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Research on Optimization of Traffic Conditions at Intersections based on Network Surveillance Shared Resources

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Abstract

At present, domestic traffic problems constrain China's social and economic development, urban traffic congestion has become the core of people's growing concern, and solving urban traffic congestion has become the responsibility of the whole society without delay. Especially at the intersections in big cities, the traffic jam phenomenon is particularly serious, and it seriously affects people's traveling plans during the peak period of commuting. The article will start from the perspective of information visualization, combined with the characteristics of smart city information technology, analyze the current problems of urban traffic intersections, and intend to monitor and divide the number of traffic intersections at different times of the traffic flow and the number of people to scale, according to the network to monitor the visual analysis of the data resources, to assist the traffic management system to optimize the control of the traffic signal length, to achieve the largest possible number of vehicles to let go! The traffic light is used to reduce traffic congestion and optimize the efficiency of people's travel.

Keywords

Network Monitoring; Shared Resources; Pedestrian and Vehicle Traffic; Visualization.

1. Introduction

In recent years, more and more private cars on urban roads, especially in big cities, basic manpower a become a standard for work.But in the convenience of life at the same time, the city's traffic problems are also getting worse.Every day in the morning and evening there are up to nearly two hours of rush hour, in some commercial gatherings of the intersection of the phenomenon of traffic jams is particularly serious, which greatly affects the work of the people going to school and other groups of people's original travel plans. People who are busy with their work and at the same time are also constantly concerned about the urban traffic problems, if not timely and effective solutions will be given to this will also constrain the steady development of China's economy [1].

Installed at each intersection above the traffic lights, has become the most common and most effective means of traffic diversion in major cities. For the safety of normal road conditions, people and vehicles can play a certain role in easing the traffic flow, but according to the actual intersection of traffic in the situation.There are still some problems: the two directions of people and vehicles in order to walk at the same time, but in the intersection of the road, often a lane for the main road, more vehicles, release time longer; the other lane for the secondary road, fewer vehicles, release time should be a little shorter. Two lanes of the traffic light interval cannot be changed according to the change of the flow of people and vehicles.

In the background of the urbanization process is advancing, people's demand for traffic is getting bigger and bigger. Reasonable planning of inter-city traffic structure and promoting the construction of a comprehensive three-dimensional traffic network are very important for

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improving the happiness of life and the economic development of the region. After years of rapid development, domestic data visualization technology has become one of the representatives of advanced technology, and has become an important technology for in-depth 3D visualization and cloud computing data analysis. Especially in recent years, the popularity of the comprehensive three-dimensional transport network construction project, the progress of data visualization technology and the integration of comprehensive three-dimensional transport network construction, data visualization technology to the life of the deep penetration of transport construction, play an increasingly important role [5]. Based on this, this paper will start with the intelligent regulation of traffic signal length problems, the use of data analysis, data sharing visualization ,and intelligent regulation methods, to achieve the purpose of smooth and safe passage of people and vehicles.

2. Optimization Principle

2.1. Optimization Idea

Peak intersections often appear as lane congestion and another lane less vehicles, or an intersection as the center of the surrounding adjacent intersections have large and small congestion. Based on this we will intelligently monitor the intersection of the two lanes of traffic and the traffic flow relationship, according to the traffic and pedestrian flow of the intensive degree of optimization and control of traffic lights, thus reducing the time to wait for the traffic lights, improve the efficiency of travel. Traveling efficiency. While adjusting the length of the signal countdown, the traveling direction of the lanes will also be changed. When the straight traffic flow is large, the left and right turning lanes can be converted into straight-turning bidirectional lanes within the available straight time. At the same time, the real-time road conditions at road intersections will be reacted to the cloud, and the navigation system on the mobile device side will be cooperated and linked to achieve maximum release. Reduce the vehicle detention at road intersections, alleviate the impact of congested intersections radiating outwards, and optimize the control of driving time. According to the actual situation in the driving process, the use of a network monitoring system to make traffic light control flexible and efficient [2]. However, the countdown time of the current traffic signals are determined and cannot be flexibly adapted to the time control in the case of extremely high pedestrian and vehicular traffic like the peak hours. So it can be designed to make use of the network to monitor the shared resources at any time to optimize the control of the time of the device is more in line with the needs of the development of society.

