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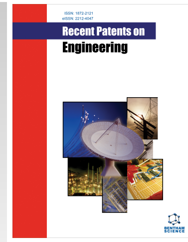

Investigation on Building Intelligent Engineering Safety Detection Based on BIM and Internet of Things Technology

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Abstract: ***Introduction***: With the rapid economic development and the continuous improvement of people's living standards, people pay more and more attention to public facilities such as housing. However, traditional manual methods have been unable to meet the requirements of current construction projects for engineering quality control and management.

Method: This patent paper analyzes the general content and methods of intelligent building safety detection, and focuses on the research status of intelligent building construction management system based on building information model and Internet of Things. The different characteristics of the two in the development direction are expounded, and their active roles in promoting intelligent building construction and improving construction project management are summarized.

Results: This paper compares the safety inspection systems of construction projects before and after the application of BIM and Internet of Things technology. The results show that during the implementation of the project, BIM can reflect the on-site situation more truthfully and intuitively, and the accuracy rate of the test results has also increased by about 3.26%. At the same time, to a certain extent, the use of the Internet of Things to complete the whole process monitoring function of the project can greatly shorten the construction period and reduce costs.

Conclusion: This can effectively reduce human intervention on the construction site, optimize the quality of the project, and make the construction project have good economic benefits.

Keywords: Building information modeling, internet of things technology, intelligent building, engineering safety, economic benefits, urban modernization.

1. INTRODUCTION

With the advancement of urbanization and the acceleration of urban modernization, people's demand for the living environment continues to increase, and suggestions have been put forward to improve the quality of life. Intelligent buildings are a new type of building facilities that have emerged in response to this trend [1]. Intelligent buildings apply advanced computer technology to architectural design, and with their intelligent and humanized characteristics, they play an increasingly important role in meeting the functional requirements of residential buildings and improving living conditions [2, 3]. This makes the entire building more perfect and distinctive, and can also effectively improve the overall performance of the building, thereby improving the comprehensive competitiveness of the building and promoting the better development of the construction industry. Due to the influence of various factors, the project will inevitably encounter unexpected situations during the construction process, such as fire, explosion and other emergencies that cause the project to fail to proceed normally, and even cause property damage and casualties. Safety control must be carried out at the construction site to ensure the smooth progress of all work. The economic interests of an enterprise are the starting point and foundation of all work.

Under the conditions of a market economy, in order to maximize benefits, a scientific and effective management system must be established. The success of the construction market should be regarded as an eternal theme. We must continue to carry out reforms and innovations, strengthen the construction of the internal control system, and adapt to the development requirements of modern society. The quality of construction in the construction industry is related to the safety of people's lives and property and socio-economic stability. Therefore, great attention should be paid to the safety of production during the construction process, and the training of construction personnel in safety awareness and

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technical management capabilities should be strengthened. “Prevention first” and “early prevention” should be realized. This can ensure that the building and its auxiliary facilities will not have safety accidents under normal use conditions, and ensure the healthy and orderly development of the market.

This article discusses the safety detection method of intelligent building projects based on building information model and Internet of Things technology, aiming to improve the quality and management efficiency of engineering projects. This article proposes a smart building safety detection solution based on BIM and IoT technology. This solution can not only improve the accuracy and reliability of detection, but also significantly improve the management efficiency of engineering projects, reduce costs and shorten the construction cycle. The effectiveness and practicability of the design scheme have been verified through experiments, indicating that it can effectively meet the needs of smart building safety management at the current stage and has certain promotion value. The innovations of this study are reflected in the following aspects: First, through a comprehensive analysis of existing literature, this article systematically discusses the safety detection and management of intelligent building engineering projects. Compared with traditional manual methods, BIM and IoT are used to Technology can achieve more efficient safety inspections while reducing labor intensity; secondly, during project implementation, BIM technology can reflect the on-site situation more truly and intuitively, and the accuracy of inspection results has increased by approximately 3.26%, while the application of IoT technology It realizes the whole process monitoring of the project, greatly shortens the construction period and reduces costs; in addition, this article also emphasizes the importance of data collection and sharing through the use of BIM technology and IoT technology for the entire life cycle of smart buildings, and How to integrate BIM solutions through cloud computing platforms to achieve full-process data integration from program design to construction management and completion acceptance.

Through in-depth research on the application of BIM and IoT technology in smart buildings, this article not only proposes an effective smart building safety detection system, but also further elaborates on how these advanced technologies can promote the development of smart buildings, optimize project quality, and reduce safety accidents. The probability of occurrence ensures the safety of buildings under normal use conditions, provides a strong guarantee for the healthy and orderly development of the market, and also provides new possibilities and technical support for the realization of intelligent sustainable building systems.

2. RELATED WORKS

With the increasing improvement of people’s living standards and the acceleration of social and economic construction, various kinds of safety accidents occur frequently, which brings huge losses and casualties to enterprises, and seriously affects the safety of people’s lives and property and the normal order of production and life. It is necessary to effectively monitor and manage, and constantly innovate and optimize modern building technology and management concepts. It is necessary to develop intelligent building technology, and take positive measures to control potential safety hazards, so as to ensure that all work in the construction process can be carried out smoothly.

