Internet of Things: A Vision that can change the world is knocking our door in the next step

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Abstract- The convergence in multiple technologies in today's scenario has resulted in the evolution of new concept that we call as Internet of Things. With the help of this paper we are going to discuss various elements IoT, concept of IoT. The paper includes the details of Ubiquitous computing, Radio Frequency Identification, M2M, various research scope in the field of IoT, challenges that are faced by researchers across the world. International vision towards this vision is also discussed here Most important is the applications in various fields we have discussed such as industry, transport, home etc. At the end we have advantages and disadvantages of IoT along with the conclusion drawn.

Keywords: Internet of Things, Radio Frequency

Identification, WSN, Ubiquitous computing, M2M

I. INTRODUCTION

IoT or Internet of things is basically an inter-connected web between physical devices, vehicles, buildings and other items embedded with that are software sensors. electronics, actuators, a network connectivity that enable these objects to collect and exchange data. "Things" in the IoT section can refer to a wide variety of things such as automobiles with built-in sensors. In this paper the scope of this technology is properly discussed for the interconnected automation, by giving a separate section for the term "IoT". The IoT requires a huge scalability in network space to surge of devices so the network architecture becomes an integral part to be noted here. When this concept of IoT was introduced in the beginning a number of questions raised about the functioning of it, this was the technology which was increasing rapidly without any appropriate consideration on the security and the regularity changes that are involved. Therefore if an individual is researching on such a vast topic then this point becomes itself as important. Pros and Cons – being a user of any type of technology and product a user firstly analysis it before buying and using it so that he is able to know about the pros and cons of the product. Similarly, here this technology was seen as a doubtful concept that whether this is going to help us or not? So the merits of this is also discussed in this paper. At the end of this paper a whole sum-up or the notes is also discussed.

II. STRUCTURE OF IOT

APPLICATION LAYER	
NETWORK LAYER	
DEVICE LAYER	

Fig. 1. Structure of IoT: Layers

The IoT basically creates an opportunity to measure, analyse and collect an ever-increasing variety of behavioural statistics. Targeted marketing of products and services could be revolutionised by cross-correlation. The structure which is discussed here is for the smart cities, smart buildings, smart transport, smart industries etc. The structure of IOT is basically reduced / decomposed to three layers mainly: application, networking and device layers. This layering system helps us to analyse the structure more easily. The application layer basically manages the whole structure at security, capabilities, process and service management. The second layer deals with transmission of the data from one device to another or from one end to another.

III. ELEMENTS OF IOT

There are four key elements of IoT that we are going to discuss here:



Fig.2 : Elements of IoT

Sensing

The very first step in IoT is gathering the information at a point of activity. This information can be captured by any device that is commonly found like wearable devices, wall mounted control etc. The sensing can be of any type let it be biometric, biological, visual, environmental, audible. One of the unique feature is that the device gathering the information is different from the device performing the sensing task. A specific and separate technology of sensing is required for the purpose.

Communication

The interesting part of IoT starts from communication. Even today many IoT devices are designed that does not give support for optimal communication with cloud services. IoT devices need a means which can transmit information sensed at device level to cloud based services for further processing. For this purpose we require Wi-Fi or WAN communication. Short range communication like Bluetooth, ZigBee and for positioning GPS is also required.

Cloud Based Capture

Gathered information by IoT device is transmitted to Cloud Based Services and then the information is linked with other cloud based data to provide useful information to the user. The data that is consolidated can be from other internet sources as well as from others who are subscribing with similar IoT devices.

Information Delivery

At last the information delivery to the user is required to be done. User can be commercial, consumer or an industrial user. The goal here is to provide information in as simple and as transparent way as possible. There is a need of a well thought out, designed and executed UI which can provide optimised experience across multiple device platforms and across multiple OS platform.

IV. IOT CONCEPTS

Ubiquitous Computing



Fig. 3. Ubiquitous Computing

This type of computing can occur using any device, anywhere, anytime, in any location and in any format. Interaction of user with computer takes place in many different forms like laptops or tablets. The interaction can also take place with day to day objects like keychain, fridge, glasses, wrist band etc. This concept use inexpensive processors which reduces the memory and storage requirements and also captures the real time attributes. This concept basically relies on converging internet, wireless technology and advance electronics.

