Research on Traffic Control and Induction Collaborative Framework of Smart City in the Environment of Vehicle Network

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Abstract. At present, how to use the advanced technologies such as Internet of Things and Internet of Vehicles technology, high-precision Beidou positioning technology, big data technology and artificial intelligence technology to integrate and develop the road network resources of existing large and medium-sized cities is domestic. Research hotspots in the academic and engineering fields. This paper deeply analyzes the operation mechanism of traffic control and traffic flow guidance system, and focuses on the application of traffic control and induced coordination. It is proposed to combine multi-agent theory and intelligent decision theory in traffic coordination control to better realize traffic control and induction, provide real-time road network information to better solve existing traffic congestion problems, and seek regional traffic. Optimized control provides a theoretical basis.

1. Introduction
The concept of intelligent transportation system is in the middle of the century. Developed countries have summarized the development and application experience of electronic information technology and communication technology in the field of transportation. It is the preferred strategy for solving traffic problems in the world. With the improvement of public technology facilities and equipment, it provides a technical environment for the development of vehicle networking, enabling vehicles to receive road network information and partially realizing the real-time information exchange function under the vehicle network. Traffic control and traffic guidance play the role of order parameters in the traffic system. It is essential to achieve intelligent collaboration between the two, which governs the operational status of the traffic flow.

In order to effectively alleviate traffic congestion, UTCS (Urban Traffic Control System) and UTFGS (Urban Traffic Flow Guidance System) must be coordinated to rationally distribute road network traffic flow in space and time, so that road network traffic flow can be properly allocated. And optimize to achieve good traffic management results. Therefore, studying the synergy between UTCS and UTFGS has important practical significance for effectively alleviating urban traffic congestion in China.

2. Research purposes and significance
Urban traffic problems, represented by traffic congestion and other problems brought about by them,
have become a serious problem facing the world. The solution to the traffic problem must adopt the ideas and methods of system engineering, through scientific and systematic comprehensive management. Traffic control and traffic guidance must work together to ensure the realization of their respective functions. The significance of the synergy between the urban traffic control system and the traffic flow guidance system is reflected in:

(1) **Achieve common traffic management goals**

The cooperation between UTCS and UTFGS can optimize the traffic management objectives, make the induction information more accurate, and thus greatly improve the efficiency of road transportation, and truly achieve the smooth and effective operation target of the road network.

(2) **Realizing resource integration of traffic management system**

The control system and the inductive system can be built on a common subsystem. Traffic flow detection system, road information collection system, traffic information release system, data communication system traffic flow real-time information processing system, controlled network geographic information system and all other data and information about the network environment can be controlled and induced The system is jointly owned and utilized.

(3) **Realizing the time and space complementarity of traffic management means**

Traffic control is mandatory passive management. Vehicles on the road network must be observed. Induction is the active management of flexibility. Travelers can choose to obey or choose to disobey.

In short, in the urban traffic management, the control system and the inductive system are interconnected, independent, complementary, and each have their own characteristics. Control-induced synergy can achieve synergy between overall and local management, dynamics, and stability. Coexistence of coercion and flexibility is a necessary means to achieve safe, efficient and smooth operation of traffic.

3. Research content

Aiming at the problem of the combination of the existing traffic control system and the traffic guidance system, this paper uses the inductive information as one of the means of traffic management, combined with the distributed characteristics of traffic control, and adopts multi-agent technology in traffic control and induction. Hierarchical hierarchy theory and intelligent decision-making technology, which influences the path selection of travellers, establishes a user-optimized and system-optimized traffic control system and traffic guidance system integration model to solve the formulation of traffic control and induction synergy strategy. Achieve system optimization in an achievable sense.

(1) **Construction of intelligent transportation service system in the environment of car networking**

The intelligent traffic guidance service system is proposed to adopt five functional modules: traffic information module, traffic flow prediction module, path guidance module, information communication module, information service module and a data platform.
(2) Research on collaborative framework based on traffic control and induction

Traffic control and traffic guidance are two important components of traffic management. Therefore, in the process of establishing the intelligent decision support system in traffic management, it is necessary to fully consider the realization of traffic control and induction and the joint work of the two. Based on the transportation system is a complex large system, the hierarchical intelligent control mode is considered when constructing the model. The hierarchical intelligent traffic control system proposed by Sardis consists of three levels: organization level, coordination level and control level. It can reduce the dimension of the problem, obtain real-time control scheme with less computing resources, and can make rapid traffic events. reaction. The traffic control and induced collaborative system model constructed by combining multi-agent technology and hierarchical structure, the road segment agent, intersection agent, regional agent and central agent are set up in the system. The structure is shown in the figure 2:
(3) Information processing of traffic control and traffic guidance synergy

In traffic management, timely and accurate traffic information is directly related to the correct and reasonable formulation of traffic management strategies. Traffic information can characterize the parameters of traffic flow characteristics and reflect traffic conditions. It is the basis for the development of coordinated strategies for traffic control and traffic management. Only based on real-time, high-precision basic traffic parameter information and road network traffic flow state information can the corresponding traffic control and induction strategies be developed. Only the corresponding control strategy, induction strategy and coordination strategy can be developed to manage the traffic flow to the optimal operation state reasonably and effectively. The collection and processing of traffic basic information is the guarantee for the realization of traffic control and traffic induced coordination.

