Application direction of 5G technology in ship networking

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Abstract

Ship networking is the specific application of IoT in intelligent water transportation. It can achieve resource integration and information sharing in long-distance, multi-sectoral and inter-regional situations. The application of 5G technology in ship networking may bring ships to intelligent.

Keywords

5G technology; ship networking; intelligent ship.

1. Introduction

In the traditional shipping, the information resources related to the ship's licensed goods are inferior in information, and the information acquisition delay is large. However, in reality, with the deepening of global international trade, the amount of sea freight is also increasing, and the shape of the ship is also developing. Gradually tend to be large-scale, which has a huge contradiction with the backwardness of ship informationization [1]. The application of the Internet of Things in water transportation and the development of 5G technology have provided conditions for the mitigation of this contradiction.

2. 5G technology introduction and development status

2.1 Introduction to 5G Technology

5G is the fifth generation mobile communication technology. It is an extension of the fourth generation mobile communication technology. According to the data, the speed of 5G network theory reaches 10Gb / s, and 10Gb / s is equivalent to the download speed of 1.25Gb / s.The trend of 5G technology includes more connections, that is, the link between people has become saturated, 5G will make people and things and things connected with things; secondly, more traffic, 5G technology can support more devices to connect to the network, Support more users to use more traffic.

5G technology has three application directions, namely eMBB, mMTC and URLLC. eMBB means that the network will increase the baseband rate by increasing the bandwidth. eMBB can be used in scenarios requiring continuous wide-area coverage and hotspot high-capacity. Due to the greatly improved network speed, the minimum delay can reach 1 millisecond; mMTC can be applied to more. Terminal and low energy consumption scenarios of the Internet of Things;The URLLC has lower latency and higher reliability, and is mainly used in the industrial control industry, which is not used in traditional LTE.

2.2 Development Status of 5G Technology

According to the report, the third test of 5G technology has achieved the expected results. Various vendors have developed commercial 5G base stations for eMBB macro coverage scenarios. 5G technology has become closer to our lives [2]. Currently, global operators and related industries have launched research and incubation of 5G related applications, covering mobile surveillance, ultra high definition video, augmented reality (AR) / virtual reality technology (VR), games, drones, car networking and Smart cities, power grids, factories, education and medical care have further promoted the deep integration of 5G and vertical industry applications, helping the digital transformation of the entire society. In general, 5G new services will gradually mature in stages. The core applications of 5G are still for the transmission and processing of pan-video and images in various fields, such as AR/VR, ultra-high-definition video and image applications.

5G technology can meet the unified link requirements of the Internet of Things in land transportation. In the low-latency, high-bandwidth, high-mobility car networking scenario, the architecture will solve the differentiated performance indicators in the diversified application scenarios of the Internet of Things. The challenge.Compared with 4G technology, 5G technology not only improves the network speed, 5G technology can further utilize the spatial dimension, has more reliable, safe and flexible performance, and has a stronger spectrum management mechanism to improve spectrum efficiency. It also reduces costs. Therefore, 5G technology is the optimization of 4G technology, and the application of 5G technology and ship networking will also make ship network better development [3].

3. Introduction to ship networking technology

Ship networking is the specific application of the Internet of Things in intelligent water transport, which enables resource integration and information sharing in long-distance, multi-sectoral, and cross-regional situations [4]. In terms of the development of intelligent shipping systems in Europe, in 2006 the EU launched the Pan-European Inland Navigation Integrated Information Service (RIS) demonstration project, through the construction and improvement of ship tracking and tracking systems, electronic message systems, inland river electronic maps and display systems, etc. With the shipping infrastructure, European countries have established their own comprehensive information service systems, forming a pan-European inland navigation integrated information service system covering the Rhine and Danube rivers, providing traffic management, transportation information, logistics information, emergency rescue, etc. The eight information service functions have realized the high efficiency, safety and environmental protection of pan-European inland navigation transportation.

