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A CASE STUDY ON INTERNET OF THINGS

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***Abstract*— We are entering in a new era of computing technology i.e. Internet of Things (IoT). IOT is a sort of "universal global neural network" in the cloud which connects various things. The IoT is a intelligently connected devices and systems which comprised of smart machines interacting and communicating with other machines, environments, objects and infrastructures and the Radio Frequency Identification (RFID) and sensor network technologies will rise to meet this new challenge. As a result, a enormous amount of data are being generated, stored, and that data is being processed into useful actions that can "command and control" the things to make our lives much easier and safer—and to reduce our impact on the environment. The main objective of this paper is to provide an comprehensive overview of the IoT scenario and reviews its enabling technologies and the sensor networksand their usages in our daily life. Also, it describes a six-layered architecture of IoTand their usages in our daily life. However, this manuscript will give good comprehension for the new researchers, who want to do research in this field of Internet of Things and facilitate knowledge accumulation in efficiently.**

Keywords— **Internet of Things, RFID, Internet Protocol, WSN, Barcode, Wi-Fi, Bluetooth, Sensors**

I. INTERNET OF THINGS

"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it" was Mark Weiser's central statement in his seminal paper [Weis 91] in Scientific American in 1991. There is a sea change in human's daily life as well as in working conditions in organizations after the arrival of IT and ITeS technologies. This is becoming well-known concept across many horizontal and vertical markets including a common man's everyday life in the society, as it has several applications. The development of the Internet of Things (IoT) has been primarily driven by needs of large corporations that stand to benefit greatly from the foresight and predictability afforded by the ability to follow all objects through the commodity chains in which they are embedded . The ability to code and track objects has allowed companies to become more efficient, speed up processes, reduce error, prevent theft, and incorporate complex and flexible organizational systems through IoT . The IoT is a technological revolution that represents the future of computing and communications, and its development depends on dynamic technical innovation in a number of important fields, from wireless sensors to nanotechnology.This is useful for many of the real-world applications and services, and one would for example apply it to build a smart residence; windows can be closed automatically when the air conditioner is turned on, or can be opened for oxygen when the gas oven is turned on. The idea of IoT is especially valuable or persons with disabilities, as IoT technologies can support human activities at larger scale like building or society, as the devices can mutually cooperate to act as a total system.

RFID: RFID is the key technology for making the objects uniquely identifiable. Its reduced size and cost makes it integrable into any object . It is a transceiver microchip similar to an adhesive sticker which could be both active and passive, depending on the type of application. Active tags have a battery attached to them due to which they are always active and therefore continuously emit the data signals while Passive tags just get activated when they are triggered. Active tags are more costly than the Passive tags however they have a wide range of useful applications. RFID system is composed of readers and associated RFID tags which emit the identification, location or any other specifics about the object, on getting triggered by the generation of any appropriate signal. The emitted object related data signals are transmitted to the Readers using radio frequencies which are then passed onto the processors to analyze the data.

INTERNET PROTOCOL: Internet Protocol (IP) is the primary network protocol used on the Internet, developed in 1970s. IP is the principal communications protocol in the Internet protocol suite for relaying datagrams across network boundaries. The two versions of Internet Protocol (IP) are in use: IPv4 and IPv6. Each version defines an IP address differently. Because of its prevalence, the generic term IP address typically still refers to the addresses defined by IPv4. There are five classes of available IP ranges in IPv4: Class A, Class B, Class C, Class D and Class E, while only A, B, and C are commonly used. The actual protocol provides for 4.3 billion IPv4 addresses while the IPv6 will significantly augment the availability to 85,000 trillion addresses. IPv6 is the 21st century Internet Protocol. This supports around for 2128 addresses.

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WSN: WSN is a bi-directional wirelessly connected network of sensors in a multi-hop fashion, built from several nodes scattered in a sensor field each connected to one or several sensors which can collect the object specific data such as temperature, humidity, speed etc and then pass on to the processing equipment. The sensing nodes communicate in multi-hop Each sensor is a transceiver having an antenna, a micro-controller and an interfacing circuit for the sensors as a communication, actuation and sensing unit respectively along with a source of power which could be both battery or any energy harvesting technology. However has proposed an additional unit for saving the data, named as Memory Unit which could also be a part of the sensing node.

