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Research Article

Influencing Factors and Simulation Modeling of Tourist Environmental Protection Behavior under the Background of OSG Platform

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Due to the continuous socio-economic progress, tourism has flourished. In addition, the improvement of people's living standards and constant changes in social awareness and concepts has also made tourism a normal part of daily life. In the past few years, there has been a boom in overseas travel, and tourism has become a rigid demand. This study proposes a new method and model that enables researchers to conduct in-depth analysis and discussion on the influencing factors of tourists' environmental protection behavior. Additionally, OSG platform can be used for simulation and modeling. This study uses OSG platform to conduct a simulation experiment on tourists' environmental protection behavior. The results of the experiment indicate that tourists' environmental protection behavior is related to six factors, including tourist characteristic factors, tourists' environmental attitude factors, tourists' emotional factors towards scenic spots, tourists' habit factors, social factors, and promotion conditions. At the same time, these factors have some validity. The experimental results involving tourists' environmental protection behavior can provide more targeted methods and guidance for the development of tourism and also enable tourism to develop more comprehensively and perfectly.

1. Introduction

With the constant advancement of the social economy, the tourism industry continues to thrive. The living standards of the people have improved. As their social consciousness and ideas are constantly changing, travel and tourism have become the normality of their daily life. In the past few years, there has even been an upsurge in overseas travel, and tourism has become a rigid demand [1, 2]. However, what follows is the emergence of new troubles and issues, such as the problem of littering in the scenic spots and uncivilized behaviors that are detrimental to environmental protection and destroy the historical sites and facilities in the scenic areas [3, 4]. Therefore, analyzing the factors that may affect tourists' environmental behavior, then instilling in them the correct concept of environmental protection, and continuously improving their behavioral habits so that it becomes a conscious behavior of citizens are the urgent challenges and key points to be solved [5].

Environmental protection behaviors are also referred to as environment-friendly low-carbon behaviors and environmental protection behaviors in our country. At present, the studies of environmental awareness carried out by the experts in the industry are mainly concentrated on the demographic factors such as age, education level, and birth environment of citizens, as well as subjective environmental and ecological education, environmental attitudes, environmental awareness, and other factors, or research

regarding the influence on tourist behaviors from the perspective of tourist motivation [6]. Hence, the intervention to environmental protection behaviors mainly focuses on publicity, punishment, and other solutions at present. However, little attention has been paid to the influence of traditional Chinese culture and the mechanism of rewards and punishments on environmental protection behaviors.

The literature research on the influencing factors of tourists' environmental protection behavior mainly focuses on the investigation of environmental protection awareness, environmental protection behavior, and the relationship between some single or several factors and tourists' environmental protection behavior. Scholars have investigated the demographic factors such as tourists' age and education level, and there are not many achievements in systematically studying the influencing factors of tourists' environmental protection behavior. Huangxueli et al. explored and analyzed the leading factors affecting tourists' low-carbon tourism life behavior, while Zhaoliming et al. conducted empirical research on the influencing factors of public low-carbon tourism behavior. The existing literature mainly studies from the perspective of tourists' psychological awareness and emotion. The intervention policy on tourists' behavior focuses on publicity and education, ignoring the empirical research on the impact of Chinese traditional cultural factors, incentive policies, and punitive policies on tourists' environmental protection behavior. To a certain extent, the existing literature lacks in-depth research on the mechanism of various influencing factors on tourists' environmental protection behavior. Therefore, this study makes an in-depth and systematic study on the internal and external influencing factors of tourists' environmental protection behavior through grounded theoretical methods, constructs a theoretical model of the influencing factors of tourists' environmental protection behavior, discusses the action mechanism of internal factors and the governance mechanism of external factors, and explores effective intervention mechanisms, so as to put forward policy suggestions for effectively guiding tourists' environmental protection behavior. These will ultimately help to promote the formation and maintenance of Chinese tourists' environmental behavior habits and have important theoretical value and practical guiding significance for reducing environmental pollution, building an ecological and low-carbon society, and promoting people-oriented social and economic healthy and sustainable development.

