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Retraction

Retracted: Regulation Mechanism of Spatial Capacity of Tourist Resources in Scenic Spots Based on Internet of Things Technology

Complexity

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] X. Xie and W. Zhang, "Regulation Mechanism of Spatial Capacity of Tourist Resources in Scenic Spots Based on Internet of Things Technology," *Complexity*, vol. 2021, Article ID 3934894, 12 pages, 2021.

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Research Article

Regulation Mechanism of Spatial Capacity of Tourist Resources in Scenic Spots Based on Internet of Things Technology

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At present, it is urgent to solve the problem of scenic area tourism environmental capacity. This paper analyzes the causes of congestion and overload in scenic spots and then points out that the methods to solve the problem are capacity restriction and flow control. This paper first calculates the spatial capacity of various tourism resources in a scenic spot by using mathematical model and then studies the intelligent spatial management model of tourist flow in the scenic spot based on the Internet of Things technology. Based on the Internet of Things technology, the spatial capacity control platform of tourist resources in scenic spots built in this paper can realize the structure analysis of peak forest of tourist flow in scenic spots and the fractal and fractal dimension analysis of tourist flow and determine the spatial and temporal threshold of tourist flow control in tourist destinations. Through capacity restriction and flow regulation, tourists can be scientifically channelled and distributed, which can greatly reduce congestion and overload, enhance tourist experience, and improve tourist satisfaction, so as to promote the sustainable development of the scenic spot.

1. Introduction

With the development of national economy and society, the scale of tourism market is expanding rapidly, and tourist attractions are springing up like bamboo shoots after a spring rain. Over the past 30 years since the reform and opening up, China's tourism industry has developed rapidly with an average annual growth rate of more than double digits. The increasing number of residents traveling leads to the problem of congestion and overload in tourist attractions. Especially during the annual "National Day" Golden Week, domestic residents travel on a large scale, which makes the tourist flow surge in some famous 5A tourist attractions and the scene is extremely hot. At present, the number of scenic spots with "intelligent" equipment and technology is very limited, and the construction of smart scenic spots has a long way to go. Although many scenic spots have begun digital and intelligent construction and made some progress, they are not many that can really be put to use and achieve remarkable results. The information and intelligent construction of scenic spots fails to keep up with the pace of economic development, and the management lacks effective means to predict or even improve the overload of scenic spots, which objectively also leads to the problem of congestion and overload. More and more tourists are flooding into the scenic spots, causing greater load bearing pressure and security risks for the scenic spots. In order to effectively deal with this problem, scenic spots must implement flow control, publish the approved maximum carrying capacity, and formulate and implement flow control programs, under the guidance of laws and regulations, by adjusting the stay time of tourists, diverting tourists, and other measures, scientifically regulating the number of tourists, to explore the problem of tourism environmental capacity of scenic spots, to maintain the sustainable development of scenic spots.

The Internet of Things has just seen the emergence of a new industry in recent years, and through the combination of information sensing equipment and information network, it will have a network connection object and to expand, through information network, the object can be accurate positioning, tracking, monitoring, and other related functions, not only existing in between people and objects, but also existing between the objects. The application of Internet of Things technology can be generally divided into three aspects. The first aspect is perception. Through various advanced technologies, objects are positioned, and information is obtained. Secondly, the information network is connected, and the object is placed in the Internet area for capture. Finally, the information network of the captured object is integrated and analyzed through various intelligent means such as cloud computing, and then various operations of the object are completed. Capacity relates to the natural environment and the quality of tourist experience. Capacity research is to seek a dynamic balance between environmental protection and tourist experience. A reasonable capacity can minimize the damage to the natural environment without reducing the quality of tourist experience. Capacity restriction, as the name implies, is to limit the number of tourists in the scenic area by certain means. According to the author, capacity should be divided into global and local kinds [1]. Global capacity, which refers to the general sense of the tourism environment capacity, is for the entire scenic area. The overall capacity limit means that the number of tourists received by a scenic spot shall not exceed the maximum carrying capacity approved by the competent authority of the scenic spot. Flow control means scientific diversion, navigation, and guidance of passenger flow, so that tourists can be evenly distributed and orderly exchanged in the scenic spot, so as to eliminate the overloading of scenic spots as far as possible and achieve the load balance of the whole scenic spot. It is difficult to model tourism system involving tourists' recreational behavior by traditional mathematical analysis method, but computer simulation is a good method to study this complex social system. In this way, on the premise that the total number of tourists in the scenic spot is certain, local congestion and overload problems must be alleviated. In order to realize flow regulation, a mature intelligent management system of spatial and temporal distribution is needed, which involves four steps: information collection, information transmission, information processing, and information release. At present, information collection mostly adopts Internet of Things technology, namely, RFID, GPS, infrared ray, etc., information transmission mostly adopts wireless communication technology such as GPRS, 3G, mobile AD hoc network, etc., and information release adopts LED display, mobile APP, or broadcast, etc. As for information processing, how to guide tourists according to the actual situation, or equivalent, how to make decisions or recommendations, is the key to realize the intelligent system of space-time diversion.

With the increasing demand for tourism, the number of people crowded in holiday scenic spots has become normal, especially the problem of capacity overload in scenic spots with high visibility and superior location. However, there are no good measures to solve the capacity problem at present, and the study of effective measures to regulate the capacity of scenic spots has become an important topic for the development of tourism.

2. Related Work

Since the concept of tourism capacity was put forward, scholars have put forward several capacity indicators of natural environment and human environment, and many scholars have conducted extensive research on the concept and calculation method of tourism environmental capacity. Shi [2], on the basis of discussing the tourism capacity, specifically analyzed the current situation of the tourism capacity of the Summer Palace and made corresponding calculation. The concept system and measurement of tourism capacity are then put forward systematically. Case studies on tourism capacity are extensive. Wenling [3], Yao [4], Tian [5], and other scholars have carried out relevant studies on the spatial capacity of tourist attractions. Many scholars have made some improvements and amendments to the measurement methods of environmental capacity of different types of scenic spots. Yang [6] summarizes the research results and characteristics of tourism environmental capacity at home and abroad, evaluates the traditional measurement formula of tourism environmental capacity widely used in China, points out the defects of the traditional formula, and puts forward the revised formula of tourism environmental capacity and its applicable scope. Wang [7] pointed out the error of the turnover rate in the general algorithm. Virtual tourists appeared in the calculation, which led to the calculated value much higher than the actual value and often greatly overestimated the capacity value. Therefore, a new algorithm of turnover rate was proposed to make the calculated value close to the actual value of PUSL. Zhu et al. [8], aiming at the defects of the calculation method of traditional tourism environmental capacity, revised the traditional calculation formula of tourism environmental capacity by analyzing the characteristics of the formula and, by comparing the differences between the revised formula and the traditional formula, proposed the applicable scope and rationality of the revised formula P91. Gao [9] pointed out that the traditional model did not consider the time and space distribution of tourists in the scenic spot is not balanced problem, therefore, on the basis of predecessors' research. Guo [10] discusses the problem of tourism space capacity calculation. According to the behavior of tourists, it analyzes the factors that should be considered in the calculation of the turnover rate with diagrams and proves the theoretical defects of the total capacity calculation method from the mathematical point of view and puts forward a small algorithm. Overall, Chinese scholars' research on tourism capacity focuses on measurement and regulation strategies. The control of tourism capacity is more reflected in the adjustment of tourism supply perspective and the restriction of tourists' behavior and pays less attention to the quality of tourist experience.

