

Development and application of web information system in enterprise management under SSH framework

Ziqiu Gao^{1*}

¹ Bishkek State University (BSU), Bishkek, 720001, Kyrgyzstan

* Corresponding Author: 18332182573@163.com

Citation: Gao, Z. (2023). Development and application of web information system in enterprise management under SSH framework. *Journal of Information Systems Engineering and Management*, 8(2), 22733. <https://doi.org/10.55267/iadt.07.13841>

ARTICLE INFO

Received: 23 Feb 2023

Accepted: 28 Apr 2023

ABSTRACT

With the development of information technology in society, many enterprises have set a set of enterprise information management systems for themselves. This paper proposes an Enterprise Management Information System based on the SSH framework for the Web. Firstly, the key technology in Web, Java 2 Platform, Enterprise Edition (J2EE), is combined with Spring-Strut-Hibernate (SSH) framework, and a lightweight solution of J2EE Web application is adopted to build a Web application with a clear structure, good reusability, and easy maintenance in a short period. The functional design and development process of the information system is explored and studied in detail, and computer software design and development technologies, tools, and methods are used to build an information solution for the enterprise project management business. The internal functions of the system are divided into project planning, implementation, suspension, change, evaluation, and result management, which can provide information technology tools to support the enterprise project management business according to its actual content and management mode. All key information of this system is stored in the database, and the database tables can be divided into system-like tables and project-like tables according to the design and definition classification. Finally, the implementation of some major functional modules in this system. The integration of the system SSH and the main public functions are implemented, and then the details of how the key functions such as user login, project information filling, and auditing are implemented in the enterprise project management information system, and how the document generation function is implemented after project approval. In this paper, the enterprise management information system performance test showed that the system response time, average occupancy rate of CPU, and memory during the test have reached the expected requirement. The maximum response time of 2.423 seconds, CPU and memory (physical) maximum average occupancy rate of 21.24% and 25.25%, respectively, all conform to the requirements of the performance index.

Keywords: Information System, SSH Framework, J2EE, Database, Enterprise Management.

INTRODUCTION

With the development and popularity of computer networks, computers have been applied to various fields, bringing revolutionary changes to all walks of life. Traditional office methods, such as written delivery and verbal notification, are increasingly showing their defects such as low efficiency, slow information transmission, inconvenient access to official documents, and waste of resources (Lin, 2010). Whether large enterprises or small enterprises are facing the rapidly changing market environment, they need to constantly adjust themselves according to changes in the outside world, rationally organize the resources and work processes of enterprises, and strengthen risk management. With the rapid

development of information technology and the acceleration of the pace of information exchange, the use of computer and software technology, the integration of advanced management theories, and the informatization transformation of enterprises have gradually become important ways to improve the management ability of enterprises. A high-performance management system platform has become an urgent demand in many enterprises (Wang, Feng, & Wang, 2013). An enterprise management information system is defined as a set of technical methods based on accepted management principles for planning, evaluating, and controlling work activities to achieve the desired end result on time, on budget, and according to

specifications. The Enterprise management information system is used to realize enterprise office automation. Through its construction will rely on the latest and mature technology of computers, improve the level of enterprise information, and realize the sharing and circulation of information resources within the unit. For leaders at all levels to understand the situation in a timely and rapid manner, to provide efficient and convenient services for macro management and scientific decision-making, and to grasp the dynamics of all aspects of the unit's staff. By freeing people from tedious, disordered, low-order, and low-end work and engaging in core affairs, the working efficiency and controllability of information of the unit can be improved as a whole, office costs can be reduced, and executive power and management level can be improved (Ying, 2016).

Currently, the research proposed by Carvalho et al. (2023) has become central not only to try to prevent/minimize risks, showing what has been done in this ICT field, but more importantly, the future direction to try to prevent or minimize possible risks; Kou and Sun (2019) designed an effective energy management system based on J2EE, researched and analysed the requirements of the system, and carried out a detailed design of some of the main functional modules of the energy management system; Pereira and Vaz (2016) studied the impact of analyzing variables related to governance, structure and economy on the economic and financial performance of Portuguese banking institutions; Zhang et al. (2006) proposed an engineering design management system architecture based on workflow technology and Web services, which solves the current problems in the engineering design management system by introducing a workflow hierarchical model and Web services, using the flexibility of workflow technology and the loosely coupled characteristics of Web services; Frogeri et al. (2022) studied the identification and analysis of factors affecting the adoption of ERP in SMEs, achieved through qualitative methods, inductive logic, explanatory epistemology and multiple case studies (six companies) of companies located in the southern state of Minas Gerais, Brazil.

