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The Current situation and development trend of wireless communication technology

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Abstract

This paper will summarize the characteristics and classification of the cellular communication technology, and aiming at the development process of cellular communication technology and the future development trend of communication technology, and hope to provide ideas for the relevant researchers of communication technology.This paper probes into the present situation and countermeasures of labor education in higher vocational colleges under the background of the new era. Based on the problems of labor education in higher vocational colleges, this paper analyzes the causes of labor education problems.

Keywords

Cellular communication, development process, development trend, phase characteristics.

1. Introduction

Since the 21st century, mobile communication has become an indispensable key technology in people's life. At present, the development scale of wireless communication in China is also increasing year by year, as shown in Figure 1-1. With the rapid development of mobile communication, the overall measures are diversified, with higher and more open advantages, and to a large extent can meet the conditions of people's life and production in the Internet era. At present, the development of various industries in society is relatively rapid, and the demand for mobile communication is also developing and expanding, and its role is also increasing. However, the power of a single base station is very small. Seemingly complex giants can only cover a range of hundreds of meters. In dense urban areas, a 4G base station in the 1800MHz band has a coverage radius of about 300 meters. Therefore, it is impossible for isolated base stations to provide good services by themselves. It is necessary for many base stations to work together, abide by the same rules, and communicate with each other to meet the needs of mobile communication[1-6]. Together with other transmission and control nodes, a large number of base stations form a "network". The industry generally calls this network "wireless mobile communication network".

The history of mobile communication can be traced back to the 19th century. In 1864, Maxwell proved theoretically the existence of electromagnetic waves; In 1876, Hertz confirmed the existence of electromagnetic waves by experiments; In 1900, Marconi and others succeeded in using electromagnetic waves for long-distance radio communication, and the world entered a new era of radio communication. Mobile communication in the modern sense began in the early 1920s. In 1928, Purdue University students in the United States invented a superheterodyne radio receiver working at 2MHz, which was soon put into use in the police station in Detroit. This is the world's first mobile communication system that can work effectively; In the early 1930s, the first AM two-way mobile communication system was put into use in the police station in New Jersey, USA; At the end of the 1930s, the first FM mobile communication system

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was born. Experiments show that the FM mobile communication system is more effective than the AM mobile communication system[6-9].

In the 1940s, the FM mobile communication system gradually occupied the mainstream. During this period, the communication experiment and electromagnetic wave transmission experiment were mainly completed, and the small-capacity dedicated mobile communication system was realized in the short-wave band. This kind of mobile communication system has low working frequency, poor voice quality and low degree of automation, and is difficult to communicate with the public network. During the Second World War, the military demand promoted the rapid progress of technology and led to the huge development of mobile communications. After the war, the military mobile communication technology was gradually applied to the civilian field. By the 1950s, the United States and some European countries had successfully developed the public mobile phone system, which technically realized the intercommunication between the mobile phone system and the public telephone network, and was widely used. Unfortunately, this public mobile phone system still uses manual access, and the system capacity is small. From the mid-1960s to the mid-1970s, the United States launched an improved mobile phone system, which uses 150MHz and 450MHz frequency bands, adopts large area system and small and medium-sized capacity, and realizes automatic wireless channel selection and automatic access to the public telephone network. In the mid-1970s, with the increase of the number of civil mobile communication users and the expansion of business scope, the contradiction between the limited spectrum supply and the increasing demand for the number of available channels became increasingly acute. In order to make more effective use of the limited spectrum resources, Bell Labs of the United States has put forward the theory of cell system and wireless networking, which is a milestone in the history of mobile communication development. It has opened the way for the wide application of mobile communication systems in the world.

In short, with the changes of the times and the development of history, mobile communication was born after scientists discovered and proved the existence of electromagnetic waves at the beginning, and the development of mobile communication was also gradual, from AM to FM, and then in order to make more effective use of the spectrum and develop the wireless networking theory, which led to the current wireless mobile communication technology.

2. The Development of wireless communication

In the 1970s, Bell Labs of the United States took the lead in developing the successful AMPS system. People can finally use the wireless communication technology with large capacity and the ability to communicate at any time. It uses the frequency multiplexing technology. AMPS system not only solves the problem of small communication capacity, but also solves the problem of limited spectrum resources. This technology not only has the characteristics of large capacity and high call quality, but also ensures that the terminal can communicate freely in the area covered by the communication network. Since its promotion in the United States in the late 1970s, AMPS system has been widely praised for its excellent performance and service, and has made contributions to the development in the United States and the world, and has made positive contributions to the research of wireless communication in the world. Japan and Europe also established their own wireless communication networks in the mid-1980s. These countries have established the first generation of wireless communication system, which is called the mobile communication system analog suppression dual-frequency division system, or 1G system for short. Placing mobile users in channels with the same time interval but different frequencies is called FDMA, which is one of the main technologies in data communication. Using FDMA technology, the channel under centralized control in the frequency division multiplexing transmission system can be allocated to different

