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Towards Digitization of Construction Industry: An Exploration into the Path of Optimizing Community Living Environment and Transforming Industrial Building Heritage

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Abstract. Industrialization and urbanization are intertwined, resulting in huge destruction of the earth's ecosystem and unprecedented deterioration of human living environment. In urban construction, different historical periods have different development stages, and different development stages have different levels of buildings corresponding to them. The residential buildings in the old industrial zone are the products of typical times. Based on the principle of integrating human construction activities into the ecosystem, the comfort of the residential environment in the residential area is improved. At the same time, the research on the ecological technology means of saving energy and reducing energy consumption is carried out to make the industrial residential area built after the old age more suitable for use and living in terms of energy conservation, health, comfort and ecology, and improve the quality and performance of life. This paper constructs an intelligent scheduling algorithm for the optimization of community living environment and the reconstruction of industrial building heritage.

Keywords: Intelligent scheduling; Human settlements; Industrial architectural heritage;digitization of construction industry
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1 INTRODUCTION

Human settlements are the basic conditions for human survival and development, also known as human settlements. It not only refers to the physical space of human living and activities, but also includes population, resources, environment, social policy and economic development [20]. How should human beings create their own habitat and living environment in order to seek harmony between human beings and the environment? The study of human settlements has become an important topic facing all countries in the world in the new century [8]. Since the 1970s, the global population has increased dramatically and resources have decreased sharply. Urbanization has swept

the world. The level of urbanization has improved year by year, and people have flocked to big cities. With various urban problems, urban living environment has declined sharply. With the development of economy, people's living standards have been improved day by day, and their living needs have also changed. A sustainable community living environment should take into account the preservation of resources, environmental protection and rational use of them, and strengthen the concept of continuous reinvestment of resources and environment to regenerate them [13]. Through the development of education and science and technology, we can constantly improve the resource utilization, environmental protection, production and consumption structure, and the quality of economic growth, so as to not only construct appropriate living conditions for the present generation, but also preserve and create the foundation for future generations to build a good living environment [7]. This process is compounded in the planning, construction and development mode of human settlements, which constitutes the basic understanding of sustainable development of human settlements. Improving the community living environment and building a beautiful and livable community is an important task of implementing the urban and rural development strategy, which is related to the construction of community social civilization and the fundamental well-being of farmers [22]. Optimizing and upgrading the traditional living environment is not only conducive to speeding up the shortcomings of community living environment construction, but also an inevitable trend of building characteristic landscape and developing community economy. Optimizing the living environment should be carried out from macro and micro levels [10]. Macroscopically, it is necessary to make overall planning to promote the coordinated development of human settlements and urban social and economic benefits, which is consistent with the objective of urban residential land suitability evaluation. At the micro level, we should insist on the sustainable development of urban residential areas [6].

How to solve the housing problem of urban residents on the basis of ensuring the quality of life, how to let different social strata coexist harmoniously, how to reduce the cost of living and management, and how to increase social benefits [16]. These are problems worthy of consideration by the whole society. Combining the transformation and reuse of the old industrial building heritage with the urban residential function provides a way to solve these problems. In the process of urbanization, a large number of historical relics must be eliminated. Large industrial factory buildings are an important part of them that cannot be ignored [2]. From the sociological point of view, the industrial heritage buildings in the city have a certain historical connotation and have become the historical carrier in the minds of local people. They are the witness of a special history. From the perspective of economy and ecology, large-scale demolition of industrial heritage buildings means huge damage and waste both in terms of urban ecological environment and development economy. On the one hand, industrial buildings, with their unique architectural form and style, embody strong industrial characteristics [15]. On the other hand, as a material carrier to record the development of industrial civilization, the renewal and development of industrial relics will inject new vitality into them and promote the regional economic development. How to learn from the successful experience of protection and utilization at home and abroad and protect these industrial heritages reasonably and effectively is of great practical significance to inherit and carry forward the spiritual places and urban context of cities and optimize the living environment of urban communities [14]. Based on the actual situation of the industrial heritage in the community, this paper puts forward corresponding protection suggestions for different levels of industrial architectural heritage, and puts forward protection measures for the protection and utilization of historical areas of industrial heritage. The design principles and reuse patterns of industrial heritage protection and utilization summarized in this paper provide theoretical basis for industrial heritage protection and improvement of human settlements in the Community and other industrial areas in China.

