Analysis on construction practice of intelligent prefabricated building based on BIM technology

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Abstract. In the rapid development of Chinese construction industry, intelligent assembly building construction based on low cost, high efficiency and other advantages, in the practice of inquiry has been widely paid attention to. Although scholars around the world have strengthened the research on the theory of intelligent prefabricated building construction technology, with the vigorous development of the construction industry, a large number of safety problems have emerged in existing construction projects. Therefore, some scholars have proposed to scientifically solve the problems faced by intelligent prefabricated building construction management with the help of information integrated BIM technology, so as to build a highly efficient and normative safety management system. On the basis of understanding the construction management of intelligent prefabricated building and the research status of BIM technology, this paper deeply discusses how to apply BIM technology in intelligent prefabricated building construction and give full play to the unique advantages of BIM technology according to the main characteristics and construction requirements of intelligent prefabricated building construction in the new era.

Keywords: BIM technology; Intelligent building; Prefabricated construction; Building construction; Safety Management

1. Introduction

BIM technology refers to building information management technology and building information model technology, which has the characteristics of information consistency, information visualization, information simulation and information optimization. It can integrate construction units, construction units, design units and supervision units on the same platform and share building information model, so as to ensure the visualization and fine construction management of construction projects. From the perspective of practical application, BIM technology has multiple functions, such as collaborative management, three-dimensional rendering, accurate planning, effective control and collision inspection, and is an important basis for intelligent prefabricated building construction management in the new era. [1-3]Prefabricated construction refers to the type of building in which prefabricated components are transported to the construction site for assembly and construction. It is less affected by climate and other factors during the construction and management period, and the actual operation is simple and the construction period is short. Therefore, it is very suitable to be widely used in the urban construction and development in the new era. This architectural concept first appeared in the 1960s, because of its unique technical advantages, so it has been widely used around the world. Nowadays, with the continuous development of information technology and industrial technology, the theory and technology of prefabricated buildings have been further optimized, which can not only concentrate the construction design together, but also better meet the development needs of green environmental protection. It should be noted that prefabricated building construction is also faced with many problems, such as the existence of architectural design errors, the project construction design link is difficult to ensure the quality of late operation, resulting in the emergence of a large number of safety hazards during the construction application; The construction quality of the site is low, and the construction units and supervision departments with safety risks in various technical materials do not deal with them in strict accordance with the regulations and requirements, so it is difficult to guarantee the quality and safety of the project on the basis; Safety management personnel do not fully understand the technical standards of prefabricated building construction, whether it is the

design scheme, or the management system has defects, not in strict accordance with the construction drawings or construction plans for the operation, which leads to the efficiency and quality of prefabricated building construction projects are too low.[4-6]

In the process of construction management, BIM technology is regarded as the carrier of modeling, collect and sort out the parameter information, and cooperate with all departments to complete the project design and comprehensive management with the form of information technology, which is a new technical means proposed by the intelligent prefabricated building construction management in the new era. In the construction process of prefabricated building engineering, the main directions of integrated application of BIM technology are shown in Figure 1 below:
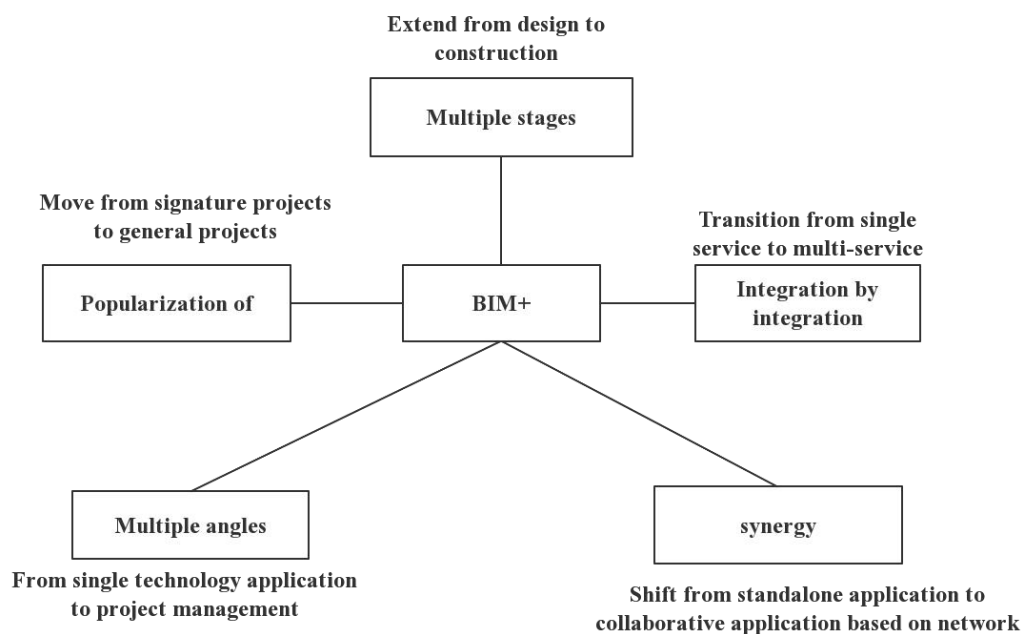

