Research Article

Optimal Design of Ecological Landscape Spatial Structure Based on Edge Computing of Internet of Things

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Ecological landscape space refers to a whole composed of many different ecosystems in a larger area. The spatial structure of the ecological landscape is the spatial arrangement and combination of the components and elements of the landscape. With the sustainable development of today's world, the procedure of urbanization is also accelerating. The urbanization procedure has significantly changed the types of urban landscapes and the spatial structure of urban landscapes, which will also produce corresponding ecological effects. No matter how good or bad the ecological effect is, it will have a certain impact on people's lives. Therefore, continuously promoting the majorization of the spatial structure of urban ecological landscape is a significant method to promise the healthy improvement of the city. This article is aimed at studying the optimal design of urban ecological landscape spatial structure based on edge computing of the Internet of Things. This paper uses city A as the experimental object to design a space structure majorization experiment of urban ecological landscape based on the edge computing of the Internet of Things, and the experiment draws a conclusion. The urban ecological landscape structure majorization plan based on the edge computing of the Internet of Things increases the biodiversity index of city A by 1.2, indicating that the method of optimizing the structure of the ecological landscape based on the edge computing of the Internet of Things has a better effect of optimizing the structure of the ecological landscape.

1. Introduction

Cities have always been places where mankind lives and seeks development and are also the center of technological innovation, economic development, and social development. It can be said that cities are the most important living environment for mankind. In the procedure of urban development, various problems are usually encountered, and the ecological problem is one of the most important problems. The problems of urban ecological environment are often caused in the space of urban ecology landscape. With the continuous acceleration and deepening of contemporary urbanization, the types and structures of urban ecological landscapes have also undergone significant changes. However, changes in the spatial structure of the urban ecological landscape will inevitably have a certain impact on the urban ecological environment.

In the procedure of urbanization, more and more natural landscapes and agricultural land in urban areas are continu-

ously transformed into urban construction land, which has led to the continuous increase in urban greenhouse gas emissions. The development of urban industry has led to an increase in emissions of fossil combustion exhaust gas in urban areas. Moreover, due to the sustained growth of urban building land, the urban ecology type of land is reduced, which leads to aggravation of urban landscape fragmentation and destroys the original ecological function and landscape function of urban ecological landscape. The destruction of the ecological functions and functions of the urban ecological landscape will cause the material and energy circulation in the urban ecological system to be hindered in time and space, which will cause a huge adverse impact on the urban regional ecological system. At the same time, the destruction of the spatial structure of the urban ecological landscape will also lead to other global ecological and environmental problems. For example, severe weather such as urban heat island effect, air pollution, water pollution, greenhouse effect, smog, and sandstorms has increased.

The aggravation of such environmental problems will undermine the sustainable development of the global ecological environment. It has destroyed the living environment of human beings all over the world and threatened the survival and development of all human beings on the earth. Therefore, the research on how to promote the continuous majorization of the dimensional structure of urban ecological landscape and protect the urban ecological environment has extremely important practical significance.

Edge computing refers to the use of an open platform that integrates network, computing, storage, and application core capabilities on the side close to the source of objects or data to provide the nearest end service. The innovation of this article lies in the idea that combining with the edge computing of the Internet of Things, it discusses a beneficial method to promote the optimal design of urban ecological landscape spatial structure.

2. Related Work

Because the research on how to promote the continuous majorization of the spatial structure of urban ecological landscape has extremely important practical significance. In recent years, more and more researches on how to promote the continuous majorization of the spatial structure of urban ecological landscape have emerged in the academic circles. Among them, Min et al.'s main content is the study of forest ecological landscape structure in urban ecological landscape. They conducted a quantitative analysis of the urban forest ecological landscape structure in the built-up area of Jinan and proposed a majorization strategy for the forest ecological landscape structure through RS and GIS technology [1]. The research of Chao et al. mainly analyzed the relationship between the urban green space ecological landscape structure and social economic variables in different cities in the Munich region of southern Germany. They combined the multicity dynamic scenario modeling method to compare and evaluate the impact of different urban green space ecological landscapes on social and economic development [2]. Cui et al. found that rapid urbanization led to more fragmentation of urban green space and at the same time reduced the connectivity of urban green space. Therefore, they use a geographic information system and remote sensing technology to solve the problem of a green space ecological source through landscape spatial pattern analysis and ecological connection index analysis method [3]. The research of Oehrlein et al. mainly focuses on the total scale and accessibility of urban green spaces. They proposed a new method that takes a linear algorithm as the core to evaluate the scale and accessibility of urban green space in a comprehensive manner and can calculate the optimal distribution ratio between urban residential areas and green space [4]. Dobbs and others believe that vegetation is one of the main resources for cities to participate in ecosystem functions and provide ecosystem services. They studied the relationship between the landscape structure of more than one hundred cities in the world and factors such as population, socioeconomic, and climate and concluded that the best description of the urban landscape is the number, fragmen-