The optimization of human settlements is an important part of sustainable development. The environment is comfortable and close to people's lives. As an indicator of environmental comfort, it must be further refined [19]. Therefore, to optimize the human settlement environment, it is

necessary to make overall arrangements for various urban undertakings, coordinate and balance, develop scientifically, build supporting facilities, pay attention to the improvement of community environmental quality, take into account the improvement of urban comprehensive facilities, and form a path to promote the sustainable use of industrial heritage areas in small and medium-sized cities [5]. The necessary measures to achieve the above goals are to transform the heritage buildings in the old industrial areas of the city, determine the specific distribution in various undertakings of the community, and form a reasonable land use structure, spatial structure, and benefit structure [24]. In the face of these practical problems, we should not only improve them from the technical level, but also comprehensively consider the current national policies, market environment and other macro factors, and endow them with the times and progressiveness at the spiritual level. Only in this way can the reconstructed industrial architectural heritage give full play to its own value and better serve the social and economic development and construction [11]. The innovation of this study lies in:

1. Simply using neural network to plan the building group transformation scheduling will produce local optimal problem to a large extent, and can not find the global optimal solution. Through research, this paper found that the combination of the self-learning characteristics of neural network and traditional genetic algorithm to intelligent scheduling algorithm can solve the above problems.

2. This paper regards cloud computing system as a collection of multi-level systems, and each agent is encapsulated by each cloud computing resource node. According to this idea, the scheduling algorithm is implemented. Different resource nodes distributed in the cloud computing platform form the agent system. This system is at the bottom, and the bottom system can provide good computing services for the upper and upper systems.

2 RELATED WORK

Beata Nowogo ń Ska put forward the theory of "human settlement environment science", pointed out that there are inextricable internal links between urban and rural areas in terms of population mobility, economic development, material exchange, information transmission, cultural exchange and land use, and emphasized that urban and rural areas should be studied in a unified framework [1]. The optimization system of rural human settlements built by Senior C includes village and town planning, infrastructure subsystem optimization, and environmental health subsystem optimization. Through the preparation of the safety pattern network map and the acceptance of the optimization indicators, the optimization of rural human settlements can be achieved and a harmonious society between urban and rural areas can be built [18]. Villarejo P, in his Preliminary Exploration of Industrial Heritage, tried to point out the value composition of industrial heritage by clarifying the concept of industrial heritage, and revealed the urgency and necessity of industrial heritage protection, so as to further carry out the survey and identification of industrial heritage, and finally looked forward to the development trend of industrial heritage protection and reuse [21]. Sadredinov S A proposed that more consideration should be given to urban vulnerable groups such as low-income people as the object of residence use, so as to take this opportunity to change the quality of the living space of this group, so as to promote the humanized development and humanistic harmony of the whole society [17]. Li H put forward the concept of graded protection of industrial heritage in his master's thesis "Analysis of Post industrial Landscape", and expanded the focus from a single old industrial building to the overall industrial area, even a larger scale industrial landscape, which has made a breakthrough compared with the initial research in China [12]. Deng Z et al. believed that the recycling of old buildings, as the embodiment of the concept of green energy conservation, has its own advantages in resource recycling and energy conservation. The old industrial buildings have become the main transformation objects because of their excellent characteristics. The superior location, solid structure and good spatial adaptability are not available in other types of buildings [4]. In his book "Protection and Reuse of Industrial Building Heritage in Berlin, Germany", Karlen I

reviewed Germany's industrial development process, summarized Germany's experience in protecting industrial building heritage in terms of laws, regulations and technology, and filled a gap in this field in China [9]. In terms of intelligent scheduling algorithm, Xiuqi H proposed a new coding method to solve various unexpected situations when using genetic algorithm to solve scheduling problems. In combination with various real examples of industrial heritage building transformation, many different scheduling models have been constructed, thus providing theoretical and technical guarantees [23]. In order to solve the problem of time uncertainty in environmental modification, Zhiming Y et al. designed an improved genetic algorithm by combining tabu search with genetic algorithm, which solved the maximum completion time problem in scheduling problem [25]. Deng F took the maximum fuzzy time as the goal of building reconstruction, proposed an improved artificial bee colony algorithm, and verified it with good results [3].

