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# Research on Knowledge Base System Based On UML and JQueryEasyUI

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## ABSTRACT

Aiming at the problem of complex bearing information in a company, the process of developing a bearing information knowledge base system (KBS) was studied, the modeling technology of UML and the technical framework of jQueryEasyUI were analyzed theoretically, then a method about using UML modeling to plan the development mode and system architecture of software product was proposed, finally, the friendly available KBS modules could be developed by using jQueryEasyUI. System framework, bearing module and finite element simulation curve module in the bearing information KBS were treated as examples, the process of KBS by using UML and jQueryEasyUI to assist in software development was introduced. The results indicate that the modeling technology of UML for determining the software requirements and defining the information architecture in modules of bearing information KBS was efficiently, the reuse of jQueryEasyUI could improve the speed of bearing information KBS development with modularity, based on meeting the goal of KBS, the efficiency could be improved.

**Keywords:** Bearing information, KBS, UML, jQueryEasyUI, Software development.

## 1. INTRODUCTION

Knowledge base system [1] (KBS) contains the theoretical knowledge and factual data related to one field, which are stored in computer by some representative options and express the knowledge of problems solving explicitly. According to the requirement analysis, the set of software functions decompose into modular executable program units, by using different technology framework to achieve program units [2]. Wu Jun, Jin Cheng Qian [3] collected the knowledge about design and evaluation of Human-Computer Interface in the driving room of agricultural equipment, applied the object-oriented approach based on these features, and used the representation method of frame knowledge to develop a certain KBS. In the PLA Information Engineering University, Zhou Jie [4] designed a kind of entity KBS architecture and integrated the technology related named entity effectively. In Germany, AV Robin Andersson, ski and Jan Komorowski [5] presented a user-oriented view of RoSy, a Rough Knowledge Base System. The system tackles two problems not fully answered by previous research: the ability to define rough sets in terms of other rough sets and incorporation of domain or expert knowledge. In America, S Corporatoin [6] developed a system for linking medical terms for a medical knowledge base system, which generates medical knowledge base information by using predetermined data source specific message syntax information in identifying first and second information received from first and second data sources respectively.

Above all, the development mode of the KBS is generally based on the actual demand, and the reuse of the technology about KBS developing is seldom involved. These studies lack of combing of functions of KBS and reusing the existing technical scheme or framework.

## 2. THE KEY TECHNOLOGIES OF UML AND JQUERYEASYUI

### 2.1 The UML

Unified Modeling Language (UML) [7] is adopted as the industry standard by OMG [8] (Object Management Group). The application of UML not only for business modeling but also other types of modeling, it is that a graphical language for modeling and software development which provides modeling and visualization support for all phases of software development. UML has 3 basic building blocks: thing, relationship and diagram. It defines five kinds of views from different points of system [9] and each view corresponds to a specific research system respectively. The five kinds of views including Use-Case Diagram, Class Diagram, Object Diagram, Sequence Diagram and others, total of nine kinds of diagram about static and dynamic included. As shown in

Table 1.

**Table 1.** Five kinds of views in UML

| View | Static Diagram | Dynamic Diagram |
|---|---|---|
| Use Case View | Use-Case | |
| Logical View | Class, Object | Statechart , Sequence, Collaboration, Activity |
| Component View | Component Diagram | |
| Concurrent View | Component, Deployment | Statechart, Sequence, Collaboration, Activity |
| Deployment View | Deployment | |

Use Case View is used to describe the set of functions that the system should have, which is an abstract representation from views of the external users and aims to define the functional requirements of the system, and to achieve the interaction between user and the system. Logical View reveals the state of design and collaboration in internal system and display the designing process of functions, using Class Diagram and Object Diagram to describe the static structure, using the Statechart Diagram, Sequence Diagram, Collaboration Diagram and Activity Diagram to describe the dynamic behavior. As shown in Figure 1, Use-Case Diagram shows a number of roles and the connections between role and use-case provided by system. Class Diagram shows the relationships between class and class. Object Diagram is an instance of class diagram, and usually is a complex Class Diagram to describe the relationship between object contained in the specific time. Sequence Diagram is used to show the interaction between objects and reflect the dynamic cooperation between objects.