Wireless Sensors Network technology and RFID technology when combined together opens up possibilities for even more smart devices, for which a number of solutions have been proposed. An example solution is provided by the Intel Research Labs in the form of Wireless Identification Sensing Platform (WISP). WISP is a passive wireless sensor network with built-in light, temperature and many other sensors. Both WSN and RFID Sensor Networks have their own advantages but RFID Sensor Networks have a low range and their communication is Asymmetric while WSNs have a comparatively longer range and their communication is Peer-toPeer. Moreover most of the WSNs are based on the IEEE 802.15.4 standard, which specifies the Physical and MAC layer of LowRate Wireless Personal Area Networks (LR-WPANs). The technologies that enables the integration of WSN with the IOT are a hot research topic, many solutions have been proposed for that including that of a 6LOWPAN standard, that allows IPv6 packets to be transmitted through the networks that are computationally restricted. Also there's ROLL routing standard for end-to-end rout

BARCODE: Barcode is just a different way of encoding numbers and letters by using combination of bars and spaces of varying width. Behind Bars serves its original intent to be descriptive but is not critical. In The Bar Code Book, Palmer (1995) acknowledges that there are alternative methods of data entry techniques. Quick Response (QR) Codes the trademark for a type of matrix barcode first designed for the automotive industry in Japan. Bar codes are optical machine-readable labels attached to items that record information related to the item. Recently, the QR Code system has become popular outside the automotive industry due to its fast readability and greater storage capacity compared to standard. There are 3 types of barcodes of Alpha Numeric, Numeric and 2 Dimensional. Barcodes are designed to be machine readable. Usually they are read by laser scanners, they can also be read using a cameras.

WI-FI: Wireless Fidelity (Wi-Fi) is a networking technology that allows computers and other devices to communicate over a wireless signal. Vic Hayes has been named as father of Wireless Fidelity. The precursor to Wi-Fi was invented in 1991 by NCR Corporation in Nieuwege in the Netherland. The first wireless products were brought on the market under the name WaveLAN with speeds of 1 Mbps to 2 Mbps. Today, there are nearly pervasive Wi-Fi that delivers the high speed Wireless Local Area Network (WLAN) connectivity to millions of offices, homes, and public locations such as hotels, cafes, and airports. The integration of Wi-Fi into notebooks, handhelds and Consumer Electronics (CE) devices has accelerated the adoption of Wi-Fi to the point where it is nearly a default in these devices [24]. Technology contains any type of WLAN product support any of the IEEE 802.11 together with dual-band, 802.11a, 802.11b, 802.11g and 802.11n. Nowadays entire cities are becoming Wi-Fi corridors through wireless APs.

BLUETOOTH: Bluetooth wireless technology is an inexpensive, short-range radio technology that eliminates the need for pro- S. Madakam et al. 171 prietary cabling between devices such as notebook PCs, handheld PCs, PDAs, cameras, and printers and effective range of 10 - 100 meters. And generally communicate at less than 1 Mbps and Bluetooth uses specifi- cation of IEEE 802.15.1 standard. At first in 1994 Ericson Mobile Communication company started project named "Bluetooth". It is used for creation of Personal Area Networks (PAN). A set of Bluetooth devices sharing a common channel for communication is called Piconet. This Piconet is capable of 2 - 8 devices at a time for data sharing, and that data may be text, picture, video and sound. The Bluetooth Special Interest Group comprises more than 1000 companies with Intel, Cisco, HP, Aruba, Intel, Ericson, IBM, Motorola and Toshiba.

SENSOR: WSNs are vulnerable to several types of attacks because sensor nodes are the part of a bi-directional sensor network as discussed in Section 4.2, which means other than the transmission of data, acquisition of data is also possible. [48] described some of the possible attacks that includes Jamming, tampering, Sybil, Flooding and some other kinds of attacks, which are summarized as followed:
(1) Jamming obstructs the entire network by interfering with the frequencies of sensor nodes.
(2) Tampering is the form of attack in which the node data can be extracted or altered by the attacker to make a controllable node.
(3) Sybil attack claims multiple pseudonymous identities for a node which gives it a big influence.
(4) Flooding is a kind of a DOS attack caused by a large amount of traffic that results in memory exhaustion.