3 URBAN COMMUNITY LIVING ENVIRONMENT AND INDUSTRIAL ARCHITECTURAL HERITAGE RENOVATION

3.1 Human Settlement System

City is the core of a region and the symbol of modern human civilization. It has developed with the emergence and development of human civilization. With the arrival of industrial civilization, the intensification of urbanization process and the expansion of urban scale, people's lifestyle is more and more far away from nature. People long for a peaceful and green living space, but the increasing pollution and destruction are reducing the comfort of the living environment. Therefore, building a good urban residential environment and an ecological city is an inevitable trend of urban development and an ideal model of urban development in the 21st century. With the change of the times, the human settlement environment problems show new features and models (as shown in Figure 1). When the regional development is carried out on a large scale and the central function of the city reaches a certain critical value, the urban diffusion effect will prevail. It drives the overall development of the regional economy by providing products, services and various infrastructure to the surrounding hinterland, transferring funds, technologies, equipment, and disseminating ideas, culture, information, etc.

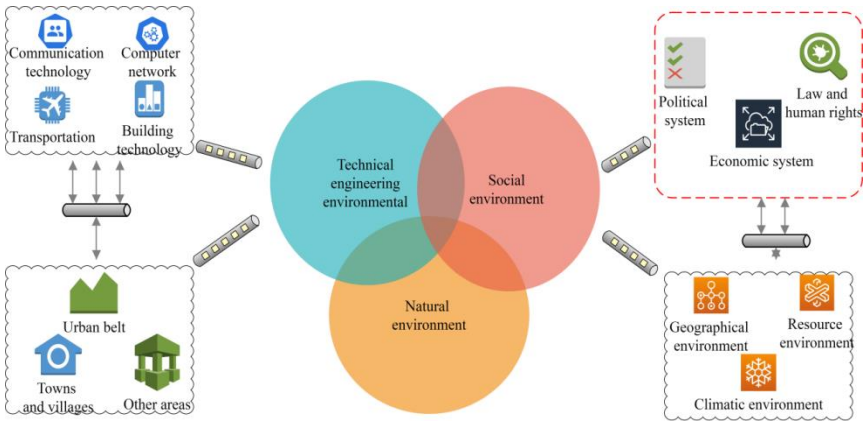

Figure 1: Human Settlement Environment Problems.

The urban human settlement environment system is an artificial environment system formed under the comprehensive effect of many factors such as nature, economy, society, culture and technology. They combine and interact with each other to form the urban residential environment system (as shown in Figure 2). In this system, people are the core of the system and the main body of system

development. Therefore, we can see that the optimization of human settlement environment should focus on the needs of people and optimize according to the characteristics of human activities and lifestyles in order to develop an ideal living environment for adults. As a space closely related to people's daily production and life, the comfort of human settlements will directly affect people's quality of life. The human settlements in different regions have different conditions, so the corresponding indicator system should be established according to the local conditions and the characteristics of the human settlements in the studied regions. As an organic whole, the indicator system of human settlements construction should be able to comprehensively reflect and measure the main characteristics and development status of the assessed region.

