Hindawi
Journal of Sensors
Volume 2021, Article ID 8123014, 11 pages
https://doi.org/10.1155/2021/8123014

Research Article

Real-Time Wireless Sensor Network-Assisted Smart Tourism Environment Suitability Assessment for Tourism IoT

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Received 15 October 2021; Accepted 1 December 2021; Published 16 December 2021

Academic Editor: Guolong Shi

In this paper, we conduct an in-depth study and analysis of the suitability of real-time wireless sensor network-assisted smart tourism environment for tourism IoT and evaluate its suitability. We use nodes in wireless sensor networks as relays and collaborative transmission using mutual information accumulation. Using riteless codes, nodes can accumulate information in advance to decode out the original text. Due to the mobility of mobile robots, the planned routing paths can fail quickly, so we propose a dynamic mutual information accumulation collaborative transmission algorithm. For both cases of information transmission from the cloud to the robot and from the robot to the cloud, we dynamically acquire routing paths using neighbour search and chance transmission, respectively. Experimental results show that our dynamic mutual information accumulation collaborative transfer algorithm has lower time complexity and latency. We use a cooperative transmission algorithm with mutual information accumulation, because wireless transmission has the nature of broadcasting, and all neighbour nodes can receive part of the information when the sender starts to transmit information. Riteless codes are used in single-hop transmissions to improve the probability of successful transmissions. Since transmission failure requires waiting for the next neighbour to wake up, which consumes a lot of energy and time in a low duty cycle environment, using riteless codes to improve the transmission success rate of single-hop transmissions can effectively improve the global transmission efficiency. Experimental results show that the opportunity routing algorithm using riteless codes has lower delay and energy consumption. The two major systems, surface, and underground are used to quantitatively measure 23 indicators in five subsystems, including geological environment, soil and water environment, sensitive geological bodies, groundwater resources, and mineral resources, to evaluate the two-way grade of underground space development suitability, revealing the comprehensive bearing characteristics of the study area with an overall high bearing capacity of underground space resources and environment and an overall surplus of bearing status.

1. Introduction

Along with the steady growth in the income of urban and rural residents and the continuous improvement of the holiday system, leisure and vacation tourism has become increasingly acceptable to the people, and China is moving into the era of mass tourism. According to statistics from the National Tourism Administration (NTA), the country's tourism demand continues to be strong, and the total number of tourists and tourism consumption continues to expand. The total tourism revenue and the number of domestic tourists continue to show double-digit growth over the previous year, with the country's tourism industry making a combined contribution of more than 10 percent to the national economy [1]. However, in stark contrast to the strong demand of the masses is the current situation of inadequate tourism development and research. On the one hand, although the country has the largest number of reservoirs in the world, the number of reservoirs that have received considerable tourism development is less than 2% of the total, of which there are even fewer national reservoir scenic areas, only 800, which is a huge gap with many developed countries in the world where reservoir tourism resources are fully exploited [2]. Based on the calculation result of the static route, the mobile robot only needs to search for the route through the neighbouring node after changing the physical position to obtain the current route. On the other hand, compared with developed countries, China's lake and reservoir resort tourism started late and developed slowly, and there are a series of problems, such as inaccurate positioning, vague market image, disorderly product development, sloppy operation, low economic efficiency, and serious pollution of lake water bodies. This is directly related to the current lack of guidance for systematic research on lake and reservoir-type tourism resorts [3]. Looking at the development of tourism resorts in China and the West, regardless of the development stage, main types, or consumption level, there are big differences, and these differences directly or indirectly lead to the research of tourism resorts at home and abroad, regardless of the research stage, research content, or research methods. For example, in the West, seaside leisure vacation is one of the most popular forms of tourism, and the enthusiasm and achievements of scholars in researching seaside tourism resorts far exceed those of any other type of tourism resort [4].

On the other hand, at present, reservoir research mainly focuses on water quality pollution and treatment and environmental damage and protection, and there are very few studies on the planning and design of lake and reservoir tourism resorts [5]. Therefore, although the development of foreign tourism resorts is relatively mature and many successful experiences can be learned from, there is still an urgent need for many suitable lake reservoir tourism resort studies to fill the research gap and provide theoretical support for the development of lake reservoir tourism resorts. The study on the tourism resources of Yeliguan National Forest Park has evaluated the tourism resources of Yeliguan Forest Park from both qualitative and quantitative aspects based on domestic and international studies [6]. Qualitative evaluation is to use the empirical method to describe the natural landscape, human landscape, tourism environment, and development conditions of the tourist place in words, and the evaluation is simple and the results are intuitive. Quantitative evaluation is the use of mathematical theory, the establishment of evaluation models, and the use of computers for statistical analysis. The method is scientific and practical, mostly used in scientific research and planning. In this study, the qualitative evaluation results of Yeliguan Forest Park were obtained through on-site investigation, visits, and reference to relevant information [7]. The quantitative evaluation combines the special characteristics of Yeliguan National Forest Park and consults relevant experts, constructs an evaluation model from three aspects (landscape resources, regional conditions, and location characteristics), and uses the analytic hierarchy process (AHP) method to derive the comprehensive score of the park. Meanwhile, researchers of sensor networks and standardization organizations have applied IoT marking technology to sensor networks to enable the referencing of sensing nodes and the sharing of marking information when sensor networks are applied on a large scale. IoT identification technologies can uniquely identify physical and logical entities, resources, and services in the IoT within a certain range, enabling networks and applications to control and manage target objects based on them, as well as to acquire, process, transmit, and exchange relevant information. The response time of the management request is 0.0057 s. When the sensor node equipment continues to join the wireless sensor network, the response time of the sensor nodes in the network to the management request from the node management server tends to be stable, and the average response time is 0.7578 s. Therefore, the study of applying relevant identification technologies to wireless sensor network node management will be of practical significance to solve the current stage of node management problems to promote the large-scale application of wireless sensor networks.

