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Internet of things: Vision, Challenges and Future Scope

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Abstract: This paper provides the overview on various aspects of internet of things. Internet of things (IoT) is a rapidly growing branch ofIT sector. It is the next step towards creating the future. The term IOT is called as system of systems where all devices are connected to each other . They communicate with each other and can take decisions independently and act accordingly.Internet of things has a great trend towards robotics,sensing,artificial intelligence and networkingand having advancement in softwares with low prices of hardware and modern techniques towards technology.Its new and enhanced elements bring major changes in the delivery and reliability of products ,goods and services..In the end of the paper we can clearly define vision ,challenges and future scope of internet of things.

Keywords: IOT, Roadside Units(RSU),Smartcity,RFID, NFC.

I. INTRODUCTION

Internet of things is a scenario of combining computers and networks to monitor the deices and for sharing the available resources with each other.Internet of things also referred to the system where deployed devices services offered by the internet protocols and most of the times these devices are called “smart objects” which cannot be directly operated by humans[1].

In Context with IETF,the term smart object are those embedded devices that are having typical limitations such as limited power,memory,consumption and processing resources.Internet of Things is basically a framework in which all the things have their own demand and challenge in presence of Internet.

IOT definitions represents the criteria in which network connectivity and computing capability extend towards resources of objects,devices,sensors and all the items related to everyday life that are not normally considered to be computers.This allows the smart objects to exchange and consume data with minimal human interference.

These gadgets gather information utilizing various sensors like Photo sensors, health sensors, temperature sensors and so forth inserted in them. These devices then share the collected data with each other or the internet to perform a specific task, for example, a sensor on an Air Conditioner senses the temperature and humidity of the environment and adjusts the settings automatically without human involvement, another example of IoT devices can be a robot that sees a picture through a camera and sends that image to the cloud to be processed and gets back the result from the server containing the details of that image (Google Vision). The data can be sent or received using number of wireless technologies such as RFIDs (Radio Frequency Identification), Bluetooth, NFC (Near Field Communication) etc. Such devices are known as ‘Smart Devices’ as they automatically gather the data without human involvement [3][4].

IOT plays a significant role in building modules of the smart cities[9]

- Smart Disaster Management Service (SDMS)
- Smart Transportation Systems (STS)
- Smart Healthcare Networks (SMN)
- Smart Environment Control (SEC)

The Smart Disaster Management Service (SDMS) is the module of the smart city implementation, which is linked up with the interchange of the data among the occupants during the disasters like Hurricanes, Tsunami, Storms, Floods, Earthquake, etc.If the data is effectively exchanged then it can save lot of lives .
Smart Transportation Systems (STS) is the module of the smart city networks which is associated with the intelligent transport systems .The information of traffic can be send from one place to another by either using moving vehicles or through fixed RSU [6].There is a smart transportation facility where data is gathered and analyzed and after that information is broadcasted to all vehicles and decision can be taken

Smart Healthcare Networks (SMN)is the module in the smart city environments, which is primarily associated with the exchange of the healthcare data among the residents in order to manage the emergency service as soon as possible under the critical conditions. The healthcare sensors deployed on patient gather information that can be used to keep track of patients[10].

Smart Environment Control (SEC) is the module of the smart city environments for the control and prevention of the high pollution situation by regularly monitoring and predicting the increasing levels of the pollutants in the environment among the cities. A example that can be taken is mobiles phones can be used to track noise level in an area, if noise level increases above certain threshold value then mobile phones can pass information among each other and decision can be taken

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accordingly. Similarly air pollution sensor can be used to check the pollution in given area .This can help in reducing pollution[7].

II. COMPONENTS OF IOT

These are the components used in IOT –

- The *'things'*
- Sensors
- Transmitter and receiver devices
- Communication channel

Thingscan be anything – a mobile phone , wrist watch a microwave oven, a vault , transportation bus, or even a house too. So it can be any physical object that is connected through a network and devices share information among them .Refer figure 1

Fig 1. IOT scenario

The **sensors** are responsible to collect the different type of information, required to perform a set of activities to accomplish the desired task[8]. To sense the information present in different configurations in the surroundings, following are the broad classes of sensors-

a) Temperature sensor

Temperature detector is a part of an electronic circuit that senses the data near the thermal energy of any physical object or a body. Thermal expansion stands out to be the most widely accepted and the simplest phenomenon to measure temperature of a body, such as in a mercury-thermometer.

