

Research on Early Warning System of Consulting Risk for Power Engineering Project

Jingfeng Ou¹, Jianwen Yuan², Jing Tian⁴, Wei Zhang³, Wenyan Cao¹, Ke Bai⁴*

¹Guangdong Chengyu Engineering Consultation and Supervision Co., Ltd, Foshan, 528200, China

²Dongguan Power Supply Bureau of Guangdong Power Grid Co., Ltd, Dongguan 523000, China

³School of civil and hydraulic engineering, Huazhong University of science and technology, Wuhan 430074, China

⁴Guangzhou JOY-YOUTH Science & Technology Co., Ltd, Guangzhou 510030, China

*Corresponding author: baike@joy-youth.com

Abstract. In the new era, with the rapid development of China's economy, the overall capacity of engineering consulting for construction projects in my country's power industry exceeds demand, and there is a strong demand for cleanliness and intelligence. Power construction companies are facing huge challenges. Grid companies have deployed project management information systems in accordance with relevant national regulations. Therefore, power construction companies or power engineering consulting companies project management engineering consulting In order to effectively avoid accidents in the power system, the power grid signal monitoring risk combined with regulation and control is regulated and controlled. Early warning system.

Keywords: PProject management information system, real-name system, smart site management, power engineering, engineering consulting.

1. Introduction

With the continuous acceleration of China's smart grid construction and the continuous development of ubiquitous power Internet technology, a large number of construction projects of power construction companies are also under construction. In the new era, with the rapid development of China's economy, the overall capacity of engineering consulting for construction projects in my country's power industry exceeds demand, and there is a strong demand for cleanliness and intelligence. Power construction companies are facing huge challenges. Grid companies have deployed project management information systems, such as real-name systems, smart site management systems, etc., in accordance with relevant national regulations. Therefore, power construction companies or power engineering consulting company's project management engineering consulting in order to effectively avoid accidents in the power system, a power grid signal monitoring risk early warning system that combines regulation and control. Real-time control of the monitoring



signal through the system ensures a good early warning effect and improves the efficiency of adjustment and control.

1.1. Establish a risk measurement structure model

1.1.1. ISM model analysis method. The Interpretive Structural Modelling Technology (ISM) was proposed by the American scholar J. Warfield in 1973. It is mainly used to analyse the relationship between a large number of elements that make up a complex system (including one-way or two-way causal relationship, size relationship, exclusive relationship, and correlation relationship), Subordination or subordination relationship, etc.), and expressed in the form of a multi-level hierarchical structure. This kind of system structure modelling method plays a very important role in the practice of system engineering [2]. The description of the risks and risk factors of power supply enterprises is shown in Table 1. The basic steps to construct an ISM model are as follows.

Table 1. Power engineering consulting enterprise engineering project management engineering consulting risk

Serial number	Risks and risk factors	Directly affected factors
1	Natural risk	7, 14, 17, 11, 12
2	Macroeconomic risk	7, 14
3	Social risk	8
4	Policy and regulation risk	8, 13, 14, 15, 16, 19
5	Technology risk	9, 10, 11, 13
6	Weather risk	9, 10, 11, 12
7	Financial risk	
8	Organizational risk	11, 12
9	Construction risk	7, 10, 11
10	Maintenance risk	7, 11, 18
11	safe operation	7, 18
12	Maximum load duration	11, 18, 21
13	Transaction mode	7, 11, 14, 15, 16, 19, 20
14	Electricity price risk	7
15	Price control	7, 16
16	User cost allocation	7
17	Uncertainties	7, 9, 10, 11, 18, 21
18	Transmission congestion	11, 21
19	Time-of-use electricity price	7, 12, 16
20	Ancillary services	7, 14
21	Undersupply risk	11
22	credit risk	7
23	Local policy	12, 14, 20

(1) The constituent elements of the collection and sorting system. The paper sets up a certain binary relationship that must be considered, forms a consciousness model, and obtains a set of system elements, denoted as $N = \{e_i | i = 1, 2, \dots, n\}$, where e_i represents the itche element of the system [3].

(2) Determine whether there is a direct binary relationship between every two elements in the element set. The paper uses the adjacency matrix $A = (a_{ij})_{n \times n}$ to represent all direct binary relations. If the element e_i has a direct binary relationship with the element e_j , then $a_{ij}=1$; if the element E does not have a direct dual relationship with the element F, then $a_{ij}=0$.

(3) Use the adjacency matrix A to establish the reachable matrix M . The thesis assumes $B_n = A + A_2 + A_3 + \dots + A_n$, and then from B_n , the non-zero elements are replaced with 1, and the zero elements remain unchanged [4]. The matrix changed in this way is called the reachable matrix M .