2.2. Optimization Method

Using the network monitoring system to check the scale of traffic flow and pedestrian flow of the two lanes of the intersection in each period time, to carry out data visualization and analysis based on the database. Using computer modeling and simulation technology, all the data related to the operation of the traffic system to carry out big data analysis and modeling calculations, to objectively and accurately describe the traffic operation situation of the urban road network, to summarize and analyze the traffic operation law of the network and to predict the development and change trend of the traffic operation situation. Predict the development trend of traffic operation. Reasonable Optimization and regulation of traffic signal timing [3].

First of all, the traffic monitor is mapped to the urban road network to build the urban road network map [3]; when the system monitors the traffic flow of a certain lane is dense, the data will be sent to the cloud information base and make a reasonable analysis of the configuration, to give the appropriate length of traffic light intervals; finally, the instructions will be sent to the intelligent equipment in the traffic light to regulate the time of the light. The length of traffic light interval is generally 30s-60s, when the monitoring of the north and south lanes traffic is

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dense, the system automatically extends the length of the north and south lanes traffic light countdown, and appropriately shortens the length of the east and west lanes traffic light countdown; on the contrary, when the detection of the east and west lanes traffic is dense, the system automatically lengthens the length of the east and west lanes traffic light. If the traffic density of the two lanes is similar, the traffic lights of the adjacent road sections are regulated at that time to ensure the coordinated passage of multiple parties. At the same time, the cloud information is shared with the driver's intelligent mobile device in real-time, informing the driver in advance of the road ahead of the intersection of the human and vehicular traffic density and traffic light duration information to reduce the peak period of the intersection of the vehicle stagnation, to achieve the maximum number of human and vehicular traffic diversion to alleviate the problem of traffic congestion, and to improve the efficiency of the traffic system control.

Intelligent network traffic is the current direction of development of urban transport, joining the advanced information networking technology for intelligent network traffic to provide adequate technical support for real-time accurate and efficient integrated traffic network management and transport platform to provide the possibility of establishing. Effective use of data visualization technology can realize the problems such as a difficult collection of road information and collection of residents' opinions during the construction of a comprehensive three-dimensional traffic network, realize the comprehensive coverage of the road information collection process, and effectively make up for the problems such as information collection errors and low collection efficiency brought about by the manual collection of road information under the traditional mode. To study the scale of traffic flow and pedestrian flow of the two lanes of the intersection in each period time, the traffic signal system is optimized and regulated reasonably.

2.3. Optimization Steps

2.3.1. Data Analysis

First of all, we will be the city's vehicle information for the cloud network processing, so that the vehicle is transformed into an intelligent mobile device, to enable the vehicle and the Internet to connect. So that the vehicle current affairs traffic information can be shared and analyzed, and from the background of the network segment to obtain information, real-time network monitoring of the vehicle’s, and then combined with several videos of the vehicle data, many joints. You can make the data get the maximum use of data, and finally realize the visualization of network monitoring data.

2.3.2. Data Sharing Visualization

When real-time vehicle and road data collection and uploaded to the cloud system, the background to establish the relevant data analysis library. Through network monitoring and analysis, visual data analysis cloud computing, and other technologies of the integrated analysis of the results of the timely response to the traffic monitoring system and the vehicle, so that the vehicle can be informed in advance of the real-time dynamic information about the upcoming traffic road. According to the actual situation promptly on time to make the appropriate driving strategy, the network monitoring system using the response back to the message can be intelligent, and the network monitoring system can use the response back to the message, and then the data sharing and visualization. The system can intelligently arrange the time of traffic signals by using the message back, and better solve the problem of traffic congestion.

2.3.3. Intelligent Control

According to the real-time traffic condition information in the cloud, a traffic signal effective adaptive regulation algorithm is proposed based on the current traffic flow [4]. According to the historical cloud traffic data, predict the current intersection of people and vehicle flow

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information. If a single intersection traffic lights, should be done to achieve a large amount of vehicle retention of the principle of the longer the corresponding opening time; if the main road traffic lights, should be based on the cloud data on the intersection of traffic flow prediction and analysis, change the length of the current intersection traffic lights and cycle, while the adjacent road traffic light regulation, to achieve coordinated control of the trunk road and adjacent intersections. Coordinated control with adjacent intersections. To achieve the maximum degree of vehicle diversion, reduce the number of vehicles stalled at the intersection, ease traffic congestion, and improve the efficiency of the network traffic monitoring system.