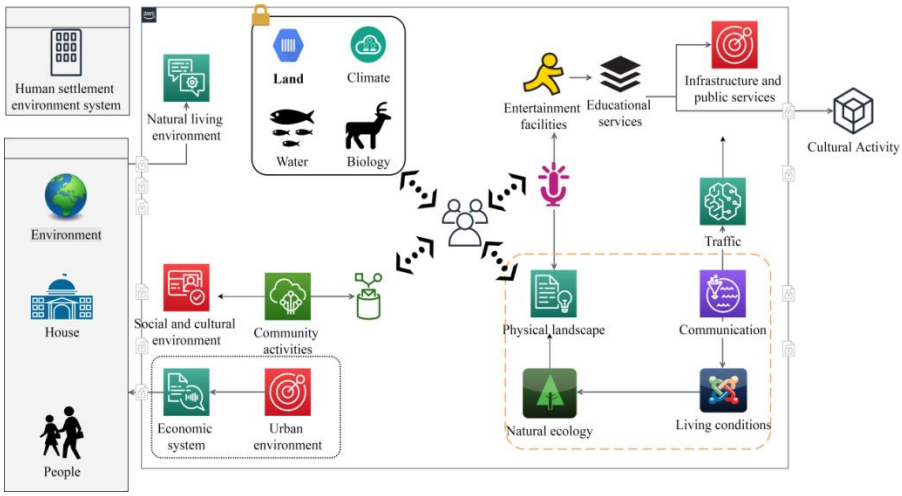

Figure 2: System Composition of Human Settlements.

3.2 The Value of Industrial Heritage Buildings

Industrial architectural heritage is the core content of urban economic growth mode and industrial upgrading and transformation in the post industrial era. With the adjustment of industrial structure and the development of world economic integration process, cultural and creative industries are gradually replacing old manufacturing industries and starting to develop rapidly, and many industrial architectural heritage has been injected with new practical functions precisely because it has lost its original purpose. The protection of industrial heritage buildings is due to their value. The ultimate goal of all protection measures directly acting on the industrial heritage building noumenon is to protect the value of industrial heritage buildings. Therefore, the most fundamental problem that needs to be discussed in the transformation of industrial heritage buildings is the value of industrial heritage buildings. Only by understanding and grasping the value of industrial heritage buildings can we know the specific object and content of protection, further determine how to protect, what protection methods to adopt, and what corresponding protection measures to choose. The author believes that the value composition of industrial heritage includes the following five aspects:

Industrial heritage is the material carrier recording the social economy, science and technology of an era, and has witnessed the tremendous changes in science, technology, economy, culture and other aspects under the influence of industrial activities.At the same time, industrial heritage reflects the pursuit of a better life of human society and the power of human beings to control the material world, and has a profound impact on history and today's social morphology.

Industrial heritage contains cultural values cast in industrial activities such as enterprise spirit and corporate culture, which exist in people's memories, feelings and living habits related to industrial activities. It has the functions of cognition, education and notarization, which is the embodiment of the social and cultural value of industrial heritage.

The scientific and technological value of industrial heritage is mainly reflected in the site selection planning of industrial land, the construction of buildings and structures, the design of technological process, and the building materials, structures and construction techniques in construction projects.

It reflects the school, characteristics and style of the development history of architectural art in a certain historical period. Architecture or planning design reflects the advanced nature of the times and has high quality. The artistic expression, appeal and aesthetic value of buildings, structures and mechanical facilities.

4 INTELLIGENT SCHEDULING ALGORITHM

The energy dispatching algorithm in the industrial building reconstruction is embedded in the central controller of the intelligent reconstruction system. By controlling the operation of the equipment, the scheduling of different forms of reconstruction is realized. It can not only directly affect the architectural design to improve the safety, convenience and comfort of the building, but also adjust the load balance and stability of the design through demand response measures to ensure the reliable operation of the scheme. The main component is used to evaluate the construction quality of the human settlements in the Community. The establishment of the indicator system is mainly based on the general conditions that must be met when evaluating the urban human settlements. The data mainly comes from the calculation of the correlation coefficient matrix between the original indicators based on the standardization of the original indicators. Calculate the principal component contribution rate and cumulative contribution rate according to Table 1.

