Simulated Annealing Algorithm in Nature Conservation Environment and Historical Culture

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Abstract: China's society and economy have stepped into the stage of high-speed modernization and construction, but the result is often a disorderly and unreasonable change of society, and more seriously, it leads to the irreconcilable contradiction between modern development and preservation of history and culture in cities. In the process of socio-economic construction, more and more cities are losing their traditional regional history and appearance. In the process of high-speed urbanization, the conservation planning of representative historical and cultural (HAC) urban areas has also become a hot topic of concern. In this paper, we take the historical culture of an urban area in city A as an example, coordinate the relationship between the historical culture conservation and the natural conservation environment in this urban area based on the simulated annealing(SA) algorithm, count the current situation of historical architectural style conservation, public facilities protection and environmental greening in the urban area, and propose corresponding environmental protection strategies for the historical culture urban area.

1. Introduction

The various problems of HAC cities in the process of urban modernization, such as the serious destruction of resources such as cultural relics and monuments and ancient town culture, the weak awareness of cultural resources protection, and the conflict of interests between protection and development, can be attributed to the unsound mechanism of urban environmental resources development at a deep level [1]. Therefore, it is important to study how to preserve urban history and culture while protecting the natural environment.

The research on nature conservation environment and historical culture has achieved good results. Current research by foreign scholars on the conservation of historic and cultural towns is more focused, and many targeted initiatives have been proposed around conservation and development, which have played a greater role in better securing the heritage of historic towns and villages [2]. The research of many scholars also reflects the importance of foreign academics to the

protection of historic and cultural towns, further creating a good atmosphere for the harmonious development of the protective construction of historic and cultural towns and urban ecological environment, and promoting the government and society to pay attention to environmental and cultural protection work [3]. Many local governments in the vigorous development of the local tourism industry, ignoring the construction of urban ecological environment, although the local economy has made a positive contribution, single its protective development has become an urgent problem [4]. In summary, it is necessary to build a mechanism for HAC construction and urban environmental protection in urban areas.

This paper first introduces the concept and components of the SA algorithm, then proposes the necessity of studying the nature conservation environment and urban history and culture, then analyzes the current situation of environmental protection and HAC coordination in an urban area of city A, and finally proposes suggestions for ensuring a green and healthy environment while building a HAC urban area.

2. Basic Overview

2.1. SA Algorithm

The principle of the SA algorithm is very simple and requires only a little modification of the conventional iterative improvement algorithm. The SA method uses the Boltzmann probability distribution as the basis for determining the optimization process, and the solution for the early start of the algorithm may be solvable, so the system has reached the minimum energy level [5, 6].

The SA algorithm uses an alternate process to reach a state of quasi-thermodynamic equilibrium, and its main feature is that it allows hill-climbing (i.e., movement that worsens the value of the objective function), a process that makes it partial minima at higher temperatures, thus avoiding falling into a local optimum [7]. The main components of the SA algorithm are.

(1) Acceptance function (AF)

In the SA algorithm, the AF procedure changes the function dialogue, the function view, and the changes to the function objective, denoted by ΔE [8].

$$P = \exp\left(\frac{-\Delta E}{T}\right) \tag{1}$$

Where T is the current temperature.

(2) Initial temperature (IT)

It is key to find the appropriate IT in the SA algorithm, and there are two commonly used methods for determining the IT, which are the error determination method and the IT adjustment method [9, 10].

(3) Equilibrium state (ES)

The ES is a very critical component of the SA algorithm, and once the ES is reached, it cools down, i.e., the annealing operation is performed, and to reach the ES at each temperature (ET), several sufficient leaps (transfers) must be performed, which we also refer to as the number of iterations (TNOI) at ET, and the strategies for determining TNOI at ET include the static strategy and the adaptive strategy [11]. The static strategy is determined before the start of the search and is fixed; the adaptive strategy is one in which the number of iterations changes dynamically according to the characteristics of the search, and TNOI is different at ET [12].

(4) Cooling schedule

In SA algorithms, the data collection and many processes are divided into several parts. If a test copy is available, the algorithm performance can be tested, but the computation time is longer [13].