In this study, a quantitative analysis of factors that may influence environmental protection is carried out first. In addition, 3D simulation modeling is performed based on the OSG platform so as to guide the environmental protection behaviors in tourists, and effective policy recommendations are put forward.

2. Methods and Model Constructions

2.1. Data Analysis. The main factors that affect tourists' environmental behavior are six factors: tourists' attitude, tourists' characteristics, social environment, tourists' emotion, promotional conditions, and habits. Moreover, the influence mechanism and path of the above six factors on tourists' environmental protection behavior are also different. Tourist characteristic factors are the internal causes of tourists' environmental protection behavior. Different attribute characteristics make tourists show different environmental protection attitudes, which directly affect the production of environmental protection behavior. Through the interview, it is found that the consistency between psychological awareness and environmental protection behavior is obvious, but some punitive measures will arouse people's rebellious psychology and produce nonenvironmental behavior. According to sociological principles, social factors determine both psychological awareness and behavioral motivation. Therefore, many scholars regard social factors as the prefactor of behavior and take this as the premise to explore the direct effect of social environmental factors on tourists' environmental protection behavior, as well as its guiding effect on tourists' environmental protection behavior through psychological factors.

Based on the existing theories, the commonly used questionnaire survey method is adopted in this study to select interviewees, carry out interviews, and acquire and collect the corresponding data so as to obtain the most realistic and relevant data accordingly. The design of the questions to be asked in the interview is shown in Figure 1. It should be noted that before the questionnaire survey is carried out, it is necessary to explain the connotation of some environmental protection behaviors to the tourists so as to ensure that the tourists can have a thorough and in-depth understanding of the questionnaire, followed by proper exchange and communication of their ideas.

Based on the concept of the algorithm, the business entity should first make the judgments as follows:

(1) Whether the investment of the enterprise in environmental protection technology in the previous cycle was increased or decreased

(2) Whether the profit of the enterprise was increased or decreased in the last cycle

According to the results of the questionnaire survey regarding the two issues designed, a certain probability adjustment is made to the investment, in which the tourists are involved, as listed in Table 1.

When they accept the concept of environmental protection and become aware of the influence of their behaviors, tourists have experienced a process of learning, understanding, and acceptance. In accordance with their subjective awareness and surrounding environment, some targeted technical changes and adjustments are made to the subjective awareness of tourists accordingly. When the probability of investment in the corresponding environmental protection is adjusted, a random number is given randomly (the range of its value is [0, 1]), and the environmental awareness judgment on the tourist is carried out according to random numbers mentioned above, as shown in equation (1):