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communication users according to relevant requirements. Compared with fixed allocation, FDMA can exchange channel capacity according to corresponding requirements during operation. In the FDMA system, one spectrum is used as the forward channel, while the other spectrum is used as the reverse channel. It will allocate one channel to the communication user, that is, a pair of spectrum. The reverse channel refers to the channel from the mobile direction station to the base station. Compared with the forward channel, it refers to the channel from the base station to the mobile direction station. The base station of this communication system must transmit or receive signals of different frequencies at the same time in the process of user communication. Communication between users must reach the base station before it is possible to transfer. Therefore, in order to achieve communication between users, two channels must be occupied at the same time. The FDMA system uses FM multiple access technology, compared with the previous analog communication system using FDMA. FDMA essentially divides the entire communication system into countless channels with the same spacing distance, and assigns these channels to different communication users for communication. These channels are independent of each other and do not interfere with each other. The concept diagram of the first generation wireless communication technology is shown in Figure 1.

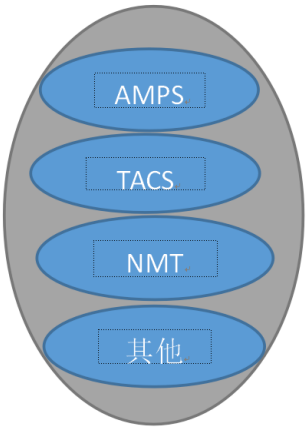

Figure 1 1G simulation technology

The technology that people call GSM mobile communication is actually the second generation of digital wireless mobile communication service. It means to provide users with relevant services, such as voice services, data services, etc., through the GSM mobile communication network operating in the 900/1800 MHz band. When researching and developing the GSM mobile communication system, the researchers chose TDMA technology at the wireless interface of the system, and took MAP protocol as the mobile management protocol of the core network of the system. At present, there are more than 200 countries and regions in the world that use GSM phones for communication and exchange. After the mobile operator signs the "mobile roaming" agreement, users can make free calls between them. The advantages of GSM mobile communication are reflected in the digital signaling and voice channel, which can be compared with previous standards, so GSM mobile communication is also known as the second generation mobile phone system, which also shows that digital communication has existed in the system for a long time. GSM is a wireless network. In simple terms, a mobile phone should be connected to the wireless unit area with the shortest distance it can search when it is in use. Different radio frequencies are the channels for GSM network operation. The concept diagram of the second generation wireless communication technology is shown in Figure 2.

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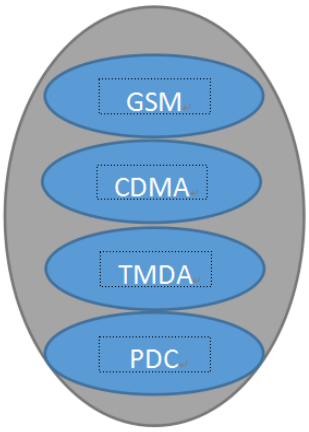

Figure 2 2G simulation technology

The wireless mobile technology that can support high-speed data transmission is also called the third generation mobile communication technology. 3G service can support the transmission of voice and data at the same time, which is about hundreds of kb, so its transmission speed is faster. The future mobile communication system is the third generation mobile communication system that uses broadband CDMA technology and provides voice and data services for mobile users at the same time. It is the most advanced mobile communication system at present and can solve some major problems and drawbacks left by the previous two generations of systems. Compared with 1G2G, 3G system has the advantage of enabling users to conduct high-quality data transmission and voice call services worldwide without being affected by time, place and mode. Therefore, the third generation mobile communication attaches importance to the user's autonomy factor, regards the user as God, and puts the user in the first place. Therefore, the third generation mobile communication is also known as the future personal communication system. The third generation mobile communication technology is the broadband CDMA system, that is, the division technology. Multi-access technology is actually a technology that allows mobile stations near the base station to seize and occupy the channel to enter the base station and receive mobile signals from the base station. The premise of mobile communication is that it occupies a certain channel. The multiple access technology used at this stage applies the narrowband code division multiple access (CDMA), time division multiple access (TDMA) and frequency division multiple access (FDMA) in the previous two generations of communication. The three technologies have their own advantages. FDMA means that different mobile stations occupy different frequencies; TDMA means that different mobile stations occupy the same frequency; But the time period occupied is slightly different; CDMA means that different mobile stations occupy the same frequency, but each mobile station has different random code order, so the number of mobile stations served by the same frequency is determined by the number of random codes. Wideband CDMA has better performance, which has the advantages of wider operation bandwidth, stronger resistance to signal interference, and improved signal transmission function. The concept diagram of the third generation wireless communication technology is shown in Figure 3.