Construction safety is the key to enterprise development, and many scholars have studied it. Menassa Carol C reviewed the evolution of intelligent building representation from BIM to digital twinning. He realized seamless management of the real world and virtual platform and synchronized construction process control, facility management, environmental monitoring and other life cycle processes, so as to promote the development of BIM to digital twinning in the application of building environment [2]. Ibrahim Farah Salwati Binti reviewed the use of the IoT in Malaysia’s construction industry in the construction of 4.0. The use of the IoT in construction technologies such as BIM, intelligent communication, sensors, big data, augmented reality, location services and remote operations effectively reduced the risks of construction errors, defects and construction delays [4]. Mohammed Subhi Aswad optimized the intelligent building management system and adopted distributed technology to realize data interaction between systems, which made it have good scalability and scalability [5].

Kodur Venkatesh assessed fire hazards in buildings. He put forward detailed strategies to improve building fire safety from four aspects of building fire protection function, supervision and law enforcement, consumer awareness and technology and resource progress, and identified future research and training needs [6]. Siountri Konstantina focused on the application of new technologies in the construction industry, such as BIM, IoT and blockchain. He also focused on checking their interconnection and interoperability on the proposed system architecture in a building case, and made use of these functions to better support the project implementation process [7]. Durdyev Serdar investigated the reasons for the delay of the construction project and reviewed it from the aspects of climate conditions, equipment shortage, poor site management, *etc.*, which helped to better understand the key areas that needed attention, and took measures to minimize or control the factors that caused the delay of the construction project [8]. The purpose of building safety was to ensure the use function and structural integrity of the building. Its management and maintenance could ensure the normal performance of the building.

BIM and IoT technology are important directions of future building informatization, and many scholars have explored based on this. Wuni Ibrahim Yahaya identified the key success factors related to the management of construction project stakeholders, and discussed their ranking and potential relationship, which was helpful to identify the construction safety risks [9]. Ismail Zul-Atfi Bin explored a new building environment management system based on information and communication technology, which provided a platform integrating management and service for construction sites with its characteristics of efficiency, flexibility and security [10]. Meng Qingfeng studied the implementation status of BIM application and integration technology in the construction life cycle from two perspectives. Its design, production, manufacturing and construction needed to be managed through information technology [11].

Dao Quoc Viet studied the application case of BIM in public construction project management unit, and discussed the methods to strengthen management and improve project efficiency and benefit under the BIM environment from the perspective of experience and lessons learned and organizational change [12]. Ibrahim Farah Salwati Binti believed that it was necessary for construction enterprises to transform traditional practices into digital and modern technologies, and proposed a full-process integrated BIM solution based on cloud computing platform to achieve data collection and sharing in the whole process from scheme design to construction management and completion acceptance [13]. Banerjee Anish investigated the BIM integrated IoT architecture, and provided a comparative evaluation of the decision parameters related to its characteristics and subsequent application in the construction industry, which was intended to provide data reference for industry personnel to analyze and predict in design, construction and maintenance [14]. BIM and IoT provided new solutions for the development of smart cities, which played an important role in improving construction efficiency and reducing construction costs.

In order to ensure the safety and reliability of construction projects, scientific and reasonable construction technology research is required. Based on BIM and IoT technology and combined with relevant theories and practical experience, this paper systematically discussed and analyzed the safety inspection and management of intelligent building projects. Compared with traditional manual methods, it could achieve higher efficiency, and reduce labor intensity. This could also improve project quality, and reduce the probability of safety accidents, so as to achieve the purpose of better ensuring the use function of buildings.

3. INTELLIGENT BUILDING ENGINEERING SAFETY MANAGEMENT MODE

3.1. Principle and Advantages of BIM and IoT Technology

3.1.1. BIM Technology

In modern construction project management, in order to improve the quality and benefit of construction projects, it is necessary to optimize the construction method constantly. BIM (Building Information Modeling) is an advanced and effective construction method, which combines science and technology such as computer, network and communication. Its application in construction projects can not only improve construction efficiency, but also significantly improve the quality of project schedule management. BIM technology carries out detailed analysis of construction projects through digital and intelligent means, optimizes resource utilization and construction process, improves project economic benefits, reduces resource waste and environmental impact, and promotes sustainable development. Therefore, the combination of BIM and traditional building information technology is an inevitable trend, and its technical principles and advantages are shown in Fig. (**1**).

BIM is a new engineering management mode that takes computer as the core, and takes computer-aided design, spatial database and various 3D entity data sets as the basic platform. It integrates the new generation of information technology and the construction industry, and realizes the digitalization and informatization of buildings. It can effectively solve the problems brought by traditional construction methods, such as saving labor costs, reducing costs, and shortening the construction period. This makes people work more efficiently and conveniently, and also promotes the transformation and upgrading of the construction industry. Its specific application range is very wide. It can integrate all the data needed in the construction project and realize information sharing in the construction project management; it can also improve the level of engineering design by transforming engineering drawings into 3D models to assist design; this even improves the efficiency of project management by establishing professional databases; through monitoring the whole life cycle of the project and ensuring the quality of the project, the refined management of modern construction enterprises is finally realized [15].

3.1.2. IoT Technology

With the advent of the Internet era, the interconnection of everything has become a trend. IoT is gradually entering people's lives and getting more and more attention. This is why more and more enterprises are starting to set foot in this field. However, in the actual work, how to do a good job in the construction and promotion of intelligent IoT management is a difficult point, which requires enterprises to carry out targeted work in combination with their own conditions. The basic introduction of IoT technology is shown in Fig. (**2**).

