Research on the Future Market Applications of 6G Network Technology

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Abstract. 5G network technology is already quite mature and, in most places, has popularized the use and application of the 5G network. The successful research of this technology has brought a lot of convenience to human life. After 5G, research on 6G is proposed. The research topic of this paper is about 6G networks, and the blank of 6G applications in the future is obtained by comparing the previous 5G networks. Conclusions are drawn by comparing and analyzing cases in the literature. 6G can do all the functions of 5G and be faster and more efficient. In the future, 6G will show new development trends such as immersive, intelligent, and global, and form new market applications such as immersive cloud XR, holographic communication, and sensory interconnection.

Keywords: 5G · 6G · Application · Market · network

1 Introduction

The two giants of 5G, China and the United States, were also the first to study 6G technology. These two countries have already established the research basis for 5G and may have some similarities in 6G networks. Other countries also proposed starting research later. From the development of 5G to now, it has entered the commercial world, and most of the vision has been realized. There are three main application scenarios: eMBB (Enhanced Mobile Broad Band); URLLC (Ultra-reliable Low Latency Communications); and Massive machine-type Communications (mMTC).

Compared with 5G, the advantages of 6G will completely surpass those of 5G in terms of storage capacity, accurate real-time, high synchronization, and reliability. If the developed 6G network has the above advantages, it may surpass the 5G research path. Because 6G has not been pushing out a wide range of applications and is still in the research stage, there is a vacancy in the next 6G after the success of the development of a wide range of commercial and application. At present, the research direction of 6G mainly includes research on 6G band and bandwidth [1], AI, and 6G communication. This paper mainly studies the application or service industry of 6G in the future by comparing the technical characteristics of 5G. Problem solving and application in the future will have more options as a result of the comparison research to the future of 6G, which will not only provide convenience to human life but also contribute to the

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advancement of human science and technology. This paper enriches the relevant academic research content and can make people further understand the future research and application direction of 6G.

2 6G'S Development and Vision

2.1 The Market Demand

The rapid development of artificial intelligence (AI), machine learning (ML), deep learning (DL), augmented reality(AR), virtual reality (VR), 3D media or 360-degree video, the Internet of Things (IoT), Enterprise Internet of Things(E-iot), biological and nano Internet of Things (IoBNT) and many other applications has led to a significant increase in global communication traffic [2–4]. Global mobile traffic will increase by nearly 55%. This increase illustrates precisely the impact of advanced communication systems on traffic. The ecosystem industry, the robotics industry, and the field of machine interaction are becoming mainstream. In order to improve the quality of intelligent life and the general application of automation, there will be many sensors to be put into cities, cars, homes, industry, food, toys, and other things. Therefore, the future may require high data rate transfer and extremely high reliability to support these applications.

2.2 Analysis of 5G

5G wireless networks are already in use for the United States and China. 5G is expected to be rolled out worldwide between 2020 and 2024. 5G networks do not have enough capacity to accommodate the next fully automated and intelligent network that provides all services and a fully immersive experience [5]. Although 5G communication systems will have huge advantages over existing networks, in 15 years [6] they will not be able to meet the requirements of the evolving intelligent and automated systems of the future. Compared to fourth generation (4G) communication [7, 8], 5G networks will offer new functions and better experiences. By 2030, the world is likely to be data-driven, with almost instantaneous, unlimited wireless connectivity.

2.3 6G Development Vision

As a result, 6G can advance wireless technology and improve the performance of existing network systems. As a vision of the future, in terms of speed, 6G is likely to utilize a higher spectrum than previous generations in order to increase rates, which are expected to be 100 to 1000 times faster than 5G [5]. Specifically, the 6G network will utilize the high spread spectrum of multi-band to realize the link from 100 gigabits per second to terabits per second. For example, the combination of the 13 GHz band, the millimeter wave band (30300 GHz), terahertz (0.06–10 THz) [5]. In order to overcome the limitations of 5G in supporting high data-driven applications using connections over 100 Gbps and ultra-reliable low-delay communication (URLLC), sixth generation(6G) wireless systems with new appeal need to be developed.

