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Study on the Whole Process Supervision Technology of Digital Intelligent Enabling for Building Safety and Quality Appraisal Institutions

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Abstract: In order to fully implement the "Notice of The General Office of the State Council on Printing and Printing the Special Rectification Work Plan for the Safety of Self-built Houses", in view of the endless collapse of houses such as self-built houses, the traditional supervision methods of housing safety appraisal agencies are dishonest and the agency appraisal reports are distorted. Based on the principle of "the whole process of Internet + digital intelligence", this paper develops a set of digital and intelligent regulatory software system suitable for regulatory departments. It mainly introduces the basic application functions of this system, and takes the whole-area appraisal project of Taizhou City as an example to show that this regulatory system manages in all aspects such as human, machine, material, law and environment. The system has the advantages of thoughtful use steps, simple steps, scientific and accurate. At the end of this paper, the benefits and promotion value of the whole process of intelligent enabling supervision system are summarized and analyzed.

Keywords: Housing Safety Quality Appraisal; Digital Intelligence; The Whole Process; Supervision Technology.

1. Introduction

With the efficient and coordinated development of economy and society, and the efficient and coordinated development and security of infrastructure in Zhejiang Province, it has achieved a good start of striving to promote "two firsts" and demonstrated the elegance of "China's infrastructure" [3] with the "Window of Zhejiang". At present, our country is in the new stage of fast development of "digital intelligence". Housing safety appraisal supervision work also gradually follow the footsteps of the traditional people-oriented supervision transformation to automatic digital intelligent supervision. The use of "the whole process of the Internet + digital intelligence" technology more effectively improves the work efficiency of the supervision and management department, but also vigorously promotes the important measures of the construction of digital identification.

The safety, stability and reliability of the housing structure are the basic guarantee for the people to live and work in peace and happiness. The housing safety appraisal agency is the main judge to judge the quality of the project, and the supervision and management department is the general "sentry" that the people rely on. With the increase of market redundancy of appraisal organization and the lack of leading documents of supervision and appraisal organization, there are still many difficulties in the development of high-quality construction projects in our country. The main embodiment is: 1) has not formed a standardized housing safety appraisal body supervision procedures; 2) The efficiency of traditional supervision and management means is low, and it is difficult for many people to coordinate and cooperate; 3) The reproducibility of the results supervision of appraisal institutions is poor and can not be traced back to the source;4) The personnel, equipment and facilities of the appraisal institution are difficult to control [4]. Therefore, the results of housing safety appraisal often have no process, and the supervision and management are interfered by various factors, thus promoting the use of high-tech auxiliary supervision [5].

With the intelligent development of "digital" province in Zhejiang Province, digital information management has been tried and applied in the whole process supervision of housing safety and quality appraisal institutions. Based on the principle of "the whole process of Internet + digital intelligence", this paper develops a whole process supervision system of building safety and quality appraisal institutions. It focuses on the application function of this system, and shows the operation process of its application in practical supervision work.

2. Introduction to the Whole Process Supervision System of Housing Safety and Quality Appraisal Institution

2.1. System Survey

Housing safety appraisal management platform is a supervision and management system platform based on the document spirit of "National self-built house safety special rectification work program" [6], "Zhejiang Province Housing use safety Management Regulations" [7], "Zhejiang Province self-built house safety special renovation Implementation Plan" [8] and so on, to create "timely rectification of hidden safety problems in place, serious pursuit of responsibility and accountability". By compacting the appraisal responsibility of the housing safety appraisal institution, it ensures that the property owner and the user of the housing safety responsibility, speeds up the handling speed of the rectification unit to the housing safety hidden danger,

improves the supervision level of the supervision department of the housing safety appraisal scientific, fine and intelligent, and realizes the whole process of the housing safety appraisal supervision. The whole business can be traced, the identification information can be reproduced, the rectification process has left marks, the punishment list has feedback, and the key indicators are very clear. Standardize the working process of appraisal institutions and rectification units, and force enterprises, institutions and personnel to be trustworthy. Finally, the brand building of "Zhejiang live in peace and contentment" [9] is realized.

This system relies on the current Internet information technology, combined with the corresponding supervision experience, realizes the combination of Internet and supervision platform, and effectively improves the work efficiency of the supervision department. The overall frame diagram of the digital and intelligent supervision system of the supervision platform of housing safety appraisal is shown in Figure 1.