Variable	***Characteristic value***	***Contribution rate***	***Cumulative contribution rate***
1	*8.836*	*81.147*	*99*
2	*5.607*	*95.523*	*81.1*
3	*4.909*	*29.476*	*88.2*
4	*8.522*	*14.182*	*80.2*
5	*4.745*	*4.7338*	*82.9*
6	*8.577*	*2.5633*	*88.4*
7	*4.101*	*8.8651*	*98.2*
8	*4.829*	*2.6301*	*86.1*
9	*5.002*	*1.4169*	*85.4*
10	*4.179*	*9.4357*	*82.3*

Table 1: Eigenvalues and Contribution Rate of Principal Components.

$$z_i = \frac{\lambda_i}{\sum_{k=1}^{p} \lambda_k} \tag{1}$$

The cumulative contribution rate is:

$$\Delta z_i = \frac{\sum_{k=1}^{i} \lambda_k}{\sum_{k=1}^{p} \lambda_k} \tag{2}$$

The tradeoff of multiple objectives and the effective combination of multiple technologies will realize the further development trend of intelligent scheduling algorithm. More intelligent and humanized design is the key to solve the current development needs of intelligent scheduling algorithm. The multi-objective optimization problem is composed of decision variable parameters, objective functions and constraints, which can be summarized as a minimization problem as follows:

$$F(\overline{x}) = f_1(\overline{x}), f(\overline{x}), f_m(\overline{x}) \tag{3}$$

Among them, X is the decision space formed by the decision vector, and f is the target space formed by the target vector.

The problem of combination is how to reasonably and effectively arrange the resources, running time and sequence of its components or operations under certain constraints, so as to obtain the optimization of time or cost. It is also such a process that, on the premise of satisfying certain constraints, a certain scheduling objective is optimized on the basis of limited resources.

Among them, the parameter relation expression is:

$$\min(k) = \sum_{i=1}^{K} \frac{T_k}{\Delta t_k} \tag{4}$$

$$\sum_{i=1}^{n} Y_i P_i \le 0 \tag{5}$$

$$\sum_{i=1}^{n} X_{ij} = Y_j,\ j = 1,2,\cdots,n \tag{6}$$

$$\sum_{j=1}^{n} X_{ij} = Y_i, i = 1,2,\cdots,n \tag{7}$$

$$\sum_{i=1}^{n} Y_i = n \tag{8}$$

In the formula, P_i represents the quantity required for community environment optimization i, which means that the actual load of managers is less than or equal to the maximum load limit Q. Formula (6) means that each community can only be served by one manager. Formulas (7) and (8) indicate that managers can only start from one community and eventually go to another. Formula (9) means that each community must be served.

As the fixed cost remains unchanged, to minimize the total cost of industrial building transformation, only the cost and penalty cost need to be considered. The mathematical model for minimizing the total cost can be established as follows:

$$Z = w\sum_{i=0}^{n}\sum_{j=0}^{n} t_{ij} X_{ij} \tag{9}$$

During the design, the material selection is mainly light, which can effectively reduce the building foundation load, so as to effectively prevent the occurrence of settlement. Generally, the construction project should be built on the foundation with the same stiffness as far as possible. If different foundations are used according to the actual needs of the project, technicians should carefully investigate the specific soil conditions in the construction area in advance. Personnel should carefully investigate the specific soil conditions in the construction area in advance. Select the appropriate foundation treatment method based on the relevant calculation simulation data results. Select the appropriate foundation treatment method based on the simulation data results.

$$T_1 = \sum_{k=z+1}^{z} \int_0^{t_{ij}} (t_{ij} - t)\phi(l,k)dt \tag{10}$$

In the formula, T_1 represents the increased working hours of the operating staff required for the retrofit of the industrial building.

After transformation, the users are positioned as young individuals who are engaged in creative industries and need space for survival and entrepreneurship, or small teams of 2~6 people who can have a suitable living and entrepreneurial environment.

5 INVESTIGATION AND ALGORITHM SIMULATION EXPERIMENT

Through the research on the distribution of industrial enterprises, it is sorted out that some industrial enterprises that were built earlier and have made greater contributions to industrial development, and still exist at present, are the objects of this industrial heritage study, and a list of building attribute evaluation items is obtained (see Table 2). Then, by means of questionnaire survey, we put forward questions on the appearance, service facilities, safety conditions and other aspects of the staff and residents in several factories, so as to understand the needs of people for the transformation of the current situation, so as to better determine the direction of further transformation. A total of 50 questionnaires were sent out and 48 valid questionnaires were recovered.

