Design and Implementation of Capital Management Information System for Central Financial Fund Project Based on MVC Pattern

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Abstract—With the increase in the number of projects and the use of the fund budget standard, the original way of geological exploration fund project fund management gradually fails to meet the needs of efficient project fund management and rapid analysis and query, and promotes the standardization of management by realizing the information of fund project fund management. The central geological exploration fund project capital management system has been designed and realized, based on the B/S framework of MVC pattern. The background development adopts the development way of ASP.NET MVC, and uses the Ninject framework to solve the coupling problem of the components in the program. The foreground development adopts jQuery framework, with excellent cross-browser compatibility. It has seven functional modules, covering four stages of the whole process of the project capital management of the geological exploration fund. It meets the needs of users such as the fund management center, the supervision department, project undertaking units and economic experts. This enables the fund management center to not only keep track of the execution of individual project funds, but also to monitor and manage the execution of project funds in different batches and years, effectively meeting the needs of the central geological exploration fund project fund management.

Keywords- MVC; B/S; Project fund management; System design; Whole process management component

1. Introduction

In order to establish a virtuous cycle mechanism for investment in mineral resources exploration, the state established the central geological exploration fund in 2006 [1]. The central geological exploration fund has its own characteristics in terms of budget preparation methods, budget review and the use of fund budget standards [2]. With the increase in the number of projects and the use of the fund budget standard, the original way of managing project funds gradually failed to meet the needs of efficient management and quick analysis and enquiry of project funds. The first is the lack of fund management database, which has a certain impact on leaders' understanding and decision-making analysis of project fund issues; Second, the lack of network management, it is difficult to achieve the purpose of remote real-time monitoring project funds; Third, some project units do not understand the fund budget standards, which leads to errors in budget estimates and budgeting, and is not conducive to the standardized operation of project fund management. Wang XT (2017) and Wang FR (2021) believe that the construction of project management information system plays an important role in the management of key projects of government agencies [3][4]. Zhuang BQ et al. (2021) proposed

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that it is an inevitable trend of The Times to use information technology to improve the overall management level and build an information system platform for water conservancy construction project management [5]. Liu XW et al. (2022) researched and built a network supporting service system with the budget preparation of geological survey projects as the core, and realized the unified management of the budget preparation of geological survey projects [6].Information technology is an important means of regulating the management of project funds, and the use of fund management systems to participate in the whole process of project fund management is an important way of promoting the correct use of the fund budget criteria and the standard implementation of fund management methods.

2. Analysis of system user requirements

There are four main types of participants in the whole process of fund project capital management. The first type of participants is the fund management center, which is responsible for the overall management of fund projects, such as the overview, prediction, settlement review and fund allocation organization and management. The second type of participant is the Supervision Department, which assists the fund management center to carry out the fund allocation review and settlement preliminary review. The third type of participant is project undertaking unit, which carries out the work of outline, prediction, settlement preparation and fund allocation application. The fourth type of participant is economic expert, which carries out overview, forecast, settlement review work. In order to better describe the relationship among users, requirements and system functional units, this paper designs the use case diagram of the above four types of users, as shown in figure 1−4, which shows a system functional model diagram that external users can observe. In a fund project cycle, under normal circumstances, the undertaking unit needs to compile five times, the supervision department only appears in the preliminary examination of the fund disbursement stage and the settlement stage, and the fund management center needs to organize economic experts to conduct three times of examination. Strengthening and regulating the fund management, providing supplementary decision support for the management level and reducing the workload of users are the biggest business requirements of the system design.

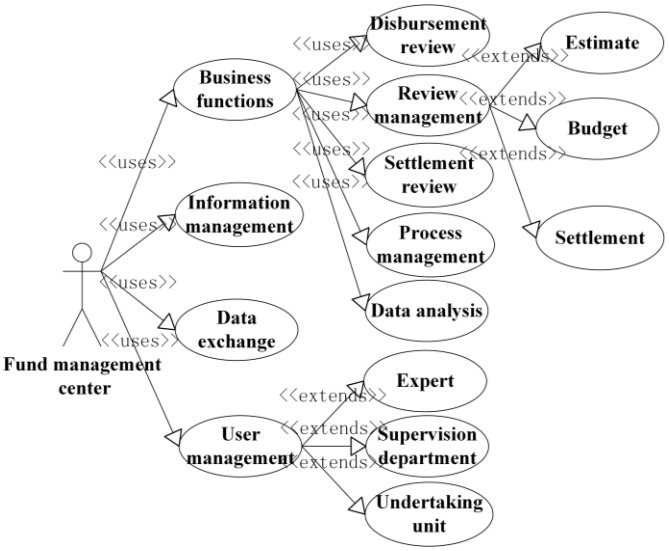

Figure 1. Use case diagram of fund management center.

