderly in their homes thus reducing hospitalization costs through early participation and treatment. Control of home appliances such as air conditioners, refrigerators, washing machines etc., will allow better home and energy management.

Thus the consumers will become more involved in the IoT revolution just like the Internet revolution. Social networking is set to undergo another transformation with billions of interconnected objects. An interesting development will be using a Twitter like concept where individual 'Objects' in the house can periodically tweet (give) the readings which can be easily read from anywhere creating a TweetOT (Tweet of Things).

4.2Enterprise

The 'Network of Things' within a work environment is referred as the enterprise based application. Data collected from such networks is used only by the owners and the data may be released exclusively. The first common application is the Environmental monitoring which is enforced to keep track of the number of residents and manage the utilities within the building (e.g., HVAC-heating ventilation and air conditioning; lighting). Sensors have always been an inbuilt part of the factory setup for security, automation, climate control, etc. This will ultimately be replaced by a wireless system giving the flexibility to make changes to the setup whenever needed. This is nothing but an IoT subnet devoted to factor maintenance.

4.3 Utilities

Smart network and smart metering is another potential IoT application which is being implemented everywhere. Efficient energy consumption can be achieved by continuously monitoring every electricity point within each house and thus using this information to modify the way electricity is used-up. Video based IoT, which incorporates image processing, computer vision and networking grid, will help develop a new challenging scientific research area at the intersection of video, microphone infrared, and network technologies. The most widely used camera network applications, i.e. surveillance, helps track targets, detect left luggage, identify suspicious activities and monitor unauthorized access. Video based IoT, which integrates computer vision, image processing and networking frameworks, will help develop a new challenging scientific research area at the intersection of video, infrared, microphone and network technologies.

4.4 Transportation and Logistics

Smart logistics and transportation are placed in a separate area due to the nature of data backbone implementation and sharing required. Modern traffic is the main reason of traffic noise pollution, urban air pollution and effects of greenhouse gas emissions on the environment. Traffic congestion directly enforces momentous costs on social and economic activities in most urban areas. Productivity and Supply chain efficiencies, including timely operations, are severely impacted by this congestion causing cargo delays and delivery schedule failures. Dynamic traffic information will affect cargo movement, allow improved scheduling and better planning. The transport IoT will enable the use of large scale WSNs for online monitoring of origin– destination (O–D), travel times, queue lengths, route choice behavior, noise emissions and air pollutant. The IoT is likely to substitute or even completely replace the traffic information provided by the existing sensor networks of inductive loop vehicle detectors installed at the intersections of existing traffic management systems. They will also hold the development of framework-based models for the planning and design of decrease and relief plans, as well as improved algorithms for urban traffic control, which includes multi-objective control systems.

V. CONCLUSION

The vision of the future of IoT is that it becomes a utility with increased developments in communications, sensing, actuation, control, and in harvesting knowledge from vast amounts of data. This will in turn enhance the quality of lifestyles from today. Anyone could easily well as avoid re-inventing the wheel when a particular community solves a problem. Predict what the urban lifestyles would be is. New research problems arise due to the large scale of devices, the connection of the physical and cyber worlds, the openness of the systems, and continuing problems of privacy and security. The devices connected in the IoT network enable new, smart applications, analytics and business models that result in a cleaner, more efficient and sustainable way of living. More cooperation between the research communities will help solve these infinite problems sooner as

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