Integrated Design of Smart Campus Operation and Maintenance Management System Based on BIM in Big Data Environment

Zhang Jianfeng, Gan Yinghao, Jiang Yechao

East University of Heilongjiang, Harbin, 150066, China

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Abstract: Smart campus comprehensively uses technologies such as mobile internet and big data to integrate, analyze and share all kinds of data in universities. The campus building is a place that needs to carry history and reflect the characteristics of the times. With the continuation of historical time and the change of management personnel, there may be breakpoints in campus operation and maintenance management, such as the mismatch between the completed drawings and the actual construction, the unclear level of underground pipeline network, the inability to accurately determine the cause and source of accidents, and the lack of obvious effectiveness of space management. To solve the problems existing in traditional campus operation and maintenance management and improve management efficiency, this paper proposes an integrated design of intelligent campus operation and maintenance management system based on BIM. Reverse application of BIM technology, review and import the completed campus project information, get rid of BIM's thinking inertia of forward planning, design, construction and maintenance, find out the errors between the construction drawings and the actual completion, revise and improve the as-built drawings, and ensure the accuracy of normal campus operation and maintenance.

1. Introduction

With the quick development of information technology, the informatization architecture of universities is moving from the digital campus era of "data island" to the smart campus. On the basis of the original system architecture, a physical platform is needed to carry multiple applications, which makes the IT architecture of the data center more complex and propose new demand for operation and maintenance [1]. Smart campus in view of big data environment is under the backdrop of modern information technology, applying information service platform, providing fast, convenient and high-quality services for teachers and students, effectively improving the comprehensive management level of the school, and thus improving the educational, teaching and cultural level of the school.

At present, the traditional operation and maintenance management mode is backward, which has gradually failed to meet the actual operation and maintenance management needs of buildings. The building operation and maintenance management system in view of BIM technology can make up for the shortcomings of the existing management mode and management technology. Therefore, the research group introduced BIM technology into campus operation and maintenance management, and with its powerful information and data functions, it can efficiently manage construction projects.

2. Big data

About big data, many international research institutions have described it, among which McKinsey research institute explained it as follows: it is a data collection whose scale tremendously outnumber the capability of conventional database software tools according to obtain, storage, management and analysis [2]. Big data has the following basic features:

First, the data scale is huge. The data storage capacity of big data is huge, ranging from hundreds of TB to tens of hundreds of PB, and even the scale of EB. Second, the data flow is fast. On the one hand, with the deepening of information application, the amount of data is increasing in a blowout

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way; On the other hand, users have high requirements for data access, processing and delivery, and the data processing speed must be extremely fast. Third, the data types are diverse. Big data will generate various types of data from various angles. From the data relationship, it is separate into structured, semi-structured and unstructured data From the generation type, it is separate into transaction data, interactive data and sensing data; From the data format, it is divided into text, picture, audio, video, spectrum and so on. Fourth, the data value density is low. Although there is a large amount of data, only a very small part of it is valuable. Fifth, the data analysis is true. The existence of massive data samples makes the data results mined and analyzed more authentic and scientific, and can truly restore and predict the true colors of things, which is also the future development tendency of big data.

3. BIM technology and intelligent campus management

According to the management rules of buildings in smart campus, combined with BIM application technology, we can simulate real objects to realize the management plan. Smart campus integrates BIM technology application management system, which can effectively manage each major, and then realize comprehensive management and scientific classification, so that we can provide a better solution management method and avoid collisions and contradictions caused by majors [3].

Smart campus refers to a new campus which takes modern information technologies such as Internet of Things, cloud computing and big data analysis as core technologies, promotes the integration of information technology and education and teaching, achieves the purpose of improving teaching effect and quality, provides a data-based, network-based and intelligent perception environment, integrates teaching, scientific research, management and life, and has a profound impact on education and teaching. Smart campus is produced on the basis of digital campus construction in the process of educational informationization, and it is the performance of upgrading digital campus to a certain stage [4].

Smart campus has the following three main characteristics: First, integrate modern information technology into various application service fields of campus to achieve information contact each other and resource sharing; The second is to satisfy the diverse require of teachers and students and provide a comprehensive and intelligent environment and personalized services; Third, through intelligent sensing surroundings and complete information service platform, it supply channel interface to realize mutual perception and communication between campus and the outside world [5].

To sum up, "smart campus" is an information-based and digital campus integrating computer network technology, Internet of Things technology, RFID technology, cloud computing, big data analysis and intelligent sensing of information terminals.

