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Application of Intelligent Construction in Building Project Based on BIM

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Abstract: BIM technology is widely used in the construction of intelligent buildings. Based on BIM technology, the scientific and safety requirements of intelligent building design are constantly improved, and the advantages of BIM technology are brought into full play in the field of architectural design. BIM technology can realize the digitalization and intellectualization of building design. It can effectively control the cost of architectural design, and use the relevant simulation module to comprehensively analyze the structural strength, spatial illumination changes, air flow and other conditions of architectural design. At the same time, BIM technology can also use digital marking technology to prefabricate modules to improve the efficiency of architectural design and construction, effectively shorten the construction cycle, and truly realize the intellectualization of architectural design. Intelligent building construction based on BIM integrates the management of intelligent visitor, intelligent security, intelligent monitoring, intelligent canteen, intelligent energy, intelligent facility management and other systems into the integrated operation management platform of the park, so as to achieve the purpose of improving safety management, enhancing customer interaction, reducing labor costs, ensuring operation quality and reducing operation energy consumption.

1. Introduction

Building intelligent system integration is to further integrate several independent subsystems into the integrated system management platform through standardized protocols or interfaces. This includes the organic integration of building automation management system, office automation and integrated communication to achieve information and resource sharing. In the process of building intelligent construction, BIM is mainly based on information data. Make the building process information, so as to achieve intelligent. In the process of building construction, through the collection of building information, and then establish a building database, through intelligent calculation and analysis, so as to meet the requirements of modern buildings. BIM technology makes the construction process more scientific and reasonable. Reduce the waste of materials and the use of manpower in the construction process, and improve the efficiency and capacity of construction. Intelligent building can make up for and improve the shortcomings and shortcomings in the construction process through big data and cloud computing technology. In the process of construction, through the use of BIM technology, the construction is intellectualized, thus reducing

the difficulty of construction workers to see the design drawings. Through three-dimensional visualization, workers can clearly and intuitively understand the internal structure of the whole building and optimize the whole construction process, which can not only improve the quality of the project, but also reduce the construction time of the project.[1] These systems can be integrated into the flat building information model in the work, which is called "BIM" for short, and its core is to establish the three-dimensional model of the building. It can provide a complete, reasonable and real construction engineering information database. Based on digitalization, construction engineering information will be updated and enriched with the progress of the project. BIM is applicable to the design stage of the project, as well as the whole life cycle of construction and operation. It provides a platform for the design, construction, construction and supervision parties of the project to work together. With the continuous expansion of the scale of modern urban construction and the wide application of information technology in architectural design, the level of intellectualization and informatization of urban construction has been significantly improved, among which the application of BIM technology in the construction of smart cities. It not only changes the traditional way of architectural design, but also effectively improves the efficiency of modern smart city construction, making architectural design more scientific. Moreover, the construction of smart city is the integration of modern science and technology and traditional architectural design, emphasizing the structure, space, layout and function of traditional architectural design, through BIM technology can effectively design traditional architecture. It has an important impact on promoting the construction of smart cities.

2. Basic features of BIM

2.1. Visualization

2.1.1. Design Visualization

BIM tools have a variety of visual modes, generally including hidden line, shading with border and realistic rendering.[2] It also has a walkthrough function, which can show the model to the customer by creating a camera path and creating an animation or a series of images.

2.1.2. Construction Visualization

Visualization of construction organization: Through the creation of various models, virtual construction can be carried out in the computer to visualize the construction organization. [3]Visualization of complex structural nodes: By using the visualization features of BIM, complex structural nodes can be presented in an all-round way, such as complex reinforcement nodes, curtain wall nodes, etc.

2.1.3. Visualization of equipment operability

BIM technology can be used to check whether the building equipment space is reasonable in advance. Compared with the traditional construction method, this method is more intuitive and clear.

2.1.4. Visualization of Electromechanical Pipeline Collision Inspection

By assembling the professional models into a whole BIM model, the collision point between the electromechanical pipeline and the building can be displayed intuitively in a three-dimensional way. In the BIM model, the collision points can be found in the real three-dimensional space in advance,

and the CAD drawings can be exported after the collision points or unreasonable points are adjusted by various professionals in the model.

2.2. Integration

Integration means that BIM technology can carry out integrated management throughout the whole life cycle of the project from design to construction and then to operation. In the design stage, BIM enables architecture, structure, water supply and drainage, air conditioning, electrical and other specialties to work based on the same model, and integrates the whole design into a shared building information model. The conflict between structure and equipment, equipment and equipment will appear intuitively, which will promote the integration process of design and construction. During the construction phase, BIM can simultaneously provide information on building quality, schedule, and cost. BIM can be used to realize visual simulation and visual management of the whole construction period; In the stage of operation and management, improve the level of revenue and cost management. It provides great transparency and convenience for developers to sell investment and owners to buy houses. This technology has clearly demonstrated the overall benefits of coordinated design, shorter design and construction schedules, significantly reduced costs, improved workplace safety, and sustainable construction projects.

