

Survey on 5G (Fifth Generation) Technology

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ABSTRACT: 5G is popularly known as fifth generation technology. In last few decades wireless technologies have experienced the four generations namely First Generation(1G), Second Generation(2G), Third Generation(3G) and Fourth Generation(4G) technologies. 5G is the latest innovation of cellular technology that has three main features, greater speed than previous generations that is up to 1gbs speed, lower latency when compared to 4G or other technologies like 1G,2G,3G, and the ability to connect a more devices simultaneously and has more storage capacity. This paper gives a brief idea about 5G wireless technology and evolution and revolution of other technologies (1G,2G,3G,4G). With 5G the international access will be ease and it will better connectivity at cell edge and 5G will be more helpful in medical industries and in vehicle industries.

KEYWORDS: 5G, Massive MIMO, IoT

I. INTRODUCTION

In right now, there are four technologies namely 1G, 2G, 3G and 4G in the telecommunication business. The applications and uses are beyond all the expectation of a normal human being, let's have an example, a movie 1gb movie can be downloaded within the seconds, with 5G a file which is more than 1gb or large file can be uploaded within seconds with its speed and it offers more capacity than 4G. With 5G and its high speed that is up to 20gbs speed, its sufficient to change the sense of a mobile usability. 5G with a newer features, new ideas and smart phone will attract the users to use 5G technology. The disadvantages with other technologies was in 1G the issue was security and speed, in 2G the is issue was speed and privacy, in 3G the issue was coverage and capacity and implantation cost is high and in 4G the issue is , the network is not available in every place and capacity is less, required high latency and cost is high. The 5G internet connection will be available at every place with all the applications and other notable features, like gaming choices, vast multimedia options, connectivity in every place, zero latency, quick reply time, and extremely good sound and with 5G it is also able to send the HD video without compressing or changing quality of audio. From last two decades the mobile usage has led to the revolution in mobile technologies. It is started from the 1G to 4G now 5G.

II. LITERATURE SURVEY

The authors Gohil, Asvin and Hardik Modi, in their paper explained about, How the communication will be in 5G technology and how communication is different from other technologies and also, they explained how dominant the 5G technology in feature. The authors told that the 5G communication will be completely wireless and the access will be easy at international level [1].

The authors Singh, Sapana, and Pratap Singh, in their paper explained about the network architecture of 5G network and also explained about protocol framework of 5G. With 5G architecture, service providers can implement the latest technology to adopt the value-added services which include support for Internet of Things (IoT), network slice security [2].

The authors Molina-Masegosa, Rafael, and Javier Gozalvez, in their paper explained how 5G technology will be helpful in the vehicle communication process and how it can avoid accidents and save time. Since 5G will play very important role in IoT with the help sensors it easy to avoid accidents, tracking the vehicle, driving the vehicle without driver [3].

The authors Vook, Frederick W., Amitava Ghosh, and Timothy in their paper explained about the solutions for 5G beamforming and how MIMO (massive input and massive output) will be more helpful when compare to 4G. The authors have told that Beamforming is an innovation that permits the massive MIMO base station receiving wires to guide the radio signals to the clients [4].

The authors Boccardi, Federico, in their paper explained about how 5G technology can be achieved in telecommunication business using five disruptive technology directions. They have told to deliver the extraordinary 5G technology it as to developed end-to-end preceptive with respect to network, security, distributive cloud, network slicing, industrial automation [5].

The authors Patil, Suvarna, Vipin Patil, and Pallavi Bhat, in their paper given an overview of 5G like what is 5G, some applications of 5G and how 5G is better than 4G. 5G is a forthcoming technology which is designed to meet the massive growth in data, the Internet of things with millions or billions of connected devices and to initially operate in conjunction network [6].

The authors Hu, Yun Chao, in their paper explained how mobile edge computing technology will help to achieve the 5G technology and explained about the what is mobile edge computing. Mobile edge computing provides a highly distributed environment which can be used to deploy applications and services as well as to store and process to mobile users [7].