IoT is another new concept after the Internet. Its core is the wide range connection based on mobile terminals and can be extended to all walks of life. IoT realizes the information transmission between people and objects through the perception and processing of hardware devices. It is based on wireless mode and realizes information exchange, transmission, storage, analysis, control and management through radio frequency identification technology, Bluetooth and other wireless communication technologies. The data collected by various sensors are transmitted to the cloud platform, and then the cloud service is used to provide corresponding data analysis, prediction and other decision support, which can realize intelligent management, networked collaborative work and personalized customized production. In the field of industrial manufacturing, various resources in the factory are integrated through the IoT, which enables enterprises to better adjust the product structure, process plan and production process according to user needs. This has greatly improved the competitiveness of the manufacturing industry,

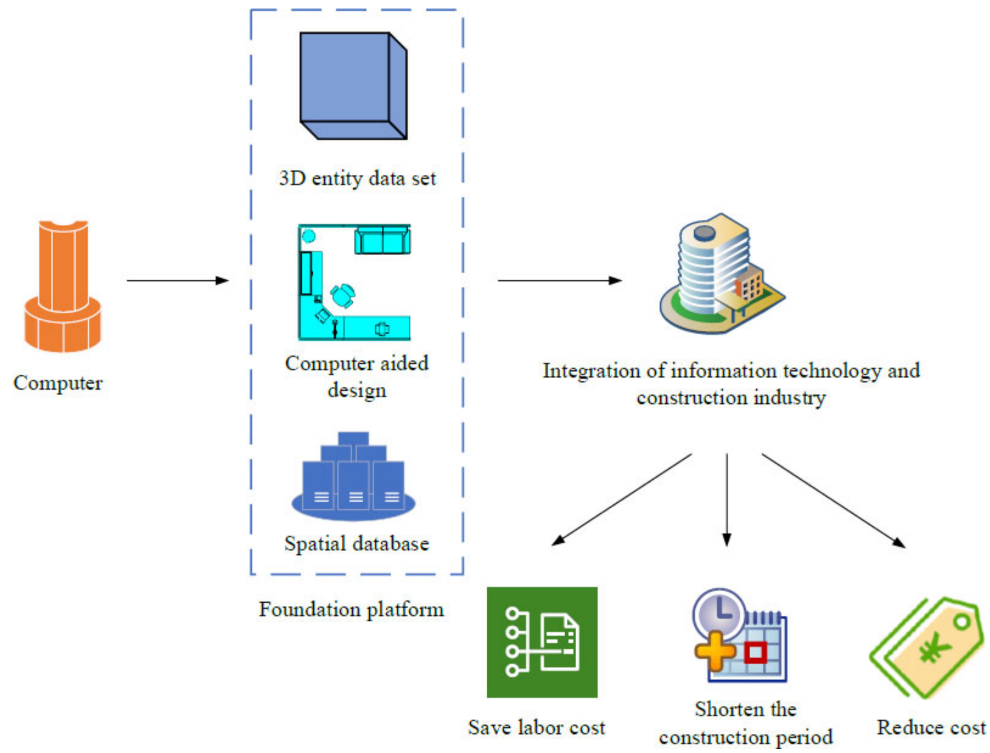

Fig. (1). BIM principle and advantages. *(A higher resolution / colour version of this figure is available in the electronic copy of the article)*.

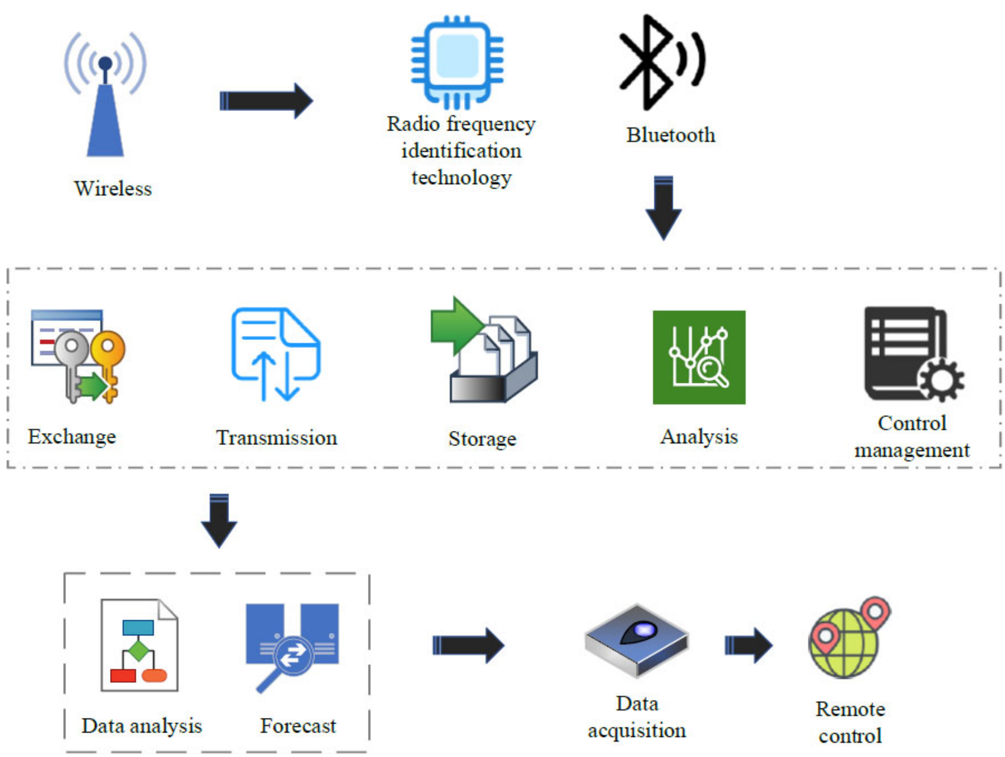

Fig. (2). IoT technology principles and advantages. *(A higher resolution / colour version of this figure is available in the electronic copy of the article)*.