With the concept of sustainable tourism development becoming popular, the research on tourism environmental capacity and carrying capacity, as an important basis and carrier for sustainable regional tourism development, has become one of the hot topics in domestic and international tourism research in recent years. Wei [11] believes that the optimal environmental capacity of a tourist area aims at the maximum number of tourists that can be accommodated in a tourist site under the premise of ensuring the tourist effect. Shao [12] believes that tourism environmental capacity is a conceptual system without special reference. According to the attributes of capacity, it can be divided into basic capacity and nonbasic capacity. The latter is the result of the former's concretization and extension in time. Among them, the basic capacity is divided into five kinds, and the nonbasic capacity is divided into three kinds. At the same time, a detailed and fruitful work has been done on the measurement of the mathematical model of tourism environmental capacity. Liu [13] has called tourist environment capacity the tourism environment carrying capacity and defined the tourism environmental bearing capacity as follows: in a certain environment and existing state of structure combination is not harmful to the contemporary and future changes in the premise of tourism destination in a certain period which can withstand the number of tourists. Li [14] also believes that tourism environmental capacity is tourism environmental carrying capacity. Regardless of the controversy, the research on tourism environmental capacity and tourism environmental carrying capacity is still a very active direction in current tourism environmental research. Qin [15] conducted a preliminary study on the comprehensive evaluation index system of ecotourism environmental carrying capacity in nature reserves.

3. Design of Spatial Capacity Control Platform of Tourist Resources

3.1. Construction of an Intelligent Spatial Capacity Control Platform for Tourism Resources in Scenic Spots. Spatial capacity intelligent control platform is an important management method that combines people (tourists and employees) in the scenic spot with things (forest, historic sites, geology, etc.) and Internet of Things technology. Its connotation is mainly reflected in the following aspects: First is comprehensive and timely perception of all spatial states of the scenic spot through Internet of Things; second is the visual management of scenic spots. Communication technologies such as video monitoring are used to integrate tourists and staff into the intelligent scenic spot platform, and visual management of the scenic spot is realized through timely gathering of scenic spot management information. Thirdly, using the advantages of scientific management and information technology to change the organizational structure of scenic spots, they change the disadvantages of slow information transmission and long running time of scenic spots. The fourth is to use information technology to monitor the emission of toxic substances such as pollution gases in the scenic area, take timely measures to promote the scenic area to achieve ecological energy conservation and green environmental protection, and ensure the sustainable development of social economy in the scenic area.

As for the research on tourist management in scenic spots during peak periods, it reached its peak in foreign countries from 1960s to 1980s, and the nature of "acceptable limit" and "controllability" of tourist capacity was gradually recognized by researchers. LAC (Limits of Acceptable Change), ROS (Recreation Opportunity Tree), VIM (Tourist Impact Management), VERP (Tourist Experience and Resource Conservation Theory), TOMM (Tourist Organization Management Model), and many other scenic spot management tools began to appear [16, 17]. Based on sorting out the theories of the abovementioned scholars [18], the following management steps are proposed: conducting tourism market survey of scenic spots, including tourism environment survey and tourist characteristics survey of scenic spots, as well as detailed investigation of environmental resources status and influencing factors of scenic spots. The tourist behavior of scenic spots is analyzed, and the tourist capacity of scenic spots is accurately measured. At the same time, combined with the forecast analysis of tourist flow, the regulatory approaches and means adopted are analyzed and implemented through the decision-making of regulation and control, and the results are fed back. The regulatory process is shown in Figure 1.

Scenic area capacity estimation is the first step, followed by real-time flow control of the scenic area. First, operators or managers of major scenic spots should calculate the maximum capacity of their scenic spots to accommodate tourists according to the methods mentioned in the above literature. Secondly, to achieve the purpose of capacity control, scenic spots must gradually change from the traditional way of selling tickets on-site to the way of preselling tickets and booking in advance. This is because it is difficult for the traditional way of selling tickets at scenic spots or travel agencies to accurately grasp the actual number of visitors to the scenic spots every day. On the contrary, the use of online reservations can be a good way to know the number of visitors every day. In this way, tourists can travel according to their scheduled time, and scenic spots and cultural relics protection units can also control the flow of people according to their scheduled time and provide more detailed and effective services. However, considering the level of knowledge of the Chinese people, not all tourists have the awareness of booking in advance, so in the transition period, it is also needed to use the traditional on-site ticket sales in combination.

In practical application, before the opening of the scenic spot every day, the number of tickets booked through electronic channels should be counted first, and then the maximum number of tickets sold on the day should be published according to the total capacity of the scenic spot. When the number of tourists who booked, presold tickets, and the number of tourists who purchased on the spot reach the maximum carrying capacity of 80%. It should be started including issuing early warning (through far and near public media and scenic spot channels, timely release of scenic spot flow in advance), traffic control (targeted launch of traffic capacity dynamic adjustment plan, through the surrounding road control, parking control in the area, bus scheduling control, and other measures to reduce the number of