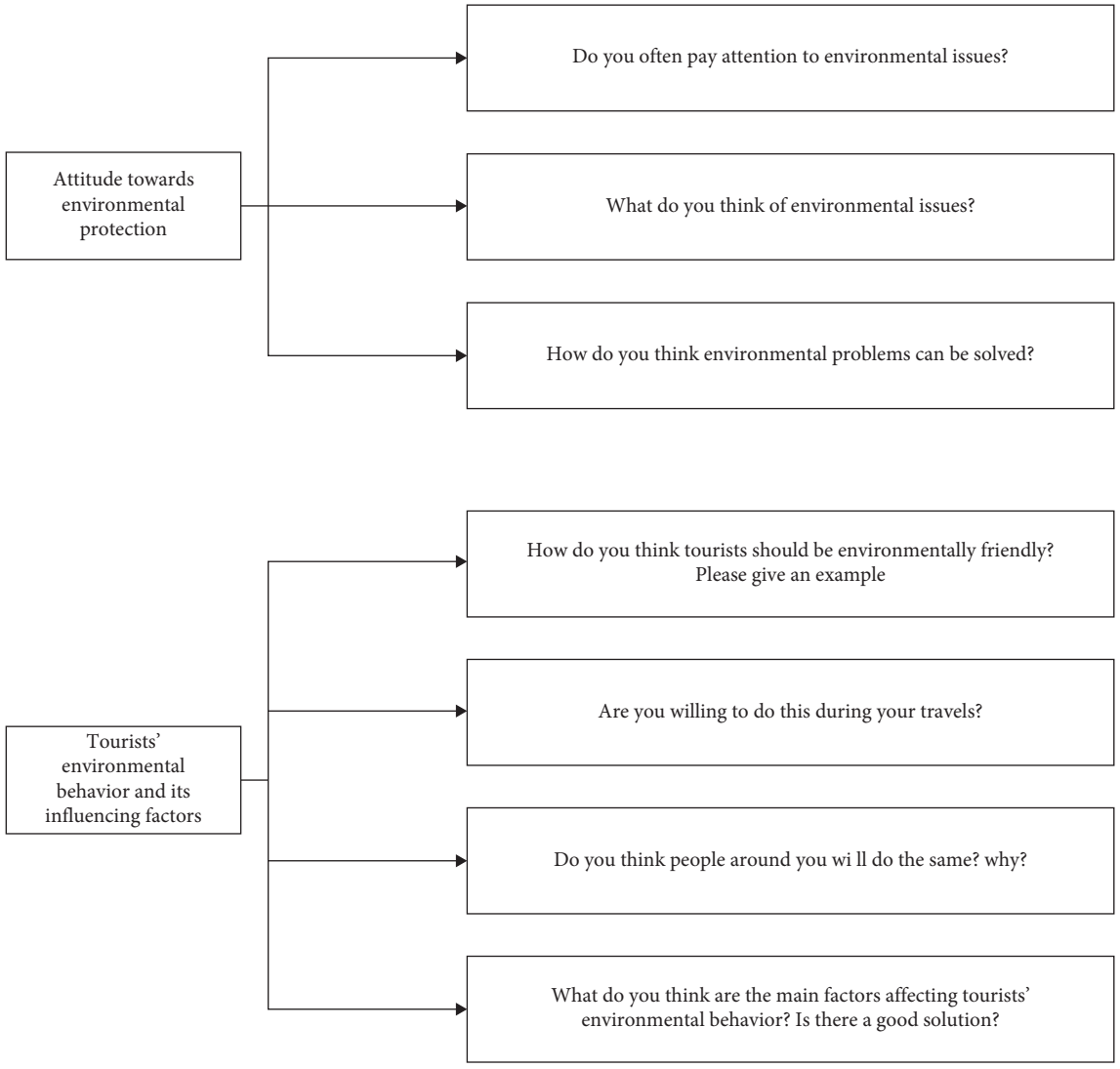

Figure 1: Questions to be asked in the interview.

Table 1: Process of probability adjustment for the willingness to invest in environmental protection technology.

Investment in environmental protection technology	Changes in profit	Changes in probability
Decrease	Increase	$(p^d + \omega, p^i - \omega/2, p^c - \omega/2)$
	Decrease (including remaining unchanged)	$(p^d - \omega, p^i + \omega/2, p^c + \omega/2)$
Increase	Increase	$(p^d - \omega/2, p^i + \omega, p^c - \omega/2)$
	Decrease (including remaining unchanged)	$(p^d + \omega/2, p^i - \omega, p^c + \omega/2)$
Remain unchanged	Increase	$(p^d - \omega/2, p^i - \omega, p^c + \omega/2)$
	Decrease (including remaining unchanged)	$(p^d + \omega/2, p^i + \omega, p^c - \omega/2)$

$$\text{techlnvest} = \begin{cases} \text{techlnvest}(t-1) - \Delta I_1\left(0 \le r < p^d\right), \\ \text{techlnvest}(t-1) + \Delta I_1\left(p^d \le r < p^i + p^r\right), \\ \text{techlnvest}(t-1)\left(\left(p^i + p^r\right) \le r < 1\right). \end{cases} \tag{1}$$

In response to the uncivilized and noncompliance of tourists with the relevant environmental protection stipulations and requirements, local governments should issue the corresponding laws and regulations or administrative measures to restrain and punish the violation behaviors so as to achieve the purpose of addressing three issues with one initiative. At the same time, based on the theory of public opinion, local governments should rely on the public to criticize the illegal and nonconforming behaviors of tourists. For example, in Nanjing's Xuanwu Lake, tourists illegally and privately picked the precious double lotus flower. In serious cases, it can also provide the corresponding means of

supervision and reporting. The specific process is shown in Figure 2.