In this paper, it proposes an enterprise management information system based on the SSH framework for the Web. Firstly, the key technology in the Web, J2EE, is combined with the Spring-Strut-Hibernate (SSH) framework, and a lightweight solution for J2EE Web application is adopted to build a Web application with a clear structure, good reusability, and easy maintenance in a short period. The functional design and development process of the information system is explored and studied in detail, and computer software design and development technologies, tools, and methods are used to build an information solution for the enterprise project management business. The internal functions of the system are divided into project planning, implementation, suspension, change, evaluation, and result management, which can provide information technology tools to support the enterprise project management business according to its actual content and management mode. All key information of this system is stored in the database, and the database tables can be divided into system-like tables

and project-like tables according to the design and definition classification. Finally, the implementation of some major functional modules in this system. The integration of the system SSH and the main public functions are implemented, and then the details of how the key functions such as user login, project information filling, and auditing are implemented in the enterprise project management information system, and how the document generation function is implemented after project approval. The performance test of the proposed enterprise management information system shows that the system's response time, average CPU, and memory usage all meet the expected requirements during the test period. The maximum response time was 2.37 seconds, and the maximum average CPU and memory (physical) occupancy were 20.04% and 24.83%, respectively, which met the performance requirement index values.

J2EE TECHNOLOGY AND SSH FRAMEWORK

J2EE Platform

Figure 1 is the J2EE platform architecture, we can see, that J2EE is developed on J2SE technology, which provides various companies with things, like notification services, system security, reliability, etc. The J2SE platform meets the functional standards of the environment related to the operation of Java. The various components of J2EE, including the company JavaBean (EJB), Servlet, and JSP, run inside the J2EE container and are accessed through connectors to the company's information management system, including databases, resource management systems, and related systems (Wang & Han, 2006). J2EE applications can integrate a full range of clients, including desktop and wireless clients, as well as clients that can browse the Web. J2EE provides a high-performance, secure, and scalable operating environment that supports the development enterprise (Quan & Jing, 2008).

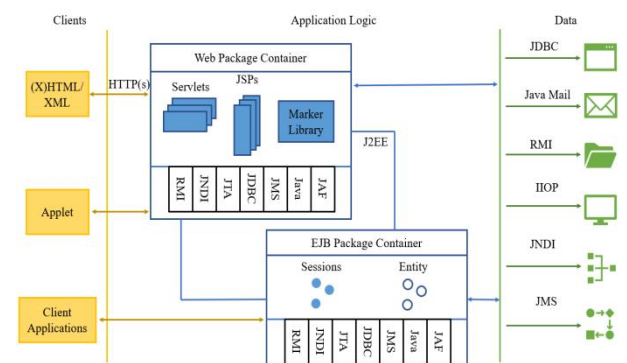


Figure 1. J2EE Platform Architecture

J2EE has a multi-layered end-to-end application system architecture. When designing J2EE applications, the first thing it must do is select the type of J2EE client. Then based on the user having the characteristics of the application in the link and the mode of use of the client required type and the

required communication protocol to make the appropriate choice, like the Java Web Start client is more suitable for more complex user graphical interface (Shan, 2013). Once it encounters a large amount of data and information entry as well as analysis and statistical aggregation of the entered data, it can choose the JNLP communication protocol when the user has a large number of interaction needs.

On the middle tier, the focus is on the application server and WEB server. In the implementation, the application server and WEB server can run on a single or multiple platforms. Here it needs to prepare a large number of application servers and WEB servers considering scalability and security (Mintchev, 2011), and the WEB servers receive the various requests sent to the client and dynamically generate the response through Servlet and JSP technologies, which can continue to call the enterprise running inside the EJB container of the application server. The JavaBean will then perform the processing of the business.

SSH Framework

Spring Framework

Spring is a lightweight J2EE framework that consists of several modules including IoC container, Spring AOP, Spring Web MVC, Spring DAO support, Spring ORM support, transaction management, etc. Its core is the control flip (IoC) and dependency injection DI mechanism. Spring uses the mechanism of set-value injection (using Setter methods to implement dependencies) and constructor injection (implementing dependencies in the constructor methods) to create IoC containers that can construct components (Luo, 2012). In this way, the required business components can be obtained directly through the container, without the need to write factory patterns, singleton patterns, or other methods of construction.

What was previously only possible with EJBs, Spring can do with basic JavaBeans. But Spring's use is not limited to server-side development. Any Java application can benefit from Spring in terms of simplicity, testability, and loose coupling (Bleck et al., 2003).

Struts Framework

For Web applications using the Struts framework, the processing reflects the characteristics of the MVC system, as shown in Figure 2 below.

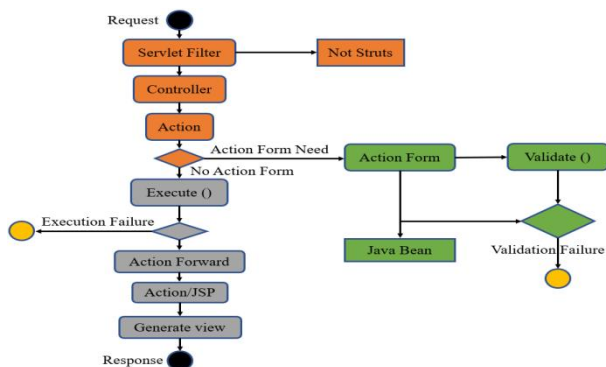


Figure 2. Struts Workflow

(1) The Action Servlet is loaded and initialized when the Web application is started. The Action Servlet reads configuration information from the struts-config.xml file and stores them in various configuration objects, usually storing the Action mapping information in the Action Mapping object (Anjomshoaa et al., 2006).

