The Research on Assistant Application of Artificial Intelligence Technology in Building Construction

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Abstract. There are many potential threats in the construction process. So how to avoid safety accidents in the construction process become many enterprises have been trying to solve for many years. We will use BIM 5D technology to present the construction progress and safety problems in the construction process in this paper. We simulate the construction process to find the problems in the construction, and use RFID technology to detect whether the real-time location of the equipment and operators in the construction site is consistent with the data of the simulated construction process. We can reduce the occurrence of safety accidents by controlling the construction process and simulating the construction data. It not only can control and deal with the construction safety problems effectively, but also achieve the goal of speeding up the construction progress, reducing the construction cost and improving the construction safety. At the same time, it can realize the efficiency, safety and intelligence of the construction site.

1. Introduction

The problem of construction safety has been bothered so many construction enterprises in the construction industry. There have been various preventive measures and safety treatment measures in the past decades. However, due to the imperfect technical standards of BIM and RFID in China and the low recognition of technology in the industry, construction units are reluctant to use BIM and RFID technology considering their own interests. In recent years, the rise and development of BIM and RFID technology have been gradually applied to construction, in order to reduce or avoid safety problems in the construction process. Chang Chenguang et al. proposed to use BIM technology to build a model in the research of assembly building construction process management based on BIM and RFID technology, confirm construction site information through RFID technology, and apply BIM and RFID technology to component hoisting, manufacturing and handling management. However, there is no in-depth study on the safety management of BIM and RFID technology in construction site. Zhang Jiachang et al. discussed the application of BIM and RFID technology in life cycle management of assembly building, it promoted the rationalization and scientificization of life cycle management of construction project, also reduced the occurrence of safety accidents effectively in construction process, but using BIM and RFID technology to prevent hidden safety dangers in construction has not been discussed in depth. Under the background of information age, we use BIM and RFID integrated technology in construction can predict the potential safety hazards in advance and prevent the occurrence of safety accidents effectively. Managers also can grasp the construction
situation of workers and equipment in construction site conveniently and concisely. This is not only an innovative way to avoid safety accidents, but also an inevitable trend of the future development in the construction industry.

2. Principle of BIM and RFID Technology

2.1 BIM Technology

BIM (Building Information Modeling) technology is to take the relevant information data of construction project as the basis of the model, and establish the building model, then use digital information to simulate all the information in the building. BIM technology has changed the plane display of the two-dimensional model, it can three-dimensional displaying all kinds of information and data in the building. This technology is based on computer software tools. On the premise of huge database functions, it can not only visually display, but also compare various datas in project management, then find out deviations to achieve fine management [3].

2.2 RFID Technology

RFID (Radio Frequency Identification) is a wireless communication technology that use for automatic real-time identification. Electronic tags and readers needn’t mechanical or optical contact. It can identify specific targets, read and write related data, and exchange information through the coupling of space magnetic field or electromagnetic field [4]. It is a non-contact automatic identification technology consisting of electronic tag, reader, middleware and software system. The main function is to exchange information through the coupling of space magnetic field or electromagnetic field, and input the information into the software quickly and browse on the reader.

3. Foreign and Domestic Research Status

3.1 The research status of BIM technology

BIM technology can be accurately described as virtual design and construction, and it is a digital expression of the entity and functional characteristics of engineering project facilities. Conflict between equipment and workspace is a common safety hazard in construction site activities. Zhang Jianping of Tsinghua University et al. improved the analysis method of building structure by using 4D BIM, which can continuous and dynamic safety analyze in the process of simulated construction continuously and dynamically. They lay a foundation for further study of building life cycle safety management by combining architectural design, structural analysis and construction management. Sijie Zhang [6] applies BIM technology to carry out automatic safety inspection of construction progress. The algorithm can analyze the building model, assess the risk of falling in each construction area automatically, detect potential safety hazards and propose preventive measures. Before starting construction, BIM technology can make safety construction plan, when, where and how to prevent building safety accidents, and also can analogue simulate fire safety evacuation. It can simulate the fire safety evacuation of buildings, carry out safety, risk detection and avoid conflicts in the early stage of planning and design. And carries out security, risk detection and conflict avoidance in the early planning and design stage. Using BIM technology, we can derive the simulation model of the construction site, through the calculate stress-strain to analyze the safety of the construction site. It provides effective help in the safety hazards.

