Research Article

Traffic Optimization Model Based on Regional Road Network Traffic Diversion Technology and Internet of Things

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Today’s traffic control system is developing in a more intelligent direction. The progress of electronic technology has created a traffic control and management system using a variety of control methods. The development of computers creates a more intelligent traffic optimization model for optimizing network traffic. In the limited road space, traffic control research will focus on maximizing the use of existing traffic management equipment to improve vehicle circulation efficiency and avoid congestion. In this context, combined with the temporal and spatial characteristics of traffic congestion, this study investigates the storage capacity of existing road space and seeks the optimal control method for local regional road network congestion. For the technical problems of traffic diversion in the existing two-phase control method and the queuing order in the adjacent lanes in the four-phase control method, the optimal control method is proposed, which solves the technical problems of traffic control and the phenomenon of “queuing injustice” in the adjacent lanes in one direction. The safety degree and traffic efficiency of vehicle operation are improved. The traffic flow from the same entrance to the main intersection forms a signal phase while slowing down or blocking these traffic flows can effectively improve traffic safety and traffic efficiency. Combined with the development of traditional traffic control system, this study introduces the development status of Internet of things technology and puts forward an intelligent traffic control system based on Internet of things technology. Real-time vehicle traffic information is sent to the Lora gateway through Lora wireless network, which is responsible for data transmission and protocol conversion.

1. Introduction

Urban congestion not only brings inconvenience to residents, prolongs travel time, increases fuel consumption and other negative effects, but also causes road traffic accidents, pollution and other problems, which often brings huge losses to urban life, road safety, and the national economy. According to the data released by the Ministry of transport, China’s direct economic losses caused by traffic congestion amount to hundreds of billions of yuan every year. It can be seen that many inconveniences caused by congestion can not be ignored. The mitigation and management of regional road network have been highly valued by the government and relevant departments as an important issue related to the national economy and people’s life. Excess vehicle traffic refers to the total number of vehicles passing through the intersection or road network in a certain period of time. During peak hours, more vehicles must “flow” to quickly evacuate the stagnant traffic flow, so as to avoid overcrowding due to waiting for vehicles in the road section, quickly get rid of the crowded traffic situation, and reduce the traffic pressure on the road section and prevent traffic congestion caused by overcrowding. Therefore, in the study of traffic diversion technology, many control methods have been optimized to maximize the traffic flow of intersections or road network. In the study of preventing supersaturation at major intersections, we also introduce a control model to optimize the peak traffic at intersections [1]. The search in the literature shows that the current oversaturated traffic optimization control has achieved successful results. However, due to the complexity of road traffic problems and their importance in daily life, people’s interest in road congestion research has not weakened. Today’s traffic control system is developing in a more intelligent direction. The progress of
electronic technology has spawned different methods to control traffic control and management systems. The progress of computers makes the network traffic control and management system more intelligent. The progress of artificial intelligence, big data, and Internet of things algorithms makes traffic management possible. The control system has higher efficiency and more functions. Traffic congestion usually occurs at a specific time and place, and has the characteristics of time zone and geographical constraints. Determine the congestion period according to the characteristics of the traffic optimization model, and formulate and implement appropriate optimization methods during this period, which can improve congestion, traffic pressure, and traffic performance indicators; Considering the regional characteristics of road congestion, the congested regional road network is selected as the research object to optimize the main intersections of the local road network, prevent congestion and form a comprehensive operation mode of the road network.

2. Related Work

Some research introduces the traditional congestion evaluation and detection methods, which depend on the evaluation of micro traffic mode or the calculation of traffic indicators at a single intersection or road section. Then, the weighted average network method is used to determine the traffic condition of the road network. However, it is impossible to consider the overall efficiency of the road network, such as the average saturation and average speed of the road network, and it is difficult to describe the operation of the road network from a macro perspective. The literature introduces the existing comprehensive urban traffic congestion indexes, such as RCI and TTI indexes proposed by a provincial transportation association and road network traffic use index proposed by a city, which can only simply express the absolute amount of congestion [2]. However, the traffic characteristics in different regions are different, so it is necessary to study the congestion change in the target region. The literature introduces that most of the research on the factors affecting traffic use is from the perspective of the traditional balance of supply and demand, but it is relatively weak in the specific practical trend, and less introduces the relevant relationship of road network in terms of traffic structure. The literature introduces the differences in land characteristics, time dimension, road network structure, and other factors [3]. Different regions have different congestion characteristics. However, it can not be generalized. In order to understand many factors causing traffic congestion, it is necessary to study the characteristics of all kinds of traffic congestion. In order to find an effective and simple way to express the impact, we should explore the relationship between urban congestion and various factors [4]. Compared with the statistical model, the algorithm technology based on Computational Intelligence (CI) has shown a strong ability to analyze highly nonlinear and complex data. If fewer conditions are assumed, more detailed regression results can usually be obtained. At present, domestic researchers have begun to use machine learning, deep learning and other algorithms in motion research, but there are still some deficiencies compared with foreign research or other fields [5]. They should try to study and implement better motion effect algorithms, so as to speed up the search progress and improve the accuracy.