and also provided more convenient and efficient service experience for enterprises. In addition, the system also has data acquisition function, which can identify, locate and monitor objects in the environment, and realize remote intelligent control, online monitoring and real-time alarm. This has played an important role in ensuring people's personal and property safety. The application of iot technology in sustainable computing is particularly important. Through real-time data acquisition and analysis, the Internet of Things will significantly improve the efficiency of resource utilization, reduce energy consumption and environmental pollution. For example, intelligent building systems use iot sensors to monitor and control lighting and HVAC systems to achieve optimal use of energy and reduce carbon emissions. In short, the Internet of Things can be said to be a new generation of information technology integrating communication, sensing and information processing, which has a wide range of applications and huge development potential, and provides technical support and innovation paths for achieving sustainable development goals. This plays a positive role in promoting the development of intelligent sustainable building systems [16].

3.1.3. Artificial Intelligence

The application of artificial intelligence (AI) technology in building engineering provides new possibilities for the realization of intelligent sustainable building systems. The combination of BIM (Building Information Modeling) and Internet of Things (IoT) technology with AI technology can greatly improve the efficiency of safety inspection and management of construction projects [17, 18], while promoting the sustainable use of resources and environmental protection. AI technology extracts valuable information from a large amount of data collected by iot sensors through machine learning and deep learning algorithms, and analyzes data from various sensors in real time, including structural health monitoring, environmental monitoring and energy consumption monitoring, to provide a scientific basis for the safety management of construction sites.

Secondly, AI can intelligently adjust the operation of lighting, air conditioning and heating systems according to the usage and environmental conditions of the building; Combine meteorological data and user behavior patterns to predict the energy needs of buildings and optimize energy supply chain management to achieve optimal energy efficiency. Moreover, in construction management, AI can realize intelligent construction process management through BIM and Internet of Things technology, carry out real-time monitoring and analysis of construction progress [19-21], construction quality and resource usage, and identify anomalies and potential problems in the construction process. In the operation and maintenance phase, AI can predict equipment failures and maintenance needs through continuous monitoring and analysis of building operation data, optimize maintenance plans, and extend equipment life. In general, AI technology provides strong technical support for the realization of intelligent sustainable building systems, and promotes the green transformation and sustainable development of the construction industry.

3.2. Construction Project Safety Detection Process

Safety is the premise of social development and the lifeline of every enterprise. With the increasing trend of economic globalization, the construction industry is becoming more and more competitive in the market. To enhance the competitiveness of construction enterprises, it needs to strengthen the quality management and risk prevention during the construction process. This can not only ensure the overall construction efficiency and quality level of the construction project to be effectively improved, but also provide a stable and reliable foundation for the entire project construction. The general process of construction engineering safety inspection is shown in Table **1**.

Table 1. Construction engineering safety testing process.

Stage	Degree of Risk	Description
Project approval	Lower	Project cost is uncertain, material supply is insufficient or short
Design and construction	High	Equipment construction, installation and commissioning and project quality problems
Completion acceptance	Higher	Building structure and other aspects of the connection and coordination

The safety detection process of intelligent building engineering can be divided into three stages, namely, before, during and after the event. In short, they are the project approval stage, the design and construction stage and the completion acceptance stage. Among them, project approval generally needs to go through preliminary demonstration, engineering survey, scheme review and other procedures. The safety risk at this stage is low, but its complexity also brings great uncertainty to the whole project. For example, the project cost is uncertain, the material supply is insufficient or short, and so on. Therefore, in this process, all preparations must be made to ensure the realization of construction quality and progress objectives.

The project construction stage is mainly to systematically study and master various professional technical knowledge involved in the project construction. On this basis, the engineering management theory would be applied to the actual work to realize the automatic control of the engineering project, and finally achieve the purpose of improving the engineering quality and efficiency. The safety inspection at this stage generally starts from the preliminary preparation, including the construction of equipment and facilities, installation and commissioning, and project quality. Once an accident or accident occurs, it would cause great losses to the construction unit. Therefore, the process requires the participation of relevant professionals and timely implementation of various security measures to successfully complete all tasks.

The completion acceptance stage is mainly completed through the relevant regulations and documents issued by the relevant departments, which is also the most important aspect of the whole project. Through the supervision and inspection of the project, the achievement of the expected objectives is ensured. This period involved a lot of content. This includes not only the quality problems of building structures, building materials and other materials, but also the working conditions of the interrelationship and coordination between the construction equipment and installation technology, electrical automation control, water supply and drainage system and other disciplines. Therefore, for intelligent buildings, the construction unit must strengthen its own management awareness at this time and formulate scientific and reasonable measures according to the actual situation to ensure the smooth progress of the project construction.

