Research on Intelligent Construction of Expressway Management

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Abstract: With the improvement of China's political status, economic level, and people's consumption level, in order to narrow the gap between urban and rural areas, the construction of highways has become more and more perfect. The development of information technology has made Internet technology widely used In all walks of life. The intelligent application of highways in engineering facilities can not only improve the safety factor of the facilities, but also improve the engineering efficiency, provide guarantee for the rapid development of China's transportation industry, and promote better and faster development of the country.

1. Introduction

The application of intelligent technology in the management of expressways is actually the effective use of technologies that combine information and communication technology, data integration analysis technology, electronic control technology, and the Internet of Things. The management of expressways is not limited to highway facilities. The management and control of the road is more important to effectively and reasonably deal with the triangle relationship between the road, the vehicle and the user. Only by finding a more reasonable way to get along with each other can the road management system be truly developed. Compared with the traditional highway management model, intelligent management reduces the level of staff participation and improves work efficiency. On the contrary, it allows more auto users to participate in the processing and collection of highway information. With a sense of personal participation, I felt that I was also making practical and meaningful things about the management and construction of highways[1]. So far, seven areas of highway intelligent service in China have been accepted by the public.

2. Seven Aspects of Functionalization of Highway Management

Advanced traffic information services: With the development of the Internet today, people can quickly find the location and the best route of the place they want to go through the network, as well as the driving situation on the highway in the highway will be in the form of pictures and fingerprints. The records bring convenience, save time, and protect the safety of travelers to a certain extent.

Advanced traffic management system: Through the application of the IoT technology combined between equipment and equipment, in the traffic management of highways, we can see electronic cameras, speed sensors, etc. everywhere, compared to traditional car users' conscious compliance or arrange a large number of workers on the road to ensure the safety of travellers and obtain traveler information. The development of information technology has saved the time of staff and travellers and saved a lot of manpower, alleviating the inconvenience of travel to the car. Distress.

Advanced public transportation system: With the improvement of the economic level, people's lives have become richer and they want to go anywhere at any time. Based on this, China's public transportation has developed rapidly. In addition to traditional buses and trains, subways, high-speed rail The emergence of airplanes has provided the most fundamental guarantee for enriching people's lives. [2] People don't need to go to the ticket office to queue for tickets first, and they can buy the tickets and tickets you need through the mobile app. In addition, when time is too late, you can directly enter the waiting room through your ID card. In addition, there are also bicycle sharing in the city for people to ride, which also brings a lot of convenience to people's

lives.

Advanced vehicle control system: While the appearance of the car brings convenience to people, there are also some hidden dangers, so the vehicle control system is largely to protect the safety of travelers and improve the vehicle itself to the surrounding environment Or car users bring harm. For example, the emission of automobile exhaust gas is largely the main reason for the decline in the quality of people's living environment. The invention and installation of exhaust gas purifiers in automobiles are to purify automobile exhaust gases. Then some of the exhaust gas is purified and recycled in the car.Because there are many equipments in the car, there will be a connection between the various equipment in addition to the impact. In order to prevent the air conditioning signal from affecting the normal use of the car engine, there is an idle speed Control. When the power is turned on and off, the engine's idle state will keep the car at its best, will not affect the normal use of the car by the user, and will also ensure the safety of the user.

Advanced freight management system: The rapid development of the Internet has flooded people's lives with the Internet. In today's era, more and more people choose to shop online, in order to enable users to view the security information of their purchases anytime, anywhere. And location information, so the cargo management system is also more perfect. The development and improvement of technologies such as positioning tracking and full-range monitoring are to ensure the safety of consumer goods, so that consumers and businesses can trust to achieve long-term effective cooperation. Promote the development of business chains.

Advanced electronic toll collection system: Let 's not say that traditional manual monitoring and charging may not have such accurate capabilities. In terms of manpower alone, it will also make the staff lack skills, waste too much human resources, and the blessing of information technology saves a lot of manpower. Resources, so that more people have the opportunity to engage in other industries and realize their personal value.