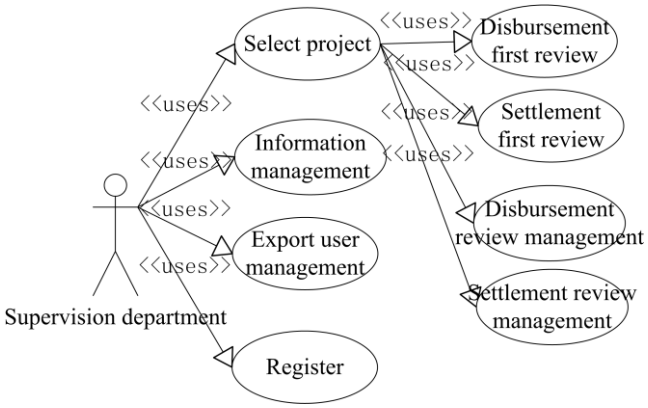

Figure 2. Use case diagram of Supervision Department.

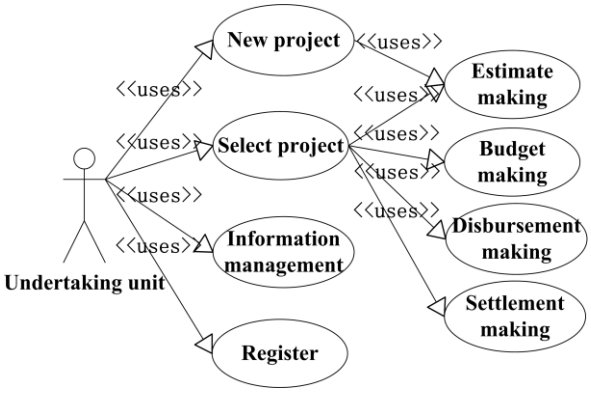

Figure 3. Use case diagram of undertaking unit.

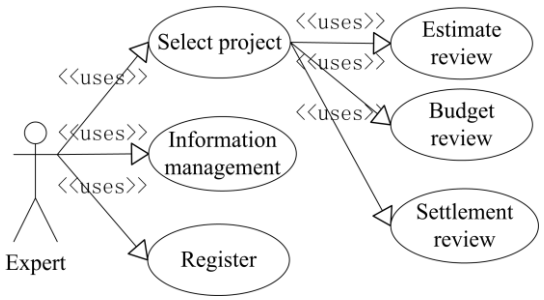

Figure 4. Use case diagram of expert.

3. OVERALL DESIGN OF SYSTEM

3.1 System development technology

The central geological exploration fund project fund management system is based on the B/S (Browser/Server) architecture. The development of the website background adopts the development mode of ASP.NET MVC, and the key technology used belongs to the network development technology of Microsoft. It mainly includes MemberShip, LINQ TO SQL, LINQ TO XML, ADO.NET Entities Model, MSDTC and other key technologies [7]. In order to solve the coupling problem of the components in the application, the lightweight IOC framework base on Ninject is used to separate the application into loosely coupled, highly cohesive modules and then assemble them in a flexible way, making the code easy to write, reusable, and easy to test and modify [8]. The foreground development adopts lightweight jQuery framework, which has excellent cross-browser compatibility, supports various browsers (IE 6.0+, FF 1.5+, Safari 2.0+, Opera 9.0+), and realizes perfect Ajax technology. This allows developers to focus on business logic when working with Ajax, without worrying about complex browser compatibility and the creation and use of XMLHttpRequest objects [9]. The system was finally deployed to IIS, and the technology selection was in line with the characteristics of the project, which was conducive to the work. The overall structure of the system is implemented using a multi-tier architecture model, i.e. Presentation layer, project fund management business logic layer, data access layer and data storage layer, which is conducive to the development, maintenance, deployment and expansion of the system [10].

