Internet of Things : Survey

Submitted by : Sakshi Chandel

Student ID : 1124298

Canvas handle : schandel@student.unimelb.edu.au

Outline

I. Introduction

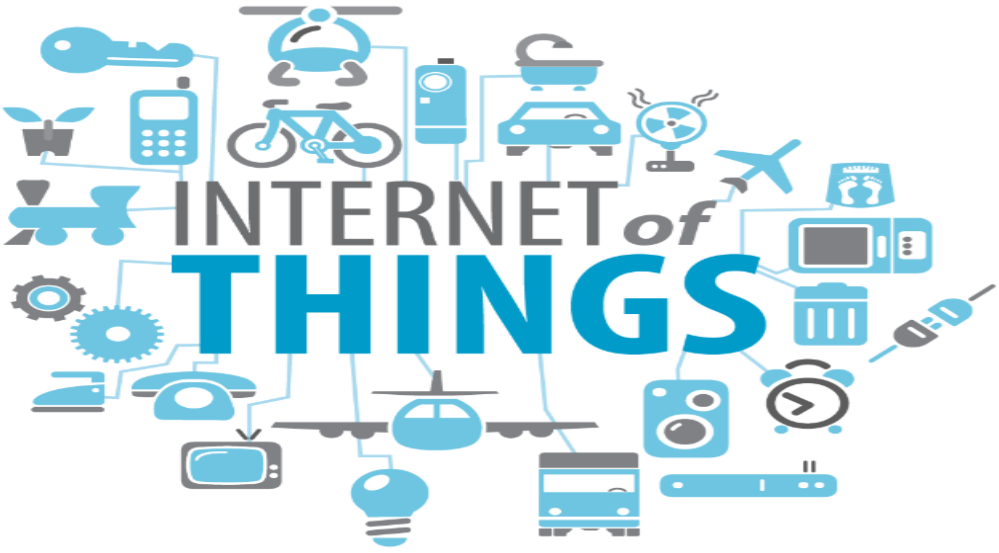
II. Related Work

III. Comparison of Key Approaches

(Benefits and Disadvantages)

IV. Conclusions and Future Directions

V. Reference



Introduction

Internet of things is been a paradigm which is gaining popularity day by day in the current scenario of modern wireless telecommunications since the term was introduced in 1990s.The basic idea of "Internet of things" is, things such as Radio-Frequency Identification (RFID) tags, sensors, actuators, mobile phones, etc. –which through unique addressing schemes, are able to interact with each other. It allows 'people and things to be connected Anytime, Anyplace, with Anything and Anyone. Sensors and actuators are devices, which help in interacting with the physical environment. The data collected by the sensors has to be stored and processed intelligently in order to derive useful inferences from it. IoT has a basic "Three-Layer-Architecture" which includes Perception layer, Network layer and Application layer. Perception layer takes data/information from the physical environment with the help of sensors and actuators such as temperature sensors etc. Network layer is responsible for connecting to other smart things, network devices, and servers. Its features are also used for transmitting and processing sensor data. Application layer is used to display desired output from these sensors as an application in a way better understand by the end-users like deploying this application on devices which support IoT such as smartphones .Such technology will help to create 'a better world for human beings', where objects around us know what we like, what we want, and what we need and act accordingly without explicit instructions. In this context, assisted living (smart AC, refrigerators), e-health, enhanced learning are only a few examples of possible application scenarios in which the new paradigm will play a leading role in the near future. Similarly, from the perspective of business users there are also other domains and environments in which the IoT can play a remarkable role and improve the quality of our lives. These applications include transportation, industrial automation, and emergency response to natural and man-made disasters where human decision making is difficult. According to one of the research papers of IEEEE, published in 2019 saying 23 billion devices were connected to the internet in 2019 , which will stretch to 30 billion devices by 2020 .Apart from advantages ,there are possible threats as mentioned in one research paper of DIEE, University of Cagliari, Italy concerning the threat due to information security and privacy .It also mentions the fact that this threat can cause harm more than that of internet has been today.

