Research on Key Construction Technology of Building Engineering Under the Background of Big Data

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Abstract. In the era of the construction engineering industry informatization, the collection, storage, and reuse of big construction data is the only way to apply and inform big data in the construction industry. Relying on the reverse logistics management system, modern construction technology can simulate the timeliness of materials, funds, and time limits of the actual construction site according to the logistics reverse engineering principle. Then, reverse the active management status of the internal logistics model of the actual project. It is one of the critical problems for construction engineering informatization to study applying big data and cloud computing technology to solve problems from massive and complicated data or mass data. Since the research on big data and cloud computing technology started late in construction engineering, it is worth studying which aspects of these technologies can be used in the whole life cycle of this field. This paper proposes a structural construction optimization identification method based on IPEM rapid reanalysis. USES the co-solubility of reverse logistics structure construction technology and applied the data mining method to solve many problems such as refined construction management leftover material surplus in the later construction stage. Finally, a construction optimization model of reverse logistics building system based on improved data mining is proposed according to the actual engineering requirements.

Keywords: Big data, Cloud computing, Application requirements, Construction projects, The construction technology.

1. Introduction
Emerging industries and new technologies such as mobile Internet, Internet of Things, big data, cloud computing, remote technical services, collaborative network design, engineering simulation, 3D printing, realistic scene design, and BIM change the traditional survey and design, engineering construction management and maintenance mode. Building engineering's information technology carries the data model of building structures, which contains rich design information and construction information. The operation and maintenance units can effectively improve management and work efficiency by relying on these data and information. The current architectural design phase has been
basically achieved in the field of digital, but still needs to strengthen in particular process data processing ability, more because of the construction and operation stages of a data processing method and ability limit, makes the design results failed to adequately applications, difficult to realize information integration and sharing the stage as a whole, restricted the informatization construction in the field of architecture [1]. It is one of the critical problems for construction engineering informatization to study applying big data and cloud computing technology to solve problems from massive and complicated data or mass data. Since the research on big data and cloud computing technology started late in construction engineering, it is worth studying which aspects of these technologies can be used in the whole life cycle of this field. Combined with the characteristics of big data and cloud computing, this paper puts forward a shallow view on the possible application requirements in the stages of planning, design, construction, operation, and maintenance of architectural engineering, aiming to provide a reference for future research work and improve the level of informatization in the field of architecture.

2. The necessity of big data collection for construction projects

2.1. Basis of data sharing
As the construction of different construction projects all over the Country, propulsion, completed and put into operation, will produce a large number of engineering materials and data, most of which are related to the building engineering construction, the enormous amounts of information construction of data, and the information has a three-dimensional space orientation, quantities, prices and multidimensional characteristics such as time. Only by collecting these data, following the standard format commonly used in the industry, and relying on the Internet as the media platform for collection and storage, can form the basis of data sharing [2].

2.2. Provide more accurate data analysis for project decision-making
Around the building engineering construction management department due to lack of practical techniques, the release of basic information construction belongs to the time lag, the primary information summary, and refining, lack of upstream and downstream industries, high-level, accurate data, such as comparative analysis, cannot provide construction engineering construction management and decision-making of project development trend analysis and forecasting.

2.3. Improve the overall informatization integration of the industry
At present, China's construction management and even the entire engineering construction field of information integration is relatively low. Traditional construction workers obtain construction information from budget software, quota manual, and various adjustment information tables. Calculate the amount of work manually according to the drawing information. The construction data of construction units, design units, bidding agencies, construction units, and supervision units are basically archived according to different projects. The information is so complex and disorderly that it gradually becomes an island of useless information. By collecting data, construction of establishing a database of resources sharing, using big data technology and method, can extract valuable data from vast amounts of information, for the supervision department, the construction project construction, design, construction enterprises, consultants, construction bidding agencies to provide information and decision-making, improve the integration of informatization in the management of construction engineering construction industry [3].