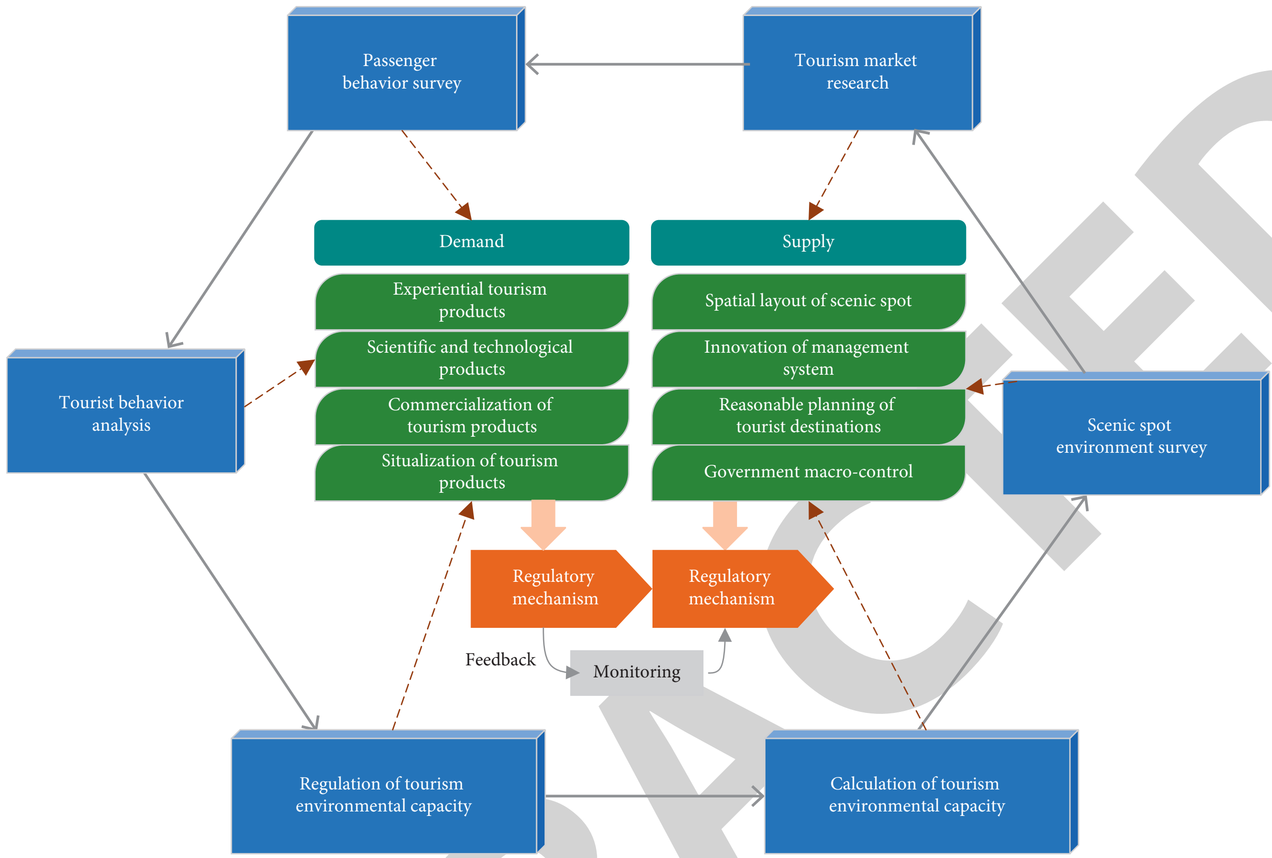

Figure 1: Flow chart of scenic spot management and control.

tourists), entrance restriction (reasonably design the way and way for tourists to wait in line, reduce tourists at the entrance of scenic spots by means of discount compensation and extension of validity period), and other measures to control the tourist flow and immediately stopping selling tickets.

This platform has established a mature intelligent management system of spatial and temporal distribution, which involves four steps: information collection, information transmission, information processing, and information release. At present, information collection mostly adopts Internet of Things technology, namely, RFID, GPS, infrared ray, etc., information transmission mostly adopts wireless communication technology such as GPRS, 3G, mobile AD hoc network, etc., and information release adopts LED display, mobile APP, or broadcast, etc. As for information processing, how to guide tourists according to the actual situation, or equivalent, how to make decisions or recommendations, is the key to realize the intelligent system of space-time diversion. This system adopts the tourist independent diversion mode, which means that tourists can independently choose their own routes from several recommended routes or according to the density of different scenic spots through the information release of the spatiotemporal diversion management system, so as to achieve the purpose of diversion indirectly. According to the tracking information, the data centre can count the number of tourists arriving at each scenic spot in real time and then publish it to the LED display at each intersection through the 5G network, prompting tourists to choose their own travel routes. This platform is combined with LED, broadcasting, and mobile APP: set up LED electronic screens at obvious places such as entrances, signboards, intersections, and markers in scenic spots; broadcasters are set up at tourist gathering places in scenic spots. By programming and designing a shunt navigation APP application, tourists can download the APP application to their mobile phones when entering the park, so that they can learn the geographical distribution map of each scenic spot and obtain the load situation of each scenic spot in real time by refreshing.

3.2. Composition of Regulatory System. Through revealing the connotation of tourism environmental capacity regulation, it can be found that the regulation is a relatively complex system engineering. In order to achieve the control goal smoothly, it needs the coordination and cooperation of various parties, and it also needs to follow and operate in accordance with certain procedures. Refer to current academic mainstream practice; the specific flow of tourism environmental capacity regulation can be summarized as follows: first, see the destination environment resources, facilities, economic, social, and other various aspects of basic conditions detailed investigation, and according to its particularity take appropriate measurement methods of environmental carrying capacity to make accurate calculation, get specific values; secondly, on the basis of obtaining specific values, the types and suitability of recreational activities in the tourist destination are analyzed, and the corresponding index system is established by selecting indicators such as natural environment ecology, social and economic development, and tourists. Then, the established index system is closely monitored, and the monitoring results are analyzed. At the same time, the current situation of tourist flow in the tourist destination should be predicted and analyzed to judge the current or future tourism capacity problems and their severity, and the specific regulation (or crisis treatment) approaches should be given for decision-making analysis. Finally, the specific control channels (or crisis management mechanism) are implemented on the ground, and the problems encountered in the implementation process and the implementation results are timely fed back to facilitate the decision-making system to respond in time and make corresponding adjustments. See Figure 2 for the specific process.

By revealing the connotation of regulation and sorting out the regulation process, the author believes that the regulation of tourism environmental capacity is actually a complex system, and it is more appropriate to call it the regulation system of tourism environmental capacity. It consists of several subsystems, and each subsystem runs through different regulation process.

The supporting collaborative system is the guarantee system for the smooth operation of the environmental capacity regulation system of the tourist destination, which mainly refers to the various resource supports that can guarantee the normal operation of the environmental capacity regulation system of the tourist destination and the coordination among them. Tourist capacity of the complexity of the control system determines the impossible monomer, needs the supply of various resources and allocation, and mainly involves the human resources, capital investment, information technology, the monitoring method, and resource elements such as policies and regulations, and these resources are auxiliary to each other, with cooperation, mutually playing their biggest role.

Based on the foregoing elaboration on the composition of the environmental capacity regulation system of tourism destination, it is found that these subsystems are interrelated and closely related, and they are all indispensable components of the overall system. Only when they cooperate can the overall system give full play to its maximum effectiveness. In addition, these subsystems correspond basically to the regulatory process (see Figure 3), throughout which they provide intellectual support for the normal operation of the process. Although the environmental capacity regulation system of tourism destination is complex, it still has certain regularity. As long as we grasp some regularity, we can simplify the complexity and grasp the core and essence of environmental capacity regulation.

3.3. Theoretical Basis and Computational Model. Li [19] summarized the achievements and characteristics of studies on tourism environmental capacity both at home and abroad and pointed out that there is a fixed functional relationship between the area of scenic spots and the ecological passenger capacity of scenic spots. In addition, due to the different environmental states in different periods, the capacity of ecological passengers is also different. Because the scenic spot is a complex large-scale scenic spot, including mountains, canyons, artificial built, and a series of scenic spots, different types of scenic spots on the ecological requirements are also different. For some areas that have been widely visited by tourists, the ecological requirements are not as high as those for the deep zone, so the ecological passenger capacity is relatively low in the ecologically sensitive areas and high in the areas that are widely visited by tourists. Based on this, four factors related to the ecological tourist capacity R of the scenic spot can be extracted: the tourist area of the scenic spot S, the period of the scenic spot environment T, different types K, and different ecological requirements D.

Set the function relationship between the above factors and the ecological passenger capacity of the scenic spot as F; then $R = f(S, T, K, D)$, as shown in Figure 4.

Point A in Figure 4 represents the optimal scale of ecological passenger capacity; that is, each factor has a smaller and smaller effect on the increase of ecological passenger capacity. When the ecological factor acts on the effect of passenger capacity, the increase of ecological factor input causes the decrease of the increase of ecological passenger capacity. The ecological passenger capacity represented by this critical point is the optimal size of the tourist capacity of the scenic spot.