3. Intelligent Construction Measures for Highway Management

3.1 Improve the System to Ensure the Implementation of Intelligent

No matter what kind of industry you are in, there are certain rules and regulations in the development process that will not go astray or crooked. With the correct general direction, it is the most solid foundation in a project construction. [3] Therefore, in order to Improve the management system of the expressway to ensure the normal implementation of the management measures for the expressway. First, the leadership of the expressway construction department must make regulations to implement the intelligent construction of the expressway as an indispensable part of the management of the expressway. With job positioning, there must be a certain work cycle, and what results will be achieved in this cycle. These are the overall planning that needs to be made by the leadership part. Only in this way can intelligent management be involved at every step. In the process of highway management, only by ensuring that intelligent management is implemented, will there be opportunities to find problems in future applications to avoid risks; in addition, it is necessary to clarify the job tasks of each worker, and directly find the main responsible person if there are any problems. Encourage every staff member to participate in the intelligent management of kilometers, give play to their personal value, and maximize the efficiency of intelligent use; finally, there is an effective monitoring mechanism.In addition to monitoring the safety of the equipment, it is more important to monitor the safety factor of the equipment in addition to monitoring the staff's use of intelligent management. Develop intelligent road applications.

3.2 Attention to Basic Information Protection

More and more devices under the Internet of Things technology require user information input, to a certain extent, it is more likely to cause user information leakage. Therefore, in order to improve user trust, more attention should be paid to the use of traveler information in intelligent road applications. The degree of guarantee.Only by gradually avoiding all the problems that people worry about and gradually avoiding the risks that people worry about, can the intelligent

management of highways develop better and effectively.

3.3 Integrate Equipment and Build an Information System

The intelligence of expressways is not only the intelligence of expressways. In this era of Internet +, the development of information technology has brought a great degree of convenience, but at the same time it also brings the risk of information leakage. The information management is integrated to realize the information integration. No matter where the car users can quickly and accurately find and extract the information, accurate data presentation does not need to worry about some safety factors, which makes the high-speed management more complete, convenient, and trustworthy. And don't worry about the loss and destruction of metadata because the database system is different.

4. Highway Network Construction

4.1 Characteristics of the Highway Network

The expressway usually refers to a partition with a certain width in the center, with two or more lanes on each side, for a large number of up and down cars to run at high speed, continuously, safely and comfortably, and all three-dimensional intersections and controlled access Highway.

The highway network can be regarded as a complex transportation network composed of nodes and edges.

The expressway network nodes mainly refer to the interchange interchange nodes at the intersections of expressways and expressways. According to the design form of interchange interchange nodes, vehicles can make left turn, right turn, and go straight, and generally U-turns cannot be made. The side of the highway network refers to the section of the highway connecting the nodes. Vehicles driving on the side follow the rule of driving to the right. Due to the physical isolation of the central part of the highway, vehicles cannot turn around. This article does not study general social vehicles. The main research is It is a vehicle configured by highway management for daily highway operation management and traffic accident emergency rescue. Some characteristic parameters of the edge reflect the connection between nodes.

In order to ensure the safety and comfort of highway operations, service facilities are provided at appropriate intervals along the highway to provide personnel with rest and to provide vehicles with fuel, maintenance and repair, etc., which are collectively referred to as highway service areas in China. Considering human physiology Bearing capacity and average travel distance after a car failure. According to relevant national regulations, the distance between service areas along the expressway should be controlled at 50km, and the maximum should not be greater than 60km. Generally, an expressway service area will be set every 50km. In actual settings, the spacing of the service area is combined with the regional environment to consider the layout of the service area. Highway service areas, general social vehicles are not allowed to U-turn, but for special highway emergency vehicles, management patrol vehicles U-turns can be made through special channels.

