IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

A REVIEW OF 6G-NETWORK TECHNOLOGY

Dr.Rakesh Kumar Giri
Assistant Professor,
Sunrise University, Rajasthan, India

Abstract: The ubiquitous availability of wireless networks has increased over the world. With the proliferation of 4G networks, wireless and communication have become increasingly important in the information exchange system. Now that the globe is advancing toward a 5G system, some countries have already implemented it and are working on developing a 6G system until 2027-2030.In India, 5G systems were available by the end of 2021.This research paper provides an overview of the future use of wireless communication on a 6G technology system. 6G technologies offer great levels of security, secrecy, and privacy, as well as high rates of speed, bandwidth, precision, and network protocol stability. In this article, we identify the primary possible aspects of a 6G system, as well as the communication strategies required and the problems that will arise in order to achieve success with 6G technology.

Index Terms – Wireless technology, wireless communication, mobile communication, tactile communication, holographic communication, 6G, 5G.

I. INTRODUCTION

The wireless communication has brought the revolutionary changed in the field of mobile communication. As with increasing demand in the field of mobile/wireless communication in last few years. Wireless technology transfers the data over the large distance without use of interface. Mobile communication is started from different generation of 0G generation to 4G till now and launches the 5G technology

It has been observed that mobile communication has been upgraded within every 8 - 10 years. This paper will show some key features that will upgraded the 5g system. We consider that 6G mobile communication technology will launch around 2030.The 6G technology provides immense scope for innovative research and development, 6G will work with ultra high speed data network with great coverage area for all the networks in this paper will understand now the 6G technology will help for future aspects.

I. BACKGROUND:

To justify 6G we first provide background network information strategy from 1G to 4G having their own capabilities and limitations and 5G technology status and the research progress towards 6G systems.

A) 1G TECHNOLOGY

The 1G network was introduced in the 1980s and designed for voice services. . It was based on analog system. It used Frequency Division Multiplexing. Analog cellular systems consist of three basic elements: a mobile telephone (mobile radio), cell sites, and a mobile switching center (MSC). These three elements are integrated to form a ubiquitous coverage radio system that can connect to the public switched telephone Network (PSTN). It support speed up to 2.4kbps. Major Contributors were AMPS (Advance mobile phone system) was first launched by the US, NMT, and TACS.

There many disadvantage in 1G system including hard handovers, a lack of security and privacy guarantees, and low transmission efficiency. Phone services are not encrypted, meaning that data transmissions and phone conversations can neither be secure nor private. As a result, the entire network and its users face significant security and privacy challenges, including cloning, eavesdropping, and illegal access.

B) 2G TECHNOLOGY

2G was launched in Finland in the year 1991. It was the first digital cellular networks, which had a number of obvious benefits over the analogue networks. The 2G network is based on digital modulation techniques, such as Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA), which can support both voice and short message services. The most important and widely used mobile communication standard in 2G is GSM (Global System for Mobile Communications). GSM is to make the system as secure as a Public Switched Telephone Network (PSTN). Its security and privacy services include: 1) anonymity, 2) authentication, 3) signalling protection, and 4) user data protection.

Signalling and user data protection are also implemented using encryption, and the Subscriber Identity Module (SIM) plays an important role in the encryption keys. There are two main methods for preserving privacy for users: the first is radio path encryption, and the second is Temporary Mobile Subscriber Identity (TMSI).

2G platform, digitals systems are designed for low power consumption and this makes the handset and equipment less expensive, Digital signals are considered environment friendly, The use of digital data service assists mobile network, operators to introduce short message service over the, cellular phones, Digital encryption has provided secrecy and safety to thedata and voice calls, Since it uses digital multiplexing, more calls can be accommodated into same amount of bandwidth.

Despite the great improvements in security and privacy over 1G, 2G still suffers from many weaknesses. One important security issue is that the authentication is one-way; the network authenticates the user, but users cannot authenticate the network, which results in security holes. Illegal devices, such as base stations, can disguise themselves as legitimate network members, deceiving users and stealing their information.

C) 3G TECHNOLOGY

The security of the 3G system is based on the 2G technologies. That isto say, GSM and other elements incorporated in 2G proved to be necessary, while additional robust security elements also needed to be adopted. The 3G network emerged in 2000 to provide “high-speed” data transmission and access to the internet, which means at least 2 Mbps. However, this speed could support advanced services that are not possible in the 1G and 2G networks, including web browsing, TV streaming, and video services.3G technologies provides value added services like mobile television, global positioning system & video conferencing. The third generation of mobile systems provides high-speed data transmissions of 144kbps and higher.

The 3rd Generation Partnership Project (3GPP) provides a complete security system governing access that comprises two parts: air interface security, which is mainly used to protect users and the signaling information transmitted by wireless links; and the provision of user network authentication to ensure the physical reliability of users and both sides of the network. In terms of privacy, 3GPP incorporates some subscriber privacy requirements for 3G users, such as confidentiality of user identity, location and traceability.

However, the 3G networks are still vulnerable to threats associated with the Internet Protocol (IP) traffic and encryption keys.Further, the radio interface between the terminal equipment and the service network also provides opportunities for a set of attacks. Threats related to wireless interface attacks fall into the following categories: 1) unauthorized access to data; 2) threats to integrity; 3) Denial of Service (DOS); 4) unauthorized access to services. Privacy issues are mostly related to certain types of attacks, such as AKA error messages, designed to destroy user identities and confidential or sensitive information.

D) 4G TECHNOLOGY

4G is the fourth generation wireless technology and was developed in 2010. LTE (Long Term Evolution) is considered as 4G technology, providing the data rate of up to 1 Gbit/s on the downlink and up to 500 Mbits/s on the uplink. 4G technology coordinates a number of present and future wireless techniques such as "OFDM, MC-CDMA, LAS-CDMA and Network- LMDS" to deliver liberty of drive and continuous roaming from one technology to a different. LTE "long-term evolution" and Wi-MAX "wireless interoperability for microwave access" are pondered 4G technologies.