Related Works

There are different research papers published related to Internet of Things .One of them of which is published by IEEE in 2020 discussed about Multimedia of IoT: A comprehensive Survey . The article focuses on giving a detailed survey of various M-IoT network architectures. The survey also discusses the various M-IoT applications i.e., traffic monitoring, habitat monitoring, surveillance for public safety, industrial monitoring, and health monitoring. It also comprehends the design for M-IoT communication by summarizing performance metrics for M-IoT architectures. The survey also tells the M-IoT computing paradigm comprising multimedia data compression, event processing, fog/edge computing, cloud computing, and Software Defined Networks (SDNs) for data computing. It also discuss various routing protocols in the context of multimedia data delivery in M-IoT. It also provide a survey on different physical MAC (PHYMAC) protocols for M-IoT. It discussed open issues, challenges, and future research directions involving M-IoT. This article does not shows the different architectures of IoT like other surveys mentioned below. This survey is basically a complete comprehensive survey about Internet of things. This survey give detailed survey on IoT's applications .

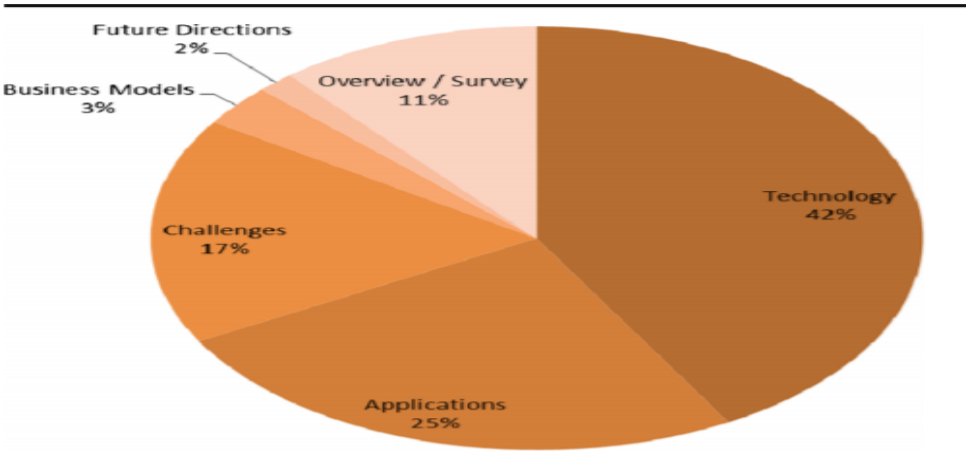
Another survey of Hindawi as Journal of Electrical and Computer Engineering in 2017 discussed about different sensors of IoT like neural sensors , RFID , medical sensors , environmental and physical sensors .It also displays different layers of IoT as well like discussed in IEEE survey 2020.The survey states different applications of Internet of Things like Health care, Home Automation, smart cities. It also mentions different middlewares of IoT like OpenIoT, FiWare. It discussed about different architectures of IoT like Three-And-Five-Layer-Architecture, Cloud and fog based architecture .It relates different research papers on IoT . The survey also discusses the various M-IoT applications i.e., traffic monitoring, habitat monitoring, surveillance for public safety, industrial monitoring, and health monitoring. It also comprehends the design for IoT communication by summarizing performance metrics for IoT architectures. This survey also mentions of different applications of IoT like healthcare, and business models of IoT. This survey did not mention of different protocols used in IoT like mentioned in one survey of Ad. Hoc Network in 2015.

This survey mainly focusses about IoT architecture, protocols and applications .It also give a brief understanding and comparison of other surveys/articles about IoT.

Another survey paper by Ad. Hoc Network published in 2015 discussed about Internet of Multimedia things and contributed about vision of the IoMT, whose potentialities are discussed with the help of specific use-cases. It also mentioned the distinct architectural design and characteristics of IoMT as compared to the existing multimedia systems are comprehensively discussed. The technical specifications and requirements posed by the IoMT systems are identified and discussed. The communication protocols designed for IoT are discussed and their feasibility for IoMT is analyzed. The potential multimedia processing technologies are presented that can facilitate efficient multimedia communication, specifically via wireless multimedia device. The solutions to the processing/computational issues are provided by introducing the notion of multimedia-aware cloud combined with multi-agent systems in IoMT architecture. The survey mainly focusses on the multimedia of Internet of things .This survey did not mention about different protocols of IoT but discusses about how Internet of things related to multimedia things. It focusses on how IoT can play a role in improving multimedia communications.

