

Research on Collaborative Management of Construction Project Based on BIM5D Cloud Platform

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Abstract: The thesis takes BIM integration as the core and builds a BIM5D cloud collaborative management platform based on the three modules of model center, data center and application center. Through the 3D model data interface, it integrates multiple professional BIM models for construction, and uses the BIM integration model as the carrier. , Integrate various key information in building construction into the same platform, and use the characteristics of BIM model to be intuitive and computable to provide help to all parties in the construction. All parties to the construction project can use the WEB, PC, and mobile devices at any time. Access the BIM5D cloud platform anywhere, conduct 5D visualization applications, realize information sharing and collaboration between all parties in the construction, and achieve the purpose of completing project construction tasks efficiently and with high quality. Taking the application of a construction project as an example, the paper verifies the practical performance of the BIM5D cloud collaborative management platform and provides a reference for the implementation of collaborative management of construction projects.

1. Introduction

BIM (Building Information Modeling) is a multi-dimensional model information technology, and its application and development is the inevitable trend of the development of construction industry informatization in the future. BIM technology provides a convenient platform for all parties involved in construction projects to coordinate their work. The introduction of BIM has completely changed the past relatively independent work in the construction industry, inconvenient communication and cooperation, and obstacles to information sharing. It is considered to solve the problems of construction industry production. Fundamental problems and important potential means to improve project performance[1].

The application of BIM in my country first started in design companies, and it has been very effective in the deepening design and structural design of large and complex projects[2]. Under the vigorous promotion of national policies, the application of BIM in the construction phase is gradually promoted, and there are fewer applications in the operation and maintenance phase, and the full life cycle application of BIM has not yet been realized[3][4]. Research on information intercommunication and collaborative work in BIM applications is still in the emerging stage. Due

to the existence of imperfect workflow, software connectivity and professional interactivity, all parties to the construction project and all aspects of the construction life cycle still exist. A certain degree of disconnection, information sharing is difficult to achieve, and effective collaboration is impossible[4] [5]. To this end, the paper takes BIM integration as the core and Internet technology to build a BIM5D cloud collaborative management platform based on three modules: model center, data center, and application center, so as to realize information sharing and collaboration between all parties in the construction to achieve high efficiency and high efficiency. The purpose of completing the project construction tasks in quality.

2. BIM5D Cloud Platform and Collaborative Management

BIM5D refers to the addition of two types of information, time schedule and cost, to the three-dimensional model (3D) to form a BIM5D building information model. The use of BIM5D technology to perform three-dimensional modeling, construction simulation, schedule control and resource optimization of the project can effectively improve management efficiency[6].

The construction project is a systematic project. In the project management, the owner, the designer, the construction party and the project participants are involved. The construction project consists of multiple subsystems such as construction, water supply and drainage, electrical, HVAC, steel structure, and curtain wall. In order to ensure the quality and quantity of the project, it must go through the cooperation of the participating parties and the cooperation between the professional subsystems. At present, there are more and more engineering projects with large engineering volume, high construction technology difficulty, tight schedule, and many participants. Such construction projects have great challenges in data management and work collaboration. The BIM5D cloud collaboration platform formed by Internet + BIM5D breaks down various barriers and boundaries between project-related participants, engineering information, and work processes, and realizes efficient and collaborative management of construction projects.

3. Integration of Construction Project Management System based on BIM5D Cloud Platform

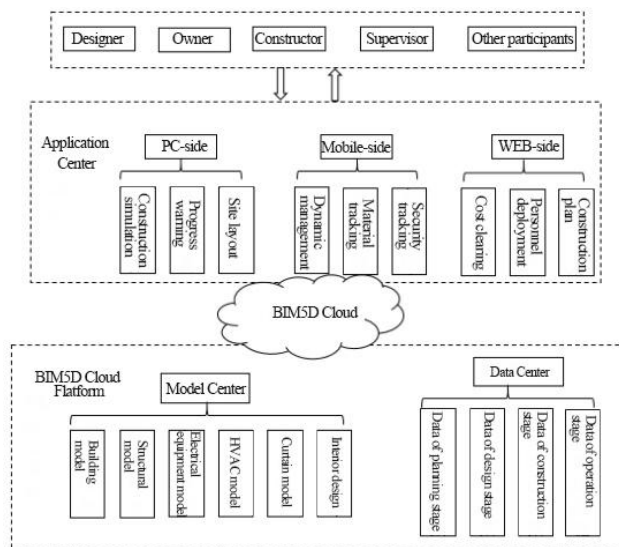


Figure 1: Construction project management system integration platform based on BIM5D cloud

