The Case Study on Safety Evaluation System of Electrical Engineering Project

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ABSTRACT: The paper designs and develops a new type of evaluation system based on the requirements of electrical engineering project safety evaluation management. This paper designs a multi-layer system architecture of display layer, control layer, logic layer and data layer. The detailed design of basic information management, evaluation data management, supervision data management, comprehensive evaluation management and other functions of the system are completed by using the unified modeling language (UML) sequence diagram and class diagram, and the number of systems is designed. Database conceptual model and data table structure. On this basis, the paper completes the database establishment and data loading. The innovations of the system include: (1) introducing a multi-dimensional project quality evaluation model based on qualitative and quantitative analysis, which evaluates the quality of electrical engineering projects from the aspects of project progress, supervision evaluation and safety evaluation, and completing the evaluation of electrical engineering project quality in the form of final score by flexibly setting evaluation model; (2) introducing safety control model to realize participation evaluation. The unification of privileges and data of price users ensures the security of evaluation data. Finally, the paper completes the system function test and performance test, verifies the stability and reliability of the system operation, and achieves the expected functions, and constructs a comprehensive quality evaluation model for electrical engineering projects.

***Keywords*:** Safety control model; supervision data; data sharing; evaluation and monitoring system

INTRODUCTION

The improvement of related technologies in electrical engineering is affected by various subjective and objective factors, leading to the emergence of various problems. This article mainly aims at the problems existing in the electrical automation construction process, puts forward corresponding preventive measures, and continuously improves the overall quality of electrical engineering.

Since the end of the 1990s, the importance of project management information construction has been gradually recognized by many countries. Project management is an important part of information construction, and some large enterprises have developed corresponding application systems. Due to the limitation of technical conditions at that time, there was a lack of data sharing and editing, and for data security needs, some shorter sharing time limits adopted.

Compared with developed countries with informatization, the Chinese project management informatization construction started late, and enterprises started late in project informatization management. In the business field,

some software companies have developed application platforms based on project data management, most of which have solved the project sharing needs based on collaborative office requirements. But these platforms are not compatible in metadata operations, detailed processing of permissions, etc. Currently, big data platforms put forward requirements for the integration of heterogeneous data. Therefore, these project data management platforms are restricted to the enterprise in terms of market application and promotion, and they are weak in data security control, and the divided user roles and user permissions are not refined. There is a lack of necessary control strategies in dealing with the diversified data of the enterprise. Therefore, the main research work of this article includes the following aspects:

(1) Analyzed the source of each part of the data involved in the comprehensive quality evaluation of the project, analyzed the user roles related to the system, and put forward the functional requirements for basic information management, evaluation data management, supervision data management, and comprehensive evaluation management, and completed the system from different aspects. The analysis of system functions puts forward system non-functional requirements from the aspects of system performance and safety.

(2) Completed the design of the electrical engineering project quality evaluation business system, first proposed a four-tier structure system based on the display layer, display control layer, business logic layer and data layer, completed basic information management, evaluation data management, and supervision data management, Comprehensive evaluation management and system management module design, the system database was designed.

(3) Complete the technical realization of the functional modules, and use the .NET framework to realize the functions of basic information management, evaluation data management, supervision data management, comprehensive evaluation management and system management, and select typical modules to perform functional and performance tests to verify Whether it meets the quality evaluation objectives of electrical engineering projects.

LITERATURE REVIEW

China has a long history and rich experience in comprehensive engineering quality evaluation. Since 1905, the Chinese construction projects have entered a period of systematic development. The period from 1980 to 1980 was mainly the introduction of foreign research results. In 2008, China State Construction Corporation developed the comprehensive engineering quality evaluation system. The system was implemented using PHP+MYSQL technology. The comprehensive evaluation of the construction quality of each project is carried out in the form of a percentage system, which is composed of safe construction, schedule control, and capital management. The introduction of the system has achieved good results. In spite of this, there are still many problems in the existing comprehensive project quality evaluation, which are manifested in several aspects: (1) Comprehensive project quality evaluation is too formal; (2) Evaluation method is too narrow; (3) Comprehensive project quality evaluation software The system cannot form multi-departmental data sharing; (4) The data source in the comprehensive evaluation model of project quality is single[1].

At present, there are many problems in the informatization construction of engineering quality evaluation software. Multi-layer architecture design adopts modular and hierarchical design ideas to achieve the goal of achieving the independence of data, business, and functional performance of the application system. Each layer

is designed with an independent function. When business requirements change at the same time, only a certain level needs to be updated and replaced according to the content of the change, without affecting the processing of other levels. The commonly used hierarchical structure is divided into three layers: data layer, business layer and function layer. The functions of each layer are described below[2-4].