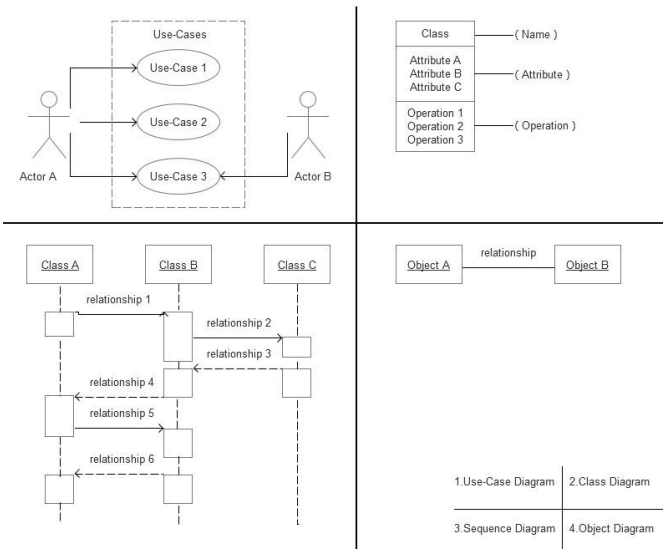


**Figure 1.** Four kinds of diagram in UML

## 2.2 The jQueryEasyUI

JQuery [10] is a lightweight and multi browser compatible Javascript library, its core ideas are writing less and doing more. JQuery allows user to handle HTML, events and animation effects more easily, and is convenient for the website to provide AJAX interaction. Modular approach allows developer to develop powerful static or dynamic web pages easily. EasyUI [11] is a set of UI plug-in based on jQuery, simple to define the user interface and quick to provide the technical framework of modular reusing, cause to reduce time and size in software development because of simple and powerful performance. Here are two ways to declare the UI component.

(1) In HTML

dialog content.

(2) By JavaScript

<input id="" style="" />

$('').combobox ({ url:, required:, valueField: ', textField: '});

## 2.3 Application in a case

Giving a module named A Class from KBS. There are three attributes in A Class: Attribute A, Attribute B, and Attribute C. For each attribute, there are three operations to handle: Operation A, Operation B, and Operation C. In this module, two roles have access to it: Actor A and Actor B, Actor A has the authority of three kinds of operation, Actor B has the authority of two kinds of operation. Above all, based on UML modeling to get Use-Case Diagram and Class Diagram, as shown in Figure 2.

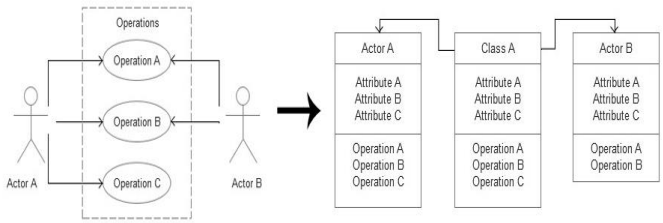


**Figure 2.** UML for A Class

According to the set of functions about A Class, it can be determined by EasyUI Operation A technology framework, Operation B EasyUI technology framework and Operation C EasyUI technology framework in jQueryEasyUI to carry out the module software development. Code as follows:

if (actor=Actor A)

{ id="Operation A", id="Operation B", id="Operation C", true }

else if (actor=Actor B)

{ id="Operation A", id="Operation B", true }

## 3. THE DESIGN OF BEARING INFORMATION KBS

Aiming at the problem of complex bearing information in a company caused by accumulation of knowledge, based on the requirement of production process, a bearing information KBS needs to be developed. In the process of building bearing information KBS, the main work is to transfering existing knowledge sources into knowledge module and storing in the KBS, based on the demand analysis to develop

a KBS by UML and software development technology, including jQueryEasyUI. UML for knowledge sources of research and analysis, JQueryEasyUI as a software development technology, as shown in Figure 3.