3.2 The research status of RFID technology

Many scholars have made relevant research on RFID technology in safety management area of construction industry. Professor Hu Wenfa of Tongji University and his student Luo Shuguang [7] studied the application of RFID technology in steel component construction. They established a progress monitoring system based on radio frequency identification technology, collected real-time progress information in construction process by RFID technology, reduced data transmission steps,
and ensured the accuracy and real-time performance of progress control. Yang et al. have proposed a danger identification system based on RFID technology in the article, which can avoid safety accidents and carry out safety management in construction site. Yoon, Su-Won et al. think BIM and RFID technology can be applied to logistics schedule management system, which through the combination of RFID+4D system with BIM model, VR engine technology to achieve real-time management and schedule control. RFID technology can through non-metallic materials such as wood and plastics and scan all equipments with RFID tags quickly, which greatly improves the efficiency of business processing and provides effective guarantee in safety management.

4. BIM-RFID Security Management System

4.1 Establishment of Management System
Safety management system should focus on collecting and analyzing relevant data in construction, accurately grasping the real-time status of project site in construction process, preventing unsafe behavior of relevant personnel in construction site, eliminating unsafe state of mechanical equipment or goods on site and unsafe factors of construction site environment, so as to avoid accidents. RFID technology can collect information of construction workers, cargo, machinery and working environment and relative position for safety management system by means of RFID tags, sensors, fixed readers, etc. in real time and accurately. It can effectively avoid the occurrence of safety accidents, as shown in Figure 1.

Figure 1. RFID technology Information Gathered

4.2 Safety Management Operation System
The operation process of the system mainly includes three stages: data collection and processing stage, security assessment stage and security early warning stage. The flow chart of security management system based on BIM and RFID technology is shown in Figure 2.

Figure 2. Security Management System Running Flow Chart
Firstly, the engineer establishes the construction site model by BIM 5D technology, adds the project progress and security hidden danger on the basis of 3D technology, checks the accuracy of various logical relations through simulation construction, discovers all kinds of problems and risks that may occur in the construction process in time, and modifies and adjusts the model and plan according to the problems, then optimizes the BIM model, if in advance. If there is no problem, it can guide the implementation. Then we can collect construction data information automatically through RFID technology, and dispose and analyze them. We need strictly control the equipment and workers to work according to the virtual construction process. Once the system analysis shows that the work is out of the standard of simulated construction, it will send warning signals immediately to workers and safety managers. After the manager take corresponding safety measures, they collect the field data again through RFID technology until it is consistent with the simulated construction data.

We apply BIM and RFID integration technology to the construction site, scan the information of the site in real time through RFID technology, and compare the real-time data with the simulated construction data in BIM model. When workers breaking away from the simulated construction standard, it will send warning signals in time. This can not only effectively reduce the occurrence of safety accidents caused by subjective factors, but also detect and warn the potential safety hazards in the construction process in time, effectively reduce the occurrence of safety accidents. It not only effectively reduce the occurrence of safety accidents caused by subjective factors, also detect and warn the potential safety hazards in the construction process in time, reduce the occurrence of safety accidents effectively.

5. Application Prospect of BIM-RFID Technology in Construction
Combining BIM with RFID technology, we can better realize the collection, transmission, processing, feedback and control of all kinds of information on construction site. We also can build a reliable safety early warning system, which can be more intelligent, omni-directional and real-time control of construction site operations. BIM-RFID technology not only can calculate and predict the potential safety hazards in advance through BIM technology, also can effectively reduce the safety accidents caused by analyzing subjective factors and calculating the real-time information of the construction site, and strictly controlling the site to work according to the simulated construction data. With the application of new scientific and innovative technology in construction, the combination of BIM and RFID technology in construction safety is not only a technological innovation, but also a great revolution in construction safety controlling. The information can be transmitted, and construction workers can be accurately located in real-time, which makes BIM and RFID technology become more intelligent and safe in the safety management system.

6. Conclusion
(1) This paper analyzed and summarized the feasibility of applying BIM and RFID technology to the safety management of construction projects by analyzing the research status of BIM and RFID technology, and combining the research in the field of safety management and information technology at home and abroad. Using BIM and RFID technology to analyze the real-time data and predict the potential safety hazards in the construction site, which opens up the application direction and management methods of information technology in the field of safety management in the construction industry.

(2) In the aspect of system design and function realization, this paper designs and constructs a safety management system by combining BIM and RFID technology, giving priority to the construction safety issues, and using BIM 5D technology to pre-establish construction model, then put the real-time information of RFID technology into the BIM 5D construction model data and compare with the simulation data of BIM 5D model, when inconsistent with analog data, alarms are timely issued by real-time communication equipment. It can reduce the occurrence of safety accidents and achieve real-time management of field equipment and construction workers.

(3) The development of BIM technology and the application of RFID technology are still in the
primary stage in our country. We need professional talents who can master software and management. For the construction site, metal and bad weather seriously interfere with the RFID technology, and the site data cannot be collected. The cost of using RFID technology is also high. But with in-depth research and technological improvement, I believe these problems will be overcome one by one.

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