The construction project management system integration platform allows all construction.

The BIM 5D cloud collaboration platform is for owners, designers, construction parties, and project participants, with the main goal of solving construction project collaborative management, relying on BIM three-dimensional visualization models, making full use of the Internet, cloud computing, model lightweight, and information integration, Big data analysis, Internet of Things and other technologies to create an integrated solution for the collaborative management of construction project information.

The BIM5D cloud collaboration platform takes BIM integration as the core, and is based on the three modules of model center, data center, and application center. It integrates multiple professional BIM models of construction through 3D model data interfaces, and uses the BIM integrated model as a carrier to construct construction. The various key information in the BIM model is integrated into the same platform, and the BIM model is intuitive and can be calculated and analyzed to provide assistance to all construction parties. All parties to the construction project can access the BIM5D cloud platform anytime, anywhere through the WEB, PC, and mobile devices, Carry out 5D visualization application to realize information sharing and collaborative management of all parties in the construction, as shown in Figure 1.

The construction project management system integration platform allows all construction parties to integrate into the BIM5D project management work model. It is built around the model center, data center, and application center. It integrates multiple professional models such as architecture, structure, electrical, HVAC, glass curtain wall, and interior design, covering Engineering information materials at all stages of the whole life cycle of a construction project. In addition, PC, mobile, and WEB applications can meet the application needs of participants in different positions.

4. The Design of the Three Central Functions of the BIM5D Cloud Platform

4.1. Lightweight Design of BIM5D Cloud Platform Model Center

In the model center of the BIM5D cloud management platform, the designer of the project needs to share the professional models to the database of the management platform, and classify them according to different professions and different floors, so that the professions can carry out collaborative design and reduce construction collisions. In addition, participants of all parties in the construction of the project can browse the BIM models of different accuracy through mobile phones, tablets, computer clients, and WEB terminals according to the engineering construction needs of each profession and each floor. According to the size, material, and ratio of the database model To improve the quality of construction and reduce the risk of rework.

4.2. Shared Design of BIM5D Cloud Platform Data Center

The data center of the BIM5D cloud platform provides information integration and sharing applications for engineering projects (as shown in Figure 2). First, use different software to establish each professional model through each discipline; then through the IFC standard to integrate and classify each professional model into the data center, to establish the engineering project database; at each stage of the engineering project, all participants of the project can obtain it through the database Corresponding information, collaborative work and construction management. In the project design, construction and other stages, all participants of the project can edit and query the information in the database within the scope of authority to ensure the update of the database and the efficiency of collaborative work.