6G will be powered by a combination of all the features of the past, such as network density, high throughput, high reliability, low latency, low power consumption, and large scale connectivity. The 6G system will also continue the advantages of previous generations, including new services brought about by new technologies. These new services include artificial intelligence (AI), smart wearables, implants, autonomous vehicles, computational reality devices, etc. [9].

The most important requirement for 6G wireless networks is the ability to process large amounts of data and connect devices at extremely high rates. The rapid growth of global Internet usage is from 7% in 2020 to 43% in 2030. Global mobile traffic is expected to increase 700 times over 2008 levels by 2030 [5].

To cope with the development of 6G, the fusion of photonic technology and artificial intelligence(AI) proposes two possible 6G implementation technologies: photon-based cognitive radio and holographic radio. In addition, since many studies have described the performance of low-delay optical networks, multipurpose, full-spectrum, and all-photon RANs may be used and play an important role in uBBLLC scenarios [10]. In the uMUB service, the extraterrestrial integrated network also employs a 100Gbps hyper spectral extraterrestrial integrated network based on laser-millimeter wave-terahertz convergence, of which the most critical technology is all-photon satellite payloads. Therefore, high-performance photonic integration technology will become a new paradigm in the next generation of wireless communication, as well as a revolutionary and subversive technology.

3 Market Economy Analysis

The 6G era of the 2030s will present a unique set of challenges and opportunities for human society and humanity, many of them of global relevance. The value of the 6G vision and associated to use cases will ultimately be the only way to support trillions of dollars of 6G-related R&D investment in the next 15 years. Figure 1 shows the possible 6 G relevant effects on the value of the key dimensions.

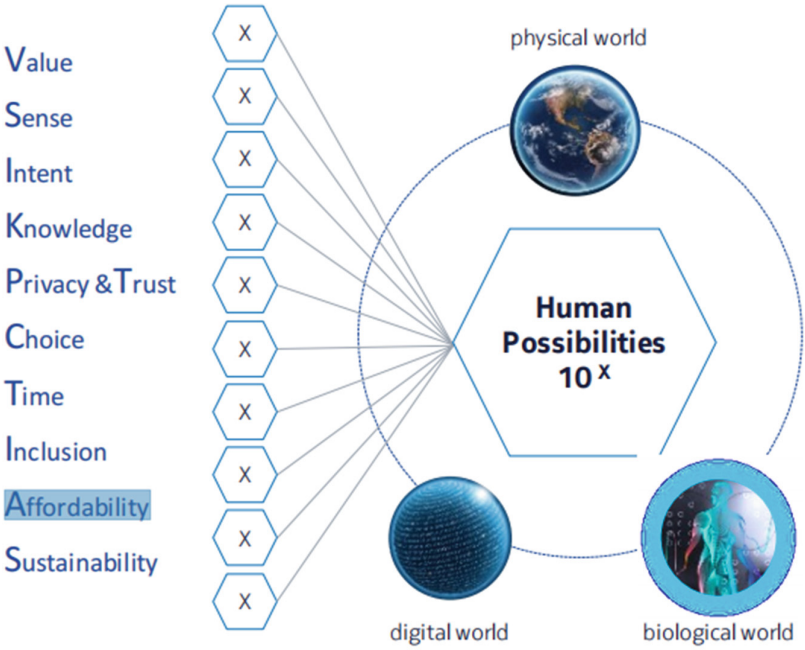

Fig. 1. Human Possibilities 10×

3.1 Tangible Benefits

For example, the technique in the prophase of R&D costs, after the success of the late development in use costs, brings to the company's profits, after counting use from a deeper level. For example, this scientific and technological achievement brings convenience to human beings as well as an impact on the world pattern.

3.2 Thirst for Knowledge

For knowledge learning is a scientific research base and has a large knowledge system, which may have a positive impact. The progress of scientific research is not satisfied with the present and will explore more esoteric knowledge, just like at the time of 5G development. Humans will move from more than 1.8 GHz frequency band to 3 GHZ–6 GHZ.