The authors Osseiran, Afif, Jose F. Monserrat, and Patrick Marsch, in their paper explained about the 5G wireless communication that is will 5G will be completely wireless or not and also explained how it is better than 4G wireless communication and also explained about the advantages of 5G wireless communications over 4G or other technologies. 5G will provide High resolution and bi-directional large bandwidth shaping. 5G is simpler and efficient. 5G Technology will facilitate subscriber supervision tools for the short action and it is easily manageable with the previous generations [8].

The authors Kachhavay, Meenal G and Ajay P. Thakare, in their paper explained about the evolution and revolution of 1G, 2G, 3G, 4G and 5G and also explained how 5G is different from other technologies in the form of speed, latency and capacity. The authors have explained about the different features of 1G, 2G, 3G, 4G and 5G and how these technologies have been changed from one technology to other technology and what made the technologies to be changed [9].

The authors West, Darrell M, in their paper explained about the how 5G can will be helpful in Internet of Things to solve for medical and vehicle industries. With sensors of Internet of Things, it possible to perform brain surgery, driving the car without driver, water control and farming without helpers which is more helpful for farmers [10].

The authors Roh, Wonil, in their paper explained about millimetre-wave beamforming for 5G technology and how this technology will help in achieving the 5G implementation. The controlling innovation utilizes propelled signal handling calculations to decide the best way for the radio sign to arrive at the client [11].

The authors Li, Shancang, Li Da Xu, and Shanshan Zhao in their paper explained about, how 5G will play important role in Internet of Things. The 5G will play a vital role in internet of things like in medical, education, framing, vehicle industries with the 5G speed, capacity and with its low latency [12].

The authors Jaber, Mona, in their paper explained about the backhaul challenges for 5G technology during the implementation and deployment 5G network. While deploying the 5G some technical challenges and common challenges as to be faced, the technical challenges like intercell interference, efficient medium access control and traffic management and the common challenges like communication, navigation, sensing, security and privacy [13].

The authors Gupta, Akhil, and Rakesh Kumar Jha, in their paper explained about the network architecture of 5G network. With 5G architecture, service providers can implement the latest technology to adopt the value-added services which include support for Internet of Things (IoT), network slice security [14].

The authors Panwar, Nisha, Shantanu Sharma, and Awadhesh Kumar Singh, in their paper explained about the How the communication will be in 5G technology and how communication is different from other technologies and also, they explained how dominant the 5G technology in feature. The authors have explained about the different features of 1G, 2G, 3G, 4G and 5G and how these technologies have been changed from one technology to other technology and what made the technologies to be changed [15].

Summary of literature survey

In literature survey, the authors have explained about the 5G technology, like what is 5G, where 5G is used, what are the applications of 5G technology, what are challenges as to be faced while developing 5G, what are advantages of 5G, what are societal concerns that can be solved by using 5G, how it is better than other technologies, came to know about the evolution and revolution of other technologies with 5G, studied about the how 5G architecture is different from 4G architecture and how 5G will be helpful in medical industries, vehicle industries, how speed 5G is, how dominant 5G will be in future, how mobile edge computing will help in 5G implementation, how better 5G than 4G, explained about the different features and applications of 5G, explained about the communication of 5G with different industries.