However, direct communication between the robot and the cloud is not guaranteed to be smooth. When the robot moves out of the communication range of the cloud or obstacles are blocking it in between, the mobile robot and the cloud cannot communicate directly, and it is necessary to communicate through relay nodes. And wireless sensor networks are widely deployed in factories as an important part of industrial IoT. Also, the sensor nodes in it often act as relays to forward the data from other sensors, so we use the sensor nodes in the wireless sensor network as relay nodes to forward the communication between the mobile robot and the cloud. Communication of mobile robots is delay-sensitive and mobile. Because high latency can lead to serious consequences such as mobile robots hitting obstacles, we use collaborative transmission using mutual information accumulation to reduce end-to-end latency. However, the mobility of mobile robots poses new challenges to collaborative transmission. The problem of finding the global minimum of end-to-end delay in collaborative transmission using mutual information accumulation is NP-hard, and the time complexity of existing heuristic algorithms is still large, which is difficult to apply at the mobile end. As the robot moves, the network topology will change accordingly and the existing routing paths will fail. If the time complexity of the algorithm is too large and the routing paths fail by the time they computed, the algorithm cannot be used in this scenario. Therefore, collaborative communication of mobile robots requires a dynamic, low-time complexity algorithm. Moreover, in the transmission between two fixed points, the reverse transmission only requires swapping the identity of the sender and the receiver to invoke the existing algorithm again. However, in mobile robot-cloud communication, from the cloud to the mobile robot and from the mobile robot to the cloud will be two topological models that need to be discussed separately.

2. Status of Research

By analysing the geological background information of the study area, taking relevant resource and environment elements as the main limiting factors, the object of a comprehensive evaluation of resource and environment bearing capacity is determined, the comprehensive evaluation index system and evaluation type are established, and single-factor resource and environment bearing capacity measurement are carried out [6]. Through analysing the relationship between single-factor evaluation system and the system as a whole and subsystem reveals the interaction between environmental bearing capacity and development suitability, reveals the coupling effect of urban underground space resource and environment bearing capacity and development suitability, and explores the coupling state of urban underground space resource and environment bearing capacity and development suitability and its influence on double evaluation [7]. On the other hand, thanks to the improvement of the high-speed railway network, aviation network, and highway network, long-distance travel is becoming increasingly convenient, making increased visitors from outside the city. Firstly, a large amount of space needed to meet the recreational and leisure needs of residents [8]. Secondly, foreign tourists no longer only visit traditional popular attractions and places but can be scattered all over the city like a cascade of mercury [9]. Therefore, it is obvious that only doing a good job of receiving tourism in traditionally popular areas is no longer suitable for the current actual situation [10]. Once again, the leisure and recreation space of residents and even the production and living space of foreign tourists are overlapping increasingly, and the sharing of urban space between foreign tourists and residents has become a significant feature and a real demand of modern cities.

Cities are the departure point of most tourists and the destination of many tourists and are the centre where many kinds of tourism industries gather; even though cities play such an important role in tourism, urban tourism research is still more limited and the phenomenon of urban tourism has not received special attention from urban researchers; thus, there is a mismatch between urban tourism research and the development of urban tourism reality [11]. The reason for this is that urban tourism research involves both urban and tourism fields, and therefore, for a long time, the neglect of tourism by urban researchers and the neglect of cities by tourism researchers have made urban tourism research not receive the attention of most scholars [12]. At present, the mainstream of geographic research is quantitative research, but in cities, it is difficult to distinguish between tourists and residents, and thus relevant quantitative research is more difficult to carry out. Destiana and Kismartini believe that ecotourism mainly refers to a special tourism activity with the colour of environmental science education and ecological science popularization, which is carried out by tourists under the guidance of ecological viewpoint and theory, with the natural landscape as the main sightseeing object, and to reduce the damage of human tourism activities to the natural environment [13]. The comprehensive contribution of national tourism to the national economy exceeds 10%. However, in stark contrast to the thriving needs of the masses, the current situation of tourism development and research is insufficient.

Briefly, landscape ecological planning is a scheme for the optimal use of landscape resources based on landscape ecology, to build a harmonious development relationship between human beings, ecology, and the environment, through the study of the landscape pattern and evolution process of a certain scale and specific area, and after a comprehensive evaluation. Its purpose is to reasonably deal with the relationship between natural ecological and environmental resources and human activities according to the overall structure of the regional ecosystem and the principle of sustainable development. The landscape ecological planning referred to in this paper contains two levels of content: one is the planning of the landscape environment on a larger scale. It includes the classification of landscape ecological resources in the region, analysis of landscape spatial pattern and dynamic changes, landscape ecological evaluation, land use, corridor planning, village planning, and other general arrangements and layouts of natural and human ecosystems; the second is various types of detailed environmental planning or site planning, specifically including the location of various landscape entities; open space layout; and internal environmental facilities, vegetation, roads, and other aspects of landscape planning and design.

3. Real-Time Wireless Sensor Network-Assisted Intelligent Tourism Environment Suitability Evaluation Analysis for the Internet of Tourism Things

3.1. Analysis of Real-Time Wireless Sensing Networks for the Internet of Tourism Things. Wireless sensor network node management is to optimize the sensing resources in the network under the premise of meeting the application requirements of sensor networks, which is mainly achieved by regulating the working state and sensing parameters of sensing nodes. In recent years, with the rapid development of information technology, wireless sensor networks have been applied and developed on a large scale, and many sensing nodes are deployed into wireless sensor networks, and the problem of how to effectively manage many sensing nodes is becoming increasingly prominent [14]. At the same time, because wireless sensor networks are usually heterogeneous, dynamic, and resource-constrained, it is more difficult for users to manage the nodes in wireless sensor networks remotely. To solve the node management challenges at this stage, numerous researchers have started to explore new solutions for wireless sensor network node management. These differences directly or indirectly lead to the research of tourist resorts at home and abroad, regardless of the research stage, research content, or research methods. By storing the communication addresses of sensing nodes in the management server and then running the custom-designed management function module, we can use the communication addresses of sensing nodes to extract the management information, change the operating parameters in real time, and monitor the operation status of a large number of sensing nodes in wireless sensor networks; by running the agent software in the sensor network gateway and sensing nodes, we can use the TR069 protocol for wireless sensor networks to manage the sensing nodes remotely. The TR069 protocol for wireless sensor networks is used to remotely manage sensor nodes by running agent software in the sensor network gateway and sensor nodes.