3.2 Module function design

The main module functions are designed according to the central geological exploration fund project fund management requirements, including login management module, budget standard automation module, administrator module, project estimate module, design budget module, fund allocation module, settlement management module, etc.

3.2.1 Login management module: The first is the identity authentication function, which can confirm the user role by logging in with the correct user name and password and provide corresponding permissions. The second is the module management function, can provide after identity authentication can operate the project list and can operate the module list, and can choose to enter. The third is the basic user management function, to achieve some basic functions of user self-management, including user registration function, modify my password function, retrieve my password function, modify my information function.

3.2.2 Budget standard automation module: The first is the automated calculation function of the fund budget standard, which enables the automation of the budget standard for the 2 versions of the fund budget standard in 2011 with a business expense allocation and the fund budget standard in 2011 without a business expense allocation. Second, the work area related coefficient acquisition function enables the calculation of area adjustment coefficients and terrain grade coefficients by entering the project area coordinates.

3.2.3 Administrator module (dedicated for fund manage center): One is the process management control function, which provides overall control of the system processes. Management of the business process stage in which the project is located, display of process information and project declaration review information, the ability to issue start, accept, cancel, return business processes, etc. Second, the project funds analysis function analyses the management of project funds in the form of reports. Third, there is a data exchange function with other software. Fourth, the user management function, to achieve management of other users some advanced functions, including management of user rights function, add user function, delete user function, modify user information function, etc.

3.2.4 Project estimate module: First, the project estimate preparation function, including the realization of the preparation of project and unit information, the preparation of the estimate summary table, the preparation of the estimate schedule, view the "main means of work cost proportion table", upload the preparation instructions and other documents, export the summary table and schedule function. The second is the project estimate review function, including economic expert review, filling in the "central geological exploration fund project estimate review opinion form", viewing information on the preparation of the project estimate of the fund, downloading the estimate preparation instructions and other related documents, exporting the estimate review form.

3.2.5 Design the budget module: The first is to design the budget preparation function, including the preparation of the budget summary table, the preparation of the budget breakdown table, the uploading of documentation such as preparation instructions, the export of the summary and breakdown tables. Secondly, the design budget review function includes economic expert review, filling in the budget preparation instructions and the "central geological exploration fund project design budget review opinion form", viewing the budget preparation information of the fund project, viewing the review opinion information of the project budget estimate, downloading the budget preparation instructions and other related documents, exporting the budget review form.

3.2.6 Fund allocation module: The first is the compilation function of the allocation application, including filling in the compilation description, progress payment application form and implementation progress information table, uploading related documents, exporting progress payment application form and implementation progress information table. The second is the fund allocation review function of the department of supervision, including filling in the pro-

gress payment allocation application form and the review comments on the implementation progress statement, exporting the progress payment allocation application form and the implementation progress statement. The third is the fund center fund allocation review function, including filling in the progress payment allocation application form comments, viewing and implementing the progress statement review, exporting the progress payment allocation application form and implementation progress statement.

3.2.7 Settlement management module: The first is the compilation function of settlement application, including the compilation of settlement application form, uploading documents such as compilation instructions, exporting summary table and detail table. The second is the preliminary examination function of the department of supervision, including viewing the information of the settlement application form and filling suggestions, downloading the budget preparation instructions and other related documents, exporting the settlement application form. Third, the fund center settlement expert review function, including filling in the central geological exploration fund project capital settlement review form, view the project capital settlement report, export settlement review form. The fourth is the fund settlement handling function, including checking the review opinions of the project fund settlement, the comprehensive allocated funds, the suggested settlement number and the quality deposit to be retained.

3.3 Database design

Based on SQL Server2008 R2, the database is constructed, including basic database, fund project capital management database and user database. The first is the basic database, including the fund budget standard basic database, the regional adjustment coefficient basic database and the terrain level basic database three parts. The second is the fund project capital management database, which mainly stores the data of the fund project, business process, declaration, preparation and review at each stage, etc. In order to describe the database model, E-R diagram is used to display entities, entity attributes and relationships, and express the complete logical structure of the database, as shown in Figure 5. The projects table is an important table in the entire database, and its table structure is shown in table 1. The third is the user database, which mainly stores user registration information, permissions, roles and other data.

