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Research on Construction and Function of Safety Monitoring System for Integrated Construction Site Based on BIM

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Abstract: The effective construction of safety monitoring system at construction site depends on perfect management system and advanced technical support. And the lack of information technology platform, resulting in reduced management efficiency, information is not accurate and other issues. Based on the construction site safety monitoring system to achieve the goal, to do a good job in advance prevention, to take the latest information collection technology RFID and BIM integrated comprehensive and effective monitoring of the construction site, constitute the main technology in the monitoring system, thus ensuring the construction site safety monitoring efficiency , Comprehensive, real-time, etc., on the management and technical two points to achieve the construction site safety monitoring, improve the quality of safety management.

Key words: construction site; safety monitoring system; RFID; BIM; management

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0 Introduction

RFID is an advanced information collection technology, information collection objective and timely, the scope of a wide range and have storage function, BIM is a new information technology, with interactive, visualization, synergy and other characteristics, has been in the global construction industry To achieve full development, the integration of the two can make the information can be automatically collected and BIM model to achieve visualization, its development momentum cannot be underestimated. So far, many experts have proved that the integration of the two has a wide range of applications and significant use of advantages, for its use in the construction industry, Western countries are relatively comprehensive, and our research is still limited to facilities management, Supervision and so on. Therefore, this paper based on the integration of BIM and RFID to establish the construction site safety monitoring system to improve the current experience management, construction unitled, information collection is not real-time phenomenon, to ensure that the construction site safety monitoring of efficient, comprehensive, real- enhance the quality of safety management has an important role.

1. Construction of Safety Monitoring System for Integrated Construction Site

1.1 Construction principles

RFID (radio frequency identification technology) is an automatic identification technology, can automatically collect information, generally by the label, the reader composition. RFID tags which have anti-oil, waterproof features, can penetrate plastic products, wood products, but also to store a variety of information and storage capacity. This shows that RFID is suitable for construction site safety monitoring.

BIM is the physical characteristics of building engineering equipment, functional characteristics of the digital representation, including a variety of engineering information, to achieve the information interactively. For the construction site safety monitoring, BIM three-dimensional visualization of the characteristics of the analysis, control the construction site to hide the threat of an important role. At the same time with the deep implementation of the project, through the BIM4D model to analyze structural contradictions, prevention and monitoring of construction site safety issues.

BIM and RFID integration principle is the label through the application interface and BIM to achieve information sharing. RFID tag information is the BIM database distribution database, in the initial construction should be related information such as ID, etc. into the BIM database. In the construction with the label of the continuous scan, information changes and BIM interaction, you can real-time to BIM model of the object-related information, and automatically stored.

1.2 System architecture

Based on BIM and RFID integrated construction site safety monitoring system architecture,

including information collection layer, information processing layer, information application layer three parts.

1. Information collection layer

The layer is to use RFID reader to collect construction site tag information, and real-time monitoring, including the label definition, label placement and related facilities, tracking three steps.

① Label definition

Definition of the work of the label in general before the construction site supervision team with the safety monitoring group security analysis of the safety threat list, according to the construction site of the specific circumstances, in accordance with the building materials, people, equipment, such as the definition of different types of labels, and clear the number of facilities and specific layout The

② Label layout and related facilities

After the definition of the label, to the label storage ID identification, functional characteristics, the scope of the basic information, while the BIM database, and then in accordance with the design of the deployment of facilities, attached to the corresponding label.

③ Tracking monitoring

When the construction personnel enters the corresponding area, it is judged whether or not the personnel can enter according to the tag ID, the work range and the like, and the tag database in the security device judges whether the personal information is comprehensive and does not satisfy the initial setting.

2. Information processing layer

RFID tags after scanning through the network transmission to the BIM three-dimensional or four-dimensional model, the display of space within the device object location information, function information. Construction safety monitoring team can be real-time understanding of the construction site of the specific situation, straightforward. If the construction site at risk of dangerous action or the environment is in danger, the model will be issued by the level warning. For example, the construction workers in the security range, the model on the construction staff to show a green that once the danger range will appear yellow and issued a warning sound, if the construction staff did not stop near the dangerous area will appear red and continue to issue an alarm, The monitoring team came forward to prevent, if still unresolved on the security monitoring team to assist. At the same time, not on-site staff can also use the BIM model to understand the actual situation and with the coordination of the model processing, given the relevant processing recommendations (see Figure 1).