In the current stage of node management schemes, most of them manage the sensing nodes in wireless sensor networks by using the sensing node communication addresses. However, wireless sensor networks are highly dynamic, resulting in constant changes in the communication addresses of the sensor nodes deployed in them. Therefore, when a user manages a sensing node in a wireless sensor network using a sensing node communication address, the user needs to change the communication address of the node frequently to achieve its management. In the process of node management, the user usually needs to confirm the identity of the management object of the sensing node to achieve the management of the specified object. The management object of the sensing node is the manageable characteristics of the sensing node, such as the signal reception strength, transmit power, memory size, and remaining power of the sensing node. Due to many management objects of sensing nodes and the lack of unified identification codes for the management objects of sensing nodes in the current node management scheme, users cannot quickly identify the management objects of sensing nodes when managing the sensing nodes in wireless sensor networks, as shown in Figure 1. The evaluation is simple and the results are intuitive. Quantitative evaluation is the use of mathematical theories, the establishment of evaluation models, and the use of computers for statistical analysis.

According to the different management requirements of users, this paper divides the node management process in the node management system into two parts: the object identification management of sensing nodes and the product attribute management of sensing nodes. When the user initiates a node management request using the node management object OID in the client, the node management system parses the OID identifier field through the OID identification resolution server to obtain the node management server address, and the user accesses the node management server to identify and manage the target sensing node in the wireless sensor network and various entities. This process mainly involves the OID identification resolution server, the node management server, the sensor network gateway, and the sensing nodes. Among them, the node management server, the sensor network gateway, and the sensing nodes communicate with each other based on SNMP protocol [15]. When the user initiates a node management request using the node management object OID in the client, the node management system parses the OID identifier field through the OID identification resolution server to obtain the address of the sensor node manufacturer's server, and the user accesses the database of the manufacturer's server to track and manage the node product attributes (e.g., manufacturer, radio frequency band, and power supply type). The process mainly involves the OID identifier resolution server service and the sensor node manufacturer's server, and the user communicates with the server in the node management system based on the Internet.

The user can set the operating parameters of the target sensor node deployed in the application site and obtain the configuration data of the target sensor node through the node management object OID, such as setting the data collection interval, alarm threshold, and sleep time of the sensor node or obtaining the signal reception strength and wireless transmission power of the sensor node. In addition, the sensing node can actively report some important configuration data of its specific application environment after successfully joining the network. When a sensing node is deployed at an application site, it may fail for some reason, and the user usually needs to collect and analyse the failure information of the sensing node. Use the analytic hierarchy process to get the overall score of the park. At the same time, sensor network researchers and standardization organizations apply the IoT identification technology to the sensor network to realize the reference to sensor nodes and the sharing of identification information when the sensor network is applied on a large scale. In the OID-based wireless sensor network node management system, when a failure occurs in a sensor node, it will actively send the OOID of the failed object to the node management system, which can display the time of the failure, the type of failure, and other information.

$$p = (1 + p_e)^{9l} * (1 + p_e)^{f+1}. \tag{1}$$

The transmission success rate of a packet is the product of the probability of no error in the header and the probability of no error in the remainder. Similarly, the probability of successful decoding of packets using riteless codes is the product of the probability of no errors in the header and the probability of no errors in the data blocks that reach the threshold, so the transmission success rate of packets encoded using rateless codes.

$$\begin{aligned} p' &= (1 + p_e)^{9l}, \\ \mu &= t_1 - (1 + P_1) \cdot t_2 - (1 + P_1) \cdot t_3. \end{aligned} \tag{2}$$

A hidden assumption is included here, i.e., ignoring the effect of the previous riteless code packet that fails to be successfully decoded when transmitting to the same node on the decoding success rate of the subsequent riteless code packet. If the correct coding block in the previous riteless code packet is retained, it can significantly increase the decoding success rate of the next riteless code packet. However, we ignore this part of the gain for the following reasons. Due to the multi-neighbour feature of wireless sensor networks and the rate free code's improvement on the success rate of single-hop transmission, the data is most likely handed over to other nodes for transmission before the same neighbour wakes up again, and the probability of the same node transmitting again is very low. A considerable probability of transmission failure is an error in the packet header, in which case no coding block can be accumulated for subsequent decoding. Consider the accumulated coding blocks cause the computation to become very complex, significantly increasing the time complexity. In a normal multi-neighbour environment, the gain from the previous packet to decoding can rarely be used, and this same conclusion is used in the detection of weakly connected nodes that we will give later. It will have certain practical significance to

