Basics of IOT

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***Abstract*— The Internet of Things is directly refers to using the standard Internet Protocols to do human-to-thing or thing to thing communication. The main motive of IoT is to create a virtual footprint of all the devices and people that are connected to it. It gives a new method of communication between all the things and the people, and also between the objects itself. Internet of Things provides a different level of communication. This paper explains all the concepts and mechanism of IoT in brief. The technologies which are important enable IoT are RFID systems are Sensor networks and intelligence technologies. The potential applications of these technologies are reviewed and the major research issues are described.**

***Keywords* — Sensor, Actuator, Microcontroller, RFID, WSN.**

I. Introduction

Internet of Things is a framework in which objects like figuring gadgets or machines or living items like creatures or individuals can share information and share to each other with no connection of human.

IOT is the inter-networking of physical gadgets, autos, structures, houses and different things outfitted with hardware, sensors, actuators and system availability that empower those articles to gather and trade information. The Global Standard Initiative on Internet of Things (IOT-GSI), in 2013, characterized the IOT as "the framework of the data society". IOT enables objects to be sensed or controlled remotely across existing network infrastructure creating opportunities for more direct integration of the physical world into computerbased systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

Each 'thing' can be uniquely identifiable through the embedded computing system of IOT but also be able to inter-operate within the existing internet infrastructure. The word 'Things' in the sense of IOT, can be referred to many number of devices. For example a heart monitoring implants, bio-chip transponders, on-firms animals, electric clams in coastal waters, vehicles with built-in sensors, DNA analysis device and many more other smart devices. Legal scholar suggests thinking of "Things" as an "inextricable mixture of hardware, software and service". All these devices collect useful data with using various existing technologies and then share the data between other devices, autonomously.

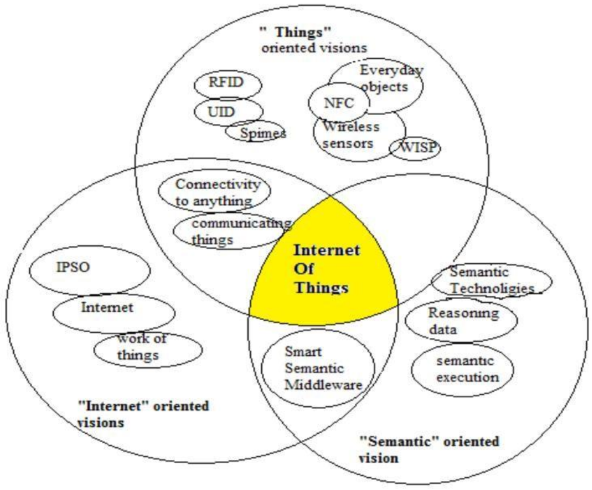

Fig. I.I Convergence of different visions of IoT

II. History of IOT

The idea of the Internet of Things came into limelight in 1999, through the Auto-ID focus at MIT and related market-examination distributions. The Radio-Frequency Identification (RFID) was seen by Kavin Ashton who was one of the originators of the Auto-ID focus, as an essential for the Internet of Things at the point. Ashton lean towards the expression "Web of Things", if every one of the articles and individuals in day by day life were given identifiers, PCs could oversee and stock them. Other than utilizing RFID, the labeling of things can likewise be accomplished through such advances as Near Field Communication (NFC), standardized tags, QR codes and computerized promoting..

The expression "web of Things" was given by Peter T.Lewis in a discourse in 1985 given at the U.S Federal Communication Commission (FCC) upheld remote session at the Congressional Black Caucus fifteenth Legislative Weekend Conference. In his speech, he said that "The Internet of Things is the integration of people process and technology with connectable devices and sensors to enable status manipulation, remote monitoring, and evaluation of trends of such devices".

III. Applications

IoT enables the objects in our everyday working or living environment to communicate and elaborate the information gathered from the environment which will make a lot of applications possible. The applications of IoTtechnologies, that can either be applied directly or closer to our current living habitats, grouped into 3 domains.

