Research on the Development of Intelligent Fire Inspection System for Construction Engineering

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Abstract. Combining with the characteristics of fire protection inspection of construction projects, this paper develops a smart fire inspection system for construction projects based on information technology. The system is equipped with functional modules such as electronic handbook records, intelligent data processing, remote rectification interaction, and risk assessment reminders for fire acceptance personnel in on-site acceptance scenarios. On-site acceptance and filing spot checks are standardized, standardized, visualized and intelligent. The system application can assist the fire inspection of construction projects, save administrative resources, effectively improve service quality, and increase social and economic benefits.

Keywords: Construction Engineering; Fire Inspection; Wisdom System.

1. Introduction

In recent years, driven by the accelerating global digitalization process, the global e-government model is on the rise. Especially with the outbreak of the new crown epidemic in 2020, the e-government model has become an important channel for the government to provide services to the public. Since the local housing and construction departments have undertaken the function of fire protection inspection, in accordance with the Central Committee of the Communist Party of China, the General Office of the State Council and the Ministry of Housing and Urban-Rural Development on deepening the reform of fire protection law enforcement [1], refining the fire protection design review and acceptance of construction projects, doing a good job in the fire protection design review and acceptance work of construction projects, optimizing According to the requirements of the business environment, we will effectively promote the "one-stop service" of fire supervision, constantly improve the "Internet + supervision" law enforcement mechanism, explore the use of Internet of Things and big data technology, real-time and intelligent assessment of fire safety risks, and strengthen the construction of information technology. Application in engineering fire protection design review and acceptance technical service organization and personnel management.

As an important matter of fire inspection work, fire protection acceptance should conform to the strategic development direction of digital government and smart city. Develop a set of intelligent fire inspection system to provide convenient and reliable recording and summary tools for fire inspection work, which can innovate the thinking and mode of acceptance, promote openness and transparency of the acceptance process, and deepen the application of acceptance data resources in government management and social governance. From the perspective of verification, accelerate the transformation and high-quality development of the construction industry, enhance the endogenous power of digital government, and help improve the overall efficiency of digital government.

2. System Architecture

2.1 Build a smart acceptance system based on as-built drawings System using big data, artificial intelligence, Internet of Things, cloud computing, etc.

Technical means, build a set of intelligent acceptance system based on as-built drawings. Assist fire inspection personnel and third-party agencies to carry out on-site inspection of fire inspection

and acceptance in a standardized manner, and help construction units to intuitively and accurately apply for inspection, rectify and

Through the acceptance, promote the remote interaction of all parties in the process, statistically analyze the relationship between the common problems of acceptance and specific points and project types, risk prevention and control of major dangerous points, and the development trend of acceptance, etc. Fire investigation, command and dispatch and other acceptance related work.

By providing an intuitive and detailed corroborating view, and using the system's openness and transparency, it helps to unify the standards for on-site inspection behaviors to improve service quality through reform and innovation; the acceptance records can help enterprises to delineate the key points of construction and acceptance, and reduce the repeated rectification and failure of enterprises from the source. When the situation in place occurs, the government-enterprise contradiction of "can't pass without rectification, but the burden of rectification is heavy" is eased, and data application is used to optimize the business environment; the system provides information-based tools for standardizing law enforcement, and promotes the design and implementation of construction projects by the responsible entities in accordance with laws and regulations. On-site construction is carried out according to the drawings, and the materials and products used are in line with the specifications, and the project quality is supported by the standardized process.

2.2 Business function and performance analysis

The current status of newly accepted fire protection acceptance and record sampling (re)check items in the business scope of the system. On-site inspection links, including pre-inspection preparation, implementation of on-site inspection, third-party reporting, rectification response by the construction unit, and formation of the final acceptance report.

Role settings

The management party, the acceptance party, the third-party service organization, and the enterprise party.

Database

Project database, drawing library, unit database, common problem library, major danger points.

Functional module

Check handbooks (acceptance personnel, third-party agencies); report processing (service report, acceptance report, rectification report); one-click acceptance (one-click inspection report); acceptance assistant (immediate warning, overdue warning, non-compliance reminder, ask for help Assistant, evaluation assistant, rectification assistant); statistical analysis (common problem management, point sorting, type distribution, acceptance trend, compliance statistics, major danger points, risk control); clue handover; information library (point model library, specification library, common disease library) and so on.

Docking interface

Docking with fire approval system, relevant law enforcement system and plan approval system.

Performance

Through the analysis of system business requirements and user analysis, the performance index requirements of the system are obtained:

(1) Support no less than 50 concurrent users;

(2) In a stable network environment, the system response time of a single operation on the operational interface is less than 5s;

(3) Support offline data storage, and data will be automatically uploaded after going online.