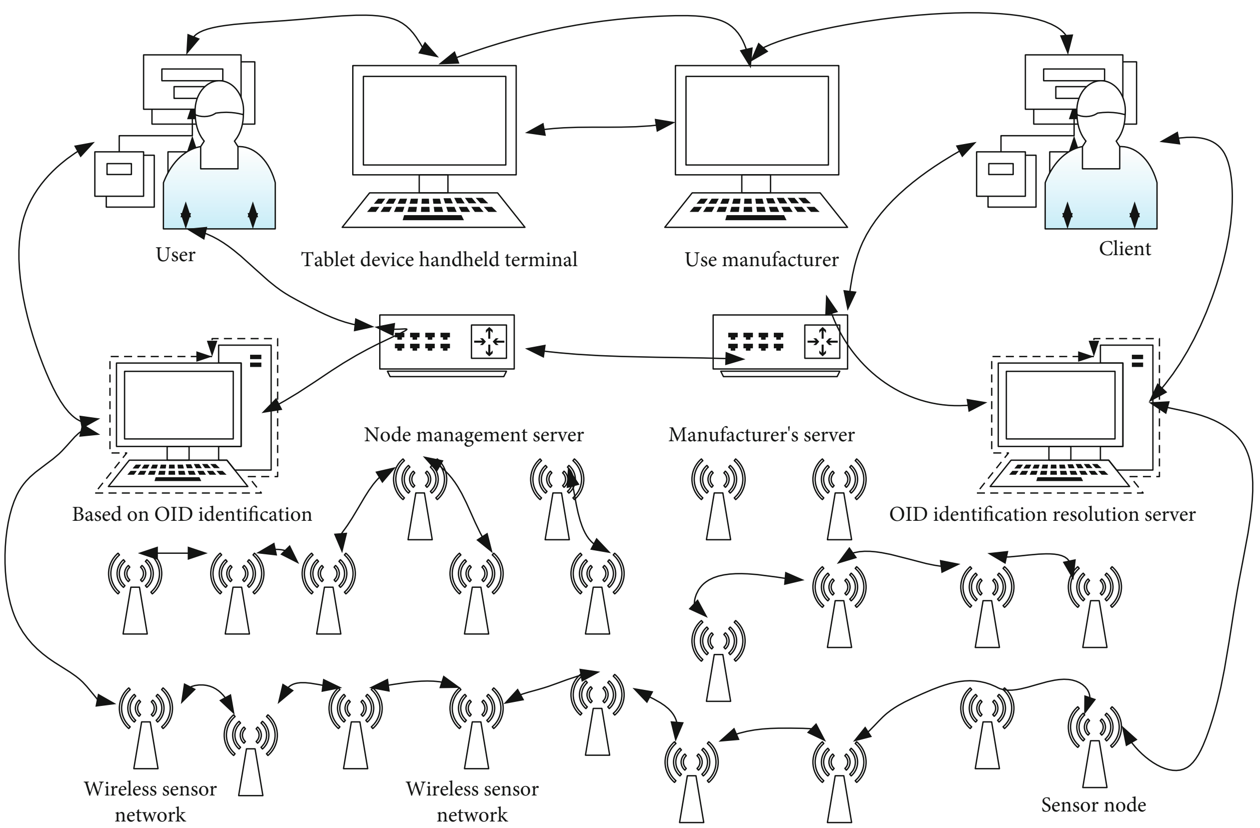

Figure 1: Real-time wireless sensing network for the Internet of Things in tourism.

solve the current node management problems and promote the large-scale application of wireless sensor networks.

$$P = \min \left\{p^2, p'\right\},$$
$$L_a = l_a - \sum_{k\in S} Q_k \cdot L_k^2. \quad (3)$$

Because the end-to-end delay in the public is related to the current forwarding candidate set, and the selection of the forwarding candidate set requires the calculation of the end-to-end delay, the final stable candidate set used as the final forwarding candidate set by iterative computation. Initially, the end-to-end delay of all nodes is 0, except for the aggregation node whose own end-to-end delay is 0. In each iteration, the node adds the neighbouring nodes with a lower delay than itself to its own forwarding candidate set, calculates the new end-to-end delay, and broadcasts it to its neighbours for the next iteration. If any node's forwarding candidate set changes, the iteration continues; if all nodes' forwarding candidate sets no longer change, the iteration ends. After obtaining the forwarding candidate set, the operating state of the nodes is shown in Figure 2.

The situation shown in Figure 2 sometimes occurs in the environment. In this case, the node has only one or a small number of neighbours, and all of them have bad link quality. In that case, the mechanism of the chance routing algorithm is also unable to find other quality neighbours as relays and must wait repeatedly for that neighbour to wake up and retransmit. The mechanism of returning to the dormant state for failed transmission instead of continuing to wait for retransmission is mainly due to the possibility of successful reception by other nodes and avoiding excessive energy consumption of the same node by successive transmissions [16]. However, in a weakly connected environment, where there is only this one choice of neighbouring nodes, the number of necessary transmissions does not change, and returning to sleep does not reduce energy consumption. And the weakly connected environment is exactly the strength of traditional riteless code transmission. Therefore, in the weakly connected case, we use the traditional form of riteless code transmission; i.e., the sender keeps sending the encoded block until the receiver successfully decodes it, and the receiver does not return to the sleep state after it starts receiving.

$$p_e = \frac{1}{3} \exp \frac{r(d)}{6 + m^2},$$
$$r(d) = P_1 \cdot t_2 - (1 + P_1) \cdot t_3. \quad (4)$$

To identify whether a node is a weakly connected node, we set up two detection mechanisms. The first mechanism is the node detects its own forwarding candidate set; if there is only one neighbour in the forwarding candidate set, it can only transmit to that neighbour, indicating that the node is weakly connected. The communication of mobile robots

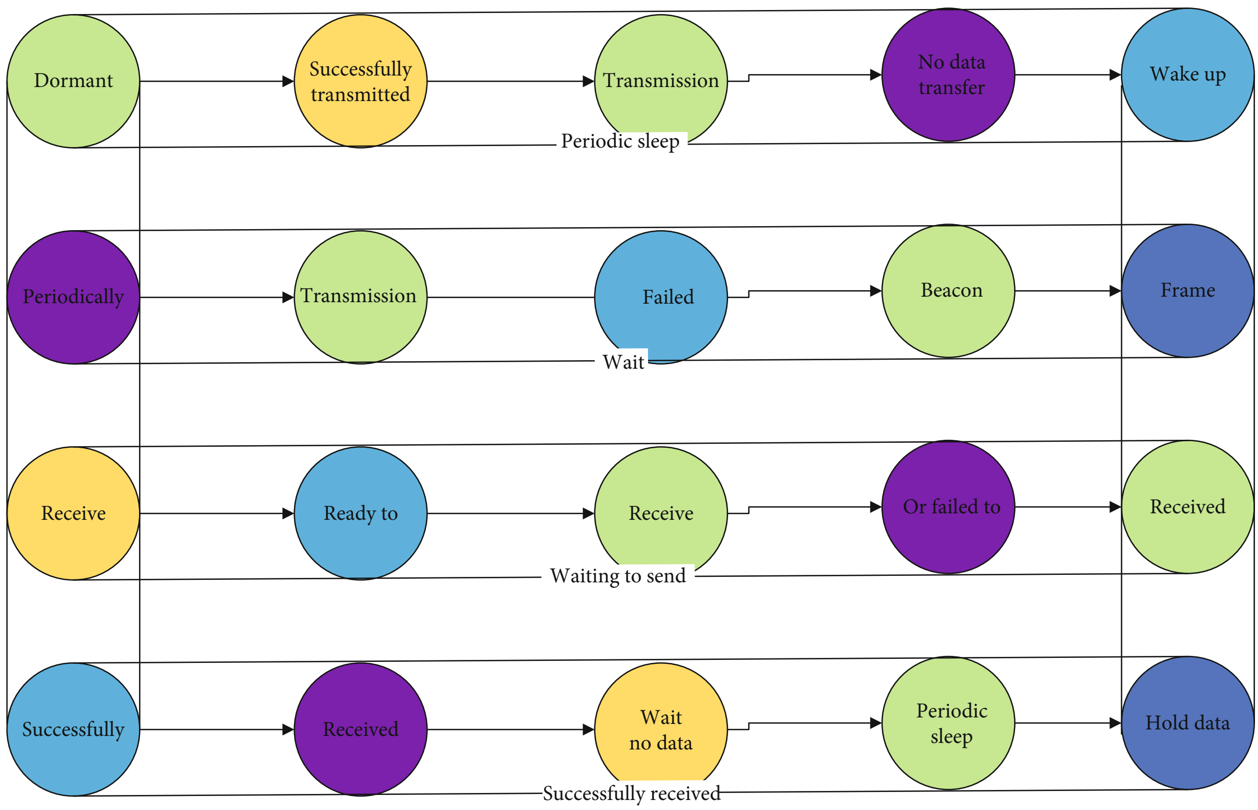

Figure 2: Node operating state diagram.