The Applications of 4G technology such as wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content and Digital Video Broadcasting (DVB) are being developed to use a 4Gnetwork 4G is a research item for next-generation wide-area cellular radio and having features like

1. 4G is a conceptual framework and a discussion point to address future needs of a high speed Wireless network.
2. It offers both cellular and broadband multimedia services.
3. Theoretically, 4G is set to deliver 100Mbps to a roaming mobile device globally, and up to 1Gbps to a stationary device.
4. 4G will bring almost perfect real world wireless or called ―WWWW: World Wide Wireless Web

The LTE networks are also vulnerable to DoS attacks, data integrity attacks, illegal use of users and mobile devices, and Medium Access Control (MAC) layer location tracking. the other Drawbacks of 4G Battery uses is more, Hard to implement, Need complicated hardware, Expensive equipment required to implement next generation network.

E) 5G TECHNOLOGY

5G is the latest generation of cellular mobile communication which was started from late 2010s. 5G performance targets high data rate, reduced latency, energy saving, cost reduction, higher system capacity, and massive device connectivity. The main focus of 5G will be on World-Wireless World Wide Web (WWWW). It is a complete wireless communication with no limitations.

5GB communication systems target in most of the technology domains once again to increase in the respective capability by a factor of 10–100 compared to the previous generation of communication systems. 5G networks will deliver an extensive variety of services comprising enhanced mobile broadband (eMBB), ultra-reliable and low-latency communications (uRLLC), and massive machine type communications (mMTC); The security and privacy issues in 5G networks can perhaps best be divided by network architecture and, more specifically, into three tiers of the architecture: the access networks, the backhaul networks, and the core network.

Although 5G is still in the initial stage of commercial scale, i.e., the related technical characteristics need to be further improved and the business model of Internet of Things and vertical industry application scenarios need to be further explored, it is also necessary for us to synchronously look forward to the communication needs of the future information society and start

the concept and technology research for the next generation mobile communication system. Here we try to analyze the necessity of the immediate start-up of the concept and technology research on the next generation mobile communication system (here in after referred to as 6G) from three aspects.

5G technologies are associated with trade-offs of several issues, such as throughput, delay, energy efficiency, deployment costs, reliability, and hardware complexity. The 5G communication systems that are going to be released very soon will offer significant improvements over the existing systems; they will not be able to fulfil the demands of future emerging intelligent and automation systems after 10 years.

II. 6G TECHNOLOGY

To overcome the constraints of 5G for supporting new challenges, a sixth-generation (6G) wireless system will need to be developed with new attractive features. The key drivers of 6G will be the convergence of all the past features, such as network densification, high throughput, high reliability, low energy consumption, and massive connectivity. The 6G system would also continue the trends of the previous generations, which included new services with the addition of new technologies. The new services include AI, smart wearable's, implants, autonomous vehicles, computing reality devices, sensing, and 3D mapping. The most important requirement for 6G wireless networks is the capability of Handling massive volumes of data and very. Improvements of computing and storage capabilities of mobile terminals, an increasing number of malicious programs can beexecuted, which may Cause more damage. Typical examples include viruses, tampering with hardware platforms, operating system vulnerabilities, etc.

III.USES OF THE 6G TECHNOLOGY

Internet of Everything: IoE is the seamless integration and autonomous coordination among a large number of computing elements and sensors, objects or devices, people, processes, and data using the Internet infrastructure.5G has the revolutionary aims for IoE by transforming traditional mobile communication layout. However, 5G is considered as the beginning of IoE and addresses many challenges from standardization to commercialization. The 6G system will provide full IoE support. It is basically a kind of IoE, an umbrella term that integrates the four properties, such as data, people, processes, and physical devices, in one frame.

IoE is generally about the physical devices or objects and communicating with one another, but IoE introduces network intelligence to bind all people, data, processes, and physical objects into one system. IoE is used for smart societies, such as smart cars, smart health, and smart industries. The use of energy-efficient sensor nodes is considered as one of the critical constraints supporting massive IoE connectivity in 6G. Low-power extensive area networks (LPWAN) have that potential to support broad area coverage (up to 20 km) networking with long battery life (>10 years) and low deployment costs. Hence, LPWAN participates commercially in most IoE use cases. This application can be supported by the features of uMUB, uHLSLLC, and Uhdd of 6G communication.

Extended Reality: Extended reality (here in after referred to as XR) services, including augmented reality (AR), mixed reality (MR), and VR are essential features of 6G communication systems. All these features use 3D objects and AI as their critical driving elements. Besides providing perceptual requirements of computing, cognition, storage, human senses, and physiology, 6G will provide a truly immersive AR/MR/VR experience by joint design integration and high-quality 6G wireless connectivity. Advanced features of wearable devices such as XR devices, high-definition images and holograms, and the five senses of communications accelerate the opportunity for performing the human-to-human and things communications. Innovative entertainment and enterprise services such as gaming, watching, and sports are provided without time and place restrictions.

VR is a computer-simulated 3D experience in which computer technologies use reality headsets to generate realistic sensations and replicate a real environment or create an imaginary world. An actual VR environment engages all five senses.

AR is a live view of a real physical world whose elements are augmented by various computer-generated sensor inputs, such as audio, video, visuals, and global positioning system (GPS) data. It uses the existing reality and adds to it by using a device of some sort.

MR merges the real and the virtual worlds to create new atmospheres and visualizations to interact in real-time. It is also sometimes named as hybrid reality. One critical characteristic of MR is that artificial and real-world content can respond to oneanother in real-time.

XR refers to all combined real and virtual environments and human-machine interactions generated by computer technology and wearable. It includes all its descriptive forms such as AR, VR, and MR. It brings together AR, VR and MR less than one term. The high-data-rate, low latency, and highly reliable wireless connectivity provided in the 6G system are very important for a genuine XR (i.e., AR, VR, and MR) experience. The 6G service, uHLSLLC, will make it possible to deploy the XR applications in the future successfully.