Safety detection of buildings can effectively prevent accidents, and prevent man-made damage and damage or losses caused by fire or other reasons. This can also improve people's ability to prevent dangerous factors through various ways, and timely detect potential safety hazards, so as to avoid unnecessary economic losses. Therefore, the safety detection of the system can directly affect the overall function and use effect of the building, which in turn urges the construction enterprises to continuously improve their management level and service level, thus promoting the progress of the industry.

3.3. Establishment of Safety Management Evaluation Indicators for Construction Projects

3.3.1. Analytical Hierarchy Process

It is assumed that there are I evaluation indicators, and the indicator system is constructed:

$$\alpha = \{\alpha_1, \alpha_2, ...\alpha_i\} \tag{1}$$

The judgment matrix is as follows:

$$P = (\alpha_{mn})_{Ii} \tag{2}$$

In the formula, m and n represent two safety indicators; α_{mn} represents the comparison result of the importance of index m and index n; the maximum characteristic root of the matrix is λ_{max}; its corresponding feature vector is Z, which represents the importance of each influencing factor.

The consistency of matrix P is checked, and its definition formulas are as follows:

$$CI = \frac{\lambda_{max} - i}{i - 1} \tag{3}$$

$$CR = \frac{CI}{RI} \tag{4}$$

In the formula, CR is the test coefficient, which is generally used to judge whether the matrix passes the consistency test. RI is a random consistency index whose value is related to the order of the matrix. The higher the order, the greater the value of RI and the greater the deviation.

3.3.2. Fuzzy Evaluation Method

Like the analytic hierarchy process, the evaluation index of this method is defined as $\alpha = \{\alpha_1, \alpha_2, ...\alpha_i\}$. It is assumed that there is a set of evaluation levels:

$$b = \{b_1, b_2, ...b_i\} \tag{5}$$

Each level corresponds to a fuzzy subset, and the fuzzy relation matrix is established:

$$W = \begin{bmatrix} W|a_1 \\ W|a_2 \\ \cdots \\ W|a_n \end{bmatrix} = \begin{bmatrix} e_{11} & e_{12} & \cdots & e_{1j} \\ e_{21} & e_{22} & \cdots & e_{2j} \\ \cdots & \cdots & \cdots & \cdots \\ e_{i1} & e_{i2} & \cdots & e_{ij} \end{bmatrix}_{ij} \tag{6}$$

Among them, $W|\alpha_i$ represents the degree of membership, and e_{ij} represents the evaluation of factor i on grade j.

3.4. Application of Modern Technology in Building Safety Detection

In the whole construction project, its quality is one of the important factors related to the safety of construction enterprises and people's life and property, so it is very necessary to carry out scientific and effective detection of construction projects. However, at present, there are still some problems in the quality inspection of construction projects, which are mainly manifested in the lack of perfect management system and insufficient technical force. These have seriously affected the overall safety of the project, so it is necessary to strengthen the attention of relevant personnel to the construction project quality inspection and take effective measures to improve the project quality level. This paper would analyze the process of building safety detection based on BIM [22-24], IoT and other modern technologies in order to improve the technical level and management ability of the construction industry, as shown in Fig. (**3**).

The application of IoT technology enables the whole system to monitor the construction progress, cost, progress and relevant data of each project in real time, and feed back these parameters to the management personnel in time, so as to grasp the implementation of the project budget in time. This realizes the intelligent monitoring function, thus greatly improving the work efficiency, and achieving efficient project management and project planning. BIM is based on 3D models, and uses computer modeling software to build digital entity models of engineering projects, which also carries out visual display and management. The combination of BIM and IoT technology can realize information sharing among all links of the whole life cycle of the building, thus creating a building safety risk detection and assessment system based on BIM, IoT, big data and 5G (5th Generation Mobile Communication Technology) network environment [25, 26]. It takes architecture as the basic information carrier to realize digital expression, real-time monitoring and control of urban planning, design, construction, operation and other processes [27]. The specific design idea is as follows:

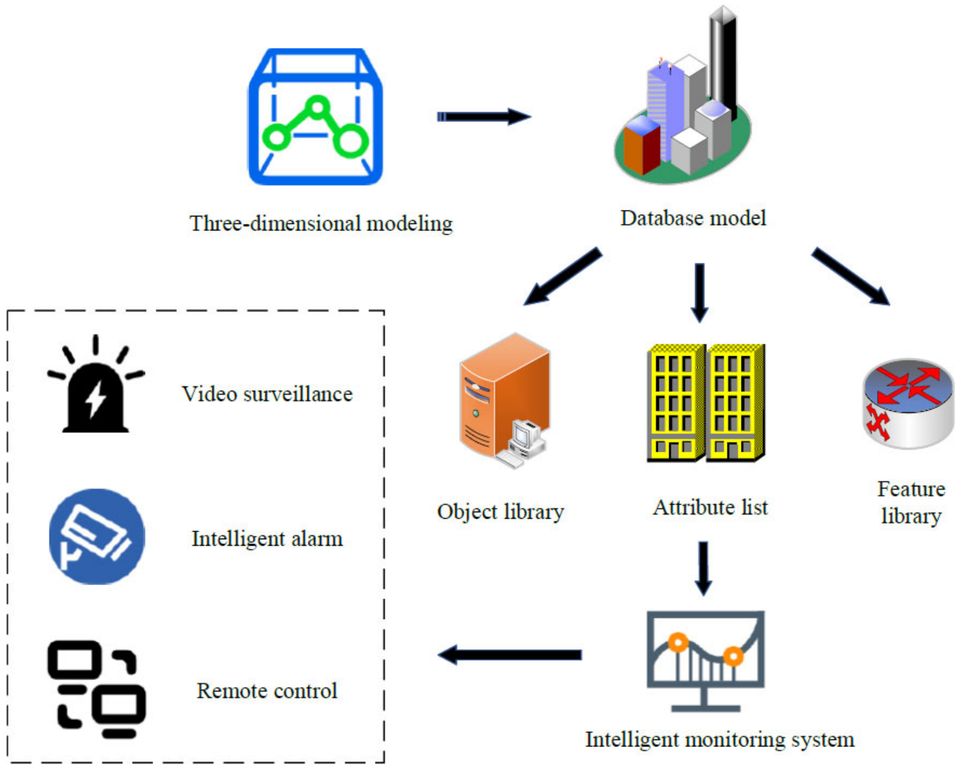

Fig. (3). Application of BIM and IoT in construction engineering safety detection. *(A higher resolution / colour version of this figure is available in the electronic copy of the article)*.

First of all, BIM carries out 3D modeling of the building, and analyzes its structure and functional characteristics, which also establishes the corresponding database model, including object database, attribute table and feature database [28]. The IoT connection equipment is used to build an intelligent monitoring system to achieve real-time collection and management of information in the building, including video monitoring, automatic patrol, intelligent alarm, remote control and other functions, which provides a basis for subsequent intelligent decision-making [29, 30]. Finally, the data is transmitted to the cloud server through wireless transmission to realize big data analysis, thus forming a complete visual research report for management reference. The integrated development of BIM and the IoT is a new technical means, which can better play their advantages, and improve the efficiency of safety evaluation of construction projects. This can also reduce the cost of construction projects, and improve the level of project management, so as to promote the healthy, stable and sustainable development of the construction industry.

4. EXPERIMENTAL METHOD

4.1. Comparative Experiment and Discussion of Building Safety Detection Effect Based on BIM and IoT Technology

A certain area was undergoing regional engineering construction. A construction project was randomly selected from the project for investigation, and 10 professionals were invited from a safety management company to conduct safety inspection on the project. These 10 people were randomly divided into two groups: A and B. There were five people in each group. Group A adopted the traditional manual detection method for safety assessment, while Group B adopted the intelligent management system based on BIM and IoT technology for detection. It was known that the proportion of men and women in the two groups was balanced, and the professional level was equal. Comparative experiments were designed from three aspects of detection time, safety and accuracy, and experimental data were recorded and analyzed.

4.2. Data Evaluation

4.2.1. Test Time Comparison

The time spent by Group A and Group B to complete a safety inspection was separately counted, and the results were shown in Fig. (**4**).

As shown in Fig. (**4**), figure a showed the detection time of Group A members, and figure b showed the detection time of Group B. It could be clearly seen that the curve of Group A was much higher than that of Group B. Group A curve experienced a rise and then a decline, and it rose again and then gradually stabilized. The data range was always distributed in the range of 20-35 minutes, and the maximum difference was about 7 minutes. On the contrary, the curve of

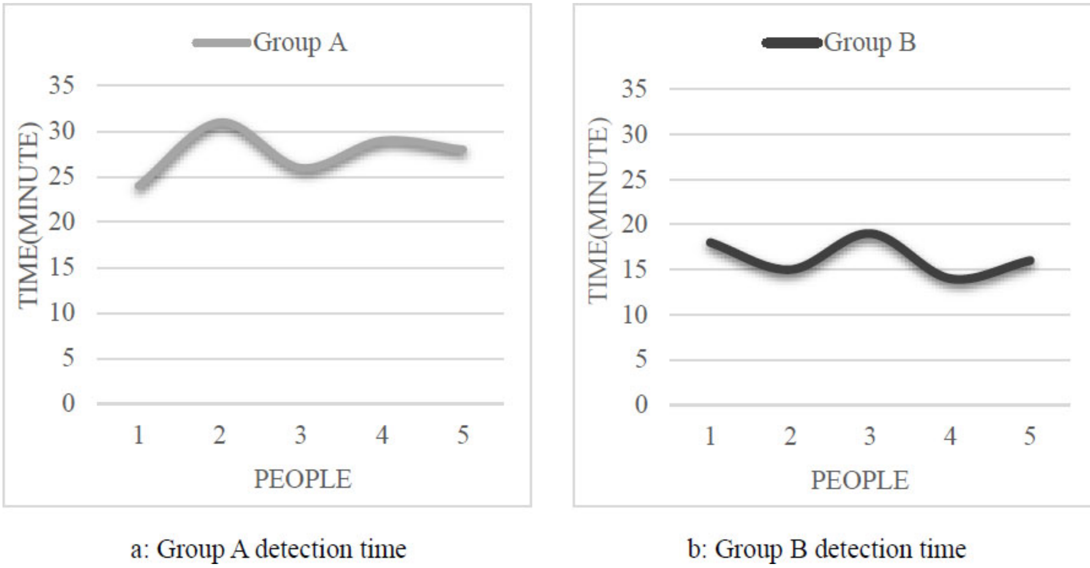

Fig. (4). Comparison of detection time between the two groups (**a**, **b**). *(A higher resolution / colour version of this figure is available in the electronic copy of the article)*.