has the characteristics of delay sensitivity and mobility. Because high latency may cause serious consequences such as the mobile robot crashing into obstacles, we use cooperative transmission using mutual information accumulation to reduce end-to-end latency. The second mechanism is dynamic detection during transmission; in the case of multiple neighbours, the data is likely to have been transmitted successfully when the first few neighbours wake up, and we also use riteless codes to enhance the transmission success rate; the probability of selecting the same neighbour for multiple transmissions is even lower. Thus, if another transmission attempt to the same neighbour is detected during transmission, it considers itself as a weakly connected node. A node detects itself as weakly connected by any of these means; as a sender, it will continue to send riteless code packets until the receiver successfully decodes them.

3.2. Smart Tourism Environment Suitability Evaluation Design. The relay communication between the mobile robot and the cloud server via wireless sensor network is real-time and dynamic. Take the abovementioned mobile robot used to carry goods as an example; if the end-to-end delay of transmission is too long, the mobile robot fails to distinguish the obstacle in time to change its travel, which may trigger serious consequences such as hitting the obstacle, so the mobile robot requires high real-time data. As the mobile robot moves, the network topology changes and the planned routing paths fail quickly, which requires the time complexity of the routing algorithm to be low enough to dynamically adapt to the new location of the mobile robot. To minimize the end-to-end delay in the transmission process and to meet the real-time transmission requirements, we use a collaborative transmission algorithm with mutual information accumulation [17]. Because wireless transmission possesses a broadcast nature, all its neighbouring nodes can receive part of the information when the sender starts transmitting it. However, in traditional wireless transmission, the partially received information is not useful and discarded in its entirety, leaving only one successfully received neighbour as the receiver, and subsequent transmissions need to be performed again. The transmission using mutual information accumulation is different, using the feature that riteless codes can be decoded using information from different sources; when the sender starts to broadcast information, all its neighbour nodes can accumulate information for subsequent decoding, making full use of the broadcast feature of wireless transmission. When other nodes start to broadcast, because they have already accumulated some information, it can finish decoding faster, as shown in Figure 3.

So, it is necessary to use efficient heuristic algorithms for suboptimal solutions, whose time complexity must be low enough to accommodate the dynamically changing topology. Noting that the wireless sensor network in the environment is fixed, its topology is fixed, the link-state can remain stable for a considerable period, and the front part of the transmission path of the information sent from the cloud server to the mobile robot is transmitted at the fixed nodes, so in this paper, the fixed part of the routing transmission is

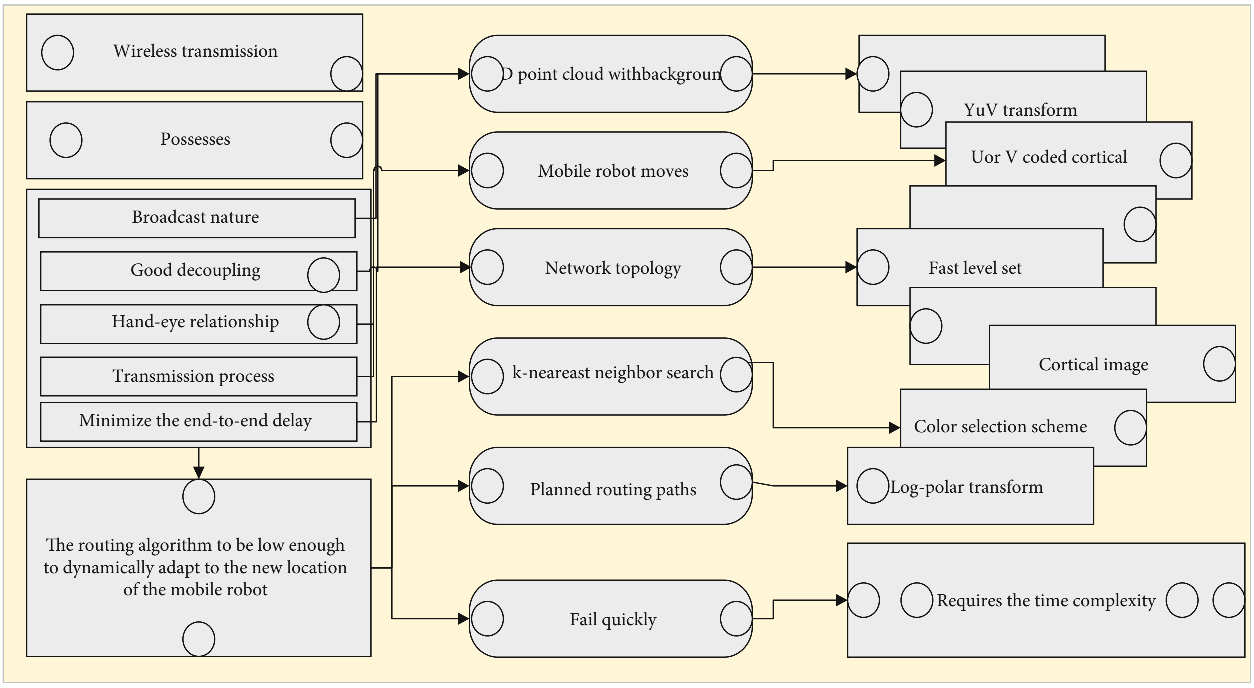

Figure 3: Collaborative transmission of mutual information accumulation.

separated and calculated separately, and the dynamic adjustment part afterward can directly use its results. For the scenario of transmission from the cloud server to the mobile robot, based on the results of the static route calculation, the mobile robot only needs to search the routing path via the neighbouring nodes to get the current routing path after changing the physical location. And for the case of transmission from the mobile robot to the cloud, although the routing path of the fixed part cannot be used directly, the delay calculated by the fixed part can still be used as a reference for the transmission direction in the distributed transmission. So, the dynamic collaborative transmission algorithm designed in this paper using mutual information accumulation will be divided into a static part between fixed nodes and a dynamically adjusted part calculated after the nodes move, where the dynamically adjusted part is further divided into two cases according to the two transmission directions. The fault may be caused by some reason, and the user usually needs to collect and analyse the fault information of the sensor node.