I. 6G WITH ARTIFICIAL INTELLIGENCE (AI)

The most certain enabling technology for 6G has to be AI. Due to the advances in AI techniques especially deep learning and the availability of massive training data, recent years have seen an overwhelming interest in using AI for the design and optimization of wireless networks, and it is a consensus that AI will be at the heart of 6G. In fact, recent success has motivated AI to form part of 5G although in 5G AI is only expected to operate in isolated areas in which massive training data and powerful computing facility are available. from physical layer designs such as channel estimation and preceding, to network resource allocation such as traffic control and cache storage management, to security and authentication, and to dynamic cell and topology formation and management, to fault prediction and detection, and etc. The list continues. It is reasonable to believe that some form of AI will be realized as part of 5G and AI will become more of the core components in 6G. Deep learning, the most powerful AI techniques at present, is however based on deep neural network (DNN), which relies on training in a centralized fashion. Yet 6G is moving towards a more distributed architecture like fog-RAN handling millions and billions of end-to-end communications anywhere around the world.

The distributed cloud structure necessitates training to be done at the network edges and handicaps the operation of deep learning. Although the recently developed federated learning partly addresses this problem by allowing training to take place at distributed locations, this is more a distributed implementation for centralized learning, and communications between the distributed clouds and a central network manager is required . Also, federated learning for optimization is much less powerful because updates in the user level are averaged before sending back to the central manager.

Nonetheless, the 6G Mitola radio is aiming at realizing true AI in an integrated manner from the device level all the way up to the entire network. The fine resolution of the specific needs and constraints of the UEs is as essential. The required optimization draws some similarity to players competing in a game, so game theory is expected to be useful although game theory by itself is not readily an optimization method.

For 6G to succeed, an integration of AI and game theory will enable a truly distributed learning mechanism where multiple AI agents can teach and learn from each other by interactions. We estimate that collective AI that can combine AI with game theory in an effective manner will bring the true brain power to 6G.

II. HEALTHCARE SYSTEM:

Smart Healthcare: Medical health systems will also be benefited by the 6G wireless networks because of innovations, such as AR/VR, holographic tele-presence, mobile edge computing, and AI, will help to build smart healthcare systems. Ageing population is putting a huge burden on the healthcare system. In addition, smart healthcare will be aimed at giving the same experience to patients as if they are diagnosed by doctors in person, which means that secure high-definition video conferencing will be needed over the air. 6G will be needed for smart healthcare to truly take off and gain popularity for wide acceptance. Even remote surgery will be made possible by using 6G communication.

High-data rate, low latency, ultra-reliable (zero-error) 6G network will help transfer large volumes of medical data quickly and reliably, improving access to care, and the quality of care. On the other hand, THz, one of the critical driving technologies of 6G, has growing potential uses in healthcare services, such as terahertz pulse imaging in dermatology, oral healthcare, pharmaceutical industry, and medical imaging.

A) Biomedical communication: biomedical communication is an essential prospect of the 6G wireless communication system. The in-body sensors with the provisioning of battery-less communication technologies are predominantly desirable for reliable and long-term monitoring. Body sensors can afford reliable and continuous monitoring of human physiological signals for applications in clinical diagnostics, athletics, and human-machine interfaces. A near-field compatible battery-free body sensor interconnection system was introduced in Linet al.with the ability to establish wireless power and data connections between may remote points around the body. The uMUB and uHLSLLC services of 6G can characterize these applications.

B) Five Senses Information Transfer: To experience the world around them, humans use their five senses of hearing, sight, taste, smell, and touch. The 6G communication systems will remotely transfer data obtained from the five senses. This technology uses the neurological process through sensory integration. It detects the sensations from the human body and the environment and uses the body effectively within the environment and local circumstances. BCI technology effectively boosts this application.

C) Wireless Brain-Computer Interactions: The brain computer interface (BCI) is an approach to control the appliances that are used daily in smart societies, especially home appliances and medical apparatus. It is a direct communication path between the brain and external devices. BCI acquires the brain signals that transmit to a digital device and analyzes and interprets the signals into further commands or actions. BCI services necessitate higher performance metrics compared to what 5G delivers.

Wireless BCI requires guaranteed high-data-rates, ultra-low-latency, and ultra-high-reliability. For example, both downlink (next-generation XR) and uplink (multi-brain-controlled cinema) brain-to-thing communication require very high throughput (>10 Gbps) and ultra-reliable connectivity. The features of uHLSLLC and uMTC in 6G wireless communication will support the actual implementation of BCI systems for a smart life.

III. SMART SYSTEM PROJECT:

A) **Smart Homes:** Over the last decade, the efforts in smart Utilities focused largely on smart energy grid due to ease of integration and particularly the rapid progress in smart meter deployment. However, the progress for other utilities has been much slower. Despite this, IoT technology will soon mature and liberate all the elements in homes, and make them smart. The challenge of course will be to support the massive data rate at homes and provide security protection for personal data. 6G will be tasked to provide the necessary infrastructure for all the data intensive services. Also, 6G is expected to integrate fully with AI for autonomous decision making in homes.

B) **Super-Smart Society:**The superior features of 6G will accelerate the building of smart societies leading to life quality improvements, environmental monitoring, and automation using AI-based M2M communication and energy harvesting. This application can be characterized under all uMUB, uHLSLLC, mMTC, and uHDD services. The 6G wireless connectivity will make our society super-smart through the use of smart mobile devices, autonomous vehicles, and so on. Besides, many cities in the world will deploy. Flying taxis based on 6G wireless technology. Smart homes become a reality because any device in a remote location can be controlled by using a command given from a smart device.

IV. COMMUNICATION TECHNOLOGY:

A) Holographic communications:

6G is expected to be a conversion point from the traditional video conferencing to a virtual in-person meeting. To this end, a realistic projection of real-time movement needs to be transferred in negligible time, which resorts to holographic communications

Holographic communications are one aspect that will add glamour to the 6G era. A hologram is a 3D technology that manipulates light rays beamed to an object and subsequently captures the resulting interference pattern using a recording device. In fact, transmitting 3D images without a stereo voice is insufficient to depict the in-person presence characteristics. In the 6G era, reconfigurable stereo audio will motivate the development of a platform for use in capturing several physical presences in each configuration. In other words, sample freedom for entities exists to interact with and modify received holographic data and video if the need arises.