(2) Based on the request URI, the Action Servlet retrieves the <action> sub-element that matches the user request and determines the corresponding Action Mapping instance. If it does not exist, it returns a message that the user request path is invalid (Zhang et al., 2002). If it exists, the matching <form-bean> child element is retrieved from the configuration file based on its "name" attribute to determine the Action Form to be used in the next step.

(3) If the Action Form instance does not exist, create an Action Form object and save the form data submitted by the customer to the Action Form object.

(4) Decide whether form validation is required based on the configuration information. If validation is required, call the validate method of the Action Form.

(5) If the validate method of Action Form returns null or returns an Action Errors object that does not contain an Action Message, it means that the form validation is successful (Xu et al, 2016).

(6) The Action Servlet decides which Action to forward the request to based on the mapping information contained in the Action Mapping instance; if the corresponding Action instance does not exist, it creates the instance first and then calls the execute method of the Action to perform the corresponding business logic processing.

(7) The execute method of Action returns an Action Forward object, and the Action Servlet forwards the client request to the JSP component pointed to by the Action Forward object.

(8) The JSP component pointed to by the Action Forward object generates a dynamic web page and returns it to the client.

Access control (also known as authorization) is an important security control principle that determines who can and cannot do what. Whether it is an operating system, file system, database system, or any other system is necessary to implement an access control system to prevent malicious or improper use (Wang, 2011). In Java Web applications, access control is usually implemented both declaratively and programmatically using JAAS (Java Authentication and Authorization Service) and some other similar mechanisms.

The Struts framework is very extensible, and Struts has built-in support and can be extended to meet access control needs in either way, depending on which approach is chosen (Debruyne & De Leenheer, 2013). Struts have a role-based control mechanism to implement the declaration of secure actions. In struts-config.xml, each action has a role attribute, and it is possible to assign different roles to the same action, separated by commas:

```

<action path="/logon"
input="/index.jsp"
roles="user, manager, admin"
  
```

...../>

Hibernate Framework

Hibernate is a Java environment-oriented object/relational database mapping tool. Object/Relational Database Mapping ORM This term indicates a technique for mapping object model representations of objects to SQL-based relational model data structures.

Hibernate perfectly implements the complete mapping of relational records to persistent object relationships. It not only manages the mapping of Java classes to database tables (including the mapping of Java data types to SOL data types) but also provides methods for querying and fetching data, which can greatly reduce the workload of manipulating databases compared to using JDBC and SOL to manipulate databases manually using Hibernate (Wang, 2011). Hibernate is useful for applications that implement object-oriented business models and business logic in Java-based middle-tier applications. hibernate integrates well with a wide range of web servers or application servers, and today supports almost all popular database servers. It can help you eliminate or wrap vendor-specific SQL code, and help you convert result sets from a tabular representation to a set of objects.

Because Hibernate is so flexible and offers a variety of runtime composition options. The following diagram shows the "most comprehensive" architecture, which maximizes the encapsulation of persistence layer functionality and requires the least amount of development effort, making it one of the most commonly used approaches in development. The Hibernate architecture is shown in **Figure 3**.

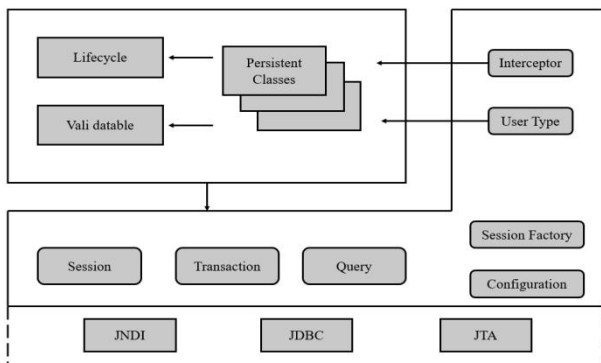


Figure 3. Hibernate Architecture

After applying Hibernate, the application interacts with the persistence layer from a thoroughly object-oriented perspective, avoiding the embarrassment of traditional object-oriented development in the data persistence aspect of non-object-oriented.

The Session Factory is called through the connection factory instance to add, modify, and delete database table records and call the Query to achieve database queries. Details are as follows:

(1) Hibernate configuration files: one is Hibernate.properties file, which is an ordinary text file, and the other hibernate.cfg.xml file, which is an XML format file. The Hibernate configuration file is the configuration file for the

database connection, which configures the connection driver, the data source, the database connection username, and the corresponding password (Li et al., 2009).

