Application of Computer BIM Technology in Building Energy Saving Design

Huwei Zhang

Abstract In order to improve the performance of building energy saving, information communication, computer network, automation control and other applications are the current development direction of building energy saving technology. They form a series of technical measures for the operation and intelligent monitoring of building energy-saving management system. This paper introduces and analyzes the application of information technology in building energy saving. In view of the demand of building energy conservation on intelligent building energy consumption monitoring, this paper proposes a system framework of building energy consumption monitoring and analysis system based on Internet of things, which has certain enlightenment for further realizing real-time monitoring and control of building energy consumption and improving energy-saving level.

Keywords Computer technology · BIM technology · Architectural design · Building energy saving design

1 Introduction

With the continuous improvement of living standards, computer technology has become indispensable in our life. Global energy demand is growing rapidly. Construction accounts for about 15% of the world's energy consumption. Intelligent and systematic energy management technologies are increasingly being developed to reduce energy use in the construction industry. Previous studies have used their own decision models, including knowledge base and rules. However, in the field of building energy, they lack a structural framework for organizing information and knowledge representation as a set of concepts. In order to enhance the framework and knowledge representation, we adopt ontology. In addition, ontology can

H. Zhang (✉)
Liaoning Jianzhu Vocational College, Liaoyang 111000, Liaoning, China
e-mail: zhanghuwei003@sohu.com

J. C. Hung et al. (eds.), *Innovative Computing*, Lecture Notes in Electrical Engineering 791, https://doi.org/10.1007/978-981-16-4258-6_94

provide reasoning function and context awareness. We propose a rule-based ontology reasoning system to provide context awareness. In this system, we design an ontology model of building energy-saving management, and generate reasoning rules from the accumulated knowledge base of building energy-saving measures. The measures of eliminating waste and saving energy are put forward [1, 2].

Due to the continuous improvement of computer technology, many experts have studied the computer BIM Technology. For example, some teams in China discussed the application of BIM Technology in computer-aided building energy-saving design, analyzed the current development and application status of computer energy analysis software at home and abroad, and then proposed the way to solve the problem BIM Technology according to the existing problems. Through a large number of examples, the application of BIM Technology is discussed from the aspects of scheme stage, late design stage and fluid analysis. It is concluded that BIM Technology has fundamentally changed the way and process of building information creation. Some teams have studied the application method of BIM Technology in public building design through green building evaluation standards, green building theory, and building information model (BIM) technology. This paper introduces the application of BIM Technology in green public building design. Through the application of design methods in specific public building design cases, such as indoor and outdoor environment, energy saving, material saving and other design effects, the economy, rationality and personality of BIM Technology in public building design are verified. Some experts have studied how to combine BIM Technology with various technologies in the process of residential building design, and apply BIM Technology to the process of architectural design, so as to help architects conveniently, accurately and effectively analyze residential building space, make components, and analyze building energy consumption, So as to better realize the residential building design in the architectural design stage, especially in the scheme stage, and better manage the whole life cycle of residential buildings [3]. An expert also introduced the relevant concepts and technologies of BIM into the energy-saving transformation of existing office buildings, analyzed the universality and specificity of existing office buildings, and sorted out the relevant theoretical system of energy-saving transformation of existing buildings. This paper summarizes the targeted transformation strategy system of existing office buildings, and concludes that the energy-saving transformation of office buildings is universal and regional in qualitative strategy system, and has adaptability and specificity in quantitative design of energy-saving transformation strategy. Only by accurately grasping the relationship between the two and taking information as the basic criterion, can BIM play a great role and potential, The office building after energy-saving transformation can better serve the office users [4]. Although the research on computer technology is abundant, there are still some deficiencies in the research of computer BIM Technology.

In order to study the computer BIM Technology, this paper studies the application of computer BIM Technology in response surface method experiment, and finds out the green building design of computer BIM Technology. The results show that

the computer BIM Technology can achieve the goal of green and energy-saving buildings.

2 Method

2.1 Application of Computer BIM Technology in Response Surface Method Experiment

BIM Technology takes information as the medium between the components. The operation mode of the system will change from the traditional manual drawing to the form of integrating data information. In this information-based design mode, any design behavior is aimed at information rather than a simple element, This enables the various fields related to architecture to share a platform that everyone can identify and exchange information platform. BIM Technology is a new engineering digital design method in architectural design industry in recent years. Through building information model, comprehensive civil engineering design, related detection and pipe network control can be realized. BIM Technology has been widely recognized by international academic circles and software developers. As a new supporting technology in the engineering construction industry, BIM is not only based on one or a kind of software, but also includes different applications of different specialties, different application parties and different project stages. Therefore, the application of BIM has derived a series of related technology software platforms. Among them, the information core modeling software is the key core. This paper reviews the application of response surface methodology and visual communication technology in biosorption modeling and optimization. The theoretical background and application program of the method discussed are described. The most commonly used experimental designs, their limitations and typical applications are introduced. How to determine the accuracy and significance of model fitting is also introduced. In addition, the references for modeling and optimizing absorptive using RSM and ANN methods in recent years are also introduced [5]. Special attention should be paid to the selection of factors and responses, as well as the statistical analysis of modeling results. The application of visual communication technology in response surface methodology (RSM) optimization experiment design can theoretically guide experimental optimization and provide optimization design for exploring new technology in actual production [6, 7]. This method can be used in medical chemistry, life science, film culture and other fields. It provides a new research idea and method for experimental optimization design. For example, suppose an experimenter wants to find out the levels of temperature (x1) and pressure (x2) to maximize the yield (y) of the process. The yield is a function of temperature and pressure levels, As shown in follow:

$$y = f(x_1, x_2) + \varepsilon \tag{1}$$

where ε represents the observation error or noise of response y, including uncontrollable adverse factors and model fitting errors. If the expected response is e (y) = f(x1, x2) = η, then

$$\eta = f(x_1 + x_2) \tag{2}$$

2.2 Computer BIM Technology Green Building Design

Drawing is an important ability of BIM. All kinds of plane, section, elevation drawing and statistical report can be obtained from BIM model. Therefore, in the green building design based on BIM, construction drawing is the most easy task design compared with the previous design stage. After deepening the design, the design result is a three-dimensional model with rich building information. In BIM Technology, what you see is what you get means that if you want to draw a plan, you only need to point the view interface to the relevant floor of the required plan to get the floor plan of the relevant floor. In the 3D view, the detailed drawing of the stairs can be obtained by cutting the stairs; the layout of the complicated piping in the computer room will also be very clear in the 3D view. In the context of project documentation, BIM can significantly reduce design errors, and the resulting models can be reused during the construction phase, for example, for planning and costing, and for asset management at handover. The characteristics of BIM itself make the drawing more like an accessory of the model. Although the drawing is still an important method to record and guide the whole process of building construction, in the future, the drawing will probably stop being the way to express the design information, and the model will become the main expression method of building information stipulated by law and contract. The American Institute of steel construction has such a paragraph in its standard that if the steel structure of a scheme is represented by model and drawing at the same time, the design record shall be subject to the model. If the current legal restrictions on the format of drawings are lifted, it is believed that the development process of BIM will be further accelerated, which will also provide the possibility to further improve the efficiency of design and construction.

3 Experience

3.1 Extraction of Experimental Objects

Computer BIM Technology extraction is mainly to extract its features. Traditional feature extraction methods mainly include texture structure extraction, color difference selection, self structure feature extraction and orientation feature extraction

[8]. In this chapter, aiming at the complex factors such as the diversity of computer BIM Technology objectives, the uncertainty of information and data, and the problems existing in the interactive design extraction of computer BIM Technology, the compensation fuzzy interaction design is introduced into the computer BIM Technology extraction, and a computer BIM Technology extraction method based on compensatory fuzzy interaction design is proposed Visual communication technology extraction, in-depth study of network structure conception, membership function establishment, sample creation, feature selection and selection, model construction and other related issues [9].

3.2 Experimental Design

The CNN model structure extracted by feature method can be divided into three steps: the first step is interactive design p reprocessing, including edge preserving relaxation filtering and pixel block extraction; the second step is feature extraction of visual communication technology; the third step is feature fusion classification. Because ape can mines the effective information in the original spectrum and lacks spatial information, if it does not Denise in advance, it is necessary to implement the feature fusion and classification, On the other hand, it can make up for the lack of spatial information of each pixel, or extract the spatial features of each pixel better than the single feature in the space. In order to verify the validity of the model, two public data sets, namely, kindness and gregariousness, were selected for comparative experiments. Then, the noise interference features are denotative to improve the classification accuracy. If the noise is not predecessor, the noise is too large, resulting in the neural network unable to learn the features we want, so the classification accuracy is very low. Finally, a comparative study is carried out [10].

3.3 Statistical Analysis of Data

Mathematical statistics: use Excel data processing software to analyze and statistically process the relevant data, and present them in the form of charts. The formula is as follows:

$$SUMIF\left(\$A\$2:\$G\$2, H\$2, A3:G3\right) \tag{3}$$

4 Discussion

4.1 Development of Green Building in China's Construction Industry

Green building is one of the measures to alleviate the significant impact of building stock on environment, society and economy. However, there is a lack of systematic review of the large number of studies that are crucial for future research. Compared with traditional buildings, the benefits of green buildings are quantified, and various methods to realize green buildings are discussed. It is found that the existing research mainly focuses on the environmental aspects of green buildings. Other dimensions of green building sustainability, especially social sustainability, are largely ignored. Future research opportunities are identified, such as the impact of climate conditions on the effectiveness of green building assessment tools, validation of actual performance of green buildings, unique needs of specific groups of people, and future proof. In recent decades, there are more and more researches on green building. China's construction industry "energy conservation and emission reduction" situation is grim. The share of building energy consumption in China's energy consumption has exceeded 24%. Among them, the energy consumption of air conditioning and heating accounts for 50–80% of the total building energy consumption, which has become the largest energy consumption in China. As of 2010, the proportion of completed housing area in China is 11.20% in the East, 12.34% in the west, 31.50% in the south, 15.40% in the north, 9.08% in the southwest, 10.84% in the southeast and 10.09% in the central region. The southern region is a domestic region with good economic foundation. The total amount and speed of urban buildings are in the forefront of China. The whole southern region and northern region account for half of the total amount of the country, as shown in Table 1 (Fig. 1).

However, China's urbanization process is developing rapidly. In 2010, there are 50 billion square meters of buildings in China, and the total building area of houses in 2015 will reach six times that of 2000. From 2005 to 2007, China's urbanization rate increased from 12.34 to 15.67%, and the number of urban population increased from 644 to 733 million, with an average annual increase of 17 million urban population. With the sustained and rapid development of China's social economy, people's requirements for indoor comfort of buildings are gradually improved, and building energy consumption will continue to rise, which brings great pressure to China's building energy conservation and emission reduction work. Energy will be consumed

Table 1 Statistics of land area of various regions in China

Region	Eastern region	Western region	Southern region	Northern region	Southwest China	Southeast China	Central region
Area covered (%)	11.20	12.34	31.50	15.40	9.08	10.84	10.09

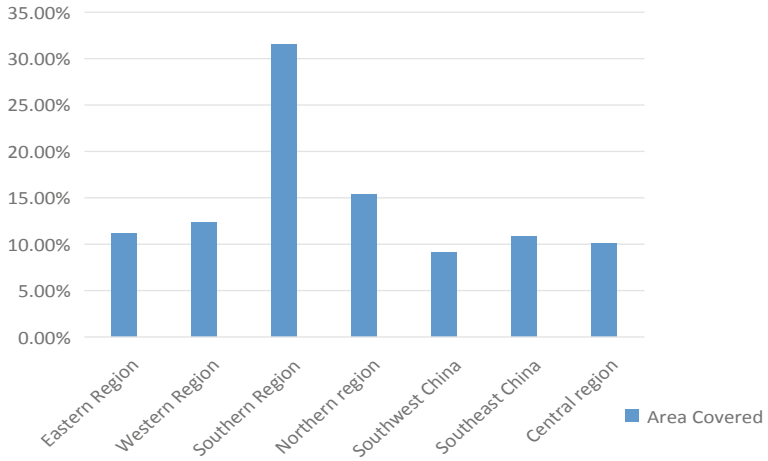


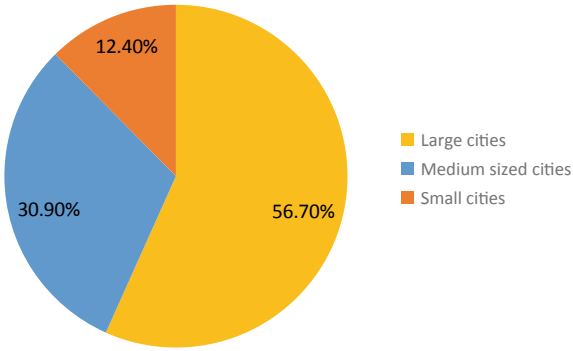
Fig. 1 Statistics of land area of various regions in China

Table 2 Energy consumption in different cities

City type	Large cities	Medium sized cities	Small cities
Energy consumption rate (%)	56.7	30.9	12.4

in the process of architectural design. Buildings in China are divided into high energy consumption and low energy consumption. According to the energy consumption of different urban buildings, we found that the design of large-scale urban buildings consumes the most energy. As shown in Table 2 (Fig. 2).

Fig. 2 Energy consumption in different cities



5 Conclusion

Building energy saving is an important means to reduce the cost of building design, through network and computer control, can significantly reduce building energy consumption. On the basis of "green building", this paper analyzes the actual environment of the building by using computer, adapts to natural light, uses artificial lighting correctly, and realizes the goal of green energy-saving building. The computer simulation of building energy consumption is one of the important auxiliary tools in the field of energy conservation. Architects can easily evaluate the energy saving of the design process through computer simulation at any stage of the design process, or predict the future or existing building energy consumption through the test, and diagnose and analyze the building thermal engineering, which provides the accuracy for optimizing the building design and minimizing the energy consumption The basis of. Aiming at the influence of simulation on reducing building energy consumption, this paper discusses the application of simulation in architectural design training. The performance of the simulator in different stages of the design process is studied by using quantitative method. The influence of simulation on the design process, building performance and energy efficiency is investigated. The results of this study show that there is a significant difference between the perception of design process before and after use.

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