Table 1. Intersection traffic flow data table East West South North

Intersection/direction	East	West	North	Sourth
a	127/h	148/h	57/h	44/h
b	78/h	86/h	157/h	188/h
c	45/h	35/h	134/h	154/h
d	19/h	35/h	23/h	16/h
e	189/h	57/h	35/h	153/h
f	80/h	65/h	142/h	231/h
g	67/h	149/h	155/h	87/h
h	114/h	157/h	253/h	228/h
i	126/h	148/h	274/h	97/h

Table 1 indicates that the number of vehicles traveling in one hour in all four directions at each intersection. From the table, it can be seen that some intersections have high north-south traffic and low east-west traffic, which indicates that the north-south direction is the main road in the city. And more consideration should be given to the traffic condition of the intersection. After data analysis to regulate the countdown length. And some intersections, in the east-west or north-south direction only one direction of the flow is larger, which indicates that most of the vehicles at this intersection a turning cars, the significance of this phenomenon is that this intersection and the next intersection with the next intersection, to be integrated into the next intersection of the signal length of the joint decision!

3. Optimization Strategy

3.1. Use of Existing Big Data for Traffic Visualization

The signal light intelligent regulation system is based on the operation of a large database. With the rapid development of the economy and society, the urbanization process is also getting faster and faster, data visualization technology is also widely used, due to the construction of a comprehensive three-dimensional traffic network in the process of the emergence of more problems, the traditional method is not easy to deal with. Based on the data visualization of the road traffic operation situation monitoring system can be following the interactive operation of the operation mode, through the data visualization accurately describes traffic operation situation and the law of change. For the traffic congestion, key vehicle monitoring, parking management, and other structured problems encountered in the operation of the traffic system relying on the professional data resource base and standardized operation process, the human-computer interaction operation mode is used to solve the structured problems [5]. And extract effective information from it. Applying data visualization technology in the construction of comprehensive three-dimensional traffic networks can effectively solve the problems of traffic operation efficiency road planning and construction, and unbalanced development of construction in various regions. Worldwide, it is becoming a trend to research and develop big

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data technology, use big data to promote social development, optimize urban governance, and improve government services and regulatory capabilities. The data scale is growing at a high speed, and in recent years, the data scale has been growing at a high speed in geometric progression. Big data acquisition, storage, management, processing, analysis and other related technologies have made significant progress. Now the development of big data is stable as well as the future is also a very good development trend. Therefore, this has laid a solid foundation for the intelligent control of traffic lights, which also makes the intelligent control of traffic lights in the technology reliable support, which also makes the traffic lights intelligent control system used in the market feasibility becomes higher.

3.2. Rationalization of the Use of Signal Lights to Improve Travel Efficiency

Rapid urban development in recent years, the people and cars on urban roads are accelerating growth, but the city's traffic facilities have not changed accordingly, although the establishment of a large number of traffic light intersections to evacuate the traffic, due to the red and green traffic light time is not able to intelligently adjust the traffic light interval according to real-time conditions, the city's traffic problem still exists. Especially in the morning and evening traffic flow to reach its maximum value! Road traffic, traffic flow is basically in a saturated or supersaturated state, slow vehicles, coupled with hawkers occupying the road to set up stalls, and vehicles parked indiscriminately, is the focus of urban traffic management and difficult. So now the emergence of traffic signals does not completely solve the problem of urban traffic congestion, and if the existing traffic signals are based on some intelligent analysis and regulation, the traffic problem can be mitigated to a certain extent. So that it can also be a more reasonable use of existing resources to improve the efficiency of people's travel [4].

3.3. Reasonable Optimization, Reduce the Incidence of Traffic Accidents

In this fast-paced era, both to cross the zebra crossing pedestrians or driveway to drive drivers do not want to wait too long at the intersection, once waiting too long, people's emotions will become impatient. Gradually people break the red light, the car breaks the lanes, which greatly increases the incidence of traffic accidents, which is a very serious problem, so we must try to avoid the occurrence of such problems. The intelligent time allocation of traffic signals can reasonably allocate the waiting time of people and vehicles, reasonable control of pedestrians and vehicles waiting time. This greatly reduces the probability of people due to emotional deterioration and thus making the violating of traffic rules, thus greatly reducing the probability of traffic accidents.