3.3 Personal Questions

As mentioned above, 6G technology has high security and reliability. Time. Because 6G is more intensive in the base station and its transmission speed is many times faster than 5G, it also saves a lot of time and improves efficiency. The simple reason for the choice is that 6G is more secure, reliable, and efficient than traditional networks.

3.4 Purpose of Sustainable Development

The cost should be affordable compared with that of 5G in the future. Sustainable development, green energy saving and sustainable development, as the characteristics of the 6G networks, reflect the importance of the 6G networks to energy consumption and human sustainable development. The 6G network will achieve cost reduction and lower energy consumption while improving network performance, promoting the development of energy-saving software and hardware, networking technology, improving energy efficiency, and promoting green development and sustainable future network development.

According to the above analysis of the ten major factors influencing human development, 6G network technology can be applied to many fields and contribute to the development and progress of each field. It can also reduce energy consumption and costs, as well as save a lot of time. It will have some effects on future urban planning. Because 6G network coverage is much higher than 5G, it will require a base station to cover a very large area. There are many applications for 6G that will be shown in the following paragraph in comparison with the application of 5G network technology.

4 Comparison with 5G Applications

4.1 The 5G and 6G Connection

The 6G network can be said to be an extension of the previous 5G network, which is an iterative relationship. The biggest difference between the 6G network and the 5G network is that the performance of the previous 5G infrastructure has been improved. Therefore, the analysis of the applications of 5G network technology can show the wide applications of 6G network technology in the future.

5G has three major network capabilities: 1. Enhanced mobile broadband (eMBB): This large broadband technology is intended to meet the demands of high data rates, ultra-HD video calls, and VR/AR industries in everyday life, such as video surveillance and environmental monitoring. 2. Mass machine communication (mMTC, short for “big connection”): this capability is widely used in the Internet of Things industry because the Internet of Things has low real-time performance requirements but high terminal density requirements. In daily applications, it is used in the transportation and power industries. 3. Low latency, high-reliability communication (uRLLC, short for low latency): This is the most obvious distinction between communication network generations. Low latency is applied in industries requiring high reliability, such as remote device control and security monitoring.

4.2 Service Direction

The integration of the above three capabilities will form the common services of 5G.

4.2.1 Intelligent Control

Remote device control: using 5G's high bandwidth and low latency, as well as a combination of artificial intelligence, edge computing, cloud computing, big data, and other technologies, an artificial or machine can operate and control the remote device after sensing and identifying the remote environment, improve efficiency and solve the problem of insufficient resources, such as through remote control in industry, agricultural machinery control in agriculture, remote diagnosis and remote surgery in medical treatment, unmanned driving in traffic, and so on.

4.2.2 Identify

Target and environment identification is the use of 5 G big bandwidth and low latency ability, the sensing device(fixed installation or installed on the unmanned aerial vehicle(uav), the robot's camera, AR glasses worn by the staff, and laser radar and other sensors) scans the environment or the target information, edge or transferred to the cloud computing platform, using artificial intelligence and large data capacity to identify the environment or the target. This kind of business can be used in public places and for intelligent security in vehicles, as well as for some cities in traffic equipment and road deformation, quality monitoring, environmental monitoring, quality inspection of industrial products, telemedicine, and so on.

4.2.3 Ultra hd Video and XR Technology

Uhd and XR playback: UHD videos and VR/AR content stored on cloud platforms and edge computing are presented to users through UHD display screens, VR headsets and AR glasses with the large bandwidth and low latency of 5G. This type of service can be widely used in the service industry.

4.2.4 Information Service

Using 5g connection, the environmental information and equipment status information of sensors, information collection, user behavior information and workflow in cloud computing platform are collected and shared through data processing to realize the environment, equipment, transaction, action and insight, decision-making and optimization process, and the results on terminal devices. This kind of service is widely used in the service industry for user service, business decisions, process optimization, and monitoring management. Then there is the application of these technologies in various industries: education, health care, electricity, and so on.