If a region can carry out tourism activities, the decline of resource conditions cannot be avoided. In order to maintain the environmental authenticity of the Three Gorges Scenic Spot, this study puts forward a model affecting the degree of authenticity; that is, environmental authenticity is $f(r, t, e)$ [20], where r is the ecological passenger capacity of the scenic spot, and the greater the ecological passenger capacity is, the lower the authenticity of the environment is; t is time. The increase of time can bring the increase of authenticity, but it does not always increase at a fixed speed. The increase of time should make the increase of environmental authenticity less and less. This is the optimal retention point for the degree of authenticity for time determination.

Taking a national 5A scenic spot in the development stage of tourism life cycle as an example, the resource of the scenic spot is under increasing pressure during the peak season of tourism. The average stay time of tourists in the scenic spot is 4.5 hours. In one unit opening time, tourists can visit the whole scenic spot. The stay time of tourists in the scenic spot is less than one unit opening time. The following model [21–23] can be used to calculate the spatial capacity of various tourism resources in the scenic spot.

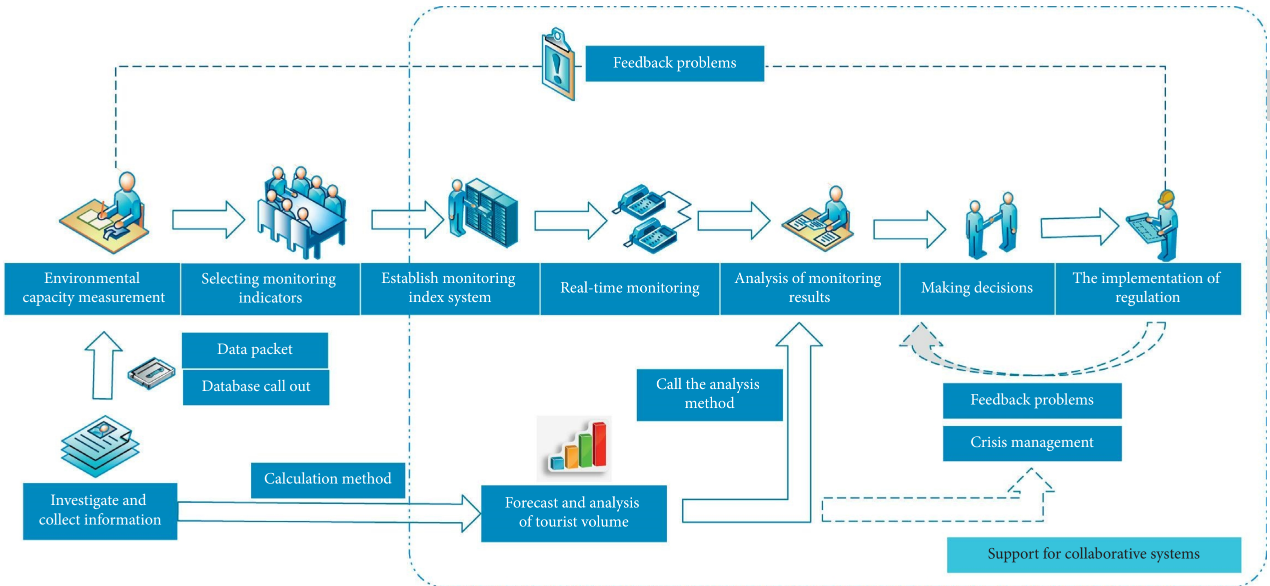

Figure 2: Control flow chart.

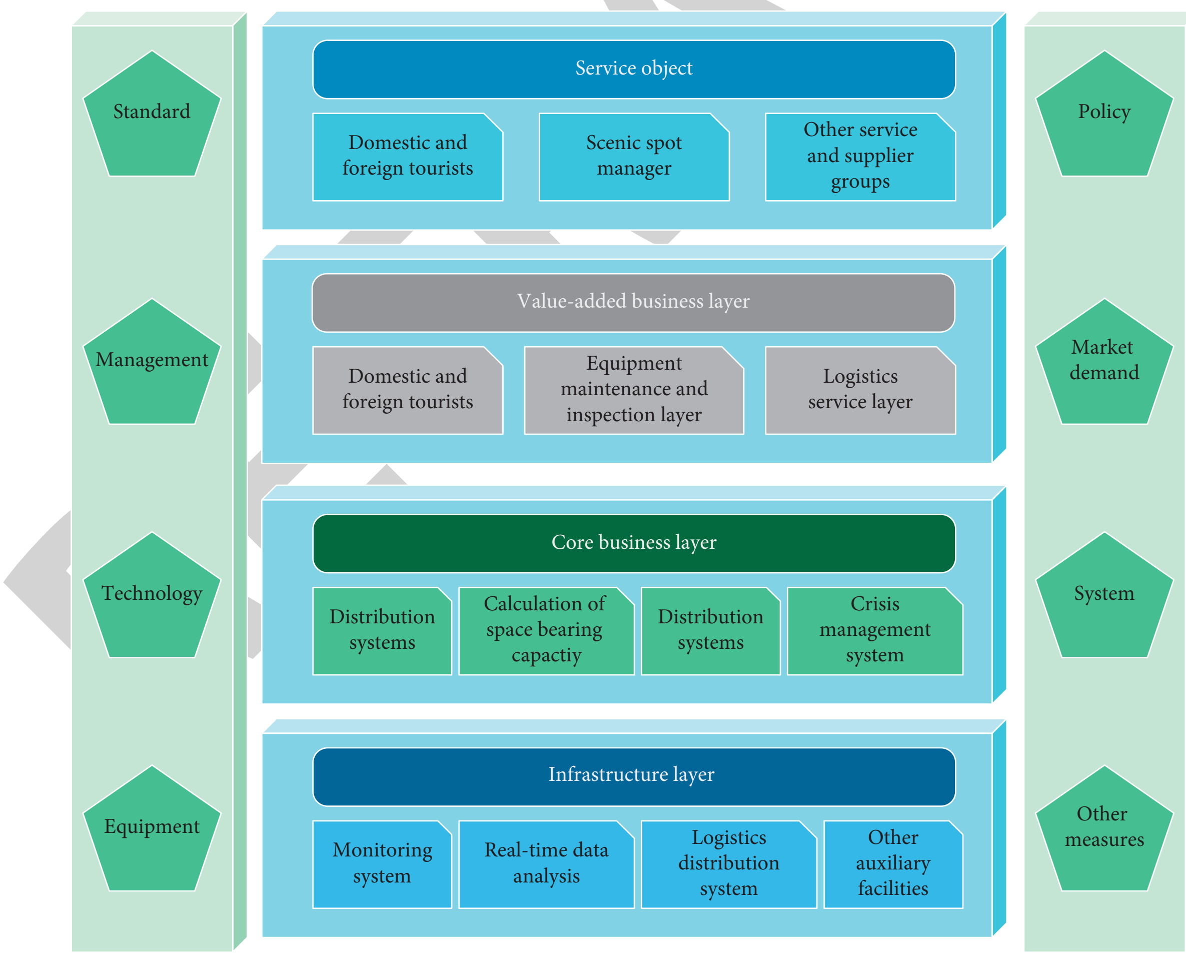

Figure 3: Scenic spots tourism resources space control platform system.