tation, and spatial distribution of vegetation [5]. Soltanifard and Jahari's research evaluated the spatial characteristics of the ecological quality of urban green spaces. Through spatial analysis and correlation testing, they made a thorough inquiry of the connection between the ecological landscape and ecological quality of the green space and reached a conclusion. If the scope and continuity of urban green space are too low, it will not be able to effectively support some key ecological services [6].

3. Majorization Method of Ecological Landscape Spatial Structure

The urban ecological landscape space refers to the urban ecological whole composed of many different ecological systems in the entire urban area. The spatial structure of urban ecological landscape is the spatial arrangement and combination of important components of the urban ecological environment system. The urban ecological landscape structure can be shown in Figure 1.

3.1. Edge Computing of the Internet of Things. Due to the accelerated popularization and development of mobile network technology and Internet of Things technology, today's world has entered a new era of Internet technology where everything can be connected. In this context, the number of mobile verge devices on the Internet will increase dramatically. The massive amount of data generated at the bottom of the Internet of Things perception will cause the number of cloud computing transmission loads to increase rapidly, which will also easily lead to relatively long Internet delays [7]. As a new technology to improve the experience of using network resources, the edge computing technology of the Internet of Things can be used for computing and storage services at the verge of the Internet due to its proximity to the data source. And it can provide users with a task transfer platform, which effectively reduces the delay of Internet data transmission. The edge computing technology of the Internet of Things refers to providing users with nearby network resource services on an open platform with network transmission, computing, and storage functions on the side closest to the source of things or data. Edge computing applications are launched at the verge of the network, and its service response speed is relatively fast, which can meet the basic needs of various industries in real-time processing, intelligent computing, and privacy protection. The edge computing of the Internet of Things is located between the physical entity and the industrial connection, and it is located on the top of the physical entity, which is completely different from the traditional cloud computing technology. Cloud computing technology can still access historical data generated by edge computing. In fact, people can regard edge computing as the eyes, ears, and limbs of the entire computer intelligent system. Although the core server of the computer intelligent system can make the intelligent system have relatively strong artificial intelligence, it will not be able to function if it lacks edge computing capabilities. And various big data procedureing applications often encounter the difficulty of not being able to collect suitable data, and

FIGURE 1: Urban ecological landscape structure.

edge computing can solve this problem for the big data algorithm of the core server. It can be drawn that the edge computing of the Internet of Things not only compensates for the transmission delay of the cloud computing platform but also meets the needs of core server computing expansion [8]. The basic framework of IoT edge computing is shown in Figure 2.

As a new architecture, IoT edge computing has its own unique characteristics [9]. The main difference between it and cloud computing lies in its service location, resource performance, and service quality [10]. The main features of IoT edge computing are as follows: first, relative to cloud computing, IoT edge computing is physically closer to the ground, as shown in Figure 3.

Second, the service node of edge computing is relatively low. Traditional cloud computing services are driven by ultra-high-performance infrastructure, but mobile edge computing only needs to process a small range of data in advance to provide real-time response functions. Finally, edge computing obeys multiple communication protocols. The edge computing of the Internet of Things can not only realize the short-distance transmission of the Internet of Things center but also support the connection of the cloud computing data center to realize the long-distance network transmission of the Internet [11]. They are the main distinguishing features between edge computing and cloud computing of the Internet of Things.

All in all, IoT edge computing is a network service technology that can achieve low latency, fast transmission, and link capacity improvement and energy efficiency.

3.2. The Edge Computing Resource Distribution Algorithm of the Internet of Things. The edge computing resource distribution algorithm of the Internet of Things is an algorithm that can reduce the cost of small- and medium-sized base stations in the local area network, so as to satisfy the energy depletion limits in the enduring majorization procedure and finally achieve network resource load balancing [12]. This algorithm first establishes a task load model, analyzes the total amount of tasks received by the base station, and then establishes a calculation model to predict and analyze the cost of local calculation and offload calculation of tasks from the perspective of time delay and energy depletion. Then, establish a credit model to conduct risk assessment on the

offload target selected by the base station. Finally, a marginal cost model is established, and the way to complete the task is selected through this model [13].