In terms of the intelligent development of China's transportation sector, the construction of China's Intelligent Transportation System (ITS) has achieved fruitful results. The intelligent transportation technology represented by non-stop charging has effectively promoted the improvement of transportation efficiency. At the same time, the construction of the Internet of Vehicles with the characteristics of the application of the distinctive Internet of Things technology is becoming a hot spot for the development of intelligent transportation. In terms of water transportation, after long-term informatization development, the domestic river shipping management technology and service level represented by the Yangtze River has made great progress. Various modern technical means such as Global Positioning System (GPS) and Automatic Ship Identification System (AIS) Radio frequency identification (RFID), video surveillance systems, etc. have been applied to different degrees, which has greatly promoted the development of the inland shipping industry. The application of IoT technology represented by intelligent shipborne terminals, RFID, and visual perception to inland navigation It is accelerating and deepening. However, at present, the biggest obstacles in the development of ship network demand analysis and overall architecture are mainly from the complexity of inland navigation information resources and the ambiguity of user needs, as well as the information interaction and information security design between multi-system platforms.At present, the ship network is the same as most of the application scenarios of the Internet of Things, mainly based on the diversified resources of the wireless channel provided by 4G mobile communication technology[5].

4. 5G technology possibilities for application on ships

To apply 5G technology to ships, the main consideration is the base station problem. Due to the significant increase in carrier frequency caused by 5G technology, traditional macro base stations are increasingly unable to cope, and small base stations and even micro base stations will appear on a large scale. The high-density networking technology in 5G technology can prepare for the large-scale deployment of small base stations, and the building sites such as wall-mounted bus stations can be used as small-base station deployment sites [6], so similar deployments can be deployed on ships. Small base stations to achieve the possibility of applying 5G technology on ships.

5. 5G'application in ship network

Due to the application of 5G technology in the Internet of Things, the ship network will continue to grow and develop. 5G technology will be applied in the following areas:

5.1 Information Service Scenario

Providing information services can effectively improve the crew driving experience. Typical application scenarios include high-precision chart download/update, inLine navigation services, traffic information acquisition, etc. In the future, 5G networks that meet high bandwidth and mobility requirements can provide real-time and accurate channel information and weather forecast services for ship-to-network users. The ship connects to the MEC cloud server through the network to request information service. The application server performs comprehensive analysis through the data collected by multiple channels, sends the optimal information to the ship, and provides services to users at any time in the place where the network covers.

5.2 Traffic Safety Scenes

When the ship is driving in an accident-prone area such as a narrow-water port near the shore port, improving traffic safety is of great significance for avoiding traffic accidents and reducing the loss of life and property caused by the accident. Although ship equipment has been greatly improved compared to the past, collision accidents are still the most common accidents.

In the future, the sensory capabilities of smart ships are based on the exchange sharing and data fusion of various information sources (such as radar, laser sensors, AIS, high-precision electronic charts, etc.), and 5G networks can meet their high close to 100%. Reliability, millisecond end-to-end latency, and hundreds of megabits per second transfer rate requirements. Through the onboard terminal, the local sensor and remote service information are intelligently integrated, and the cooperative sensing can effectively improve the safe and maneuverability of the ship, and provide reliable guarantee for the ship to chase, meet, and avoid obstacles.

5.3 Traffic efficiency scenarios

Optimizing traffic efficiency is of great significance for energy conservation and emission reduction of ships and the use of waterways in densely populated areas. In the future, the wireless communication technology can be used to ship ships in the area and ships in the port. At the edge of the 5G network MEC, the computing nodes meet the information of ships, port and weather. On the one hand, the 5G network is used to provide the ship with low delay and high reliability. Inbound and outbound information of each time period and real-time status of each port; on the other hand, the edge calculation node can optimize the ship's driving plan and coordinate the ship's operation strategy, so that the shipping company can maximize the utilization rate of the ship, thereby reducing operating costs. Accelerate traffic efficiency, improve traffic safety, and reduce emissions and fuel consumption to a certain extent.