Another survey which was published by Information Systems Frontiers in 2016 and mentioned about different classification/components of IoT like software and hardware . The survey also mentions about different applications like of healthcare sectors ,Social applications ,smart infrastructure .The survey discusses about challenges and security issues of Internet of Things. This survey mentions the facts about different hardware of IoT like RFID, sensors networks ,NFC, etc. The survey mentions the fact that how different software of IoT like middleware , searching and browsing .Different architectures of IoT are also explained ,some of them which are hardware or network architecture ,software architecture ,process architecture and general requirements . This article also compared different focusses of varieties of surveys written on IoT and it mentions the facts that about 42 percentage of IoT surveys focussed on Technology ,25 percentage of IoT surveys focussed on applications of IoT,11 percentage of IoT surveys focussed on overview/surveys of different surveys ,17 percentage of surveys focussed on challenges on Internet of things ,only 3 percentage of surveys focusses on business models, and only 2 percentage of surveys focussed on future directions.

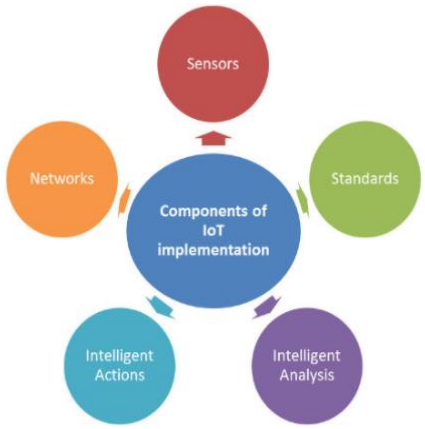
Another article which is written by Shancang Li 1published in 2014 ,which is a comprehensive survey about Internet of Things .This survey also mentions the different layers of Internet of Things which are namely Sensing Layer, Network Layer, Service Layer and Interface Layer. Sensing layer is integrated with available hardware objects to sense the statuses of things; & Network layer is the infrastructure to support over wireless or wired connections among things; & Service layer is to create and manage services required by users or applications; & Interfaces layer consists of the interaction methods with users or applications. This survey mainly provides an overview of the definitions, current research, standards, and future research of IoT. The survey mentions the current research on IoT system architecture is discussed. The article also discusses the enabling technologies of IoT are investigated. Last but not the least the applications of IoT are reviewed. Finally, some emerging research issues are identified and the future research directions are discussed. The survey mentions that how the lack of standards may decrease the competitiveness of IoT products .There have been many research which are going on related to IoT standards and policies .Some researches includes (1) designing policies and distributed architecture; (2) ensuring the privacy and protecting users; (3) realizing the trustiness, acceptability, and security of networks; (4) developing standards; (5) exploring new enabling technologies such as micro-electronicmechanical system. This survey also discussed various applications of IoT including Industrial applications , healthcare applications , social IoT etc Challenges are also mentioned in this survey like designing an SoA for IOT is a big challenge , in which service based things might suffer in terms of their performance .



A pie chart showing number of research articles that address/support a particular objective/feature.

Comparison of Key Approaches (Benefits & disadvantages)