As shown in Figure 2, it is first necessary to determine the capability of tourists. Through the establishment of the corresponding model, the subjective constraints are explored and used to discuss the relationship between input and output and represent it with a quantitative function [7–10], as shown in the following equation:

$$Q(T) = T(t)L^{\alpha}K^{\beta}. \tag{2}$$

In the above equation, $Q(t)$ stands for the actual output quantity invested by tourists in the period t; $T(t)$ stands for the technical level of tourists, environmental protection awareness, and so on; L stands for the labor force input by the corresponding environmental protection enterprises and training institutions for the purpose of cultivating environmental protection awareness; K stands for the investment capital theory of environmental protection enterprises; α and β are constants. $T(t)$ is obtained as follows:

$$T(t) = \frac{B - \text{techlnvest}(t)}{1 + B - \text{techlnvest}(t)}. \tag{3}$$

For the purpose of further simplifying the model, the input cost of the enterprise in environmental protection is simulated based on equation (4), in which C_1 and C_2 are constants:

$$\text{productCost} = C_1 \cdot Q(t) + C_2 \cdot L. \tag{4}$$

2.2. Coding Category. Through the collection, preprocessing, classification, and sorting of the data acquired, the samples are divided into two parts: samples for analysis and samples for the test [11–14]. The samples for analysis are used for the simulation of results, and the samples for the test are used to test the effectiveness of the method proposed in this study. With respect to the premise of analysis, it is necessary to encode the data effectively, which is carried out mainly in three aspects: open coding, spindle coding, and data analysis.

The first step is open coding. The so-called open coding refers to the whole process, in which the concept of questionnaire survey and data acquisition is used to represent the corresponding data [15–17]. In this study, it is first necessary to sort out, consolidate, and classify the behaviors of tourists that are subject to the influence of environmental factors and identify whether they are subjective factors or not, their level of education, the family, social environment, and whether their behaviors are simply imitation of others or induced by other factors. The analysis of the real responses in the questionnaires is carried out through combining word by word and consolidating the information effectively so as to extract the coding elements and obtain the preliminary result to be further analyzed. Through further optimization, analysis, and screening of the data results, the sets of processed data are formed accordingly, and these data sets are further namely abstractly to form data sets after open coding.

On the basis of open coding, further in-depth analysis is carried out in this study on the influencing factors, and 25 indexes are extracted accordingly. These indexes can be divided into 6 major categories, and the bar graphs of some indexes are shown in Figure 3.

After the analysis of the samples is completed, the verified samples are selected to carry out practical verification of the experimental method based on the theory to determine the effectiveness and feasibility of the proposed method and the reliability of the samples. The results of the verification suggest that the influencing factors are relatively fixed and highly correlated. Hence, the relevant indexes selected in this study can be used to carry out environmental protection evaluation appropriately and effectively.

3. Development of a Prototype System for the Simulation of Traffic Flow

3.1. System Design. On the basis of data analysis, the existing 3D software research foundation is combined [18–20]. In this study, a relatively mature OSG platform is selected to establish the model and construct the platform for simulation of the traffic flow in the scenic area. From the perspective of business process analysis, the system mainly includes data loading, data analysis, and data visualization, such as 3D simulation and modeling of the road network in a scenic area, which can be used to carry out microscopic simulation of the traffic flow on the roads in the scenic area. It should be noted that as the roads in the scenic area are dynamic, data processing, 3D visualization, and other features are provided. The software framework of the microscopic simulation prototype system for road traffic in the scenic area is shown in Figure 4.