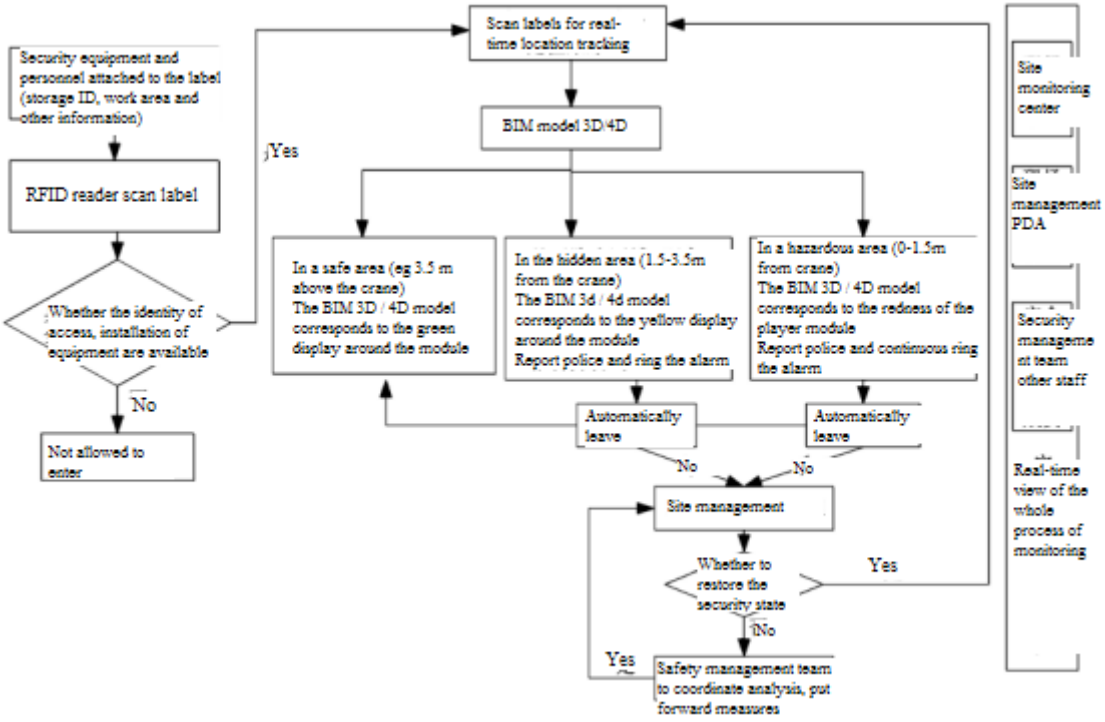

Figure 1 On-site staff of the dangerous behavior of the system monitoring diagram

3. Application management

In general, the construction site safety monitoring began since the implementation of the construction project. The system consists of an analysis phase, a monitoring phase, which begins before the project is implemented. The analysis phase is usually in the design process, the specific work includes: First, the parties jointly analyze the security threats, the production of monitoring lists and labeling of the equipment and BIM database logo; Second, with BIM model simulation specific construction process, develop some measures To prevent possible security threats; third, with BIM structural contradictions test to prevent the emergence of structural security problems. The monitoring phase is generally constructed in the construction phase, combined with the analysis phase to specify the monitoring object, define the label, install the equipment, and in the construction through the scanning input BIM model, to achieve positioning tracking, continuous information update to form BIM database. In any construction session, all staff can use the system to understand the construction technology, according to the BIM model of security threats in the region and technology for prevention and control. The safety supervision team can directly understand the specific situation of the construction site and the operation status of the equipment by means of the system. The security threat area or the warning behavior can be remotely simulated and analyzed, and the real-time communication is given.

2 System function analysis

2.1 Visual positioning tracking, automatic storage of information

RFID reader according to personnel, equipment and other label scanning to achieve tracking and positioning, and its location, performance and other information transmitted via the Internet to the BIM model, the visual reflection of the specific situation of the construction site. When the relevant personnel into the dangerous area, the monitoring system will produce a warning reminder, safety supervision team can a real-time understanding of the location, the specific situation and other information. And strayed into the dangerous areas of the relevant personnel will also be warned to remind, take the initiative away. In addition, the label has a storage function, the reader will scan the information, the information will automatically update and save, and update the BIM database, when the security accident occurs quickly find out the cause, enhance the efficiency of accident handling, reduce adverse effects.

Compared with the traditional security monitoring, the information collection is scanned and updated to the system through the RFID reader. At the same time, sharing information through BIM completely breaks through the limitation of paper transmission, reduces the working pressure of the manager and realizes the safety monitoring. RFID is an advanced information collection technology, BIM is an advanced information technology, the integration of the two, can guarantee the construction site safety monitoring efficiency, real-time and comprehensive.