(2) POJO object: it is the so-called "Plain Ordinary Java Object". POJO objects need to be serialized, so they must implement the Serializable interface.

(3) Object-relational mapping file: *.hbm.xml is the mapping data type definition file of Hibernate, which defines the mapping content containing the source data required by ORM (Bruno, 2007). The source data contains the declarations of the persistence classes and the mapping of the database of properties, pointing to the foreign key associations of fields and other entities, and is the file that developers focus on designing.

(4) Connection Factory file: Connection Factory.java is the java class that creates the instance of session Factory is the factory of session, which corresponds to a data source, the relationship between session Factory and session is similar to the relationship between connection pool and connection.

ENTERPRISE MANAGEMENT INFORMATION SYSTEM BASED ON SSH FRAMEWORK

Information System Master Design

The functional model of the enterprise project management system is designed based on the SSH framework, and its general design is shown in Figure 3.1. Spring MVC in the SSH framework is used to realize the background forwarding of the system business operation requests and the management and maintenance of the foreground interaction views, and Spring components are used to manage and maintain the background business function objects of the system to realize the core function processing of the system (Li & Zhang, 2010). At the same time, the MyBatis component is used in the background to provide data object persistence engine services for the system during the background database management operations. The specific functional model design is shown in **Figure 4**.

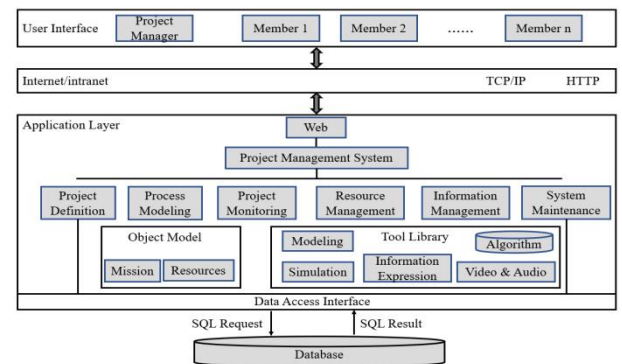


Figure 4. General Design of Information System

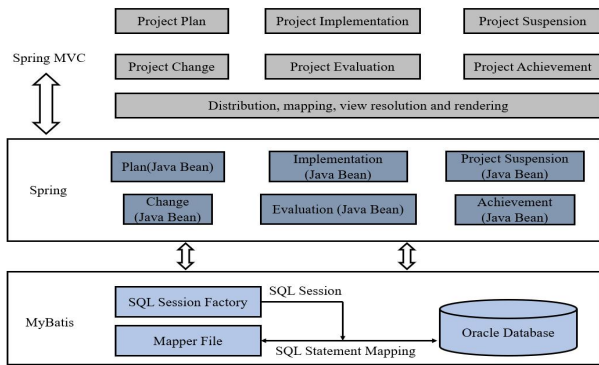


Figure 5. Schematic Diagram of the System Functional Model

As shown in **Figure 5**, in the functional model of an enterprise project management system, the Spring MVC component of SSH framework is used to realize the system user's Web on the client side. The distribution processing of the request submitted in the page and the mapping processing of the corresponding controller, as well as the view query analysis of the processing result after the completion of the background function of the system, the view rendering processing (the processing result is fed back to the client Web page for display) and other functions (Ko, Yang, & Lee, 2017).

The backend database management functionality of the system is implemented using the MyBatis component in SSH, in which the SQL Session Factory instance of the MyBatis component is used to provide SQL Session support (Chengalur-Smith, Duchessi, & Gil-Garcia, 2012; He, Teng, & Peng, 2009). The Mapper receivable file of the data entity class is also used to implement the mapping of specific SQL statements for database operations to respond to the backend database operation requests sent from the Spring container component.

The enterprise project management system was developed using Java Web technology. Therefore, the network structure of the system is designed in a B/S distributed application mode. The personnel involved in enterprise project management access and operate the system functions through the Web browser in their office hosts, and the intermediate network environment is the internal business network of Meishan Power Supply Company. The server side of the system is implemented by the server host deployed in the company's information room, where the Tomcat Web service, which is commonly used in Java Web applications, is used to publish functional software to provide network distribution and service response support for the core functions of the system.

Detailed Design of Information System

In the detailed functional design of the enterprise project management system, the functional structure of the system is designed in a modular way by encapsulating each functional requirement of the system, and the functional structure of the system can be obtained as shown in **Figure 6**.