A. Supply Chain Management

The Real-time information processing technology is being used in IoT that are based on RFID and NFC. We can accurately overlook and manage realtime information, work-in-progress and in-transit stages with reliable due dates can be obtained. This would increase the forecast that would be more accurate. Automated rebuilding of out-of-stock products and decrease of stock would be conceivable. Applying these advancements would require a couple days and can essentially work with zero security stock. Transportation autos, transports and taxicabs and also streets crossing points will turn out to be more instrumented with sensors, actuators, and handling power. Important information could be collected that can help traffic control and guidance, help in the management of the depots, and provide tourists with appropriate transportation information. Traffic Information Grid (TIG) is one of the important applications of IoT which is implemented on Shanghai Grid.

B. Healthcare

The IoT technologies such as RFID, WSN, etc., can provide many benefits in the domain of

healthcare. For example, the health status of a person could be inferred from the RFID tags on clothes or from discovering a wearable medical device. The applications in hospital could be categorized into: hospital staff and patients tracking, identification and authentication of people, automatic sensing data collection and, and remote health-care

C. Disaster Alert and Recovery

Recently, due to natural disaster and accidental disasters which are taking place frequently, technologies like RFID and WSN plays a crucial role in alerting the disaster before it happens, and recovery after it ends. The on-time access to relevant information on hazardous environmental conditions would give the residents in the nearby area some time to prepare themselves procedures, preventing the damage and reducing the number of casualties derived from the event. WSN enables the processing, acquisition, and transmission of environmental data from the location where disasters originate to potentially threatened cities. Then this information could be used by authorities to rapidly assess critical situations and to organize resources for the accident disaster recovery, for example, after a coalmine accident occurs, instant tracking and positioning of trapped workers using RFID technologies could provide timely rescue and decreases very much of casualties and economic loss. Knowing trapped workers' geographic distribution and comparatively accurate position, the rescue operations would be more focused therefore be time-efficient.

Apart from the applications above, there are many others applications that could be described as futuristic since they rely on some (communications, sensing, material and industrial processes) technologies that are still to come or whose implementation is still too complex. The most advanced futuristic applications includes robot taxi, city information model and enhanced game rooms.

VI. Enabling Technologies of IoT

There are many technologies that enables Internet of Things. Networks are crucial to the field that are used to communicate between devices of an IoT installation is a role that several wired or wireless technologies may fulfill.

A. *Short-Range Wireless*

Bluetooth low energy (BLE), Light-Fidelity (LiFi), Near-Field Communication (NFC), QR codes and Bar codes, Radio-Frequency identification (RFID), Wi-Fi Direct, Z-Wave, ZigBee, are the technologies that are used for short-range wireless connectivity in IoT.

B. *Medium-Range Wireless*

HaLow (a varient of the Wi-Fi standard giving stretched out range to low power correspondence at a lower information rate) and the LTE-Advance (a high speed system for communication particular for mobile networks) are two of the fundamental advances that are utilized for medium range wireless network in IoT.

C. *Long-Range Wireless*

Low-power wide-area networking(LPWAN) (wireless networks that are designed to enable long range communication at a low data-speed reducing energy and cost required for transmission), Very Small Aperture Terminal(VSAT) (satellite communication technology using small dish antennas for narrow-band and broadband data) are the two main technologies that can enable longrange connectivity for the IoT.

V. Network Architecture of IoT

IP has many schemes that can make IoT a reality. By combining the IEEE 802.15.4 and the IP addresses and also the LoWPAN which would make IoT working. Implementing IoT depends mainly on the architecture. The network architecture includes several layers: the field data acquisition layer is implemented in such a way that they can fulfill all the requirements of various enterprises, industries, institutes, societies, governments etc. Fig V.I the generic layered architecture for IoT. The layered engineering has two distinct divisions with an Internet layer in the middle to fill the need with a typical media for communication. The two lower layers are used for

capturing of data and the two layers at the top are responsible for data utilization.

