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Innovative Application and Development Trend of Smart Transportation in the Construction of Smart City

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Abstract. The rapid development of instant messaging, Internet of Things, big data, etc., provides technical support for the changes that urban transportation systems are facing. Complex transportation systems are gradually turning into measurable decomposable and controllable. The new intelligent transportation, through the complete data collection to support the road network traffic capacity, demand and state analysis, and then drive the new generation of intelligent transportation innovation business applications, bringing great convenience to people's life and social development.

1. Application Status and Characteristics of Smart Transportation in the Construction of Smart City

At present, the construction of smart cities has gradually entered the deep water period, and as the important content of smart city construction, smart transportation has highlighted the following characteristics:

1. Formed a deep application based on traffic big data technology.

The smart transportation under big data focuses on big data processing technology and intelligent analysis technology. Big data processing technology mainly solves the problem of data collection, storage and analysis. Intelligent analysis technology is about the analysis and understanding of video, solves the problem of video structuring, and promotes the transformation of video data to video information. Big data technology is essential for infrastructure security for big data applications.

2. Smart transportation gradually forms the centralization of smart city application and forms a new urban traffic brain.

Construction of intelligent traffic management system, full utilization of traffic information technology and achievements, and a more complete road traffic management system can effectively improve the overall management level, service level and operational efficiency of the road network to a certain extent, and improve the ability to respond to emergencies and deal with them quickly.

The development process of the intelligent traffic management system is mainly divided into three stages: the initial stage, the improvement of the construction of the outfield facilities and equipment, and the construction of various basic application systems; the intermediate stage, the construction of the integrated command platform and the big data analysis and judgment center to achieve the summary display of the data and the flat command and dispatch; in the advanced stage, the city will build a "traffic brain" and use cloud computing, big data, artificial intelligence and other technologies to realize the interconnection of system data. Let the data help the city to think and make decisions, and create a traffic environment that can self-regulate and interact with human beings. At present, large and medium-sized



cities in China have basically completed the construction of the intermediate stage, and built an integrated command platform and a big data analysis and judgment center, which has realized centralized control of all systems, centralized display of all data, and comprehensive statistical inquiry. Based on this, the flat command and dispatch based on GIS map is realized. Domestic small and medium-sized cities have basically completed the construction of the initial stage, and the outfield facilities and equipment and various basic application systems have been basically completed. However, whether it is a large city or a small or medium-sized city, the entire transportation system has a large body, but lacks a unified commanding brain, so that time-varying, non-linear, discontinuous, unmeasurable, and uncontrollable traffic systems are always in a flat, single and blind management mode.

2. Difficulties and bottlenecks in the application of smart transportation in the construction of smart cities

The road traffic system is a complex system that is interrelated and influential by the three elements of people, vehicles and roads involved in transportation. High efficiency, safety and comfort are the overall objectives of the system. According to their own subjective consciousness, the driver controls the vehicle in accordance with the predetermined target and in accordance with the traffic rules. The vehicle is also affected by the road and environmental conditions. The dynamic characteristics of the vehicle and the dynamic characteristics of the vehicle disturbance are also to some extent. Affects the final path of the vehicle. The transportation system is very similar but different from the telecommunication system. The switch is similar to the intersection, the light is similar to the road, the mobile phone number is similar to the license plate, and the calling behavior is similar to the travel behavior. The telecommunication system is easy to manage, but the transportation system is difficult to manage. The main reasons include:

1. The capacity of the transportation system is difficult to determine, mainly due to vehicle performance, driving behavior, climatic conditions, and management mode. The transmission channel capacity of the telecommunication system is fixed.

2. The dynamic changes in the travel demand of the transportation system, which are mainly due to the uncertainty of the source, the identity of the traveler and the purpose of travel. Since the telecommunication system is with settled IP (Internet Protocol), knowable OD (Origin, Destination) and the transmission dynamic demand.

3. The travel route and travel mode of the transportation system are difficult to control, mainly because the travel route and travel mode depend to a large extent on people's subjective consciousness and time and space sensitivity. The transmission of the telecommunication system is completely controllable.

In summary, the vast telecommunication system network can accurately and efficiently connect the communication between two IPs during idle or busy periods, which is completely in a measurable and controllable state. However, the traffic system is time-varying, non-linear, unmeasurable, and uncontrollable, so the transportation system is much more complicated than the telecommunication system.

3. the innovative application of new intelligent transportation in smart cities

The transformation of urban transportation system provides technical support for new intelligent transportation. Under the perfect infrastructure conditions, it supports the analysis of road network traffic capacity, demand and status through complete data collection, and then drives the smart transportation innovation business applications of new generation. Compared with the traditional "chimney" vertical construction management mode that is common in traditional intelligent transportation systems, the core features of the new generation of intelligent transportation systems are as follows:

1. In the acquisition layer, the state parameter detection turns to identity detection;
2. Single business supported type detection turns to deconstructed complete detection;

3. from the data analysis of the sub-business support type to the traffic model analysis based on the identity detection supported by the computable road network;

4. from a one-way vertical business system to a system-linked business system;

5. from the after-the-fact emergency response type to the pre-predictive prevention and control type.

The new intelligent transportation guides the construction and management of intelligent transportation systems, making the transportation system measurable and controllable. According to the IDPS system framework, the core of urban intelligent transportation system construction lies in various types of infrastructure (marking lines, bayonet, video surveillance, traffic signals, etc.), an urban traffic brain and multiple business application systems (organized according to business needs). The urban traffic brain is the center, and it mainly adopts two key technologies: the computable road traffic network model and the traffic system model based on intersection identity detection.