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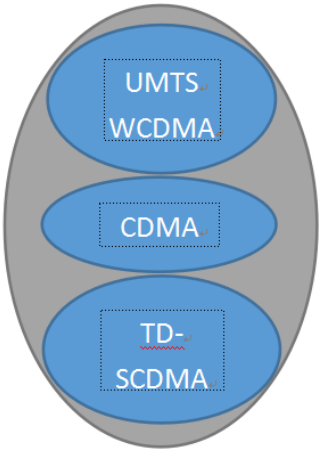

Figure 3 3G simulation technology

The communication technology that people are using in modern times is also called the fourth generation wireless mobile communication technology. 4G carries out innovation on the basis of 1G, 2G and 3G communication technology to enhance the business function and internet access rate of wireless communication. 4G technology can be divided into two categories: TD-LTE and FDD-LTE. TD-LTE refers to the 3G technology that improves and improves the air access technology, using the orthogonal frequency division multiplexing technology standard and the multiple-input multiple-output technology standard. Compared with 3G network, the advantage of 4G network is that the transmission speed is increased by about 50 times, and the transmission effect of video image is comparable to HD TV. Although 4G technology has been widely used in the world at present, there are still some problems, including the following two points: 1. Lack of unified international standards, and various mobile communication systems interfere with each other; 2. The signal is easily blocked by larger buildings, etc. Our great scientists are also constantly committed to developing more advanced communication technologies.

After years of construction, wireless network has become the basis of mobile communication, with a wide range of coverage and safe and reliable communication. According to Qualcomm's prediction, the global Internet of Things connectivity will exceed 5 billion by 2025. From smart wearable devices to smart water meters and electricity meters, from smart well covers to vehicle-mounted terminals, it will cover smart cities, smart transportation, environmental monitoring and health care. A large number of intelligent terminals will access the network, and wireless network will become the main carrier network of the Internet of Things. With the diversification of Internet of Things access modes and the development of fog computing, edge computing and cloud computing, the architecture of wireless Internet of Things for 5G networks is gradually clear, as shown in Figure 2-4 below. In the network architecture, the transport layer and edge resource layer are separated, and the application layer and service management layer are decoupled. The sensing layer is the entrance of information. Through various sensors and embedded controllers, the collected parameters are imported into the sensing layer through various communication methods, such as ZigBee, Bluetooth, WiFi, LoRa, etc. The awareness layer is the front end of the whole architecture. All data information is generated through this layer, which is the infrastructure of the architecture. The transmission layer is responsible for data transmission. 5G terminals, NB - IOT terminals and eMTC terminals are all divided in this layer. Another important part of the transport layer is the 5G Internet of Things gateway, which is responsible for protocol conversion and transmission, and converts various communication methods (ZigBee, Bluetooth, WiFi, LoRa, etc.) of the sensing layer into 5G communication compatible data format.

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The main functions of the edge computing layer are device access and data processing. Most edge computing terminals use embedded terminals. edge computing can effectively share and reduce the core network overhead. The core network only needs to process the data after edge computing, which greatly improves the network performance. This layer also involves functions such as security, authentication and identity recognition. Fog computing connects the cloud computing layer, providing seamless connection between the edge computing layer of the Internet of Things and public and private clouds, including interface definition, permission management, resource management and function definition. The cloud computing layer includes public cloud and private cloud. It is the entry point of all data. A large amount of data is stored and calculated in the cloud data center to provide services for the upper application. The highest layer of the architecture is the application layer, and the ultimate purpose of all layers in the architecture is to serve this layer.

3. The Phase characteristics of wireless communication system

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Phase characteristics of wireless communication system

The first stage, from the 1920s to the 1940s, is an early stage of development. During this period, some preliminary tests of transmission characteristics have been carried out, and a special mobile communication system has been developed on several short wave bands. Its representative is the vehicle radio system used by the Detroit police in the United States. The working frequency of the system is 2MHz, which was increased to 30-40MHz by the 1940s. It can be considered that this stage is the starting stage of modern mobile communication, characterized by the development of special systems, low working frequency and simplex or half-duplex working mode.