(4) Establish a hierarchical structure model based on the reachability matrix. A multi-level hierarchical directed graph is used to represent the structure of the model.

(5) Compare the explanatory structure model with the existing consciousness model. If they do not match, return to step (1) to correct the relevant elements and their binary relations and the interpretation structure model.

1.1.2. Model calculation. According to the above method, the thesis expresses the direct correlation between 23 variables as adjacency matrix A . Matrix A does not include the first row and the first column of the table. They are the numbers of the variables [5]. Calculate the matrix A according to the step (3) of the previous section, and get the reachable matrix M through transformation. The reachable matrix M we get is to arrange each row in ascending order according to the elements of the row and the size of the row, and divide the unit main sub-matrix with the largest order at a time, and use the practical method of explaining the structure model to draw the hierarchical structure. Figure, as shown in Figure 1.

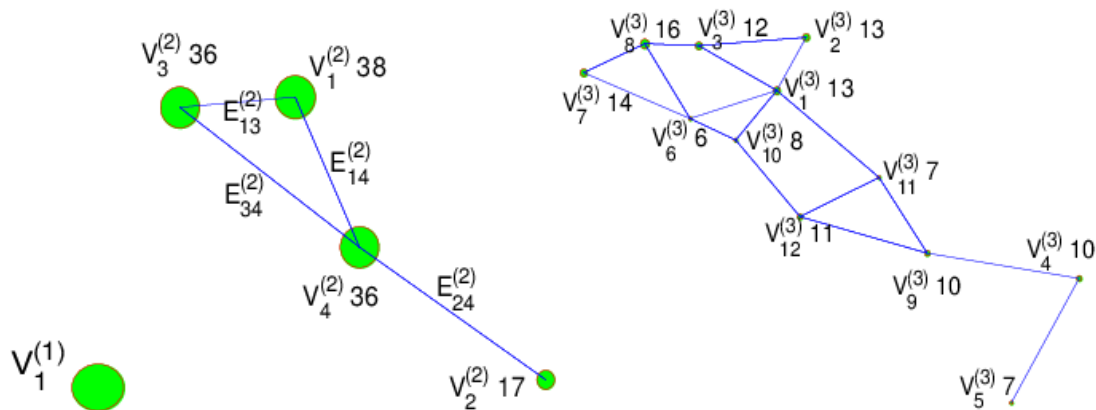


Figure 1. Hierarchical directed graph of the risk system structure of a power supply company

1.2. Quantitative risk measurement structure model

1.2.1. Type decision tree method to quantify node risk and prediction. Except that the source risk node is an exogenous variable and cannot be controlled manually, the other risk nodes are all endogenous variables, which are characterized by: (1) affected by other risks; (2) inherent risks (that is, no other risks) the influence itself also has certain risks); (3) It can be adjusted by the influence of human factors. Give each non-source risk node a previous period risk value, which is the score given by the corresponding management department based on the actual situation of the previous year, and then invite relevant experts to give the predicted value of the next period source risk node, according to the weight given Calculate the comprehensive influence amount, use the influence amount and the corresponding risk node's previous value for equal weight calculation, and get the predicted value of the node in the next period [6]. Power Engineering Consulting Company provided the actual scoring of each management link in the previous period, the expert predicted value of the source risk node, the corresponding weight of each direct sub-category risk factor, and the calculated predicted value of the risk factor. The sum of the weights of all the direct sub-categories risk factors is 1. Figure 2 shows the weight relationship between each factor more intuitively.