3. Regional Road Network Traffic Diversion Technology

3.1. Regional Road Network Division. At present, the urban traffic index is released to monitor the status of the urban road network and overall traffic changes. However, the macro research and evaluation of the overall operation health of the city play a very limited guiding role in improving traffic congestion, mainly because it is impossible to determine the key areas, and it is not clear which areas should be monitored first to play a greater role in improving the overall operation effect of the city [6]. Therefore, it is necessary to further limit the assessment scope, divide the city into several different units, and then analyze the characteristics of each unit in the area from the aspects of traffic activity status and mutual relationship, which is called road network area. The purpose of road network area classification is to distinguish various characteristics of changes and link information such as changed local road conditions and terrain, so as to accurately identify the congested areas of major cities and analyze the conversion of these types, which lays a foundation for establishing the impact model of local activities and formulating relevant remedial measures.

The traffic condition data of the regional highway network can directly determine the feasibility of traffic diversion. The following indicators are analyzed.

Traffic volume refers to the number of traffic units passing through a given location, section, or lane at a given time. Among them, the average annual traffic volume (SADT) is the index of road design and management control [7]. Traffic management shall fully analyze the current situation and annual average daily traffic volume of each road in the network, and support sound traffic management by analyzing statistical data, regional distribution of road characteristics, and local road traffic volume. The research on the traffic condition of the regional road network is helpful to statistically calculate and extend the regional distribution and annual growth rate of current traffic volume, and provide a basis for predicting traffic volume and the construction of traffic control endpoints; By calculating the traffic distribution map of the road network in relevant areas, identify the distribution of congestion points and the remaining capacity of each road, so as to provide the basis for selecting traffic control routes and changing congestion points [8]. Predicting the traffic distribution of local road network is helpful to determine the indicators such as vehicle flow, traffic diversion mode, and diversion path. The traffic volume forecast in this study includes three parts: trend traffic volume forecast, induced traffic volume and restrained traffic volume forecast, and transfer traffic volume of off-road transportation. Induced traffic volume refers to new traffic generated by road construction or
reconstruction, which contributes to economic development [9]. Restraining traffic volume refers to the traffic volume loss caused by the deterioration of the driving environment or the decline of traffic capacity caused by the construction of commercial roads in the process of expressway expansion. The trend traffic prediction adopts a four-step prediction model composed of four steps: trip generation, trip distribution, mode split, and trip assignment. For specific road sections, the total traffic volume of each traffic area is allocated to each road section in the traffic network. According to the traffic distribution prediction, space data OD (OD traffic volume survey, “O” refers to “ORIGIN,” “D” refers to “DESTINATION”) is reserved for specific road network for distribution [10]. This project introduces the static multipath allocation method, and adjusts the road network by comparing the distribution results with the actual traffic flow of each section at the end of the year. By adjusting the occurrence and attraction of the road network and travel, the distribution result is close to the actual traffic volume, so as to predict the annual traffic of the road network.