FIG. 1 Application direction of BIM technology

Based on the above analysis, it is found that the application of BIM technology in prefabricated buildings will present the characteristics of multi-stage, popularization, multi-angle, synergy and integration, which will help the construction unit to intelligently control the installation site, verify the corresponding technical scheme according to the form of intelligent installation and splicing verification, and simulate and analyze the whole construction process. After finding the problem, warn the management in time and ask them to quickly develop a solution based on their own work experience. According to the application technology of prefabricated building construction in recent years, BIM technology, as an important reform form of computer aided technology, can further improve the refinement and high precision of building construction and meet the needs of urban construction and development in the new era.[7-9]

According to the research results of BIM technology in recent years, construction enterprises can carry out intelligent analysis and selection of the database on the basis of the collection of relevant data and information. In the process of exploring the design of prefabricated buildings, BIM technology can further improve the work efficiency of employees in the department. On the one hand, BIM technology has the characteristics of simulation and execution. The staff can quickly check the transmission mode of the building and understand the construction management progress of the project in the design analysis. On the other hand, BIM technology has the characteristics of visualization, can get rid of the traditional work mode only relying on construction drawings and imagination, convenient designers to create pictures or images, and finally three-dimensional presentation of intelligent prefabricated building structure, which can not only improve the efficiency of practical work, but also attract more customer groups to actively participate in the

communication and decision-making of construction. Achieve the expected work objectives quickly. On the basis of understanding the accumulated experience of intelligent prefabricated building construction, this paper focuses on the BIM technology content applied in intelligent prefabricated building construction from the aspects of project design, equipment monitoring, automatic alarm and so on, and defines the project design principles and structural optimization measures based on the sustainable development of the building industry. In order to build and develop the socialist road with Chinese characteristics in the new era.