The temperature including linear cooling, geometric cooling, and logarithmic cooling, and the three schemes are shown below:

$$T_i = T_0 - i \times \theta$$
$$T_{i+1} = \varepsilon \times T_i$$
$$T_i = \frac{T_0}{\ln(i+10)}$$

(2)

where T is the temperature at the ith alternate, θ is a constant, T_0 is the IT, $\varepsilon \in (0, 1)$, and the value of ε is best taken between 0.50 and 0.99.

2.2. The Need for Research on Nature Conservation Environment and Urban History and Culture

(1) Analysis from the perspective of human landscape elements

Cultural landscape is a precipitated culture of human activities in urban areas, the expression of human wisdom and the ability to transform nature. HAC districts have great HAC value, and after the historical changes, the number of their landscape remains is very large. Along with the rapid pace of urbanization in today's society, the degree of protection for HAC neighborhoods is insufficient, and the old areas of some cities have lost all their color, and it is difficult to find HAC features with ancient historical charm landscape [14, 15].

(2) Analysis from the perspective of natural landscape elements

Areas with a long history of natural landscapes that constitute landscape features are in an urgent current situation due to the lack of work related to the preservation of their natural landscape environment in HAC urban areas. From the perspective of greening, the urban areas are not comprehensive, the surrounding landscape environment is too monotonous, the urban areas have little green coverage, and the awareness of ecological landscapes is weak [16]. From the perspective of materials, most of the historical urban areas use rougher landscape materials, lack natural landscape elements, have too cold an appearance, do not have a lively atmosphere of life, and lack comprehensive systematic planning and design [17, 18].

3. Current Situation of HAC and Natural Environment Protection in An Urban Area of City A

3.1. The Current Situation of the Protection of Historical Style Buildings

According to the relevant data collection, it is counted that there are 113 buildings classified as cultural relics protection building units in an urban area of city A, among which 36 are national protection building units, 25 are municipal protection building units, 48 are incompatible with the historical landscape of urban area of city A, and 4 are key recommended protection units, see Table 1 for details.

Table 1. The number of historical style buildings

Heritage Protection Level	Quantity / Building
National level	36
Municipal-level	25
Incompatible	48
Key Protection	4

For these historical buildings, some have undergone subsequent repairs, while others still retain their initial appearance. Different historical buildings have different conservation status due to the frequency of use and the people's awareness of conservation. According to the field survey, the percentage of historic buildings in city A with good preservation is %, while the percentage of those with medium preservation is about % and the percentage of those with poor preservation is about %, as shown in Table 2 and Figure 1.

Table 2. Preservation status of historic buildings

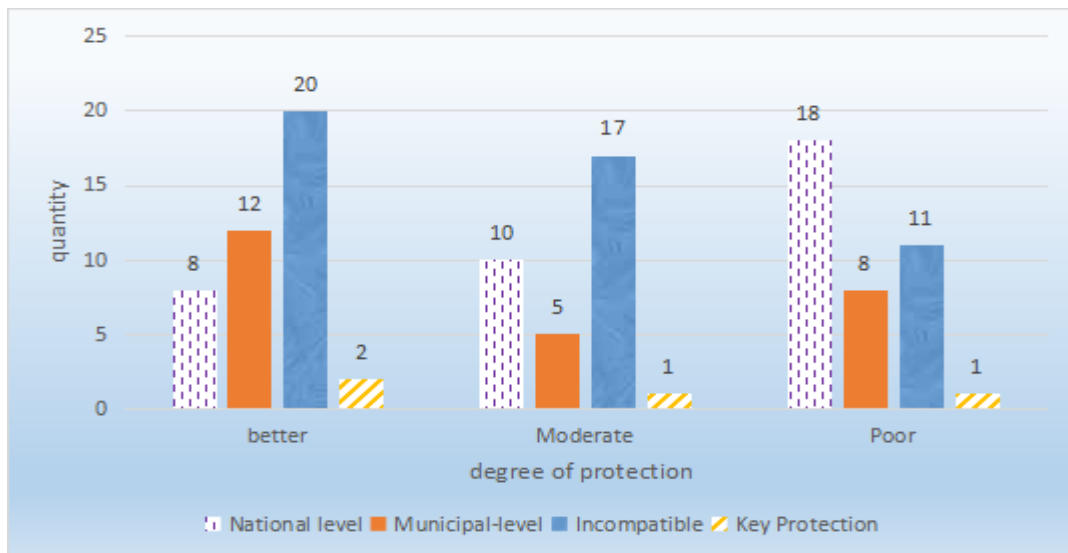|	National level	Municipal-level	Incompatible	Key Protection	Proportion
better	8	12	20	2	37.17%
Moderate	10	5	17	1	29.20%
Poor	18	8	11	1	33.63%
Total	36	25	48	4	/