3.2. Traffic Diversion Method. The importance of node Z is a measure of the socio-economic activities of the city where the node is located. It is a measure of the relative importance of these cities in the region in the network. The calculation model of node importance is calculated according to the following formula:

\[ Z_i = \sum_{k=1}^{n} \alpha_k \frac{z_k}{z_n}. \]

The tolerance shall be calculated according to the following formula:

\[ T_i = \sum_{k=1}^{n} (C_k - Q_k). \]

The calculation model of detour (average detour) is calculated according to the following formula:

\[ R_i = \frac{\left( \sum_{k=1}^{n-1} (OD_k \times t_k) \right) / \left( \sum_{k=1}^{n} (OD_k) \right)}{\sum_{k=1}^{n-1} T_k / n}. \]

The collinearity (average collinearity) calculation model is calculated according to the following formula:

\[ G_i = \frac{\sum_{k=1}^{n} (t_k / T_k)}{n}. \]

Benefit type indicators include node importance, tolerance, and saturation of project road sections, and cost type indicators include destination proximity and detour. The normalized index value of the utility index is equal to the index value of each node divided by the maximum value of the index, and the normalized cost index value is the reciprocal of the quotient of the index value of each node divided by the maximum value of the index, as shown in Table 1.

The weight of each indicator is determined by the analytic hierarchy process, as shown in Table 2.

Traffic control and management technology includes traffic monitoring and sensing technology, control strategy, traffic control data selection and sharing technology, mainline control mode, ramp entrance and exit control mode, road network control mode, etc., which requires a number of technologies to coordinate with each other. The control planning procedure is shown in Figure 1. Therefore, traffic diversion technology is a technical means to ensure the smooth and rapid implementation of daily management and production plan. This provides practical significance for improving management efficiency and effectively ensuring smooth and safe road transportation.

Trunk line control mode refers to the regulation, early warning, and control of traffic participants on the extended highway trunk line. Trunk line control adjusts highway traffic parameters based on traffic engineering theory to reduce the impact of trunk line congestion. Trunk line control can effectively coordinate the traffic flow at main intersections and key times [11]. Variable speed control uses various speed limit signs and variable information signs on the main roads to limit the speed between vehicles, so as to change the traffic congestion and lane utilization, maintain the stability of traffic flow, and finally increase the road width in terms of traffic capacity. The basic principle of speed control is to determine the optimal speed and optimal density under the maximum allowable traffic volume according to the relationship between climatic conditions, road and traffic volume and density, and according to the limit of extending the smooth and reliable operation of mainstream traffic on the highway. The relationship between the three parameters of traffic flow is shown in Figure 2.

4. Research and Application of the Traffic Optimization Model Based on Regional Road Network Traffic Diversion Technology

4.1. Application of Internet of Things Technology. At present, the Internet of things is a rapidly developing electronic technology. The core of the Internet of things is to electronically connect people’s various life objects to the Internet by creating an intelligent network that can optimize them by retrieving, searching and requesting information. English is "Internet of things," also known as "Internet of everything" [12]. Simply put, "the Internet of things is the Internet connected with things." The Internet of things is known as the second billion-dollar technological revolution after the Internet. In the early stage of the Internet of things, many Internet applications of the Internet of things have been created. More and more Internet of things devices are connected to the network through wireless communication. Representative wireless technologies include Bluetooth, WiFi, rfid1, and ZigBee. The main task of this phase is to build network infrastructure and manage connected devices and endpoint intelligence at the same time [13]. In the second stage, the proliferation of networking terminals created massive data sources for the Internet of things and produced big data. At this time, sensors, instruments, and other devices...
Table 1: Weight coefficient of each index.

<table>
<thead>
<tr>
<th>Definition</th>
<th>Equally important</th>
<th>Slightly important</th>
<th>Light and strong are important</th>
<th>Strongly important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaling</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2: Judgment matrix.