In other words, one can interact with the received holographic data and modify the received video as needed. All this information needs to be captured and transmitted over reliable communication networks that should have an extremely large bandwidth

B) TACTILE COMMUNICATIONS:

Holographic communication makes it possible to transmit a virtual vision of close-to-real sights of people, events, and environments. The cinematic experience will be incomplete without deploying a tactile Internet that would allow the real-time conveyance of an image. Some of the expected beneficiaries of this technology are teleportation, cooperative automated driving, and interpersonal communication. For these technologies, a haptic touch could be easily implemented using communication networks. Realizing this technology may lead to the abolition of the open systems interconnection network model and the adoption of a cross-layer communication-system design.

Another aspect that requires attention is how to design procedures such as buffering, queuing, scheduling, handover, and protocols that will meet the needs of 6G networks. Obviously, the existing wireless communication systems are incapable of satisfying these needs; hence, over-the-air fiber communication systems require analysis.

For example, new physical layer (PHY) schemes need to be developed, such as to improve the design of signalling systems, waveform multiplexing, and etc. As for the delay, all delay sources should be treated carefully, including buffering, queuing, scheduling, handover and the ones induced from protocols. Existing wireless communication systems cannot fulfill these requirements, and there is a necessity to over-the-air fiber communication systems

C) HAPTIC COMMUNICATION FOR VAR

Haptic communication adds the sense of 'touch' to traditional audio visual communication over the Internet, and is the key to unlock the potential of VAR this will have massive impact on different economic sectors including manufacturing, education, healthcare, and smart utilities. .

The proposed 6G wireless communication will support haptic Communication; remote users will be able to enjoy haptic experiences through real-time interactive systems.

This type of communication is widely used in several fields such as AI and robotics sensors, physically challenged people to learn through touch, the medical haptic methods in surgery, and gaming virtual meeting room and holographic projection also require massive amount of real-time data transfer over the air, and will need 6G to meet the end-to-end latency requirements. The implementation of haptic systems and applications can be facilitated by uHLSLLC, mMTC,and uHDD features of 6G communication networks.

D) HUMAN-BOND COMMUNICATIONS:

Human-centric communication is expected to be one of the main drivers of 6G communication. With this technology, humans are expected to access and/or share physical features or express physical phenomenon as it is. Invariably, the five human senses will be involved in this project. An example of this technology is the "communication through breath" project, which makes it feasible to read a human bio-profile using exhaled breath, even the interaction with the human body by inhalation using volatile organic compounds. Consequently, such technology facilitates disease diagnosis, emotion detection, collection of biological features, and remote interaction with the human body.

Designing a communication system capable of mimicking the five human senses demands interdisciplinary research collaborations. Such research efforts would naturally result in hybrid communication technologies capable of extracting various physical quantities and then distribute them to the intended receiver via secured channels.

E) THREE-DIMENSIONAL INTEGRATED COMMUNICATIONS (3D-INTECOM)

Before the evolution of 6G networks, device communication heights were inconsequential, as could be seen from the established propagation empirical models. This situation anticipates change in the 6G 3D-InteCom model which highlights the need for a radical change from two to three Dimensions, through which the heights of communications nodes must be considered. Some of the notable technologies that have already incorporated this dimension are satellite, unmanned aerial vehicle (UAV), and underwater communications. Satellite communications enable communication services on board with acceptable service quality, but are too costly, especially in aircraft cabins.

To provide high-quality communication services on board, not only new communication technologies must be employed in 6G communications, but also novel networking architectures shall be in use.

F) BIG COMMUNICATIONS (BIGCOM)

BigCom in 6G aims to provide a large coverage of urban and remote areas by maintaining resource balance, thereby allowing subscribers to communicate with one another everywhere with a high data rate speed due to the unconventional technologies adopted by 6G communication systems, such as an extremely large bandwidth (THz waves) and a high AI that will include operational and environmental aspects as well as the services of the networks.

V. AUTOMATION SYSTEM

A) **Connected Vehicles and Autonomous Driving:** The auto-motive and transportation industries are experiencing a generation change, partly due to the connectivity and networking.

With AI and extreme data rate, autonomous and connected vehicular technologies will reach a new height. Note that massive amount of data will need to be shared amongst vehicles to update live traffic and real-time hazard information on the roads, and to provide high-definition 3D maps. All those information will be processed by AI in the autonomous command and control transportation network. As vehicles generally move at very high speeds, the network needs extremely low round-trip time for communication. It is highly likely that V2X technologies will not mature by the 5G cycle and its full potential will only be realized in 6G.

B) CONNECTED ROBOTICS AND AUTONOMOUS SYSTEMS:

Currently several automotive technology researchers are investigating automated and connected vehicles. The evolution of data-centric automation systems is currently surpassing the proficiencies of 5G. In some application domains, it is demanding even more than 10 Gbps transmission rates, such as XR devices. The

6G systems will help in the deployment of connected robots and autonomous systems. The drone delivery UAV system is an example of such a system. The automated vehicle based on 6G wireless communication can dramatically change our daily lifestyles. The 6G system promotes the real deployment of self-driving cars (autonomous cars or driverless cars). A self-driving vehicle perceives its surroundings by combining a variety of sensors, such as light detection and ranging (LiDAR), radar, GPS, sonar, odometry, and inertial measurement units. The mMUB, and uHLSLLC services in the 6G system will confirm reliable vehicle-to-everything (V2X) and vehicle-to-server connectivity.

A UAV is a type of unmanned aircraft.6G networks will support the ground-based controller and the system communications between the UAV and the ground. UAVs help in many fields such as military, commerce, science, agriculture, recreation, law

and order, product delivery, surveillance, aerial photography, disaster management, and drone racing. Moreover, the UAV will be used to support wireless broadcast and high rate transmissions when the cellular base station (BS) is absent or not working.

C) Automation and Manufacturing

6G will provide full automation based on AI. The term “automation” refers to the automatic control of processes, devices, and systems. Massive incorporation of robots into automation and ware house transportation is vital for industry growth. The emerging concept of Industry X.0 aims to enhance the Industry 4.0 by exploiting social, mobile, analytics and cloud (SMAC). The radio environment with a very complex network comprised of hundreds or thousands of robots is a challenge. 6G will fully support the Industry X.0 revolution by offering massive URLLC as well as massive IoT and embedded AI capability. EMBB- Plus eMBB-Plus in 6G will replace its 5G counterpart of eMBB and provide a high-quality experience (QoE) in data utilization and standards. 6G will fully characterize the automation system with its disruptive set of technologies.