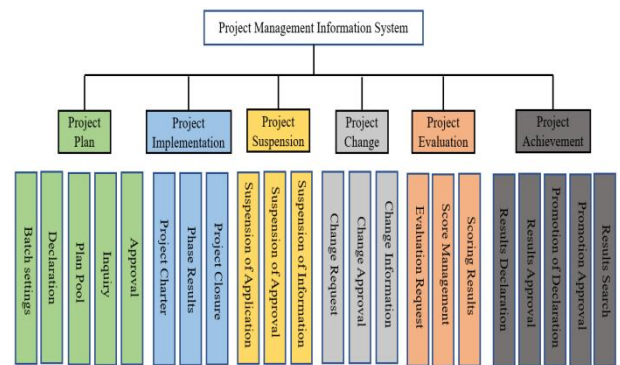


Figure 6. System Functional Module Structure

As shown in **Figure 6**, the project plan management module of the enterprise project management system includes five submodules: project plan batch setting, project plan reporting, project plan pool management, project plan query, and project plan approval. Three sub-modules are included in the project implementation management module: project charter management, stage results management, and project closure management (Trad, 2015). The project suspension management module includes three sub-modules: suspension application management, suspension approval management, and suspension information query. In the project change management module, there are three sub-modules: change application management, change approval management, and change information query. The project evaluation management module is divided into 3 sub-modules: project evaluation application, project rating management, and rating result query. In the project result management module, there are 5 sub-modules: project result declaration, project result approval, project promotion declaration, project promotion approval, and project result query.

Database Design

For information technology project management systems, the database is the information base for all functions. Database design is the process of providing a logical design that determines the best data model and processing model for a given application environment, as well as a physical design that determines a reasonable storage structure and access method for the database. A design process is established that reflects both real-world information and information linkages, as well as the ability to achieve system goals and access data efficiently on a given database management system (Kim & Suh, 2011). All key information of this system is stored in the database, which can be divided into system-like and project-like tables according to the design and definition classification. The structure and functions of each table are briefly described below.

System Class Table

System class tables mainly describe the system-related information, including users, roles, projects, files, workflows, and node connection information. They describe the definition of the system from various aspects and together support the system architecture.

(1) User Information Table: It mainly stores information

about users and establishes unique identifiers, authentication information, and personal information for users. The user

information table is shown in **Table 1**.

Table 1. User Information Table

Field Identification	Field Type	Allow Empty	Field Description
User_Sys_ID	Int	N	Internal user identification
User_Login_ID	Varchar (20)	N	User Login Name
User_Display_Name	Nvarchar (50)	N	User Name
User_Sex	Nchar (1)	N	User Gender
User_Email	Varchar (50)	Y	Email
User_Password	Varchar (32)	N	Password
User_Telephone	Varchar (50)	Y	Phone
User_Mobile_Phone	Varchar (50)	Y	Mobile Phone
User_Status	Int	Y	User Status
OU_ID	Int	N	Department ID

(2) Role Information Table: It stores the role-related information of the system, such as the name of the role, and

the role information table is the information source for role management. The role information table is shown in **Table 2**.

Table 2. Role Information Table

Field Identification	Field Type	Allow Empty	Field Description
Role_ID	Int	N	Role ID
Role_Name	Nvarchar (32)	N	Role Name
Role_Desc	Nvarchar (128)	Y	Role Description
Role_Status	Int	N	Role Status
Create_Date	DateTime (8)	Y	Create Time
Modified_Date	DateTime (8)	Y	Modify Date

(3) Task Module Node Information Table: It stores information related to task module nodes, such as the node number, the project number to which it belongs, and the node style (Liu, 2009). Task module nodes are the basic

elements that make up the system process, and the relative relationship between nodes is established by the node number and the next node number. The connection between two numbers constitutes a directed link between two nodes. The task module node information table is shown in **Table 3**.

Table 3. Task Module Node Information Table

Field Identification	Field Type	Allow Empty	Field Description
Link_ID	Int	N	Serial Number
Function_ID	Int	Y	Node Number
Project_Code	Varchar (50)	N	Item Number
Next_ID	Int	Y	Next Node Number
Rev Begin Time	Varchar (50)	Y	Program Start Time
Rev End Time	Varchar (50)	Y	Program End Time
Rev Day	Varchar (50)	Y	Planned Duration
File Day	Varchar (50)	Y	Intake Period
Execute Begin Time	Varchar (50)	Y	Actual Start Time
Execute End Time	Varchar (50)	Y	Actual End Time
Execute Day	Varchar (50)	Y	Actual Duration
Rev money	Nvarchar (50)	Y	Program Funding
Execute Money	Nvarchar (50)	Y	Actual Funding
Execute User ID	Int	Y	Person In Charge
Status	Int	Y	Status
Have File	Int	Y	Availability of Documentation
Style	Int	Y	Node Style

Project Tables

Project-type tables mainly describe project-related information, such as project contracts, funding, operation, etc. They keep project information closely related to each unit

and user and are the database for monitoring and optimizing project operations. Some of the more important ones are as follows.

(1) Project Information Table: This table stores specific information about the project, such as project name, number,

duration, contract, responsible person, etc., and can describe in detail the project attributes (Chu & So, 2020). **Table 4** is the

basic information table for project management.