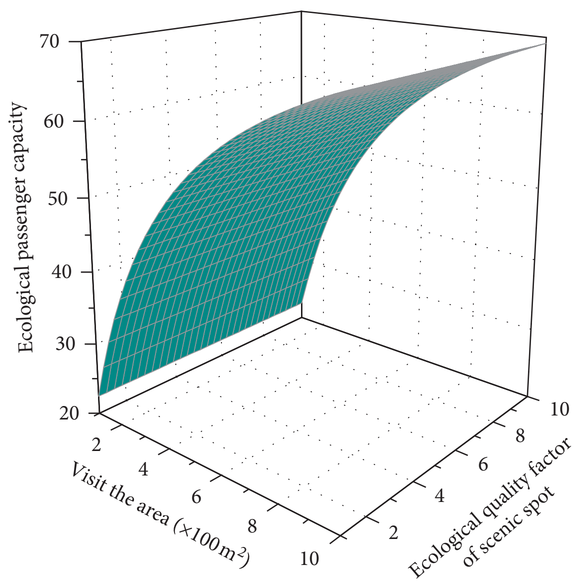

Figure 4: Optimal scale model of scenic spot ecological passenger capacity.

When $T_0 \leq (T/2)$, $T = nT_0 - 1$, and then

$$Cp = \int_t^{T_0} p^{-1}(t)\mathrm{d}t, \tag{1}$$

$$\begin{aligned} Cp &= Cq, \\ Cs &= \int_{t_0}^{t_0+T_0} p^{-1}(t)\mathrm{d}t - C_q, \end{aligned} \tag{2}$$

where C_p is the time-limit capacity (number of people) of the whole scenic spot resources based on practice; C_s is the spatial limit daily capacity (person-time) of the whole scenic area resources based on practice; t is the daily opening time (hours) of the scenic spot; T_0 is the average stay time of tourists in the whole scenic area (hours); t_0 denotes the opening time of the scenic spot; t_1 represents the time point of the first tour cycle after the opening of the scenic spot; t_k indicates the point at which visitors are banned from entering the scenic area (theoretically coinciding with the point at which visitor numbers begin to decline); C_q is the theoretical limit capacity of the whole scenic spot resource space at the time point (calculated by the general formula); $p(t)$ is the time density function of the limit number of tourists entering the scenic spot. The scenic spot is a typical one-way tour scenic spot. Tourists visit each scenic spot in turn along the only main road. In order to prevent congestion in each scenic spot, theoretically, the unit time flow of tourists in each scenic spot must be the same, which requires the same number of tourists entering the scenic spot per unit time, so

$$p(t) = \frac{C_q}{t + T_0}, \tag{3}$$

$$Cp = \int_t^{T_0} \left(\frac{C_q}{t + T_0}\right)^{-1} \mathrm{d}t, \tag{4}$$

$$Cs = \int_{t_0}^{t_0+T_0} \left(\frac{C_q}{t + T_0}\right)^{-1} \mathrm{d}t - C_q. \tag{5}$$

However, when $p(t)$ is the time density function of the reasonable number of tourists entering the scenic spot, and C_q is the reasonable time point capacity of the whole scenic spot, then C_p is the reasonable time point capacity of the whole scenic spot resource space based on practice, and C_s is the reasonable daily capacity of the whole scenic spot resource space based on practice.

4. Application of Internet of Things in Intelligent Resource Management of Scenic Spots

The Internet of Things collects data through the perception layer, transmits data and analyzes data through the network layer, and guides social practice through the application layer. Therefore, combining with many technologies of the Internet of Things to guide the construction of smart scenic spots meets the needs of current social development.

The construction of smart scenic spots is mainly applied in the following aspects:

(1) Internet of Things technology can provide information services for intelligent scenic spots [24–26]. The intelligent system collects information by using information acquisition technology at the front end of the information system of intelligent scenic spots, radio frequency identification technology (RFID), sensors, camera video acquisition terminals, microwave traffic flow monitoring, and other information acquisition technologies [27, 28]. Data transmission is done through communication optical fiber network and other related servers, network terminal equipment. Access and operation of resources are realized through the information infrastructure of the Internet of Things [29], data exchange and information transmission are guaranteed, and the operation of business system and the operation of the whole smart scenic spot are supported. The scenic spot can use the collected information to instantly publish the relevant information of the scenic spot through the LED information release screen, so that tourists can grasp the relevant information in time and choose the tour route and tour time. At the same time, the use of wireless network communication technology allows tourists in the scenic spot to achieve wireless Internet access within the scenic spot and grasp the various aspects of information they care about; In addition, through the electronic touch screen, the tourist information, weather, accommodation, transportation, and other related information of the scenic spots can be released to ensure the smooth development of tourist activities.

(2) Internet of Things technology can provide intelligent tourism system for smart scenic spots

For the personalization of tourism activities, where more and more tourists choose self-help tour and self-driving cars, this part of the tourism product supply department needs to provide the corresponding product, especially due to the lack of the understanding of foreign cultures, transportation, and other visitors, which leads to many tourist who cannot visit attractions or are restricted by time. In addition, even within the scenic spots, because some scenic spots cover a large area and have complex spatial layout, even if tourists have paper maps, the complex terrain cannot well protect the needs of tourists, which will make the whole tourist process become boring and full of regrets. Therefore, it is very necessary to use the Internet of Things technology to provide tourists with an intelligent tour system inside and outside the scenic spots. The scenic spot tour system mainly uses RFID technology and voice synthesis technology to provide tourists with intelligent self-service guide explanation service, using GIS technology and radio frequency to guide tourists and vehicles, to meet the needs of tourists in a short period of time to visit the scenic area. GIS is used to store and transmit the map data of scenic spots for tourists to consult and inquire at any time, so as to create an electronic map to meet the needs of tourists.

(3) Internet of Things technology can provide a marketing virtual experience system for smart scenic spots

Smart scenic spots use panoramic photos, global eyes, RFID sensors, and other technology systems for real-time transmission of scenic landscape, weather, etc., through the front display of natural and cultural scenery features of the scenic spot, to stimulate tourists' tourism motivation, so as to attract tourists to carry out tourism activities [30]. Using virtual reality technology, to build a virtual 3D tourism environment, can be done in case of damage of the scenic spot as it will let visitors go through virtual experience without getting in the scenic spot and help with this scenic area virtual experience marketing; at the same time, the virtual technology on the ecological fragile areas and limited environmental capacity of the scenic spot is particularly significant, through virtual display and the experience of scenic spots. It can provide a way to develop ecotourism in areas where nature reserves, forest parks, geoparks, and other natural landscapes are main attractions.

(4) Internet of Things technology can provide intelligent monitoring and positioning system for smart scenic spots.

Smart scenic spots integrate the video system with RFID identity tracking system and develop a staff trajectory positioning system using wireless network to track and manage the designated positions of staff in the scenic spots and conduct real-time voice messages with the staff.

