Intelligent Building Design Based on Internet of Things

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Abstract. As an important part of today's intelligent building engineering, the construction quality of the Internet of Things system automation system largely determines the reliability, security and operation order of the engineering construction. When building the Internet of Things system, the construction personnel must strictly follow the rules and regulations and design scheme, and also strengthen the control and management of field work design, construction material quality, project processes and procedures. Based on the above requirements, combined with the current status of the project, this paper studies and discusses the improvement measures of the construction of intelligent building networking system, hoping to provide reference for the industry [1].

Keywords: Intelligent Construction, Construction Problem, Design Measures

1. Introduction

Intelligent building is often the result of cross research with the Internet of Things system, including the Internet of Things, monitoring and security, information transmission, automation management and other advanced technologies, not only brings great convenience to People's Daily life, but also creates a more comfortable and safe living space for people. In real life, intelligent buildings often play a role through many different kinds of Internet of Things systems, such as intelligent power supply and distribution system, temperature regulation system and security system. The effectiveness of these systems is managed by intelligent design based on computer control, so people should constantly improve intelligent design and construction technology to ensure the normal operation of intelligent buildings [2].

2. Characteristics of intelligent building design and construction based on Internet of things

With the development of China's economy and urbanization, the construction industry is gradually implementing modernization and intellectualization, and intelligent buildings are being paid more and more attention, which makes intelligent design more and more popular, and residents' quality requirements for building networking system are also gradually improving. People pay more and more attention to the practicality and security of the Internet of Things system. The quality level of the Internet of Things system fundamentally affects the function of the whole building. High-quality Internet of Things systems can detect their own system failures at runtime.

As shown in Figure 1 below, if problems existing in the construction of the Internet of Things system in construction engineering can be solved, the quality of the Internet of Things system can be...
improved, so as to make its operation more efficient and stable.

Figure 1. Characteristics of intelligent building design based on Internet of things

In Figure 1, some advanced technologies, new materials and design ideas are often used in the current construction of intelligent buildings [3]. These new things bring great uncertainty to the construction of the Internet of Things system, and also bring severe challenges to staff. The staff must have a certain technical level and operate in strict accordance with the construction procedures, such as the design of foundation groove excavation:

\[ V = (A+2C+K \times H) \times L \]  \hspace{1cm} (1)

In the above formula, \( V \) represents the amount of earthwork in the base groove; \( A \) represents the bottom width of the slot; \( C \) represents working face width; \( H \) represents the depth of base slot; \( L \) is the length of the base slot.

The length of the base groove of the outer wall is calculated by the center line of the outer wall, and the length of the base groove of the inner wall is calculated by the net length of the inner wall.

Foundation pit excavation is another design idea:

\[ V = \frac{1}{6} h \left[ A \times B + A \times B + (A + A) \times (B + B) + A \times B \right] \]  \hspace{1cm} (2)

In the above formula, \( V \) represents the volume of foundation pit; \( A \) represents the upper length of the foundation pit; \( B \) represents the width of the pit opening; \( A \) represents the length of foundation pit bottom; \( B \) represents the width of foundation pit bottom.

In addition, construction personnel and designers should constantly learn new technologies and update their knowledge reserves to better match new technologies and new designs, so as to complete construction work with high quality. Project acceptance units should also strengthen supervision of project quality to ensure the smooth operation of Internet of Things systems and intelligent systems.

3. Main problems of Internet of Things in intelligent construction design of buildings

3.1. Incomplete design and construction scheme
In the current Internet of Things system construction projects, there are incomplete design and construction schemes. Construction plan and design drawing is the reference standard of the whole project construction work, all work must be carried out in accordance with the plan and drawing, its importance is self-evident. Incomplete or missing, unclear project drawings, not only affect the
progress of the project, but also cause construction disorder. In addition, there may be a process disorder caused by the lack of feasibility of the scheme design due to the insufficient capacity of designers or scheme makers. Either way, it will bring great damage to the whole project [4-6].

3.2. The quality of the Internet of Things system is poor
One of the purposes of introducing intelligent Internet of Things system automation technology into modern building engineering is to reduce the waste of resources. In order to achieve this goal, the software that controls the operation of the system should be optimized to make the power consumption of the Internet of things system meet the expected standards. In order to realize energy saving and emission reduction of buildings, the most important measure is to control the electricity consumption of air conditioning [7]. Can calculate the floor in general normal air conditioning power consumption, and then the number of air conditioning, outlet point, air conditioning switch standard scientific configuration, in order to ensure that the air conditioning temperature regulation function can play a normal role at the same time, as far as possible to reduce power loss. Also maintain a reference valve opening between 80% and 90%, as shown in Figure 2 below:

![Figure 2](image_url)  
**Figure 2.** Application effectiveness of iota systems (%)

As shown in Figure 2, the problem widely existing in the Internet of Things system is low quality. However, with the improvement of the intelligent level of buildings, the requirements on the Internet of Things system will only increase, and the use of substandard construction products will cause more problems. In addition to affecting the overall quality of the building, but also may cause safety accidents.