.b) Pressure sensor

The pressure sensor measure the force applied per unit area .displacement or force to determine pressure. The application of a pressure sensor can be found in a *smart security system*. In that case if force applied on door is more or intolerable then sensor detects the situation and alarm is generated.

c) Position and Displacement sensors

Position is the coordinates of an object with respect to a defined point of reference and displacement is defined as the change in position of the object. The position and displacement sensors are used in GPS system for path finding purpose. These sensors can be used to find the coordinates which can further used for analytics .

d) Acoustic sensor

An acoustic sensor which is just like the pressure sensor, in terms of working principle but they differ in way to collect information Audio sensors are chiefly termed 'microphones', nonetheless a microphone is often used for infrasonic and ultrasonic sound too.

Transmitter and receiver devicesare used for sending and receiving the data between devices. Once the information is collected by the sensors , then next step is to exchange the information between the devices. The sharing of data is done with help of communication protocols that provides security as well as reliability. The information collected by the device is processed first ,then it is transmitted over channel. The whole process can be understood by workflow diagram .Refer Fig 2.

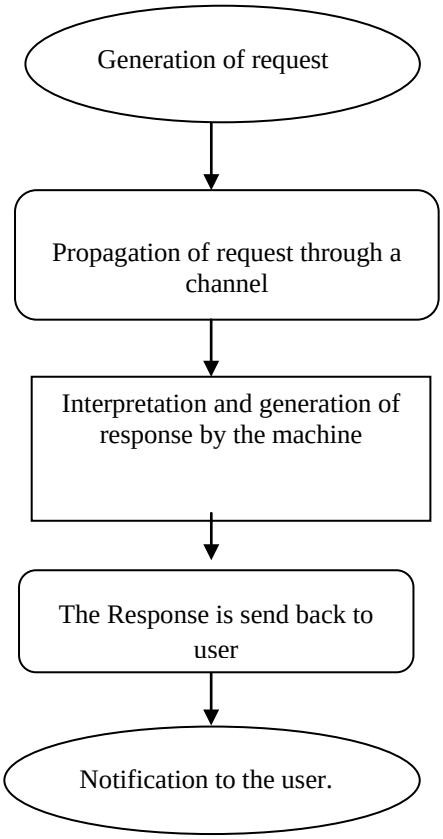

Fig 2: Workflow process

Communication channelis always required while transmitting the data from one source to another source.There are basically two types of media through which information can be passed on. One is Guided media and one is unguided media . In guided media there is always a requirement of physical medium through which data can be send . In unguided media there is not requirement of physical medium. Since in IoT system that is very large system ,wireless or unguided media is strong requirement[2]. The wireless standards used for mobile phone communication, Bluetooth communication or for wifi services are most today[5]. Through wireless media , many number of devices can be connected with each other. But that communication should be done at very fast pace . So high speed internet standards are always required. Even the existing wireless standards can also be used as protocol for communication. The following is list of protocols that can be used for IoT communication. Refer figure 3.

IOT PROTOCOL	STANDARD	FREQUENCY
BLUETOOTH	Bluetooth 4.2 core	2.4GHz
ZIGBEE	3.0	2.4GHz
Z-WAVE	Alliance –ZAD1	900MHZ
6LOWPAN	RFC6282	2.4GHz
THREAD	15.4	2.4GHz(ISM)
WI-FI	82.11n	2.4GHz and 5.3 Bands
CELLULAR	GSM/GPRS	2100 MHz
SIGFOX	sigfox	900MHz
NEUL	neul	470-790MHz
NFC	ISO 18000-3	13.56 MHz
LORAWAN	LoRawan	various

Fig 3: Various IOT protocol

III. ADVANTAGES OF IOT

There are various advantages of Internet of things .few of them are listed below:

a) Dynamic and Self adapting : The internet of things system has the capability to dynamically adapt with the changing context and take action based on their operating conditions.For example the camera used for surveillance purpose can change there mode from day to night depend on the daylight.

b)Self configuration :IoT devices has the self configuring capability, which allow the large number of devices to work together in order to provide certain functionality. The devices used in IoT can set up set up networking and can upgrade there software without user intervention.

c) Interoperable protocols: The internet of things devices can support number of interoperable communication protocols and can communicate with each other and also with there infrastructure .

d) Reduction of human efforts:The IoT devices has the capability to communicate with each other an take decision on there own with minimal or no human intervention. This make the IoT system autonomous .The example of this scenario is google driverless car concept that is totally based on automatic driving .

e)Unique Identity **:** Each of the IOT devices has unique identity that help them to query the devices and monitor there status and control them remotely.