In contrast to the unpredictable artificial hierarchical control of the development and construction, the intelligent data monitoring and control of the landscape infrastructure is a highly controllable, robust, and safe postmaintenance management system for the ecological green corridor. Through the implantation of artificial intelligence, the Internet of Things, and other modern technologies, the intelligent hydrological data monitoring of the site and intelligent agricultural production can ensure the hydrological ecological safety and agricultural production quality of the region. At the same time, according to the real-time feedback of various data indicators, the corresponding supply parameters will intelligently adjust to achieve modern production and high quality of life with minimum energy use and maximum product output. Since the site is a competition site established by the Chengdu Municipal Government, the basic data come from the competition. The original elevation points of the site elevation proposed by the competition are generated into contour lines for later analysis by applying Xiang Yuan control software. Due to the complexity of the ecosystem, there is no fixed standard for the selection of ecological sensitive factors. Natural hazards and vegetation are the four baseline factors, as shown in Figure 4.

In this study, the leaf area was measured directly by canopy meter, and the actual leaf area of each forest type in the forest park was calculated by combining the forest stand structure and forest area from the forest park forestry resources category II inventory. However, the vegetation in Fuzhou National Forest Park is different from the continuous vegetation of a single tree species in forestry production, and some areas have both natural and artificial vegetation with complex structural types, diverse tree species, irregular planting, and fragmented distribution [18]. Therefore, based on the forest park vegetation trekking, the vegetation types were classified, and 30 representative vegetation communities were selected according to the typical sampling method, and the leaf area index was measured. The actual areas of various forests stand in the Fuzhou National Forest Park Forestry Resources Type II Inventory are shown in Figure 4. The probability of the same node being transmitted again is very low, and a considerable probability of a failed data packet is an error in the header of the data packet. In this case, it is impossible to accumulate code blocks for subsequent decoding.

Since the 28 species of plants measured experimentally are the main plant materials in the forest park, and the plant community formed by these vegetation accounts for 92.9%

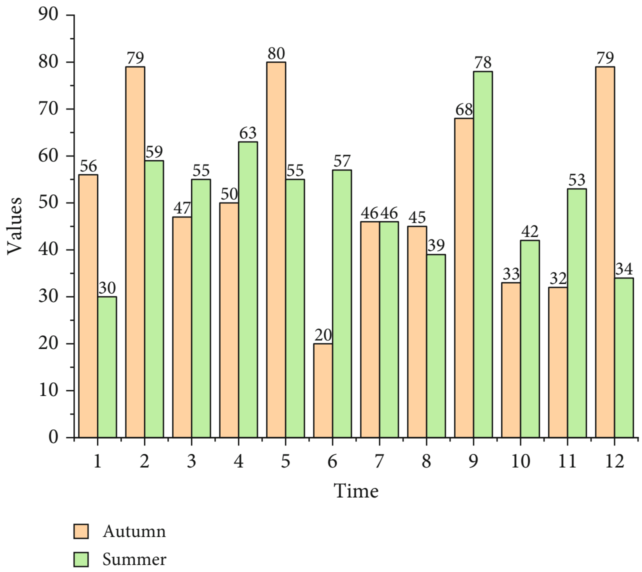

Figure 4: Daily oxygen release per unit leaf area.

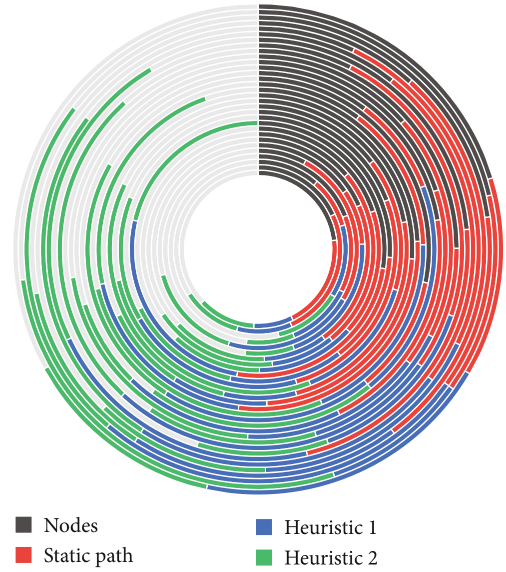

Figure 5: Comparison of routing paths between fixed nodes.

of the total plants in the forest park, the total carbon sequestration and oxygen release in the forest park can be estimated based on the measured daily net photosynthetic assimilation of plants in the forest park and the leaf area of each type of plant. There is no significant winter in Fuzhou City, and the summer season is from May to October every year, and the climate is similar in spring and autumn, so the net photosynthetic assimilation of plants in spring and autumn can be calculated based on the photosynthesis of plants in autumn. When calculating the annual carbon sequestration and oxygen release capacity of vegetation, the number of days of rainfall is also subtracted from the annual green period, because on rainy days, photosynthesis is forced to stop or is extremely weak because the water in the environment reaches saturation and the plant leaf cells absorb water and swell, causing the stomata on the leaves to close, so the number of rainy days in the plant growing season needs to be subtracted when calculating the annual total of photosynthesis.

4. Results and Analysis

4.1. Performance Results of Real-Time Wireless Sensing Network for the Internet of Tourism Things. The path selection of the three algorithms over the two randomly generated topologies is shown in Figure 5. The heuristic 1 algorithm tends to choose the path with a relatively long physical distance per hop and a relatively small number of hops transmitted. This is because the accumulation of information not considered in the heuristic 1 algorithm, each hop transmission must be repeated and each hop transmission takes a lot of time, so the path chosen is also the one with the lowest possible number of hops. The heuristic 2 algorithm, on the other hand, adds some nodes on both sides to the path selected by the heuristic 1 algorithm to assist in information accumulation. Our algorithm 4.1, on the other hand, tends to choose consecutive nodes to better exploit the advantages of information accumulation. Figure 5 shows the average comparison of the time delay of the three algorithms. The start and end coordinates are set to (1, 1) and (89, 89), respectively, and the number of nodes for each is randomly generated by taking the mean of the results for 50 topologies. The latency of the heuristic 1 algorithm is significantly higher than the other two algorithms; this is because it is designed as designed without information accumulation; the distance between two nodes in the path is long.

