IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Review Paper on 5G WIRELESS NETWORKS IN IoT

MS. Neha singh [1], Palak saini[2], Deepali yadav[3] and Manisha yadav [4]

[1] *IGDTUW,ECE proffesor,Delhi, India*

[2] *IGDTUW,ECE 3rd year student,Delhi, India*

[3] *IGDTUW,ECE 3rd year student,Delhi, India*

[4] *IGDTUW,ECE 3rd year student,Delhi, India*

Abstract— Abstract— We are surrounded by a world of electronics and fasting technologies and hence IoT is presently an emerging technology worldwide. The Internet of Things is a network of physical devices like (vehicles, home applications, and other objects) embedded with such devices (electronics, software, sensors, actuators, and network connectivity) that allows us to enable these objects/devices to connect and exchange data. Through internet they can be inter operated with each other. With the introduction of 5G wireless communication, the world of the internet has changed. 5G wireless technology helps to deliver higher multi-Gbps peak data speeds, more reliable, ultra-low latency, increased availability, huge massive network capacity, and more similar user advantages for more users. Higher performance and better efficiency provides better user experiences and connecting new industries through 5G. In this study, we provide a vision of IoT which will be the driving force behind the huge massive digital revolution in the future. The communication technologies and the architecture of 5G in IoT systems have been discussed in detail. In addition, we also indicated the profound challenges of current standard communication technologies in IoT and future research directions of IoT.

Keywords— IoT, 5G, 4G, Wifi, LoraWan, Bluetooth, Wifi Direct, Zigbee, architecture

I. INTRODUCTION

The Internet of Things (IoT) is the collective network of physical devices such as sensors, software, and other technologies for connecting and exchanging data with other devices and systems over the internet[1]. The field is developed because of new technologies like computing, sensors, powerful embedded systems, and machine learning. [2]. IoT faces limited bandwidth due to the large network and transfer of big data[3]. It's a powerful technology for a new generation of IoT that will provide edge computing to make IoT more effective and efficient[4]. 5G is providing a massive change in the Internet of Things (IoT)[5]. New 5G networks are giving way to transformative IoT applications[6]. IoT is growing rapidly in every area such as smart cities, smart homes,3D printing, etc[7]. 5G gives faster, more stable, and more secure connectivity which is introducing self-driving vehicles[8,9], smart grids for renewable energy, AI-enabled robots on factory floors, etc. There are many merits and demerits of 5G[10,11]. 5G is a mobile network that is globally standard. 5G based on the OFDM (Orthogonal Frequency Division Multiplexing) method[12].

II. 5G-IOT ARCHITECTURE

Under this section, We will see an architecture on 5G, called 5G-IoT, which has the following characteristics: modular, efficient, agile, scalable, simple and responsive to high demands. [6]

a. Physical Layer

The physical layer contains devices like wireless sensors, actuators, controllers, etc. This layer is also similar to that of other IoT architectures. Nanochip is used in devices to reduce power consumption and accelerate the transfer of data. Devices such as (thermal sensors, motion sensors, displays, integrated circuits, etc.) are used to perform a task. [2 , 7]

b. Communication Layer

5G network offers us d2d communication for device connectivity for high data rate support. It offers another new feature of 5G which makes it a robust solution in the 5G-IoT architecture. Devices are connected to communication centers in the layer. [2 7]

c. Computing Layer

In this layer the data is taken to process at the edge level.5G technology and with the ease of mobile devices (like smartphones), computing the data will be more powerful and provide data in real-time.[2,7]

d. Data Storage layer

This layer provides data storage. The data is taken from physical devices and stored and drawn as well. This layer requires special security protection and should be responsive to future applications' enormous data volume and traffic.[2,7]

e. Management Service layer

This layer consists of three sub-layers as follows:

Network Management Sub-Layer:When there are change in type of communication in between the devices and data centers, network management is needed.The WNFV provides topology updates and communication protocols which gives us the quality for the IoT structure. Other useful technology is the 5G-IoT architecture. IoT network management and its network reconfiguration are done by WSDN.