(1) The microscopic framework for the traffic in the scenic areas is designed, simulated, and implemented in practice. Through the combination of big data, intelligent transportation, computer simulation, and VR/AR technology, 3D simulation modeling is carried out based on the microscopic traffic in the scenic area. At the same time, on the basis of data modeling, a model system for the microscopic simulation of traffic flow in the scenic areas is established. It adopts an open framework and is characterized by the operation across the platforms, extensible, portable, and other features. Users of the platform can add or delete the corresponding simulation models and analysis modules based on the location and traffic features of the scenic area. Meanwhile, the platform can also be used as auxiliary support for the government transportation department, and it can assist in intelligent traffic analysis and be used for road evacuation in scenic areas.

(2) *Analysis of the Parking of Scooters in an Environment with Full Coverage*. Combined with the features of the scenic area, the relevant international theories are combined to customize the related models and indexes based on the scenic roads, real-time traffic, and other aspects. At the same time, the relevant models can be fused into the microscopic simulation model of the scenic area. It should be noted that all factors

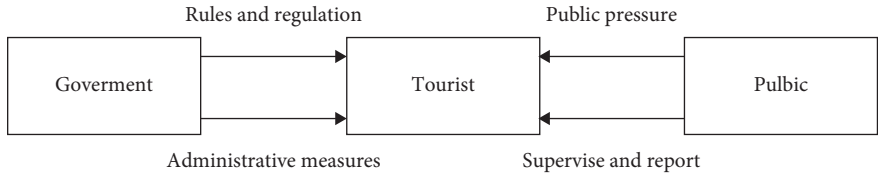

Figure 2: Interaction between the government, the public, and the tourists.

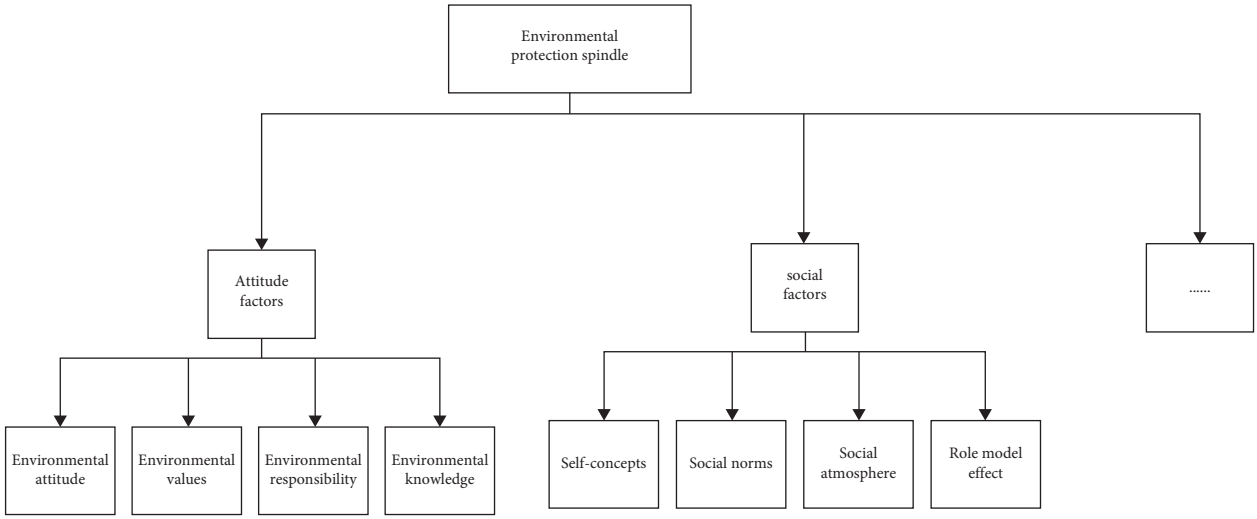

Figure 3: Theoretical model of factors that may influence the environmental protection behavior of tourist.