Interest and communication. In addition, in the electronic ticket system, the intelligent chip will be combined with the electronic ticket, so that the electronic ticket has the positioning function. Specifically, smart scenic spots can use cloud computing, GIS, and other technologies to forecast and report the tourist flow according to the spatial and temporal distribution of tourists in the scenic spots. The tourists stay time and other data are used to forecast the probability, period, and degree of congestion of important scenic spots in the scenic area, so that the scenic area can conduct real-time control. In addition, for traffic and roads, scenic spots can use the Internet of Things and other technologies, such as the use of intelligent ticket and license plate recognition technology, to master the number of tourists and the tourist capacity of the scenic spot, with real-time control. At the same time, the Internet of Things and GIS technology are used to monitor the tourism traffic in real time, find out the hidden danger in time, and forecast the passenger flow. The effective positioning of tourists by using the extranet technology can help tourists avoid getting lost in the process of pursuing personalized tourism and being unable to be rescued in time. Besides, tourists can use the Internet of Things technology to find supplies and shelters in time and reduce the probability of safety accidents for tourists.

4.1. Test Experiment of Spatial Regulation of Scenic Spot Tourism Resources. By importing the statistical data of some scenic spots into the control system database, the structure analysis of tourist peak forest, the fractal dimension analysis of tourist flow, and the spatial and temporal threshold of tourist flow control in tourist destinations can be realized.

4.1.1. Structure Analysis of Tourist Flow Peak Forest in Scenic Spot. Tourist traffic years changes included in "week," "month," and "season" as the unit for time, such as multiple time scales, and the change rule of the micro-time-scale traffic analysis often require stratification; therefore, this research adopts the layered method, and time of a scenic spot domestic tourism traffic hoodoo structure is analyzed.

Based on the daily statistical data of inbound tourist flow in the scenic spot in 2019, the peak forest structure chart of inbound tourist flow was drawn to further reveal the characteristics and rules of the structural change of inbound tourist flow in the year. According to the characteristics of climate change and tourism off-season, the key nodes are marked on the figure, as shown in Figure 5.

We can see from Figure 5 that the tourism traffic years changes in general are "M" type distribution characteristics, with two main peaks in the corresponding 4, the tourist season in May and October is the peak tourist season, traffic is in high volatility, including 4- or 5-month season averaging more than 2800 people, and in a day of traffic in October peak season the traffic averages more than 3100 people. The annual variation of inbound tourist flow has obvious fractal characteristics. Numerous irregular abrupt peaks or concave valleys in the figure form the structural

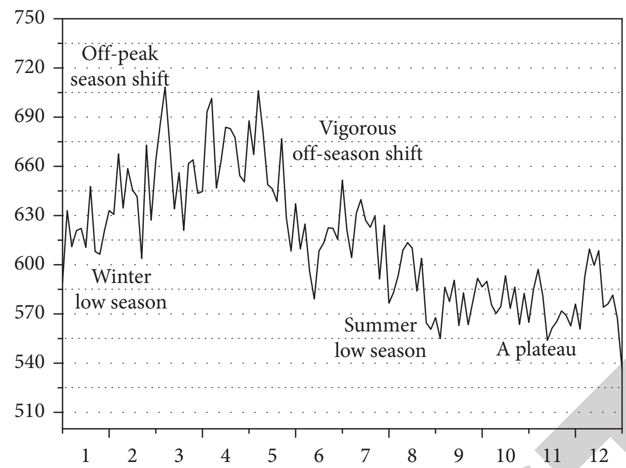

Figure 5: Annual variation of tourist flow in scenic spots in 2019.

change of the peak forest of inbound tourist flow. The change of the peak forest structure of inbound tourist flow includes the mutual transformation process of the two peak seasons and shows the characteristics of "similarity," "symmetry," and "antisymmetry" in different periods. Among them, March and September are the transition period of inbound tourism from off-season to peak season, and the change trend of passenger flow during this period is similar. June and November are the transition period of inbound tourism from peak season to low season, and the variation trend of passenger flow in these two periods is also similar. Both peak season in May and peak season in October fluctuate at a high level, and the change trend is similar, and the change trend of inbound tourist flow in May and October is symmetrical. However, the transition period of inbound tourism from off-season to peak season and from peak season to off-season is antisymmetric.

According to the statistical data of passenger flow of this scenic spot from 2019 to 2020, the seasonal variation trend charts of passenger flow of two typical scenic spots are drawn, as shown in Figure 6.

As can be seen from the figure, the inbound tourist flows of the two selected scenic spots have obvious seasonal variations within the year. The tourist flows in spring, summer, and autumn are large, while the tourist flows in winter are the smallest, showing a trend of spring >, autumn >, summer >, and winter. Among them, the inbound tourist flow in spring and autumn accounted for 67.70% of the year, and the inbound tourist flow in winter accounted for 9.24% of the year. The characteristics of domestic tourism are also obvious in terms of seasonal variation. The first scenic spot shows the variation characteristics of summer >, spring >, autumn >, winter, and the second scenic spot shows the variation characteristics of summer >, autumn >, spring >, winter. The average monthly index of domestic tourist flow in spring, summer, and autumn was more than 10%. The average monthly passenger flow index was only 1.86% in winter. Investigating its reason, spring, summer, and autumn climate is relatively mild and suitable to carry out tourism activities; in addition, the annual holiday is more concentrated in the spring, summer, and autumn (such as the tomb-sweeping day in April, May, the international labor day, Dragon Boat Festival in June, the Mid-Autumn festival in September, October National Day, etc.), resulting in the first three quarters of traffic, and the winter climate is relatively cold, coupled with fewer holidays (only New Year's Day and Spring Festival), thus forming a sharp decline in passenger flow.

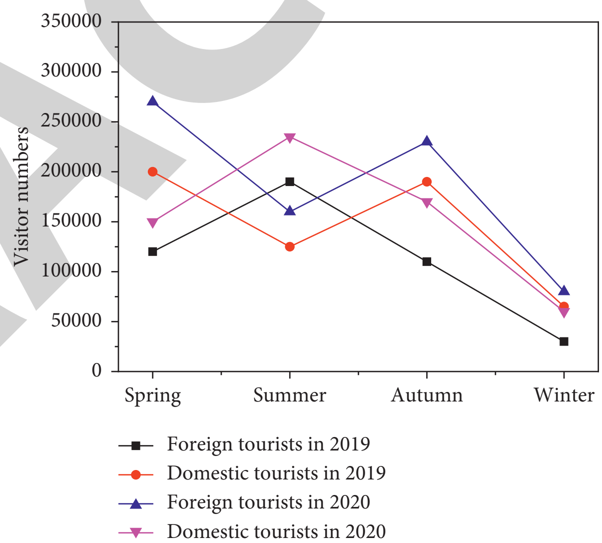

Figure 6: Seasonal variation of tourist flow in a scenic spot.

4.1.2. Fractal and Fractal Dimension Analysis of Tourist Flow. This study adopts the statistical data of passenger flow in 2019 and 2020 to analyze the time fractal dimension of inbound tourist flow and domestic tourist flow in a scenic spot and further analyzes the difference of time fractal dimension of inbound tourist flow and domestic tourist flow.

