



Application of Green Building Design Concept in Architectural Design under Data Mining

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ABSTRACT

With the increasing awareness of ecological environment and environmental protection, more and more design concepts are shifting towards green, intelligent, and sustainable directions. Green building design has also sparked a trend in the construction industry and is being widely applied. Therefore, when enterprises engage in architectural design, they should actively respond to national environmental protection policies, change traditional design methods, and adopt new energy-saving and environmentally friendly green building concepts. This paper uses data mining and BIM (Building Information Modeling) technology to analyse the green building design concept and verifies its application in architectural design through practical examples. Data mining technology analyses the key factors influencing green building design and establishes relevant correlations. The application of BIM systematic management technology to green building design is studied. The results indicate that the data mining-based graphical green building design better meets the requirements of modern architecture.

Keywords: Data Mining, BIM Technology, Green Building, Architectural Design Application

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1. Introduction

The concept of green building design is proposed and used based on architectural evaluation standards, and the understanding of theoretical concepts also needs to follow clear regulations [1]. Traditional architectural design thinking only stays at basic aspects such as terrain, building type combinations, and material selection. As modernization and sustainable development continue to accelerate, an increasing number of people prefer green and healthy building types [2]. From the perspective of green living and green design, the full life cycle characteristics of the construction industry are quite evident. To achieve green building design requirements,

considerations must be made in terms of ecology, energy consumption, pollution, and other environmental aspects. Green building design concepts can ensure the health of people's lives and provide efficient working environments and indoor and outdoor environments for the audience. This is also the basis for ensuring harmonious coexistence between buildings, modern society, and natural ecology [3]. In addition to green design requirements, comprehensive performance should also satisfy various aspects such as health comfort, safety durability, and convenient living. During the construction process, the green concept must be accurately positioned, and the core ideas of green building design should be grasped to ensure that every construction process reflects the concepts of energy saving and environmental protection [4].

To adapt to the development of modern society and meet people's needs for green living, this green building design can not only avoid environmental pollution problems but also improve the quality of life [5]. Paying attention to the selection of various internal construction materials and the use of process technology in advance can also reduce energy consumption and resource waste to a certain extent. In order to promote the sustainable development of the construction industry and maintain the normal operation of the ecosystem, the priority should be given to the use of recyclable materials in materials and energy [6]. Finally, combining people's spiritual needs, design comprehensive buildings that include aesthetics, comfort, safety, and full functionality. We conducted a background investigation and explored several basic principles as theoretical support: firstly, the environmental protection principle. Pollution is the most serious problem in construction, and it is also an urgent problem that needs to be solved during the development of the construction field [7]. Environmental pollution mainly manifests in aspects such as noise, water sources, and air. Under the concept of sustainability, green building design needs to deeply integrate construction projects and maintain the ecological environment with the goal of green economic development. Secondly, the economic principle issue. When the living standards of modern society continue to improve, the functionality of buildings also faces new challenges and requirements. Many buildings often have material and resource waste problems during the construction process, and this economic problem brings tremendous pressure to construction companies. Therefore, the green building design concept needs to ensure feasibility in practical applications. Lastly, the people-oriented principle. In the design concept, it should follow the needs and expectations of the people for building groups and consider normal functional use. This includes the comfort and safety of the internal environment and ensuring aesthetics while maximizing the functionality of the building.

2. Current Development of Mining Technology and Green Building Design Concept

The construction industry consumes a large amount of energy during the construction process, and overall resource waste has gradually exceeded other industrial projects, making it a major consumer in various countries. Under the guidance of China's carbon neutrality initiative, corresponding regulations and plans need to be based on energy-saving and green principles. The position of green building design in the deepening urbanization construction is irreplaceable, and the national requirements for its environmental quality and other indicators are increasing [8]. Green building design belongs to a new type of construction concept under the large environment, which utilizes energy-saving and environmental protection for highly efficient use of building energy. In the era of big data, the development of various data technologies has also played a significant role in the construction industry. Massive data information has become an important reference index for today's social production and design. Considering that the green building design concept is gradually taking shape, applying relevant big data technologies to green building design is an inevitable trend. Utilizing data mining and graphic

image design analysis can open up new possibilities in the architectural trend [9]. This data processing technology not only optimizes management and classification of information but also improves the accuracy of algorithm results in practical operations. The emergence of data mining technology can not only solve the problem of dynamic data calculation but also help improve the speed of system operation. This emerging technology based on big data environment can extract important elements in the data features when dealing with a large amount of dynamic, complex, nonlinear, and random data information. Furthermore, data mining technology is an effective extraction and analysis method for dynamic large-scale databases, which can provide valuable assistance for enterprise planning and enhance the industry's development potential [10].