5 Discussion

Because 6G and 5G are derived, the relationship between more than 5G of all applications can be improved with 6G. It will also introduce technologies such as artificial intelligence and block chain, which have the advantages of high intelligence and reliability, and also in the next 6G, which consists of the 5G first application and some other areas (Fig. 2).

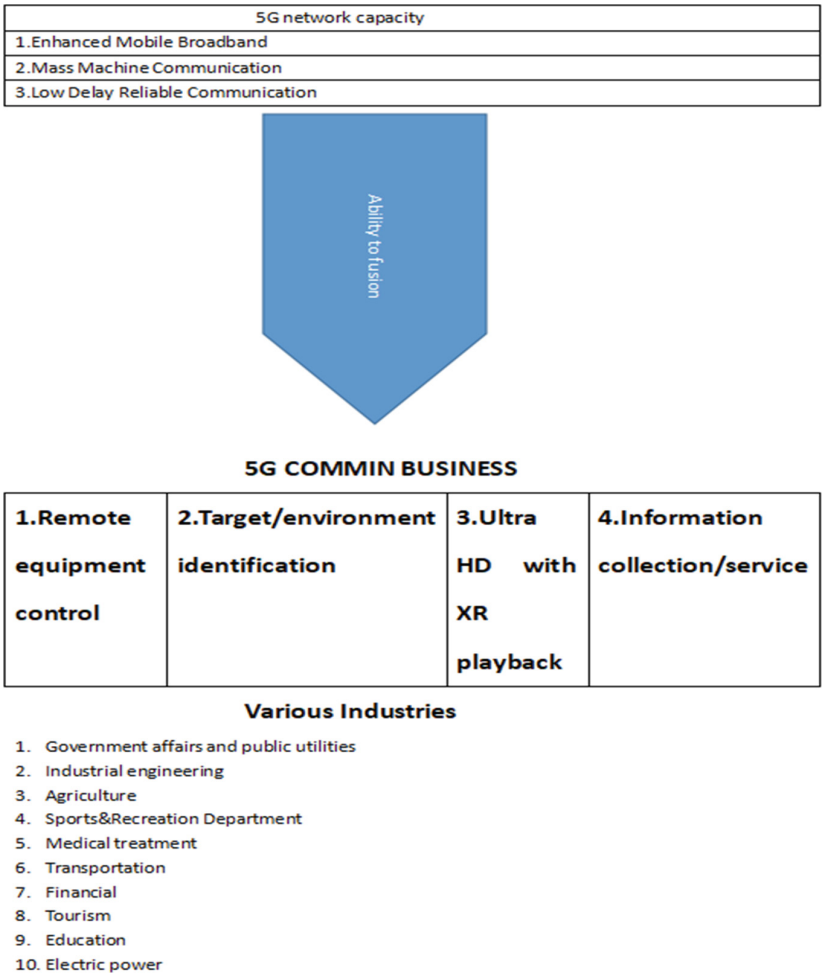

Fig. 2. 5G Application

6 Conclusion

Above, a brief introduction of 6G technology has been made, its key technologies have been briefly analyzed to find out its advantages, and the future market analysis of 6G technology has been analyzed based on the data about ten key factors for human beings. Finally, by comparing the three major capabilities and application markets of 5G network technology, the three unique advantages of 6G network technology can not only occupy the previous 5G market applications but also develop unique applications. Not only is it faster and faster than 5G technology, but 6G also has unique technical applications, such as XR technology and holographic communication.

Because 6G technology is not open to popularization and application now and we know little of the content, the paper is a comparison study of the SAN technology—5G

to come to the conclusion that there is no specific data which has a certain limitation on paper. The research direction in the future should be on the board and the disadvantages of 5G stretched out to achieve a 6G standard. For example, one of the key technologies is terahertz communications, which can meet the six gigabyte spectrum requirement.

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