Serial No	Architectural nature	Building quality	Number of building floors
1	Textile industry	Better	Three floors
2	Related industries	Poor	Three floors
3	Related industries	Commonly	Three floors
4	Machinery industry	Poor	One floor
5	Machinery industry	Poor	One floor
6	Machinery industry	Commonly	One floor
7	Related industries	Better	Two floors
8	Related industries	Poor	Two floors

Table 2: Building Attribute Evaluation Items.

From Table 2, it can be found that the industrial categories of the land are mainly textile industry, machinery industry and related industries. At the same time, the building quality is basically above the average, mainly with good quality. It can be seen that the building as a whole is well preserved and can be properly repaired, protected or reused, and has good cultural and economic value. Of course, the number of floors in the building is mainly one or two.

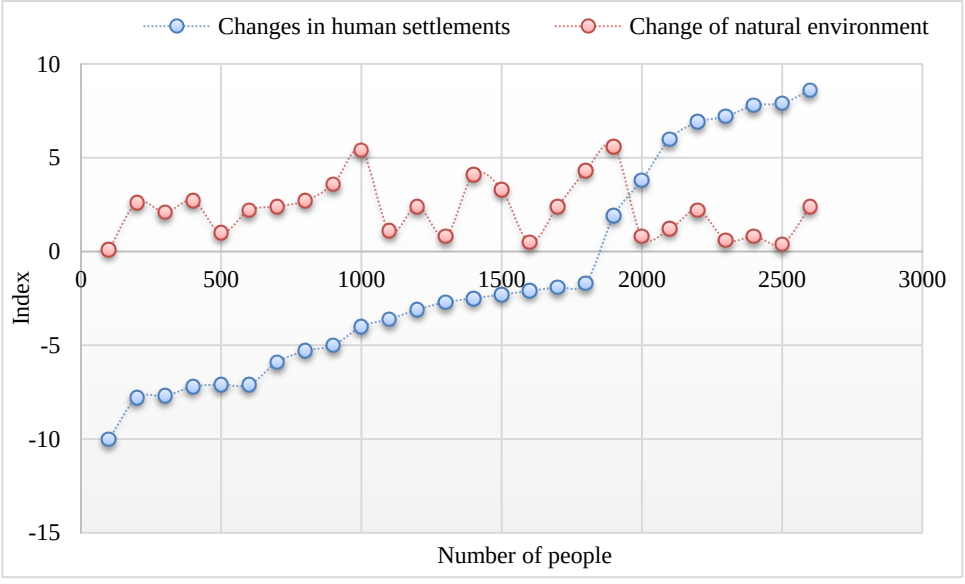

Figure 3: Comparison of the Development of Per Capita GDP in the Community and the Construction of Urban Living Environment.

The survey also found that the improvement of the natural environment quality of the Community was relatively slow and volatile, seriously lagging behind the overall level of the quality of urban human settlements. The contribution rate to the construction of the quality of human settlements in the Community is very low and has delayed, which hinders the overall improvement of the quality of urban human settlements (Figure 3).

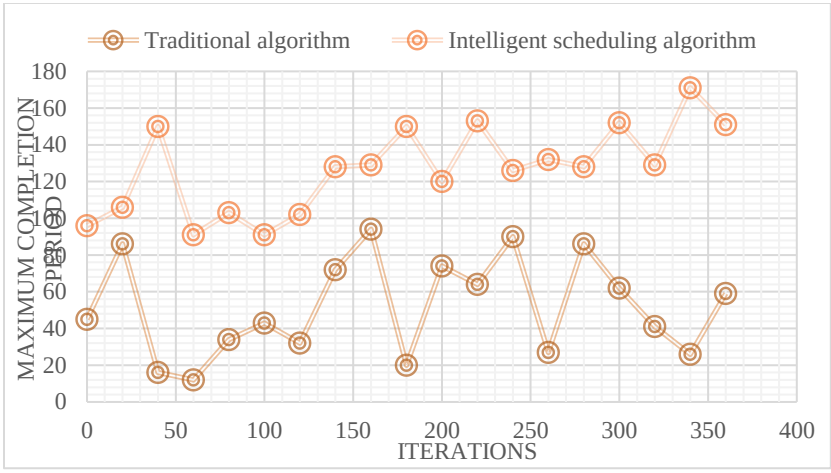

Figure 4: Convergence Curves of Different Algorithms for Optimal Computation Allocation Technology.