Table 4. Project Information Table

Field Identification	Field Type	Allow Empty	Field Description
Project_Code	Varchar (50)	N	Project Number
Project_ID	Int	N	Serial Number
Project_Name	Nvarchar (50)	Y	Project Name
Work Flow_Code	Varchar (50)	Y	Workflow Template Number
Rev Begin Time	Varchar (50)	Y	Program Start Time
Rev End Time	Varchar (50)	Y	Program End Time
Execute Begin Time	Varchar (50)	Y	Actual Start Time
Execute End Time	Varchar (50)	Y	Actual End Time
Rev money	Nvarchar (50)	Y	Program Funding
Execute Money	Nvarchar (50)	Y	Actual Funding
First Node ID	Int	Y	Header Node
Last Node ID	Int	Y	Tail Node
Project_Instruction	Nvarchar (4000)	Y	Project Description
Contract Code	Varchar (50)	Y	Project Contract Number
Manager_Sys_ID	Int	N	System ID of the Person in Charge

(2) Project Funds Information Table: This table stores information about the project funds. Funds are the guarantee of project operation, and the input and flow of funds must be

clear, clear, and traceable, so the design of funds information is also particularly important. **Table 5** mainly stores the information on fund allocation units, contracts, and fund usage.

Table 5. Project Information Table

Field Identification	Field Type	Allow Empty	Field Description
ID	Int	N	Serial Number
Code	Varchar (50)	Y	Grant Order Number
Table_Date	DateTime	Y	Date of Filling the Form
Project_Code	Varchar (50)	Y	Project Number
Contract_ID	Varchar (50)	Y	Contract Number
Get_Units	Nvarchar (100)	Y	Winning Bidder
Get_Price	Varchar (50)	Y	Winning Bid Price
Request_Funds_Now	Varchar (50)	Y	Amount of This Request
Give_Funds_Now	Varchar (50)	Y	Amount of This Allocation
Given_Funds_Total	Varchar (50)	Y	Cumulative Amount of Appropriation
Build_Project_Man	Nvarchar (50)	Y	Project Leader
Used_Money_Now	Varchar (50)	Y	Amount Spent This Time
Left_Money_Now	Varchar (50)	Y	Current Balance

ENTERPRISE MANAGEMENT INFORMATION SYSTEM IMPLEMENTATION AND TESTING

User Module Implementation

After the user enters personal information and clicks submit, the system will perform page validation. This system is using Struts' Validator to implement the page validation function. The user will fill in incomplete or incorrectly, and the system should return specific error information to provide the user for correction (Lin et al., 2007). The validation rules for the fields on this page are defined in the xitong-validation.xml file in the WEB-INF\xitong directory.

Regis.jsp implements the page display layer and Action-Registration implements the business logic layer.

After the user enters the correct personal information on

the page, the page is first verified, and after the verification is passed, the Action bean takes out the personal information saved by the user (Lu, She, & Feng, 2009). Then it is stored in the User DTO object and then the save Info method is called, and finally, the user's information is saved to the database.

After the user's information is saved to the database, the Action Form outputs the message to the page via the forward method, defining a successful registration message in the Action Messages object. The real content of the message is in the resource file, while the keyword of a success message is stored in the Action Messages object.

The main code of the user registration implementation is as follows:

```
public void action Performed (Action Event e) {
    String str = e. get Action Command ();
    If ("registration ". equals(str)) {
```

```

User = new User ();
user. set User Name (jtf1. get Text ());
user. set Pass Word (jtf2. get Text ());
user. set Email (jtf4. get Text ());
String re Pass Word = jtf3. get Text ();
if (! (user get Pass Word (). equals Ignore Case (re Pass
Word))) {
jtf2.set Text ("Password input error ");
itf3.set Text ("Password input error ");
} else {
jf. set Title ("Register successfully" + "Welcome" + user.
get User Name ());
jtf2.set Text ("*****");
jtf3.set Text ("*****");
list. add (user);
}
} else if ("Login "equals (str)) {
try {
read From File ();
} catch (Exception e1) {
e1. print Stack Trace ();
}
}
}

```

The user enters the correct user's name and password. The program queries the backend database for the presence of the user's name and password by using the find By Login Name method (Ilayeruma & Zdravkovic, 2009). A username is found and the corresponding password is retrieved from that record by the user's name. If the password in the database is the same as the one entered by the user, the server-side will return true to the front end, and the Action Bean will receive the return value and output the correct message to the front-end page: "You have successfully logged in."

The main code for user login implementation is as follows:

```

public void match (User user) {
Boolean match = false;
for (User usr: list) {
if (usr. get User Name (). equals (user. get User Name ())
&& usr. get Pass Word (). equals (user. get Pass Word ()))
{
jf. set Title ("Login successful");
match = true;
break;
}
}
if (! match) {
if. set Title (" User name or password is wrong, please re-
enter! ");
jtf1.set Text ("")

```

```

jtf2.set Text ("");
jtf3.set Text ("");
jtf4.set Text ("");
jtf1. request Focus ();
}
}

```

Functional Implementation of Each Module

The process starts with entering the project task page, provided that the user has permission to edit the project task. Users click the "Add" button to enter the task editing page (Chung & Leung, 2007). After filling in the task information, click "Save" and the system will verify the information filled in. If the task holder already has another task in the same period, a prompt message will be given to ask to fill in the task again. If the time verification is passed, the project task list page is returned and refreshed.

