Research on Informatization Construction Technology Based on Computer Statistics

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Abstract. With the advent of the information age and the era of knowledge economy, engineering project management in the 21st century is bound to move towards information management, and the core competitiveness of project management is also increasingly dependent on information technology. In view of this, the difficulties in the process of engineering project management informatization are analysed and the significance of its construction is pointed out. On this basis, the content, influencing factors and countermeasures of engineering project management informatization construction are discussed.

Keywords: System backup, system restore, statistics, Ghost, project construction.

1. Introduction

As a complex system engineering, construction project engineering, dynamic design and information management are particularly important to the overall quality and safety of the project. In order to accurately reflect the actual degree of deformation and deformation trend of the construction process of the construction project and after work, the deformation monitoring has become an indispensable component in the design, construction and operation of the construction project, and is regarded as a direct indicator of engineering construction and operation safety. Construction project engineering monitoring can provide construction feedback information in time to provide a basis for improving the design. Through the comparison and analysis of the monitoring data and the theoretical value, the correctness of the design theory can be checked, and the amount of deformation is strictly controlled within the standard range. Due to the difference between current monitoring originals and data collection methods, although massive real-time dynamic monitoring data can be obtained, it cannot achieve regionalized and visual integrated management, and it is difficult to comprehensively and intuitively display the overall working behaviour of monitoring objects and the changing trend of monitoring physical quantities. As a result, the necessary safety guarantees are lacking during the construction of the project.

Therefore, this article relies on the object-oriented programming language C #, large-scale relational database platform Oracle, GIS technology and 3D visualization technology to establish a spatial monitoring database and a series of related 3D visualization models for construction project
engineering monitoring information. The high-efficiency thematic management information system not only provides intuitive and reliable data, information support and visual decision-making services for the construction and safety management of construction projects through the LAN in C/S mode [1].

2. Necessity of information management of engineering projects

2.1. Application technology and goals of engineering project management informatization
The widely used information technology in project management includes Internet database technology, automatic control technology, advanced monitoring technology, project theme network, virtual reality technology, etc. The convenience of the application of these technologies in the storage and retrieval of project information, remote management of the construction site, and assistance in scientific decision-making are unmatched by traditional management models, as shown in Figure 1. Informatization of project management to achieve precise management by informatization of management data, to realize standardized business processing by informatization of process management and control, to assist informatization of decision-making to improve organizational operations, and the ultimate goal is to improve the efficiency of engineering project management the implementation subject of management informatization benefits. The main body of implementation therefore has the motivation to promote the construction of informatization, so that the informatization of project management continues.

![Figure 1. Information technology of project management](image)

2.2. Development trend of engineering project management informatization
With the continuous updating of management ideas in the field of engineering project management, the ever-changing needs of engineering project management, the continuous development of information technology and the continuous interaction between information technology and engineering project management ideas and methods, the general direction of future engineering project management informatization development It is specialized (information management software tends to be more professional), integrated (the communication and cooperation between all parties involved in the project are more efficient) and networked (project management personnel located everywhere can obtain project information through the network), while emphasizing the openness of the system Sex and availability. The informationization of engineering project management can conform to the trend
of the increasing number of engineering projects of large-scale enterprise groups, the ever-expanding scale, the increasing number of participants, and the increasing requirements for the control of engineering construction goals [2].

2.3. Requirements for engineering project management information

2.3.1. Informatization of engineering related data. Within the full life cycle of the project, the project-related materials and data distributed in various places are stored in the central database. From the project site to the headquarters, all levels of management personnel and relevant functional departments change and read information according to the authority to ensure senior management People can also get first-hand data quickly and accurately.

2.3.2. Communication and informatization to realize remote management and control. The headquarters of the group issued instructions and notices to the project construction unit, and the construction unit submitted to the headquarters for approval, all through the information platform. In order to improve the response speed and efficiency, the instruction or request should also be able to be delivered to the relevant processor mobile terminal (such as a mobile phone) in the first time. The information system should also have functions such as video conferencing and on-site visual monitoring, to a certain extent, to achieve remote management and control of the project site by the headquarters.