2. Methods

2.1 Project Design

In order to ensure the steady development of the current prefabricated construction project towards the direction of intelligence and advanced, the most critical thing is to pay attention to the construction of a perfect operation platform in the architectural design of the application of technology, arrange professionals to arrive at the site for investigation and analysis, and on the basis of sorting out and analyzing the relevant data, directly store it in the database of the building platform, and then conduct modeling and analysis. According to the 3D modeling software as shown in Figure 2 below, the staff is required to define the application planning scheme by analyzing the structure of the prefabricated building project on the basis of clear management requirements and design drawings, and then put forward the corresponding modeling plan and import the obtained model into the platform.[10-13]
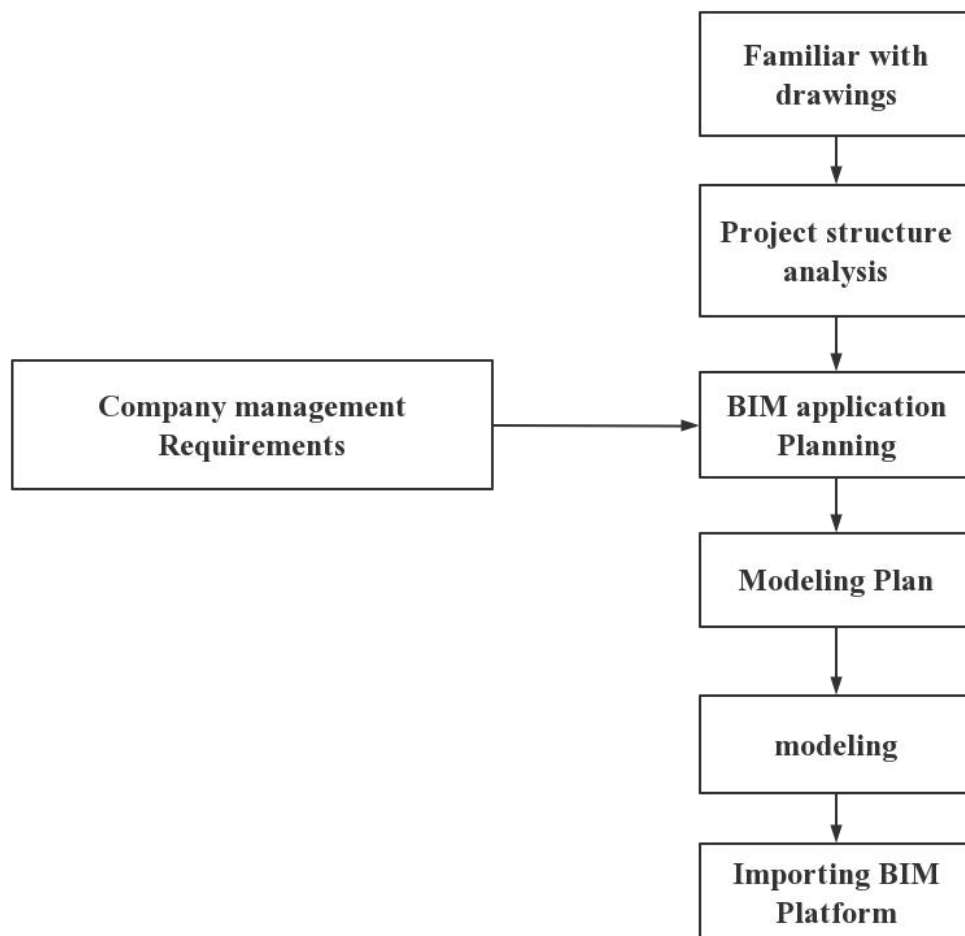

FIG. 2 Flow chart of 3D modeling

The application of BIM technology in the process of project design can clarify the basic parameters of model simulation according to the surrounding environment, plan and design the overall construction scheme, and create a prefabricated building model more suitable for site routine. Compared with the traditional two-dimensional drawings, digital annotation and text analysis can more clearly show the construction difficulties and key areas, and help the construction units, project owners, design units and other quick access to relevant information. Generally, the use of BIM technology to design prefabricated building projects needs to focus on the three contents of architectural design, structural design and equipment design. Finally, the BIM model can be obtained by completing the assembly according to the building household module.
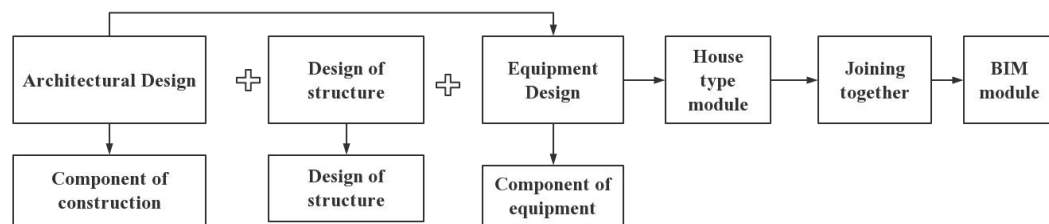