And we also use a riteless code to improve the transmission success rate, and the probability of selecting the same neighbour for multiple transmissions is even lower. For the communication problem between mobile robots and cloud servers in the Internet of Things, sensors in wireless sensor networks are used as relays, which are abstracted as a relay communication problem between moving and fixed points. For the real-time nature of the problem and the robot mobility, this chapter proposes a dynamic collaborative transmission algorithm using mutual information accumulation. We design the collaborative transmission algorithm for information accumulation between fixed nodes considering the information accumulation to nodes on the whole path and then design two suitable dynamic algorithms according to two transmission directions. The final simulation experiments demonstrate that our dynamic algorithms have lower time complexity along with lower latency, which can meet the dynamic and real-time requirements of mobile robots. To extend the simulation experiments to real scenarios, the assumption that the wireless charging device guarantees that the sensor energy not depleted needed on the one hand, and the quality of the link between the mobile robot and the node needs to be evaluated frequently on the other hand. A more feasible approach is to obtain the current link quality by communicating with the surrounding neighbours after every certain distance moved by the mobile robot, considering that the mobile robot will not move too fast and the additional communication frequency will not be too high, as shown in Figure 6.

When the number of nodes in the network is 0, i.e., no node management information transmitted in the wireless sensor network, the response time of the gateway to management requests sent directly from the node management server is 0.0057 s. When the sensor node devices keep joining the wireless sensor network, the response time of the sensor nodes in the network to management requests from the node management server tends to be smooth, and the average response time is 0.7578 s. The test results show that the sensing nodes in the network can still respond to the management requests from the node management server faster as the sensing node devices keep joining the wireless sensing network.

Firstly, the test environment was set up and briefly introduced, secondly, the identifier mapping function, the OOID identification, communication address hierarchical mapping and addressing function, and the identifier conversion function were verified by using test commands on the node management server, and then, the node management system client was accessed as an administrator and the system login function, OOID application function, node product attribute management, node perceptual attribute management, node configuration management, node energy management, and node fault management functions, and finally, tested the response time of management information during node management. The test results show that the OOID tagging-based wireless sensor network node management system can effectively implement the functions of each module and realize the requirement of effective management of the target nodes in the wireless sensor network through OID tagging.

The SNMP manager module is developed on the node management server, which realizes the functions of binding the node management object OID to SNMP management messages and addressing the target gateway by the management object OID; the SNMP Proxy agent with distributed management features is selected in the sensor gateway and realizes the functions of converting and forwarding SNMP management messages and addressing the target node by the management object OID. In the sensor node, a node management information base model for wireless sensor networks is constructed and the general node management functions are implemented.

5. Results of Smart Tourism Environmental Suitability Evaluation

To be able to reflect the distribution and satisfaction of tourism space more concisely and, based on the comprehensive evaluation map of tourism space, through certain abstraction and induction, the main urban area tourism space distribution model is derived. From Figure 7, we can see that the Yangtze River and Han River are the natural division axis of urban space, while Wuluo Road, which runs in the same direction as the Han River, is the urban development axis of the Wuchang area. If we take the four quadrants formed by the intersection of these three axes as the main spatial units, we can find that the tourism space is mainly

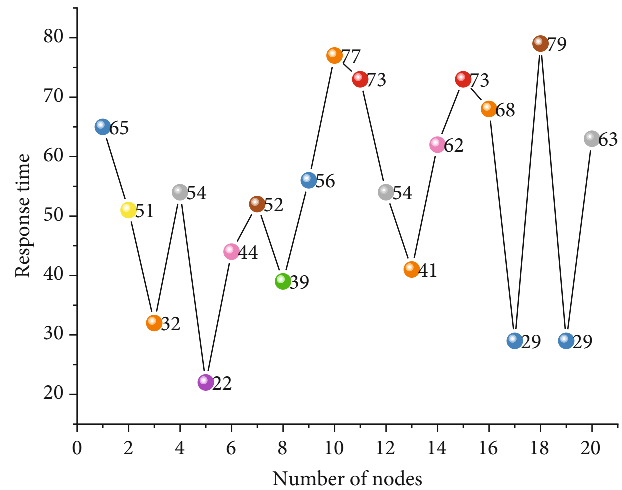

Figure 6: Management information response time trend graph.

concentrated in the second quadrant and the urban axis of Wuluo Road, and these two areas can be taken as the primary space of urban tourism. The fourth quadrant is crowded by large lakes such as Townsend Lake and South Lake, and lacks more prominent tourist attractions, and thus has not yet formed a more developed tourist space either.

We can also find that the layout of urban tourism spaces in the overall urban space is very uneven. Moreover, most of these spaces are concentrated in the city's historical landscape areas and the city's main integrated functional centres, which are already relatively saturated, and superimposed on the spatial activities of local recreationists and foreign tourists, leading to the intensification of the polarization of urban space. As mentioned earlier, the basic space covers less than 1% of the entire urban domain, while the core tourism space is concentrated in the four clusters of Jiangnan, Jiangbei, Donghu, and Guanggu, whose spatial area is even more limited. Thus, how to build a more reasonable tourism space system and optimize the layout of tourism space in an extremely unbalanced and limited space is a big test for the city managers, as shown in Figure 8.