IV. CHALLENGES AND OBSTACLES TO IOT

a) Deployment of IPV6**:**As per the increasing demands of technology sensors and computing devices would be connected to the Internet with having unique IP address.Internet of Things continues to grow ,devices that require true end to end Internet connectivity will not be able to rely on IPV4.They will need a new enabling technology IPV6.This protocol makes the management of network easier due to auto configuration capabilities and offers improved features in security.

b) Sensor energy**:**The important hardware in IOT is its sensors.The devices consist of high energy modules,power management modules and sensing modules. So ,In order to reach IOT at its height sensors will need to be self sustaining and independent.The changing of batteries in the billion of deployed devices across the world would not be possible.So we need a way that sensors could generate their electricity from environmental elements such as vibration of light and airflow

c) Heterogeneous Things: Internet of Thingsauthorize framework to maintainits working with some heterogeneous devices who are dissimilar with each other in response to convention, datalocation, data collectionand data storing capability and so on are analyze. It is a demanding as well as difficult challenge to build such a protocolthat supports transmissionof information among all devices. Standard datastructure is required tofacilitatedevice to device (D2D) transmission of information more efficiently.

d) Power: The devices developing the base of Internet of Things are wireless in type and deployed in hostile terrain (e.g. environment monitoring sensing devices) where power is the crucial problem. Eventuallypower savingeffectivealgorithms and hardware are requiredforreducingthe rate ofconsumptionof battery power and make sensor device to stayeffective for long duration of time.

e) Safety: -Most of similar device as of thedifferent frameworks, safetyshines out among the most necessary problem. This problem turns out to be mostcrucial in Internet of Things when these are inworkingstage the system perform persistently. Particular information seclusion methodology are needed to give suitable advantage to the end client as shownby their power. Data encryption computationare ought to be much more supported. Particularinformationisolation technique are also needed to deliver proper privilege to the end clients according to their capability. Most significantly, the algorithmformulated should be power efficient such that they can be used in very low power, low energy devices across different Internet of Things based application.

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f) Real-Time Solution:It might be difficult to execute the 'Anytime' concept of IoT in reality. The real-timesystems need to be executed from the grass root level of the IoT things to react significantly at any time. Thecomplexity of the existing real-time systems should be reduced, such that they can be used in nano-scopicdevices.

h) Intelligence:Machine to machine communication has high significance in IoT because machine automation must be enhanced to reduce delay, traffic, and instant action. Smart technologies need to be highly intelligent to empower automated systems.

i) Secrecy: The ubiquity and communications involved in IoT can give many accommodations and also helpful administrations for people, additionally can make several chances to manipulate security i.e. it creates many opportunities to disrupt privacy. To take care of the safety issues made by IoT utilizations without bounds, the security arrangements for each (framework) workspace must be established.. Once determined each IoT application must maintain safety. Frequently paradigm must be able to explore user's requests for data retrieval and the policies such that the requests should be analyzed against the policies to resolve whether they should be accepted or denied.

V. CONCLUSION AND FUTURE SCOPE

The number of smart devices is increasing day by day so the scope of it has been continually making for an advancement of mechanical alterations in our everyday activities, which creates our life less hard and more agreeable through different innovations and applications. There are various applications of IoT like smart home, smart cities, smart environment, smart energy, retail, logistics, smart agriculture and so on. The increasing effectiveness of smart devices and there intelligent behavior makes the vision of IoT vision more closer to reality. But there are still lot of issues in the implementation of IoT. Since there is large amount of data is generated and exchanged through IOT devices, So security becomes the prime concern . The management of data is also the major concern in IOT specially when heterogeneous devices are involved in it. The large number IOT devices leads towards more data generation so another problem created which is called as the scaling problem. Another issue in the IoT is network architecture. Some architectures are proposed for specific domains like meter reading, industry applications and healthcare,but still there is need of a flexible scalable and cross platform architecture.These challenges of internet of things make it very trendy topic of research forresearch scholars.

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