The first is the task load model. Assuming that the upload of user terminal s tasks follow the Poisson distribution and its average task upload rate in the time interval t is i , the average task load rate on the base station is

$$\vartheta_i = \sum_s \pi_s^i. \quad (1)$$

Next, establish a calculation model. First, the calculation energy depletion of the base station is linearly related to the task load, so the local calculation energy depletion can be shown as follows:

$$E_i^s = k\omega_i^2 \beta^i. \quad (2)$$

Among them, k is the energy depletion of one CPU cycle. Because of the limited computing power of the base station, the task load needs to be procedured in order [14]. Therefore, the average calculation postponement for a task to be completed on the base station is

$$D_k^i(\beta^i) = \frac{1}{u_i} - \omega_i. \quad (3)$$

Among them, A represents the amount of tasks that has to be programmatic on the base station per unit time. Similar to the calculation delay, with the aim of facilitating the calculation, the average transmission delay can be obtained by modeling the $M/M/1$ queuing system as

$$D^{si} \beta^i = \frac{1}{\gamma^i} \beta. \quad (4)$$

Namely,

$$D^{si} \beta^i = \frac{\nu}{1 - \gamma^i}. \quad (5)$$

Among them, ν represents the time that the network broadband serves a task. In summary, in each time interval t , the sum of the time delays for the completion of tasks on the base station is

$$D^t \beta = \gamma_i^l D^{it} \beta^i + \sum_{it} \beta^t. \quad (6)$$

The total energy depletion of the base station is

$$E_i^l(\beta^l) = E^{it}. \quad (7)$$

Next is the trust model: since base stations are deployed by SBSs by users, compared to task local procedureing or offloading to cloud procedureing, offloading to other base stations may have a higher risk of security and privacy leakage. Therefore, when selecting peer-to-peer offloading

FIGURE 2: The basic framework of IoT edge computing.

FIGURE 3: The relative position of cloud computing and edge computing.

objects, the trust issue between base stations needs to be considered [15]. Assume that the trust value between the base stations is

$$T_t^i = \frac{d_i}{\sum_e d_i} * \beta_i. \quad (8)$$

Among them, T_t^i is the trust value between the base stations, and when the trust values of the two base stations are both 0, $T_t^i=1$. Using the social trust network, the security risk cost of transferring the computing task of one base station to other base stations is modeled as follows:

$$R_t^i = \sum_e \beta_{it} R_{it}. \quad (9)$$

Namely,

$$R_t^i = \sum_e \omega_i \beta_{it} (I - T_i). \quad (10)$$

Among them, A is the conversion of security risks into a value equivalent to currency costs and B is the amount of offloading calculations between each base station. Next, in order to more intuitively show the difference in cost between local calculation and offload calculation, four auxiliary

FIGURE 4: The algorithm flow of IoT edge computing resource distribution.

functions are set using the concept of marginal cost [16], as shown in the following:

Marginal calculation delay function:

$$d_{it}(\beta_{it}) = \frac{1}{u_i} + \beta_{it}. \quad (11)$$

Namely,

$$d_{it}(\beta_{it}) = \frac{u_{it}}{\beta_{it}}. \quad (12)$$

Marginal transmission delay function:

$$g_i(\gamma_i) = \frac{v}{(\gamma - v\gamma_{it})}. \quad (13)$$

Marginal uninstall risk function:

$$r_i = \frac{\partial(\beta_i)R}{\partial\gamma_t}. \quad (14)$$

The marginal function of cost required to complete the task:

$$\aleph_{it} = w_c(\beta_{it}) + w_r. \quad (15)$$

In the procedure, the unit is unified in the calculation model and the trust model; that is, operating expenses and risk expenses are converted into corresponding costs. This concludes the basic flow of the entire algorithm. The basic procedure of the edge computing resource distribution algorithm of the Internet of Things can be shown in Figure 4.

Among them, the trust model refers to the model of finding and traversing the trust path when establishing the trust relationship and verifying the certificate. The trust model of urban landscape spatial structure refers to a model that finds and facilitates the trust path when establishing the trust relationship for urban landscape spatial structure data.

