Adaptive networking control method and application of 5G vehicle networking node

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Abstract: at present, with the development of information technology, 5G network has been born, which also makes the Internet of things and the Internet based on the network develop rapidly. In this context, vehicular ad hoc network technology has attracted much attention. This technology has promoted the development of intelligent transportation from the research, birth and application in practice, so that intelligent transportation has been supported at the technical level, and its intelligent system has been optimized. In addition, vehicular ad hoc network technology plays a key role and value in road rescue, driverless and remote dispatching management. Therefore, this paper not only strengthens the greedy traffic aware routing, but also optimizes the problems existing in its operation, and puts forward improved methods for the reference of the industry.

Keywords: vehicular ad hoc network; Control method; Application strategy

1 Theoretical basis of 5G Internet of vehicles

The vehicular ad hoc network can also be called “Internet of vehicles”. Its main function is to communicate between the nodes of the vehicle and the vehicle to realize the interaction and transmission of data information. The Internet of vehicles belongs to the next subsystem of the self-organizing network. In the Internet of vehicles, vehicle nodes can communicate with each other in the environment without infrastructure, which has the characteristics of self-organization. At the same time, the Internet of vehicles can provide diversified services for on-board terminals, such as avoiding accidents, adjusting traffic flow efficiently, and obtaining information from corresponding places such as shopping malls, restaurants, and gas stations. Due to its important role in the intelligent transportation system, the Internet of vehicles has attracted the attention of many parties in the society. Therefore, the IEEE Committee has developed the IEEE 802.11p standard for vehicular ad hoc networks. At the same time, the FFC part of the United States also supports and promotes the application of DSRC technology based on improving the communication efficiency between vehicles and between vehicles and infrastructure.

1. The network architecture of the Internet of vehicles has evolved

In short, the Internet of vehicles is to connect each vehicle to a public network, and each on-board terminal can receive information about vehicle travel, such as road information, location information and the location of other vehicles. From the specific subject, the Internet of vehicles has four important parts: first, the vehicle terminal; Second, infrastructure; Third, public network; Fourth, pedestrians. These four parts constitute the overall Internet of vehicles. The operation of the Internet of vehicles also relies on specific communication protocols to realize the interaction and transmission of data and information, and ultimately serve the vehicle terminal. It is also an extension of the Internet of things technology, and it is also an all-round system of the integration of the Internet of vehicles and the vehicle mobile Internet.

To make the communication architecture of the Internet of vehicles three-dimensional, it is necessary to support business methods such as multi-mode access, high reliability and low delay. The structure integrates the latest communication technology, while retaining the previous technical support. Finally, according to the actual needs, the most appropriate technology is used to realize the interaction and transmission of information and data. Vehicle to vehicle communication can be completed through base stations, while outside base stations, it can only be completed by “direct communication” between vehicles. In the Internet of vehicles, the function of communication between vehicles and roadside facilities can be realized. Therefore, optical fiber technology can be used to improve the communication quality of the Internet of vehicles.

The development route of the Internet of vehicles business is: telematics intelligent networking intelligent transportation. The overall development trend is more and more diversified, intelligent and comprehensive, and the purpose is always to provide high-quality services for end users. At present, lte-v2x integrated with 4glte network is mainly used as the network of the Internet of vehicles. There are three types of application scenarios: first, traffic management; Second, driving safely; Third, entertainment applications. After continuous development, the Internet of vehicles is now facing a variety of business needs, and the technology affected is also constantly improving. With the upgrading of 5G communication technology, the Internet of vehicles in the future will have a variety of technologies, such as 5G-v2x and lte-v2x, and maintain the coexisting operation state to build a higher quality network.

2. Key technologies in Internet of vehicles

(1) wireless communication technology

The communication part of the Internet of vehicles belongs to the field of wireless communication, which contains two kinds of communication technologies, the first is long-distance mobile communication technology, and the second is short-distance video communication technology. Among the long-distance mobile communication technologies, technologies include 5G, 4G, GPRS and LTE, and the latter’s communication technologies include RFID, WiFi, etc. In the application of technology, it is mainly reflected in: etc automatic toll collection at toll stations, video monitoring, monitoring and dispatching data packet transmission, etc.

(2) cloud computing technology

The application of cloud computing technology in the Internet of vehicles has two advantages: first, it can improve the efficiency of

business and provide accurate services to users in time; Secondly, cloud computing can give the platform powerful computing power of information and data, display real-time data, provide diversified service support, and play a key auxiliary role. For example, in the traditional navigation technology, generally only static data is used, which cannot be updated in real time according to the road conditions, which has a certain impact on the user's driving. After adding cloud computing, the vehicle terminal can obtain the latest road condition information through navigation, adjust the driving status in real time, and make the service of the Internet of vehicles valuable.