2.3. Parameterization

Parametric modeling refers to the establishment and analysis of models through parameters (variables) rather than numbers. New models can be established and analyzed by simply changing the parameter values in the model. The parametric design of BIM is divided into two parts: "parametric entity" and "parametric modification engine". "Parametric element" means that the element in BIM is in the form of a component. The differences between these components are reflected through the adjustment of parameters, which hold all the information of elements as digital building components; "Parametric Change Engine" refers to the technology of parameter change so that any changes made by users to building design or document parts can be automatically reflected in other related parts.[4]The essence of parametric design is that the system can automatically maintain all the invariable parameters under the action of variable parameters.

2.4. Emulation

2.4.1. Building Performance Analysis Simulation

Building performance analysis simulation is based on BIM technology. Architects give a lot of building information (geometric information, material properties, component properties, etc.) To the virtual building model created in the design process, and then import the BIM model into the relevant performance analysis software to get the corresponding analysis results. Performance analysis mainly includes energy consumption analysis, illumination analysis, equipment analysis, green analysis and so on.

2.4.2. Construction Simulation

Simulation and optimization of construction scheme; Automatic calculation of quantities; Eliminate site construction process interference or construction process conflict.

2.4.3. Construction schedule simulation

Construction schedule simulation is to integrate spatial information and time information into a visual 4D model by linking BIM with construction schedule, so as to reflect the whole construction process intuitively and accurately.

2.4.4. Operation and maintenance simulation

Equipment operation monitoring: BIM technology is used to realize the functions of searching, positioning and information query for building equipment. Energy operation management: monitor and manage the energy usage of tenants through BIM model, endow each energy usage record table with sensing function, and collect and process information in time in the management system. Through the energy management system, the energy consumption is automatically statistically analyzed, and the abnormal usage can be warned. Building space management: Based on BIM technology, the owner can intuitively query and locate the space location of each tenant and the tenant's information through three-dimensional visualization, such as tenant name, building area, lease range, rent and property management. It can also realize the reminding function of various information of tenants, and realize the timely adjustment and update of data according to the change of tenant information.

2.5. Coordination

Design coordination, overall schedule planning coordination, cost budget, quantity estimation coordination, operation and maintenance coordination. Operation and maintenance management is mainly embodied in the following aspects: ① space coordination management; ② Coordinated management of facilities; ③ Coordination and management of concealed works; ④ Emergency management coordination; ⑤ Energy conservation and emission reduction management coordination.

2.6. Optimality

BIM and its supporting optimization tools provide the possibility of optimizing complex projects: combining project design with return on investment analysis, calculating the impact of design changes on return on investment, so that owners know which project design scheme is more conducive to their own needs, and optimizing the design and construction scheme can bring significant improvement in construction period and cost.

2.7. Graphability

Using BIM technology, in addition to the output of building plans, elevations, sections and details, it can also produce collision reports and component processing drawings.

2.7.1 Output of construction drawings

① Collision between architectural and structural disciplines: mainly including whether the elevation, column, shear wall, etc. in the architectural and structural drawings are consistent.
② Collision of each discipline inside the equipment: mainly to detect the conflict between each discipline and the pipeline.
③ Collision between architectural and structural disciplines and equipment disciplines: for example, collision between equipment and interior decoration.
④ Solve the spatial layout of pipelines: Based on the BIM model, the spatial layout of pipelines

can be adjusted and solved, such as the narrow corridor of the machine room and the intersection of pipelines.

2.7.2. Component processing guidance

① Provide the component processing drawing
② Component production guidance
③ Realize the digital manufacturing of prefabricated components

2.8. Information Completeness

Information completeness is reflected in that BIM technology can describe 3D geometric information and topological relationship of engineering objects, as well as complete engineering information, such as object name, structure type, building materials, engineering performance and other design information. Construction process, progress, cost, quality, manpower, machinery, material resources and other construction information; Engineering safety performance, material durability and other maintenance information; Engineering logic relationships between objects, etc.

3. Application of BIM in the construction industry

BIM will greatly improve the production efficiency of the construction industry through the digital and visual full-cycle platform. At the same time, the predictive management and maintenance functions contained in BIM will also promote the construction industry to a new level.

3.1. Intelligent application of BIM technology in architectural design stage

Digital BIM models allow for sharing, collaboration, and versioning in a way that paper drawings do not. With cloud-based tools such as Autodesk's BIM 360, BIM collaboration can seamlessly span all departments within a project, allowing teams to share project models and coordinate planning. At the same time, with the help of cloud tools, project teams can view drawings and models on site and mobile devices. Get real-time access to the latest project information. In the planning stage, accurate cost estimation is essential, and cost changes in the construction process are difficult to control efficiently, which promotes the rapid development of model-based cost estimation, that is, 5D BIM. 5D BIM adds time schedule and cost estimation to traditional 3D modeling, bringing construction project management to a new stage. Using BIM tools, designers can visually preview the entire project in the early stages of construction.