3. Basic overview of big data cloud computing platform

3.1. The technical architecture of cloud Computing
The architecture of cloud computing mainly includes the following aspects. Physical layer: includes server cluster and storage column, which constitute the computing and storage resources of the
distance education system and is the basis of monitoring service based on cloud computing. Virtual service layer: the computing and storage resources in the physical layer are pooled through virtualization technology, and the resource scheduling in the resource pool is carried out according to the requirements. The middle layer is the link between the client and the cloud interface; according to a foolproof strategy is responsible for the decision whether to accept the request of the client send, send virtual layer for resource scheduling, at the same time accept the response information transmitted via the cloud, and go to the Internet client, including service request monitoring module, admission control module, the virtual machine request admission control module and task distribution module. Customer layer: contains remote monitors distributed on the Internet, sending requests to the remote monitoring system through different types of terminals, and receiving the video content. Figure 1 shows the technical architecture of cloud computing.

3.2. An open-source implementation of cloud computing
Hadoop is a distributed computing framework organized by Apache Open source, which can run applications on a cluster composed of a large number of inexpensive hardware devices and provide a set of stable and reliable interfaces for applications, aiming to build a distributed system with high reliability and good scalability [4].

4. Advantages and related technologies of the construction supervision system

4.1. System Advantages
The monitoring and management system applied in construction engineering is different from the monitoring system applied in other fields. The main characteristic of its development is to gradually evolve into the mode of multi-network integration. Nets to achieve more effective integration between the whole system, the whole monitoring system is designed for a typical vertical state. Still, this kind of design also has apparent drawbacks. Its malpractice lies mainly in the design and application of the high cost; in addition to the whole system's service response time, it will have sure extend, this kind of design pattern in a short time to complete the processing of information and business discussion will
exist specific difficulties. In this design, the original design mode has been changed to some extent. After adopting the design mode of cloud computing, the integration and fusion of the whole system will be higher in the operation process, and it can be completed more efficiently in the process of processing massive data. With the help of cloud computing technology, the uniformity of the construction engineering monitoring system is more perfect, and the waste of resources in the original design is much improved, which can effectively reduce the waste of resources.

An advanced platform for the regulatory system, to truly realize the whole process of highly intelligent management, must adopt some advanced technology on its every link, and through the implementation of the construction engineering archives of the whole process supervision model has got significant breakthroughs, such as cloud computing technology, business rules technology, artificial intelligence technology, archives information radar technology, the Internet of things technology, full-text retrieval technology, intelligent OCR recognition technology, such as virtual private network technology, the technology innovation and rapid development of IT technology in recent years the environment, have made a significant breakthrough in the industrialization, and more stable and mature. Therefore, these advanced and innovative technologies can be well used in the whole process of project archives supervision platform planning, data processing, and data utilization.

4.2. System hierarchy division
In the project engineering monitoring system of construction engineering enterprises, there are three main modules: the first is the district-level master station system, whose primary function is to provide adequate monitoring and management services for the entire project managers. The second is the master station system module, in which the main objects of its service are different monitoring locations and monitoring devices. The module can effectively transfer the monitoring information between various monitoring devices and realize the timely exchange of information. The third is the monitoring and management module of the construction site. This module's primary function is to transmit and manage the information generated by the construction site's monitoring equipment to realize the effective management of the construction site by enterprise managers [5].