The 6G automation systems will provide highly reliable, scalable, and secure communications using high-data-rate and low latency provisioning, i.e., uHLSLLC, mMTC, and uHDD services. The 6G system will also provide network integrity because it ensures error-free data transfer without any data loss between transmission and reception

Wireless communication of network optimization, handover, and interference should be able to exploit the concepts of big data to facilitate these operations. Providing other add-ons such as accurate indoor positioning and a globally compatible connection among diverse mobile operating networks is expected, at an affordable rate for network subscribers. A strategy should be designed for eMBB-Plus communication services without compromising the security, secrecy, and privacy of network subscribers.

VI. ADVANTAGES OF 6G

1) Cell-Free Networks

One hot topic at the late stage development of 5G is UAV wireless network which proposes to adopt flying base stations for providing mobile coverage in situations where there are no infrastructures or the infrastructures are heavily compromised due to disastrous events, and reconnaissance activities. In 6G, the full potential of UAV wireless networks or drone cells will be realized, and their application will be widely extended to mobilize the network resources to achieve cell-free networks where arbitrarily small latency may be obtained. To take full advantage of the fluid cells formed by UAVs, the optimization for resource allocation (including radio, energy and computing resources), trajectory, content caching and user association will be achieved jointly. Also, in 6G, UAVs will not only serve as flying base stations to provide radio coverage but also content providers and computing servers. There will be lots of synergy with other emerging technologies. For example, AI will take the network usage data to learn and dynamically find the best paths for the UAVs and optimize their other parameters. This will inevitably lead to dynamic reconfigurations of the network topology. In addition, UAVs will benefit greatly from WPT technologies that can keep them moving all the time, while UAVs will also help support service-based network slicing.

2) Dynamic Network Slicing:

Dynamic network slicing permits a network operator to allow dedicated virtual networks to support the optimized delivery of any service toward a wide range of users, vehicles, machines, and industries. It is one of the essential elements for management when many users are connected to a large number of heterogeneous networks in 5GB communication systems. Software- defined networking and network function virtualization are the fundamental enabling techniques for implementing dynamic network slicing. These influence the cloud computing paradigm in network management, such that the network has a centralized controller to dynamically steer and manage traffic flow and orchestrate network resource allocation for performance optimization.

3) PHYSICAL-LAYER SECURITY:

6G networks are human-centric because human-centric communications are the most important among many 6G applications. Consequently, security, secrecy, and privacy should be the key features of 6G networks. 5G systems persist several security challenges in terms of decentralization, transparency, data interoperability, and network privacy vulnerabilities. In 6G, the current methods of regulation and process of privacy and security are not enough to maintain the physical safety of the network.

However, the RSA cryptosystems became insecure under the pressure of Big Data and AI technologies. As a consequence, a new physical-layer privacy technique needs to be developed for Big Data and AI-based future 6G communication. Physical- layer security design and secure interactions with the upper layers are compulsory in 6G. Physical security technologies and quantum key distribution via VLC are vital solutions to provide security in 6G. It is expected that large-scale quantum computing is increase due to the massive development of edge and cloud infrastructures, asymmetric cryptography can increase its research interest in this area. Utilization of machine learning in automated security in the field of network virtualization and softwarization will help to detect and prevent attacks in an optimal way.

4) PLANNING OF ECONOMIC PROSPECT:

Economic prospect is also important for the deployment of 6G communication. A new implementation of 6G will cause a considerable network infrastructure cost. However, the transformation of the 5G system into a 6G systems and proper planning can reduce the cost. Hence, the potential for infrastructure, data, and spectrum sharing must be appropriately investigated to make the 6G network cost-effective.

5) RADAR-ENABLED CONTEXTUAL COMMUNICATIONS

Intelligence only shows if there is sufficient information to analyze. Radar technologies enrich environmental awareness for mobile UEs and IoT devices and enable context-aware communications to the level that has not been able to achieve before. This will give 6G radios the environmental awareness to empower AI at the device level. Combining the observations from radars with AI, UEs will be able to identify and localize potential eavesdroppers or adversaries by observations from radar and adapt their communications for enhanced protection using physical layer security approaches. The 6G radios will also store

behavioral data of the environment, and can predict suspicious activities of malicious nodes. In addition, methods like physical layer authentication which relies on users' behavioral data will be possible.

6) OAM COMMUNICATION

Exploiting polarization diversity and OAM mode multiplexing, it has been demonstrated that very high capacity wireless communication systems can be built to work over a distance of a few meters. Several independent data streams transmission over the same spatial wireless channel can be designed which increases the area spectral efficiency by many fold. The performance is particularly promising at a relatively short distance which can be useful for industrial automation. A mmWave OAM system in was reported to have achieved more than 2.5Tbps rate with spectral efficiency of a massive 95.7bps/Hz.
This can be a lucrative technology for Industry 4.0 which is envisaged as one of the key 6G use cases.

7) METAMATERIALS BASED PROGRAMMABLE RADIO ENVIRONMENT

Despite the enormous success over the past decades, traditional antenna design techniques have seemingly reached their limits, and any further efforts are expected to result only mild incremental gains. Nonetheless, Metamaterials-based antennas have been researched for nearly two decades, not yet making an impact in previous generations of mobile communications.

This will change in 6G where Meta materials based antennas will become the norm for UEs, permitting the massive MIMO technology to be employed at mobile phones as well. The maturity of Metamaterials-based antennas will also make small-sized highly efficient wideband antennas possible, which gives the hardware flexibility that the 6G radio needs.

Another new form of antenna technology, which will come to light in 6G, is fluid antenna, made of conductive fluid, metal fluid or ionized liquid that can be shaped to any desirable form to suit the propagation environment. The fluidic structure breaks the boundary between the pre-defined antenna hardware and signal processing, and allows to optimize its position and shape for extraordinary diversity and multiplexing gains, while having the ability to reduce the electromagnetic fields (EMF) exposure by adapting to human gesture in the case of mobile phones, based on the environment and the needs at any given time. Presumably, a single software-defined fluid antenna can provide the rich diversity that only massive MIMO antennas could achieve, while enjoying the flexibility to alter its shape, size and position to fully utilize the surface of a UE.