<table>
<thead>
<tr>
<th>Index</th>
<th>Node importance</th>
<th>Relative tolerance</th>
<th>Saturation of project section</th>
<th>Destination proximity</th>
<th>Detour</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node importance</td>
<td>2</td>
<td>1/6</td>
<td>1/8</td>
<td>1/4</td>
<td>1/4</td>
<td>0.04</td>
</tr>
<tr>
<td>Relative tolerance</td>
<td>6</td>
<td>2</td>
<td>1/4</td>
<td>4</td>
<td>4</td>
<td>0.26</td>
</tr>
<tr>
<td>Project section saturation</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>0.51</td>
</tr>
<tr>
<td>Destination proximity</td>
<td>3</td>
<td>1/4</td>
<td>1/6</td>
<td>2</td>
<td>2</td>
<td>0.11</td>
</tr>
<tr>
<td>Detour</td>
<td>4</td>
<td>1/4</td>
<td>1/6</td>
<td>2</td>
<td>2</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Figure 1: Design procedure diagram of traffic diversion control.
4.2. Traffic Period Optimization Algorithm. Effective management of traffic lights at intersections can ensure safe and efficient traffic at intersections and improve various traffic indicators. At present, the commonly used signal control methods include clock control, adaptive control, and induction control. Among them, the control effect of adaptive control and induction controller depends on the operation state of media detection equipment and the accuracy of real-time traffic flow information [15]. In order to avoid the problem of control failure caused by sensor error or sensor error, the sequential control system usually needs to be defined when implementing adaptive induction control and control system. In the timing control system, the signal cycle length, green signal ratio, and phase deceleration sequence are constant. Because the traffic flow of urban road networks changes periodically, the one-time management system can not meet the changing traffic demand and various monitoring methods in different time periods of a day. Time of day (TOD) came into being. At a historic moment, multi-cycle control usually divides the 24 hours of a day into multiple traffic cycles according to the changes of traffic flow, and then formulates the traffic light control scheme most suitable for traffic demand according to the characteristics of traffic volume [16]. Accurate time allocation is a prerequisite for TOD to obtain all the benefits of control and improve control performance [17]. Therefore, how to achieve objective and accurate traffic time allocation results through scientific and reasonable allocation methods has become a research topic in the field of multitime monitoring [18]. People have subjective factors that interfere with the division of motion cycles. In this study, we propose a traffic cycle allocation method based on an image segmentation algorithm [19]. The first mock exam is to improve the segmentation accuracy. According to the coverage of daily traffic flow, the traffic flow is divided into three states, and the traffic data of the same mode are combined into the traffic data matrix to get the corresponding traffic volume. MATLAB image generation is used to convert each traffic flow data matrix into the corresponding traffic flow data image, and then the advanced FR FCM (fast robust fuzzy c-means clustering algorithm) mean clustering algorithm is used to segment the image to remove the fuzzy boundary, and the final result of traffic period distribution is obtained by comprehensively considering the change degree of traffic volume in each period [20, 21].

When determining the signal control level of the intersection, the traffic flow data shall be fully considered. The traffic volume at different times may reflect the change in the number of vehicles directly entering and leaving the intersection, which is an important standard for allocating traffic time. When the detector collects and transmits the traffic flow at each entrance of the intersection within a 1-hour sampling period, 24 values composed of daily traffic flow vectors are obtained, as shown in

$$x_d = [x_d(1)x_d(2)\cdots x_d(24)], \quad d = 1, 2, \ldots, 7. \quad (5)$$

Collect the daily traffic flow in the specified time period, and compile all daily traffic flow vectors on Monday from the traffic flow $X_1$ matrix on Monday according to

$$X_1 = \begin{bmatrix} x_1^1(1) & x_1^1(2) & \cdots & x_1^1(24) \\ x_1^2(1) & x_1^2(2) & \cdots & x_1^2(24) \\ \vdots & \vdots & \ddots & \vdots \\ x_1^N(1) & x_1^N(2) & \cdots & x_1^N(24) \end{bmatrix} \quad (6)$$

The average traffic flow at any time of the day is not only an important index for evaluating traffic conditions, but also a key basis for planning signal synchronization. However, extreme conditions in the data set can easily affect the average value and can not reflect the range, so they usually can
not fully reflect the changes in traffic volume similar to specific days of the week. In this study, we propose a new concept of traffic flow distribution considering the change in daily traffic flow.

\[ X_i(m) = \begin{bmatrix}
    x_i^1(m) \\
    x_i^2(m) \\
    \vdots \\
    x_i^p(m)
\end{bmatrix}, \]

\[ X_j(m) = \begin{bmatrix}
    x_j^1(m) \\
    x_j^2(m) \\
    \vdots \\
    x_j^q(m)
\end{bmatrix}, \]

\[ R_{ij}(m) = \begin{cases}
    \frac{b-c}{d-a}, & a \leq b \leq d, \\
    \frac{d-a}{b-c}, & c \leq a \leq b, \\
    \frac{d-c}{b-a}, & a \leq c \leq d, \\
    \frac{b-a}{d-c}, & c \leq a \leq b \leq d 
\end{cases} \]

Based on the above situation, calculate the coverage rate of the daily traffic distribution of \( i \) and \( j \) days according to the formula, that is, the total coverage rate of 24 days.

\[ R_{ij} = \sum_{m=1}^{24} R_{ij}(m). \tag{8} \]