2.2 Implementation of the whole process of security monitoring, from the point line surface for real-time monitoring

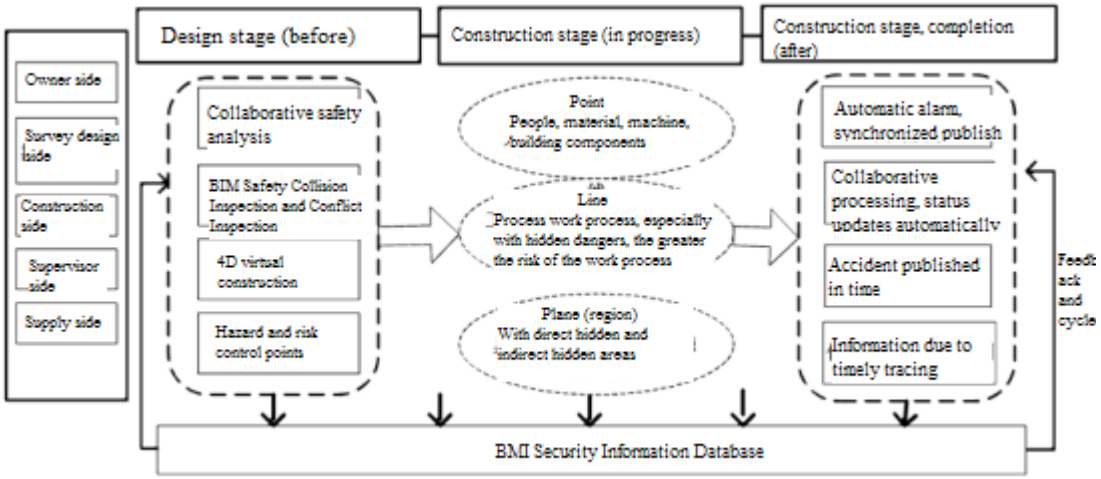

Figure 2 Monitoring system and information application diagram

The key to the implementation of safety monitoring is the construction site, safety accidents have a causal and chain, so only monitoring the construction site is difficult to meet the prevention and monitoring of safety accidents. To prevent and monitor the safety accident, should be in the construction before the possible part of the accident can be real-time control. The original pre-prevention is mostly in the early construction or the main process before the start, mostly by the construction unit for analysis. And the system from the design link with BIM joint owners and construction units according to the scene analysis, the entire safety monitoring process is comprehensive and efficient. In addition, with BIM's security contradiction test and simulation construction, have a certain degree of prevention of security incidents. In the specific construction links, combined with the safety analysis data, it is likely to occur in areas such as safety accidents, technology and other real-time positioning and tracking updates, if the scene of security incidents, such as misconduct, improper storage of building materials, Safety supervision team can use the system in real time to master the accident location, the cause of the accident, the scene and so on.

2.3 Collaborative participation, timely exchange and efficient handling

Before the construction site safety monitoring mostly construction unit alone analysis, for the handling of security incidents are mostly by the management staff with experience to judge, the analysis is not comprehensive, reduce the quality of security incidents. The system through the BIM to achieve information sharing and information exchange, from the design link to coordinate the owners, designers and other involved in security analysis, timely exchange of the integration of security recommendations, the effective implementation of the project during the implementation of security incidents. In fact, all parties can use BIM to query the system to understand the construction safety situation.

2.4 Real-time update of information to form BIM database

RFID tag is the BIM database distribution database, the storage of the object ID, security, and other information and through the network input BIM model, accompanied by continuous scanning of the reader, all kinds of information is updated so that BIM information expanded into BIM database. After the end of the construction project, the database can also be used as a basis for post-construction maintenance, the company's other construction projects have a certain reference value, can improve the company, the industry's overall safety monitoring level.

2.5 Cost-effective and economically viable

The so-called economic efficiency refers to the reduction in cost when it is put into production. The system consists of hardware (readers, network cable, etc.), software (applications, etc.) and service costs (installation costs, maintenance costs, etc.) three parts. The general cost-benefit is reflected in cost reductions and production increases. Return on investment (ROI) is an important indicator of cost-benefit analysis, and a construction project to take RFID and BIM's return rate is roughly 2.2, and many construction companies have built the system, as long as the payment of application-compatible service fees, which can be seen, Based on BIM and RFID integrated construction site safety monitoring system cost-effective relatively reasonable.

3 Conclusion

The safety of the construction industry has been the long-term attention of experts and scholars, and its research is imminent. "Lean construction" is the new project management concept, can reduce the cost and improve the security, Western developed countries have been deeply studied and widely used, China is still in the initial stage, based on the concept can establish a comprehensive and effective building management system. And efficient management system depends on the management system and technical support, based on information collection technology RFID and information technology BIM integrated construction site safety monitoring system, can fully monitor the site safety, to ensure the construction site safety monitoring of efficient, comprehensive, real-time, to enhance the quality of security management.

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