Research on the Whole Process Engineering Consulting Mode of Smart Hospital Based on BIM Project Management Mode

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Abstract. With the progress of science and technology, intelligent medical treatment has become the main way of medical treatment in the future. Therefore, in the future construction of smart hospital, we must control the whole process of engineering consultation through computer software, which will better build smart hospital. At the same time, BIM Technology has gradually penetrated into the whole construction industry and digital operation management field, which will become the most important digital technology in the future. BIM project management (hereinafter referred to as PM) will become an important tool for smart hospital management. Firstly, this paper analyzes the whole process framework of smart hospital. Then, this paper analyzes the whole process engineering resources based on BIM PM. Finally, some suggestions are put forward.

Keywords: Computer Software, Bim, Project Management, Smart Hospital, Whole Process Engineering Consultation

1. Introduction
Smart medicine comes from Sam palmisan. In 2009, the U.S. industry and Commerce for the first time put forward the concept of "smart earth" to Obama, including smart power, smart healthcare, smart city, smart transportation, smart supply chain and smart banking. Smart healthcare is a medical model that uses the new generation of Internet of things, cloud computing and other information technologies[1]. By means of perception, material connection and intelligence, hospitals can connect the physical, information, social and commercial infrastructure related to medical and health construction, which can meet the needs of corresponding medical and health ecosystem. Intelligent medicine is the advanced stage of intelligent application in pharmaceutical industry. However, through the integration with the Internet of things, intelligent medicine will form the advantages of information system integration, information sharing and intelligent processing, which can’t be compared with traditional hospitals[2]. Smart medicine is usually composed of smart hospital, regional health and family health. This paper mainly studies smart hospital. Hospital is an important public building to ensure people's life safety, which will realize the normal operation of construction projects. At present, there are many problems in the PM of hospital construction in China, such as lack of professionalism,
imperfect system and extensive management mode. Through BIM PM mode, we can maximize the project value, which has been widely used in the field of PM\cite{3}. Therefore, we promote BIM PM technology, which will improve the whole process engineering consultation of smart hospital.

2. Application of BIM project management in the whole process of smart hospital construction

2.1. Design phase
The design stage is the key stage to ensure the quality of hospital construction project and control the project cost. Through BIM, the designer can carry out pipeline collision analysis and building performance analysis. The traditional two-dimensional CAD plan can’t show the complex parts of pipeline in the deepening design stage, which will lead to the difficulty to achieve the optimal pipeline layout. In terms of design intention, BIM Technology can fully avoid the lack of information transmission in traditional two-dimensional design, which can improve the quality and efficiency of design and construction. Through BIM, we can avoid mutual interference in the construction of various disciplines, which is conducive to the later maintenance and overhaul of pipelines. Hospitals have higher requirements for the comfort of indoor environment and the performance of buildings. Through BIM and other professional software, design units can carry out various performance analysis of hospital construction projects, which can scientifically improve the comfort of hospital indoor environment. Through the analysis of building performance, we can analyze the building energy saving potential, which can realize the green development of the hospital\cite{4}.

2.2. Construction stage
The construction stage is the longest duration and highest risk stage of hospital construction project. Through BIM Technology, we can simulate the construction progress. Through 4D building information model, we can simulate the real construction process, which will find out the possible problems and risks in the project process. In view of the construction problems, we can adjust and optimize the building model in advance, which will enhance the level of PM in the construction stage. In the application of deepening design and construction simulation, BIM software can be applied in the construction stage, which changes from a single Autodesk Revit to a variety of software, such as SketchUp, NavisWorks, Guanglianda, maigcad, Tekla, Fuzor, etc. Through the model input, export, correction, check, we can make more perfect construction\cite{5}.

2.3. Information management
Through BIM, 100 million yuan of project information can be stored, exchanged, changed and tracked, which shortens the distance between developers, construction units, design teams and project managers. Through BIM, the design team can change the effective annotation of design drawings. The PM personnel can update the drawings in time, which will remind the construction unit to carry out the construction according to the latest design scheme. According to the final construction plan, the project manager can fully control the project budget, such as project development, capital flow, material problems, etc. Through detailed feedback to developers or subcontractors, we can avoid problems such as project payment settlement and construction acceptance. Based on the traceability of BIM software, we can implement the authority management policy for the completed projects, which is convenient to save the complete information of the projects. Through the completion of project analysis, we can get the optimization and improvement plan, which will improve the efficiency of PM\cite{6}.

