A Survey of Internet of Things (IoT) - Applications, Merits, Demerits & Challenges

Kavyashree E D[1], Vidyashree H D[2], Anil Kumar B H[3]

Assistant Professor, Department of Computer Science, Academy for Technical and Management Excellence College of Engineering, Mysuru, India[1,2,3]

ABSTRACT: Internet of Things (IoT) is one of the recent trends and fastest growing technology in communication technology. IoT is automating human life and known as network of network. Networking is accomplished using sensor network, embedded system and RFID technology, there is a device to device communications also know as machine to machine communication (M2M) human can even interact with these devices but most of the work will be done by device itself. IoT interacts with the devices like smart phone, home appliances or vehicles, and items like sensors and actuators which are embedded in to it connect and exchange the data. The lifecycle of IoT collects the data, communicate with the data, analyze the data and finally performing required action over it. IoT bridge the gap between virtual and physical world.

KEYWORDS: IoT, Applications, Smart Devices, Machine to Machine Communication, Wireless Sensor Networks, RFID.

I. INTRODUCION

Kevin Ashton coined the name Internet of things in 1999, co-founder and executive director of Auto-ID Center, a global research network of academic laboratories focused on RFID and the IoT. In today's epoch, People always wanted the technology to reduce their pressure and live comfort and happy life, it is IoT making their life simple and satisfied. According to the preliminary forecasts about 50 billion devices will be connected to the internet and the IoT market reach about $1.7 trillion by 2020. Device collects the useful data from one device using existing technology and flow the data to other devices. Smart applications are becoming part of our lives. There is a thing to thing communication rather than human to human communication. Hardware and software are the important elements in IoT. Through this IoT each device can be identified, connected and can take decisions independently. IoT is used in various domains; the accomplishment of success in the field of IoT was not easier [1].

IoT is applied in the technology such as Radio Frequency Identification (RFID), wireless sensor network, and embedded system also used in the application such as smart cities, smart home, medical, agriculture, industries, education, governance, mining, and habitat etc. IoT has huge benefits and flaws in the implementation level. IoT has a broader vision enabling each user to access information. In IoT digital and physical entity can be used to enhance new services to an application. Challenges in the IoT are security, privacy, and compatibility. Uploading information, electronic tag, are some of the attributes of IoT and it lives in a versatile environment with a less resources [2].
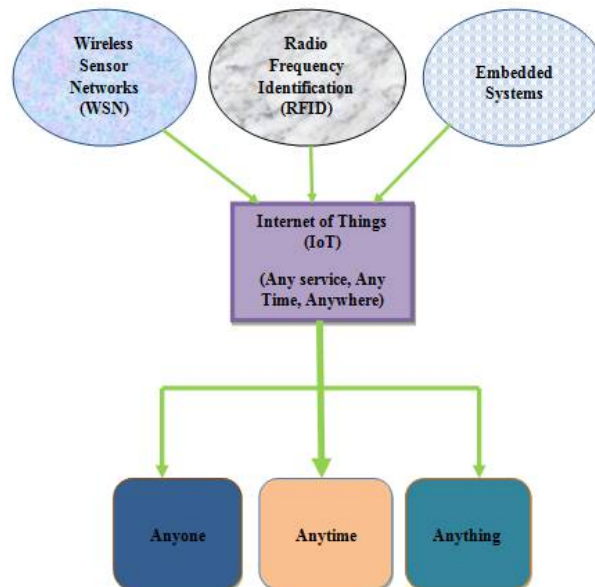
Fig 1.1: IoT shows the vision of anytime, anywhere any media, communications

IoT allow things to things connection and human to thing communication via internet. Light weight solution would always be the first priority for the IoT security [1].It includes many fields like Control Systems, Automation, Wireless Sensor Networks, Automation, and Embedded Systems [3]. IoT also knows as **IoE** Internet of everything. Main vision of IoT is "anywhere, anytime, anything". Future technologies make IoT feasible .Communication technology and networking use is the fundamental concept of internet.

II. LITERATURE SURVEY

This review focuses on application of IoT, and its challenges;

1. **Alok Kulkarni et al.[3]:** A review on Healthcare applications of the internet of things, briefs about evolution of internet, explains IoT and its healthcare, applications of healthcare and future scope.
2. **Akshay Gapchup et al.[2]:** Briefs on Health care systems using IoT, Explains IoT healthcare networks, healthcare issues, advantages of IoT in healthcare organization, Applications of IoT in Helathcare industry, and IoT Healthcare challenges.
3. **Anastasiia Strielkina et al.[4]:**Author explains about healthcare modeling in IoT using the queueing theory. Explains about Healthcare IoT infrastructure and its components and also briefs about communications and functions of the main components in IoT infrastructure with an case study.
4. **Sarweshp P et al.[5]:** Gives introduction to energy efficient network architecture for IoT applications, Explain Network architecture, Primary node placement assumptions, REEQ packet format, with simulation results including performance evaluation, network life time estimation based on death nodes and average energy received by nodes.
5. **Sahil Sholla et al.[6]:** Briefs about Incorporating ethics in IoT enabled connected smart healthcare. Outlines ethical requirements with a context table and manners map table.
6. **Rupali A.Meshram et al[7]:** Focuses on IoT challenges and its recent applications like retail, smart cities, agriculture, medical, transportation, smart home, wearables and energy management, and also give overview on IoT.

7. **Priya Matta et al.[8]:** Gives brief introduction on IoT, components of IoT and its related Models, such as internet and IoT, Cloud and IoT, and Big-Data and IoT, and many enabling technologies are discussed such as NFC & RFID , OC & QRC,ZigBee,6LOwPAN, LTE-A,Z-Wave,and IoT platforms like AllJoyn, Xively, IoTivity, 2lemetry, Homekit, and EVRYTHNG ,IoT applications and its challenges.