At present, there are many kinds of monitoring systems in intelligent buildings, such as power supply, air conditioning and ventilation, drainage and lighting, elevator and firefighting, among which one of the more important designs is automatic fire alarm equipment. At the same time, when building the Internet of Things system, construction personnel should build corresponding lightning arresters, lightning catcher and other security design. If problems occur in the construction process, lightning protection and fire protection functions may be reduced or even missing, affecting the normal operation of the design, and thus bringing hidden dangers to the lives of residents [8].

3.3. The bolt fixing technology is not advanced
In order to improve building safety and earthquake resistance, Internet of Things systems are often fixed with hanging supports, bolts and their own bases during construction. However, the bolts are often prone to corrosion and slipping. If the working condition of the bolt is not checked regularly, it is likely to gradually loosen and fall off because of its corrosion resistance. In addition, electromagnetic fields can make bolts and resistors contact each other and continue to heat up, which may cause short circuit phenomenon. In addition to the above dangerous security risks, the intelligent Internet of Things system may also have a negative impact on the lives of nearby residents in the construction process, such as vibration and noise generated in the construction work will interfere with the normal life of nearby residents, and noise generated by poor design and daily operation.

4. Internet of Things optimization measures to improve intelligent design and construction of
buildings

4.1. Unified Resource Management and configuration
The Internet of Things system and automated management system used by intelligent buildings have very high requirements for their safety and management effect. In the construction and design of the system, professionals or teams should participate in the work, and special supervisors should be arranged to supervise the construction and construction process to prevent quality problems. Before carrying out the construction of intelligent Internet of Things system, management schemes should be designed according to the actual situation of the construction site, and reasonable deployment of construction procedures should be carried out to ensure the orderly progress of the construction process. After the completion of the construction should also pay attention to check the quality of the project [9-10].

4.2. Optimize the design scheme and construction specifications
When receiving the construction drawings and design scheme, the construction unit should go to the construction site for survey in advance to improve the feasibility of the construction scheme. For example, the construction scheme can be rationally optimized in combination with the specific situation of the site, so as to improve the construction efficiency and reduce the construction cost as much as possible on the original basis. After the adjustment of the construction scheme is decided, effective communication shall be conducted with the designer to ensure the effectiveness of the adjusted scheme. The materials or technologies and processes to be changed should also be informed to the staff of all parties in a timely manner. Before the formal construction of the project, it is necessary to be familiar with and understand the engineering process, operation specifications and construction rules in detail in advance to ensure the efficient and smooth progress of the project. In most cases, the root cause of quality problems of Iota systems in smart buildings is the operation of the construction process. As shown in Figure 3 below, in order to improve the effectiveness of the design and construction work, the construction company should formulate detailed operational guidelines for each step of the operation, and strengthen the supervision and periodic review of the construction process.

![Figure 3. Application of Internet of Things system in intelligent construction of buildings](image)

In Figure 3, it can be found that for supervision and review, special supervisors should be dispatched to supervise the design and construction process, and professionals should also be hired to give technical guidance to the construction personnel. The supervision content of the project includes the review of the design scheme, the management of the construction progress and process, operation details, staff safety and other aspects. After supervision, supervision results and existing quality problems should be reported in a timely manner and solved in a timely manner.
4.3. Other aspects
The automation system of intelligent building often has high requirements on the circuit sequence and system architecture of Internet of Things system, which requires the system to give consideration to both independent control and total control, which brings challenges to the work of construction personnel. In addition, the construction sequence of iota systems, circuit connections between different designs and design fixation are also high operational requirements. In view of these characteristics, the construction personnel must be familiar with the design drawings and construction plan before carrying out the work, and check the possible flaws. The design and construction process should strictly follow the working principle of “rectification in case of problems and unified deployment on site”. During the construction process, the staff must have regular communication and exchanges with their partners to ensure that the construction work is orderly and the progress is consistent. The construction unit and supervision unit of the project should arrange professionals to supervise the work of the construction site at the same time, regularly review the quality of the work, and participate in the construction and debugging of the design if necessary, so as to fundamentally improve the efficiency and quality of the construction automation design and construction, and ensure the safety and stability of the work.

5. Conclusion
To sum up, with the advancement of urbanization and the development trend of intelligent and modernization in the construction industry, more and more technologies and processes are involved in the construction of intelligent Internet of Things system, and the requirements of engineering quality are getting higher and higher. Therefore, in order to effectively improve the functional level of intelligent buildings and quickly stand out in the highly competitive construction industry, attention must be paid to the design and construction level of Internet of Things systems and automation systems, and continue to expand the follow-up space. In addition, the technical personnel in the scheme design, should pay attention to according to the design characteristics, engineering requirements and the actual situation of construction sites to choose the most matching technology and craft, and accordingly, technical innovation and process optimization, promote the management level rise, in order to improve the quality of project results, designed for subsequent works provide the fundamental guarantee.

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