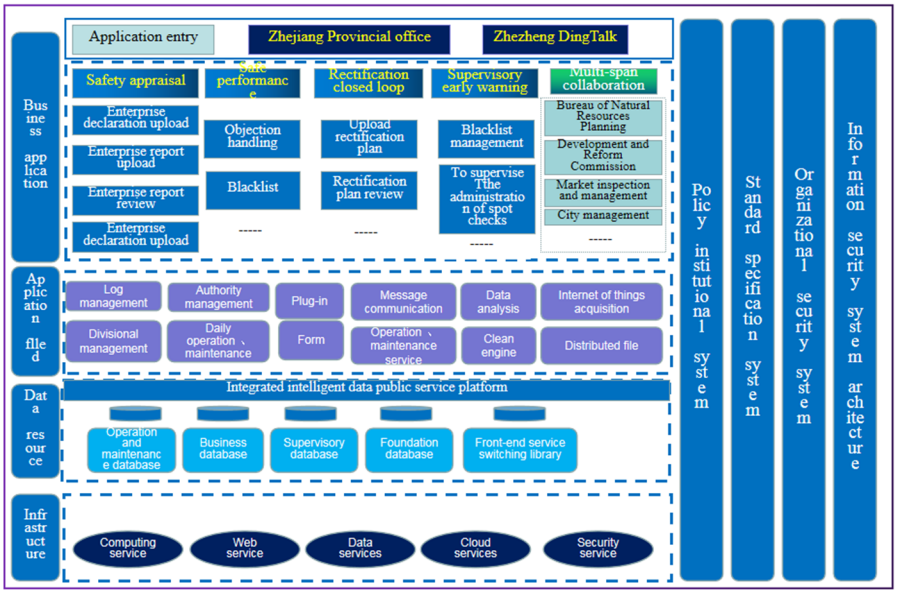

Fig 1. Building safety appraisal supervision platform digital and intelligent supervision system overall framework.

2.2. Main Function of Software

2.2.1. Home Page Data Analysis Module

To realize the basic statistics of the data generated in the supervision and management of housing safety appraisal, including the basic information statistics such as on-site detection, appraisal report and rectification plan.

2.2.2. Basic Information Management Module

1) The identification equipment is controllable, and the equipment of the identification and testing institutions should be registered and put on record in a unified manner and supervised by regular measurement certification [10];

2)Credible personnel, to realize the verification of the warehousing qualification information of the personnel of the appraisal institution, the on-site positioning and photographing of the personnel, to ensure the authenticity of the authentication report [2];

3)Unified management of appraisal institutions, with survey and design grade qualifications and meet the requirements of the foundation engineering testing, construction engineering structure testing, construction engineering steel structure testing and material witness sampling testing institutions for unified pre-qualification registration;

4) Fourthly, the house ledger can be traced back to establish a unified house ledger information for the house investigation.

2.2.3. Safety Authentication Module [11]

1) Enterprise declaration. The appraisal institution shall, as required, select the basic information, personnel, equipment, certificate of qualification and letter of commitment of the enterprise for application and registration.

2) Enterprise prequalification declaration examination. The regulatory department shall review the declaration and registration initiated by the appraisal institution. According to the status, it can be divided into pending declaration, pending audit, rejected audit and approved audit.

3) Identification entrust to fill in the form. Based on the investigation information and appraisal contract information, the system generates the house appraisal order, including the first entry and review entry, and tracks the whole process of on-site inspection, investigation and appraisal.

4) Progress query. The appraisal order provides real-time query, and the progress percentage and schematic diagram of each node can be viewed in the system, which is convenient for the person responsible for the house to query.

5) Upload appraisal report. Based on the appraisal order, the appraisal personnel will upload the appraisal report into the system and submit it to the auditor and the approver for review.

6) Appraisal report review. The auditor checks the uploaded appraisal report in the system and sends it to the construction unit or the unit with rectification qualification after approval.

7) Appraisal process management. Manage the process of house appraisal based on the appraisal order, record the appraisal track and show the appraisal progress. See Fig.2 for the security appraisal process.

2.2.4. Security Implementation Module [12]

1) Blacklist management: the responsible person for house safety violates the relevant management measures and laws and regulations in the process of house safety identification.

2) Objection handling. If the owner has any objection to the evaluation of the appraisal report, he shall file an objection application, and the competent department shall examine and

rearrange the appraisal agency for appraisal.

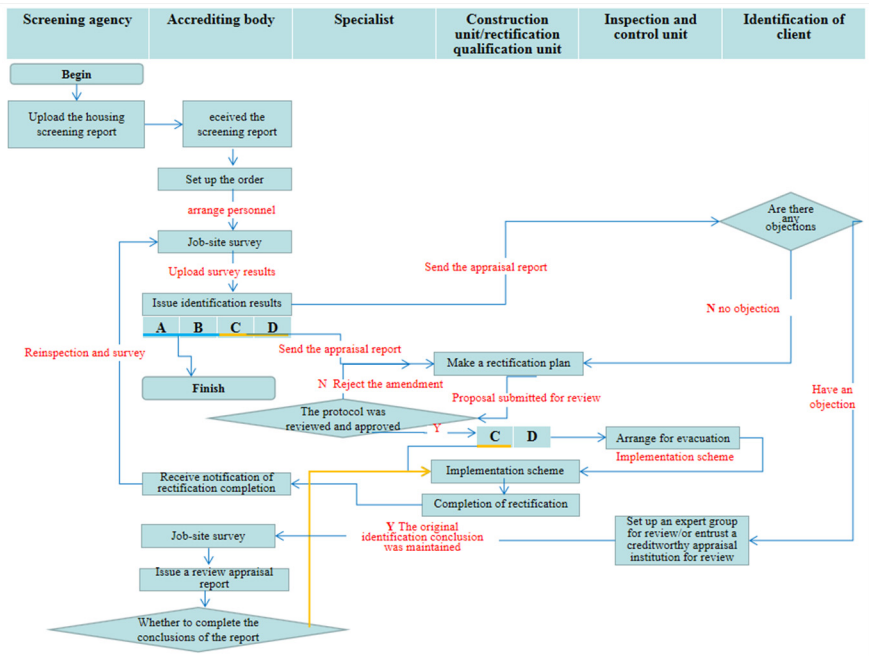

Fig 2. Flow chart of house safety appraisal.