The Task Edit screen is initialized by defining an Action From class Task Edit Form to handle HTML form input, validate the input, and display the form's prompt message (Dong et al., 2007).

In a Web application, each resource must be referenced by a URL. Resources include HTML screens, JSP screens, and custom actions. The user sends a request, which is usually a URL, or an address if you will, to first enter the task list screen and click on the "Add" button, for which the Struts framework provides an Action Mapping object. When the "Add" button is clicked, the Action Mapping instance matching the request is retrieved, and if it does not exist, a message is returned that the user's request is invalid.

Action Mapping is defined in the struts-config.xml file. The following is part of the code in the xml file:

```

<action-mappings>
<action path="/Task Edit Action.do"
type="cn. thsoft. thpms. action. Task Edit Action"
name="cn. thsoft. thpms. form. Task Edit Action"
scope=" request"
validate=" false">
<forward name=" success" path="/task edit. jsp">
</forward>
</action>
</action-mappings>

```

The work of each project team member is done according to the tasks assigned on the software project management system, and the daily reports are filled in after the work is completed according to the task completion status. When filling out the daily report, first select the user's ongoing task and then complete the work time and work progress (Abawajy et al., 2022). When saving the daily report information, the system checks whether the user's current work time conflicts with other daily reports and then saves the daily report information into the database. The assigner of the task will be automatically changed to the pending approver of the daily report, and the task progress corresponding to the daily report will also be modified.

simultaneously. If the user fills in the daily report directly without selecting a task, the approver of the daily report will be the user's department head.

If the operator is a project manager, he/she has to check the progress of the project members every day. First of all, he will search according to the defined conditions and then approve the daily reports he has seen so that he can have a good idea of the progress of each module of the project.

Ordinary users can only approve the progress of their assigned tasks, and this function is implemented on the page using JSP. That is, if the ID of the approver of the daily report is the same as the ID of the logged-in user, the "Approval" link is displayed, and the specific page code is as follows:

```

<logic: equal name=" day report" property=" project
Manager ID" value="">
  <bean: define id="user id" name=" day report"
property="user ID"/>
  <bean: define id=" date" name=" day report" property="
start Date Time"/>
  <a href="java script: postil ('<bean: write name=" day
report" property= "user ID">'
  '<bean: write name=" day report "property= "start Date
Time"/>');"
  class= "masthead-main link">
  <bean: message key= "day report. postil"/>
  </a>
  <bean: message key=" day report. postil. null"/>
</logic: equal>
<logic: not Equal name=" day report" property=" project
Manager ID" value="">
  <bean: message key=" day report. postil"/>
</logic: not Equal>
    
```

After the daily report is approved, the page will be automatically refreshed with the daily report information, which is convenient for the user to take the next step.

Information System Test Analysis

By the testing objectives of the system and the general specifications for testing business-oriented software, the system uses the testing workflow as shown in Figure 7.

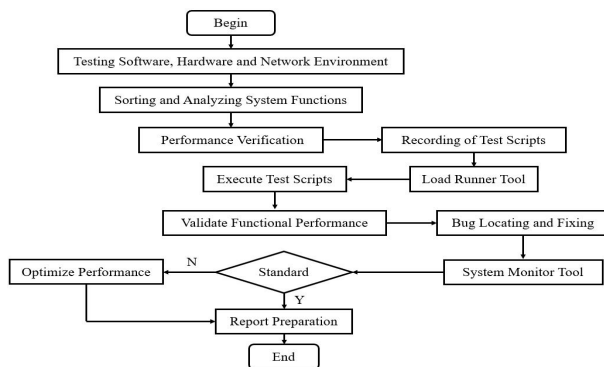


Figure 7. System Test Flow

As shown in Figure 7, in the testing of this system, the

automated testing, including functional and performance testing, is mainly performed through the LoadRunner tool in the client.

Functional testing is performed by preparing test cases for all functional items of the system recording test scripts in LoadRunner and performing functional verification and analysis of the system using automated script execution in LoadRunner. Performance testing was also implemented through the simulated concurrency mechanism of the LoadRunner tool to check the performance criteria of the system based on the simulated concurrent load environment (Wei & Li, 2006). Finally, after optimizing the performance of the system by fixing the functional bugs, the system is evaluated and the test report is prepared in general.

In the performance testing, 200 virtual users were simulated in each of the six client hosts mainly through the LoadRunner tool with the following configuration parameters.