Figure 3 Flowchart of the project design

2.2 Device Monitoring

Firstly, the BIM technology and the Internet of Things are combined by the equipment operation status monitoring to help the employees of the department to observe the operation of various technical equipment of intelligent prefabricated building construction management in real time, which can better realize the remote equipment management goal. Secondly, the equipment abnormal alarm system can accurately judge whether there are abnormal phenomena in the feedback information of the sensor and monitoring system. If the judgment result is abnormal, the system will send an alarm to inform the operation and maintenance management personnel of each department, and reflect the abnormal position in the BIM model, so as to facilitate the department staff to solve the equipment failure faster. Finally, equipment statistics and query can help department employees to check the basic information of equipment properties, space, operation and maintenance records anytime and anywhere, quickly screen the work table of equipment information, and provide technical support for the realization of intelligent prefabricated building construction management. Take the general design contractor leading management mode as an example. After the owner entrusts a general design contractor, the contract will be signed according to the application requirements of the proposed project. Besides completing the business in the design stage, the design unit or its consulting team entrusted by the owner shall organize and control the participating parties in the construction and operation and maintenance stage on behalf of the owner, as shown in FIG. 4:[14-15]
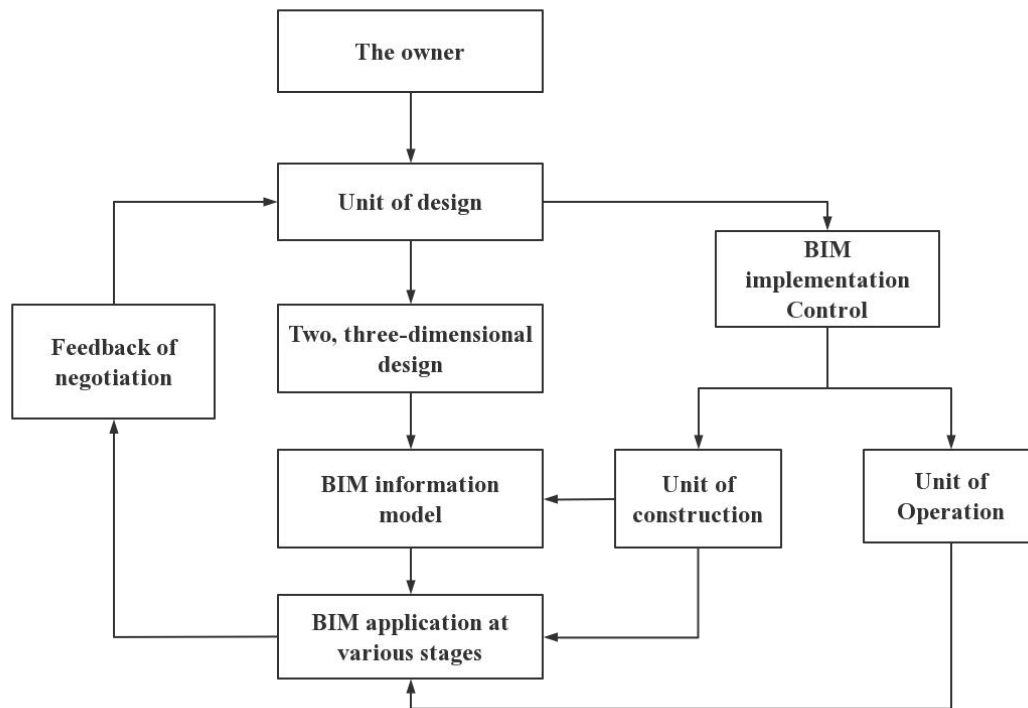
Figure 4 Design the general contractor led management mode

In this process, the construction unit and operation and maintenance unit can use the equipment monitoring system to complete the basic tasks as soon as possible.