3.2. Application of BIM technology in the construction phase

BIM allows the construction company to better coordinate with subcontractors to detect any MEP (HVAC, Electrical, Plumbing), internal or external conflicts before construction begins. For example, can electrical conduits collide with steel beams? Is there sufficient clearance at the door? With BIM software, there is an opportunity to plan ahead of the construction site and prevent these conflicts in advance. Thereby reducing the amount of rework required for any particular job.[5]According to a study by McKinsey, 75% of companies that have adopted BIM have achieved a positive return on investment.

3.3. Application of BIM technology in building management and control stage

Making good use of BIM can help construction companies save costs in various ways. For example, close cooperation with contractors can reduce the risk of bidding, reduce insurance costs, reduce

overall changes and reduce the probability of claims. Detailed visualization of the project prior to construction allows for more prefabrication of components and less waste of unused materials; At the same time, Labor costs on documentation and miscommunication can be reduced. In addition, as more and more team members use various project data, real-time collaboration in BIM software reduces the risk of companies using outdated information, ensuring that the right information is available at the right time, which is essential for a successful high-quality project. Through the application of BIM, Construction parties can plan more accurately and communicate accurately, and scheduling optimization can help the project to be completed on time or ahead of schedule. [6]Due to the progress of various technologies, today's construction industry is becoming more and more industrialized. BIM has contributed to the industrialization of construction. BIM data can immediately generate production drawings or databases for manufacturing purposes. Allow greater use of prefabrication and modular construction technique. By designing, optimizing, and building offsite in a controlled environment, you can reduce waste, increase efficiency, and reduce labor and material costs. BIM helps to improve the safety of buildings, identify potential hazards, and avoid physical injuries through visualization and site planning.

3.4. Application of BIM Technology in Facilities Management and Project Handover Phase of Construction Project

Through BIM, all data can be sent to existing building maintenance software for subsequent use. The contractor can complete the handover of the building by connecting the BIM data generated during design and construction to the building operations system. At the same time, BIM can provide accurate building information and continuous digital records. The information in the BIM model can also endow the digital operation management of the building after the completion of construction, which can bring twice the result with half the effort to the facility management and maintenance renovation throughout the life cycle of the building, and ultimately help the owner achieve a good return on investment.

4. Problems in BIM application

4.1. Information in the transmission of errors, missing and other phenomena.

Although a few architectural design software based on BIM technology, such as AutoCAD Revit series developed by AUTODESK Company in the United States and ArchiCAD series developed by Graphisoft Company in Hungary, support the input and output of IFC files. In the process of file input and output, there are errors and missing of building information. In the test of HUT-600 platform based on BIM technology developed by Kam-Calvin and others of Stanford University in the United States, it is pointed out that when the IFC file is input into ArchiCAD11 software, the internal database does not conform to the information format contained in its own IFC file, resulting in the loss and error of information contained in building components. Pazlar, T., University of Ljubljana. , et al., are also describe architectural desktop 2005,In the test of IFC file transmission between AllPlan Architecture 2005 and Archicad9, it is pointed out that each major software vendor uses its own database to connect with its display platform. Because the database is not built according to the IFC standard format, it is inevitable to input IFC files. Results such as missing information and errors during output.

4.2. The software cannot save IFC files for multiple projects

For the file storage mode used by software vendors nowadays, such as DWG file storage mode of

Au-todesk series, one file can only store one or several drawings. When faced with multiple projects, multiple files and large amounts of data, this storage mode can not be achieved. At present, software such as Revit can store a project as a file. However, there are still two problems: first, this still cannot achieve the function of storing multiple projects; Second, the size of the file with engineering as the unit of information is often very large, and its operation, such as input, output and editing, will seriously affect the efficiency of operation.

4.3. Lack of specialized software to support IFC file format

The field of architecture is a comprehensive discipline involving many specialties, such as the need for structural calculation in the design of buildings, the need for budget estimates in the cost of buildings, and so on. However, there are few software on the market that supports IFC file format in these functions. The author believes that for such problems, in the long run. It is necessary to develop various corresponding functional software on the basis of IFC documents; In a short period of time, it is necessary to develop the corresponding file format conversion software to convert the IFC format file into the file format supported by the existing functional software on the market.

5. Concluding remark

In summary, In the process of continuous construction engineering, The application of BIM technology plays a very important role in the whole life cycle of z project management, Whether in the engineering design stage, project construction stage, project control stage, project facility management and project handover stage, For the project quality control, safety management, progress control, cost management, There is also the cost control aspect, Scientific arrangements were all made for the two groups, Can manage the project construction with targeted, To some extent, it breaks the traditional construction and management mode, Improve the quality of the project construction, Promote the development of the construction industry. Therefore, in order to better use the BIM technology, it is necessary for the government to formulate unified standards and guidelines to realize the interconnection of data and information, gradually improve the BIM information platform, and ensure the security of BIM information. At the same time, colleges and universities should also carry out BIM related courses to cultivate professionals and realize the favorable combination of school and enterprises. Therefore, the development trend of the building information model BIM is inevitable. The building information model BIM is based on digitalization. Its emergence can help the participants to communicate in the first time and reduce various collision problems encountered in the design and construction stage.

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