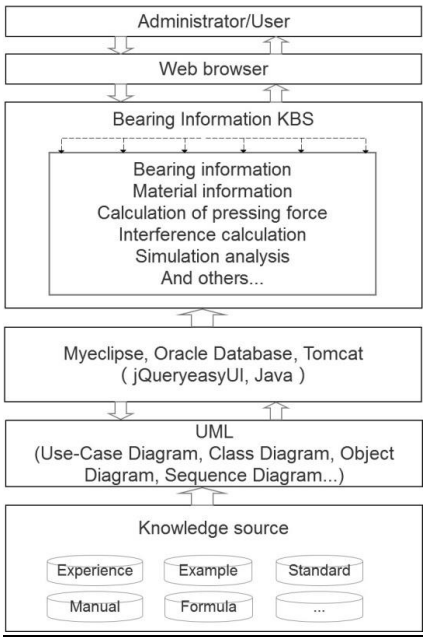


**Figure 3.** The process of constructing of bearing information KBS

### 3.1 Logical structure of bearing information KBS

According to the usage pattern and the characteristics of object-oriented in bearing information KBS, the B/S [12] (Browser/Server) structure is adopted to reduce the cost, workload of the system upgrading and maintenance in the production process, as shown in Figure 4. The user access server through browser, server installed in the Oracle database, and the Server Web for the browser to interact with data in database server.

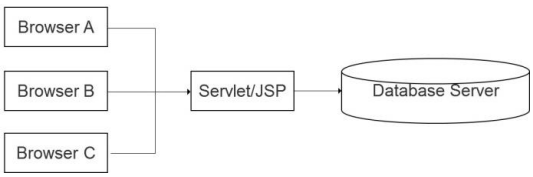


**Figure 4.** The structure of bearing information KBS

### 3.2 Framework of bearing information KBS

Knowledge source of bearing were carried out based on the demand analysis and sorting by using UML, and the bearing information KBS by means for a structured and hierarchical model. The KBS was divided into Bearing Base module, Material Base module, Data Processing module, Calculation & Analysis module, Bearing Assembly Reference module and User Management module. The framework of bearing information KBS expressed by Class Diagrams in UML as shown in Figure 5.

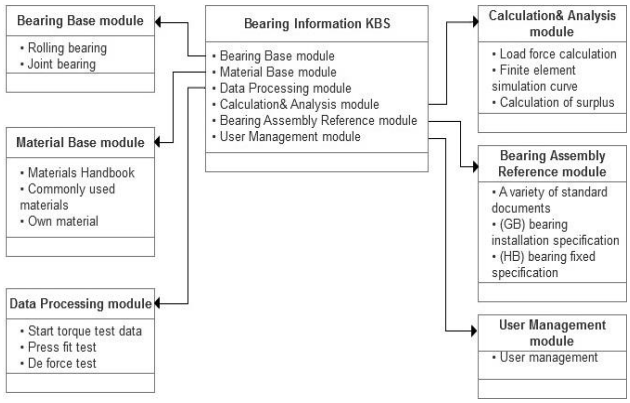


**Figure 5.** The framework of bearing information KBS

### 3.3 Technologies about bearing information KBS

In the researching and producing about bearing in reality, large amount of data are books of paper material, based on these data that could be realized by electronic reading and stored by using database technology, finally, the database of project could be established by web technology. In database, table selecting accords to the type and size of data, but such as SQL server, Oracle, MySQL, etc. each have a set of related standards, the problem of object-oriented doesn't match relational database could be solved by using the technology of Object Relational Mapping [13] (ORM), namely, metadata which descript mapping between object and database, then object in Java program could be automatically persisted to relational database. Essentially it is that the data conversion from one form to another, and then the Java program with JS/CSS technology will be stored in the data and displays in the web (Browser). Before formal development of bearing information KBS, the software architecture and technology scheme of the KBS need to be analyzed and arranged by UML, and making full use of the JSP page technology for realizing function layout, with the aid of jQueryEasyUI technical framework to develop the KBS in modular. The bearing information KBS with B/S structure, and the development language is Java, the development tool is MyEclipse10, the development database is 11g Oracle.