Table 1 The table structure for projects.

Field name	Field Type	Field Length	Description
Id	Int	4	Project Id
Batch	Nvarchar	Max	Batch
Name	Nvarchar	Max	Project name
Code	Nvarchar	Max	Item code
Theyear	Int	4	Project year
Startyear	Int	4	Start of year
Endyear	Int	4	End of year
Xmlformedprjlocations	Nvarchar	Max	Project location coordinates
Arearcoefficients	Nvarchar	Max	Area adjustment factor
Landdgrees	Nvarchar	Max	Terrain grade
Prjsetflag	Nvarchar	Max	Project renewal sources
Notsetflagreason	Nvarchar	Max	Reason no prior year project found for renewal project

Thefirstpayment	Decimal	18	Down payment
Workunit_id	Int	4	Workplace id
Estimate_id	Int	4	Estimated id
Estimateexamination_id	Int	4	Proposed budget review id
Budget_id	Int	4	Budget id
Budgetexamination_id	Int	4	Budget review id
Projectprogressone_id	Int	4	First allocation id
Projectprogressex-amsuperone_id	Int	4	First allocation of preliminary id
Projectprogresstwo_id	Int	4	Second allocation of id
Projectprogressex-amsupertwo_id	Int	4	Second allocation of preliminary id
Progressfundman-ageropinionone_id	Int	4	First allocation fund review id
Progressfundman-ageropiniontwo_id	Int	4	Second disbursement fund review id
Endproject_id	Int	4	Settlement id
Endprojectexamsuper_id	Int	4	Preliminary settlement id
Endprojectexamexpert_id	Int	4	Settlement review id
Thesuper_id	Int	4	Supervision department id

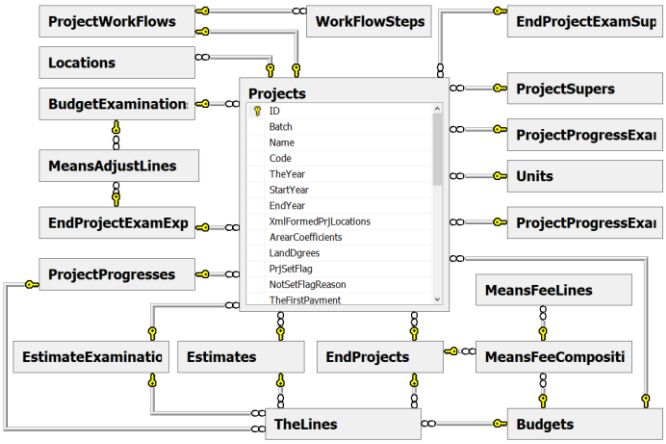

Figure 5. Main interface of system.

4. Realization of main functions of the system

4.1 Undertake the budget estimates of unit users and realize the functions of new projects

After logging in, the user of the project undertaking unit will enter the main interface of the fund management system, as shown in figure 6. Click the button of "budget estimate stage" on the left, and the button of "new project" will appear in the blank interface. Click to enter the interface of basic project information, as shown in figure 7. Fill in the project name, project

code, start year, end year and other information. When editing a continuation item, you need to specify which item the continuation item started from the previous year. If you cannot specify it, you should specify it in the text box "why the continuation item did not find the previous year item". Select the project and click the "details" button on the right side of the project to enter the project details interface. You can view all the information of the project, including the basic information of the project, budget estimate preparation, process information, and output reports.

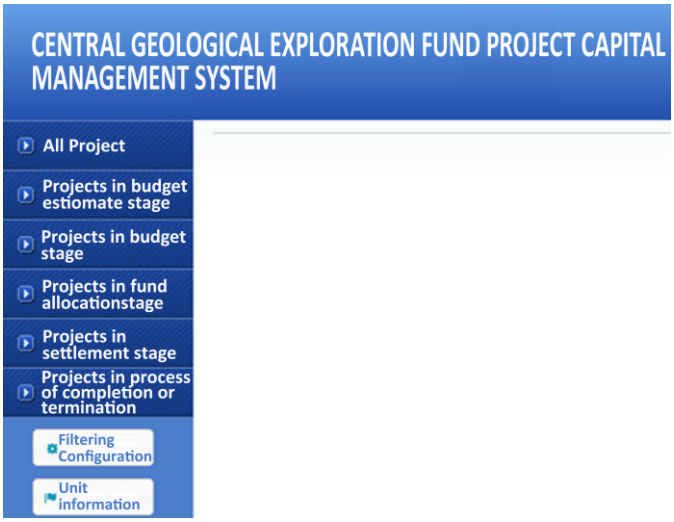

Figure 6. Main interface of system.

