Internet of Things and Its Applications

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Abstract- We are learning about the new era of computer technology i.e. Internet of Things. IoT is interesting topic of technical, social, and economic area. In the IoT, things are become active things where they are able to interact and communicate among themselves by exchanging data and information sensed about the environmental things. If all objects in daily life were used with identifiers and wireless connectivity, these objects could be communicate with each other and be managed by computers. For that they react autonomously to the real world events and provide services with or without direct human intervention. Extending the current Internet and providing connection,

1. INTRODUCTION

Internet of things (IoT) is a fast growing, user friendly technology which allows environmental things to be connected together and also allows effective interaction between the connected "things". These "things" can include any things ranging from a small pen to a big car. IoT is a technology in which things, people are provided with unique identifiers and the ability to automatically transform the information over a network without requiring human-to-human or human-to-computer communication [2]. The physical objects of the world will be seamlessly integrated into information network. The integration may be various purposes like – data capture,

communication, and inter-networking between devices and physical objects, or Things, is a growing trend that is often referred to as the Internet of Things. Other personal IoT devices like wearable fitness and health monitoring devices and network enabled medical devices are transforming the way healthcare services are delivered. IoT systems like networked vehicles, intelligent traffic systems, and sensors embedded in roads and bridges move us closer to the idea of "smart cities'', which help minimize congestion and energy consumption. In "Smart Home" IoT Application, Internet-enabled appliances, home automation components, and energy management devices are included.

monitoring and controlling among many others. Wireless links must spread beyond smart phones, PCs and Tablets. Since the physical objects of the world will be seamlessly integrated into information network. The integration may be various purposes like – data capture, monitoring and controlling among many others. Wireless links must spread beyond smart phones, PCs and Tablets. This technology is embodied in a wide spectrum of networked equipment, systems, and sensors, which take benefit of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities not previously possible. IoT technology offers the possibility to transform agriculture, industry, and

energy production and distribution by increasing the availability of information along the value chain of production using networked sensors. However, IoT raises many issues and challenges that need to be considered and addressed in order for potential benefits to be realized. A new era of IoT (internet of thing) service which will connect everything is on the way. Over 12.5 billion devices were already connected in 2010 and about 50 billion devices will be connected by 2020 [1].

Principles for IoT –

1. Value –Make consumers live more efficient, safer and seamless.

2. Data – help consumers understand the benefits and value of their data.

3. Security – build consumer confidence around IoT experiences

4. Design–delight consumers with intuitive design and usability.

2. HOW IOT WORKS

Internet, things, Internet of things, Internet of Everything! These are some of the special words you may have been hearing, reading & very likely talking about endlessly.

These are more than just keywords; IoT (Internet of Things) is a technology concept and/or an architecture which is combination of already available technologies.

IoT targets to take this connectivity to higher level by connecting different devices to the internet facilitating human-computer, computer-computer interactions also.

The illusionist have also realized that this IoT technology has business applications in areas of Home Appliances, Automotive, Industry/assembly line automation, Retail, Medical/Preventive healthcare and more.

Now that we all understand the IoT concept, it would be worthwhile to deep dive in order to get familiar with the building blocks of IoT:
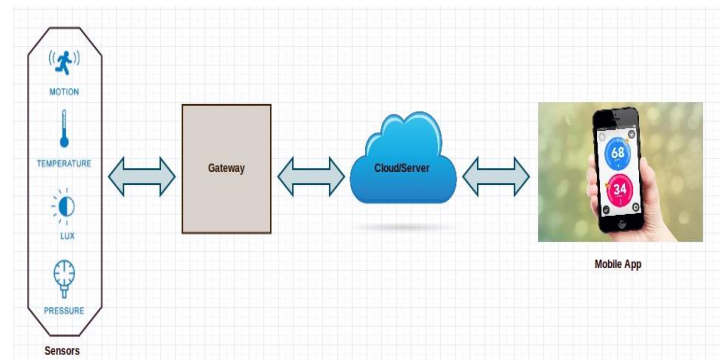
Fig(1): Working of IOT

1) Sensors & Sensor technology, they will sense a different information from Location, Environment conditions, Movement on automation line, engine maintenance data to Health essentials of a patient, Grid parameters, home appliances etc.