According to the survey, the application of data mining technology in the field of scientific research has a certain complexity, and all scientific research work requires repeated attempts and adjustments. Therefore, the accuracy and effectiveness of data information have a huge impact on the experimental research results. In addition to containing a large amount of data, rich data features are all valuable activities that require specific analysis. Whether these data can be calculated efficiently determines the results of scientific research activities. The application of data mining in this field can solve the problem of difficult dynamic data processing under traditional models, helping researchers identify effective information and complete experimental operations in a short time. In addition, with the development of computers and networks, the technical level and quality of the telecommunications market have also reached new standards. The application of data mining technology in the telecommunications industry is reflected in the integration of its vast information. By finding standard path rules from complex data sets, telecommunications practitioners can understand industry trends through data analysis and ensure telecommunications services. Finally, we explore the role of data mining technology in the green building design concept based on the above background and investigate its practical application in architectural design.

3. Mining Technology and its Application in Architectural Design

3.1 Graphical Green Building Design Analysis

The concept of green building design takes the changes in the natural environment and ecology as an important basis, emphasizing the harmonious coexistence of humans and nature. This architectural concept not only ensures the quality and safety of buildings but also meets the requirements of pollution-free and renewable utilization. It optimizes ecological harmony and stability through green environmental protection. As the green building design concept has become the core content of the reform and development of the construction industry, a large amount of resources will be consumed from the initial design stage to the completion of construction. Effective reduction of energy consumption can expand the level of green protection and create new dwellings that meet the functional needs of the public and environmental protection. Green building design may involve the utilization of various renewable elements such as wind energy and solar energy, and it reflects the artistic expression of green building design through environmentally friendly color combinations.

Big data processing technology essentially involves the integration and control of information resources in large datasets. It has been widely applied due to its ability to handle a vast amount of computations in a short time. The process of data processing, with its free capture and calculation, hides powerful decision-making effects, and the optimization algorithms for information computation are increasingly prominent in various fields. Data mining technology targets feature groups in large datasets, and with the dynamic growth of data on the internet, the scale of data and the demand for technical proficiency have become more critical. In addition, the diversity of data types falls within the scope of data mining technology, where green building design often involves

capturing and processing graphical and image features. In this context, the primary task is not only to collect information but also to combine the analyzed results to create design solutions. We define the formula for obtaining graphical features under data mining technology as follows:

$$\text{Lim} | x^2 * u / \sum_i^m j * k_0 | \quad (1)$$

Where represents dynamically changing graphical feature points. These dynamic variables not only affect the results of green building design but also influence the speed of fitting, altering the choice of design schemes. Further analysis of the computational process for information fitting and recombination in data mining technology is as follows:

$$\frac{\text{Lim} | \sum_i^m j * p_n |}{N + (U_i / D_i)} \quad (2)$$

The formula outputs operations based on the feature variables captured by data mining, categorizing similar design information points as recombined basic elements. Finally, with the help of BIM (Building Information Modeling) architecture, data resources are integrated, and relevant information provided by the architectural engineering is used as the carrier of the system. Based on real terrain data, a simulation platform is used to construct the design drawings for green buildings. The application formula for this multidimensional model processing technology in the BIM system in terms of information correlation is as follows:

$$x(j = 1, 2, \dots, m) / y^e + T^2 \quad (3)$$

Where represents the effective data variables required for BIM information modeling in computations. The combination of these two technologies as a communication design platform can enable green building designers to dynamically grasp information changes during the design process, thereby achieving an improvement in engineering efficiency.

3.2 Practical Application of Green Building Design Concepts in Architecture

In the design phase, green building concepts need to consider the comprehensive construction of buildings as well as the subsequent random variations, helping to reduce energy consumption and environmental pollution