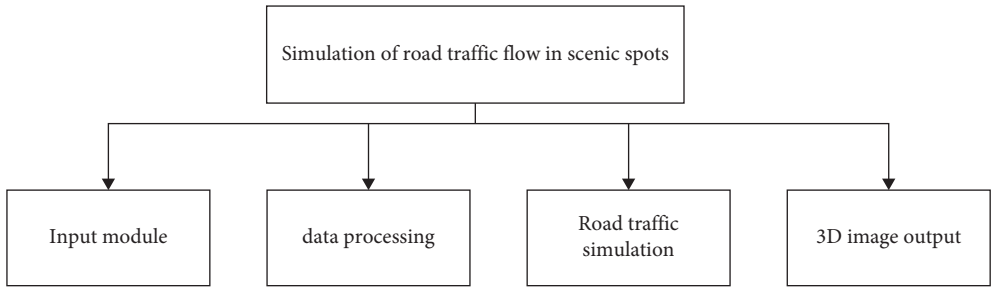

Figure 4: Software framework of the prototype system.

such as the number of tourists in the scenic spot, the emissions of scooters in the scenic area, the relative proportion of vehicle models, and the delays in parking can have a certain influence on the total emissions of pollutants from vehicles in the scenic area [21].

(3) *Management Analysis of Dynamic Resources*. In the microscopic 3D traffic simulation model for the scenic area, it is necessary to allocate resources to each vehicle in the scenic area and clarify their status at each moment in real time until the corresponding vehicles are no longer within the scope of the scenic area. If the configuration of dynamic resources is not optimized, 3D simulation will continue to occupy more and more computer resources, which can lead to a slower and slower running speed of the computer. Hence, it is necessary to optimize the configuration of dynamic resources to achieve sustained optimization of the dynamic resources, save the computation resources, and ensure the speed of 3D operation. In the practical process of 3D simulation, the vehicles are located in the scenic area, where the platform can allocate resources to the vehicles accordingly [22–25]. When the vehicles have left the scenic area, the system will release the corresponding computer resources at once.

In the practical modeling process of 3D data, high-definition and 3D object models are generated quickly based on the mature OSG platform. Subsequently, the corresponding textures are attached to establish the corresponding model for 3D data. On this basis, LOD analysis,

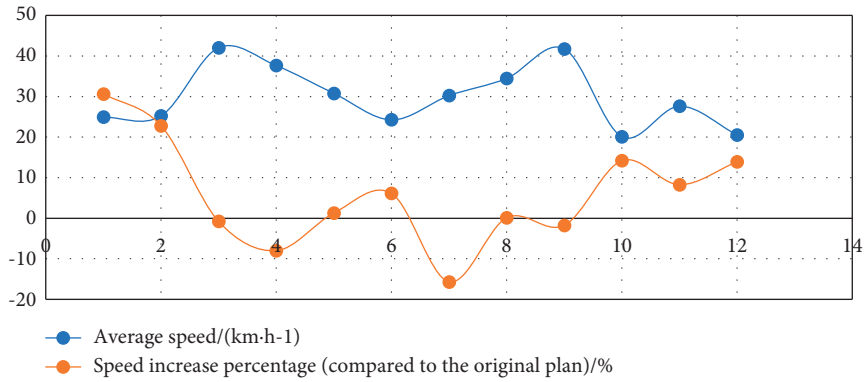

Figure 5: Traffic conditions at the intersection of the scenic spot during peak hours upon the change in the timing of the signal lights.