II. APPLICATIONS

This system is designed for a shopping complex mall but it can be also used in various organizations like educational Notice board system or at Railway station, Bus stand and Air-

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port to display the information and notification. In mall it is also used to control the humidity and temperature of mall via central AC by using temperature sensor. In Industrial organization it can be also used. E-display system may be used to display Emergency message in Hospitals. Some areas where IoT frequently used

I. Smart cities: To make the city as a smart city to engage with the data exhaust produced from your city and neighborhood.

• Monitoring of parking areas availability in the city.
• Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.
• Detect Android devices, iPhone and in general any device which works with Bluetooth interfaces or WiFi .
• Measurement of the energy radiated by cell stations and and Wi-Fi routers.
• Monitoring of vehicles and pedestrian levels to optimize driving and walking routes.
• Detection of rubbish levels in containers to optimize the trash collection routes.
• Intelligent Highways with warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

II. Security & Emergencies:

• Perimeter Access Control: Detection and control of people in non authorized and restricted.
• Liquid Presence: Liquid detection in data centers, sensitive building grounds and warehouses to prevent breakdowns and corrosion.
• Radiation Levels: In nuclear power stations surroundings distributed measurement of radiation levels to generate leakage alerts.
• Explosive and Hazardous Gases: Detection of gas leakages and levels in industrial environments, surroundings of chemical factories and inside mines.

III. Smart agriculture:

• Wine Quality Enhancing: Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.
• Green Houses: Control micro-climate conditions to maximize the production of fruits and vegetables and its quality.
• Golf Courses: Selective irrigation in dry zones to reduce the water resources required in the green.
• Meteorological Station Network: Study of weather conditions in fields to forecast ice formation, rain, drought, snow or wind changes.
• Compost: Control of humidity and temperature levels in alfalfa, hay, straw, etc. to prevent fungus and other microbial contaminants.

IV. Domestic & Home Automation: In home by using the iot system remotely monitor and manage our home appliences and cut down on your monthly bills and resource usage.

• Energy and Water Use: Energy and water supply consumption monitoring to obtain advice on how to save cost and resources.
• Remote Control Appliances: Switching on and off remotely appliances to avoid accidents and save energy.
• Intrusion Detection Systems:Detection of windows and doors openings and violations to prevent intruders.
• Art and Goods Preservation: Monitoring of conditions inside museums and art warehouses.

V. Medical field:

• All Detection: Assistance for elderly or disabled people living independent.
• Medical Fridges: Monitoring and Control of conditions inside freezers storing medicines ,vaccines, and organic elements.
• Sportsmen Care: Vital signs monitoring in high performance centers and fields.
• Patients Surveillance: Monitoring of conditions of patients inside hospitals and in old people's home.
• Ultraviolet Radiation: Measurement of UV sun rays to warn people not to be exposed in certain hours.

VI. Industrial Control:

• Machine to Machine Applications: Machine auto-diagnosis the problem and control.
• Indoor Air Quality: Monitoring of oxygen levels and toxic gas inside chemical plants to ensure workers and goods safety.
• Temperature Monitoring: Monitor the temperature inside the industry.
• Ozone Presence: In food factories monitoring of ozone levels during the drying meat process.
• Vehicle Auto-diagnosis: Information collection from Can Bus to send real time alarms to emergencies or provide advice to drivers.

III. CONCLUSION:

IoT has been gradually bringing a sea of technological changes in our daily lives, which in turn helps to making our life simpler and more comfortable, though various technologies and applications. There is innumerable usefulness of IoT applications into all the domains including medical, manufacturing, industrial, transportation, education, governance, mining, habitat etc. Though IoT has abundant benefits, there are some flaws in the IoT governance and implementation level. The key observations in the literature are that,

(1) There is no standard definition in worldwide
(2) Universal standardizations are required in architectural level



(3) Technologies are varying from vendor-vendor, so needs to be interoperable
(4) For better global governance, we need to build standard protocols. Let us hope future better IoT.

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