4. Majorization Experiment of Ecological Landscape Spatial Structure Based on Edge Computing of Internet of Things

4.1. Experimental Method. The experimental method of this experiment is as follows: first, select any city (city A) as the experimental object and data source of this experiment. Next, by analyzing the urban landscape structure data of city A from 2017 to 2019, the biodiversity of city A from 2017 to 2019 is obtained. We use biodiversity as the standard to determine the degree of majorization of the city's ecological landscape structure. Next, we will combine the edge computing of the Internet of Things and edge computing resource distribution algorithms to further analyze and procedure the ecological landscape structure data of city A from 2017 to 2019 and calculate the biodiversity of city A to judge the rationality of the urban landscape spatial structure of city A. Then, combined with the obtained biodiversity results of city A from 2017 to 2019, the majorization plan for the ecological landscape structure of city A is summarized. Finally, under the guidance of the majorization plan, the changes in the urban ecological landscape structure of city A from 2020 to 2021 and the corresponding biodiversity are obtained. Based on this, it is judged whether the urban ecological landscape structure majorization method based on the edge computing of the Internet of Things is effective [17].

4.2. Selection and Analysis of Urban Ecological Landscape Structure Data for City A from 2017 to 2019. First of all, city A is a small urban area located in Zhejiang Province. The location and transportation conditions of this area are convenient. Nowadays, the procedure of urbanization has been speeding up, but at the same time, environmental problems have become more and more serious. Therefore, the selection of city A as the object of this experimental analysis has certain practical reference significance. The urban ecological landscape structure data of city A selected in this experiment from 2017 to 2019 are shown in Table 1.

From Table 1, we can see that the urban ecological landscape structure of city A is not balanced, and the land for gardens and water areas is small; the distribution of land use in other areas is also uneven. Affected by this structure,

TABLE 1: Landscape ecological structure of city A in 2017-2019.

Years	Arable land	Garden land	Other agricultural land	Urban land	Waters
2017	33.56%	3.86%	20.9%	21%	13.98%
2018	34.8%	3.9%	18.2%	30.1%	15.2%
2019	33.86%	4.22%	40%	28.6%	15.14%

FIGURE 5: 2017-2019 biodiversity index of city A.

FIGURE 6: The relationship between the urban biodiversity and the majorization degree of urban ecological landscape structure in city A from 2017 to 2019.

we analyze the biodiversity results of city A from 2017 to 2019, as shown in Figure 5.

From Figure 5, we can see that the biodiversity index of city A has changed significantly from 2017 to 2019, from 2.4 in 2017 to 2.2 in 2019. Although the biodiversity index of city A increased in 2018, it dropped sharply in 2019. It shows that the overall biodiversity trend of city A in 2017-2019 has declined. After analysis, we believe that this is mostly been brought about by the improper planning of the urban ecological landscape structure of city A from 2017 to 2019. The connection between the urban biodiversity and the urban ecological landscape structure of city A from 2017 to 2019 can be shown in Figure 6.

TABLE 2: 2020-2021 preset ecological landscape structure of city A based on IoT edge computing.

	2020	2021
Arable land	20%	25%
Garden land	30%	25%
Other agricultural land	20%	10%
Urban land	10%	10%
Waters	20%	30%

4.3. 2020-2021 Urban Ecological Landscape Structure Majorization of City A Based on Edge Computing of the Internet of Things. After analyzing the urban ecological landscape structure and biodiversity of city A from 2017 to 2019, we combined the edge computing of the Internet of Things and the resource distribution algorithm based on edge computing to further procedure and analyze the urban ecological landscape data of city A from 2017 to 2019. Combined with the analysis of the factors affecting the changes in biodiversity of city A from 2017 to 2019, this experiment created a new urban ecological landscape structure majorization plan for city A [18]. Under the guidance of new urban ecological landscape structure majorization plan for city A created based on reasonable analysis, the preset land use planning for city A can be shown in Table 2.

According to Table 2, in order to better regulate the balance of the ecosystem of city A and increase biodiversity, the 2020-2021 urban ecological landscape structure majorization plan of city A that we created adds planning for garden land and water area on the original basis. The changes in city A's urban biodiversity 2019-2021 and the comparison with city A's 2017-2019 biodiversity under the guidance of this

FIGURE 7: Biodiversity changes in city A based on edge computing of the Internet of Things.

FIGURE 8: The relationship between the urban biodiversity and the majorization degree of urban ecological landscape structure in city A from 2019 to 2021.

set of IoT edge computing-based majorization plan for urban ecological landscape structure in city A are shown in Figure 7.

From Figure 7 we can see that under the guidance of the urban ecological landscape structure majorization scheme based on the edge computing of the Internet of Things, the biodiversity index of city A has increased from 2.2 in 2019 to 3.4 in 2021, an increase of 1.2 in total. This shows that the urban ecological landscape structure majorization effect based on edge computing of the Internet of Things is better, which makes the biodiversity of city A have a greater increase. The relationship between the biodiversity and the degree of landscape majorization in city A from 2019 to 2021 can be shown in Figure 8.