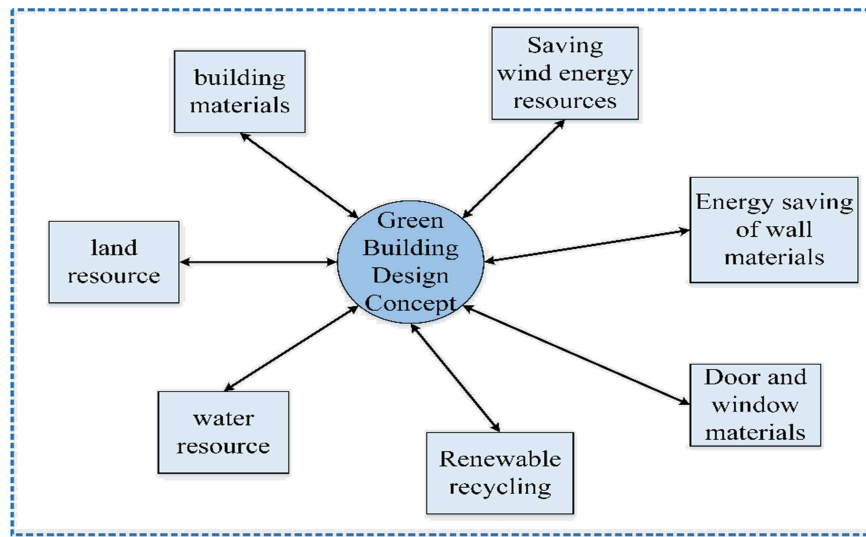


Figure 1. Green Building Design Concept Development Diagram

during the construction process. Green building design concepts need to firmly integrate the core idea of comprehensive resource utilization, focusing on the combination of ecological environment and public demands to create modern building clusters that are comfortable, highly functional, and environmentally friendly. In practical applications, green building design also needs to take into account the internal development situations of various countries. It should achieve effective and reasonable results not only in the planning of intuitive and three-dimensional buildings but also in energy-saving, emissions reduction, and unit-area utilization. It requires comprehensive consideration of synchronized development in terms of water resources, land resources, and energy resources to achieve safety and green elements within the limited conditions of the buildings. Solving the problems of wasted urban building land and environmental pollution, promoting harmony between the public and the ecological environment, and demonstrating the economic and social values of green construction. We outline the development direction of green building design concepts.

From Figure 1, it can be seen that the green building design concept includes the conservation of building materials, water resource conservation, land resource conservation, natural environment, and renewable recycling systems. The control of building materials also focuses on artificial decoration, doors and windows decoration, and wall decoration. We used data mining technology to conduct in-depth analysis of the information sources in the application examples of green building design. The analysis and processing during the data collection process are the most critical steps. If we calculate according to the lifecycle of the building, various processes such as design, construction, maintenance, and acceptance application will involve data resources. These data types can be classified as objective information, environmental information, physical information required for buildings, energy consumption information, etc. Data mining technology used cluster analysis method in the analysis of the actual application effect on green building design:

$$\frac{a_x^i + a(t / m_n)}{U_0 \sum_k j * g} \quad (4)$$

Where represents the similar data elements generated during the data mining process. According to the hierarchical integration function of clustering, data objects with abstract meanings are divided into different groups. Information within each large set that has certain characteristic traits is combined into the same category. In simple terms, it is the process of finding similar elements. Finally, with the help of building information modeling, the green design concept is integrated into the actual application projects on the network platform, facilitating the comparison of different design concepts in the research process.

4. Graphic Green Building Design Analysis based on Mining Technology and its Application

In this study, relevant and effective data were extracted from the collected green building design proposals. During the processing of basic data, a database algorithm model matching the final project was established. The database model also provides an environment support for data mining technology. At the bottom level of the data structure, 2000 basic data samples were used, which were obtained from the test results of instance projects of green building design. In the process of data monitoring and collection analysis, various distinguishing factors such as energy consumption, pollution, and energy-saving and emissions reduction were classified step by step. The upper-level processing structure of the basic data source contains multiple information modules, including the design parameter calculation module, the design object analysis module, and the simulated design concept module. The design parameter calculation needs to incorporate the results of graphic image processing under

data mining to obtain a suitable combination of characteristic data for green building design concepts, facilitating subsequent efficient and rapid design realization. According to the auxiliary project objectives of the data model, the simulated green building design schemes were synchronized and organized based on the collected data. A BIM building information model simulation platform was established, and computer-aided software on the platform was used for simulation realization. We conducted dynamic comparison and analysis of the feasibility of graphic image processing technology under data mining in green building design schemes.