Through the previous research, it is found that the inbound tourist flow has obvious fractal characteristics, which is significantly affected by the weather and climate change, and the characteristics of the off-peak season throughout the year are also significant. However, there is basically no rule to follow in terms of the weekly and monthly changes of the inbound tourist flow. The annual variation of domestic tourist flow also has obvious fractal characteristics, and the seasonal variation, monthly variation, and weekly variation have obvious rules to follow, and the change is continuous. From the above analysis, it is easy to find and grasp the variation characteristics of inbound tourist flow and domestic tourist flow in a year, which is basically consistent with the empirical analysis. However, it needs to be further analyzed whether there is regularity in different micro-time-scales within a year. Wavelet Toolbox decomposes the annual changes of inbound and domestic tourism flows at multiple time scales to further reveal the annual changes of inbound and domestic tourism flows. The biggest advantage of wavelet analysis is to separate the trend item, periodic item, and random item in the time series and separate each item according to the time scale size, so as to simplify the complex phenomena and problems. In this paper, a one-dimensional wavelet transform of inbound tourist flow in the scenic area is carried out by using the plus 3 wavelet of Daubechies wavelet system. The reason why D3 wavelet is chosen is that it has a tight support set and has good functions of decomposition, reconstruction, and local positioning of the decomposed signal. D3 wavelet is used to decompose the inbound tourist flow into four layers, namely, low frequency and four high frequency layers D1, D2, D3, and D4, as shown in Figure 7.

We can see from Figure 7 the entry tourism traffic time series after wavelet transform, and according to the different time scale size changes it into different signal part; low frequency signals are large time scale composition analysis, which represents the trend of tourism traffic sequence, with medium composition of time scale on behalf of the cycle of the tourist traffic sequence. The smaller time scale component corresponds to the random item of the tourist flow sequence. Therefore, the high frequency D1 in the first layer of wavelet decomposition shows more randomness, while the other high frequency layers D2, D3, and D4 contain the main periodic fluctuation characteristics of the annual variation of inbound tourist flow. From the perspective of high frequency layers D2, D3, and D4, the inbound tourist flow fluctuates strongly in the time range of 91–180 and 260–320. The two time scales correspond to spring and autumn, respectively, and the passenger flow varies greatly. On 1–90 and 321–366 time scales, the fluctuation of high frequency and low frequency signals is relatively weak. These two periods correspond to winter, and passenger flow fluctuates at a low level. The middle 181–259 time scale corresponds to the hot summer, and the wavelet signal fluctuates in this time range from strong to weak. This indicates that the inbound tourist flow has certain regularity in

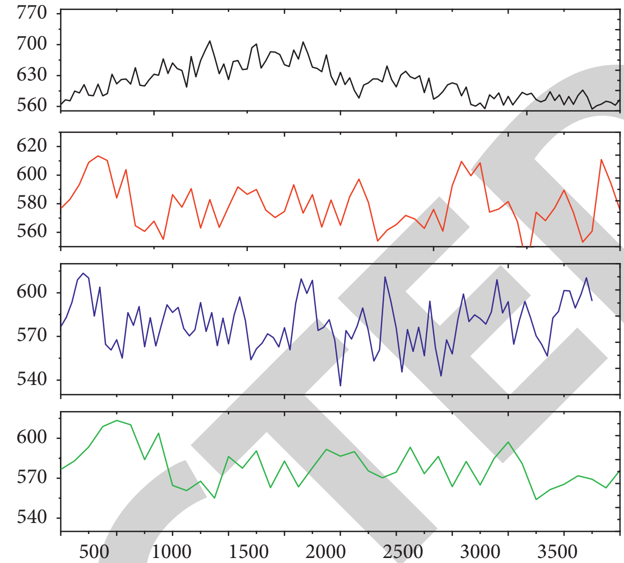

Figure 7: Wavelet analysis of tourist flow in a scenic spot.

seasons, with obvious characteristics of peak and low seasons. 91–180 and 260–320 are the peak seasons of inbound tourism, 1–90 and 321–366 are the low seasons of inbound tourism, and 181–200 are the shoulder seasons.

4.2. The Determination of the Spatial and Temporal Threshold of Tourist Flow Regulation in Tourist Destinations. This study will combine tourism traffic change rule and influence factors of the year, as well as the ecological environmental capacity of tourism, tourist space capacity, resources, and tourism infrastructure capacity, respectively, from the angle of time and space, determine the tourist traffic control valve of time and space, and further explore tourism destination traffic control mechanism, to maintain the balance changes, tourist traffic, and years, to provide scientific basis for promoting sustainable development of tourism.

From the time distribution, congestion and queuing occur only in a fixed time, and most of the time is relatively full; looking at the scenic area traffic distribution in 2020, traffic is mainly concentrated in the spring, summer, and autumn, three quarters; in particular, the summer traffic is very big, the most likely to cause traffic exceeding the maximum capacity. However, the passenger flow in winter is the smallest. Except for the increase of the passenger flow in New Year's Day and Spring Festival holidays, the passenger flow in other periods mostly fails to reach the reasonable capacity range in winter, as shown in Figure 8. Among them, the red line represents the maximum capacity control line, the red area represents the section where passenger flow exceeds the maximum capacity range, the green line represents the reasonable capacity control line, and the green area is the section where passenger flow is below the reasonable capacity range.

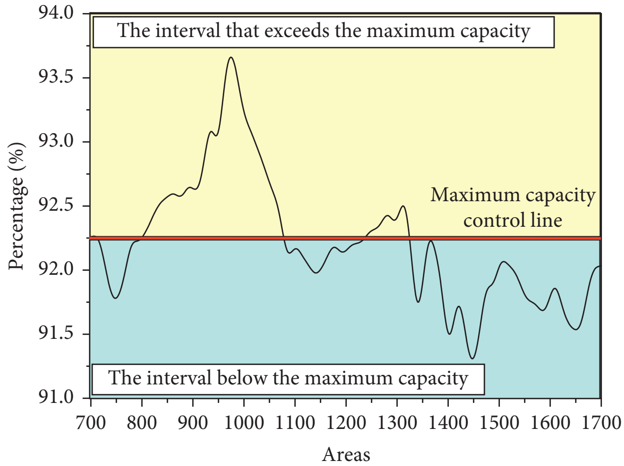

FIGURE 8: Threshold and interval of tourist flow regulation in tourist destination.

5. Conclusion

In recent years, the number of residents traveling in China is increasing, and the tourist attractions are overcrowded everywhere. It is urgent to solve the problem of congestion and overload in scenic spots. With the practical significance of the tourism resources to the tourism resources spatial capacity supply ability and the tourist flow to real time and space distribution characteristics, this paper has the practical significance of higher mathematics scenic area tourist resources spatial capacity calculation model, to detect the various resources spatial capacity, based on reasonable hot spots and the capacity limit value. Based on the Internet of Things technology, the management mode of tourist diversion service for popular scenic spots is designed to provide tourists with timely access to the latest services of scenic spots and help tourists to choose the best tourist routes and scenic spots, so as to realize the reasonable diversion of tourist flows in the scenic spots in advance. With the continuous development of information technology, the Internet of Things technology will play an important role in the construction of the spatial regulation platform of tourism resources, which is of great significance to the sustainable development of scenic spots. Although emerging technologies such as the Internet of Things can help solve the local saturation and overload problems of popular scenic spots in scenic spots, they still cannot systematically and on long term solve the contradiction of space-time supply of tourism. Through the implementation of the national measures of "tourist time and space diversion," the problem of tourism environmental capacity that troubles the management of scenic spots and tourism management departments will be effectively solved, and the scenic spots can finally achieve sustainable development.