III. 5G NETWORK ARCHITECTURE

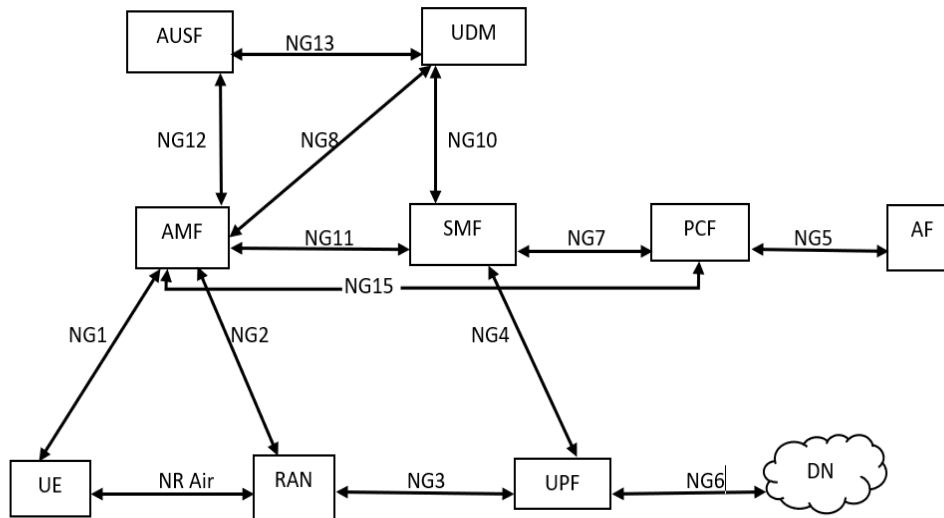


Fig 1 The 3GPP Architecture diagram of 5G

The figure 1 explains about the architecture of 5G with the following functions:

AUSF (Authentication Server Function): it's a home network and accustomed perform authentication with UE.

UDM (Unified data Management): it's information for 5G wherever it manages the networks user knowledge in a very single centralized part.

AMF (Access and Mobility Management Function): AMF receives all association and sessions data from the User instrumentality like mobile, IoT devices etc and it's accountable just for handling affiliation tasks and quality management tasks.

SMF (Session Management Function): SMF is accountable for interacting with decoupled knowledge plane and it conjointly accountable for making, change and removing protocol knowledge sessions and managing the sessions with user plane operate.

PCF (Policy Charging Function): PCF plays very important role 5G system by governing the control plane function through policy rules and user plane function through policy enforcement.

AF (Application Function): It performs the operations like accessing the network function for retrieving resources and it access the application layer for interacting with 5G network resources.

UE (User Equipment): It is mobile or any useable devices such as sensors, machines, systems.

RAN (Radio Access Network): It provides the radio access to coordinate network resource across wireless device.

UPF (User Plane Function): It is used to perform the operations like maintaining the protocol data sessions, for routing the packet and forwarding the packet, handling of QoS and for inspection of Packet.

Data Network (DN): It identifies the service provider services for accessing the internet.

- ❖ NG1 is that the reference point between the UE and Access and Mobility Management Function (AMF).
- ❖ NG2 is that the reference point between the RAN and Access and Mobility Management Function.
- ❖ NG3 is that the reference point between the RAN and User Plane Function (UPF).
- ❖ NG4 is that the reference point between the Session Management Function (SMF) and UPF
- ❖ NG5 is that the reference point between the Policy Function (PCF) and an Application Function (AF).
- ❖ NG6 is that the reference point between the UPF and Data Network (DN).
- ❖ NG7 is that the reference point between the SMF and Policy Control Function (PCF).
- ❖ NG8 is that the reference point between Unified Data Management (UDM) and AMF.
- ❖ NG9 is that the reference point between two core UPF's.
- ❖ NG10 is that the reference point between UDM and SMF.
- ❖ NG11 is that the reference point between AMF and SMF.
- ❖ NG12 is that the reference point between AMF and Authentication Server Function (AUSF).
- ❖ NG13 is that the reference point between UDM and AUSF.
- ❖ NG14 is that the reference point between two AMF.
- ❖ NG15 is that the reference point between PCF and AMF .

IV. PROPOSED TECHNOLOGY

In exiting technology that is 4G or other three technologies there are societal concerns where the access will challenging for international travel and also still 4G is restricted to certain specified carrier where cities having 4G coverage increasing day by day and in some area the users are forced to use 3G or Wi-Fi now also where there's no 4G coverage or at cell edge and other technologies has low capacity and uses higher latency. This will be solved by using 5G.

For example, the 5G will provide benefited major three uses cases:

- a. Ultra-reliable low latency communication
- b. Massive machine type communication
- c. Enhanced mobile broad band

- a. Ultra-reliable low latency communication

It includes the industrial robotics, real-time control of device, driving without driver (autonomous driving), safe network transfer, vehicle to vehicle communication.

- b. IoT (Internet of Things)

It is also knowing as huge kind of machine communication which helps in connecting billions of people together and it has potential to revolutionize the modern applications which includes agriculture, manufacturing communications.