5.4 highly collaborative scenes

V2X is a means of information interaction that is not susceptible to weather, obstacles, and distance. Typical application scenarios on land include vehicle formation driving, remote remote driving, and the like. Remote remote driving means that the driver drivesThe console operates the vehicle remotely. The camera, radar, etc. mounted on the vehicle use the large bandwidth capability of the 5G network to transmit multi-channel sensing information to the remote driving console in real time; the driver's control signals for the steering wheel, throttle and brake of the vehicle,Through the low-latency and high-reliability characteristics of the 5G network, it can be transmitted to the vehicle in real time, and it is easy and accurate to drive, accelerate, brake, turn, retreat and other driving operations [7]. By the same token, this technology can also be applied to ships, contributing to the development of intelligent ships and even unmanned ships. The long-distance driving of the ship can be operated by the land-based technicians through the ship driving system, combined with the camera on the ship, the automatic identification system of the ship, the electronic chart and the radar, and the transmitted

information is transmitted to the onshore ship driving system in real time. The technician's control of the ship's heading speed is transmitted to the ship in real time through the low delay and high reliability of the 5G network, and various driving operations are performed on the ship.

5. 5G technology security issues

Although 5G technology has improved performance in all aspects compared to 4G technology, its security flaws still need to be noted: ENISA said that existing mobile network security vulnerabilities may also be reflected in 5G networks. The upgrade work for 5G technology has "the risk of repeating the same mistakes". The 5G network supports more users and provides more bandwidth to further improve the risk level. Compared with physical communication means, it is more vulnerable to eavesdropping and attacks, and the terminal may even be destroyed. The malicious attack in the network becomes a legitimate user by masquerading, and after the trust of the network communication service is obtained, the attack starts, and the damage is hard to eradicate and promptly released. This kind of damage will lead to huge losses if you enter the ship network system through the network.In addition, 5G network technology puts new requirements on the management mechanism of the terminal. These factors make it difficult for 5G technology to establish an effective transmission management system, and information overload can easily lead to equipment failure[8].

6. Conclusion

At present, the biggest obstacles to the ship network are mainly from the complexity of the inland navigation information resources and the ambiguity of user needs, as well as the information interaction and information security design between multi-system platforms. In the 5G technology, eMBB can be used continuously. Domain coverage and hotspot high-capacity scenarios, with a very high network speed, the minimum delay can reach 1 millisecond; mMTC can be applied to more terminals and low power consumption; URLLC has lower latency and higher reliability. Therefore, the application of 5G technology in the ship network can greatly slow down the obstacles facing the development of the Internet of Things, so that shipping and shipping can be developed in an intelligent direction. However, before this, the security problem of 5G technology staying must be solved, so that the ship network can be better. Actively promote the global trade and resource circulation.

References

[1] R.Q. Zheng:*Research on Intelligent Navigation Collision Avoidance Algorithm Based on Internet of Things Architecture* (Ph.D., Tianjin University of Technology, China 2017), p54.
[2] X.L. Diao:Nokia Bell Chapter flag: 5G Phase III test results are in line with expectations, exclusive completion of 4.9GHz test,Communication world, 2018, No.777(19):44
[3] Y.M.Xiao,Y.L.Lv:A comparative analysis of 5G and 4G networks.China New Communication, 2017,19(11).
[4] X.F.Fan,Y.Guo,D.M.He:Research on Wireless Sensing RFID Application Technology System and Standard Based on Ship Networking.China Water Transport,Vol.18(2018) No.3, p.38-39.
[5] S.B.Wang:Analysis of Development Trend and Application Prospect of Vehicle Network Based on 5G Technology.Times car(2018) No.297(06), p.170-171.
[6] Y.X.Cong:*Intelligent monitoring data acquisition and transmission design of 5G small base station* (Ph.D.,Nanjing University of Posts and Telecommunications, China 2018), p79.
[7] P.Lu,J.H.Li,.W.D.Zhao:5G application in vertical industry.ZTE Technology Journal (2019) No.1,p.9.
[8] L.M.Yu:5G network security technology and development.Electronic Technology & Software Engineering(2019)No.2,p.185.