(3) routing layer technology

The traffic scenarios under the Internet of vehicles are divided into urban, township and high-speed environments. The two environments are quite different. In the urban and rural environment, there are many intersections, intersections and a large number of roadside infrastructure, and the radio will receive certain interference, resulting in bad signals; In the high-speed environment, there is very little radio interference. As we all know, the high mobility and dynamic topology of the Internet of vehicles will have a certain impact on the network performance in terms of delay and packet transmission rate. However, for non location-based protocols, location-based routing protocols have strong network performance, and can reduce communication delay and reduce packet loss. This is because they use the vehicle's navigation system (GPS) receiver and digital map) and make more accurate route decisions by considering the geographical location of the vehicle.

2 Characteristics of 5G Internet of vehicles

5G Internet of vehicles combines a variety of technologies, such as full duplex communication, ultra dense networking and millimeter wave. It is a disruptive innovation to traditional communication in terms of performance, application and service. Similarly, in the technical field of Internet of vehicles, 5G Internet of vehicles is characterized by low delay and high reliability, efficient use of spectrum and energy, and superior communication quality. Low delay and high reliability refer to the use of ultra-high density networking, which can minimize energy consumption and greatly reduce the overhead of communication commands, and then optimize the delay and broadband problems; The efficient use of spectrum and energy is always a problem in the Internet of vehicles. However, through the integration with 5G network, and through the optimization of D2D communication, full duplex communication and cognitive radio, the problem of resource shortage in the Internet of vehicles can be greatly solved and the overall operation efficiency can be improved.

3 Road emergency rescue system based on 5G Internet of vehicles

The technology of Internet of vehicles plays an important role in the construction of urban intelligent transportation. While improving the efficiency of urban traffic management, it is also a top priority to provide efficient and safe road rescue by using the technology of Internet of vehicles and sensors. In the construction of intelligent transportation, traffic safety is the top priority. At present, there are deficiencies in the intelligent development of road emergency rescue system. Therefore, based on it, from the perspective of the Internet of vehicles, this paper optimizes the traditional emergency rescue system, improves the level of road emergency rescue, and reduces the losses caused by traffic accidents. The system is mainly based on the technology of Internet of vehicles, and the node adaptive network control method is the key to improve the efficiency of network data transmission and reception. The application in the rescue system is mainly reflected in the arrangement of rescue work and the transmission of rescue information, so as to improve the efficiency of the emergency rescue system as a whole.

1. Overview of emergency rescue system

With the rapid development of social economy, cars have become a necessary part of people's daily life. The automotive industry has also ushered in a golden period of development. The number of cars is increasing year by year. At the same time, traffic safety has also become the focus of the community. There are many reasons leading to traffic accidents, but the unscientific and unreasonable emergency rescue is one of the main reasons for the large loss of traffic accidents. Therefore, how to improve the quality of rescue work is an urgent problem to be solved. In the traditional road rescue, it mainly relies on the mode of manual alarm rescue to solve the accident, but there are two problems in this mode. On the one hand, there will be large errors in the confirmation of the position in the manual alarm, resulting in the inability of accurate rescue; On the other hand, if the accident vehicle is driving at night or in a remote area, it may not be able to give a timely manual alarm after a traffic accident, and it may not be able to quickly rescue and stop the loss in time. At present, in the continuous development, application and popularization of information and communication technology and the Internet of vehicles technology, the public enjoy a wide range of advanced road traffic services, especially the Internet of vehicles technology plays an important role in it, and the public service system of transportation has been upgraded from the technical level. The application of Internet of vehicles technology in emergency rescue can greatly shorten the rescue time, improve the rescue efficiency, reduce the losses caused by accidents, and protect the life and property safety of vehicle owners to the greatest extent. The efficiency and quality of the modern emergency rescue system combined with the Internet of vehicles have been greatly improved. It uses a variety of technologies, such as GPS positioning, mobile communication and sensors. These technologies can make the emergency rescue more accurate, comprehensive and diversified. For example, when the vehicle has an accident, it can contact the rescue center at the first time, At the same time, the current location and information of the vehicle will be sent to the rescue center, and the nearest rescue personnel will be arranged for rescue work.

2. Composition and function of emergency rescue system

From a macro perspective, the rescue system mainly includes the rescue center and the vehicle terminal, and there are many modules, technologies and platforms between them, including the operation platform (visual operation), data processing and analysis, communication module, data exchange interface (traffic early warning system, traffic management system, other systems), etc. The function of vehicle

terminal is mainly to collect and transmit information after the accident, such as location, time, accident overview, etc; The rescue center is responsible for processing the information transmitted from the vehicle terminal, transmitting the results through the platform, and finally notifying the relevant rescue personnel and vehicles in the shortest time to carry out the rescue work in time.