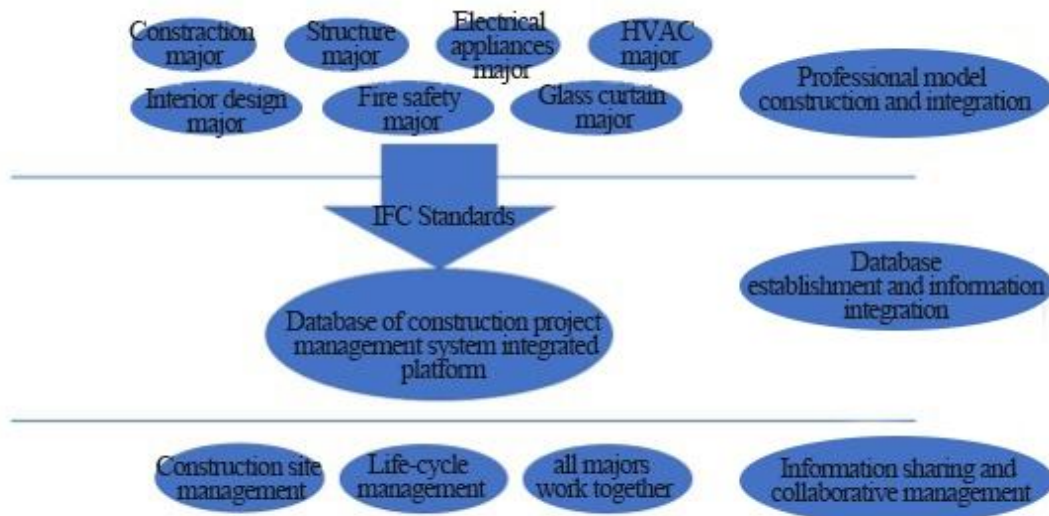


Figure 2: Data center information integration and sharing application of BIM5D cloud platform.

The data center of the BIM5D cloud platform borrows the cloud platform and network transmission to enable the owners, designers, constructors, supervisors and other parties of the project to update the progress, quality, safety, cost and other information of the project and access to provide real-time information of the project to improve the efficiency of collaborative work.

4.3. Functional Design of BIM5D Cloud Platform Application Center

The application center of the BIM5D cloud platform aggregates the design and construction data of the project participants into the database of the cloud platform through the cloud. The project participants can use the Web, PC, and mobile devices (mobile phones or tablets) to "three terminals" "Access the BIM5D cloud platform anytime, anywhere, and perform 5D visualization applications to realize information sharing and collaboration at all stages of the entire life cycle such as project planning, design, bidding, construction, and operation and maintenance. The application center can provide project participants with deep design, construction simulation, flow view, contract planning, engineering measurement, material increase, quality and safety, typical working conditions and other core applications to help managers make effective decisions and refined management.

5. Construction Project Collaborative Management Application based on BIM5D Cloud Platform

5.1. Project Overview

A large-scale construction project with a total investment of about 2.8 billion yuan, a total construction area of 180,000 square meters, and a total construction period of 1,200 days. The project includes a podium and two towers. The podium has a height of 25 meters, 3 floors underground, and 3 floors above ground. The tower includes a 35-story, 185-meter-high office tower and a 31-story, 141-meter-high hotel tower. It will be built as a headquarters office building, a five-star hotel, and supporting commercial, leisure, financial, and cultural functions. Iconic building.

5.2.Design Optimization Management Collaboration

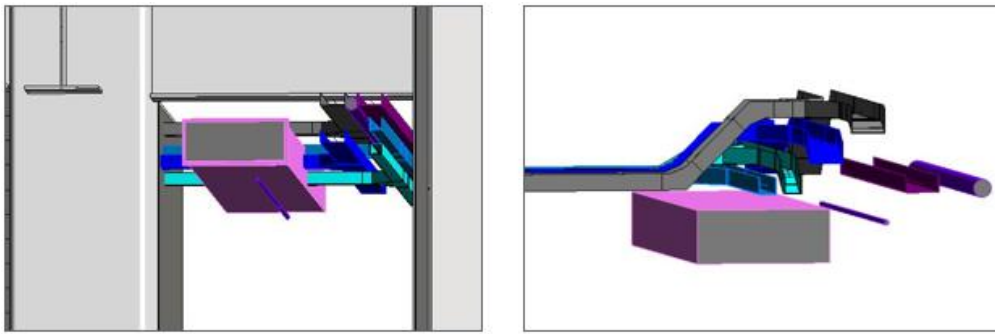


Figure 3: Comprehensive optimization of electromechanical pipelines.

This project adopts BIM technology for pipeline collision inspection in the design stage. Civil engineering, electromechanical, HVAC and other majors carry out collaborative deepening design work through the cloud platform, which is compared with the traditional manual method of deepening the arrangement of electromechanical pipelines and pre-buried drawings. With the same investment in human resources, the comprehensive deepening of BIM technical assistance saves 6 days of deepening time, resulting in a construction period benefit of about 120,670 yuan.