The .Net platform is a set of application development programs developed by Microsoft to fight against Java. It can develop B/S and C/S systems. .Net is based on componentization. Application systems developed in various languages can be invoked Shared component library to complete the realization of basic functions. The application system based on the .Net platform has great advantages in data sharing and technical framework sharing. Each development programmer can shorten the development cycle and achieve efficient development. The .Net framework realizes the layering of classic data, services and functions, and improves the convenience and scalability of later system operation and maintenance[5-8].

UML is the Unified Modeling Language. UML has become the most widely used software analysis, design and modeling tool in the field of software engineering. It describes the system from different angles through different graphics such as use case diagrams, class diagrams, and state diagrams[9-13], so that developers can complete software analysis and design.

In the system design stage, the detailed design of modules and functions is described by class diagrams. Class diagrams include entity classes, interface classes, and control classes. These three types of diagrams form a complete class diagram of a functional module. The entity class It describes the static object[14], which corresponds to the attribute table in the database. The interface class is used to realize the mutual operation of system interface objects and users, and the control class is used to complete a specific operation, which is often used in the realization and operation of business logic. The class includes attributes and methods. Sequence diagram, also known as sequence diagram, is the transfer of messages between instantiated objects in the class diagram. When a function design is described through the sequence diagram, the various objects involved and the message transfer between objects are described[15].

The above related technologies, including the .NET framework, software architecture, UML and construction tools, and other related knowledge, provide a technical basis for the analysis, design and implementation of the system in this article.

RESEARCH METHOD

1 System role analysis

System roles include project manager, project department, quality control department, and system administrator. The following will analyze these roles one by one.

(1) Project manager: Responsible for registering the basic information of the electrical engineering project that I am responsible for, and providing data entry for the data in the comprehensive quality evaluation of the project, including some comprehensive quality and construction safety evaluation information of the project, as well as comprehensive information for other project managers Quality is quantified and scored.

(2) Project department: to realize the input and batch import of project engineering information, engineering divisions, etc., to enter data for some evaluation indicators, and to review the evaluation data submitted by the project manager to determine whether the project engineering information entered by the

project manager In line with the actual situation.

(3) Quality Management Department: It mainly enters some data mastered in the project construction in the evaluation of the project manager, such as the data provided by the project supervision.

(4) System administrator: Mainly responsible for some non-business tasks, including the initialization of some values, data audit settings, and different user role permissions settings.

2 System case analysis

The above role analysis and requirement description can be divided into the overall use case diagram of the system as shown in Figure 1.

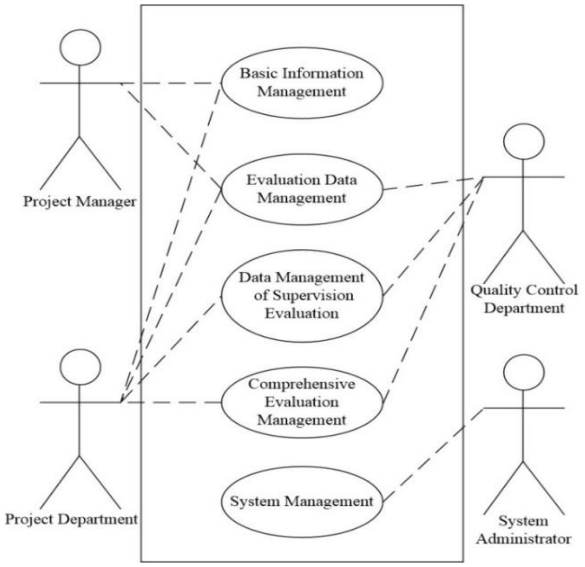

Figure1. The Overall Use Case Diagram of The System

(1) Analysis of basic information management function

Basic information management includes department information management, engineering division management and project engineering information management. Both the project manager and the project department can maintain the department, engineering branch, and project engineering information. The maintenance methods include the entry of basic information, the batch import of information, and the modification and deletion of information. The basic information management function use case diagram is shown in Figure 2.

