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Research on the Application of Computer Cloud Computing Technology in the Quality Management and Control System of Rural Construction Engineering

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Abstract: *In this paper, cloud computing technology is applied to the construction process of monitoring system, and a design method of rural construction project quality monitoring system based on cloud computing is proposed. We use decision tables to model normative knowledge, and use frame notation to organize quality monitoring information. Based on the rule engine, the quality monitoring specification knowledge and the quality monitoring data are managed separately, which enhances the maintainability of the specification knowledge and the adaptability of the system. This method makes full use of the advantages of cloud computing in resource management and service sharing, and improves the monitoring efficiency of rural construction projects.*

Keywords: *cloud computing; rural construction; engineering quality control system*

1. Introduction

Cloud computing is an emerging network computing model, which distributes computing tasks to an appropriate number of computing units in the resource pool through load balancing and other means, so that users can obtain services on demand. The services in cloud computing include computing power, storage space and information services. These atomic services are virtualized as basic units in cloud computing. It is the result of the natural evolution and integration of a series of distributed computing technologies such as grid, virtualization, service computing, on-demand computing and utility computing. Rural construction project quality monitoring is an important measure to ensure that the project complies with national laws, regulations and mandatory standards, and to ensure the quality and safety of the project. At present, China has formed a relatively complete system of rural building codes and standards. These rural building codes and standards play an important role in regulating rural building behavior, guiding design and construction, and ensuring project quality and safety [1]. As the construction of engineering projects enters the era of informatization and intelligence, in order to ensure the effective implementation of the management concept of "three controls, three management, and one coordination" for engineering projects, the overall management, overall management and intelligent management capabilities of engineering projects are improved. In this article, mainly relying on cloud computing technology to design a project schedule and engineering quality control system used in rural construction engineering enterprises, in addition to cloud computing as the basis of the system, the P2P structure also becomes the system design One of the essential contents of the process.

2. Normative knowledge modeling and information organization for quality monitoring

In order to make better use of quality monitoring data, a framework-based representation is used to organize quality monitoring information. Frame notation can effectively express structural knowledge. The monitoring objects and their quality monitoring points extracted from the specification. A quality monitoring object corresponds to a frame. The frame contains a series of slots, which are mainly used to store quality monitoring related information. Figure 1. Frame representation of quality monitoring information for cast-in-place concrete piles (picture quoted from Urban and air pollution: a multi-city study of long-term effects of urban landscape patterns on air quality trends). It contains three parts: the frame name is represented by the name of the quality monitoring object [2]. The middle part is the slot of the frame, which contains the quality monitoring information of the monitoring point of the monitoring object, as well as the quality inspection personnel and quality inspection results. The tail part indicates the normative clause referred to by quality control.