2.2.5. Rectify the Closed-Loop Module

1) Upload the rectification plan. Based on the issued appraisal report, the rectification unit shall issue the rectification plan and upload it, and revise the rejected rectification plan and upload it again. According to the status, the rectification plan can be divided into not uploaded, uploaded, to be reviewed, approved by the review, rejected, to be rectified, and rectification completed.

2) Audit of rectification plan. Experts review the rectification plan uploaded by the construction unit or rectification qualification unit, and the examination is divided into approval and rejection. Queries can be made according to conditions, and the closed-loop flow chart of rectification is shown in Figure 3.

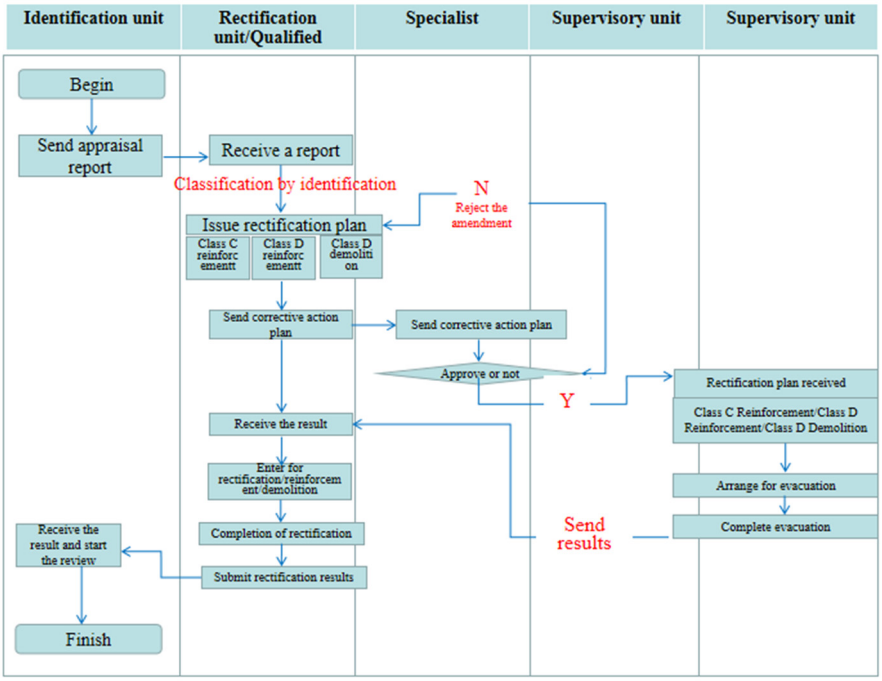

Fig 3. Rectifying the closed-loop flow chart.

2.2.6. Regulatory Early Warning Module

1) Blacklist management. To punish appraisal institutions, appraisal personnel and experts who violate relevant management measures and laws and regulations in the process of house safety appraisal, restrict the development of related business, and synchronize to the credit evaluation publicity system for publicity.

2) Supervision of spot check management. The provincial supervising experts shall initiate regular or irregular spot checks on the identification reports of suspected dangerous rooms in the identification institutions. The flow chart of regulatory warning is shown in Figure 4.

2.2.7. Data Cockpit Analysis Module [13]

Realize the centralized analysis of the data generated in the management of house safety identification, display it in a visible way in the first cabin, and display the house site

investigation information on the map with the GIS map as the bottom support, including inspection statistics, identification results statistics, rectification statistics, overdue statistics, and punishment statistics.