2.3 System Technical Framework

Build the technical framework of the construction engineering smart fire inspection system, as shown in Figure 1.

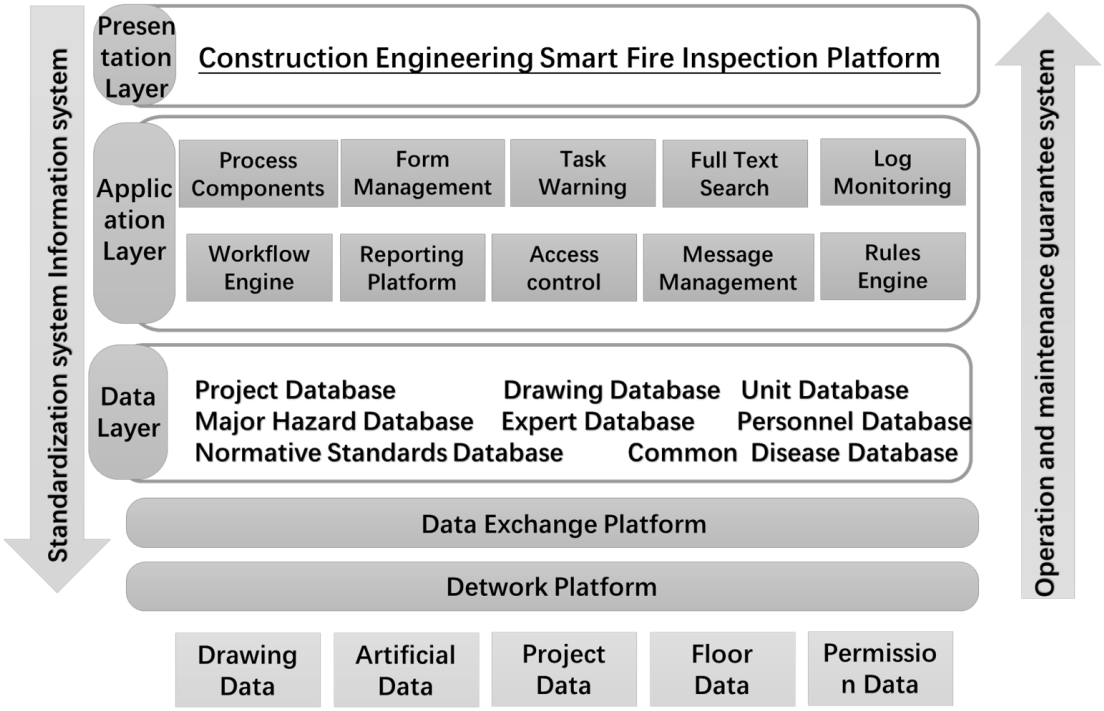

Figure 1. The overall framework of the smart fire inspection system for construction projects

In Figure 1, the system consists of data layer, application support layer, application presentation layer and standardization system, operation and maintenance guarantee system, and information security guarantee system, as follows:

2.3.1. Data Layer

Establish a database of information resources for fire protection acceptance of construction projects, including main project database, drawing database, unit database, personnel database, common disease database, major dangerous point database, standard database, etc.

2.3.2. Application layer

Including process components, form management, permission control, workflow engine, reporting platform, task warning, message management, full-text retrieval, rule engine, log monitoring [2].

2.3.3. Presentation layer

Build a smart fire protection acceptance scene for construction projects.

2.3.4. Data exchange system

Utilize the existing relevant systems to realize the data exchange outside the system, and at the same time realize the exchange of data with the existing fire control approval system, relevant law enforcement system and map approval system.

2.3.5. Security system

The construction ensures the authenticity and security of system data by establishing a system of unique account and unique lock for each person. At the same time, through some security measures of hardware equipment, the stability and security of system data are jointly guaranteed, and electronic security recognized by the state is provided. Authentication docking interface.

2.3.6. Standardization and Operational Assurance System

A standardized system established to ensure the smooth development, implementation and operation of the smart fire inspection system. In the formal operation stage of the system, an operation and maintenance guarantee system shall be established to ensure the normal, stable and safe operation of the system.

2.4 System Logical Architecture System

At the technical level, advanced technologies such as cloud computing, big data, and mobile technology are used. The main modules include: information database, report processing, check handbook, acceptance assistant, statistical analysis, clue handover, return visit management, etc. The systems involved in data interaction include fire protection Approval system, drawing approval system, relevant law enforcement system, etc. It involves user groups such as enterprises, third-party service agencies, acceptance parties, and management parties. Application performance prediction

Taking City A as an example, according to estimates, after the information system is completed and applied in the whole city, it can assist more than 1,000 construction projects with a total of about 20 million m2 projects to carry out standardized, normalized, visualized and intelligent on-site acceptance and filing spot checks (rechecks) every year.). It can save about 3900h of review time every year, and the annual saving rate of all project inspections (including review) can reach 44%. The acceptance time limit can be further compressed by about 10%. After the system is completed, it can effectively improve the quality of fire inspection services in Nanjing, effectively optimize the business environment of Nanjing's enterprises, and help Nanjing's social and economic benefits to grow again.