2.3 Automatic Alarm

It is the inevitable direction of intelligent prefabricated building construction management in the future to build an automatic warning model for prefabricated building and its equipment system by using the data integration operation platform with intelligence as the core. Based on the early warning system architecture diagram shown in Figure 5 below, it can be seen that the overall system includes the contents of the application layer, platform function, data center monitoring center, data transmission layer, data acquisition and perception layer. When a certain indicator of the device collected by the platform exceeds the upper or lower limit of the threshold, the mechanism of the early warning system is triggered and the relevant data is directly provided to the management personnel. From the perspective of practical application, the overall system design is to use the model to achieve the automation and standardization of the equipment management operation early warning process, which can not only real-time supervision of the specific state of important equipment and structure operation, but also 24-hour uninterrupted control of the prefabricated building construction site, effectively reduce the pressure of department staff, and comprehensively improve the efficiency of equipment monitoring.
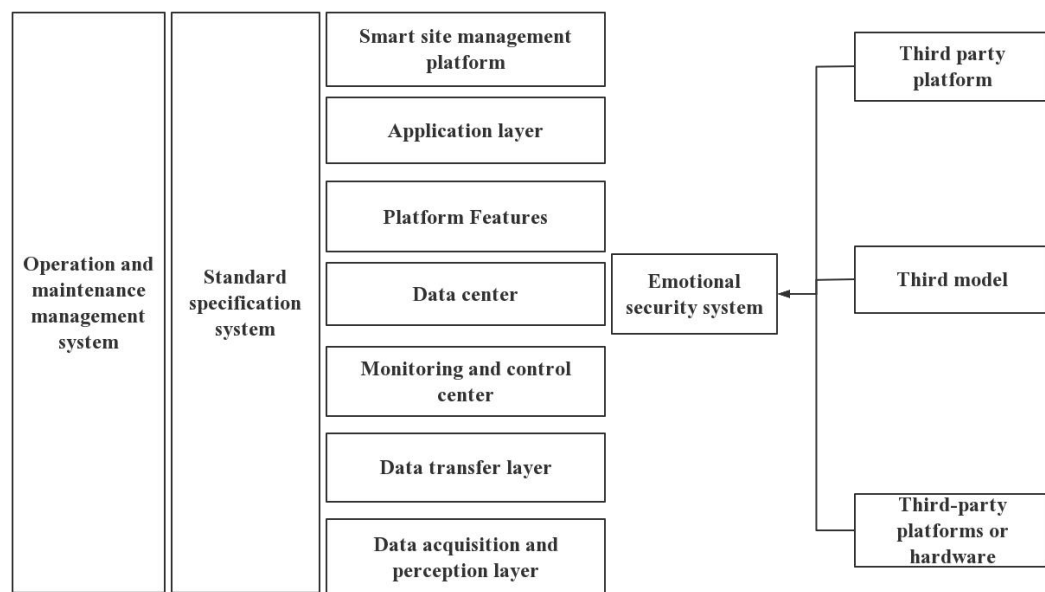
Figure 5 Architecture diagram of early warning system

3. Result analysis

According to the current BIM technology applied in the construction management of intelligent prefabricated buildings, it has the following advantages: first, it can speed up the construction progress, scientifically control the transportation of materials and the approach time, and facilitate the employees of all departments to master the basic information at the same time, scientifically control the construction progress of the construction project, and avoid the adverse factors affecting the production and transportation; Secondly, it can fully guarantee the quality of construction projects and the safety of construction sites. The application of BIM technology can ensure the collaborative management of the construction site, truly realize the visual operation, reduce the communication time between various departments, and fundamentally guarantee the quality of project construction management; Finally, it can improve the project construction efficiency. As an important carrier of data transmission and application, BIM technology collects and stores information based on BIM technology to comprehensively simulate the entire process of prefabricated building construction management, which can not only fully control the construction scheme and technical process, but also control the safety risks of construction management and enhance the accuracy of construction projects.

Under the background of the new round of technological and industrial revolution of "German Industrial Manufacturing 4.0" and "Made in China 2025", the world's construction industry is facing new changes and significant impacts. A variety of new ideas and models have emerged in the field of construction, such as networked construction, green assembly, parallel assembly plants, etc. At this time, the intelligent prefabricated building construction project based on BIM technology will develop steadily in the following directions: On the one hand, the green structure assembly system. This mode is one of the main contents of exploration and application in developed countries. Its purpose is to make the prefabricated buildings move towards the direction of safety, environmental protection and sustainable development, reduce the impact on the natural ecological environment, and improve the application efficiency of resources. On the other hand, the whole industry chain information platform. This mode is an important technical means for the prefabricated building industry to realize the whole life cycle management, quality responsibility and traceability management. It is necessary to use technology to set up an information exchange platform for the consultation, planning, design, management and other links of the prefabricated building industrialization, so as to facilitate the employees of all departments to grasp more information.

Conclusion

In conclusion, because BIM technology has unique advantages such as coordination and visualization, in the rapid social economic development of our country, faced with higher and higher requirements of construction management, intelligent assembly building construction projects, we should start from multiple angles and discuss how to apply BIM technology to build a green, energy saving and highly efficient environmental protection new prefabricated building environment. Lay the foundation guarantee for core development of construction industry in our country.

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