3.4. Efficient Linkage of Urban Intelligent Traffic System

The urban intelligent network traffic management common information platform has the role of information hub in the urban intelligent traffic management system, and the construction of the common information platform will provide the basis and possibility for the effective integration of other sub-systems of the intelligent network traffic management system. At the same time, it will provide a method and technical means for the sharing of information among the relevant departments of the city. Based on the traffic common network information platform, the construction of the traffic information service system will provide real-time and efficient traffic comprehensive information service for the public, and effectively improve the traffic information service level of the city and the operation efficiency of the traffic system, as well as improve the traveling quality of the public [6].

4. Conclusion and Prospect

The 21st century is an important period for China's economic development, and it is expected that by the end of 2035, the country will step into urbanization. Many families can afford a

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private car, which has become a necessity in almost every home for the convenience of traveling. This will be a huge strain on transport. Nowadays, the only thing that maintains the effective operation of road traffic is the traffic signals everywhere and the direction of the traffic police. The general traffic lights, due to the pre-set countdown timer, often lead to the period of work and the time when there are more vehicles, which does not allow all vehicles to pass through the intersection within a short period time. Thus forming the "rush hour". This has given rise to the expression "rush hour". Some office workers who will be late for work, in order not to be late, will choose to race against time, not to miss a minute. This leads to the widespread phenomenon of "red light jumping", which is prone to cause physical injuries. Improving the signals with a surveillance system will not only keep the roads running properly but also maintain the physical and mental health of the citizens of the city.

As we all know, traffic operation is indispensable to human beings, and there is no substitute for traffic signals to maintain their effective operation. The use of monitoring systems in the signal lights involved in the field of traffic has a very large development potential, as the use of network monitoring and sharing of resources to optimize the traffic situation at intersections. So that the signal lights humanely according to the road conditions at any time to adjust the countdown long, can effectively improve the phenomenon of "rush hour", but also allow the highway to get a greater rate of utilization. The use of monitoring systems to improve traffic signals to guide the construction and management of intelligent traffic systems, so that the traffic system becomes measurable, solvable and controllable, to achieve the traffic infrastructure according to the needs of the building, data requirements standard planning, intelligent platforms and business systems to meet the business for the city of road traffic management to lay the most solid foundation for the flexibility of the business application system to provide the most effective support. The use of data visualization technology to practically solve the problems arising during the construction of the comprehensive three-dimensional traffic network not only caters to the development policy requirements of the country but also meets the people's needs for a better life.

In the future, intelligent roads, intelligent vehicles, intelligent railways, intelligent civil aviation, intelligent waterways, etc. will develop rapidly, and managers will be able to have a more comprehensive, timely and accurate grasp of the technical operation quotations and external environment of transport infrastructure, transport equipment, etc. Convenient transport is the driving force of urban innovation development and the main driving force of urban innovation diffusion, which is of great strategic significance to urban development and transport construction.

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References

[1] Lin W. Introduction to the role and application of intelligent transport in the construction of China's smart city [N] Town Construction 2020.1.

[2] Chen K. Important position inference method based on urban traffic monitoring big data [D] Shandong, Yantai University, 2021.

[3] Li Wenming. Route Recommendation and Journey Time Evaluation Based on Traffic Monitoring Big Data [D] Shandong, Yantai University, 2021.

ISSN: 2692-7608 DOI: 10.6981/FEM.202402_5(2).0019

[4] Jiang Han, He Qi. Intelligent traffic light system based on big data analysis [J]. Information and Computer, 2019(07).

[5] Qian Rui. Research on Intelligent Regulation of Traffic Lights Based on Width Priority Search Algorithm [D] Zhejiang, Hangzhou University of Electronic Science and Technology, 2021.

[6] Liang Rongrong, Ma Anjia. Research on integrated three-dimensional traffic management construction based on data visualisation [J]. Office Automation, 2023, 28 (16).