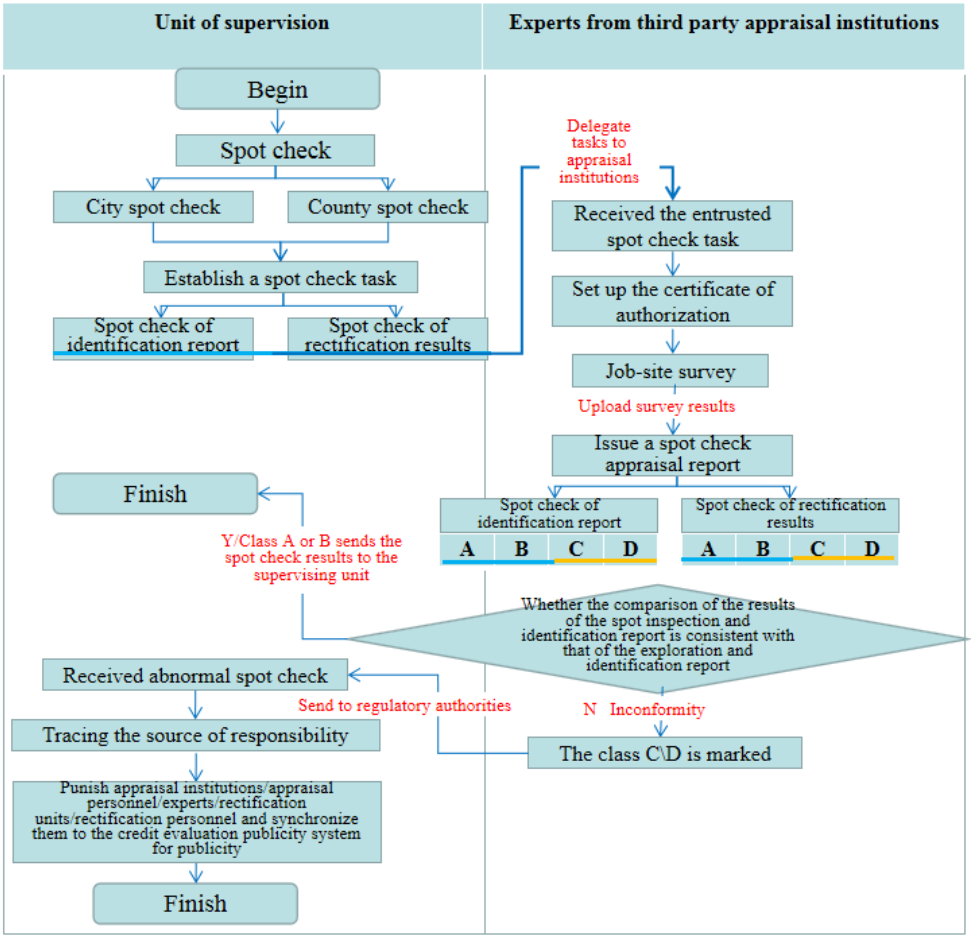

Fig 4. Flow chart of regulatory warning.

2.2.8. Personal Center Setting Module

It mainly realizes personal information modification Settings and account password Settings.

2.2.9. System Management Setting Module

It mainly realizes the system Settings of organizational department setting classification, identification classification, authority allocation, log management, announcement type, etc.

2.2.10. Mobile Workstation Integration [14]

The main function is to conduct face recognition and login through the "Zhe Li office" and then conduct on-site investigation on the identification agency. The problems and photos of the site investigation can be uploaded through the mobile phone. At the same time, the review of the rectification plan and the rectification confirmation process can be operated on the mobile phone. The identification report information can be viewed online and shared and forwarded.

2.2.11. Integration of Third-party Docking Data [15]

The main function is to reserve the business docking information of the inspection agency, and directly push the work order of the inspection agency to the house safety identification management system. At the same time, it provides open data interface to provide identification report information and site investigation information for other departments.

3. Practical Application

3.1. Overview of Regulatory Applications

This system is applied to Taizhou Housing and Urban-Rural Development Bureau. Taizhou was successfully selected as the first batch of national intelligent construction pilot cities in November 2022 [16], vigorously developing intelligent construction, aiming at digital design, intelligent production, intelligent construction, Internet of construction industry, construction robots and intelligent supervision. Forming a new construction mode with high efficiency, high quality, low consumption and low emission is an important breakthrough to realize the high-quality development of the construction industry.

Therefore, the pilot cities selected in this application have good industrial foundation, high enthusiasm of regulatory authorities, and strong leading and driving ability.

1) Business volume analysis of appraisal institutions and personnel: at present, there are about 41 appraisal institutions in Taizhou, and the average number of active people is expected to be 600 per day. According to the calculation that at least one appraisal report and review information data are uploaded every two days, the average daily business data is 600;

2) Business volume analysis of property rights owners: it is expected that the average number of daily active people is 60, and the average number of daily objections is 60;

3) Business volume analysis of rectification units and personnel: It is estimated that the average daily active number

is 50 people, and 50 data are generated daily according to the average daily upload of rectification data;

4) Business volume analysis of experts and regulatory authorities: including relevant personnel at all levels of regulatory authorities, the average daily active number is expected to be 50 person-times, according to the daily production of 10 audit, punishment and other data estimation, daily production of data 500.

3.2. Based on the Statistical Data Generated So Far by the Whole Process Supervision System of the Housing Safety and Quality Appraisal Agency

1) The system platform interface is shown in Figure 5:

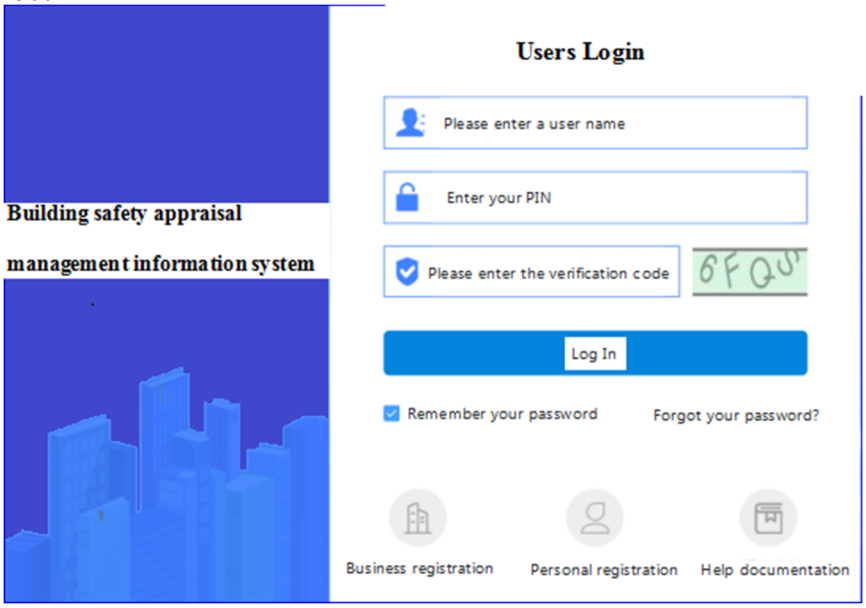

Fig 5. System platform entrance interface.

2)The homepage of the system platform is shown in Figure 6:

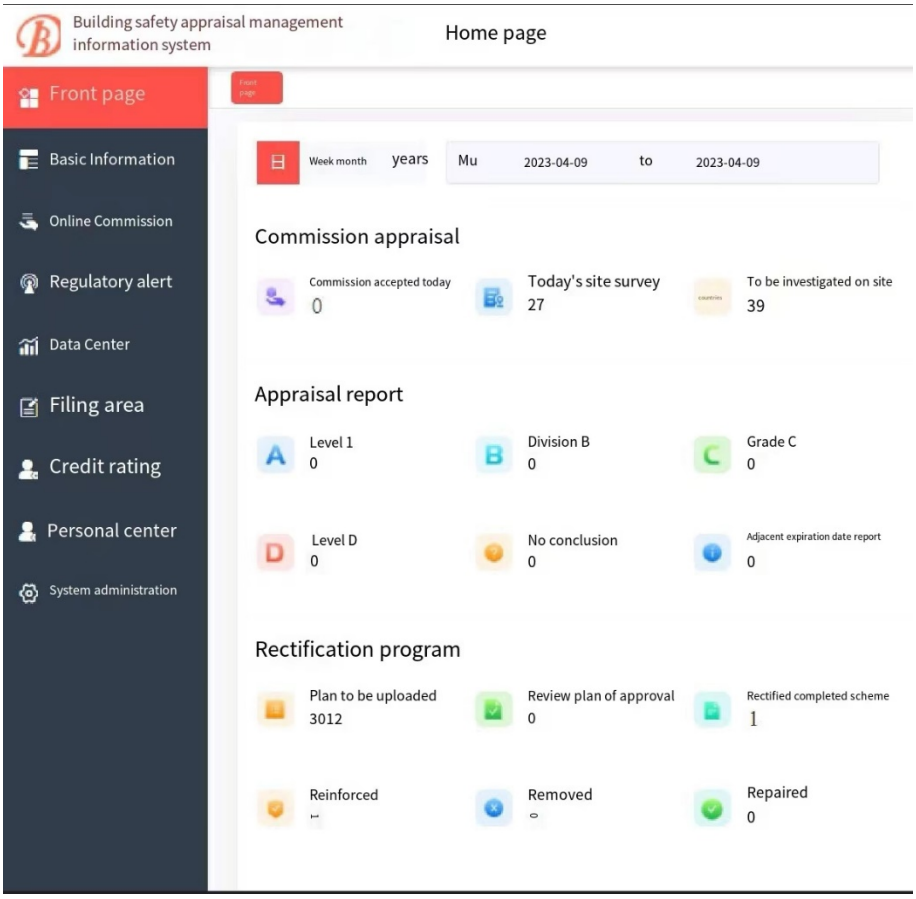

Fig 6. System platform home page content.

3)See Figure 7 for the statistical analysis of the rectification plan and supervision data:

4) The data center can query and supervise the statistics of the house safety appraisal report according to the province, city, district (county) at any time, see Figure 8.

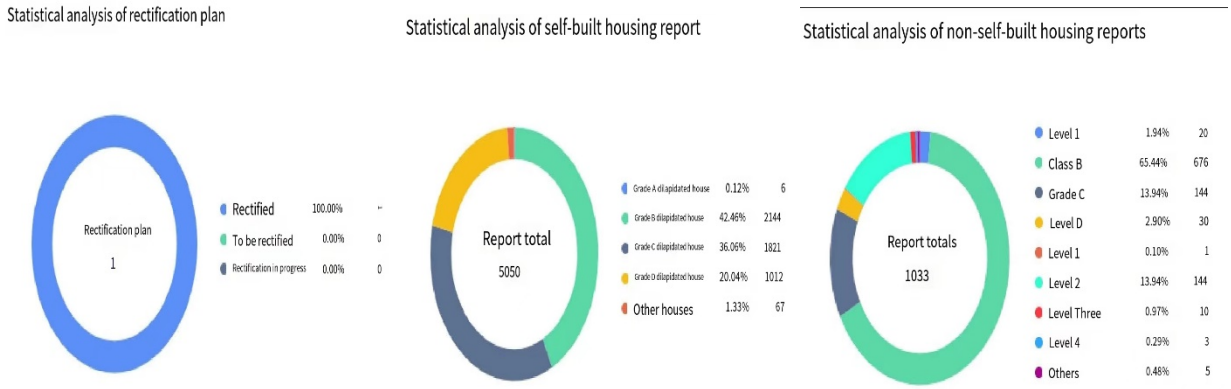

Fig 7. Statistical analysis of rectification plan and supervision data.