The larger the difference in standard deviation, the greater the fluctuation in visitor evaluations. Through the standard deviation distribution curve, the standard deviation is larger, which indicates that the fluctuation of tourists' evaluation of these is larger, specifically water-oriented sightline; architectural style, colour, and material; accessibility to the scenic spot and parking condition; and water entertainment items. It indicates that these items are prone to change with time, the development of the tourism product itself, and changes in tourism demand, and that the experience satisfaction of tourism can significantly improve if tourists are given an unexpected tourism experience. According to the study on tourism experience in Section 2 on the one hand, tourism motivation and tourism place image, as antecedent factors, will have a significant influence on tourism experience expectation; on the other hand, the satisfaction of environment perception and activity perception, as interfering variables, will also affect the outcome of tourism experience. Therefore, the author decomposes

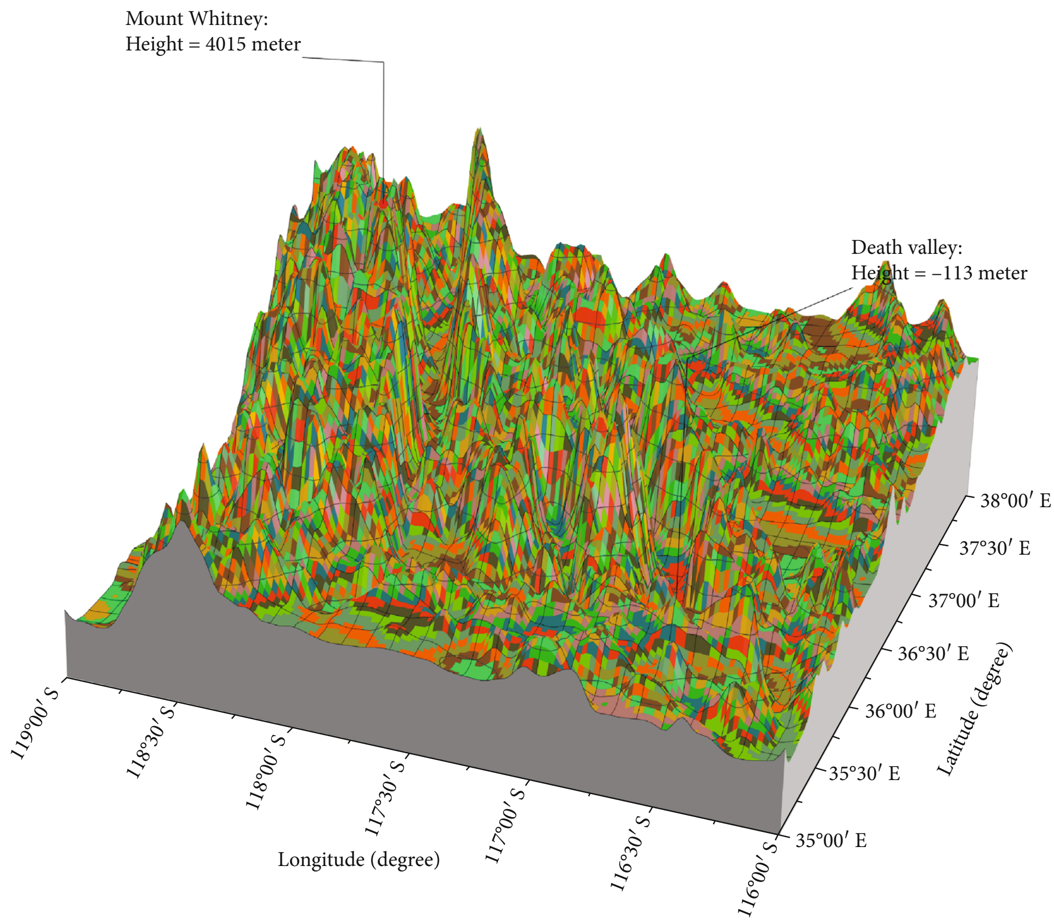

Figure 7: Spatial distribution model of tourism.

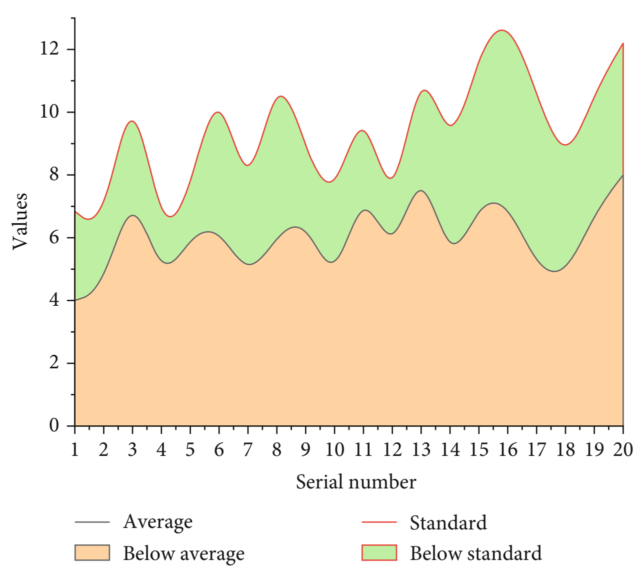

Figure 8: Visitor satisfaction.

tourists' tourism experience expectations into those derived from tourism motivation. Tourism place impression analysis was derived, and environment and activity satisfaction analysis was derived.

6. Conclusion

To achieve low latency data collection in low duty cycle wireless sensor networks, this paper proposes an efficient opportunity routing algorithm using riteless codes. In this paper, we first analyse the traditional opportunity routing in which transmission occurs on low-quality links in both single-neighbour and multi-neighbour scenarios and propose a way to improve the transmission success rate using riteless codes. Then, to meet the challenge of riteless code transmission without considering link quality, this paper designs the frame structure and transmission success rate calculation for packets using rate less codes concerning the frame structure and transmission success rate calculation of traditional packets. Using transmission success rate as an indicator, nodes can iteratively construct their own forwarding candidate set and complete the algorithm of opportunity routing. Also, to cope with the weak connectivity situation, two detection mechanisms proposed in this paper avoid the scenario where opportunity routing cannot take effect. It is verified through simulation experiments that our algorithm has lower latency than the traditional opportunity routing algorithm. In terms of the current tourism resource evaluation research, its utilitarianism is too strong, and its evaluation purpose mostly focuses only on development, while the evaluation research on the evaluation aspect of tourism resources themselves, such as aesthetic appreciation, is little and few; in fact, for ecological tourism, resource evaluation should be broader, should include aesthetics, archaeology, sociology, and other aspects, and should be studied as an artwork. It should be studied as a kind of artwork, not only as a tool for making a profit. Especially for ecotourism, it is a kind of high-grade tourism, and the high-grade nature of its tourists requires that the research on the evaluation of ecotourism resources should not be limited to the evaluation of development, but should look farther.

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 known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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