- c. Improved mobile broad band

It provides a quicker information speed and high capability by keeping the globe connected. The new application can embrace the wireless net access reception, out of doors broadcasting while not the necessity of broadcast vans .

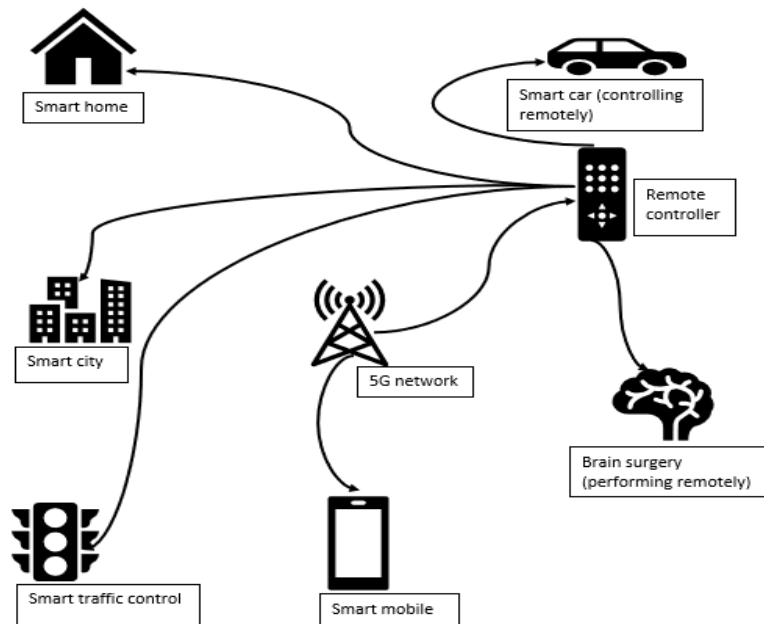


Fig 2: Block diagram for 5G use cases

How 5G will be Helpful in Medical system

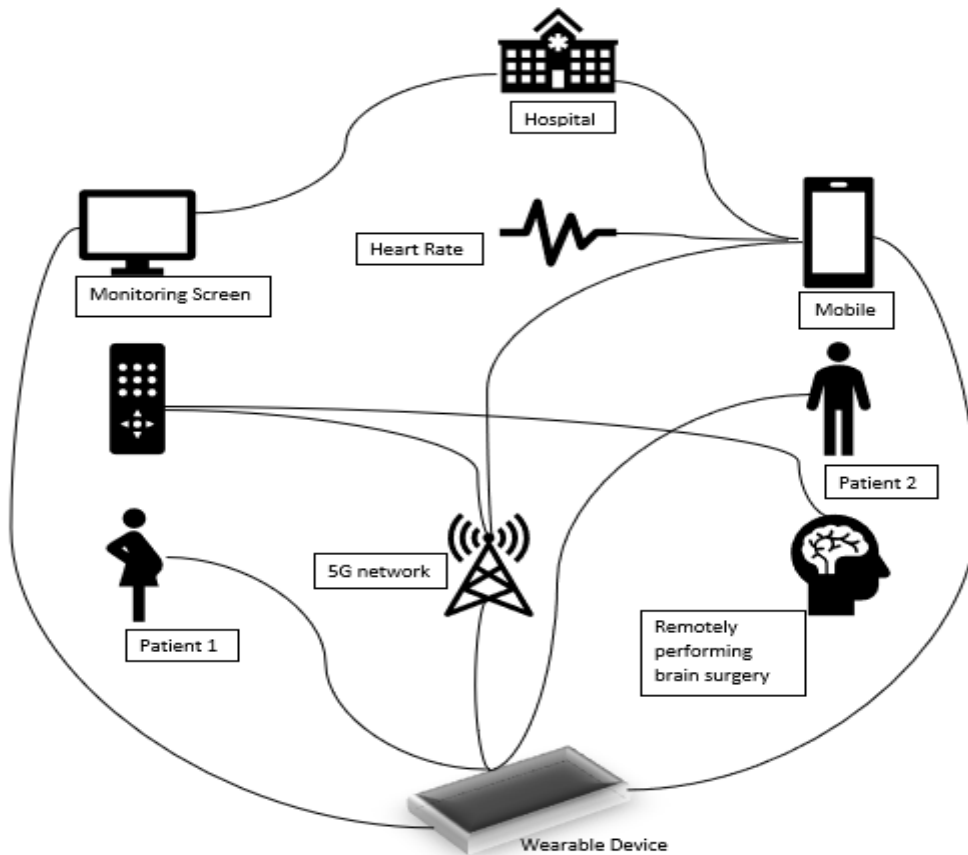


Fig 3: Shows the Uses of 5G in Health Care System

In medical System, With the help of 5G it possible perform the brain surgery remotely, and with help of IoT using 5G it is possible to make a wearable device where patient can wear those devices, so the health condition can be monitored easily by hospital staff. The above diagram shows that by wearing the wearable devices which consists of sensors like heartrate, temperature, pulse etc... it is to monitor the patients heartbeat, temperature when the he/she is in home or in other workplace, and also it is possible to perform brain surgery or other surgery's remotely with help 5G network by using IoT devices. The Smart Ambulance with 5G will include the ECG sensors, Pulse Sensors, Temperature Sensors, Alcohol, Blood pressure machine, 4K live streaming camera, X-RAY, Ultrasound scanner.

V. TECHNOLOGIES FOR 5G NETWORKS

Small Cells

Small cells area unit progressing to be a giant part of 5G network particularly at the new millimetre wave (mm Wave) frequencies wherever the association run is very short. 5G Macro Cells can utilize MIMO receiving wires that have various parts or associations with send and procure additional data at constant time. The advantage to purchasers is that additional people will all the whereas interface with the system and continue high turnout. wherever MIMO radio wires utilize vast quantities of receiving wire parts they are often alluded as 'huge or huge MIMO', nonetheless, the physical size is like existing 3G and 4G base station reception antennas.

Huge MIMO