2) IoT Gateways, as the name rightly suggests, are the gateways to internet for all the things/devices that we want to communicate with. Gateways help to connect the internal network of sensor nodes with the external Internet or World Wide Web. They do this

by collecting the information from sensor nodes & transferring it to the internet system.

3) Cloud/server infrastructure & Big Data, the information transformed through gateway is collected & processed securely within the cloud infrastructure using Big Data analytics engine. This processed information is then used to perform intelligent actions that make all our devices Smart Device.

4.) End-user Mobile apps, this mobile applications will used to control & observe their devices (ranging from room thermostat to jet engines & assembly lines) from remote locations. These apps push the important information on your hand-held devices & help to send commands to your Smart Devices!

5.) IPv6 IP addresses are the backbone to the entire IoT ecosystem. Internet is concerned about IP addresses only & not if you are a human or a toaster. With IPv4 we were running out of IP addresses, but with IPv6 (launched in 2012) we now have $3.4*10^{38}$ IP addresses![3]

3. CHALLENGES FOR IOT

3.1. Connectivity and identification:

Proper standards have to be developed for connectivity and there should be a unique identification mechanism for accessing all kind of devices. For this IPv6 was proposed as one of the solution but there is no standard mechanism till now that can be used for identification.

3.2. Reliable and scalable Network:

Here ubiquitous things are connected together and hence efficient network with good reliability and scalability is required with a Quality of service protocol which would maintain the data flow.

3.3. Power management:

Power is one of the important parameters to be considered. Energy harvesting by smart devices should be implemented and IoT devices should be self sustainable.

3.4. Security:

Security is a very important aspect of IoT. The builtin security should be implemented in devices and protocols. Usually IoT uses wireless infrastructure for communication which is prone to several attacks. Thus proper security measures should be taken to protect the data being transferred [5].

3.5. Multi device adoption:

Thousands of new devices are working and hundreds of new devices will be implemented each and every day. For that, our network should be able to adopt all kinds of devices from lower end to higher end. For example, it should manage RFID tag, temperature sensor, smart dust, multimedia sensor, server, router, bio sensor, smart chip, server, database system etc in a single track.

3.6. Privacy:

Internet of Things depends on strategies that respect individual privacy choices across a broad spectrum of expectations. The information and user specificity handled by devices can unlock incredible and unique value to IoT users, but concerns about privacy and potential harms might hold back full adoption of the Internet of Things. This means that privacy rights and

respect for user privacy expectations are integral to ensuring user trust and confidence in the Internet, connected devices, and related services [3].

4. 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-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. In Hospitals, E-display system may be used to display Emergency message. Some areas where IoT frequently used.

4.1. 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 Wi-Fi routers. Monitoring of vehicles and pedestrian levels to optimize driving and walking routes [2]. Detection of rubbish levels in containers to optimize the trash collection routes. Warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams on Intelligent Highways.

4.2. 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 [9].

4.3. Smart agriculture:-

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

4.4. Domestic & Home Automation:-

In our home, remotely monitor and manage our home appliances and cut down on your monthly bills and resource usage by using the Iot system.

4.5. Energy and Water Use:

Monitoring of Energy and water supply consumption to obtain advice on how to save cost and resources [6].

4.6. Remote Control Appliances:

To avoid accidents and save energy, switching on and off remotely. 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 [7].

4.7. Medical field:-

All Detection: Giving Assistance for elderly or disabled people who are living independent. Medical Fridges: medicines, vaccines, and organic elements which are storing in freezers, monitor and control their conditions. 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: To warn people about explosion of UV sun rays [8].

4.8. 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 [4]. 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 [7].

5. CONCLUSION

IoT is a recent technology which is booming and it has a good rate of acceptance among the people. Industries are spending a considerable amount of money and many researchers are working towards the improvement and development of IoT. The applications of IoT are many and so are the users. This technology can be considered as one of the most promising technologies of the 21st century. It is needless to say that the future wouldn't exist without IoT. It would become as an integral part of the dayto-day human life. People would become extensively dependent on IoT, at least to satisfy their medical needs. The day is not far when each person would directly or indirectly be related to at least two or three IoT networks.

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