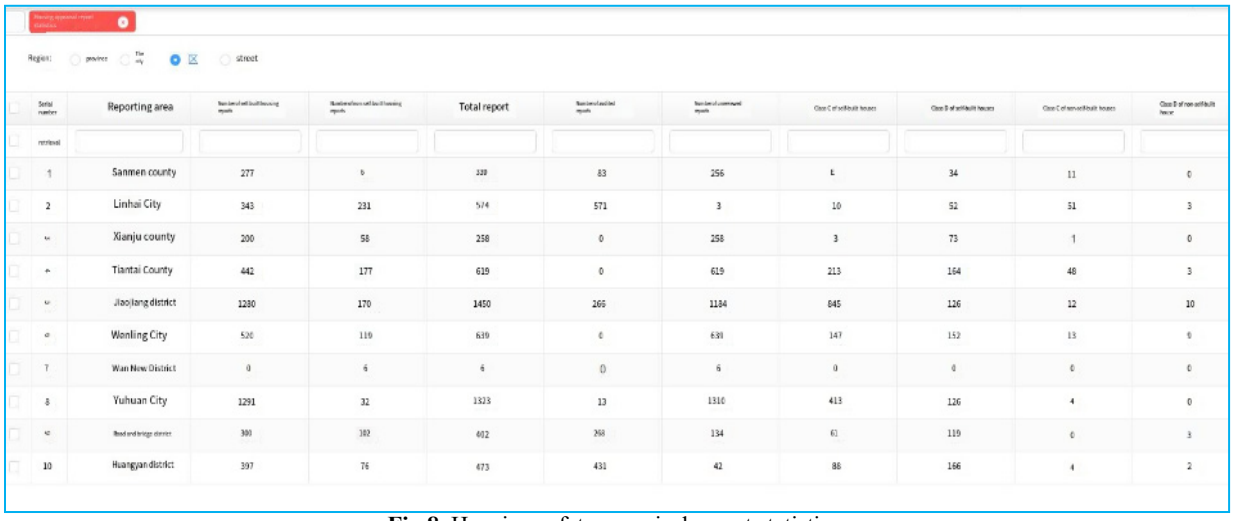

Fig 8. Housing safety appraisal report statistics.

4. Technical, Economic and Social Benefits

4.1. Technical Benefits:

Functional benefit of face positioning. Softwarized hybrid intelligent network monitoring personnel in place solution, using full digital network machine as access, and using front-end integrated scanning interface to achieve front-end linkage, real-time linkage can be carried out in the case of network interruption. Combined with face analysis and storage security redundancy design, it provides a more practical network supervision solution for whether the supervision and appraisal personnel are actually in place, whether the geographic information positioning is accurate, and to ensure that the appraisal personnel meet the basic conditions.

Integrated linkage function benefits. The house safety quality identification management system platform is equipped with a multi-department linkage port in the main control center, and the value-added business and monitoring system platform are seamlessly integrated [15]. Through the intelligent image analysis and abnormal behavior analysis software functions of the integrated software, the bad behavior of quality appraisal institutions is early warning. The monitoring platform is linked to realize the pop-up and storage of relevant images in the monitoring center and the related control center. At the same time, the management module can flexibly call and process image data according to the early warning ability.

Effectiveness of emergency command function. The integrated management platform uses advanced computer engineering, statistics, geographic information system, decision support system, data resource database, artificial intelligence and other technical means, which can provide emergency command and decision-making assistance with whole process, multi-level information services and various support means for the construction authorities and safety emergency command.

Digital regulatory function benefits. The digital intelligence of the house safety identification management system platform enables the supervision of each subsystem to manage personnel, equipment, qualifications, environment and technology. It specially designs the ports of supervision departments and business departments, distribution query, electronic registration, image superposition and other functions, which improve the intelligence of daily supervision. It can provide accurate and real-time identification quantity, identification quality and identification distribution information for regulatory departments, which is more convenient for government departments to supervise the quality and safety of projects [15].