2.3.3. Assistant decision-making and risk warning function. The information system should be able to calculate the internal rate of return of the investment project, investment recovery period and other economic indicators in the early stage of the project; analyse the investment (progress) deviations during the implementation phase; conduct financial final accounts during the completion acceptance stage; provide a scientific basis for the owner's decision-making at each stage; And prompt possible risks (such as lag in progress, investment overruns, etc.). In view of the large number of engineering projects of large enterprise groups, the information system should be able to extract key project data and generate reports according to the needs of management personnel, so that the focus of the multi-project management of the group headquarters is clear.

2.3.4. On-site assistance management. In addition to the above functions, the information system should also be able to assist in the management of project site personnel, such as analysing network node graphs and schedule-investment curve graphs, monitoring project quality and construction safety, etc.

2.3.5. Information security protection. Accompanied by the convenience brought by informatization technology is the information security risk from the Internet. Information system construction must ensure information security, use system specifications and technical means to protect data that needs to be kept confidential, and prevent "excessive access" or data leakage.

3. Functions that engineering project management information system software should have

3.1. Distributed project management system
With the ever-changing needs of enterprises for projects, the continuous expansion of business scope, fields and regions, and the frequent changes in the working locations of managers, the difficulty of enterprise project management is also increasing. The problem of how to effectively manage enterprises or businesses distributed in different places leads to the concept of distributed project management. Under this background, distributed project management systems have developed a solution to remote management with the help of modern network technology. Technology [3].
3.2. Collaborative Office System
Collaborative office originates from the research on the support methods in people's collaborative work, also known as computer-supported collaborative work (CSCW), which is a method and technology in which independent resources work together to solve specific problems through collaboration. Under the rapid development of network services and grid computing, the idea of collaborative work has gradually matured and gained people's attention. It has important value in improving resource use efficiency and core competitiveness. It can effectively upgrade the engineering project management system from the traditional pure information management tool to the collaborative decision-making platform, thereby providing a more advanced support role for project management. The ideal collaborative work platform can provide an electronic office environment with powerful functions, easy operation and instant communication for enterprises. All project participants, including the owner, the designer, the constructor, the project management and the supervisor, can send and receive documents on the platform, communicate the progress of work at any time, share and manage documents and resources, and all the communication data will be saved under the platform to ensure that all work has rules to follow, orders to check, and evidence to follow. Provide an efficient, convenient, easy-to-use and safe office environment for the entire project management.

3.3. Rich chart function
At present, the types and quantities of reports provided by various project management software systems are different. Some systems have only basic plans, schedules, and cost reports, while some have extensive settings that provide reports on individual tasks, resources, actual costs, commitments, work progress, and other content. In addition, some systems are easier to customize. The report function should be given a high degree of attention, because most users attach great importance to the software, which can generate a wide range of convincing reports.

3.4. Have comprehensive project data analysis capabilities
The main functions of the project management information system are: investment control (owner side) or cost control (construction side); schedule control; contract management. Some systems also include quality control and office automation functions. Take cost management as an example. The functions of cost control include: data calculation and analysis of bid estimation; planned construction cost; calculation of actual cost; comparative analysis of planned cost and actual cost; construction cost prediction according to project progress, etc. The cost data platform is composed of cost data information, operators, computer hardware and software, and corresponding methods. It is neither a machine nor a set of software, but an organism that gathers people, machines, software, and data information. It has a clear operation process, as long as the actual cost data on-site flows into this organism, what is returned in time is more economical technical solutions, more energy-efficient new materials, more reasonable staffing, and design changes and contract changes that are more beneficial to you. A continuous cycle.