From the Figure 4, we can clearly find that the optimal amount of computation allocation technology can intelligently allocate the limited amount of computation to each individual in the population, but excellent individuals get more computation. In other words, the optimal computation allocation technology can guide the genetic algorithm to converge to the region most likely to be the optimal solution depending on the results of accurate identification.

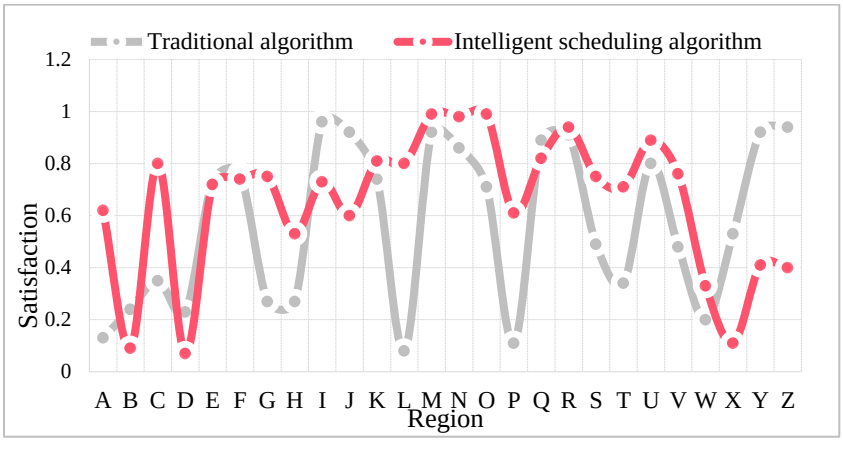

Figure 5: Comparison of Residentcomfortalgorithmsapplication.

It can be seen from Figure 5 that using intelligent scheduling algorithm to optimize the community environment is more satisfactory than traditional algorithm. The essence of resource scheduling is to prioritize users according to environmental conditions, user needs and other preconditions, and

to generate the most reasonable resource allocation scheme under the constraints of limited resources, so as to optimize the system performance under the conditions of ensuring user business needs.

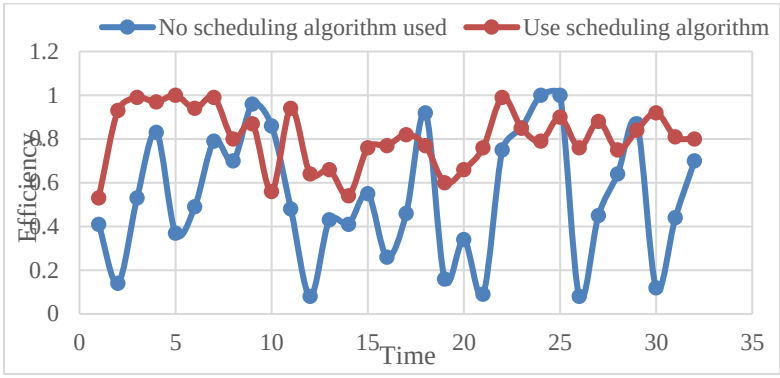

Figure 6: Comparison of Industrial Building Renovation Efficiency.

Figure 6 compares the efficiency of industrial building reconstruction in the same time when the scheduling algorithm is used and not used. It can be seen that the efficiency is higher when the scheduling algorithm is used than when the scheduling algorithm is not used. Through calculation, the average increase is 23.14%, which meets the requirements of efficient transformation and shortening the use time of the community, and verifies the effectiveness and feasibility of the algorithm in improving efficiency. The realization of dynamic adaptability is to distribute the corresponding tasks to different servers through the decentralized strategy. In this way, the stability of the operation is ensured and the running efficiency of the program is improved. In addition, the scalability of the intelligent scheduling algorithm needs to be flexible, that is, to manage multiple clouds on the basis of virtualization.