2.5 Improve service quality through reform and innovation

The system directly associates on-site problems with drawings, and implements refined management and control of the acceptance process. Enterprises can intuitively and accurately rectify and feedback point problems, improve the quality and efficiency of problem rectification, save and efficient use of administrative resources, and timely evaluate the quality of government services. Obstacles are quickly resolved through green channels, and reported problems can go directly to the management of the organization. The system can unify the standards of acceptance behaviors, record supporting materials such as pictures and videos, supervise the law enforcement process and third-party service behaviors, assist the regulatory agencies to turn inward, and prescribe "new prescriptions" for the acceptance process, eliminate "stubborn diseases", and solve difficult problems. Let enterprises experience warm and high-quality acceptance services.

2.6 Optimizing the business environment with data applications

The system can optimize the acceptance service process and promote the extension of pre-service and technical guidance. Through the sorting of common problems, trend analysis and statistics of major danger points, we will promote the formulation of verification policies that are in line with real-time, dynamic adjustment, and more scientific. In the two stages after the design review is passed and after the inspection is accepted, early warning is given to the common problems that are very likely to occur in the construction entities of each project and the key problems worthy of attention. Help enterprises to visually delineate the key points of construction and acceptance on the drawings, reduce the occurrence of repeated rectification and failure of the enterprise from the source, reduce the loss of technology, capital and time costs that are difficult to rectify after completion, and reduce the cost of repeated construction and rectification of projects , to ease the contradiction between the government and enterprises of "no rectification will pass, and the burden of rectification will be heavy". Early warning of frequent problems in enterprise acceptance, helping enterprises to sort out hidden dangers in advance, and successfully pass the acceptance later. To "reduce the weight and reduce the burden" for fire inspection and acceptance, and effectively optimize the business environment.

2.7 Ensuring economic and social benefits by standardizing law enforcement

Fire protection acceptance, filing and random inspection (re-inspection) are not only the technical service process but also the exercise of administrative law enforcement power. As an auxiliary tool for strict law enforcement, the system can timely push the relevant law enforcement systems and fire rescue agencies for violations of laws and regulations found during the acceptance process, shortening

the punishment period for violations of laws and regulations. Promoting the construction projects that have passed the acceptance check to be more in line with the requirements of the design drawings in terms of building structure, firefighting and rescue facilities, firefighting facilities and systems, water, electricity, heating, ventilation and firefighting equipment, and meet the requirements of architectural design fire protection regulations to ensure that in the event of a sudden fire, the Obtain fire-fighting tools, and link to alarm fire and rescue agencies in a timely manner to create favorable conditions for the safe and rapid evacuation of trapped people, reduce unnecessary property losses and casualties, effectively curb the spread of fire, and help minimize accident injuries. It is like an electronic barrier for inspection and acceptance of disaster prevention, mitigation and mitigation, protecting people's lives, health and property safety in the acceptance process, and escorting high-quality economic and social development [3].

3. Conclusion

All in all, to develop a set of intelligent fire inspection system as an information tool used in fire inspection and acceptance, to visualize the acceptance process, carry out fire inspection in a standardized way, facilitate the implementation of rectification and review, and provide policy basis for precision. The effective mechanism has considerable practical significance and urgent construction necessity.

In the process of on-site acceptance of construction projects, the intelligent acceptance system is used as an information-based means to assist on-site inspection, which can provide an efficient and simple way of recording problems, promote remote and accurate communication and resolution of problems, ensure fairness, openness and justice in the acceptance process, and comprehensively improve fire protection acceptance. Efficiency, in line with the policy requirements of "delegating power, delegating power and serving" and optimizing the business environment. The use of new technologies such as the Internet of Things, cloud computing, and big data [4] can realize the informatization, standardization, standardization and sunshine of fire inspection and acceptance business, promote online circulation of all links of fire supervision and law enforcement, leave traces in the whole process, closed-loop management, and improve construction projects. Fire acceptance quality.

In the future, with the continuous maturity and in-depth application of artificial intelligence plan review technology, the large-scale development of building information model (BIM) technology , and the high integration of data sharing between departments, the upgrade iteration of the smart fire inspection system will be able to Get support from more dimensions, further improve the standardization, informatization and intelligence level of fire protection acceptance of construction projects, promote the design review of construction drawings, fire supervision during construction, and the whole process of fire rescue and fire protection acceptance, and establish and improve the whole process of intelligent fire protection. management system.

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