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Revolutionised Study of Mobile Communication

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Abstract:- The journey of wireless communication has shown a great transformation over generations and this advancement in mobile communication is still going on. This review paper provides a comprehensive overview of the evolutionary generations of mobile communication, spanning from the first generation (1G) to the current fifth generation (5G) and glimpsing into the future with the upcoming sixth generation (6G) and seventh generation (7G). The journey of mobile communication began with the first generation (1G) analog cellular networks in the 1980s, which introduced the concept of voice calls. The second generation (2G) has delivered a high volume and a large amount of integration. The third generation (3G) network introduced in the early 2000s includes high-speed data transfer, enabling mobile internet access, video calling and multimedia messaging services. The fourth generation (4G) entered the era of high-speed data transmission. The fifth generation (5G), the current generation began rolling out in the late 2010s and continues to expand globally. The sixth generation (6G), a hypothetical next generation, aims to push the boundaries of mobile communication even further. The seventh generation (7G) could potentially enable highly efficient and secure communication systems.

Keywords:- *Wireless Mobile Communication, 1G, 2G, 3G, 4G, 5G, 6G, 7G.*

I. INTRODUCTION

Wireless mobile communication has completely changed the way people use communication to share information. It refers to the transmission of voice, data and multimedia content with the need for physical wired connections. It allows individuals to communicate and access information while moving, providing freedom and flexibility in terms of connectivity. In the past few decades, the mobile wireless technologies have experience of various generations of technology revolution and evolution, namely from 1G to 7G. From the original 1G technology where information was exchanged in the form of basic voice signals while 2G came up with many features that add features with new capacity and integration capabilities. This is followed by 3G which was designed to achieve greater speed with mobile broadband information. Then 4G is introduced, provides faster data speed, improved cell quality and enhanced multimedia capabilities. The recently developed 5G offers many telecommunication services. 6G and 7G are future generations and their progress will enable new possibilities and innovations, shaping the way we interact with mobile devices and the world around us.

➢ *1G Technology of Mobile Communication*

The 1G first generation mobile wireless communication system was introduced in 1980s. The 1G technology was based on analog signals. The analog system was first used in North America, and the system was used in Europe. This type of analog system provides basic voice communication and had limited capabilities as compared to subsequent generations. With 1G, the voice call can be switched on at high frequencies of about 150 MHz and above as it transmits radio towers. This is done through the Frequency Division Multiple Access (FDMA) process. In terms of overall communication quality, 1G stands at the bottom of the following. It has low volume, poor voice links, and no security at all as the voice call is also played on radio towers, making this call easy for unwanted third parties.

Fig 1: Phones used in 1G

➢ *2G Technology of Mobile Communication*

2G, or second generation, regers to the second wave of mobile communication technology. The drawbacks of the first generation cellular systems are analog voice signal transmission and limited service performance. To overcome these drawbacks the analog systems are upgraded to digital

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cellular systems. Second generation cellular systems are also known as Digital Cellular Systems. Thus 2G introduced digital voice communication, offering improved sound quality, increased capacity, and additional features. The most widely used 2G technologies were GSM (Global System for Mobile Communication) and CDMA (Code Division Multiple Access). GSM became the dominant standard globally, while CDMA gained popularity in certain regions. Although 2G networks have become outdated in many parts of the world due to the advent of newer technologies, they are still utilized in some areas where 3G or 4G coverage may be limited. 2G networks are gradually being phased out to make way for more advanced technologies like 5G, which offer significantly faster data speeds and support for a wide range of services beyond traditional voice calls and basic data transmission.

➢ *3G Technology of Mobile Communication*

The 3G techonolgy was introduced in year 2000's. It represents a significant advancement over the previous 2G systems, providing faster data transfer rates, improved voice quality, and the ability to support a wider range of services. 3G networks are designed to support multimedia services such as video calling, video streaming, and audiovisual content delivery. 3G networks have facilitated global roaming capabilities, allowing users to stay connected and access services while travelling internationally. This enables seamless connectivity and consistent service experience across different countries and network operators. 3G technology played a crucial role in the development of mobile communication, it has been largely superseded by newer generations like 4G LTE and 5G. These subsequent generations provide even higher speeds, lower latency, and more advanced features to meet the evolving demands of mobile users.

➢ *4G Technology of Mobile Communication*

4G, or fourth-generation technology, refers to the fourth iteration of mobile telecommunications standards and technologies and was developed in the year 2010. The main aim of 4G technology is to provide high speed, high quality, high capacity and low cost services for voice, multimedia and internet over IP. 4G is totally IP based technology. This generation is based on Long Term Evolution (LTE). LTE is a standard for wireless communications of high speed data for mobile phones and data transmission. It provides 10x speed for 3G networks. The speed detected by the International Telecommunication Union (ITU) which is 100 Mb. 4G LTE has revolutionized mobile communication by enabling a wide range of advanced applications and services on mobile devices.