Figure 1. Grade classification of historic buildings' wind and landscape preservation

3.2. The Current Situation of Public Facilities Protection in the Historic City

The most essential function of the historic urban area is the living and commercial area of the people, where various commercial forms are gathered and there are also living spaces for the people. The construction and distribution of public facilities in an urban area of city A, such as public toilets, garbage bins, benches and street lights, are shown in Table 3.

Table 3. Construction of public facilities

	Number of infrastructure (pcs)	Average service distance (meters)
Public Toilet	9	367.2
Seating bench	0	0
Garbage cans	21	74.5
Street lights	45	48.3

The data in Table 3 shows that public toilets, garbage cans and street lights are located in this

HAC urban area with a certain distribution, including 9 toilets with an average service distance of 367.2 m, 21 garbage cans with an average service distance of 74.5 m, and 45 street lights with an average service distance of 48.3 m. In general, the distribution of garbage cans and street lights is relatively even, while the width of the urban area is limited by the The number of sitting benches in this range is 0, which is insufficient compared with the construction of other facilities.

3.3. Urban Green Environment

The overall greening rate of the urban area is relatively low, and the distribution of greening environment is relatively unbalanced, with the greening environment along the river being better than that in the neighborhoods and hutongs. The green environment along the river is rich and diverse, and it forms an overall green environment system of plants. On the other hand, the greening rate in hutongs and neighborhoods is very low, showing a scattered distribution pattern.

The landscape vegetation outside the city is mainly old and tall, including camphor trees, willow trees and acacia trees, which are mainly distributed along the street side in an orderly manner. Because of the long time, these trees are integrated with the buildings outside the block and the landscape along the river, and the overall coordination and sense of history are strong.

3.4. The Contradiction between Environmental Pollution and HAC Preservation is Becoming More and More Acute

With the continuous development of the city, the number of local people moving to live in the city and foreign people coming to sightseeing and tourism is increasing, bringing a greater test of pressure on environmental resources, and its corresponding sanitation and cleaning capacity fails to keep pace with the development of the economy. For example, the statistical results on the quality of environmental health of the city wall in the city, the current health condition of the city wall is "satisfactory" accounting for 42.6%, "average" accounting for 27.3%, "unsatisfactory " accounted for 30.1%, about the road sanitation "satisfied" accounted for 55.4%, "average" accounted for 19.4%, "unsatisfied" of 25.2%, as shown in Figure 2.
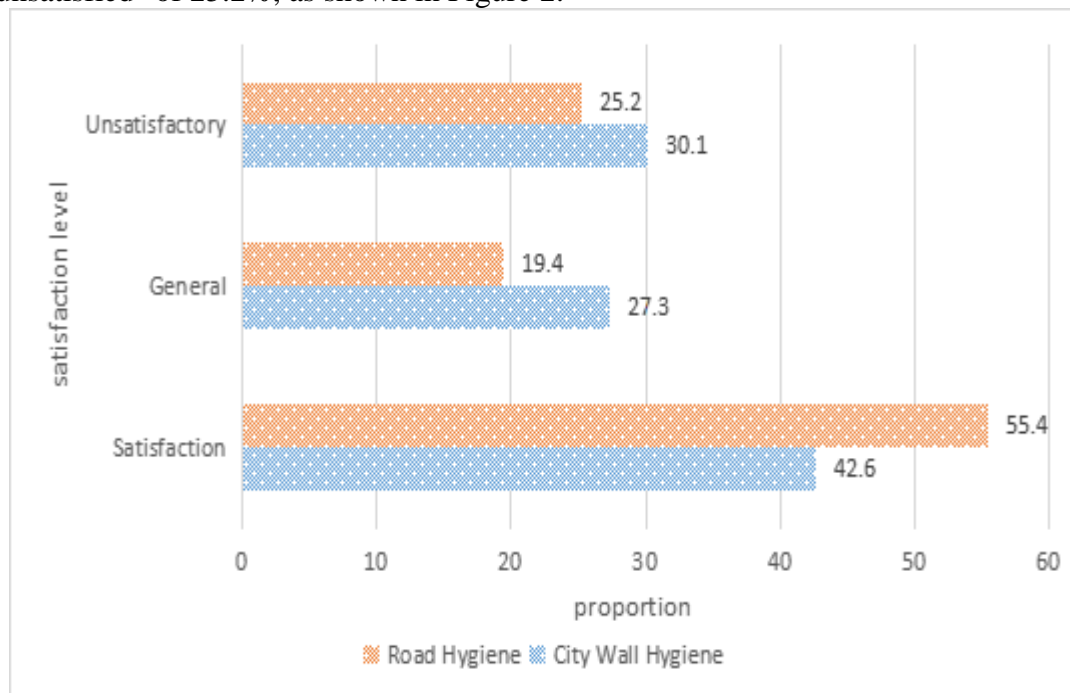