Software-defined materials (SDM) can actually be used to design large intelligent surfaces (LIS) to enable programmable wireless environment as well as for enhancing the coverage area of ultra-small cells. By doing so, it is possible to control the propagation environment by altering its electro- magnetic properties. For example, SDM can be laid on walls to provide insulation for unintended radio signals as shown in

LISs on buildings or in indoor environments are predicted by many to make their mark in 6G and some works have suggested that each link can achieve up to 0.5Gbps data rate, hence a good candidate to meet the data rate requirement of 6G. We speculate that VLC will be especially useful in vehicle-to-vehicle (V2V) communications where car's head and tail lights can be used as antennas for 'control and coordination' data communication. VLC will also be useful in scenarios in which traditional RF communication is less effective such as in-cabin internet service in airplanes, underwater communication, healthcare zones and etc.

VII. CHALLENGES

1. Limits on Flexible Radio Access

Cell size plus carrier frequency may limit the OFDM numerology option. On one arrow, utilize of numerology with the extensive subcarrier spacing is usually further appropriate for minor cell sizes owing to its smaller delay extensions than large cell increases. On the other hand, large quantities of digital cells can be used with a larger space subcarrier, but at a lower performance cost. It is similarly significant to remember that the size of cells with high frequency carriers is restricted because of problems of route propagation and Doppler propagation in case of high mobility.

2. Network security issue

Security is a serious concern for 6G wireless networks, specifically when using the Terrestrial Space Integrated Network (STIN) technique. In 6G, in addition to traditional physical series safety, other forms of privacy, as cohesive network security, must be measured together. A novel approach to security, which depends on little difficulty and a high level of security, must therefore be intensified. To this conclusion, certain physical layer security techniques intended for 5G can be protracted to 6G systems, for example, a secure MIMO mass based on low density parity control (LDPC); Mm-Wave Safe techniques can also be used for "UM-MIMO and THz band applications". When it comes to integrated network security, it is very important that there is an appropriate management purpose for diverse function means for diverse security domains. A central distribution management mechanism is a promising mechanism for STIN which takes into account the management of multicultural and certificate less communication keys. With the efficient administration and application, these physical and network layer security methods can combine this integrated security solution, which effectively protects confidential information and confidentiality on 6G networks.

3. Resource as a Service (RaaS)

The emergence of software defined networking (SDN) and network function virtualization (NFV) facilitates a move towards service oriented and integrated resource distribution which is known as RaaS. This has given rise to the concept of network slicing to create virtual networks over the physical infrastructure. It allows mobile operators or service providers to allocate virtual network resources to meet specific service needs. In 6G, programmable metasurfaces and software defined materials will likely be parts of the network resources.

Thus, one trend of development for NFV in the 6G cycle will include network slicing with software-defined materials and programmable metasurfaces, from machine learning-enabled cloud random access network (C-RAN) to fog-RAN.

4. Heterogeneous Hardware Constraints

In 6G, a huge number of heterogeneous types of communication systems, such as frequency bands, communication topologies, service delivery, and so on, will be involved. Moreover, the access points and mobile terminals will be significantly

different in the hardware settings. The massive MIMO technique will be further upgraded from 5G to 6G, and this might require a more complex architecture. It will also complicate the communication protocol and algorithm design. However, machine learning and AI will be included in the communication.

Moreover, the hardware design for different communication systems is different. Unsupervised and reinforcement learning may create complexities in hardware implementation as well. Consequently, it will be challenging to integrate all the communication systems into a single platform. Autonomous Wireless Systems: The 6G network will provide full support to automation systems such as an autonomous vehicle, UAVs, and Industry 4.0 based on AI. To make autonomous wireless systems, we need to have the convergence of many heterogeneous sub-systems, such as autonomous computing, interoperable processes, system of systems, machine learning, autonomous cloud, machines of systems, and heterogeneous wireless systems. Thus, the overall system development becomes complex and challenging. For example, developing a fully autonomous system for the driverless vehicle will be much more challenging because 6G researchers need to design fully automated self-driving vehicles that perform better than the human-controlled vehicles.

1. Spectrum and Interference Management

Due to the scarcity of the spectrum resources and interference issues, it is essential to efficiently manage the 6G spectra, including the spectrum-sharing strategies and innovative spectrum management techniques.

2. Security versus Spectral Efficiency

Achieving end-to-end, attack-proof wireless data communication requires many spectrum bandwidth preventive measures which results in a reduction in the available spectrum data available for data transmission. Finding an acceptable scheme to address the security and spectral efficiency concerns of wireless communications would entail complex computations but can be addressed via three possible strategies. First, encryption algorithms designed by security experts are expected to be highly successful. With the encryption algorithm reaching the maturity stage, realizing such algorithms might be slightly cumbersome. Second, security experts should identify a strategy to implement PHY security technologies with a loss in spectrum spectral. Third, AI algorithms are equipped with the capacity to expertly discover network shortcomings and would become handy in 6G networks for designing an early warning strategy for security fortification.

3. Spectral Efficiency versus Energy Efficiency

Unlike the 1–5G communications, the 6G counterpart can present an innovative route-breaking, energy-harvesting Technology to significantly ease this tradeoff. By energy harvesting, consumer nodes will have the capacity to harvest radio, vibratory, and solar energy from the ambient environment, thereby addressing the complications of energy utilization. The environmental advantages obtained via ubiquitous intelligent surfaces would be crucial in reducing the spectrum-energy tradeoff by responding to the ever-changing radio propagation conditions.

4. High Intelligence versus Privacy and Complexity

The balance between privacy and intelligence would be significant in 6G networks, as they are humanoid networks. Conversely, AI algorithms must interact with private data and refine them to improve network functionality, alter network figures, and deliver superior quality services

Therefore, privacy would be foregone to the detriment of superior intelligence. A candidate solution is to utilize an intermediary negotiator between the end-user data and AI algorithms. Such a negotiator should be a third party, independent if possible, and operate on a distributed fashion.