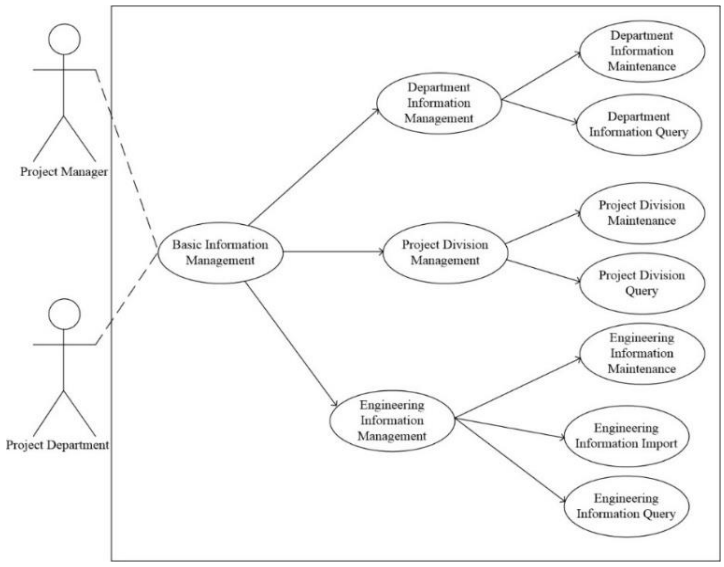

Figure2. Basic Information Management Function Use Case Diagram

1. Department information management;

2. Engineering division management;

3. Project engineering information management.

Project engineering information management is similar to department information management and engineering branch management operations, and project engineering information needs to be inquired on the basis of information inquiry.

The use case description of "Project Information Query" is shown in Table 1. Understand the engineering information query process through description.

Table 1. Project Information Query

Use case name	**Engineering information query**
Brief description	Query the detailed information of the project by entering keywords
Enforcer	Project department
Precondition	The operating user has successfully logged in to the system
postcondition	
Basic flow	1. Enter the project information query page; 2. enter the relevant keywords of the project information, such as the project number, project name, etc.; 3. the system queries the database; 4. the system displays the detailed information of the project.
Extended flow	Can select an item in the list of displayed item names, and then view the information

(2) Evaluation data management analysis

Evaluation data is the basis of comprehensive project quality evaluation. Evaluation data management mainly manages evaluation data, including project manager self-evaluation management, mutual evaluation management, owner evaluation management, and self-evaluation data review. The use case diagram of the evaluation data management function is shown in Figure 3.

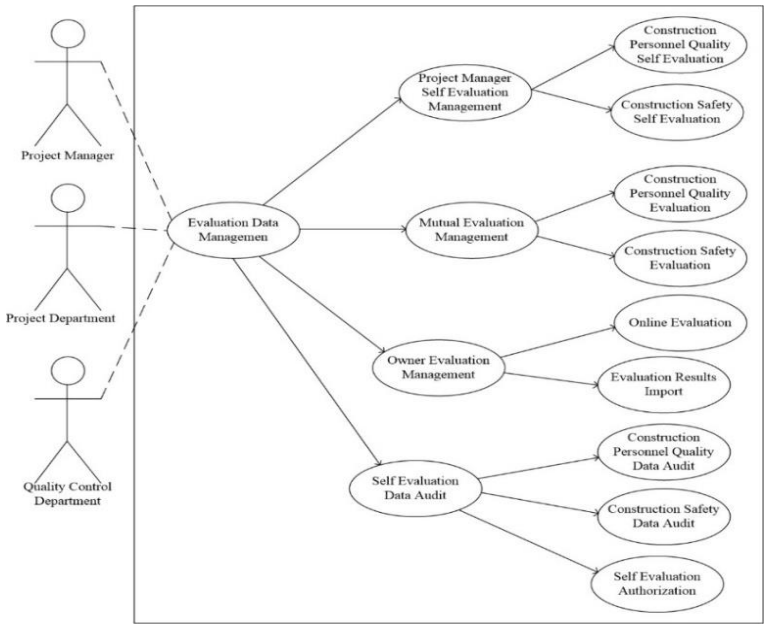

Figure3. Use Case Diagram of The Evaluation Data Management Function

The project department can authorize the self-assessment verification team of the engineering division through the self-assessment data review authorization, and the team independently or assists in reviewing the self-evaluation data of each project manager based on the self-evaluation materials and related engineering division materials. The "Online Review" use case description is shown in Table 2. Understand the online review process by describing it.