5G can use huge MIMO antennas that having numbers of antenna parts or connections to transmit and receive additional knowledge incessantly. The profit to users by {this is this is often this will be that additional users can at the same time attach with the network and maintain high turnout. the whole size of the 5G huge MIMO antennas area unit same as 4G, however it's with a much better rate of incidence than 4G. 5G mobile phones and devices conjointly can have MIMO antenna technology designed into the device for the mm Wave frequencies.

MIMO-Beam Steering Beam Steering is associate innovation that permits the huge MIMO network receiving wires to guide the radio signals to the uses. The dominant innovation utilizes propelled signal handling calculations to

decide the simplest method for the radio sign to gain the shopper. This expands effectiveness because it diminishes obstruction (undesirable radio signs). huge MIMO reception equipment and advanced beam optimize electrical phenomenon and increments potency.

VI. APPLICATIONS OF 5G TECHNOLOGY

- ❖ 5G will produce unify worldwide standard for all.
- ❖ 5G System will be available at every place and allows users to use mobile devices at any place at time.
- ❖ 5G implementation will model complete world as real Wi Fi zone.
- ❖ 5G's cognitive wireless will ease non-identical category of wireless technologies to allocate the identical scale efficiently.

VII. CONCLUSION

In this paper, the development and growth of 5G technology in medical and IoT field was examined, along with this the different technologies that is used for 5G is examined and the architecture of 5G is examined. 5G technology is the fast-growing technology, which has up to one giga byte speed and more capacity than 4G technology and uses low latency than other four technologies. With 5G the accessing of data, uploading large, downloading large data will become easier with its speed. 5G will change the lifestyle of the human beings with its applications. 5G will be more helpful in medical, vehicle, agriculture with use of IoT sensors using 5G. 5G will play an vital role in the development of IoT. And 5G will be completely wireless communication. Furthermore, the 5G will be helpful for government for running prominent governance by investing money on the 5G, since using 5G smart cities, smart farming can be done, smart vehicles can manufacture, smart hospital can be built using 5G technology.

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