BIM technology was used to check the collision between the mechanical and electrical pipelines and the civil wall. The drawings of the openings to be reserved in the structural wall were drawn, and after the design changes were confirmed, information was shared with the construction party to guide the on-site construction to reduce the wall. Chisel a second time. As shown in Figure 3.

5.3.Drawing and Engineering Change Management Coordination

Due to the complexity of this large-scale project, the types of drawings are also very complicated, involving different units, different stages, and different professions. Changes to a certain professional drawing will involve changes in other professional drawings. Collaborative management of drawings based on the BIM5D platform, associating different professional design drawings, secondary deepening design drawings, engineering changes, contract management and other information with professional model components. During the construction process, you can select any component through the visualization characteristics of the model, and quickly and jointly query the professional drawing information related to the building component and the document information related to the drawing, such as changes, contracts, subcontracting, etc., at a glance, and the drawing is refined. management.

5.4.Construction Progress Management Coordination

Associate the BIM model with the progress information, so that the progress information of each part of the project can be obtained, including the planned completion time, the actual completion time, and the construction daily report, on-site progress photos and other information. With the help of the BIM5D platform, the construction parties can realize the coordinated management of the actual construction schedule and the planned schedule, timely feedback on-site construction schedule deviations, and analyze the reasons for the construction schedule delay. Through the BIM model, it is also possible to obtain the engineering quantity information of the components, as well as the material and capital demand information.

5.5. Quality and Safety Management Collaboration

The quality and safety tracking based on BIM5D can better solve the problems found in traditional quality and safety management, such as failure to share in time and delay in quality and safety rectification. When the project site management personnel encounter quality and safety problems, they can borrow the mobile phone or iPad to take photos and upload them to the BIM5D cloud platform. The quality and safety officers will receive the message on their mobile phones. After the correction is completed, upload the corrected photos in time. In response, all parties involved in the construction can view and supervise. The BIM5D cloud platform records the characteristics of each problem, conducts quality and safety statistical analysis, and exports analysis sheets to form complete and traceable quality and safety data. Use big data to analyze the distribution trends and categories of project quality and safety issues and the concentration points of major issues, and provide data support for the future quality and safety control of the project.

5.6. Engineering Information Management Collaboration

All parties upload project engineering data and information to the cloud platform, classify the information in the database, and classify and manage it according to different types, different professions and different construction stages, and support mobile, PC client and WEB preview, Query and download. Based on the collaborative management of engineering data and documents and other information based on the BIM5D platform, the work processes of all parties are seamlessly integrated with document management, and the information exchange between the owners, general contractors and other participating parties is efficient and transparent. By setting authority processing, information can be disclosed for sharing by all parties, but information cannot be disclosed. According to the authority, only the participating parties within the authority or designated personnel within the department can view and download. The general contractor can use big data to perform output value statistics, cost analysis, statistical analysis of quality and safety issues, statistical analysis of weather and climate, and provide decision support for the management and control of the project.

6. Conclusion

In construction project management, with BIM integration as the core, combined with the actual needs of engineering project management, a BIM5D cloud collaborative management platform based on model center, data center, and application center is built, through the information and data support of big data and existing The software and hardware technical means provide a reasonable solution to the database application system for the construction parties, breaking the various barriers and boundaries between the people, information, and processes related to the project. The construction parties can access the BIM5D cloud platform anytime and anywhere through the WEB, PC, and mobile devices to perform 5D visualization applications, and realize the purpose of information sharing and collaborative management of construction projects by all parties. The BIM5D cloud collaboration platform provides fast and convenient project management support for all construction parties, and will play a positive role in optimizing project design, improving project quality, accelerating construction progress, saving construction funds, optimizing contract management, and reducing construction claims. The practical application of a large-scale construction project verifies the practical effects of the BIM5D cloud collaborative management platform, and provides a reference example for the implementation of collaborative management of construction projects.

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