4.3. Implementation technology of the system framework
The core of the software environment used in the construction monitoring system designed in this paper is distributed by cloud computing. The monitoring process and related services can be effectively simplified through cloud computing technology, and the problems of slow communication, information transmission, and business discussion generated in the traditional design method can be shortened. By simplifying the system's operation process, the software's service efficiency can be improved, and the cost of using the enterprise can be reduced. In the cloud computing server, the first step is to install the Linux system, the second step is to use the Hadoop framework, and the last step is to adopt a parallel mode in the programming model to process massive data, including audio and video information. The system structure of cloud computing is mainly divided into the following three aspects: First, the system has a service directory page, and the critical function of this design is to provide consumers with a list of directories that can be independently accessed [6]. The second is the innovation of user interaction service. In this design, the user can select a service in the service list for use, and the system automatically sends the request to the server system module to effectively implement the functions selected by the user. Thirdly, there is monitoring and statistics service in the system, which can carry out effective statistics and monitoring of the entire system's operation status. Specifically, the operation status of each stage can be counted, and the corresponding operation environment and operation background can be provided for each node. See Figure 2 below.
5. Big data construction management combined with BIM technology

Big data is a new form of current social development. With the integration of big data and various industries, big data BIM is an inevitable trend in the construction industry's development. Through the big data BIM construction management model, process management and information data integration are realized, and departments collaborate in office and data sharing.

5.1. Integrated information management

Construction information management is a necessary condition to ensure the quality and progress of construction projects. It is necessary to form a scientific, reasonable, and significant construction information management mode. Most of the traditional information statistics, sorting, and processing are completed in the form of documents. With the progress of engineering projects, the information storage capacity also increases, and the construction information management becomes more and more complicated. Under the big data BIM construction information integration system, establish the public information data table overall information data table, construction, engineering data sheets, project management, data sheets, the various departments under the access to the information to establish, modify, update, such as operation, realize the effective information collecting, sorting, processing, and real-time transmission, data, information and other related resources centralized and unified management, management can accomplish more in a short time of construction of information management, reduce duplication of work between each stage, various departments, improve the efficiency of the information management and implement the data, information resource sharing (figure 3).
5.2. Timely collection and processing of data
On the BIM data processing platform, the establishment of a database, according to the concrete construction plan, is equipped with the progress of data table, the quality of data table, cost data sheet, material data sheets, etc., through information management integration system transfer the scene real-time data, and related data analysis process of schedule, and set up the updated to remind function, if the actual situation has a deviation, real-time remind staff, ensure timely adjust and processing, do the job by the passive into the initiative, at the same time, under the big data BIM system, the contractor can be connected with other parties involved in the project, the master data information in time, guarantee the data synchronization update, real-time adjust the construction plan, make timely access to accurate and comprehensive information management personnel, and make timely and accurate processing plan, improve the construction quality and working efficiency, as shown in figure 4.
5.3. Coordination and standardization of all departments

Through the big data BIM model, all departments and personnel involved in the project can form an interconnection form. The big data BIM integrated construction management platform (Figure 5) can be used for communication and discussion, and the permissions of staff in each department can be set up to form an independent and collaborative working model. The integrated management platform of big data BIM is built to realize collaborative office work among business fields, reduce costs, improve construction efficiency, and ensure good development among schedule, cost, and quality. BIM at the same time, in the big data integrated management platform, according to the regulations of the construction management, provide the relevant data parameters, the construction of each stage, various departments in the system of real-time data communication, communication, which makes more normalized and standardized management process, managers can master the relevant data and information timely, comprehensive, considering the actual situation to deal with the problems in the construction, avoid artificial factors of interference [7].

![Figure 5 BIM Construction Integrated Management Platform for Big Data](image)

5.4. Data mining and application

Now the necessary database and system architecture are basically completed, the real-time dynamic access to the database has ensured enough reliability, so valuable information mining appears more important. Otherwise, it is just a stunning high-tech decoration. This paper compares the comparability of discovery selection and optimization selection, improves the optimization data mining method to simulate the selection process, and names it as an improved data mining method. A uniform distribution is used to produce a global field survey of feasible solutions. Calculate the scope of the construction scheme supported by the supervision. A construction scheme with high prestige and an enormous scope of influence.
\[ R_{ci} = R_{max} - \left( \frac{P_{ci} - P_{min}}{P_{max} - P_{min}} \right) + \varepsilon \left( R_{max} - R_{min} \right) \]  