Table 2. Online Review

Use case name	Online review
Brief description	Project Department to complete the online project quality review of a division
Enforcer	Project department
Precondition	The operating user has successfully logged in to the system
postcondition	Submit the results of this review
Basic flow	1. The project department logs on to the online evaluation page; 2. the system automatically displays a list of all engineering divisions to be reviewed according to the authority of the registrant; 3. the project department selects all the project list information of a certain engineering division; 4. the project department selects a certain project; 5. The project department inputs the quality control evaluation and safety control evaluation results of the project; 6. After the input is completed, submit the evaluation results online.
Extended flow	The project department can select the engineering division that has not completed the evaluation last time and continue to complete the evaluation

(3) Analysis of supervision data management function model

The example describes it, and the description of the "Supervision Data Import" use case is shown in Table 3.

Table 3. Supervision Data Import

Use case name	Supervision data import
Brief description	The project department imports the supervision data according to the engineering division
Enforcer	Project department
Precondition	The operating user has successfully logged in to the system
postcondition	Import the supervision data of a certain engineering branch into the system database
Basic flow	1. The project department logs into the system; 2. the system enters the supervision data import page; 3. selects the supervision data file to be imported; 4. the system checks the standardization of the selected supervision data file to determine whether it meets the requirements; 5. if the selected supervision file If it meets the specifications, import the data file; 6. if the data storage format of the supervision file does not meet the requirements, give corresponding prompts; 7. after importing the data file, save the record values in the file to the supervision evaluation database.
Extended flow	If the supervision file format does not meet specifications and requirements, the corresponding prompt

(4) Analysis of comprehensive evaluation management function model

(5) Analysis of system management function model

RESULTS AND DISCUSSION

1 Design of the questionnaire form

Question 1: What department do you work in?

A, project manager B, project department C, quality control department D, system administrator

Question 2: What is your current position _____?

Question 3: Satisfaction survey on the current evaluation system (very dissatisfied, dissatisfied, acceptable, satisfied, very satisfied)

	a. very dissatisfied	b. dissatisfied	c. acceptable	d. satisfied	e. very satisfied
Overall satisfaction?					
Can the current system meet your work and business needs?					
Do you think that the current system function process is clear, easy to understand and can be learned quickly?					
Whether the current system of evaluation data management module satisfaction?					
Whether the current system of supervision data management module					

satisfaction?

Whether the current system of management module satisfaction?

Whether the current system of security satisfaction?

When you encounter functional or operational problems with the current system, can you find the corresponding team? And whether it can solve the problem for you in a timely and efficient manner?

The professional skills of the corresponding team members?

The credibility of the corresponding team staff?

2 Basic information management module design

The system architecture is shown in Figure 4. On the basis of system analysis, it can be seen that the overall function of the system can be divided into five modules: basic information management, evaluation data management, supervision data management, comprehensive evaluation management and system management.

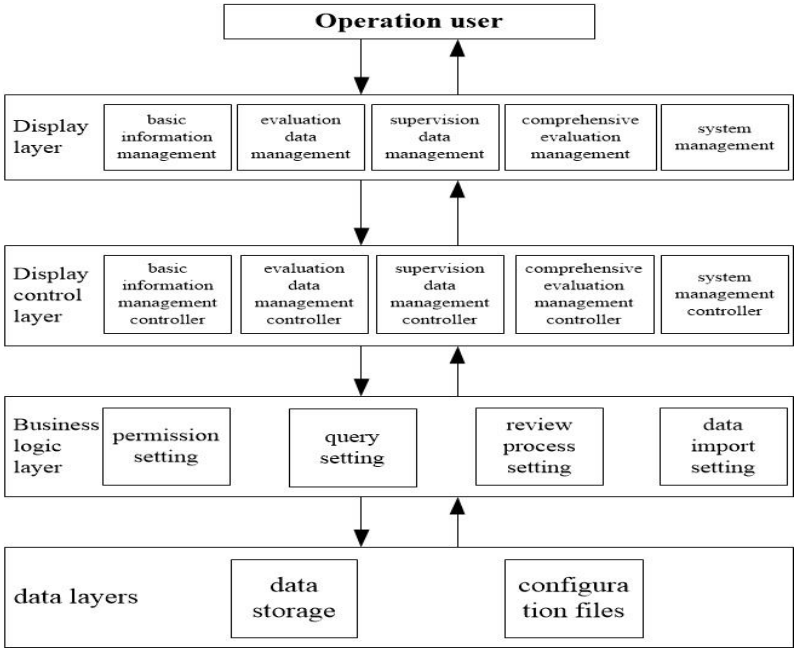

Figure4. The System Architecture

(1) Basic information management module

(2) Evaluation data management module

(3) Supervision data management module

(4) Comprehensive evaluation management module

(5) System management module

CONCLUSIONS

The research work done in this article includes the following aspects:

Based on the current status of comprehensive project quality evaluation, the paper analyzes the sources of various data parts involved in comprehensive project quality evaluation, analyzes various roles involved in the project evaluation process, and proposes basic information management, evaluation data management and supervision data the functional requirements of management and comprehensive evaluation management. Through UML, the paper completes the analysis of system function modules, dynamic models and static models. The paper analyzes that the comprehensive quality evaluation function model of electrical engineering projects can be popularized and applied in other engineering fields.