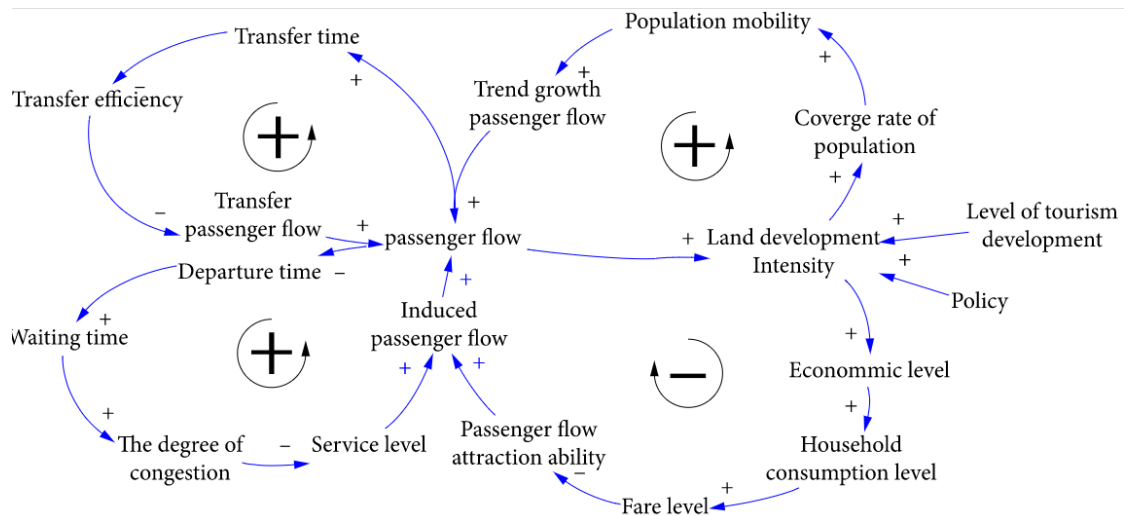


Figure 2. Intuitive diagram of the weight distribution between various influencing factors

1.2.2. *Analysis of forecast results.* (1) The financial risk of the power supply company in the previous period was 30, and the financial risk value in the forecast period was 33.8. Overall, it was low risk, but compared with the previous period, the company's financial risk score increased, indicating the overall operational risk of the enterprise will increase. (2) The risk nodes whose risk value has increased from the previous period are: 7, 22, 15, 8, 9, 19, 13, which are financial risk, user credit risk, price control, organization risk, construction risk, and execution time sharing Classified electricity price, transaction mode, 8→22→7 is a chain reaction [7]. The corresponding management departments are required to be vigilant, do a good job of user credit management and construction management in the next year, pay special attention to changes in price control policies, and straighten out the time-of-use classification of electricity prices.

2. Project Management Information System

2.1. Smart site management system

The overall system architecture design is shown in Figure 3. It can be seen from Figure 3 that the overall system architecture is composed of 4 layers, namely the early warning application layer, the data analysis layer, the calculation layer and the data collection layer. 1) Early warning application layer: Mainly located at the top of the architecture, which can realize upper-level applications and provide support for page interaction; 2) Data analysis layer: Mining basic algorithm libraries through big data analysis, analysing association rules, and laying the foundation for active warning; 3) Calculation Layer: This layer can realize the aggregation and storage of multi-source heterogeneous data, provide batch data computing services, and use HDFS+Oracle storage framework to calculate massive data; 4) Data collection layer: This layer is based on the SNMP data collection protocol. It can collect power grid signal operation and reference data.

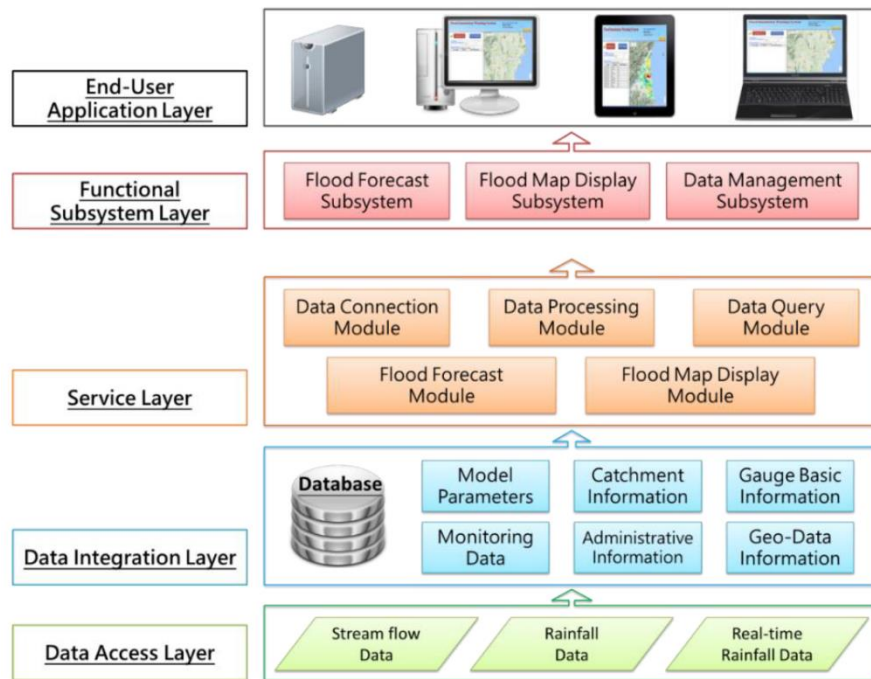


Figure 3. The overall structure of the engineering project management engineering consulting and early warning system

2.2. *Hardware design*

The system hardware structure design is shown as in Fig. 4. It can be seen from Figure 4: Industrial Ethernet + fieldbus is used to build an Ethernet redundant double loop network that runs through the power structure. The hardware structure of the power grid signal monitoring risk early warning system is mainly composed of the power system, information collectors, actuators, monitors and man-machines. It is composed of interactive interface.