Using this formula, calculate the average traffic flow for each time period on a certain day of the week, and then perform cluster analysis on the 7-day average traffic flow vector.

\[ X_d = \frac{1}{N_d} \left[ \sum_{i=1}^{N_d} x_d^1(1) \sum_{i=1}^{N_d} x_d^2(2) \ldots \sum_{i=1}^{N_d} x_d^{24}(24) \right], \quad d = 1, 2, \ldots, 7. \tag{9} \]

Looking at the data in Table 3, it can be seen that \( R_{16} = 1.45 \) is the minimum value in the table, that is, the

<table>
<thead>
<tr>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>7.67</td>
<td>8.68</td>
<td>4.82</td>
<td>7.45</td>
<td>1.45</td>
<td>4.53</td>
</tr>
<tr>
<td>2</td>
<td>7.67</td>
<td></td>
<td>7.12</td>
<td>10.16</td>
<td>5.72</td>
<td>1.84</td>
<td>3.3</td>
</tr>
<tr>
<td>3</td>
<td>8.68</td>
<td>7.12</td>
<td></td>
<td>8.95</td>
<td>5.4</td>
<td>2.71</td>
<td>4.32</td>
</tr>
<tr>
<td>4</td>
<td>4.82</td>
<td>10.16</td>
<td>8.95</td>
<td></td>
<td>4.25</td>
<td>2.97</td>
<td>1.84</td>
</tr>
<tr>
<td>5</td>
<td>7.45</td>
<td>5.72</td>
<td>5.4</td>
<td>4.25</td>
<td></td>
<td>3.06</td>
<td>4.61</td>
</tr>
<tr>
<td>6</td>
<td>1.45</td>
<td>1.82</td>
<td>2.71</td>
<td>2.97</td>
<td>3.06</td>
<td></td>
<td>7.48</td>
</tr>
<tr>
<td>7</td>
<td>4.53</td>
<td>3.3</td>
<td>4.32</td>
<td>1.84</td>
<td>4.62</td>
<td>7.48</td>
<td></td>
</tr>
</tbody>
</table>

“overlapping area” of traffic volume on Thursday and Saturday is the smallest. In other words, the difference between the traffic flow data on Thursday and Saturday is the biggest and is broken down into different categories. According to the traffic flow distribution values shown in Table 3, the traffic modes are divided into three categories: Monday, Tuesday, Wednesday, and Thursday belong to the same category, Saturday and Sunday are one category, and Friday is a separate category.

Combine all traffic flow data from Monday to Thursday from the first matrix, all Friday traffic data from the second matrix, and all Saturday and Sunday traffic data from the third matrix. Use Matlab’s “imagedc” command to convert the data matrix corresponding to the three traffic model models into traffic flow data images, as shown in Figure 3.

The figure shows the corresponding ratio of each pixel to the traffic volume. The higher the traffic volume value, the more similar the colors. If you look at the drawing image of each data set, you can see that the color block depth and color transition color gamut boundary are different, but the color block distribution is similar to the changing trend in the same traffic flow image.

4.3. Traffic Optimization Model Parameter Settings. The weighted reward formula is as follows:

\[ r_{t+1}^i = \left( \eta_1 \times (r_{t+1}^{i,1} + r_{t+1}^{i,2}) \right) + \left( 1 - \eta_1 \right) \times \left( r_{t+1}^{i,1} + r_{t+1}^{i,2} \right). \tag{10} \]

The weighted rewards with multiple weights are as follows:

\[ r_{t+1}^i = \left[ \eta_1 \times \left( \eta_2 \times r_{t+1}^{i,1} \right) + \left( 1 - \eta_1 \right) \times \left( r_{t+1}^{i,1} \right) \right] + \left( 1 - \eta_1 \right) \times \left[ \left( \eta_2 \times r_{t+1}^{i,2} \right) + \left( 1 - \eta_2 \right) \times r_{t+1}^{i,2} \right]. \tag{11} \]

Agent \( i \) chooses action \( a \) with probability \( P \) in state \( s_i^t \) as follows:

\[ P_i^t(s_i^t, a) = \frac{e^{Q_i^t(s_i^t, a)} \eta^t}{\sum_{b \in A} e^{Q_i^t(s_i^t, b)} \eta^t}. \tag{12} \]