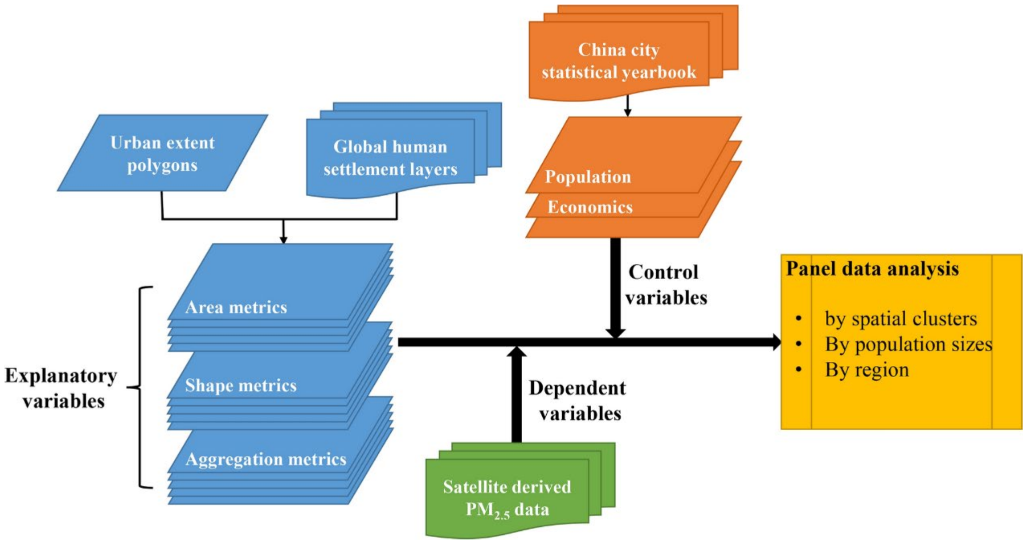

Figure 1: Frame structure representation of quality monitoring information

Each quality monitoring framework is regarded as a quality monitoring template, and the quality monitoring data template based on the framework can be easily expanded, integrated, and modified.

3. Computer-based design of quality control system for rural construction projects

3.1 Platform overview

The cloud platform is divided into mobile terminal, PC terminal, and WEB terminal. The mobile terminal uses mobile phones, tablet computers and other devices for on-site BIM model application and data collection. The PC terminal serves as a management port for centralized display and analysis of models and on-site data. The WEB terminal as a platform permission setting and data display. Project quality traceability involves various links before, during and after the event. It is necessary to ensure that the links in the entire traceability system are not disconnected, and a database with quality information is established for the entire process of project quality from the production source to the acceptance, so as to form the traceability of the project quality [3]. The project manager can timely understand and supervise the quality information of all the products from the raw materials to the finished project, and can trace the source of the problems found to ensure the safety and reliability of the quality. Lightweight viewing of BIM models. The current BIM model is relatively "heavy", and it is necessary to use a computer with a higher configuration to browse the BIM model. The cloud platform transforms the BIM model into a lightweight format, and on the basis of completely retaining the three-dimensional component and attribute information of the BIM model, it "slims down" the BIM model, reducing excessive cost input in the application of the BIM model.

3.2 System Architecture

The system adopts a modular design idea. The system functions are modularized in the outline design, and the structure of the system is displayed from a functional point of view, making the system structure clearer and facilitating later development work. The rural construction project monitoring system needs to develop in the direction of multi-network integration and multi-network integration. The vertical design architecture of the existing rural construction project monitoring system not only increases the construction cost, but also increases the service response time, making it difficult to report to the management department in a timely manner. Provide business analysis requirements. The

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emergence of cloud computing has made the rural construction engineering monitoring system platform develop in the direction of integration and unity, and the signaling analysis has developed in the direction of massive data processing. The unified monitoring system platform realizes the reintegration of resources among multiple systems and regions, effectively avoiding waste of resources and investment [4]. The engineering monitoring system can generally be divided into 3 layers: the first layer is the regional master station system, which provides related management services for the construction bureau; the second layer is the master station system of each inspection agency, which provides real-time management and inspection services for the inspection site; the third layer It provides real-time monitoring data for the entire system for the inspection system located at the inspection site, and is responsible for managing the video and environmental monitoring equipment at the inspection site, as well as providing images and environmental information of the monitoring inspection site. The management personnel can realize the monitoring and remote-control functions of the detection data, images and environment of the detection site at the monitoring workstation of the detection unit, as shown in Figure 2 (picture quoted in Unique Project Management System Leads to Successful Project Completion).