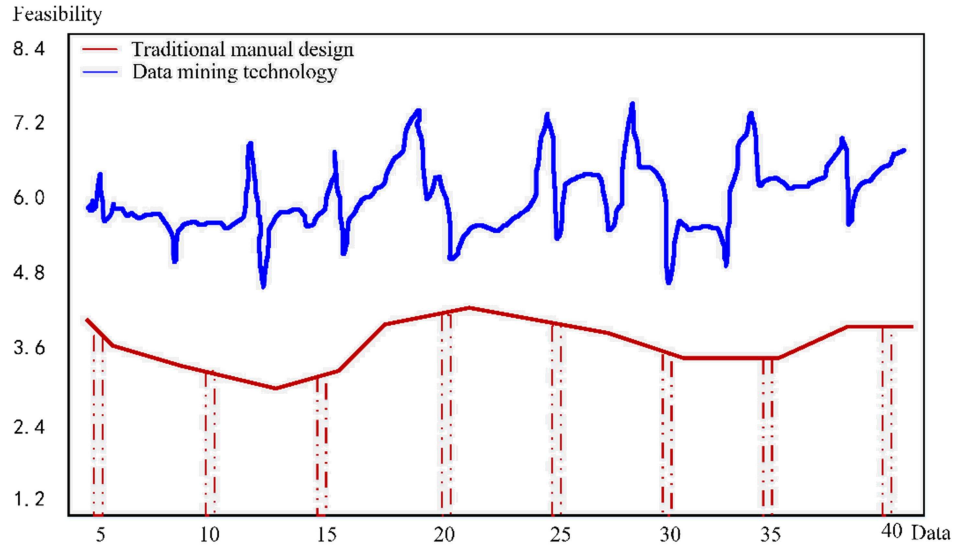


Figure 2. Feasibility Comparison of Two Technologies in Green Building Design Schemes

From Figure 2, it can be seen that the traditional manual design concept has relatively limited dynamic feasibility changes, while the green building design schemes recombined using data mining technology have a higher success rate. At the same time, we found that the basic data in the design parameter module includes geographic parameters, building physical parameters, ecological environment parameters, etc., and in our research, we only discussed and analyzed these three data parameters. Randomly selecting data samples from a large database related to the application of green building design, we compared the impact of the above three parameters.

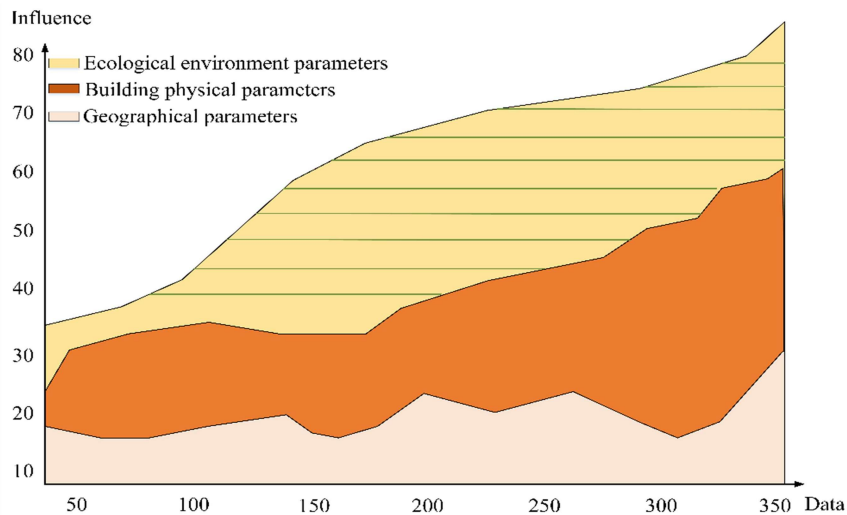


Figure 3. Impact Comparison of the Three Parameters

From Figure 3, it can be seen that the ecological environment parameter has a relatively large impact proportion among the three parameters, followed by building physical parameters, which are more likely to affect the design schemes and actual construction results. In the data mining process, the automatic discovery of relevant information and its integration into the building information model can utilize the predictive advantage of machine learning to evaluate and predict the actual application of green building design. Obtaining feedback information on the design of green buildings helps to make up for the shortcomings in traditional design schemes. BIM, as an online communication platform for design concepts, can improve the efficiency of designers in drawing up schemes and also assist in better meeting the needs of both parties. Integrating design feedback information is beneficial for overall work efficiency improvement. Meanwhile, BIM's automatic updating function provides dynamic timeliness opportunities for design development and helps to reduce negative reactions from the public towards green building design in subsequent management applications.

5. Conclusion

With the pursuit of economic development and improved living standards, the construction industry also needs to achieve optimal updates in the overall environment. Global environmental protection and ecological preservation have always been important research topics for each country. How to optimize design schemes and achieve the transformation of green building design concepts in architectural design has become crucial. This paper adopts data mining technology in the big data environment to optimize green design concepts and schemes through graphic image analysis. By combining BIM technology to construct a virtual platform for building information, it helps architects communicate with the public in a timely and effective manner. Starting from the basic requirements of green building design concepts, the paper delves into discussions on energy conservation, environmental protection, and cost savings in architectural design. Data mining technology is used to optimize and integrate the green building design process, resulting in a valuable resource package for effective design. By using the design ideas provided by the BIM information management platform and considering the influence factors of topography, physics, and the public, the paper provides practical references for the design process. The research results indicate that the graphic green building design concept under data mining technology has received favorable evaluations from a large part of the architectural design community.

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