4. Smart campus platform under big data environment

Smart campus evolved from the meaning of "Smart Earth". In fact, the smart campus is supported by modern high-tech and Internet of Things technology, in order to provide a good integrated platform for a series of activities such as school education and teaching management, campus life, cultural construction and student activities, so that teachers can handle various affairs conveniently, students can study anytime and anywhere, and school functional departments can work efficiently. The overall architecture diagram of the smart campus designed in this paper is shown in Figure 1.

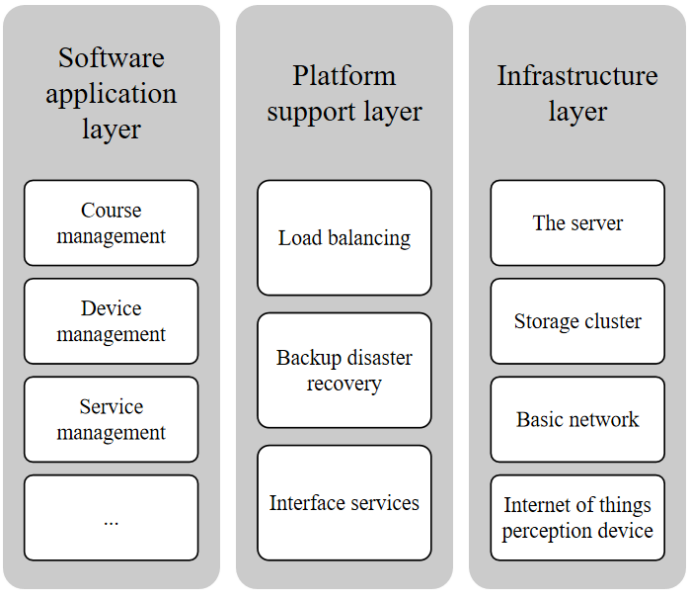

Figure 1 Overall architecture diagram of smart campus

The bottom layer of the smart campus platform is the basic facilities service layer, which is mainly used to integrate the cloud data, cloud computing and storage, security measures and system hardware of the campus system through the existing virtualization technology. Schools will produce a large number of various types of data, which can be collected, analyzed and processed in an all-round way through this layer, and then classified for sharing with relevant personnel. The main effect of cloud computing and storage is to save and compute the gather campus-related data scientifically and effectively. The network environment, Internet of Things application environment and so on of the whole campus should be configured at the infrastructure layer, which is the basic guarantee for realizing the construction of smart campus under the big data environment.

The smart campus platform under the background of big data is a pivotal interlinking the realization process, which plays a decisive role in the realization of the whole smart campus platform. At the same time, this layer is also the most difficult link in the whole platform construction. The platform support layer should collect, sort out, save and analyze the basic data, business data and teaching data of the whole school. At the same time, it needs to fully allocate and control the resources of the whole school through virtualization technology, so as to fully ameliorate the informationization level of the school and maximize the efficiency, thus reducing the related costs of the school.

In the whole procedure of building the smart campus platform, the software business application platform is one of the keys of the whole platform construction, which runs through the whole smart campus construction. The realization of the platform is mainly divided into the following three levels: intelligent management, intelligent education and intelligent scientific research, including teaching management system, public service system, library service system, digital resource sharing system, etc. By optimizing retrieval processing and flexible combination, it is finally provided to campus teachers and students in a personalized way to meet their learning and expression needs.

5. System function module settings

5.1. Operation and maintenance visualization

Visualization is an inevitable direction to turn the massive data in the data center into information that the operation and maintenance personnel can master. Various operation and maintenance related data are finally displayed on a large screen through visualization technology. First, visualization of environment and hardware data [6]. Including basic environment visualization and hardware equipment asset visualization. For example, the specific architecture of the core computer room, the usage of each cabinet space, the status of each server, etc., and color reminders

are given according to the health status of the equipment. Second, visualization of monitoring data. Include virtualization monitoring, middleware monitoring and database monitoring. Third, visualization of network architecture. Visualize the network infrastructure topology, number, model and location of network security equipment. Then use big data technology to analyze all various security policies of smart campus network, and finally realize policy visualization, path visualization, traffic visualization, risk visualization, threat visualization and change visualization. For the sake of find the shortcomings of current network safety protection, find faults and realize emergency linkage.