Definitely, customization attracts increased attention, and Intelligence versus exorbitant routines and Intelligence versus sub- routines are needed for AI algorithms and smart nodes. Such routines and sub-routines should be specified in the most fundamental procedures of 6G networks. By using this approach, intelligent portfolios can simply be delivered inside the permitted boundary. High intelligence comes at a cost in terms of network complexity and could translate to higher network operators and gadget producer budgets. Such developments would lead to a higher device cost for consumers and negate the dream of providing affordable gadgets. To tackle this issue, technological innovations in intelligent structures are essential.

5. Block chain Enabled Security and Authentication

With over 50 billion UEs and IoT devices connected everywhere with different levels of capability, 6G will need a holistic approach to secure the sheer volume of mobile data across a diverse set of platforms and comply with the strict privacy and security requirements. Block chain technology will likely play a major role in securing and authenticating future communication systems thanks to the inherent advantage of the distributed ledger technology. Some promising use cases will include distributed security management for IoT, offloading in mobile edge computing, NFV and content caching.

6. Dynamic Topology

In light of network densification, each end node will have multiple options to connect and user association decision will have a great impact on the interference pattern. This coupling with dynamic drone cells formed by unmanned aerial vehicles (UAVs) and fast moving vehicular networks will change the interference dynamics rapidly. Modeling this new interference dynamics and ensuring that the network takes full advantage of the flexibility and adaptively of cell shapes as well as topology will be a priority of 6G. New mathematical tools will need to be discovered to allow such analysis and optimization.

7. Sub-Millimeter Wave and THz Frequencies

A recent study indicates that 5G spectrum may not exceed 140GHz due to a number of challenges including the lack of understanding of channel and propagation modelling, device inability to operate at such high frequencies, and etc. In contrast, 6G will utilize spectrum beyond 140GHz with particular application in very short range communication or 'whisper radio'.However, the susceptibility of the THz band to blockage, molecular absorption, sampling and circuits for A/D & D/A conversion and communication range is among the major challenges that need to be addressed in the coming years. Another issue is that at higher frequencies, the antenna size and associated circuitry become miniaturized and are difficult to fabricate on chip while ensuring noise and inter-component interference suppression.

5. Fog Networking and Mobile Edge Computing

Edge caching breaks the network into a distributed cloud structure where training data reside at the network edges, which handicaps AI techniques to be fully functional. It is inevitable that the network is going to move towards even smaller cells for more capacity and less latency in 6G and this situation will exacerbate.

6. Peak Rate-Terabit Era

When referring to wireless mobile communication systems, the first requirement that people should consider is peak rate, which is one of the key technical indicators that the first generation of wireless mobile communication systems have been pursuing since its inception. There is no doubt that 6G will also further increase the peak rate.

From the perspective of wireless communication system development law and 6G vision, we can see that 6G peak rate may enter the Terabit Era (Tb/s). it can be seen that the growth of peak rate of 1-5G mobile communication system obeys exponential distribution (calculated according to the standardized time point of each generation system. it can be seen that there are at least two applications that need a significant increase in 6G peak rate: (1) intelligent applications (Big-Data based) require massive data transmission. Intelligent application (Big-Data based) may be an important driving force for the development of the next generation mobile communication system; (2) high fidelity AR/VR and holographic communications will be the inevitable applications supported by 6G, and the data rate required will be much higher than other wireless applications we currently know.

In order to achieve high fidelity immersive AR/VR, not only the peak rate of Tb/s, but also the lower interaction delay, i.e., both high throughput and low delay, are required. In addition, AR/VR anytime and anywhere means that we want to meet the high-speed demand at anytime and anywhere, which requires not only super-high peak rate, but also super-high coverage performance. Summarizing the above analysis, we can see that the peak rate of 6G network will up to Tb/s. In addition, not only the peak rate requirement of local coverage areas (such as hot spots), 6G network will also require the connections with high-speed and low-latency at anytime and anywhere, Which will be a huge challenge for 6G network.

7. Device Capability

The 6G system will provide several new features. Devices, such as smart phones, should have the ability to cope with the new features. In particular, it is challenging to support Tbps throughput, AI, XR, and integrated sensing with communication features using individual devices. The 5G devices may not support a few of the 6G features, and the capability improvement in 6G devices may increase the cost as well. The number of devices for 5G is expected to be billions. When communication infrastructure moves from 5G to 6G, the compatibility of those 5G devices to 6G is a critical issue. This compatibility makes it easier for end-users to use and saves a lot of money. Therefore, 6G needs to prioritize integrated communications-computing devices, computing performance improvement, and so on based on technological compatibility with 5G.

8. HIGH-CAPACITY BACKHAUL CONNECTIVITY

The access networks in 6G will have a very high density. Moreover, these access networks are diverse and widespread within a geographical location. Each of these access networks will support very high-data-rate connectivity for different types of users. The backhaul networks in 6G must handle the enormous volumes of data for connecting between the access networks and the core network to support high-data rate services at the user level; otherwise, a bottleneck will be created. The optical fibre and FSO networks are possible solutions for high-capacity backhaul connectivity; therefore, any improvement in the capacity of these networks is challenging for the exponentially growing data demands of 6G.

VIII. CONCLUSION

The wireless technology is updated every 7-8 years as like from 1G to 4G technologies every time after up gradation the system having some additional features, function and different technology parameters are used. As 5G already adopted by few countries and they are ready to begin shape for the 6G, because after the several year probably 2030-33 there is no possible support from 5G system for the users. There are already several companies, who working towards the some future initiates for wireless communication of the 6G and still it is in study phase, but it's early to discuss the function and additional feature of the 6G.In this paper we have given review on 6G technology on the basis of the AI, security, communication technology, network, uses, advantages and iOT etc. There will be several challenges and issues will have in 6G related to data traffic and others hope it will be work as future development.Lastly we want add that 6G will have some great features that will give someexcellent key potential in wireless technology to connect whole world.