Radio Frequency Identification (RFID)





This concepts include an object/tag and interrogating device/reader. This concept focuses on the technologies that use wireless communication between a tag and a reader and has a feature to track the object automatically. The tag contain an IC and an antenna and the microchip is used to store the information that manages the Radio Frequency communication with the reader. There are two types of tags: Passive tag-dependent on energy source like EM signal and Active source-Independent of energy source like battery. But this concept has a drawback of security concern.

Wireless Sensor Network (WSN)



Fig. 5. Wireless Sensor Network

This concept contains group of sensors to monitor and record physical condition of environment like temperature, sound, humidity, wind speed etc and also organises the collected data at central location. The sensor in WSN contains antenna, microcontroller, electronic circuit and battery or any other energy source. It is used in military operation, health, traffic, consumer, industrial areas.

Machine to Machine (M2M)



Fig. 6. Machine to Machine

Free communication takes place between the devices having same type and ability. It focusses on the use of distributed systems that control industrial equipment. In order to capture data that is fed to the network to provide input to machine that perform different task this concept use sensors for the purpose. Telemetry is a system that use radio waves to provide M2M type of communication between devices.

V. APPLICATIONS OF IOT

Though there are many applications of IoT, we have selected some of them to discuss upon over here.



Fig. 7. Applications of IoT

Smart Home

This application of IoT has gained the highest popularity among people. Companies are actively taking interest in Smart Home than in any other application of IoT. Many start-ups have been seen in the market dealing with the Smart Home.

Wearable

The concept of wearable is growing at a good rate. Innovations like Sony Smart B Trainer, LookSee Bracelet, and Apple Smart Watch are attracting many new start-ups in the field of wearable.

Smart City

In Smart City aspects like environmental monitoring, urban security, traffic management, and waste management are taken into consideration. IoT is used to solve daily life problems faced by the people living in cities and it makes their lives safer and easier.

Connected Car

Microsoft, Google, Apple all have made announcement to work on connected car platform. Many other start-ups are also working on the concept of connected car. Next generation internet connected car is coming up slowly.

Smart Farming

The idea of smart farming has not hit the Smart Farming till now but the moment it will reach the remoteness of farming it will revolutionise the current farming concept.

VI. SCOPE OF IOT

Due to its feature of connecting devices embedded in various system to the internet they can be controlled from anywhere representing themselves digitally. Companies can deliver better results by improving their performance by IoT analytics. In the near future we will have plenty of internet enabled devices which will become integral part of our lives. By 2020, nearly 50 billion smart devices will be part of IoT.

WHAT HAS BEEN DONE SO FAR

Your

Body

Smart Medicines- Ingestible pill that is equipped with the sensor can communicate to tell the timing of last pill taken and its identity. This data is exchanged to a fix worn on the skin to be logged for you and your specialist's reference.

Aging family member- In order to detect any change in the normal behavior of our loved old ones, a wireless sensors placed around the home that can track their daily routine.

Your Home

Lost keys Tracker- Lost keys and mobile phones can easily be detected using Bluetooth or wireless sensors.

Disaster sensor for home- There are devices that has a range of add-on sensors which can track any motion inside your home when you are away and notifies you immediately.

Your City

Clean City- Smart Trash enabled with cellular communication sends alert to the municipal corporation when the bin is full. This is done by collecting the real time data.

Pollution warning receiver- The device installed in Combined Sewer Overflows that consist of sensor that will send the alert to residents when a threshold of pollution is detected in waterways so that they can restrict their flushing.

Industry

Safety- The device has electronic system that sends notifications about the fire extinguisher that when it is blocked, missing from its place or has low pressure.

VII. CHALLENGES TO IOT

Architectural Challenge

IoT Involve wide range of nonintrusive, transparent, invisible and smart interconnected devices and sensors. These devices can communicate anytime, anywhere for any related services in wireless and autonomic manner. These devices has complex, mobile and decentralised services. There is a need to combine data different sources and determine important features that interpret data and show relationships among themselves. This is done to compare data with historical useful information. Thus single reference architecture cannot be accepted as the blueprint of all the applications of IoT. We need some external reference architecture or heterogeneous reference architecture in IoT. These architectures should be user friendly and should not restrict the user to be fixed for end-to-end solutions. There is a need of flexibility in IoT architectures.