(1)

Where: \( R_{ci} \) is the coverage area of \( C_i \) the construction scheme; \( R_{max} \) and \( R_{min} \) are the maximum and minimum coverage areas of the construction scheme. They are ECA parameters; \( P_{max}, P_{min} \) is the maximum and minimum reputation of the current construction plan, \( P_{max} = \max\{P_{ci}\}, P_{min} = \min\{P_{ci}\} \), when \( R_{max} \) and \( R_{min} \) are the same, that is, the coverage of the investigation construction plan reaches the maximum and minimum value; \( \varepsilon \) is a constant that's small enough. The small mean square deviation of the local survey supervision enables it to quickly and stably converge to the optimal local solution. The following formula describes the relationship between reputation and local survey mean square error for a construction scheme.

\[ \sigma_{ci} = \left( \frac{P_{ci} - P_{min}}{P_{max} - P_{min}} \right) + \varepsilon \left( \sigma_{max} - \sigma_{min} \right) + \sigma_{min} \]  

(2)

Where \( \sigma_{ci} \) is the construction plan \( C_i \) that investigates the mean square deviation locally; \( \sigma_{max}, \sigma_{min} \) is the local researcher of the maximum and minimum mean square deviation, and they are ECA parameters, which need to be built in the calculation model. If \( \sigma_{max}, \sigma_{min} \) can be the same, that is, the construction scheme of fixed local application study mean square error reaches the maximum and minimum values; \( \varepsilon \) is a constant that is small enough [8].

During the construction of the material model waste treatment plant, typical treatment lines, modular layout, and treatment units of arrangement layout can be divided into the linear single-line layout, linear multi-line layout, ring layout, U-shape layout, and serpentine layout. Circular, U-shaped, and sinuous layouts can be viewed as linear single-row deformations. Therefore, the optimization problem can be solved by a linear single-row layout model. With the widely used linear single line layout model, we can define a mathematical model to seek the minimum value of geometric constrained layout optimization problem. First, processing lines can be divided into multiple layout units through collaborative connectivity. Secondly, mathematical models in units of device layout and constraints can be defined. Considering the impact of the main components during treatment, constraints are defined as devices characterized by length, which play a vital role in the simulation of the device. Therefore, the optimization function can be defined as:

\[ \varphi(X)\sum_{i=1}^{\Sigma} \sum_{j=i+1}^{C_{ij}} C_{ij} \left| X_i - X_j \right| \]  

(3)

Where: \( C_{ij} \) is the process cost from the unit I to unit J.

5.5. Realization Effect

Construction BIM model on this platform, enter the scene roaming, roaming process by selecting the arbitrary components, can view the corresponding components of meaningful data information, learn the components in the construction process quality common fault causes and prevention measures, the construction of the standard information, construction accident cases of the same type, etc., to help the construction technical staff to grasp the construction essentials and strengthen construction quality control consciousness. Employing BIM informatization, this technology builds the construction
project construction database, USES BIM construction standardization model to carry the construction quality information, and USES the software platform to dynamically present the data. The construction site technicians can directly use this platform's handheld mobile terminal to select and retrieve relevant construction technical information in the BIM model, such as construction process method, construction hazard sources, construction quality problems, technical indicators, accident cases, and other information. Through the application of this platform, it can be used for technical management personnel to carry out construction technology learning, improve the on-site quality management ability of construction technicians, and virtually guarantee the construction quality.

6. Conclusions
Based on big data and cloud computing characteristics, this paper discusses the application requirements in the stages of architectural planning, design, construction, and operation. Limited by the author's understanding of the domain knowledge, the contents listed in this paper are slightly inadequate, hoping to play a role in attracting others. To improve the level of informatization in the construction field, it is an urgent problem to be studied in the next step to improve the data storage and processing capacity in the full life cycle of construction projects based on the idea of big data and cloud computing.

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