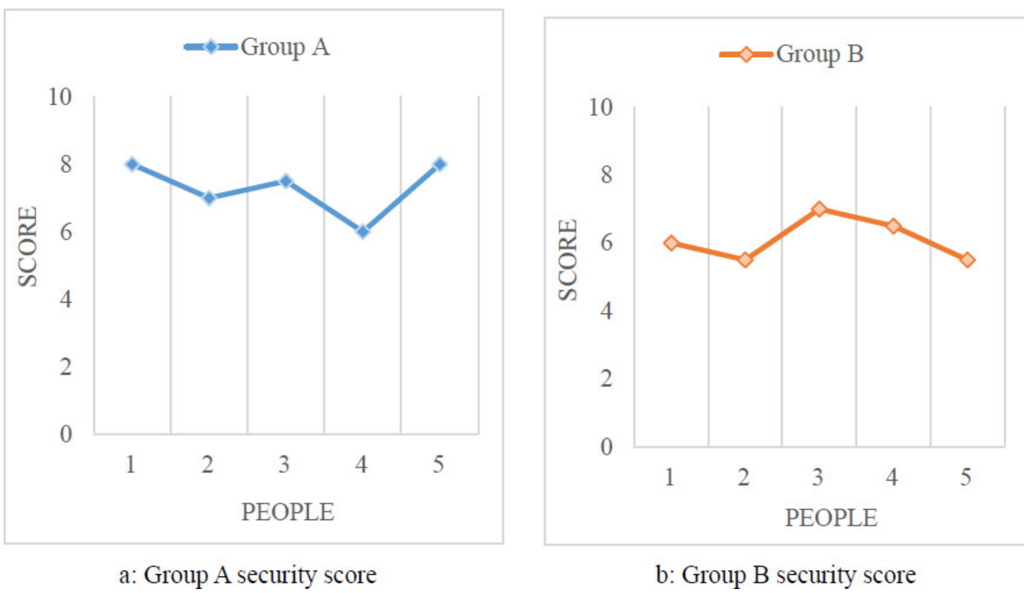

Fig. (5). Safety comparison between the two groups (**a**, **b**). *(A higher resolution / colour version of this figure is available in the electronic copy of the article)*.

Group B experienced a decline first and then a rise, and it changed in a reciprocating cycle. The time range was 10-20 minutes. The fastest time was about 14 minutes, and the slowest time was about 19 minutes. The gap was only 5 minutes at most. Therefore, the fluctuation range of Group B curve was smaller and the detection speed was faster, which could meet the needs of multi-batch and small-batch testing at the same time. This could save labor costs and material resources, which was more applicable in industrial applications.

4.2.2. Safety Comparison

After testing, the two groups were asked to score the safety of the building by combining the fuzzy evaluation method. For the same building, the lower the score, the more potential safety hazards considered by the group and the more realistic and reliable the results. The score was set to 1-10, and the result was shown in Fig. (**5**).

It could be seen from Fig. (**5**) that figure a showed the safety scoring results of Group A and figure b showed the

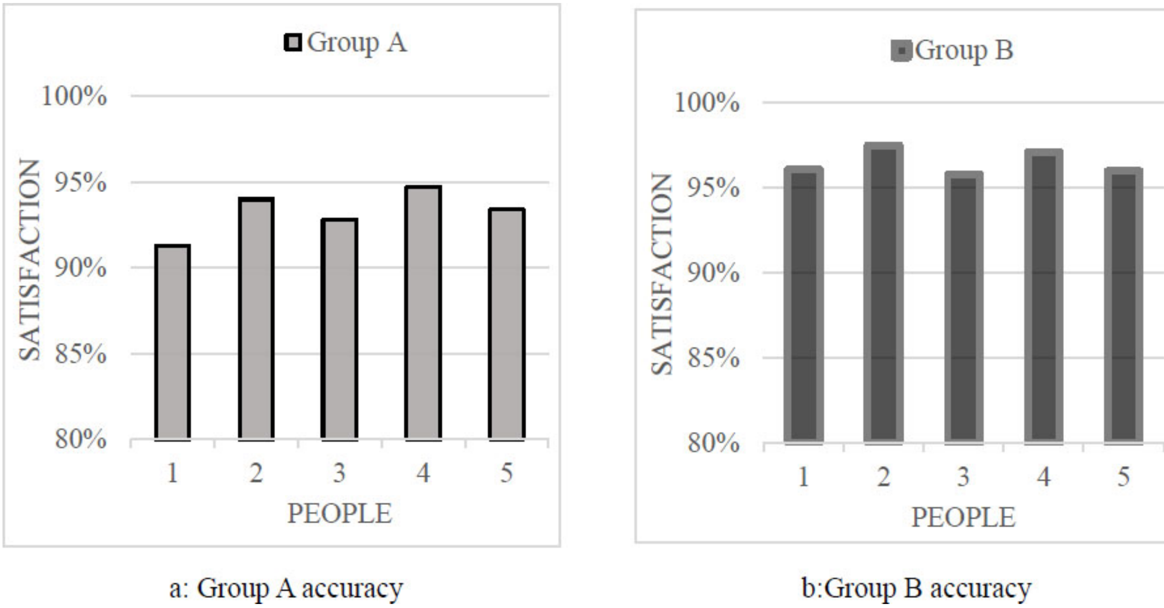

Fig. (6). Comparison of accuracy of detection results between two groups (**a**, **b**). *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