Hardware Challenge

Systems with high level of intelligence depend upon smart inter-device communication. Hardware challenge in front of researchers is that there should be wireless identifiable systems that have low cost, low size but sufficient functions. Two major essentials that we need to have is extremely low cost and low power consumption in sleep mode. Hardware design for sleeping is major hardware challenge for IoT. In this case a number of IoT terminals need to be used so it must have extremely low cost. For low cost IoT terminals low active power emerges out to be a challenge.

Technical Challenge

Complexity of IoT depends on various technologies for example different environments and different applications require different networking technologies. Also there is a need of communication technologies such as wireless communication, short –range wireless communication, fixed and mobile communication, power line communication for all kind of simple and complex IoT devices. The securities and requirements of the applications and devices varies depending upon how the users want to use the device and communicate with each other. Complexity, unwanted competition, barriers of the market, dependent systems and communication mechanisms may block the features of IoT.

Security Concern

IoT devices has poor security and attackers can harm the device easily. Loss of public data will take place breaking the trust of user. Cybercriminals may capture sensitive data by unauthorised access to devices and they may also intercept local communication. Cloud based servers where large quantities of data is targeted can also come under attack. Hacker could take control of devices and networks to cause harm to the user. For example: may alter the functioning of health related devices, a connected car may crash if the hacker want to harm the user, risk of spam messages etc.

Privacy Issues

Due to constant connection to internet the chances of tracking by government and other agencies increases. These devices can collect user data without their permission. Many devices with small displays and touchscreens makes it difficult to provide information to the user and get his consent. Due to the involvement of things, services and networks altogether privacy concern becomes prominent. Existing privacy measures are not that much suitable for IoT requirements. IoT need more technical solutions to assure privacy of the user in a better way.

Standard Challenge

A standard should be set in everything we do or use and the same applies on IoT as well. In order to develop infrastructures, services, devices and applications of IoT there is need of standard to be set. The standards should be globally available as it is more relevant for participants as compared to locally available standards.

Legal Regulations and Rights Issues

No law have been framed for IoT across the world till now. The question now arises that whether the current laws will widen its horizon for complex IoT devices or not?

Business Challenge

Technical requirements of IoT should in synchronisation with business model and application scenario. It will help developers to invest less time in business related issues. IoT is becoming a challenge for business world. It may be profitable for small industries but is not sustainable in large scale industries except few. So there is need to reduce this risk of failure betwenn business and IoT technology.

VIII. ADVANTAGES OF IOT

Saves time

M2M helps in getting accurate results in less time. So the repetition of same task every day is not required.

Better quality of life

Quality of life is enhanced as applications of IoT provide better comfort and better management.

Communication

This feature provides us total transparency and high quality due to the connection of physical devices using M2M connections.

Automation and control

Machines are communicating with each other automatically and this gives us faster output in effective time. Digital connection of physical objects with wireless systems leads to good amount of automation and control in the working of IoT.

IX. DISADVANTAGES OF IOT

Loss of privacy and security

Since the devices are connected to internet there is a risk of information leak by hackers. It would be dangerous if household, public, private and confidential information is accessed by unauthorised person.

Compatibility

It may be difficult for users to connect devices of different manufacturers. So there is a need to set a standard which all manufacturers must follow.

Complexity

IoT is so complex network that any small failure or bugs in software or hardware can become difficult to rectify. Power failure is a major issue as well.

Control over life

Our lives are already controlled by technologies and the existence of IoT will us even more dependent on technologies.

X. CONCLUSION

Concluding our paper, we would state that even before a common man can think IoT will be implemented. Technologies required are already ready and some industries and manufacturers are implementing it as well but on a small scale. Some big manufacturers are also implementing IoT in some of their devices but it is just a beginning there is still lots of things required to be done to reduce its effect on legal, social, ethical and security issue. Since it could be accessible to hackers companies would not prefer it to store and share their data. Hence with some more technologies, some more innovations, some more advancements, some more amendments IoT can take the control in the coming years.

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