The paper completed the design of the electrical engineering project quality evaluation business system. Firstly, paper proposed a four-tier structure system based on the display layer, display control layer, business logic layer and data layer, completed basic information management, evaluation data management, and supervision data management, comprehensive evaluation management and system management module design, the system database was designed. The technical realization of the functional modules was completed, and the basic information management, evaluation data management, supervision data management, comprehensive evaluation management, and system management were implemented by using the .NET framework. Typical functions were selected to test the functions and performance, and the results verified that system has reached the goal of quality evaluation of electrical engineering projects.

Starting from the requirements of comprehensive quality evaluation management for electrical engineering projects, this paper develops a comprehensive quality evaluation system for electrical engineering projects and constructs an integrated work model. The innovations of the system are as follows: Firstly, a qualitative and quantitative multi-dimensional project quality evaluation model is introduced to evaluate the quality of electrical engineering projects from project progress, supervision evaluation, and safety evaluation. The evaluation model is flexibly set to obtain the final score. The evaluation of the quality of electrical engineering projects is completed in the form of a form. Secondly, a safety control model is introduced to realize the unification of the authority and data of the users participating in the evaluation, and to ensure the safety of the evaluation data.

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REFERENCES

1. BARBANERA F, DEZANI-CIANCAGLINI M, DE'LIGUORO U. Reversible client/server interactions[J]. Formal Aspects of Computing, 2016(4):1-26.
2. HARDY S A, SARYOR MPG, SWAANENBURG M, et al. Maintaining client/server session affinity through load balancers[J]. 2017(10):632-636.
3. VLIET H V, TANG A. Decision making in software architecture[J]. Journal of Systems & Software, 2016, 117(C):638-644.
4. CHEN H M, LI C. Design and Model Checking of Service Oriented Software Architecture for Internet of Things:A Survey[J]. Chinese Journal of Computers, 2016.

5. WEI G, ZHANG C. Designand Implementation of Online Examination Management System based on ASP.NET Framework[J]. China Computer & Communication, 2017.
6. MAZZARA M. Designing a pi-based Programming Language in the. NET framework: CLR interoperability from the Programmer's point of view[J]. 2017.
7. ZHAO Y, WANG J. Design and implementation of management vehicle information system based on the. NET Framework[C]// International Conference on Consumer Electronics, Communications and Networks. IEEE, 2016:197-200.
8. CHEN Y, LINGJIA G E, WANG Y, et al. Construction of IT Operation and Maintenance Platform Based on. Net Framework[J]. Mechanical & Electrical Equipment, 2017.
9. MARTINA BAUCIC, DAMIR MEDAK. Web GIS for airport emergency response-UML model[J]. PROMET-Traffic & Transportation, 2015, 27(2): 155-164.
10. 1S UKE S, THOOL R. UML Based Modeling for Data Aggregation in Secured Wireless Sensor Network [J]. Procedia Computer Science, 2016, 78:706-713.
11. ALHROOB DAHAL. Transforming UML sequence diagram to high level petri net[C]., International Conference on IEEE Software Technology and Engineering (ICSTE), 2010，1(28): 260-264.
12. MOHAMMED MISBHAUDDIN, MOHAMMAD ALSHAYEB. UML model refactoring: a systematic literature review[J]. Empirical Software Engineering, 2015, 11(11):201-206.
13. RISHI KANTH SARIPALLE. UMLS semantic network as a UML metamodel for improving biomedical ontology and application modeling[J]. International Journal of Healthcare Information Systems and Informatics, 2015, 10 (2): 34-56.
14. ELODIE EDOH-ALOVE, SANDRO BIMONTE, FRANCOIS PINET. An UML profile and SOLAP datacubes multidimensional schemas transformation process for datacubes risk-aware design[J]. International Journal of Data Warehousing and Mining, 2015,11 (4): 64-83.
15. 1VAN BARASHEV. Translating semantic networks to UML class diagrams[J]. Procedia Computer Science, 2016, 8(9): 113-118..