Action selection based on the UCB index is as follows:

\[ a_i^* = \arg \max_{a \in A} \left\{ -Q_i^t(s_i^t, a) + \frac{\ln N_i(s_i^t)}{N_i(s_i^t, a)} \right\}. \tag{13} \]

The corresponding \( a \) of the largest \( Q \) value is as follows:
$$a_i^* = \arg\max_{a \in A} \{ Q_i(s_i, a) \}. \quad (14)$$

Reward: calculate the reward $r(s, a)$ according to the cooling time after the action:

$$r(s, a) = \begin{cases} 
0, & wt > 2wt', \\
1, & wt' < wt < 2wt', \\
2, & wt < wt'.
\end{cases} \quad (15)$$

Update of the $Q$ table: update the $Q$ value according to the following formula, a scalable game learning algorithm based on $Q$ learning, and consider the overall node characteristics:

$$Q_{i+1}^t(s'_i, a'_i) = (1 - \alpha)Q_i^t(s'_i, a'_i)$$
$$+ \alpha [r_{i+1}^t(s'_{i+1}) + \gamma \max_{a_{i+1}} \{ Q_{i+1}^t(s'_{i+1}, a_{i+1}) \}]$$
$$+ \gamma \sum_{j} \eta Q_j^t(s'_j, a'_j). \quad (16)$$

According to the actual transmission network, the detailed and complex information of the transmission network is required to be simplified, and the transmission network topology model is defined. When creating a parallel game network, each individual has only two states: betrayal ($D$) or cooperation ($C$). The description is as follows:

$$z_x = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (17)$$
$$A = \begin{bmatrix} 1 & 0 \\ b & 0 \end{bmatrix}.$$ 

The sum of individual income is expressed as follows:

$$R_x = \sum_{i \in \Omega} Z_x^T A z_y. \quad (18)$$

The process of updating the $Q$ table is as follows. If the state and behavior of node $i$ is $s$ and $\tau$, then the update of element $Q_{im}$ is
\[ Q_{sa}(\tau + 1) = (1 - \alpha)Q_{sa}(\tau) + \alpha[w(\tau) + \gamma Q_{sa}^{\text{max}}(\tau)] \quad (19) \]

Here \((\tau)\) represents the individual reward for this round given by

\[ w(\tau) = \left(\frac{R_s}{n}\right)^\theta. \quad (20) \]

When individual \(i\) is in state \(s\) in the third shift, it chooses the optimal function according to table \(Q\) as follows:

\[ a(\tau) = \arg\max_{a'}\{Q_{sa}(\tau)\}. \quad (21) \]

4.4. Module Design of Traffic Optimization Platform. As shown in Figure 4, in this chapter, we design a Q-learning game model, which adds a parallel game network control module and the existing gain-based signal control system and the use of the game network node function. When the transmission network signal optimization platform establishes connection control, the traffic network agent signal optimization process.

All the tracks in Figure 5 are divided into cells with 100 m as the unit, and the length of the track division is 200 m, and each cell can have multiple vehicles at the same time. Lane guidance is defined as two straight tracks and a right straight track. Vehicles follow the principle of keeping to the right on the road.

Traffic flow control: the traffic flow control in the road network accepts certain entry thresholds. The total number of vehicles entered during the simulation is 1501. The flow setting table is shown in Table 4.

In the experiment, the path configuration file is used to determine the behavior of the vehicle. Some behaviors are shown in Table 5.