[2]

Cloud Computing Sub-Layer: Cloud is used for data and/or information (re)process and the final values/data can be derived from 5G technology which helps mobile devices to get data in real-time. Therefore the processing operations are distributed in mobile devices to make the IoT system more efficient, sustainable, scalable, and faster.[8]

Data Analytics Sub-Layer: In this sub-layer, new methods of data analytics are used to manage data. Improvements in data algorithms improve data processing.[2]

f. Application layer

This layer contains software that interacts with previous layers and data. The software collects the data and processes them with its algorithms and then provides us with the outputs.[2]

g. Security layer

Various security features like data encryption, user authentication, network access control, and cloud security are used to protect the data.[2]

III. CHALLENGES IN IoT

1. Data security: With the increasing no. of connected devices, the no. Opportunities to exploit vulnerabilities can expose user data to theft.[1,3]
2. Scalability: The ability to manage efficiently the devices with their exponential growth is a tough task to be performed well.[3]
3. Bandwidth management: For fluent optimization of data bandwidth management is required.[3]
4. Interoperability: The speed of the data exchange between the IoT devices and the IoT-developed environment is an important factor for the smooth functioning of the task and the whole environment.[10]
5. Power quality: With the ease of the changes in internet telecommunication, the power consumption scenario came as the harsh and frequently changing environment affects the utilization of data and power[9].
6. Reachability: the communication through/to the devices should be global.[9]
7. Resource efficiency: the resources for the outranging of the devices must be efficient[9].

IV. ADVANTAGE OF 5G OVER EXISTING TECHNOLOGIES IN IoT

1. Network Slicing: The channel bandwidths are sliced according to the requirement and usage of the data transmission channel in 5G. This reduces the excess usage and wastage of the bandwidth of the channel. It also allows users to save money without purchasing unnecessary bandwidth. The other existing technologies like 4G, Bluetooth, Wifi, Radio Protocols, LTE-A, Zigbee, LoraWAN, Z-Wave, and WiFiDirect do not provide network slicing[1].
2. Low Latency Support: The 5G network has 1millisecond latency, the 4G LTE network has 20-30 millisecond latency, Zigbee maintains the latency below 140 milliseconds, and Bluetooth gives latency support of 100-120 ms[10].
3. High Capacity Support: Massive MIMO (multiple input, multiple outputs) antennas are used in 5G that have multiple elements to send and receive more data simultaneously. This helps in connecting more IoT devices to the 5G network and maintaining high capacity. Other technologies like 4G, s Bluetooth, Wifi, Radio Protocols, LTE-A, Zigbee, LoraWAN, Z-Wave, and WiFi-Direct do not provide MIMO and hence are not capable to handle a large number of devices at a time[5].
4. Faster speed: 5G has a data rate of 10 Gbps which is 10 times to 100 times better than the existing 4G LTE technology with a data rate 300Mbps, Bluetooth with a data rate of 1-3Mbits/s, wifi direct of 250 Mbps, LoraWAN of 27 kbps, etc[5].
5. Device packaging: 5G operated at a frequency of up to 80 gigacycle per sec as compared to 4G of half-dozen gigacycle per sec. Hence, small-sized antennas are required as compared to other network technologies. The data packaging rates that other technologies provide are LoraWAN of 433 Mhz (region ASIA),4G of 2.5Ghz, wifi direct of 2.4 GHz, and Zigbee of 2.4 Ghz[10].
6. Beam forming and Full duplex technologies: 5G use beam forming technology which sends the data concentrated to the device at a particular time and uses a full duplex which reduces the time for data transmission. These network technologies are not the n use of the previous technologies[10].

V. MAJOR CONCERN OF 5 G

1. Tiny cell: 5G technology uses a base station that square measure transportable still that needs vacant minimum power for operation and needs placement about each 250-500 m across the town[12].
2. Deployment of small antennas: deployment of small antennas in each 100-200 m which requires a large capital input[12].
3. Beam forming technology: as the data will be sent concentrated to the device location hence increases the requirement of multiple transponders[12].
4. Security and privacy issue still needs to be resolved with stronger solutions[11]
5. Many of the old devices which are operating with the existing or old technologies will not be compatible with 5G[12].
6. 5G infrastructure is developing infrastructure and hence requires a large capital input[11].
7. Rural areas' bandwidths are limited [11].