Figure 2. Environmental health quality in urban areas

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4. Protection and Improvement Strategies for the Environment of HAC Urban Areas

4.1. Improving the Spatial Order of the Neighborhood

Under the premise of protecting the spatial structure of urban areas, strengthening the order within its space, improving the overall appearance of urban areas and enhancing the quality of life in urban areas play a key role. Usually the most effective way to improve the spatial order of urban areas is to achieve it by optimizing the spatial order of the landscape. In the landscape spatial order, the reasonable planning and distribution of green landscape has a decisive influence on the fluidity and comfort of the whole neighborhood space. On the basis of retaining the original green landscape to the maximum extent, the green landscape of the urban area is re-planned to activate the vitality of the urban area and improve the living environment of the urban area as the goal of implementing the urban landscape environment beautification work.

4.2. Protection Measures for the Improvement of the Environment

The improvement of infrastructure facilitates the life of residents, but water supply and drainage facilities do not have full coverage; energy conservation and environmental protection because the city has the habit of saving water and energy and reuse of waste, the overall implementation is better; construction environment improvement because of the small control, new materials, antique style does not blend in the environment, the traditional characteristics of the ancient city is threatened; landscape environment and ecological environmental protection is better, local area "urbanized greenery" to be controlled and improved; decentralized and localized use of green science and technology and traditional rainwater collection, cellar water and water use of water conservation technology combined to promote the recycling of production wastewater; production waste as much as possible comprehensive use of domestic waste or sanitary landfill.

4.3. Construct Assessment and Accountability Mechanism

Urban history and culture are important resources inherited from history, and the development and protection measures of each subject will certainly have certain influence on the objective existence of urban neighborhoods. In order to ensure that the development and protection work of each subject has a more robust impact on the urban area and achieve the desired effect, it is necessary to establish an accountability mechanism for each subject, so as to urge the work of the government, enterprises, individuals and other subjects to be carried out in an orderly manner within the scope of the law and regulations, and each subject can carry out its own work more responsibly and play a corresponding effect. At the same time, it can also better regulate the competition and cooperation relationship of each subject, so that they can consciously and actively play their responsibilities, and can ensure the orderly operation and stable performance of the mechanisms established for the implementation of the protection of HAC urban areas. In reality, the checks and balances of the HAC district are mainly reflected in the evaluation mechanism.

In view of the confusion that easily occurs in the protection of urban areas, it is necessary to join the enterprises and the public and other parties to increase and implement the relevant measures for the protection of urban areas, to clarify the implementation details, to quantify the responsibilities of all parties, to vigorously promote the construction of the evaluation mechanism, to adopt modern information means, to fully utilize the big data information platform, to collect and analyze the results of the behavior of each subject, so as to effectively evaluate the protection effects and results of each measure.

5. Conclusion

In the process of protecting and utilizing the environment of HAC urban areas, the focus is unilaterally placed on the external beautification of the urban areas, while neglecting the more essential transformation of the spatial layout of the HAC urban environment and urban ecological restoration, which cannot form a holistic urban image with representative regional characteristics. Therefore, the protection and improvement of the environment of the HAC urban areas should avoid the possibility of reducing or losing the characteristics of the historical districts, and prohibit the occurrence of acts that destroy the environment of the HAC urban areas. Not only to maintain the characteristics of the urban landscape, but also to activate its practical functions, so that the historic district to maintain its due vitality, but also to promote the prosperity and development of the city, so as to complete the protection and repair of the environment of the historic district and the development of the city to promote the integration of the two.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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