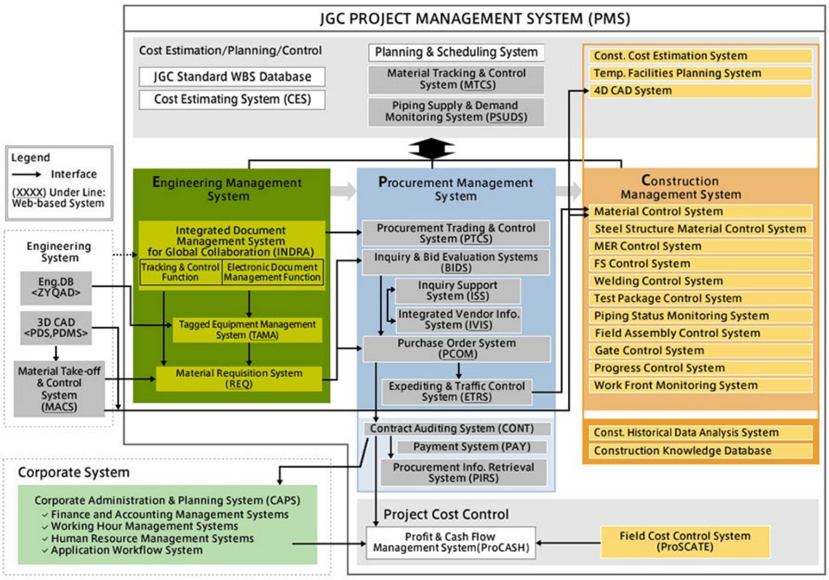

Figure 2: Construction project monitoring system

3.3 Implementation framework

The design core of the software platform is to use distributed cloud computing to make data monitoring and video services simpler, improve business response speed and service quality, and reduce overall costs. The cloud computing server installs the Linux operating system, uses the open-source Hadoop software framework, and uses the parallel programming model to realize the processing of massive video recording and intelligent analysis of related data. The architecture of cloud computing mainly includes the following services.

The service catalog is a list of services that users can access. The system management module is responsible for managing and distributing all available resources, and its core is load balancing. The user interaction interface provides an access interface to applications in the form of Web services to obtain user needs. User interaction service allows users to select and call a service from the catalog. After the request is passed to the system module, the user will be allocated appropriate resources, and then the configuration tool will be called to prepare the operating environment for the user. The monitoring statistics service is responsible for monitoring the running status of the nodes and completing the statistics of the user's use of the nodes [5]. The configuration tool is responsible for preparing the task running environment on the assigned node. After the system is completed, when the manager logs in to any project management system, he can realize the project inspection data and environmental monitoring in the customized interface, query and count all kinds of video and inspection monitoring data and intelligent analysis results.

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3.4 Function module diagram

It mainly includes engineering bureau administrators, company administrators, project administrators, and general users. The administrator function modules include organization and project management, inspection locations, construction teams, professional subcontracting, video surveillance, etc., and general user function modules include quality inspections. Functions such as inspection, construction drawings, and quality forms are shown in Figure 3 (picture quoted in Knowledge Oriented Construction Project Management System).

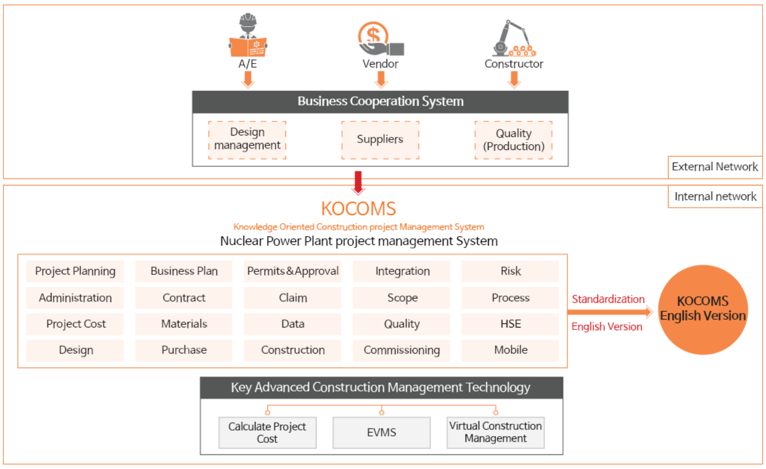

Figure 3: Functional modules

3.5 The design process of 3D quality control

1) Pre-modeling collaborative design

In the early stage of modeling, designers from rural architecture and structural majors are required to roughly determine the ceiling height and structural beam height; for areas with strict net height requirements, inform the mechanical and electrical major in advance; each major will coordinate the design for areas with narrow spaces and complex pipelines. The two-dimensional partial cross-sectional view is shown in Figure 4 (the picture is quoted from the Possible Target Corridor for Sustainable Use of Global Material Resources). Corridor (2) Comprehensive management. The purpose of collaborative design in the early stage of modeling is to solve some potential pipeline collision problems in the early stage of modeling.