The emergency rescue system can be divided into acquisition layer, communication layer and business processing layer according to the function division. Among them, the main work of the acquisition layer is completed by the vehicle terminal. It can be said that the vehicle terminal provides technical and information support for the whole rescue system, and realizes data acquisition, communication and human-computer interaction. Data acquisition includes: GPS (positioning, speed, direction, time); Data processing includes: exception handling, coordinate transformation and position calibration; Data communication includes data transmission and ensuring connection quality; The human-computer interaction includes voice and buttons to realize the efficient human-computer interaction of the terminal.

3. Sensor technology

Vehicles, infrastructure and people constitute the Internet of vehicles, and the technology of the Internet of vehicles is mainly based on the automobile and road sensor networks. From the perspective of classification, automotive sensor networks can be divided into internal and external sensor networks. These two different sensor networks provide two kinds of information inside and outside the vehicle, such as the overall status of the vehicle and road information, road infrastructure information, road maintenance status, road congestion status, etc. At present, the vehicle will trigger the rescue system in the event of a traffic accident, such as the airbag, the automatic opening of the collision door lock, and the automatic lowering of the vehicle window. Through the sensors on these vehicles, the on-board terminal can directly transmit the vehicle information data to the rescue center after the accident, and build an intelligent rescue network. Sensor technology includes vehicle positioning technology and communication layer technology. Vehicle positioning can be connected to the public service network of the Internet of vehicles, and information can be transmitted immediately in the event of an accident. The rescue center wants to obtain vehicle information, which can also be obtained through signaling information. In the communication technology, the MAC layer protocol is improved, the improved routing protocol of e-gytar is proposed, and the QoS hybrid MAC protocol of the Internet of vehicles network is improved to improve the accuracy and overall efficiency of information transmission.

To sum up, in the context of 5G, the vehicle network has developed rapidly, and relevant technologies are also constantly promoting the intelligent development of the Internet of vehicles. Especially in the road rescue system, the application of 5G Internet of vehicles can strengthen the overall system operation efficiency and improve the work quality.

References:

[1] Yiwei Jia,Yong Qi,Lanfen Wu Research on the integration and evolution of artificial intelligence and Internet of vehicles technology from the perspective of patent [j]Scientific and technological progress and countermeasures, 2022,39 (22): 20-29

[2] Shanzhi Chen Thoughts and suggestions on the development of cellular Internet of vehicles (c-v2x) and its enabled intelligent connected vehicles [j] Telecommunications Science, 2022,38 (07): 1-17

[3] Xu Qiu,Haobu Bian,Mingxiao Wu,Xiaorong Zhu Research on task unloading algorithm of expressway vehicle networking based on 5G millimeter wave communication [j]Computer science, 2022,49 (06): 25-31

[4] Mengxiao Wang,Xuejun Liu,Yanwei Fang,Jiaohong Niu. Key technologies of 5G Internet of vehicles business development and security communication [j] ICT, 2022,16 (01): 19-27

[5] Xiaolong Xu,Zijie Fang,Lianyong Qi,Wanchun Dou,Qiang He,Yucong Duan Distributed service unloading method based on deep reinforcement learning in the edge computing environment of Internet of vehicles [j]Acta computer science, 2021,44 (12): 2382-2405

[6] Yun He Research on user communication security defense mechanism and location privacy protection method of Internet of vehicles [d]Beijing University of science and technology, 2022

[7] Wanyu Hou,Yu Sun,Dawei Li,Jian Cui,Zhenyu Guan,Jianwei Liu PUF based V2V anonymous authentication and key agreement protocol for 5G Internet of vehicles [j]Computer research and development, 2021,58 (10): 2265-2277

[8] Rongyue Yang,Pengzhou Zhang, Qing Song Research and Prospect of intelligent vehicle networking based on 5G technology [j]Telecommunications Science, 2020,36 (05): 106-114

[9] Xiaobo Ma,Jiahao Peng,Lei Xue,Xiaohong Guan. Research on comprehensive security of Internet of vehicles information physical fusion system in 5G era [j]Chinese Science: Information Science, 2019,49 (12): 1640-1658

[10] Fuwei Huang,Xinzhu Yang,Huan Wang,Xiaoyan Hu Opportunity interval model of vehicle networking communication based on taxi trajectory data [j] Journal of Beijing University of Posts and telecommunications, 2019,42 (03): 91-97

[11] Rui Wang Research on shared autonomous vehicle scheduling based on Internet of vehicles [d]Dalian University of technology, 2019

[12] Chuan Wu Research on big data platform and spatio-temporal distribution situation of taxi and car networking [d]Shandong University, 2017

[13] Shuang Zhu Research on the pricing mode and method of vehicle insurance based on UBI in the Internet of vehicles environment [d]Beijing Jiaotong University, 2015

[14] Hui Han Design and key technology research of taxi vehicle networking system [d]Shandong University, 2014

[15] juan Sun New urban taxi OTS model and information system based on Internet of vehicles collaboration [d]Shandong University, 2013

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