4.5. Analysis of the Traffic Optimization Control Method. The intersection is not only a node for centralized evacuation of traffic in the road network but also a congestion point to promote vehicle aggregation and parking. Some intersections in the road network are located in the main sections with dense and complex traffic. It is an important task to transfer the traffic pressure to these sections. When traffic congestion occurs at these intersections due to poor traffic control, it is easy to wait on the roadside, resulting in traffic congestion or even paralysis, which affects people’s travel and living environment. This has a great negative impact, so preventing major node congestion of the local road network is very likely to prevent major congestion of the local road network, so as to effectively ensure the normal operation of the whole regional road network. The so-called important intersection of the regional road network is an important intersection of the regional road network. They are usually located in the city center, connecting the east-west and North-South directions of major urban lines with heavy traffic. In this paper, we define these intersections as the key intersections of urban road network, and propose a new method to optimize the management of these intersections. The traffic flow from the same entrance to the main intersection forms a signal phase, and slows down or stops these traffic flows at the same time, so as to improve driving safety and efficiency. At the same time, it effectively prevents the "queuing injustice" phenomenon of traditional two-phase control method and four-phase control method from a traffic collision in adjacent frequency bands. Based on the analysis of the characteristics of traffic flow between main intersection and adjacent intersection, a synchronous control method of related three-turn traffic flow is proposed and applied to adjacent intersections to make adjacent intersections "serve" key intersections. As required, vehicles will arrive at the main intersection to avoid congestion at the entrance of the main intersection. Based on the road wave theory, a control system for adjusting the signal phase difference at adjacent intersections is being developed, which can increase the traffic volume at major intersections and reduce significant vehicle delays and parking times. The comprehensive control scheme of adjacent intersections with "incomplete" closure control method effectively prevents the saturation of key intersections and lays a foundation for the study of optimizing local road network traffic control. In the existing two-phase control mode, the turning lanes of the left and right opposite entrances (such as two north-south or two east-west) are released at the same time, and the traffic flow of the other two opposite entrances (two East-West entrances or two north-south entrances) is prohibited. The opposing traffic flow released at the same time meets at the conflict point of the intersection. During peak hours, there are fewer vehicles in each lane, so we can safely avoid the intersection by controlling the speed at the conflict point. When multiple slow flows meet at an intersection during peak traffic hours, the distance between vehicles in each traffic flow is very short. When the first vehicle in one traffic flow wins the right of release, other vehicles in the fleet will follow and release continuously. The other traffic flow blocked will queue up at the conflict point and wait for the traffic flow to pass before releasing. This not only losses the deceleration time, but also is prone to excessive collision due to road congestion. With the introduction of traditional four-phase steering, vehicles that hinder hitting or getting stuck at intersections will slow down at different times. Vehicles in different turning lanes at the same entrance are released on time, and the time of vehicles in adjacent lanes is not synchronized.

If drivers waiting for backup in a prohibited Lane see a convoy in an adjacent lane, they are more likely to change lanes and jump into lanes or join trailing vehicles. This will not only affect the continuity of free driving, waste the green light time, but also cause vehicle collision during lane change, disrupt the normal driving of subsequent vehicles, cause road congestion, and even transition to a large-scale power supply. In order to shorten the waiting time of vehicles and improve the work of intersections, the freedom rights need to be divided according to the waiting conditions of vehicles in different lanes, combined, and released arbitrarily as needed. A group of vehicles whose queue length meets the release target without temporary collision form a long queue and release at the same time. The combination of steps is flexible, which can be applicable to the
implementation of release according to the emergency degree of vehicle departure. During travel time, the speed of vehicles entering the track is usually very high at each intersection, and the vehicle line reaches a deceleration rate, resulting in the same emergency situation for vehicles to leave each lane. The current free combination release state has actually changed to the release state of fixed duration and solid state, which has lost its original flexibility and adaptability. The phased binding release mode is only applicable to the peak period. Due to the small traffic flow, the
Table 5: Schematic diagram of route setting of some vehicles.

<table>
<thead>
<tr>
<th>Vehicle id</th>
<th>Departure time</th>
<th>Vehicle path</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>eDJ1[eJ1-eJ2-eJ3-eJ4] [eJ5-eJ6] [eJ6-eJ7]</td>
</tr>
<tr>
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<td>0</td>
<td>eDJ1[eJ1-eJ2]</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>eDJ2[eJ2-eJ3-eJ4] [eJ5-eJ6] [eJ6-eJ7]</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>eDJ3[eJ3-eJ4] [eJ5]</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>eDJ4[eJ4-eJ5] [eJ5-eJ6]</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>eDJ5[eJ5-eJ6] [eJ6-eJ7]</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
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</tr>
<tr>
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<td>0</td>
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<td>0</td>
<td>gneE3[eJ3-eJ4] [eJ4-eJ5]</td>
</tr>
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<tr>
<td>10</td>
<td>0</td>
<td>eDJ9[eJ9-eJ10] [eJ10-eJ11] [eJ11-eJ12]</td>
</tr>
</tbody>
</table>

Therefore, in the follow-up research work, the model database should be constantly supplemented according to reality, so as to cope with the occurrence of various situations and improve the applicability of the model.

**Data Availability**

The data used to support the findings of this study are available from the author upon request.

**Conflicts of Interest**

The author declares no conflicts of interest.

**References**