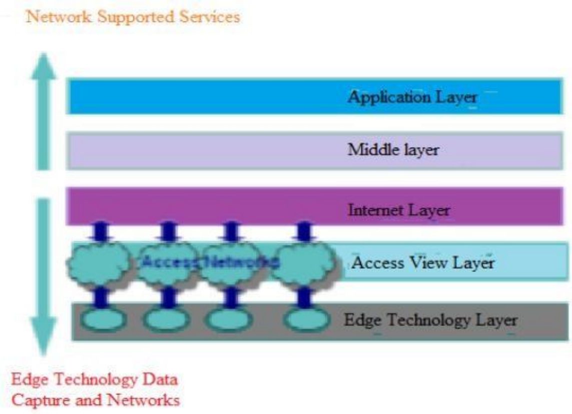

Fig V.I Layered Network Architecture for IoT

VI. Open Issues of IoT

The following are the main considered issues in context to IoT:

A. *Standardization:*

Although, many efforts have been made to standardize the IoT paradigm by scientific communities, European Standards Organizations (ETSI, CEN, CENELEC, etc.), Standardization Institutions (ISO, ITU) and global Interest Groups and Alliances (IETF, EPC global, etc.), they are not incorporated in a complete system. Efforts done for standardization have focused on several principal areas like, RFID frequency, protocols of communication between readers and tags, and data formats placed on tags and labels. European Commission, EPC global and ISO are major standardization bodies that are dealing with the RFID systems. The EPC global mainly aims at supporting the global adoption of a EPC for each tag and related industry driven standards. European Commission has made coordinated efforts focusing at defining RFID technologies and supporting the transition from localized RFID applications to the IoT. Differently from these, ISO deals with how to modulate and utilize frequencies and prevent collision technically.

The European Telecommunications Standards Institute (ETSI) has launched the Machine-toMachine (M2M) Technical Committee to conduct standardization activities relevant to M2M systems and define cost-effective solutions for M2M communications.

B. *Security and Privacy*

Authentication and data integrity is the vital element in security aspect. Due to lack of proper infrastructures and servers to exchange messages among nodes, authentication is particularly difficult in IoT scenarios. Furthermore, things have scarcity of resources compared to PCs, PDAs, cell phones, etc., to carry out complex computing. Some solutions about authentication have been proposed, but they all have serious problems and can't help in solving the man-in-the-middle attack problem. Data integrity solutions require that an adversary cannot modify data in the transaction without the system detecting the change. In the old era of information, the problem of data integrity has been widely studied. When RFID systems and sensor networks are integrated in the Internet here would be a new problem. Sensor hubs or RFID tags are spread in a wide range and invest the majority of the time unattended. Information can be modified by enemies while it is stored in the node or when it navigates the network. To protect data against the first type of attack, memory is protected in most tag technologies and solutions have been proposed for wireless sensor networks as well.

C. *Governance*

The question of "thin" legitimacy and and lack of sufficient transparency and accountability arise in the IoT environment just as in present Internet. Since IoT is not only a mere extension of today's Internet, but rather a networking of independent but interoperable systems, the Internet Governance concepts are no longer suitable to identically be applied. Learning from the regulation of the Internet, the concept of "multi-stakeholder in governance" should be perceived as the new way forward in favor of the inclusion of the whole society. Such a development challenges the traditional understanding of legitimacy and makes it

necessary to tackle the general question of who could be a legitimate stakeholder. Consequently, architectural principles are to be developed and compiled in an international legal framework. Representation only has a legitimizing effect, if the outcome reflects the represented stakeholders' value. Besides equal bargaining powers and fair proceedings, this concept requires transparency, accountability and inclusion of public opinion in IoT governance.

VII. Conclusion

In this paper, we survey the state-of-art on the IoT which includes the manifold definitions, enabling technologies and other applications and open research issues with efforts. However, this paper provides a comprehensive review of the relevant technologies. It is believed that in the near future the achievement of the vision of "from anytime, anyplace connectivity for anyone, we will now have connectivity for anything" should depend on cross-discipline and cooperative efforts in related fields.

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