4.2 Highway Network Construction

Considering that the highway network is a two-dimensional plan, the highway network is abstracted as a two-dimensional planar network composed of nodes and edges, and the highway network structure is established. Interchange nodes are used as nodes, and two adjacent interchange nodes are used as adjacent nodes. The actual traffic link between them is an edge connecting the interchange nodes, and a network of expressway interchange nodes is constructed. The mathematical model is: G1(N1, A1, F1), where , n 1 interworking interchange node set, a 1 is the arc segment set, and f 1 is the impedance set. The reachability between interconnecting interchange nodes is expressed by impedance, the greater the impedance, the lower the reachability.

4.3 Highway Network Area Division

The established highway network model G 1 (N 1, A 1, F 1) is a relatively complicated and huge transportation network with a large number of nodes and a very complex connection between nodes

In order to improve the efficiency of highway management, reduce costs, and facilitate the location analysis of management offices, the concept of minimum spanning tree in operations research and its method are introduced to integrate the complex and large highway network $G_1(N_1, A_1, F_1)$ are divided into n small transportation networks $G_1^i(N_1^i, A_1^i, F_1^i)$, $G_1^i(N_1^i, A_1^i, F_1^i) \subset G_1(N_1, A_1, F_1)$, among them, $N_1^i \subset N_1$, $A_1^i \subset A_1$, $F_1^i \subset F_1$, i = 1,2,3 ..., n, n is the number of area divisions. Area division is a process of continuous feedback and dynamic adjustment. If the results are not satisfactory or the results cannot meet the requirements in subsequent model optimization and calculations It is necessary to re-divide the area to determine the optimal area division and the number of area divisions, so that the model optimization solution results meet the requirements and reach the optimal.

The division of the highway network area is as follows:

In the traffic network $G_1(N_1, A_1, F_1)$ with the intersecting interchange node set n, take a closed loop for the node, and remove the edges connected by adjacent intersecting interchange nodes in the closed loop. The edge with the largest middle impedance. When there are more than two edges with the largest impedance on a closed loop at the same time, any one of them is removed to ensure the connectivity of the node set n=1.

5. Repeat Step 1 Until No Closed Loop Exists on $G_1(N_1, A_1, F_1)$, and the Spanning Tree Consisting of the Remaining Edges is the Minimum Spanning Tree.

Combining the actual situation of the highway network, the minimum spanning tree obtained in step 2 is divided into regions according to the following principles: one is to select the appropriate regional demarcation point from the set of interchange nodes Nt; the other is the road sections, nodes and The impedance must be uniform; the third is that the size of the partition must be moderate to meet the required service level and rescue timeliness; the fourth is to clarify the problem of zoning of the road section, and a road section must be fully divided into one zone; the fifth is that the nodes at the boundary must belong to Different zones ensure that there are at least two nodes on each road segment.

After the partitioning of the small traffic network $G_1^i(N_1^i, A_1^i, F_1^i)$, some of the interchange interchange nodes have a degree of 1 due to the division of the area. This article assumes that vehicles can be turned around here to ensure road connectivity and traffic flow.

5.1 Equivalent Deformation of Expressway Network

Since the highway is centrally separated and the vehicle is driving to the right, the vehicle is actually directional when driving between two nodes on the highway, so the highway transportation network $G_1^i(N_1^i, A_1^i, F_1^i)$ is equivalently deformed. The principle and method is to use the driving rules to drive to the right to equivalent each undirected edge connecting adjacent nodes into two directed edges with opposite directions and equal impedance. The traffic network $G_1^i(N_1^i, A_1^i, F_1^i)$ is equivalently transformed as $G_1^i(N_1^i, (A_{11}^i, A_{12}^i), F_1^i)$, among them A_{11}^i 和 A_{12}^i Undirected arc A_1^i The set of provinces deforms a set of directed arcs with opposite directions and equal impedance.

The equivalent deformation of the highway network model is closer to the actual highway, and it can better reflect the characteristics of two-way driving to the right under normal circumstances, physical isolation in the middle, and no crossing, which is more in line with the path selection and traversal of highway management.

6. Conclusion

Information technology has flooded all aspects of our lives. In today's information technology-led world, we need to be more cautious to maximize the advantages of information. The intelligentization of highway management systems, the improvement of highway service levels, and

the improvement of people The sense of travel safety promotes the effective development of highways.

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