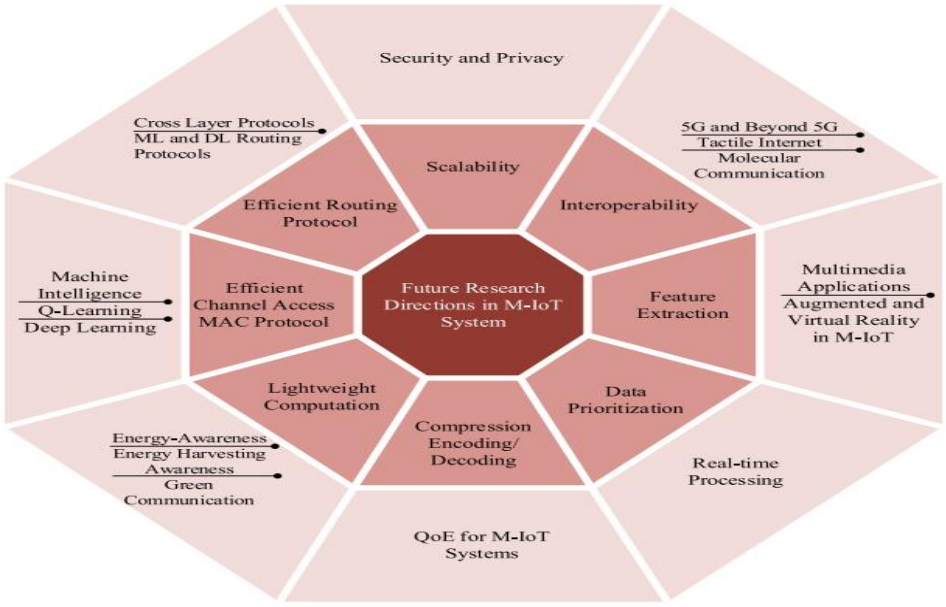
There are different key approaches and benefits mentioned in various research papers One research papers mentioned the fact the IoT can be implemented with various key approaches. One of the research papers mentioned protocols like Message Queuing Telemetry Transport (MQTT) , Zigbee, Bluetooth etc..One middle ware called FiWare used for IoT implementation which is very popular is being used in smart cities ,shop floor analytics. FiWare defines a set of SNMP APIs via which we can control the behavior of IoT devices and also configure them. Another middle ware called OpenIoT is also used which for IoT implementations . It collects data from IoT devices and also does some pre-processing of data. It has different APIs to interface with different types of physical nodes and get information from them. There are various ways by which IoT can be implemented .



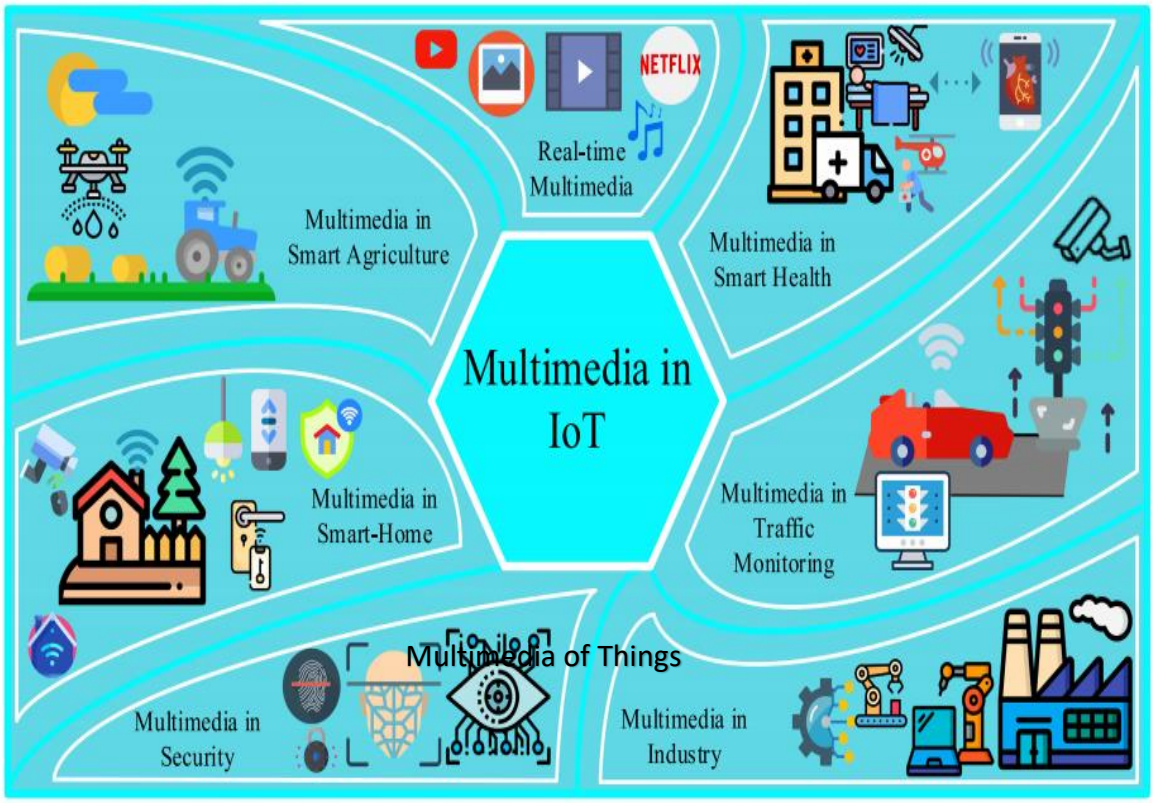
There are different components of IoT implementation including Networks, Sensors ,Intelligent Actions , Standards, Intelligent Analysis. First step of implementation includes sensors ,which according to IEEE is an electronic device that produces electrical, optical, or digital data derived from a physical condition or event. There are many challenges faced by sensors like security , interoperability. The second implementation includes Network which is responsible for transmitting signals collected from sensors using different internet technologies including Wi-Fi, LTE ,Bluetooth. There are different challenges faced in this stage including security, power consumption etc. The third stage of implementation mentions about standards of IoT. There are many challenges faced including **s**tandard for handling unstructured data. Fourth step of implementation includes analysis from data being brought out. There are many challenges including legacy systems' ability to manage real- time data and more. Fifth step includes Intelligent actions which are taken after analysis is being done expressed as M2M interfaces using UI/UX. Challenges which are in this step includes security and privacy .