After the traffic information is collected and processed, it is provided to the traffic control and traffic guidance collaborative application. The formulation of the traffic coordination strategy requires not only the current data, but also historical data to predict the future state. Therefore, the traffic information must be accurate and reliable.
(4) Research on traffic control and induced collaborative optimization based on

Traffic control and traffic induced collaborative information fusion technology. Data fusion, also known as information fusion, refers to the information processing process in which multi-sensor data is automatically analyzed and integrated under certain criteria to complete the required decision-making and evaluation. The biggest advantage of data fusion technology is that it can reasonably coordinate multi-source data, fully integrate useful information, and improve the ability to make correct decisions in a changing environment.

Data fusion technology is a comprehensive information processing technology that utilizes multi-source information to obtain a more objective and more fundamental understanding of the same thing or target. Because the traffic parameters, average speed, instantaneous speed, headway distance, vehicle classification, and lane occupancy rate of the traffic parameters that can be detected are different, the accuracy of the collected data is different, so different data needs to be performed. Fusion.

The communication control and induction synergy has always been the research focus of traffic workers in various countries. It refers to the advantages of complementary traffic between the intersections under the macro-control of the traffic center, and the advantages of complementarity between the intersections are maximized. Traffic flow, thereby improving the capacity of the road.

4. Research innovation

(1) Design of traffic coordination control structure based on multiple traffic in the vehicle network environment

The road network consisting of a large number of intersections bears the main functions of urban traffic. The road traffic network of large and medium-sized cities usually contains a large number of intersections. Such complex traffic networks must control traffic flow through traffic signals and single-segment traffic control, multi-junctions. The traffic network has the mutual influence of the
traffic flow between the intersections. Only considering the traffic problem of the single intersection cannot make the whole network reach the best traffic state. How to improve the coordination between the intersections under the premise of ensuring the smooth traffic of each intersection to increase the whole road The capacity of the network is the key to coordinated traffic control.

The intersection plays an important role in the transportation network. The traffic flow in all directions converges here, and forms traffic phenomena such as diversion and conflict of vehicles. In the urban transportation system, traffic congestion and traffic accidents often occur mainly at intersections. Intersection Agent Control Function Structure:

Traffic information is the traffic flow information on each imported vehicle at the intersection. The intersection control agent based on the intersection traffic information, based on the traffic control knowledge stored in the control strategy library in advance, combined with the signal timing optimization algorithm, determines the signal control strategy and specific scheme through calculation. To achieve the minimum vehicle delay or the shortest queue length in urban traffic, the negotiation and communication part mainly completes the exchange and negotiation of the intersection information and the surrounding agent information, and then formulates corresponding control strategies to maintain the overall system benefits. Traffic lights are traffic. The signal display device uses red, yellow, green and other different color lights to indicate the right of each road access. According to the control strategy formulated by the intersection control agent, the vehicle is controlled at the intersection by the length of the color change time.

(2) Collaborative integration framework of traffic control and guidance system based on multi-agent system

First: the two systems coexisting independently, but the signal will change with the line selection mode;
Second: jointly operate two systems to exchange traffic data and control strategies;
Third: Global integrated line selection and signal timing have the same optimization and control process.

The global integration structure of the two systems is shown in Figure 6.
At present, the road traffic control center has a synergistic mechanism for traffic flow induction and control. They use traffic information sharing as the basis for realizing the cooperation between the two systems. According to the real-time collected road network traffic information, the intersection signal timing optimization and dynamic path optimal selection synchronize and publish the inductive information to form a loop.

(3) Traffic control and traffic induced collaborative information fusion technology

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Data fusion technology has been widely used in the research of intelligent transportation systems. Data fusion is generally divided into three levels, and common data fusion technologies. As shown in Table 1:

| Fusion level | Fusion object   | Main technique                                                                 |
|--------------|-----------------|--------------------------------------------------------------------------------|
| One          | Pixel fusion    | Data association, intelligent weighted average, exponential smoothing, Recursive estimation fusion method for arithmetic mean |
| Two          | Feature fusion  | Bayesian inference, neural network, clustering                                 |

Fig 6 Structure of global integration of traffic control and traffic guidance
5. Conclusion
Summary, aiming at the importance of global strategy formulation in traffic control and induced coordination, a multi-agent based intelligent decision support system technology is adopted, and the application model framework is given. Starting from the practical application, starting from the collaborative mode and the collaborative algorithm, the multi-agent technology and intelligent decision-making technology are applied to the formulation and implementation of the inductive control collaborative management strategy. Traffic flow guidance system and traffic control system are the main means to realize urban traffic management intelligence, modernization, informationization and network. UTCS and UTFGS must be coordinated to make the road network traffic flow properly distributed and optimized, thus achieving good results. Traffic management effects.

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