Data Availability

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Consent

Informed consent was obtained from all individual participants included in the study.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

References

[1] M. Li, "Dynamic monitoring method of natural resources in libo scenic spot based on remote sensing technology," *CCAMLR Science*, vol. 25, no. 1, pp. 57–64, 2021.

[2] Y. Shi, Z. Liu, and W. Geng, "Implementation of early warning method for ecological environment carrying capacity of Tianchi scenic spot in Changbai mountain," *Ekoloji*, vol. 28, no. 107, pp. 3623–3634, 2019.

[3] G. Wenling, *Research on the Construction Mode of Information System in Scenic Spots*, Atlantis Press, Dordrecht, Netherlands, 2020.

[4] J. Yao, Y. Ye, and H. Jia, "Analysis of traffic congestion in scenic spots based on game theory," in *Proceedings of the CICTP*, pp. 4141–4154, Xi'an, China, August 2020.

[5] F. Tian, W. Zhen, and X. S. Ming, *Scenic Spot Tourists Flow Prediction Research Based on Web Search Items*, Atlantis Press, Dordrecht, Netherlands, 2017.

[6] Y. Yang, C. Yao, and D. Xu, "Ecological compensation standards of national scenic spots in western China: a case study of Taibai mountain," *Tourism Management*, vol. 76, p. 103950, 2020.

[7] Q. Wang, S. Kong, J. Chen, Y. Zhou, C. Yu, and H. Huang, "Research on safety risk assessment of Ninghai 4A scenic spots," *IOP Conference Series: Earth and Environmental Science*, vol. 371, no. 3, p. 032079, 2019.

[8] Z. Zhu, Y. Bai, W. Dai, D. Liu, and Y. Hu, "Quality of e-commerce agricultural products and the safety of the ecological environment of the origin based on 5G internet of things technology," *Environmental Technology & Innovation*, vol. 22, p. 101462, 2021.

[9] H. Gao, "Big data development of tourism resources based on 5G network and internet of things system," *Microprocessors and Microsystems*, vol. 80, p. 103567, 2021.

[10] Y. Guo, H. Liu, and Y. Chai, "The embedding convergence of smart cities and tourism internet of things in China: an advan ce perspective," *Advances in Hospitality and Tourism Research (AHTR)*, vol. 2, no. 1, pp. 54–69, 2014.

[11] H. Wei, "Integrated development of rural eco-tourism under the background of artificial intelligence applications and wireless internet of things," *Journal of Ambient Intelligence and Humanized Computing*, pp. 1–13, 2021.

[12] Z. Shao and C. Liu, "Intelligent management and service for Wisdom scenic based on internet of things," in *Proceedings of the 2011 IEEE International Conference on Cyber Technology in Automation, Control, and Intelligent Systems*, pp. 283–287, IEEE, Kunming, China, March 2011.

[13] P. Liu and Y. Liu, *Smart Tourism Via Smart Phone*, Atlantis Press, Dordrecht, Netherlands, 2016.

[14] B. S. Li and Y. H. Xie, "Real-time acquisition and analysis method and system of security hidden danger information in intelligent scenic spots under the environment of internet of things," *ISPRS-International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, vol. XLII-3/W10, pp. 437–442, 2020.

[15] Y. Qin and J. Zhang, *The Research on the Design of Integrated Management System of Intelligent Scenic Spots*, Atlantis Press, Dordrecht, Netherlands, 2020.
[16] Y. Li, "Study on the design of smart scenic spots based on smart tourism–a case study on the ancient city of Suzhou," in *Proceedings of the 12th International Conference on Intelligent Computation Technology and Automation (ICICTA)*, pp. 145–148, IEEE, Xiangtan, China, October 2019.
[17] Y. Rongrong, "Design of an information system for smart scenic spots," in *Proceedings of the International Conference on Smart Grid and Electrical Automation (ICSGEA)*, pp. 328–331, IEEE, Zhangjiajie, China, August 2016.
[18] X. Aiji, Z. Junai, and W. Junfu, *Research on Bazhou Smart Rural Tourism Platform Based on Internet of Things and Cloud Platform Technology*, Atlantis Press, Dordrecht, Netherlands, 2020.
[19] D. Li, L. Deng, and Z. Cai, "Statistical analysis of tourist flow in tourist spots based on big data platform and DA-HKRVM algorithms," *Personal and Ubiquitous Computing*, vol. 24, no. 1, pp. 87–101, 2020.
[20] D. Li, "Platform construction and application research based on the smarter tourism TMCA system," *International Journal of Simulation–Systems, Science & Technology*, vol. 17, no. 8, pp. 43–54, 2016.
[21] B. Ji, X. Zhang, S. Mumtaz et al., "Survey on the internet of vehicles: network architectures and applications," *IEEE Communications Standards Magazine*, vol. 4, no. 1, pp. 34–41, 2020.
[22] J. Shi, Y. Lu, and J. Zhang, "Approximation attacks on strong PUFs," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, vol. 39, no. 10, pp. 2138–2151, 2019.
[23] J. Zhang, C. Shen, H. Su, M. T. Arafin, and G. Qu, "Voltage over-scaling-based lightweight authentication for IoT security," *IEEE Transactions on Computers*, p. 1, 2021.
[24] W. Wang, Z. Gong, J. Ren, F. Xia, Z. Lv, and W. Wei, "Venue topic model-enhanced joint graph modelling for citation recommendation in scholarly big data," *ACM Transactions on Asian and Low-Resource Language Information Processing*, vol. 20, no. 1, pp. 1–15, 2021.
[25] J. Han, N. Lin, J. Ruan, X. Wang, W. Wei, and H. Lu, "A model for joint planning of production and distribution of fresh produce in agricultural internet of things," *IEEE Internet of Things Journal*, vol. 8, no. 12, pp. 9683–9696, 2021.
[26] J. Yang, M. Xi, B. Jiang, and H. Song, "Robust six degrees of freedom estimation for IIoT based on multibranch network," *IEEE Transactions on Industrial Informatics*, vol. 17, no. 4, pp. 2767–2775, 2021.
[27] W. Wang, N. Kumar, J. Chen et al., "Realizing the potential of the internet of things for smart tourism with 5G and AI," *IEEE Network*, vol. 34, no. 6, pp. 295–301, 2020.
[28] J. Yang, C. Ma, B. Jiang, G. Ding, G. Zheng, and H. Wang, "Joint optimization in cached-enabled heterogeneous network for efficient industrial IoT," *IEEE Journal on Selected Areas in Communications*, vol. 38, no. 5, pp. 831–844, 2020.
[29] B. Shrimali and H. Patel, "Multi-objective optimization oriented policy for performance and energy efficient resource allocation in cloud environment-sciencedirect," *Journal of King Saud University-Computer and Information Sciences*, vol. 32, no. 7, pp. 860–869, 2020.
[30] J. Wen, J. Yang, and B. Jiang, "Big data driven marine environment information forecasting: a time series prediction network," *IEEE Transactions on Fuzzy Systems*, vol. 29, no. 1, pp. 4–18, 2020.