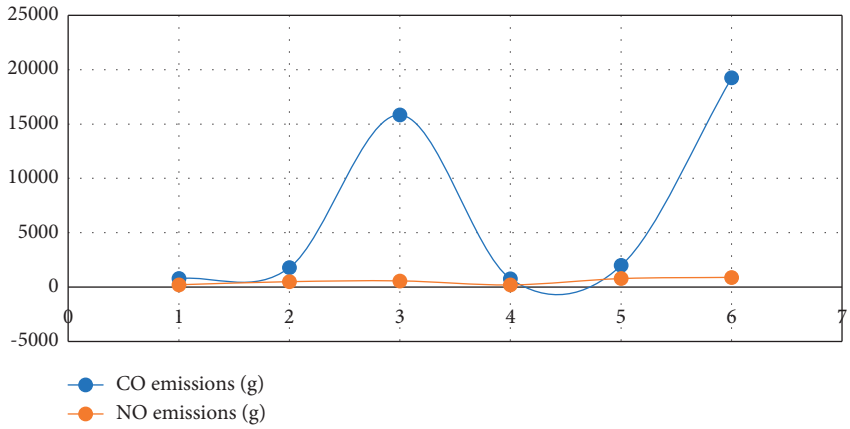

Figure 6: Comparison of vehicle emissions under different scenarios.

texture mapping, and other corresponding technologies are implemented by using the system to meet the requirements of 3D visualization. In the process of model establishment and utilization, online modeling of the 3D scene is carried out based on the corresponding open interface [26].

3.2. Simulation Application. After the 3D data are modeled, the road blockage and real-time vehicle operation during the holiday peak period of the scenic spot are simulated based on the developed microscopic simulation model for the traffic flow of the scenic spots and the corresponding pollutant emissions caused by motor vehicles at the intersection can be obtained at the same time.

The current status is analyzed through the simulation. In the east-west direction and the straight direction of the scenic spot, the speed of the vehicle flow is relatively slow, which is even less than 20 km/h. The possible reason is that there are excessive signal indications on the existing roads in the scenic spots, the corresponding interval of green light is relatively short, and there are relatively few roads. Under these conditions, congestion may occur in the scenic areas during peak periods of holidays and festivals. For the purpose of addressing this issue, combined with further communication with the signal lights and traffic control department, the corresponding interval is adjusted, and the data after the adjustment are simulated and calculated again. The effect after the adjustment is shown in Figure 5. From the results thus obtained, it can be observed that the congestion in the scenic areas during holidays and festivals has been dramatically improved [27]. However, as the duration of the green light in other directions has been extended, the driving speed of vehicles may be influenced to some extent.

The comparison of vehicle emissions under different scenarios when the simulation runs for 1000 s is shown in Figure 6. From the figure, it can be observed that (1) with the overall increase in vehicle speed, the traffic capacity of the intersection is increased, so is the total value of vehicle emissions. However, the average emissions per vehicle are slightly reduced. (2) Whether it is CO or NOx, small vehicles have the highest contribution to the total emissions, and the possible reason is that small vehicles often account for the largest proportion of vehicles running in the road network [28].

4. Conclusion

The constant advancement of the social economy has driven the continuous improvement of people's awareness of travel. In this study, the environmental protection behaviors are classified and sorted out based on the existing studies. The factors that may influence the environmental protection

behaviors of tourists are constructed, and the corresponding model is established for the analysis from 6 major factors, such as the subjective awareness of the tourists, the external environment, the habitual awareness, and the conditions. Finally, the OSG platform is used to construct the corresponding simulation model test. The results of the practice indicate that the proposed method has a certain level of effectiveness and can provide more targeted decision-making support for government departments. Based on the influencing factor model and conclusion analysis of tourists' environmental protection behavior, in order to effectively guide tourists to implement environmental protection behavior, relevant departments should consider multiple ways and means to publicize environmental protection when formulating policies and enhance people's psychological awareness of environmental responsibility and environmental protection (including tourism environmental protection). On the basis of traditional methods, we will continue to innovate the ways and contents of environmental education, such as WeChat, microblog, micro film, etc., expand the forms and contents of environmental education, advocate rationality and comfort, and enhance tourists' awareness of environmental protection, so as to promote the transformation of their environmental behavior.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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