Through the 3D visual roaming effect, users can view all areas of the smart campus intuitively, appropriately and apace. In this 3D smart campus, observers can browse more pertinently and view the objective objects at will. Managing in such a 3D virtual world can reduce the processing time and ameliorate the efficiency in the management process, and at the same time, it also provides a vivid display platform for the smart campus (Figure 2).

Figure 2 Three-dimensional visual roaming of smart campus

By simulating the building performance of BIM design model, the building environment of the building entity and the overall performance of the system can be effectively controlled. In the whole project implementation process, taking 3D design as the leading clue, simulation analysis is synchronized with BIM design, and BIM design parameters are optimized through continuous simulation [7]. According to the characteristics of the project, the building performance analysis simulation is mainly aimed at each building area or functional room, and the lighting, ventilation, vision, hearing and fire evacuation are analyzed and optimized by BIM.

5.2. Intelligent analysis and prediction based on internet of things and big data

The high level of management is the ability to prevent beforehand rather than to deal with afterwards, and new technology provides the possibility for intelligent management. For example, the basic network intelligent management system platform can monitor the stability, attenuation, bandwidth and packet loss rate of the line in real time, and use the big data analysis technology to analyze the flow and pressure of the line and intelligently adjust the line bandwidth; Forecast the popular applications of the network in the future through the data of protocol utilization; Through the analysis of accumulated repair data, the health status of building hydropower pipelines and lines is predicted for targeted routine inspection.

5.3. Building information inquiry

Building information query is to classify and manage the information of teaching buildings, office buildings, libraries, stadiums and other buildings on campus in 3D scenes. Click on any building in the 3D scene, and the information about the name, function and classification of the building will be displayed, which is convenient for managers to visually manage each building.

5.4. Security management

By connecting the transmission signals of the existing data sources of the school's inspection points into the 3D system, the display mode of the traditional inspection monitoring information is

changed, and the real-time inspection information is visually presented in the 3D scene. By avoiding the spatial form that the traditional patrol inspection system does not have, the staff can understand the overall situation of the 3D system, observe the state and position of the school patrol personnel, and correct the fatal defect of the information island. Break the traditional thinking stereotype of a single system and promote the innovative management of campus application information.

Manage vehicle entry and exit information in the parking lot through the camera, such as vehicle type (fixed vehicle, temporary vehicle), vehicle owner (stationary vehicle), entry and exit time, etc. At the same time, the location of existing empty parking spaces in the garage can be highlighted in the scene, and all empty parking spaces and routes leading to empty parking spaces can be highlighted on the garage entrance screen. It is also used to convey viewpoint operation, event control and other methods to simulate and display the movement sequence of cars entering and leaving warehouses in 3D scenes.

Monitor the position of employees in real time. The current position of the moving target of each group is displayed with 3D characters, and the personnel distribution in any area is displayed anytime and anywhere in the 3D operation and maintenance system [8]. Provide real-time personnel position tracking, crowd distribution, past track playback and other functions, and realize the retrospective change from post-employment to active early warning. Competent personnel can discover all kinds of potential safety hazards in time, and provide means for personnel monitoring and efficient command.

5.5. Asset management inquiry

Visualization of 3D data can bring visualization of asset management, formulate information technology of asset management business process, and through the unseamed comprehensive of 3D model and business procedure of system comprehensive technology, asset statistics and management departments can grasp the whole procedure of asset buy, repair, replacement and complete scrapping, purchase, use and maintenance, and make a unified tracking, thus increasing the service cycle and efficiency of campus equipment and reducing the economic cost of asset management and maintenance in schools.

6. Conclusions

The construction of intelligent campus operation and maintenance management system based on BIM under the backdrop of big data can effectively promote the intelligent and scientific development of campus management. On the one hand, it can greatly improve the school's business management level and enhance the school's management efficiency; on the other hand, it can provide a good learning and living environment for the school teachers and students, and conveniently meet their teaching and learning needs. BIM intelligent campus operation and maintenance management system recheck and import the completed campus project information, get rid of BIM's thinking inertia of forward planning, design, construction and maintenance, find out the errors between the construction drawings and the actual completion, revise and improve the as-built drawings, and ensure the accuracy of normal campus operation and maintenance. Effectively solve the problems of engineering operation and maintenance plan, space management scheme, asset information maintenance and update, disaster emergency simulation, etc. in campus management, coordinate the information exchange of all parties, optimize the campus operation and maintenance management mode, and greatly improve the management efficiency.

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