In order to analyse the impact of the project cost structure on the project, it is assumed that the above variables conform to the Cobb-Douglas cost function

\[ Y = AK^aL^bG^c \]  

(1)

Among them, \( Y \) represents the overall project cost, \( K \) represents the material cost, \( L \) represents the labour input, \( G \) represents the government project cost, and \( A \) represents the project technology. Take the logarithm of the left and right sides of the function to get:

\[ \ln Y = \ln A + \alpha \ln K + \beta \ln L + \gamma \ln G \]  

(2)

Taking the overall project cost, capital input, labour input, project cost, and technical level as a function of time, taking the logarithm of time for both sides of (2) at the same time, we get:
\[
\frac{dY}{Y} = \frac{dA}{A} + \alpha \frac{dK}{K} + \beta \frac{dL}{L} + \gamma \frac{dG}{G}
\]

(3)

Let \( \alpha \) be the annual growth rate of \( Y \), \( T \) is the technological progress rate, \( K \) is the annual growth rate of investment, \( L \) is the annual growth rate of labour input, and \( G \) is the annual growth rate of financial input, so we can get:

\[
\dot{Y} = T + \alpha K + \beta L + \gamma G
\]

(4)

Among them, \( \alpha, \beta, \gamma \) is the output elasticity of capital input, labour input, and government project cost. Now, by adding the project cost structure factor, suppose that the project cost can be divided into \( k \) parts, and the proportion of each part is \( \lambda_i \) (i=1,2…k), then \( \sum_{i=1}^{k} \lambda_i = 1 \), let \( \lambda_1\gamma_1 + \lambda_2\gamma_2 + \cdots + \lambda_k\gamma_k = \gamma \) and bring this formula into \( Y = AK^\alpha L^\beta G^\gamma \) and follow Process transformation can get:

\[
\ln Y = \ln A + \alpha \ln K + \beta \ln L + \gamma_1 \lambda_1 \ln G + \gamma_2 \lambda_2 \ln G + \cdots + \gamma_k \lambda_k \ln G
\]

(5)

The introduction of project cost structure parameters through the index is mainly based on its economic significance. It can be seen that \( \dot{\lambda}_i \) \((i = 1,2,\ldots,k)\) is the output elasticity of each part of the project cost.

4. The overall structure of the project framework

The purpose of establishing the construction project information management system framework is specifically to help developers fully understand and understand the scope and related issues involved in the construction project information management system. Evaluate existing systems. Accordingly, it should include the following four aspects: the management model of the construction project, the application of information technology in the system, the use of existing software, and the system evaluation criteria, as shown in Figure 2.

The overall framework of SIP M S includes three levels. First, the basic information management structure and coding system, including EPS, OBS, material coding, expense accounts, resource roles, management network, etc.; second, the main engineering project management business module, which assists in the “four controls," "Four management" and communication coordination; the third is the project collaborative work platform and information portal, including public information dissemination and sharing, personal information centre and summary report information.

The design of the system functional framework covers the owner unit, design unit, supervision unit, general contractor, supplier, etc., around the needs of project cost control, schedule control, quality control, HSE management, contract management, document management, to ensure project progress, costs, Quality, safety and other goals control the demand, and improve the efficiency of project collaborative work, promote standardized management and transparency.

Among the above four aspects, the first three aspects correspond to the different aspects that need to be considered when establishing the construction project information management system framework. The last aspect, the system evaluation criteria, represents the goals to be achieved by the first three aspects. This article will analyse the above four aspects in turn. In addition, it is worth noting that in the description of the construction project information management system framework model, it will mainly be represented by the model icon technology EXPRESSG, which is currently widely used information model representation method.
4.1. Data management module
The amount of monitoring data for high-fill projects is huge. According to the characteristics of data collection, a large spatial database is designed to establish efficient data management. The data management module ensures the independence, reliability, security and integrity of the data, reduces data redundancy, improves the degree of data sharing and data management efficiency, and realizes the monitoring of big data calculation, addition, deletion and modification through the information integration software system, Data bulk import and report printing and other functions [4].