4.2 Implementation of economic expert user budget review function

After economic experts log in the system, enter the main interface of the fund management system, click the option of "budget stage", you can see the list of pending projects, click the button of "receive", you can view all the information of the project on the main interface. The job description shows the budget economics lead expert reviewing the project design budget. Click the function button of "budget review" to enter the basic information interface of budget review, as shown in figure 8. The economic expert has completed the budget review, click the "submit work" button at the upper part of the interface to enter the work submission confirmation interface, and click the "submit" button to submit the work to the expert team leader designated by the fund center in the previous step.

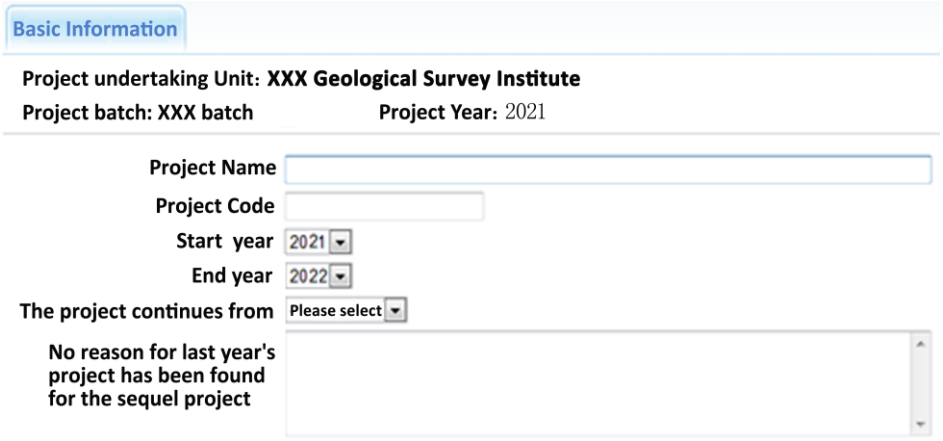

Figure 7. Basic project information screen.

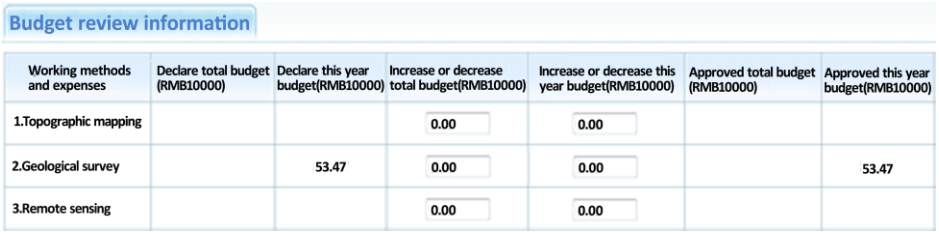

Figure 8. Budget review information editing screen.

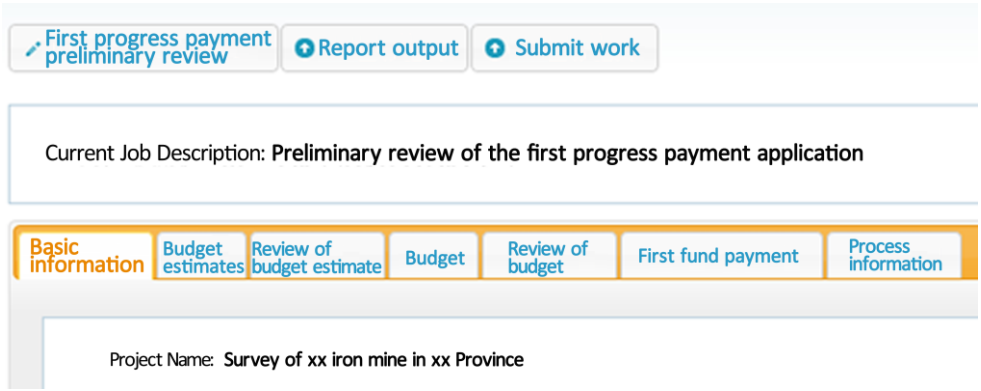

Figure 9. Project details screen.