## 4. APPLICATION IN BEARING INFORMATION KBS

### 4.1 Displaying of system framework

In the bearing information KBS, the system was modeled by Class Diagram of UML, and then the framework of system was determined, as shown in Figure 5. The function of displaying system framework was realized by using Tree EasyUI of jQueryEasyUI. Tree EasyUI displays hierarchical data with the tree-structure in web page, provides user with the functions of expansion, folding, drag, edit, and asynchronous loading, and uses loadFilter to process JSON data from web ASP.NET services. Code as follows.

```
$('#SystemFrame').tree({
    url: ,
    loadFilter: function(data){
    }
});
```

Using Tree EasyUI could fully display the framework of

bearing information KBS, according to the system framework in Figure 5, the final result as shown in Figure 6.


**Figure 6.** Displaying of system framework

### 4.2 Bearing Base module

In the Bearing Base module, bearing was divided into two categories with rolling bearing and spherical bearing, including ordinary self-aligning ball bearing, deep groove ball bearings, U/UG/UC joint bearing and various other types. Each bearing interface shows a list of information with the functions of addition, deletion, modification, query, download the Excel table and others. In the bearing information KBS, there were roles of administrator and ordinary user with different set of the functions. Above all, the models of this part were built by Use-Case Diagram and Class Diagram in the UML, as shown in Figure 7 and Figure 8.

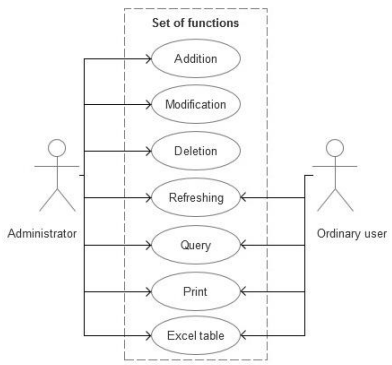


**Figure 7.** Use-Case Diagram of Bearing Base module

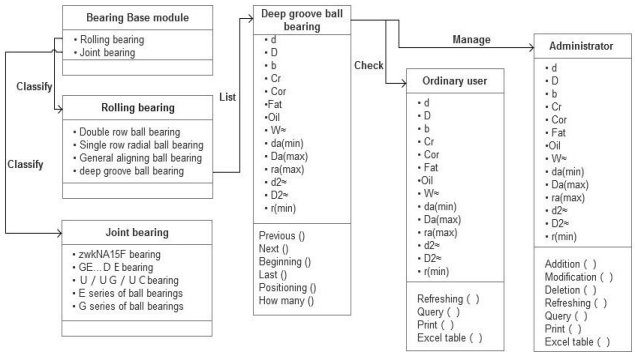


**Figure 8.** Class Diagram of Bearing Base module

With the deep groove ball bearing as an example, for the demand information which described in Class Diagram of UML, displaying of attribute information was adopted by EasyUI DataGrid of jQueryEasyUI, operating of attribute information was adopted by EasyUI Pagination of jQueryEasyUI, operating of cases was adopted by EasyUI Linkbutton of jQueryEasyUI.