Conclusions and Future Directions

This survey of Internet of Things covers a comprehensive study of Internet of Things which discussed about different work done in this field. This survey gives an information about different architectures of Internet of Things. This survey focusses on different applications of Internet of things, its challenges, information security and more .The survey also gives a comparative study of different research papers and works already done in this field of IoT. There is no doubt that Internet of Things has a very good future in improving the quality of life by connecting smart devices around us .Some example of it will be a Smart Air conditioner which can be controlled via our smart phones automatically .Internet of Things has also played a role in improving the healthcare sector by connecting various health care devices like fit bit etc. Internet of Things has played an adequate role in improving the quality of life for people in the world. But there are many challenges which IoT should address as to successfully live up to its future expectations and these challenges cannot be ignored in a long run. One of the most important challenge is security as there were many instances where IoT devices were easily accessible by hackers and information was compromised. In order to take confidence of the people in business around the world , this challenge cannot be ignored .Other challenges includes legal accountability, privacy which also should be addressed. Since the IoT has not yet been realized, it might seem early to forecast the future directions of the IoT. One future vision for the IoT is the Web of Things. The Web of Things suggests the use of web standards to fully integrate smart objects into the World Wide Web. Using web technologies can make it easier for developers to build applications using smart objects and existing web protocols can more easily enable communication of different devices. Another future direction should be to make IoT devices more secure and maintain privacy. Future research should also focus of Quality of Experience (QoE) which is an important factor in making IoT a success in future. The IoT will create new legal challenges that must be addressed. Another future vision that involves integrating more devices to the IoT. This survey also mentions challenges and future directions that should be addressed. This survey focuses on comprehensive study of different survey papers in a brief way. This survey also gives a comparative study of advantages and disadvantages of this technology.



Future Research Directions



Applications of Internet of Things

References

1. Ali Nauman ; Yazdan Ahmad Qadri ; Muhammad Amjad ; Yousaf Bin Zikria ; Muhammad Khalil Afzal ; Sung Won Kim "Multimedia Internet of Things: A Comprehensive Survey" published by IEEE in 15th Jan 2020 https://ieeexplore.ieee.org/abstract/document/8950450

2. Pallavi Sethi1 and Smruti R. Sarangi in Journal of Electrical and Computer Engineering "Internet of Things: Architectures, Protocols and Applications" /Hindawi/ 2017 ID 9324035 | https://doi.org/10.1155/2017/9324035

3. S. A. Alvi, B. Afzal, G. A. Shah, L. Atzori, and W. Mahmood, ''Internet of Multimedia Things: Vision and challenges,'' Ad Hoc Network., vol. 33, pp. 87–111, Oct. 2015.Published by researchgate.net

4. A. Whitmore, A. Agarwal, and L. Da Xu, "The Internet of things—a survey of topics and trends," Information Systems Frontiers, vol. 17, no. 2, pp. 261–274, 2015.

5. Shancang Li & Li Da Xu & Shanshan Zhao," The internet of things: a survey" Published online: 26 April 2014. DOI 10.1007/s10796-014-9492-7

6. L. Atzori, A. Iera, and G. Morabito, ''The Internet of Things: A survey,'' Computer Network, vol. 54, no. 15, pp. 2787–2805, Oct. 2010.