4.3 Implementation of the first progress payment preliminary review function

The user of supervision department enters the main interface of the fund management system and clicks the option of "fund disbursement stage". The list of pending projects appears on the main interface. The supervision department user selects an item in the project list, and the project details are displayed on the main screen. You can view the project information. The job description shows the initial review of the first progress grant application, as shown in figure 9. Click the function button of "first application for disbursement preliminary review" to enter

the comment interface of supervision department. After editing the technical supervision opinions, economic supervision opinions and opinions of the department of supervision, the user of the department of supervision can click the "save" button to complete the function.

4.4 realization of user settlement management function of fund management center

The fund management center user enters the main interface of the fund management system and clicks the "Receive" button in the list of items to be processed, and the detailed information of the project will be displayed on the main interface, and the work description will show that the fund center will process the review results of the project settlement and conduct settlement handling. Click the "settlement handling" button to enter the settlement handling editing interface, as shown in figure 10. After filling in the final payment, the fund center user can click the "save" button at the bottom of the interface to return to the main interface of the system, and click the "submit work" function button on the main interface to enter the work submission confirmation interface. Select the radio button of "settlement completed, project completed" and click the button of "submit" on the interface to represent the completion of the project and enter the completion stage. Click to enter the main interface of the fund management system, display the detailed information of the project, the work description shows the completion of the project, and the final payment of settlement appears in the column of basic information, then the function is completed.

Figure 10. Fill in the final payment screen.

5. Conclusions

Based on the principle of being close to management and advancing step by step, this paper completed the construction of the central geological prospecting fund project capital management system, which covers four stages: the preparation and review stage of project budget proposal, the preparation and review stage of design budget, the fund disbursement stage and the fund settlement stage. It meets the functional requirements of four different user types, such as fund management center, supervision department, project undertaking unit and economic experts. This system enables the fund management center to not only know the execution of the funds of a single project at any time, but also monitor and manage the execution of the funds of different batches and years. It can realize the information, automation and networking of the whole process of the project capital management of the central geological prospecting fund and effectively meet the needs of the project capital management of the central geological prospecting fund. To ensure that the project capital management of the central geological prospecting fund is standardized and orderly.

References

[1] Luan P, Gao YZ. (2014) An introduction to the project budget management of the Central Geological exploration Fund. Journal of Economic Research, 19:148-149.

[2] Luan P, Liu XY. (2015) Research on the informationization of the whole process of project fund management of Geological Exploration Fund. Friends of Accounting, 17:43-46.

[3] Wang FR. (2021) Research on the Construction of Key Project Management Information System of Government Institutions. Heilongjiang Human Resources and Social Security, 20:1-3.

[4] Wang XT. (2017) Explore the Construction of Key Project management information System of Government institutions. Computer Products and Distribution, 10:259.

[5] Zhuang BQ, Xie XG, Zhu H, Hua MW, Zhang H. (2021) Water conservancy project construction project management information system design. Journal of modern information technology,13: 23-26.

[6] Liu XW, Luan P. (2022) Geological survey project budgeting system. Journal of design and realization of modern information technology, 18: 138-141.

[7] Li Q. (2021) Design and Implementation of Enterprise Information Management System Based on Three-layer B/S Architecture. Information and Computer (Theoretical Edition), 33: 126-128.

[8] Wei LX, Ren W. (2010) Using Ninject to decouple Small and medium-sized projects. Science and Technology Information, 34: 652+654.

[9] Wang YM. (2020) Application analysis of jQuery page loading in AJAX technology framework. Computer knowledge and technology, 36: 210-212.

[10] Luan P, Li XW, LIU XW. (2014) The Construction of Information with Regard to Working out the Budget of Geological Survey Project. Natural Resource Economics of China, 11:57-60.