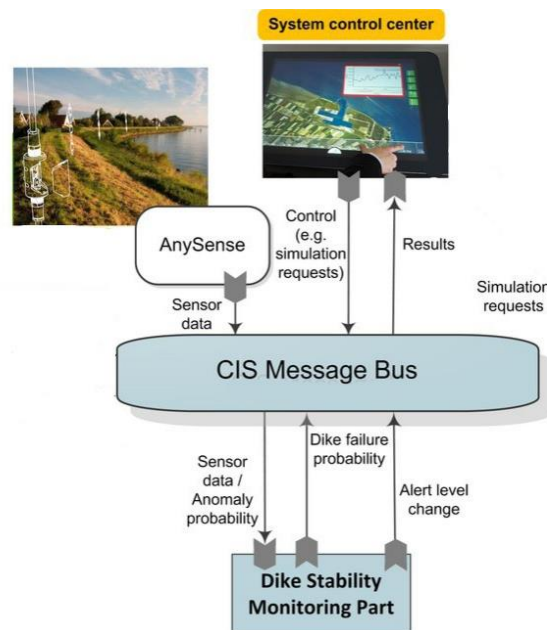


Figure 4. System hardware structure

Information collectors are mainly installed in smart terminals. They extract unstructured information from a large number of web pages and store it in a database. It is necessary to quickly and accurately determine the monitoring risks of engineering construction, intelligently diagnose all signals and process data in real time. This article uses the TLP521-3 chip as the main chip of the information collector, and connects the information channel 1 to the button BUTTON1. The button BUTTON1 is composed of 4 nodes and is mainly responsible for various problems in the power system. The information collector is mainly used to complete the real-time monitoring of substation construction.

2.3. Software design

The workflow of the intelligent construction site management system software is shown in Figure 5. It mainly includes different management modules: the hardware service is used to determine the safety status of the power grid signal during the construction site state early warning period, and to realize the early warning by monitoring its status. The warning threshold is to set the risk warning threshold of the signal and compare the current data with the warning threshold. If the monitoring data is not within the corresponding early warning threshold, it means that the monitoring behavior meets the early warning conditions, and then it is upgraded to an early warning event. Early warnings of rapid changes need to be compared with similar data. If the change is rapid, it means that the difference is greater than a certain percentage, and then monitor it. The signal has undergone a major change and needs to be upgraded to an early warning event. Trend early warning is to determine whether the signal meets the early warning conditions by analyzing the trend of the monitored signal [8]. Trend early warning needs to achieve short-term goals through the three indicators of trigger threshold, indicator and difference. Signal monitoring risk early warning; evaluation early warning is to evaluate the monitoring signal by scoring and judge whether the monitoring signal is at risk by scoring; the associated early warning is to find the causal structure between the existing object set during the operation of the information system and the infrastructure. Then realize proactive early warning of information resources. It can be seen from Figure 5 that the work flow of the system software is mainly to deal with the power flow limit set in the initialization program, and to realize the processing of power flow and transformer load rate. Each functional program module is initialized and reads the real-time data public program. These modules work together to realize the risk warning function of power grid construction site monitoring.

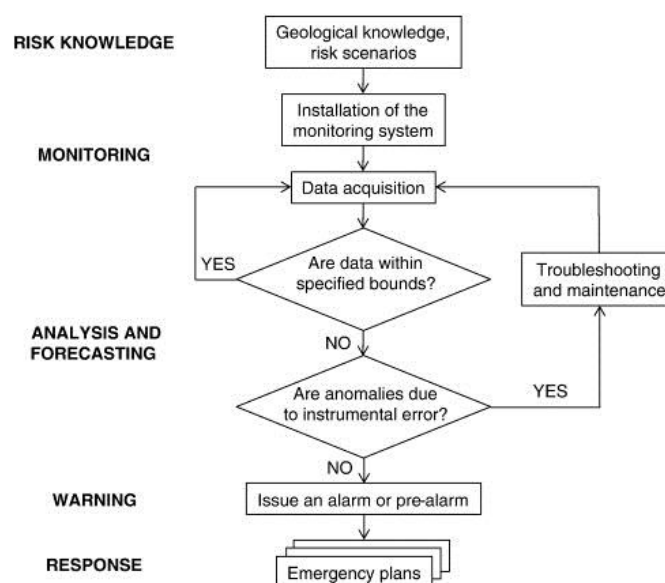


Figure 5. Software workflow

3. Conclusion

On the basis of the above theoretical research results, combined with project management, the electric power construction enterprise has carried out the overall design, detailed design and system construction of the power engineering consulting risk management and early warning system, including the overall architecture management system of the power risk early warning system. Architecture and functional modules, the business process of the smart site management system, effectively avoid accidents in the power system, and play a very important role in engineering practice.

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