8. **Rajkumar S C et al.[9]:** Focuses on Resolving difficulties in IoT applications and its challenges. Explain Link analysis, Pattern Mining, Stream Data mining, RFID, Spatial data mining, Multimedia data mining, temporal, spatiotemporal, web mining, Data cube-oriented multidimensional online analytical mining, visual data mining ,and domain specific data mining.

9. **Shweta Bhatia1 et al.[10]:** Represents five functionalities in data mining, anomaly detection algorithm, discuss on data clustering, classification, features of selection algorithm and also challenges in IoT.

10. **Narasimha Swamy S et al.[11]:** Explains IoT Challenges, opportunities, applications and communication models, outlines layered architecture of IoT, pillars of IoT, marketing trends, and briefs about communication model in IoT such as device to device communication model, device to gateway model, and back end data sharing model..

11. **Ms. A.R.Deshpande1 et al.[12]:**Discusses on smart framing ,IoT framework architecture ,pH meter, and environment for agricultural appliances.

12. **Tushar A Shah et al.[13]:** Explained components used in health monitoring system raspberry pi, ECG sensor, SPo2 sensor, heartbeat sensor, communication network etc, architecture of IoT device, and system design of IoT application stages.

13. **B.Srimathi1 et al.[14]:** Discusses on applications of ARIoT, ArIoT in E-Commerce, and its challenges. ARIoT is an indirect perspective of real world scenario inputs for this application is provided by audio, video,and GPS data.

III. APPLICATIONS OF IOT

This section presents the various applications of IoT such as farming, smart home, smart city, agriculture, healthcare, wearable's, Automation, retail.etc,[15][16][17]18][19].

1. **Wearable's:** Wearable's are experiencing highest demand in market. Wearable's which have embedded in sensors collect data from users and transmit the insight data to users, e.g. it covers health and fitness requirements. They are small in size, low power and highly energy efficient.

2. **Car connecting:** Operation such as maintenance of the car and performing operation by its own are performed. Passenger's experience the best comfort zone by accessing internet facility .Large Companies are working on this connected car solutions.

3. **Smart Cities:** One of the interesting applications in IoT is smart city; it is creating curiosity in population. Surveillance, energy management, environment monitoring, water distribution, automated transportation and urban security are examples of smart cities.

4. **Agriculture:** Supplying food to increasing population is one of the greatest demands. Government is helping farmers, by using research and advanced technology to increase their food production. IoT helps in sensing moisture in soil, controlling water usage for plant, and custom fertilizer.

5. **Smart Home:** Day by Day IoT is improving human life in a more convenient and simpler way, it is creating buzz, making people to experience new digital world never before. In future smart home will become as easier as smart phones. Eg such as switching off air conditioner when no lives in home , unlock door for friends for temporary access when owner is not available, and opening door as owner enters etc.

6. **Poultry framing:** Using this IoT application, we can gather information about cattle , knowing sickness about animal in advance stage can help to reduce large cattle sickness. This application is helpful in monitoring animals and also it saves cost.

7. **Smart Retail:** The application of IoT in retail is huge. Application enables more store experience between retailer and customers, Smartphone's help customer to get connected with store, even after out of the store. Beacon technology and smart phone provide solutions for smart retail. They keep track of consumer path through store and place premium product in high traffic areas.

8. **Healthcare:** Wearing wearable connected device serve a better health, and people can lead healthier life and happy life, it is one of the tremendous application in iot. The data collected from wearable device help in analyzing the individual health and provide solution for illness.

IV. MERITS AND DEMERITS OF IOT

This section presents the advantages and disadvantages of IoT; [15] [16] [17] [18] [20] [21]

Merits

1. *Low Cost:* Efficient utilization of resource can be achieved by using this technology. Devices are always monitored. User can be alerted if any issues arise such as bottleneck or any damage to the system.

2. *Better Life:* IoT is revolutionizing human life and it is doing better day by day. By utilizing this technology pressure in our daily life can be reduced, Human can lead a better quality life by improving comfort zone and making our life simple by correct time management.

3. *More Efficient and Time Saving:* There is no human to human communication, there is device to device communication so always accurate results can be obtained and maintains quality of service. Machine enable human to think on more creative ideas rather than repeating the same job everyday or focusing on only one job. Human can take required action only when, it is needed or in case of emergencies.

Demerits

1. *Technology is Controlling life*: As our comfort zone is increasing, our dependences on device is also increasing proportionally, People should have control and knowledge how much to use and not to use. Technology should never control us; so we should have control on it.

2. *Unemployment:* Automation in daily life is both an advantage and disadvantage to people life. Advantageous to only those who are secured and skilled and disadvantage to unskilled and illiterate people. This is the problem with any new technology proper education is only the remedy.

3. *Complicated:* Though IoT is complex in nature. Failure of software, hardware, or power supply may lead to complete disaster.

4. *Compatibility:* Interconnection of devices form different manufacturers might lead to compatible issues, this may be resolved if all the manufacturers follow the same standards.

5. *Security and Privacy Issues:* As all the information are over network it can be easily prone to adversaries, it may lead to bad condition once confidential information are leaked.

V. CONCLUSION

IoT is one of the promising approaches to the world & it works on various domains. Every object interacts digitally and avoids human monitoring the data and entering the data. Making human life simpler and easier. It is used in wide variety of applications such as smart cities, smart homes, agriculture, wearables, and healthcare it also faces various challenges like security, privacy and compatibility.

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