Intelligent analysis of functional benefits. Through continuous improvement and integration, intelligent construction has been integrated into the design concept of "networking", "intelligence", "integration", "digitalization" and "platform". The "identification business acceptance initiative report", "policy system", "standard specification system", "organizational guarantee system", "information security system" and other subsystems are seamlessly integrated with "Zhejiang Office" and "Zhejiang government pin", and at the same time, it can meet the management needs

of "province, city, county and district" multi-level networking. Through the monitoring of key links with high-definition pictures or videos and the analysis of key areas by the intelligent analysis system, the daily management ability, quality and safety prevention ability and the ability to deal with emergencies of relevant departments have been greatly improved. It has accelerated the intelligent construction of "Zhelijian", maintained the safety and stability of buildings [17], improved the quality of transformation, promoted the digital intelligent reform and development of construction projects in Zhejiang Province, and better played the functional role of government organs in serving the construction of modern cities.

Functional benefits of 3D maps. 3D electronic map according to existing buildings, roads, facilities, signals and related data to establish a vivid, real, intuitive 3D scene, each building can be real reproduction. Provide direct location embedded in the electronic map, and provide instant point zoom display building details. It can be used for 3D model of buildings and GIS system application services, including map display, control operation and data access. To achieve the overall quality control command of the building. Achieve full process, full life, full cycle supervision.

4.2. Economic Benefits:

Reduce the cost of supervision and improve the efficiency of supervision. The appraisal and supervision of housing quality and safety is an essential human and material condition for the construction authorities to carry out internal and external management, and it has always been an important project that the administrative expenditure needs to be invested continuously for a long time. However, due to the reasons of system and management philosophy, it is particularly important to reduce administrative costs and build conservation-oriented organs. To realize the rational allocation of resources, improve the efficiency of the use of financial funds, reduce administrative costs, and achieve a major system project of building supervision and conservation-oriented organs, more financial funds can be used in the areas of people's livelihood and public services with more urgent needs.

Pull my province real estate industry development. The development of house safety identification [18] has greatly promoted the development of real estate industry in our province. In particular, with the implementation of currency settlement, especially in recent years, affected by the epidemic, the active economy driven by infrastructure construction is the dominant, and the demand for commercial housing of residents increases greatly. It is expected that the homebuyers who are mainly displaced by the critical reform will become the main body of the construction market, providing a good market environment and market demand for the development of the construction industry in our province.

Boosting household consumption. With the in-depth development of the identification and transformation of platform dangerous houses, the expenditure of residents' households on house purchase has increased. Again, after the residents bid farewell to the old house and moved into a spacious and bright building, they will decorate the new house in different degrees, adding some furniture, appliances and interior decorations. According to the Taizhou area, after the residents moved into the new house, the expenditure for improving the quality of living is about 420 yuan per square meter (use area).

We will promote industrial upgrading. Promote the development of secondary industries such as building materials, chemicals, machinery, home appliances and tertiary industries such as transportation, commerce, finance and insurance, and property management. Promote the efficiency of resource allocation in the whole industrial chain of the construction industry, and promote the sharing, system integration and linkage development of upstream and downstream resources in the industrial chain.

4.3. Social Benefits:

Extend the service life of houses. Regular identification of the house safety, to provide scientific and reasonable guidance for the maintenance of the house, timely repair, or replacement of the damaged part of the house, to maintain the quality of the house, to ensure that the people live in a safe environment for a long time.

Ensuring overall social stability. The technical level of self-built houses in some rural areas is limited, and the lack of basic awareness of quality and safety makes it difficult to control the construction quality of dilaplapous old houses in rural areas, and it is easy to induce malignant safety accidents. The platform of the house safety appraisal and supervision system focuses on the online supervision of the digital intelligent system and highlights the rectification of risks and hidden dangers that are easy to cause major safety accidents to ensure the safety of the use of the house. Substantially eliminate security risks and hidden dangers to ensure social harmony and stability.

Improve the function of urban carrier. Through the safety identification and reconstruction of dangerous houses, the improvement of road traffic conditions, urban infrastructure and urban appearance environment in our province has been promoted, the function of urban carriers has been further optimized, the investment environment and living conditions have been significantly improved, and the image of the city has been significantly improved.

We will help rural revitalization and consolidate and expand our achievements in poverty alleviation. At present, there are still a small part of farmers living in the direst old houses in our province. Due to the low income level, it is very difficult for farmers to improve their housing conditions. With the in-depth development of the system platform in the identification and transformation of direst old houses in rural areas, these people will be able to live in good quality houses with safe structure and reasonable zoning. At the same time, some of the land vacated by the moderately centralized renovation of scattered direfied houses can be reclaimed for agricultural production, and the other part can be used to attract investment and introduce industrial projects, which will play a positive role in promoting the development of rural economy.

Digital intelligence construction supervision, to contribute to the digital "first province" [19]. By 2022, Zhejiang will initially build a digital trade demonstration area with large scale and strong competitiveness, digital industry agglomeration, rich digital content, digital trade convenience, and outstanding radiation driving, so as to accumulate a number of replicable and scalable experience for the development of digital trade in the country. By 2025, Zhejiang will fully form a new development pattern of digital trade, create a digital trade development mechanism, regulatory model and business environment with Zhejiang characteristics that are in line with international standards,

achieve a higher level of digital trade liberalization and facilitation, and initially build a global digital trade center. This system is used to connect "Zheli Construction" and contribute to the digital supervision mode.