4.4. Experiment Summary. At this point, the whole experiment is over. Next, we will make a summary of this experiment. First of all, the subject of this experiment is city A, and the original data selected in the experiment are the urban ecological landscape structure data of city A from 2017 to 2019. In the first step of the experiment, we analyzed the urban ecological landscape structure data of city A from 2017 to 2019 and obtained the degree of majorization of city A's biodiversity and urban ecological landscape structure. In the second step, it combines the edge computing of the Internet of Things and the resource distribution plan based

on edge computing to obtain the urban ecological landscape structure data, biodiversity, and urban ecological landscape structure majorization degree of city A from 2017 to 2019. It did further data procedureing and analysis. On this basis, it designed a new urban ecological landscape structure majorization plan for city A. In the final step of the experiment, we will compare the degree of majorization of the 2020-2021 biodiversity and landscape structure of city A under the guidance of the new city A urban ecological landscape structure majorization plan with the relevant data of city A in 2017-2019. It judges the effectiveness of the urban ecological landscape structure majorization scheme based on edge computing of the Internet of Things. The experiment concluded that the urban ecological landscape structure majorization scheme based on edge computing of the Internet of Things increased the biodiversity index of city A by a total of 1.2. It shows that the majorization design of urban ecological landscape structure based on the edge computing of the Internet of Things has a good majorization effect [19–21].

5. Discussion

As an important center for human survival and development, cities have always played an important role in social development. The development of a city can not only affect social and economic development but also affect the environment in which people live. With the improvement of the level of urban development, the environmental problems of the city have become increasingly prominent. Most of the environmental problems start from the destruction of the urban ecological landscape structure to varying degrees [22]. The urban ecological landscape space refers to the urban ecological whole composed of many different ecological systems in the entire urban area. The spatial structure of urban ecological landscape is the spatial arrangement and combination of important components of the urban ecological environment system. Urban ecological landscape plays an important role in regulating the balance of the entire city's ecosystem and maintaining biodiversity. The majorization of urban ecological landscape structure is a significant method to protect the urban ecological landscape and protect the human living environment [23].

Scientific and effective majorization methods are indispensable to optimize the structure of urban ecological landscape. Therefore, this paper combines the edge computing of the Internet of Things and the resource distribution algorithm based on edge computing to conduct a research on the majorization of urban ecological landscape structure [24]. This paper designs a majorization experiment of urban ecological landscape structure based on edge computing of the Internet of Things. In the experiment, city A, a small city in Zhejiang Province, was chosen as the experimental object and data source. Next, this article analyzes the urban landscape structure data of city A from 2017 to 2019 to obtain the biodiversity of city A from 2017 to 2019. It uses biodiversity as the standard to determine the degree of majorization of the city's ecological landscape structure. Then, this paper will analyze and procedure the ecological landscape structure data of city A from 2017 to 2019 based on the edge computing and edge computing resource distribution algorithm of the Internet of Things. Afterwards, this paper designs an optimized plan for the ecological landscape structure of city A based on the biodiversity results obtained. Finally, this article analyzes the degree of majorization of the urban ecological landscape structure of city A in 2020–2021 under the guidance of the majorization plan and the corresponding biodiversity. Based on this, this article judges whether the urban ecological landscape structure majorization method based on the edge computing of the Internet of Things is effective [25]. The results show that the ecological landscape spatial structure of smart cities in the IoT environment has been optimized to a certain extent.

6. Conclusions

Cities have always been important environmental bases for human survival and development, as well as centers of socioeconomic development and technological innovation. In today's era, the entire society is constantly developing, and cities are also constantly developing. In the procedure of urban development, not only economic and cultural development problems will be encountered but also various ecological and environmental problems will be encountered. The urban ecological environment problems often start from the destruction of urban ecological landscape and ecological landscape structure. The majorization of the spatial structure of urban ecological landscape is bound to be inseparable from scientific and effective majorization methods. Therefore, this paper uses city A as the experimental object to design an urban ecological landscape spatial structure majorization experiment based on the edge computing of the Internet of Things. The research conclusions drawn in this paper are of great significance for promoting the spatial structure of urban ecological landscape and also have certain reference value for promoting the application of edge computing of the Internet of Things in the majorization of the spatial structure of ecological landscape; at the same time, it can also promote the construction process of a smart city. However, due to the limited research level and conditions, the research in this article also has certain limitations. It is believed that more researches on the majorization of the spa-

tial structure of ecological landscape will appear in the academic circles in the future, so as to continuously promote the continuous majorization and development of the spatial structure of social ecological landscape.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that he has no competing interests.

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