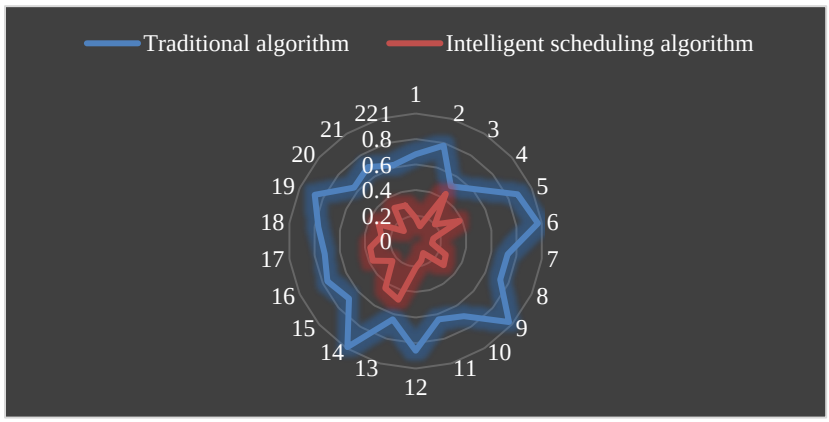

Figure 7: Comparison of Constructionconsumablesrates.

It can be seen from Figure 7 that the material consumption rate of building reconstruction using intelligent scheduling algorithm is much lower than that of traditional algorithm. Different users have different time and space requirements for obtaining information. The resource scheduling algorithm is used to sort the user priority according to the user's needs and environmental conditions, and then the resources are prioritized to users with higher priority according to this sort. The remaining users can also obtain relevant information from the scheduled resource users according to the environmental conditions or distance conditions, which is the priority based resource scheduling scheme. At the same time, in view of the deviation between the prediction information and the real-time information, a real-time correction scheduling algorithm is proposed to make real-time adjustment, and the prediction algorithm and scheduling algorithm are modified by collecting user feedback information.

To sum up, after investigation and a large number of random experimental data, the calculation results show that the performance of this algorithm is better than that of the traditional algorithm for all problem situations, and the average efficiency is increased by 31.26%, indicating that its scheduling result is very close to the optimal solution of the problem. This paper analyzes the characteristics of existing intelligent scheduling algorithms and users' demand for comfort of community living environment, and proposes a dynamic scheduling priority to ensure and enhance users' comfort experience.

6 CONCLUSIONS

Based on the concept of ecology, combined with the surrounding special geographical environment-the impact of canal and city's social function structure, life style, transportation mode and other factors on industrial heritage, it is inevitable that industrial heritage will reappear its connection with the past implicitly or explicitly, reflecting the evolution process of urban form, and so on. The development of any city has its own process of growth and development, and it will inevitably retain its own historical environment, which is the materialization of the city's history and culture and the witness and memory of the city's development. While people's living standard is improving day by day, the reuse of industrial heritage and the provision of urban service facilities are mainly to meet people's physiological needs. Physiological needs are the most basic needs of people, and recreational facilities are also the most basic service facilities in urban public space. In the use of urban public space, people's physiological needs show that people need a comfortable environment that conforms to human physiological functions when they use urban public space for various activities. By constructing an intelligent scheduling algorithm, it is used to optimize the community living environment and transform the industrial building heritage. After investigation and a large number of random experimental data, the calculation results show that the performance of the algorithm is better than that of the traditional algorithm for all problem situations, and the average efficiency is improved by 31.26%, indicating that its scheduling results are very close to the optimal solution of the problem. The summarized design principles and reuse modes of industrial heritage protection and utilization provide a theoretical basis for the protection of industrial heritage and the improvement of human settlements in the Community and other domestic industrial areas.

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