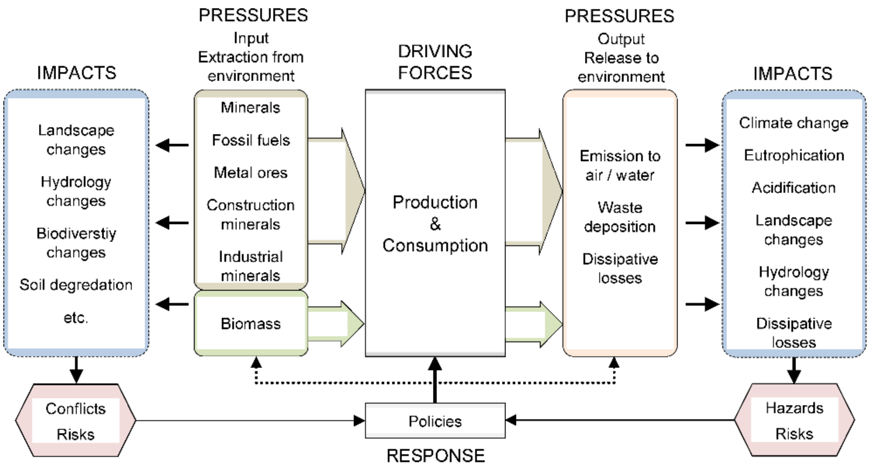

Figure 4: Corridor (2) Management Integration

2) Civil Engineering Professional Modeling

Rural architecture majors use Revit Architecture software for modeling. According to the needs of the project, the precision of modeling is different. If it is only required to complete quality control rather than the depth of construction drawings, the rural architecture major only needs to complete

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model components such as interior and exterior walls, doors and windows, glass curtain walls, elevators, escalators, stairs and ceilings. If the modeling model is completed by multiple designers, the work set or link method can be used to carry out collaborative design within the profession. As shown in Figure 5, a partial model of a rural building in a project (picture quoted from Building a Home in the U.S. Has Never Been More Expensive).

Figure 5: Partial model of rural buildings in a certain project

3) Collision detection and report generation

After each major completes the preliminary modeling, use Navisworks software to conduct inter-professional collision detection, and provide inspection reports and modification opinions. Inter-professional collision detection mainly includes civil engineering, civil engineering and electromechanical majors, and electromechanical majors. The designer re-optimizes the design based on the collision detection report and modification comments, and then performs collision detection again. and so on, until all hard collisions are resolved, and soft collisions are left in an acceptable range.

4. System implementation

The system adopts the J2EE framework under the Windows environment, and is developed under the Eclipse platform. It adopts the classic 3-tier (MVC) architecture, adopts the tomcat application server, and the SqlServer2000 database. The application presentation layer is used for the input and output of quality monitoring data and review results, standardized queries, etc.; the middle service layer (Servlet, JDBC, Drool) is responsible for data access, rule import, review and reasoning, etc. The database service layer is used for data storage management, including quality monitoring specification knowledge base, quality monitoring data template library, and quality monitoring database. Connect to the database SqlServer2000 through JavaBean, and integrate Drools into JavaBean, and implement operations such as rule definition, reading and rule-based reasoning in JavaBean.

5. Conclusion

Rural construction project quality monitoring is an important measure to ensure that the project complies with national laws, regulations and mandatory standards, and to ensure the quality and safety of the project. This paper uses the rule knowledge in the decision table modeling quality monitoring specification, uses the frame representation to organize the quality monitoring information, and on this basis, builds the original rural construction project quality monitoring system based on the Drools rule engine. Based on the Drools rule engine, the separation management of monitoring rules and monitoring data is realized, which facilitates dynamic modification of rules, fast monitoring of changes in specification requirements, and improves the maintainability of the system.

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