2.4. Completion and maintenance
Through the visualization of BIM, we can carry out the completion acceptance of the project, which will ensure the safety and quality of the overall construction of the project. Through BIM modeling technology, we can build the project maintenance model, which can record the pipeline use, equipment operation and other information in the project. Through BIM, we can ensure the efficient
and accurate management of the operation stage after the completion of the project, which will avoid the problems of long equipment maintenance cycle and short project life cycle. Through BIM, we accelerate the transformation of traditional PM mode to lean management mode.

3. **Intelligent hospital system based on BIM system**

3.1. **Intelligent hospital system based on BIM system**

This paper constructs a smart hospital system based on BIM system, as shown in Figure 1.

![Intelligent hospital system based on BIM system](image)

**Figure 1.** Intelligent hospital system based on BIM system.

3.2. **Integrated operation and maintenance management technology**

Based on virtual reality technology, the 3D visualization model is dynamically integrated with real-time operation and maintenance data. We can realize the integration of repair service, equipment monitoring, video monitoring and BIM system, which will support highly real operation and management of smart hospitals, as shown in Figure 2.

![Integrated operation and maintenance management technology](image)

**Figure 2.** Integrated operation and maintenance management technology.
3.3. Whole process engineering consulting technology based on BIM

Based on the static and dynamic data of buildings, we can introduce a variety of data mining and machine learning algorithms, which can be used for multi-dimensional statistical analysis of hospital building data. Through data analysis, we can dig out the deep-seated regular information after the monitoring data, which can be displayed vividly. Based on BIM PM, smart hospital can realize the visual management of water, electricity, coal and other energy consumption. By looking at the loop controlled devices, we can analyze the situation of each space, as shown in Figure 3.

4. Important advantages of BIM for smart hospitals

4.1. Information collection is more accurate and timely

From the hospital design, construction, and operation and maintenance stage, BIM model records and integrates the engineering information of the whole process of the hospital. In the operation and maintenance stage, the hospital does not need to collect the building information separately, which simplifies the process of information perception and collection in the operation and maintenance stage. Through BIM software, we speed up the collection process of medical information as a whole. Through BIM model, smart hospital can accurately associate spatial information, which controls hospital assets, medical equipment, drugs and other information as a whole. On the basis of BIM, medical information can be better centralized and optimized, which will better support the medical application layer. By integrating the information application of BIM Technology, we can help realize the building automation of smart hospital. Combined with BIM model, smart hospital can scientifically manage the application of power monitoring, air conditioning monitoring and fire monitoring, which will ensure the real-time grasp of hospital environment by hospital managers.

4.2. Full cycle medical information more complete

Through BIM Technology, smart hospital has achieved a high degree of data integration in the whole process of hospital project preparation, design, construction, assembly, completion and delivery, operation and maintenance, demolition and reconstruction. Therefore, the information in BIM is closely related to the whole medical process information, such as patient registration stage, outpatient stage, examination stage, prescription treatment stage, visit monitoring stage, etc. BIM project full cycle information can be used as the basic information of intelligent hospital information system, which expands the breadth and depth of medical information.

4.3. More efficient medical business processes

Medical business is a very complicated project, which makes the medical business process difficult to implement in smart hospitals. Through BIM, we can simulate the business process according to the
deep learning algorithm in the design phase, which can be accurately input. Through the implementation of patient and staff medical business process simulation, we can implement medical business more efficiently. According to different medical conditions, the system will provide different flow schemes, such as daily streamline, emergency rescue streamline, infection epidemic control streamline, barrier free streamline, etc. BIM can optimize the flow route of doctors and patients by analyzing the factors such as patient visit path, time, waiting rule and hospital space, which will improve the process efficiency of medical business.

5. Conclusion
With the development of information technology, the new medical service mode based on smart medical will become the mainstream in the future. At the same time, 3D technology is gradually infiltrating into the whole construction industry and digital operation management field, BIM will become one of the most important digital technologies in smart hospital.

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