1. Computable road traffic network model

In the existing road network model, both the flat road network model and the non-planar road network model use one-dimensional line segments to represent the road. The attribute information of the lane is not accurately described, and object association and derivation cannot be performed. The application still has limitations. Based on this, the urban traffic brain constructs a computable road network model, based on the relationship between traffic semantics and computational technology, all traffic facilities, rules, and control strategies are digitized and informative, and can be calculated, consulted, and stored in a form that can be understood by the computer. The computable road traffic network model can meet the needs of the refined management of the traffic road network, which is embodied in:

(1) Accurately describe a complex road network, including various three-dimensional intersections;

(2) establish a topological connection between roads;

(3) Describe the topological connection between the attributes of the lane and the adjacent lanes in the same section, and establish the corresponding relationship between the lane and the road;

(4) Support the expression of the traffic organization that is refined into the lane at the intersection and the road, and describes the vehicle connection relationship between the entrance and exit of the intersection;

(5) Describe the time status of the elements in the road network to describe the dynamic events. By describing the above entities and their relationships, the traffic road network model can provide traffic operation management: the traffic road network model can provide traffic operation management: the basic road network data description of the management object, the traffic operation data organization and management in the management process, and the association presentation of the management result data and the specific evaluation object of the road network. Based on the model of the road traffic network, the data and services can be loaded to realize the full expression of the road network, the hierarchical linkage of data, and the full support of system integration.

2. Traffic system model based on identity detection

The traditional transportation system model is a four-stage method based on the assumption. It is assumed that the vehicle arrives evenly, the travel demand is known and the driving route is controllable. It is assumed that 3-5% of the residents travel surveys represent the entire public, etc. All of these ignores that the nature of the transportation system is time-varying, non-linear, discontinuous, unmeasurable, and uncontrollable. Under the premise of multiple hypotheses, the decomposition of the characteristics of the traffic system can only stay between the average parameter layers of the road network. It is impossible to deeply understand the characteristics of individual travel, the intersections, sections, vehicles and other traffic elements.

Based on this, the urban traffic brain built a traffic system model based on identity detection. Using the detection method of identity features such as bayonet, RFID(Radio Frequency Identification), GPS, etc., by accurately tracking the time and space characteristics of each vehicle's travel trajectory in the road network, we can accurately grasp the traffic capacity, demand, and status of road sections, intersections, road networks, parking lots, and police forces. From the micro, meso and macro levels, on the different time scales of the past, present and future, the traffic DNA is deconstructed

comprehensively, and the traffic genes are deciphered, making the traffic system visible, measurable and controllable.

The existing intelligent traffic management system mainly has the problems that the business systems are independent, the data standards are not uniform, and the data deep mining application tools are lacking. The new smart transportation design integrates existing resources and improves construction with the concept of urban traffic brain.

4. Application prospects and trends of smart transportation in the construction of smart cities

Despite the fact that companies engaged in intelligent transportation in China are “mixed”, some companies that focus on specific fields have achieved good results in related fields after years of development. Some leading enterprises occupy an important position in the field of highway electromechanical systems, highway smart cards, geographic information systems and rapid transit intelligent systems. The application prospects and development trends of smart transportation in the construction of smart cities will have the following characteristics:

1) Internet thinking deep penetration and integration

In the second session of the 12th National Committee of the Chinese People's Political Consultative Conference, it was proposed to formulate an "Internet +" action plan, which means that "Internet +" officially rose to the national strategy. During the "13th Five-Year Plan" period, the Internet will be deeply integrated with the transportation industry and make profound changes to related links. The internet will become an upgraded technology and important idea for building smart transportation.

2) Green transportation has become a new rule for traffic development

Accelerating the development of green recycling and low-carbon transportation is an arduous and urgent strategic task to accelerate the transformation of transportation development and modernization of transportation. In recent years, our country has actively promoted green transportation construction by introducing relevant policies and conducting urban pilot projects.

3) Emerging technology applications are more popular

During the “Thirteenth Five-Year Plan” period, with the development of emerging technologies such as cloud computing, big data, mobile internet, and social network media, its application in the smart transportation industry will become more popular.

4) Internet of Vehicles is experiencing explosive growth

With the fast expansion of domestic car ownership, China is stepping into the automobile society, and the social problems and contradictions related to automobiles have become increasingly salient. At the same time, this also indicates that China's car networking market contains huge space. Meanwhile, the national government has clearly defined relevant policies and strongly supported the development of vehicle networking. During the “Thirteenth Five-Year Plan” period, with the gradual release of the dividends in the car network policy at the national level, the continuous improvement of the technical level, and the gradual penetration of Internet thinking, the Internet of Vehicles will usher in an explosive growth period.

5) Participating entities tend to diversify

During the “Thirteenth Five-Year Plan” period, the attitude of the country to the participation of social capital in smart transportation became clearer. At the same time, with the rise of “Internet +” as a national strategy, the technology and thinking mode of the Internet will gradually penetrate into all major areas of the transportation industry. Internet companies will actively participate in the construction of smart transportation, and users will also become important participants in smart transportation. The main body of intelligent transportation construction will present diversified features.

5. Conclusion

At a time when people feel that artificial intelligence is rapidly emerging and entering all walks of life, it is unknown that the exploration and practical application of AI technology in the field of smart transportation has already begun. The traffic in the future is the coordinated traffic of vehicles and roads, which is composed of smart roads and smart cars. The future traffic signal system will become the brain-

like city traffic calculation center with signal as the core. All traffic participation units will have "Autonomous" thinking. The wisdom of smart transportation will surely become wider and wider with the construction of urban traffic brains and artificial intelligence. The smart transportation "black technology" in the construction of smart cities will also bring a full sense of happiness and happiness to the people.

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