safety scoring results of Group B. The score difference between the two groups was small. It showed that the safety management of the construction project was relatively standard, and the safety level was generally good. The highest score of Group A was about 8 points, and the lowest score was about 6 points. However, only one person scored less than 7 points. The average score was about 7.3 points. The highest score of Group B was only about 7, and the lowest score was about 5.5. The average score was about 6.1. Therefore, the requirements of Group B were higher, and the scoring standard was stricter, which also controlled the construction quality better. In short, there might be significant differences in different detection methods for the construction of the same region. Therefore, corresponding strategies should be adopted to improve the security level of the whole building group area for these building functional zones.

5. RESULTS AND DISCUSSION

The accuracy of the test results of the two groups was compared, and the results were shown in Fig. (**6**).

As shown in Fig. (**6**), figure a showed the accuracy of Group A and figure b showed the accuracy of Group B. The accuracy level represented the degree of accuracy difference between the two groups. Among them, the accuracy of Group A reached more than 90%, but the highest was only about 94.7%. Compared with the actual situation, there was a large error. In contrast, in Group B, the accuracy of the test results of each member was more than 95%, and the overall performance was more stable. Compared with Group A, the error was significantly reduced. Therefore, Group B had high accuracy and stability, which was an ideal scheme for safety detection. After calculation, the average accuracy of Group A was about 93.24%, and that of Group B was about 96.5%. Group B was about 3.26% higher than Group A. Therefore, the construction engineering safety detection system based on BIM and IoT technology could realize real--time and comprehensive monitoring, management and control of various risk factors in the whole life cycle of the building. This could ensure the project quality and construction quality, thus improving the competitiveness of construction enterprises.

CONCLUSION

The development of intelligent buildings is a very important and arduous task. It must not only ensure the safe and normal operation of buildings, but also ensure that people are well protected in work and life. Designers should not only analyze the building structure correctly, but also understand its installation and construction methods. This paper introduced BIM and IoT technology into intelligent buildings, and realized intelligent management and control by building a security detection system based on BIM. It also provided users with corresponding information services in combination with the IoT platform, thus making the whole system more efficient, accurate and convenient. The results show that BIM can reflect the on-site situation more truthfully and intuitively, and the accuracy rate of the test results has also increased by about 3.26%.

This paper focused on the principle and application advantages of BIM and IoT technology. By comparing the advantages and disadvantages of the two technologies, the feasibility of their combination and the specific implementation plan were determined. On this basis, this paper further discusses the application of AI (artificial intelligence) technology in intelligent buildings. Through data analysis and machine learning algorithms, AI technology not only enhances the intelligence level of safety monitoring and management, but also significantly enhances the sustainability of the system.

In order to better adapt to the needs of intelligent building construction at this stage, the general process of project safety detection was discussed in detail. How to use BIM technology to improve the efficiency, accuracy and reliability of safety monitoring was described to achieve the purpose of improving project quality. Finally, the effectiveness and practicability of this scheme were verified by experiments, which showed that the design scheme could effectively meet the current requirements of intelligent building safety management and had certain promotion value.

CURRENT & FUTURE DEVELOPMENTS

(1) The Development Status of Intelligent Buildings

The improvement of living standards has led to an increasing demand for building quality, and traditional building safety inspection technologies are no longer able to meet the current inspection needs for various public facilities and buildings. Therefore, the concept of intelligent buildings has emerged. The development of intelligent buildings is a very important and arduous task. It must not only ensure the safe and normal operation of buildings, but also ensure that people are well protected in work and life. Designers should not only analyze the building structure correctly, but also understand its installation and construction methods.

(2) The Research Conclusion of This Article

This paper introduced BIM and IoT technology into intelligent buildings, and realized intelligent management and control by building a security detection system based on BIM. It also provided users with corresponding information services in combination with the IoT platform, thus making the whole system more efficient, accurate and convenient. The results show that BIM can reflect the on-site situation more truthfully and intuitively, and the accuracy rate of the test results has also increased by about 3.26%. This paper focused on the principle and application ad vantages of BIM and IoT technology. By comparing the ad vantages and disadvantages of the two technologies, the feasibility of their combination and the specific implementation plan were determined. On this basis, this paper further dis cusses the application of AI (artificial intelligence) technology in intelligent buildings. Through data analysis and ma chine learning algorithms, AI technology not only enhances the intelligence level of safety monitoring and management, but also significantly enhances the sustainability of the system.

(3) Future Development Direction

In order to better adapt to the current needs of intelligent building construction, it is necessary to discuss the general process of engineering safety inspection in the future, and explain how to use BIM technology to improve the efficiency, accuracy, and reliability of safety monitoring, in order to achieve the goal of improving project quality.

AUTHOR CONTRIBUTIONS

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

LIST OF ABBREVIATIONS

BIM	=	Building Information Modeling
AI	=	Artificial Intelligence
IoT	=	Internet of Things

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIAL

All data generated or analyzed during this study are included in this published article.

CONFLICT OF INTEREST

The authors declared no conflict of interest, financial or otherwise

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