VI. APPLICATION OF 5G IoT

There are many sectors where 5G will be implemented in IoT. 5G speeds up the working of these sectors and brings great advancements in the technologies used in them. example: it boosts the working capacity of the IoT devices over smart factories and homes, increases the speed of data transmission in robots and drones which facilitates us to make more advancements in them, telemedicines, checkups, health equipment and many more are some type of applications of 5G IoT.[6][4]

VII. ACKNOWLEDGMENT

I would like to take this opportunity to acknowledge the contribution of certain people without which it would not have been possible to complete my work. I would like to express my appreciation and thanks to my guide, Ms.Neha Singh, you have been a tremendous mentor to me.

VIII. CONCLUSION

The Internet of things is growing very rapidly and its application is vast. we studied the advantage and features of 5 G in IoT, the architecture of 5G-IoT, challenges in IoT, how 5 G overcome these challenges, and comparison between 5G and current technology such as Bluetooth, Wifi, Radio Protocols, LTE-A, Zigbee, LoraWAN, Z-Wave and WiFi-Direct used in IoT. IoT will help make our life easy by automating serving humanity (smart homes, smart cities, smart agriculture, smart factories, green energy, and IoT systems). we point out the challenges of communication technologies for IoT in 5G, including (1) privacy and security and (2) saving energy of communication technologies issues that still need to be resolved with stronger solutions. 5G is required due to its faster speed(data rate up to 10 Gbps), Device packaging(frequency up to 80 gigacycle per sec), 5G network offers multiple inputs, and multiple outputs and it provides high bandwidth.

REFERENCES

1. D. Wang, D. Chen, B. Song, N. Guizani, X. Yu and X. Du, "From IoT to 5G I-IoT: The Next Generation IoT-Based Intelligent Algorithms and 5G Technologies," in IEEE Communications Magazine, vol. 56, no. 10, pp. 114-120, OCTOBER 2018, doi: 10.1109 /MCOM. 2018.1701310.
2. Hamed Rahimi, Ali Zibaeenejad, Ali Akbar Safavi,"A Novel IoT Architecture based on 5G-IoT and Next Generation Technologies" Department of Electrical and Computer Engineering, Shiraz University, Shiraz, Iran. 3. X. Liu and X. Zhang, "Rate and Energy Efficiency Improvements for 5G-Based IoT With Simultaneous Transfer," in IEEE Internet of Things Journal, vol. 6, no. 4, pp. 5971-5980, Aug. 2019, doi: 10.1109 /JIOT. 2018.2863267.
3. S. Lanka, T. Aung Win and S. Eshan, "A review on Edge computing and 5G in IOT: Architecture Applications," 2021 5th International Conference on Electronics, Communication and Aerospace Technology (ICECA), 2021, pp. 532-536 , doi: 10.1109/ICECA52323.2021.9675934.
4. B. Dinesh, B. Kavya, D. Sivakumar and M. R. Ahmed, "Conforming test of Blockchain for 5G Enabled IoT," 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI), 2019, pp. 1153-1157, doi: 10.1109 /ICOEI. 2019.8862727.
5. L. C. Câmara Gradim, M. Archanjo José, D. Marinho Cezar da Cruz and R. de Deus Lopes, "IoT Services and Applications in Rehabilitation: An Interdisciplinary and MetaAnalysis Review," in IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. 28, no. 9, pp. 20432052, Sept. 2020, doi: 10.1109 /TNSRE. 2020.3005616. 7. Wireless Communications and Mobile Computing Volume 2022, Article ID 3229294, 12 pages
6. https://doi.org/10.1155/2022/3229294
7. S. Aljanabi and A. Chalechale, "Improving IoT services using a hybrid fog-cloud offloading," IEEE Access, vol. 9 , pp. 13775– 13788, 2021.
8. Uzairue Stanley, Nsikan Nkordeh, Victor Matthews Olu, Ibinabo Bob-Manuel "IOT AND 5G: THE INTERCONNECTION", 2018
9. WIKIPEDIA
10. 11.Rohit Mehta in Digital Mehta, Tech, TOI,"Pros and cons of 5G technology".
11. https://www.myrasecurity.com/en/what-is-5g/