- (1) Concurrency: 200 (a total of 1200 virtual users access load simulated in 6 hosts)
- (2) generation selection method: one-time load pressurization
- (3) Test mode: Internet Explorer mode (for Web service testing)
- (4) Test protocol: HTTP protocol
- (5) Test duration: 3 hours

Meanwhile, after all the above transactions are processed, log into the System Monitor tool of the system server to check the system performance indicators, including the average CPU/memory usage, response time, etc., and get the results shown in Figure 8, Figure 9, and Figure 10.

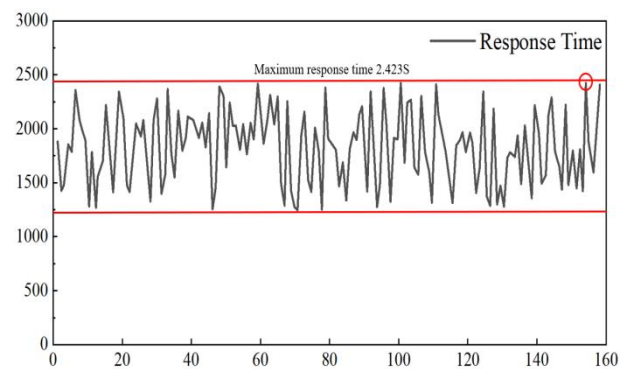


Figure 8. System Response Time

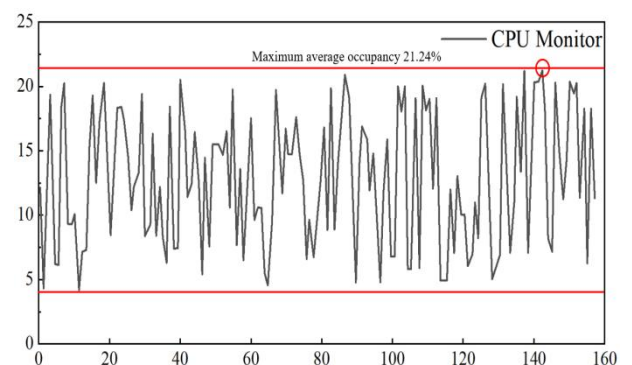
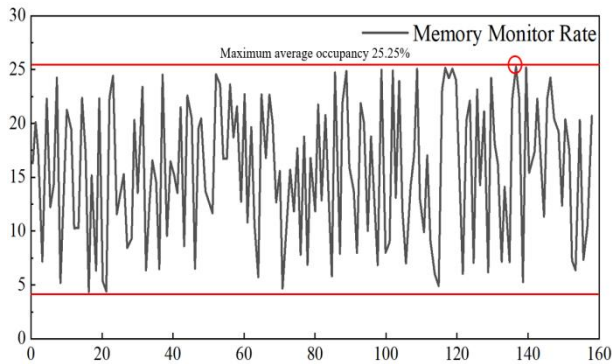


Figure 9. Average CPU Occupancy**Figure 10.** Average Memory Usage

As shown in **Figure 8**, **Figure 9**, and **Figure 10**, the system's response time, average CPU, and memory occupancy met the expected requirements during the test period. The maximum response time was 2.423 seconds, and the maximum average CPU and memory (physical) occupancy was 21.24% and 25.25%, respectively, which met the proposed performance requirements.

CONCLUSION

Enterprise project management information system realizes effective management of enterprise projects, focuses on preserving experience documents and project personnel insights accumulated in each step of the project and preserves project-related knowledge and experience to a certain extent. In this paper, based on J2EE technology and SSH framework, the enterprise management information system is proposed, and the functions of each module of the system are designed and implemented, and the specific results obtained are as follows.

This paper uses the open platform J2EE, combined with the Spring-Strut-Hibernate framework, in which Spring MVC components and MyBatis components are selected for the design of the information system. The system functional module design includes project plan management, project implementation management, project suspension management, project change management, etc. All key information is stored in the database, and the database is divided into a system class table and a project class table according to the design and definition classification.

This paper realizes the integration of the information system SSH and the main module functions. The validation function of the user registration page is implemented through Struts' Validator, and the validation rules of the fields in the page are defined in the `xitong-validation.xml` file under the `WEB-INF\xitong` directory. Specify the implementation method of project task management and project daily report management in the process of module function implementation.

In the test, the response results of the information system functions are verified by simulating the end user's Web service operation based on the LoadRunner automation test

tool. At the same time, the System Monitor tool in the system server host checked the concurrency, response time, and CPU/memory resource usage of the system. The final results showed that the maximum response time of the information system was 2.423 seconds, and the maximum average CPU and memory (physical) occupancy was 21.24% and 25.25%, respectively.

Limited to the current state of the enterprise, the system is designed to have a unified configuration process by the system administrator. Although the current stage can meet the user requirements, in the long run, with the expansion of business, and process changes, future research can start from the custom tools. It allows users to flexibly control, but also reduces the burden of system administrators, and enhances the system's ease of operation.

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