REFERENCES

1. Shuping Dang, Osama Amin, Basem Shihada, Mohamed-Slim AlouinKing Abdullah University of Science and Technology (KAUST), Thuwal 23955-6900, Saudi Arabiai,"What Should 6G Be?", arXiv:1906.00741v3 [cs.NI] 29 Jul 2020.
2. T. Arunkumar, L. Kalaiselvi, "Latest Technology of Mobile Communication and Future Scope of 7.5 G" ,International Journal of Engineering & Technology Research Volume 2, Issue 4, July-August, 2014, pp. 23-31
3. Jasmeen Gill and Shaminder Singh, "Future Prospects of Wireless Generations in Mobile Communication",Asian Journal of Computer Science and Technology ISSN: 2249-0701 Vol. 4 No. 2, 2015, pp.18-22 © The Research Publication, www.trp.org.in
4. B. Bhattacharyya and S. Bhattacharya, "Emerging Fields in 4G Technology, its Applications & Beyond-An Overview", International Journal of Information and Computation Technology, vol. 3, no 4, pp. 251-260, 2013.
5. S. Mondal, A. Sinha and J.Routh, "A Survey on Evolution of Wireless Generations 0G to 7G", International Journal ofAdvance Research in Science and Engineering- IJARSE, Vol. 1, Issue 2,pp. 5-10.
6. A.Gohil, H.Modi and S.K.Patel, "5G Technology of Mobil Communication: A Survey", IEEE-International Conferenceon Intelligent Systems and Signal Processing (ISSP), pp.288-292, 2013.
7. M. Farooq,M. I. Ahmed and M. A. Usman, "Future Generations of Mobile Communication Networks", Academy ofContemporary Research Journal, Vol. 2, Issue 1, pp.15-21, 2013.
8. R. Khutey,G. Rana, V. Devwangan, A. Tiwari and A.D.Dewamngan, "Future of Wireless Technology 6G & 7G", International Journal of Electrical and Electronics Research ISSN2348-6988 (online) Vol. 3, Issue 2, pp. 583-585, April -June 2015.
9. H.V.Prabhu and G.S.Nagaraja, "A Survey on Quality of Service Provision in 4G Wireless Networks", International Journal of Advanced Research in Computer and Communication Engineering ,Vol. 3, Issue 7,pp.7411-7416, July 2014
10. M. R.Bhalla and A.V.Bhalla, "Generations of Mobile Wireless Technology: A Survey", International Journal ofComputer Applications, vol. 5, no. 4, pp. 26-32, August 2010.
11. S. Pandey, M. Kumar, A.Panwar and I. Singh, "A Survey: Wireless Mobile Technology Generations With 5G", International Journal of Engineering Research & Technology (IJERT),Vol. 2 Issue 4, pp. 33-37,April 2013.
12. G.Rana, S. Swarnkar and A. Jain, "5G-The Wonder of Wireless Network", International Journal of Research (IJR),Vol.1, Issue.10, pp. 1390-1399, November 2014.

13. A.Vijay, M. Rawat and D.Yadav , " 4G Networks in Cellular Communication: A Survey" International Journal of Innovations & Advancement in Computer Science (IJIACS),Vol. 4, Special Issue ,pp. 485-491,March 2015.
14. Ayshath Silmiya Meril," Review: Comprehensive study of 5G and 6G Communication Network",© 2019 JETIR May2019, Volume 6, Issue 5.
15. Ms. Anju Uttam Gawas, "An overview on Evolution of Mobile Wirelesss Communication Networks: 1G-6G",(IJRITCC),Volume 3, Issue 5, May 2015.
16. Arockia Panimalar.S, Monica.J, Amala.S, Chinmaya.V,"6G Technology", (IRJET), Volume 04, Issue 09, Sep- 2017.
17. S.Ramkumar, "A Recent Review on growth of Mobile Generations-case study",(ICICSS), 2018.
18. B.G.Gopal, P.G.Kuppuswamy ," A Comparative Study on 4G and 5G Technology for Wireless Applications", (IOSR-JECE) ,Volume 10,Issue 6, Nov-Dec 2015.
19. Abdullah Al Mamun, Sultan Anwar, Hassan Ali, "4G to 5G Mobile Communication Networks: Features Analysis,Comparison and Proposed Architecture", IJCST Vol.7,Issue 2, April-June 2016
20. Ms.Lopa J. Vora, "Evolution of Mobile Generation technology: 1G to 5G and Review of Upcoming WirelessTechnology 5G", (SJIF), Volume 02, Issue 10, 2015.
21. Swati Yadav, Sugandha Singh, "Review paper on Development of Mobile Wireless Technologies (1G to 5G)", May-2018.
22. V.Lakshitha, K.V.Rohith Reddy, G.Jayanth, C.JagadeeshRaju, Dr.Manikandan K, "3G, 4G, AND 5G: A ComparativeStudy", (IRJET), Volume 05, Issue 03,March-2018.
23. SagarKumar Patel, HarshadPurohit, ShivamShah,"Review On 5G Wireless Technology", IJSRCSEIT, Volume 3,Issue 3,2018.
24. Rahul Singh Karki, Vivek B.Garia (2016),"6G Network Mobility",(ICAIM), 2016.
25. Harsh Shah, Sonal Fatangare,"Review on the Integration of Artificial Intelligence and 6G Communications",International Research Journal of Engineering and Technology (IRJET) Volume: 07 Issue: 06 | June 2020.
26. Ashish Kr. Gupta, Madan Pal Singh, "A Study of Wireless Network: 6G Technology",©2018 IJCRT | National Conference Proceeding NCRIETS April 6-7, 2018 , National Conference On Recent Innovation In Emerging Technology & Science by JB Institute of Technology, Dehradun & IJCRT.
27. MOSTAFA ZAMAN CHOWDHURY, MD. SHAHJALAL,SHAKIL AHMED, YEONG MIN JANG,6G "Wireless Communication Systems: Applications, Requirements, Technologies, Challenges, and Research Directions", current version 4 August 2020 Digital Object Identifier 10.1109/OJCOMS.2020.3010270.
28. Faisal Tariq, Member, IEEE, Muhammad R. A. Khandaker, Senior Member, IEEE, Kai-Kit Wong, Fellow, IEEE,Muhammad Imran, Senior Member, IEEE, Mehdi Bennis, Senior Member,IEEE,and M´erouane Debbah, Fellow, IEEE, "A Speculative Study on 6G",
29. Elmeadawy, Samar & Shubair, Raed. (2019)," 6G Wireless Communications: Future Technologies and Research Challenge". 10.1109/ICECTA48151.2019.8959607.