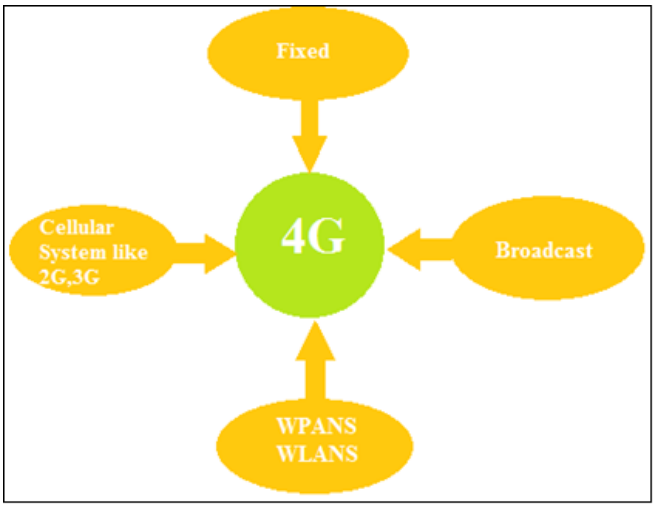

Fig 2 4G Technology

➢ *5G Technology of Mobile Communication*

5G Technology stands for the revolutionary fifth Generation Mobile technology. The advent of 5G has heralded a remarkable paradigm shift, revolutionizing the way we interact with our cell phones by harnessing the boundless potential of high bandwidth. At its core, 5G leverages cutting-edge packet switched wireless systems, employing the powerful Orthogonal Frequency Division Multiplexing (OFDM) technique. This result in wide area coverage and astonishingly high throughput at astonishing millimetre wave frequencies ranging from 10 mm to 1 mm, spanning an impressive frequency range of 30 GHz to 300 GHz. Such a leap in technological prowess enables data rates of up to a staggering 20 Mbps to be delivered over distances of up to 2 km, setting new benchmarks for wireless connectivity. 5G networks are designed to be more energy-efficient if compared to previous generations. This efficiency is achieved through techniques like network virtualization, which optimizes resource allocation and reduces power consumption. It's important to note that the deployment of 5G is an ongoing process, and its availability and performance may vary depending on the region and the specific network infrastructure in place.

Table 1 Comparison table from 1G to 5g

Featurs	**1G**	**2G**	**3G**	**4G**	**5G**
Introduced	1979	1991	2001	2010	2019
Technology	AMPS, TACS	GSM	WCDMA	WiMAX, LTE	MIMO
Frequency	800-900 MHz	1.8 GHz	2 GHz	1800 MHz	24-27 GHz
Internet Service	Normal	Narrow Band	Broad Band	Ultra Broadband	Wireless World Wide Web
Net Speed	2.4 KBPs	64 KBPs	2 MBPs	1 GBPs	10 GBPs
Application	Voice call	Voice call, short message	Video call, GPS, mobile TV	Video call, GPS, mobile TV	HD video, robots

➢ *6G Technology of Mobile Communication*

6G, or the sixth generation of mobile communication, is expected to be the next major leap in wireless technology after 5G. While 5G is still being rolled out globally, researchers and industry experts are already exploring the potential capabilities and features of 6G. 6G is expected to

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build upon the capabilities of 5G and offer even faster data speeds, lower latency, greater capacity, and enhanced reliability. It is envisioned to support a wide range of emerging technologies, such as virtual and augmented reality, holographic communications, advanced artificial intelligence, internet of things (IOT) devices, and more. 6G will include terahertz frequency bands, massive MIMO (Multiple-Input Multiple-Output) systems, advanced antenna technologies, network densification, artificial intelligence-driven networks, and novel communication architecture. It's important to note that 6G is still in the research and development phase more.

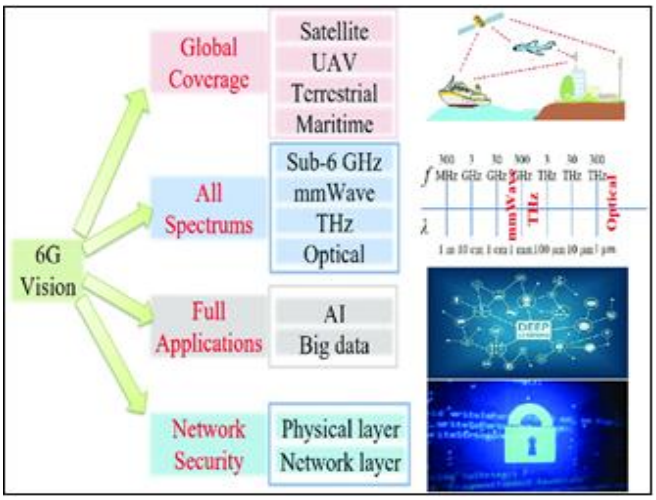

Fig 4: 6G Technology

➢ *7G Technology of Mobile Communication*

7G mobile communication represents an ambitious and hypothetical future generation of mobile network technology that remains undefined and undeveloped at present. While the groundwork for 6G technology is still in its nascent stages of research and development, the prospect of 7G pushes the boundaries even further into the future. Like its predecessor 6G, 7G is envisaged to offer unparalleled global coverage, ensuring seamless connectivity across vast distances. The research and development of 7G will focus on resolving challenging issues such as uninterrupted mobile phone usage during international travel, transcending borders and time zones. The constant movement and specific orbits of satellites will necessitate the establishment of robust standards and protocols for seamless cellular-to-satellite and satellite-to-satellite communication system. The primary objective of this revolutionary 7G technology is to enable space roaming, empowering users to stay connected and communicate effortlessly even in the most remote and celestial settings. In this grand vision, the global navigation satellite system will play a pivotal role in supporting and enhancing the capabilities of the 7G network, making space roaming a tangible reality. 7G is an exciting beacon of progress and possibility, promising to redefine the boundaries of mobile communication.

II. CONCLUSION

The landscape of mobile wireless communication is undergoing a rapid and dynamic transformation. The last few years have experienced a remarkable growth in wireless communication. In this paper we reviewed various generations of mobile communications including future generations 6G and 7G. To meet the ever-increasing demands of the modern world, the focus is on achieving unprecedented levels of speed, enhanced quality, minimal latency, expanded bandwidth, and cost reduction. This pursuit encompasses a drive to create a mobile network ecosystem that empowers individuals with seamless and high-speed connectivity, liberating them from the constraints of physical boundaries. In this transformative era, the vision is clear to foster a wireless world where individuals can seamlessly access information, communicate effortlessly, and harness the boundless potential of mobile technology to shape a more interconnected and innovative global society.

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