5. Conclusion

The development and application of this system has effectively improved the efficiency of supervision, effectively promoted the progress of digital supervision of house safety identification in our country, and solved the availability, traceability, reliability and accuracy of the whole process of supervision. The application in Taizhou shows that the digital intelligence supervision system can realize the standardization of the supervision process, the technologization of the supervision means, the continuous migration and expansion of data, the facial positioning and automatic recognition, the collaborative editing of multiple people at the same time, and the integration with the government big data inventory, etc. Its supervision advantages are especially prominent for districts and counties with large identification amount. The application of this system brings good benefits to the supervision and provides a reference for the intelligent supervision of the number of house safety appraisal.

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References

[1] Huang Qiyun, Xing Chaoqun, Yao Dongming, Yang Hongmei. Application of intelligent compiling system of housing appraisal report [J]. Engineering Quality, 2021,40(05):79-83.

[2] Qian Xiaomin, Li Weiguo, Xue Ailong. Testing agency integrated digital management of exploration [J]. Journal of quality and certification, 2023 (02) : 62-64. The DOI: 10.16691 / j. carol carroll nki. 10-1214 / t. 2023.02.007.

[3] Zhang Pei, Wang Jiao 'e, Xiao Fan. Spatio-temporal evolution and driving factors of new infrastructure development in China [J]. Progress in Geography,2023,42(02):209-220.

[4] NiLei. Related questions of building safety appraisal testing analysis [J]. Journal of engineering construction and design, 2021 (21): 29-32. DOI: 10.13616 / j. carol carroll nki gcjsysj. 2021. 11.005.

[5] Elizabeth Kennedy, Tugu Youdaine, A Study on the Relationship between Employee engagement and Employee retention [J]. Journal of Evaluation and Planning, 2010,33(4): 468-476.

[6] Notice of The General Office of the State Council on the Issuance of the National Self-Built Housing Safety Special Rectification Work Plan [J]. Bulletin of The State Council of the People's Republic of China,2022(17):27-30.

[7] Decision of Standing Committee of Zhejiang Provincial People's Congress on amending Seven Local laws and Regulations such as Regulations on the Safety Management of Housing Use in Zhejiang Province [J]. Zhejiang Provincial People's Congress (Bulletin Edition),2020(04):69-100.

[8] Zhejiang Province Department of Housing and Urban-Rural Development "Zhejiang Province Self-Built housing safety Special improvement Implementation Plan" [J]. Zhejiang Daily.2022.

[9] Ma Yuxing. To live in In a [N]. Ann national journal, 2019-09-13 (001). The DOI: 10.28576 / n.c nki. NMZBR. 2019.000552.

[10] Wahab M H A, Kadir H A, Tukiran Z, et al. Laboratory Equipment Monitoring System Based on RFID Technology [j]//2010. Journal of Electronic Engineering,2010:1-5.

[11] Mahesh G. Research on Knowledge-based evaluation methods for Building safety culture [J]. International Journal of Engineering Management, 2022:1-9.

[12] He C, McCabe B, Jia G, et al. Impact of safety climate and safety behavior on safety performance of construction workers [J]. Chinese Journal of Building Engineering, 2018,38(1): 1-4.

[13] Degkwitz T, Schulz D, Noennig J R. Research on Social Infrastructure Planning Based on GIS [J]. Journal of Ecology and Environment, 2018,29(4):344-344.

[14] Zhang Weiwei, Wang Guangxing, Yao Junduo, Liu Haibo. Design and Manufacture of Mobile Worktable and its Application in Work [J]. China Equipment Engineering, 2023 (01): 208-210.

[15] Multi-source heterogeneous data integration system plan of the enterprise in the research and design [C] / / China society of naval architecture and Marine engineering academic committee in computer application. Digital shipbuilding academic exchange conference proceedings, 2019, 2019:340-343. The DOI: 10.26914 / Arthur c. nkihy.

[16] Qiu Yue. Identified 24 intelligent building pilot cities in China [N]. The Guangming Daily, 2022-11-11 (010). The DOI: 10.28273 / n.c. Nki NGMRB. 2022.005570.

[17] win min. Set up both the house and safety management system thinking [J]. Journal of building economy, 2022 lancet (S1) : 126-130. The DOI: 10.14181 / j. carol carroll nki. 1002-851 - x. 2022 s10126.

[18] NiLei. Related questions of building safety appraisal testing analysis [J]. Journal of engineering construction and design, 2021 (21): 29-32. DOI: 10.13616 / j. carol carroll nki gcjsysj. 2021.11.005.

[19] Yuan Jiajun. Faithfully practicing the "Eighty-eighth Strategy" and striving to build an "important window" for the leading province of socialist modernization [J]. Policy Outlook, 2020 (12):4-6.

[20] YUAN Z. Hangzhou, Zhejiang: Building global heights based on digital supervision [N]. Chinese newspaper market regulation, the 2022-11-29 (003). DOI: 10.28075 / n. c nki. NCGSB. 2022.004217.

[21] Liu Dexiao, Lu Geng. Research and application of quality detection and management system for water conservancy projects [J]. Jusshe,2019(12):132.