4.2. Data analysis module
According to the design requirements, the data of the monitoring points in each bidding section are summarized and analysed, and the trend of the settlement, displacement, stress or groundwater flow and water level of a monitoring point is clearly displayed in the form of a line chart. Taking the settlement monitoring point as an example: The line graph shows the change of settlement elevation distribution and settlement at the monitoring point, the thickness of the fill changes with time, and the settlement rate changes with time. When the settlement rate is significantly accelerated or the settlement amount exceeds the expected level, the relevant departments can be prepared for inspection and prevention in advance, and the probability of accidents can be minimized. (See Figure 3).
Figure 3. Single-point settlement meter cumulative settlement and fill thickness changes with time

4.3. Data display module
In order to stratify the settlement and surface of the original foundation, surface settlement, internal horizontal displacement, horizontal surface displacement, pore water pressure, earth pressure, soil water content, groundwater level, blind ditch effluent, surface cracks and site inspection in order to show more vividly, the information integration software system draws the real-time change curve and isoline of the monitoring data according to the recursive least square method, describes the slope analysis and the volume difference of the excavation and fill to guide the construction project, which has great impact on the construction personnel. Help [5].

4.4. 3D modelling module
Different features have their own different characteristics and require different data structures and modelling methods. This article mainly studies the terrain model, uses the segmentation-merge method to construct the TIN from discrete points, and then loads it symbolically through ArcGIS. Realize the stereoscopic display of the original terrain (see Figure 4).

Figure 4. The TIN model of the whole in-situ ground surface constructed with discrete points
4.5. Three-dimensional analysis module

The TIN is constructed based on discrete points, and the three-dimensional representation state and volume of the cube under different filling times are analysed. The three-dimensional state of the filling body at different filling times is shown in Fig. 4. Fill volume algorithm is divided into volume microelements with equal elevation according to irregular grid, and the terrain of each volume microelement is simplified into a quadrangular prism, which is calculated by equations (6) and (7):

\[ h(x, y) = z_d(x, y) - z_w(x, y) \]  \hspace{1cm} (6)

\[ V = \int \int \sum h(x, y) d_s \]  \hspace{1cm} (7)

Where: \( h(x, y) \) is the grid point height difference, \( z_d(x, y) \) is the elevation before the earthwork volume change, \( z_w(x, y) \) is the elevation after the earthwork volume change, \( V \) is the changing earthwork volume, and \( d_s \) is the integral element area.

5. System detection

Information integration management based on BIM technology can coordinate various professions in the design, pipeline collision check, energy saving calculation, energy consumption simulation, sustainable analysis, construction scheme simulation, scaffolding support system verification calculation, schedule control, cost control, safety management, etc. Implement dynamic optimization and active control of the entire process of engineering projects, thereby improving the quality, work efficiency and scientific management level of engineering design, construction and maintenance management, reflecting the dynamic optimization of information for engineering project services. Such as the BIM curve proposed by Patrick Mac Leamy: the reality and ideal of the project decision-making timing (see Figure 5): Curve 1 shows that: in the development process of the project, the impact on the entire project investment, the higher the impact on the cost in the early stage, the later it has a smaller impact on cost. Curve 2 shows: the actual cost of the project cost, the more money is spent later. It can be seen from the combination of curve 1 and curve 2 that the earlier the project, the less money the project will spend, but the greater the impact on the project cost. Curve 3 shows that the traditional design process spends a lot of time in the construction drawing design phase (CD), missing the best period that affects the entire cost. Curve 4 is based on the BIM design process. The BIM technology is used to move the hump forward as much as possible. The curve 3 is moved from the construction drawing design stage to the curve 4 hump scheme design stage and preliminary design stage the problem is solved before construction, and it serves the purpose of dynamic optimization and active control [6].
6. Conclusion
Aiming at the project management of the construction general contractor, this paper establishes the construction project information management system framework. The framework includes the application of information technology, and also considers the existing project management model and various aspects of construction project management, and has strong applicability. The framework can be used to help researchers understand the scope and related issues of construction project information management system research, and can also be used by project managers to evaluate existing systems when purchasing construction project information management systems.

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