The second stage was from the mid-1940s to the early 1960s. During this period, public mobile communication services began to come out. In 1946, according to the plan of the Federal Communications Commission (FCC) of the United States, Bell System established the world's first public car telephone network in St. Louis, becoming the "urban system". At that time, three channels were used, with an interval of 120KHz, and the communication mode was simplex. Subsequently, the former Federal Republic of Germany (1950), France (1956), and the United Kingdom (1959) successively developed public mobile phone systems. Bell Labs of the United States has completed the connection of the manual exchange system. This stage is characterized by the transition from private mobile network to public network. The connection mode is manual and the network capacity is small.

The third stage is from the mid-1960s to the mid-1970s. During this period, the United States launched the improved mobile phone system (IMTS), which uses 150MHz and 450MHz frequency bands, adopts large area system and small and medium-sized capacity, and realizes automatic selection of wireless channels and automatic connection to the public telephone network. Germany also launched the B network with the same technical level. It can be said that this stage is the stage of improvement and perfection of the mobile communication system. It is characterized by the adoption of large area system, medium and small capacity, and the use of 450MHz frequency band to achieve automatic frequency selection and automatic connection.

The third generation digital mobile communication system IMT-2000 mainly uses broadband CDMA technology, which has been agreed by all countries, but the three major regional groups in North America, Europe and Japan have proposed their own standards to ITU. China has also actively participated in the research and standard formulation of the third generation mobile communication technology, and has set up the Wireless Communication Standards Research Group (CWTS) to be responsible for the research and formulation of the standard, and has submitted China's own standard TD-SCDMA to ITU. As of June 30, 1998, there were 10 types of wireless transmission technology (RTT) for terrestrial third generation mobile communication submitted to ITU,. Five of them only include FDD, two only include TDD, and three submit both FDD and TDD. Among these 10 technologies, W-CDMA proposed by Europe, cdma 2000 and

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UWC-136 proposed by North America will be the main technologies of the third generation mobile communication system, while broadband CDMA technology will be the mainstream.

The fourth stage is from the late 1970s to the present. During this period, due to the application of wireless theory, the concept of frequency reuse was put into practice. The wireless mobile communication system is based on bandwidth or interference limitation. It can effectively control interference by dividing cells, and reuse the same frequency at a certain distance between base stations, thus realizing frequency reuse, greatly improving the utilization of spectrum, and effectively improving the capacity of the system. At the same time, due to the development of microelectronics, computer technology, communication network technology and communication modulation and coding technology, mobile communication has made great progress in switching, signaling network constitution and wireless modulation and coding technology. This is a period of vigorous development of mobile communication, characterized by rapid increase of communication capacity, continuous emergence of new services, continuous improvement of communication performance, and accelerated development of technology

4. Conclusion

Fully understand the system classification, characteristics and development process of wireless mobile communication, introduce the origin, function and research background of wireless mobile communication, understand the evolution process of mobile communication, and learn that foreign scientific giants such as Max and Marconi have devoted their whole life to the research of communication technology, which lays the foundation for the research of modern mobile communication. Understand the meaning of wireless communication, that is, the network generated by connecting several base stations is called wireless communication, study the development process of mobile communication from 1G to 5G, learn its main service types, main services and the key role of mobile communication in various fields, and study the characteristics of mobile communication in the development process, as well as the technology developed in four stages from the 1920s to the mid-1970s. Understand that the disadvantage of China's domestic wireless technology lies in its reliance on foreign 1G and 2G technologies. In order not to be hindered by foreign countries in China's communication development, China has embarked on the road of independent research and development since 3G. It can be seen from the comparison between 4G and the previous three generations of communication technologies that 4G will have more advantages in network transmission and resource utilization, while 5G and 4G can enhance the efficiency of high-frequency resource utilization.

The logic of this paper is that the author first understood the development process of wireless communication, and analyzed its classification and characteristics. After fully understanding the relevant knowledge of wireless communication, he reviewed and discussed the current situation of wireless communication in China, briefly summarized the future development trend of wireless communication, and carried out a specific analysis of the possible innovation and progress of 5G.

At present, the emergence of wireless communication technology has strengthened the communication and communication between people. This technological revolution has gone through four generations at an alarming speed in decades. The emergence and disappearance of the first generation, the development and popularization of the second generation, the exploration of the third generation, the popularization of the fourth generation, and the rising fifth generation. Wireless mobile communication technology has not only created a new era, but also completely changed people's production and life style, and let people enter the high-tech era of information. I firmly believe that in the near future, through continuous innovation, exploration and research, people will let communication technology give people more novelty

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and surprise, and thus change people's lives, and make life more colorful while providing convenience. With the development of communication technology in the future, 6G and 7G will also be introduced in succession. Through learning and analysis at this stage, you can learn relevant concepts and knowledge in advance, laying a good foundation for future work or study in relevant fields.

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