EasyUI DataGrid shows the data in tabular format, provides rich support for selection, sorting, grouping and editing data, and it is lightweight and rich in function. Its features including cell merging, header-columns, footer and column freezing. EasyUI DataGrid could be created by JavaScript. Code as follows.

```
<table id="deep groove ball bearing"></table>
$('#deep groove ball bearing').datagrid({
    url:'',
    columns: [ [ ]]
});
```

EasyUI Pagination allows user to navigate data by flipping, and it supports configurable options for page navigation and page length selection. User can add a custom button on the right side of the page to enhance the function. EasyUI Pagination could be created by JavaScript. Code as follows.

```
<div id="deep groove ball bearing" style=" "></div>
$('#deep groove ball bearin ').pagination({
    total:,
    pageSize:
});
```

EasyUI LinkButton is used to create a hyperlink button and is a normal representation of <a> markers. And it can display icons and text, or just display one of them. Button width of EasyUI LinkButton can be dynamically contracted or extended to fit the text label. Creating a EasyUI LinkButton from the tag is easier. Code as follows.

```
<a id=" " href="#" class="easyui-linkbutton" data-options="iconCls:'icon-'">easyui</a>
```

The ultimate interface of deep groove ball bearing as shown in Figure 9.

**Figure 9.** The interface of deep groove ball bearing in Bearing Base module

### 4.2 Finite Element Simulation Curve

In the Data Processing module of bearing information KBS, displaying of Finite Element Simulation Curve was determined by selecting bearing type, amount of interference and friction coefficient, which had been stored in database. The Finite Element Simulation Curve was modeled by using Sequence Diagram of UML, as shown in Figure 10.

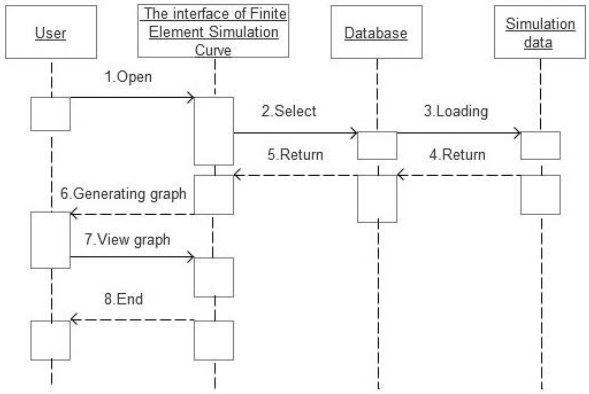


**Figure 10.** The process of Finite Element Simulation Curve

Aiming at the selection of information in the existing list to judgment the outputting data, it could be achieved by using EasyUI Combobox of jQueryEasyUI. The EasyUI Combobox displayed editable text box and drop-down list for the user to select one or more values, and the user also can type text directly to the top of the list. Code as follows.

```
<input id=" FES Curve " name=" FES Curve " value=" ">
$('# FES Curve ').combobox({
    url:'',
    valueField:'id',
    textField:'text'
});
```

The ultimate interface of Finite Element Simulation Curve as shown in Figure 11.

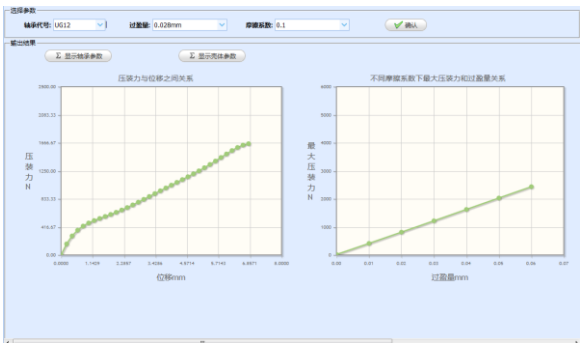

**Figure 11.** The interface of Finite Element Simulation Curve

## 5. CONCLUSIONS

This paper puts forward a new technical scheme for achieving the goal of building KBS based on ordinary implementation, the model of software development and system architecture are planned by using UML, and then a friendly available KBS module could be rapidly developed by using jQueryEasyUI framework. Based on the study of UML and jQueryEasyUI, the system framework, the bearing base module and the finite element simulation curve module were treated as examples and the process of UML and jQueryEasyUI to assist in software development was introduced. The results indicate that the modeling technology of UML for determining the software requirements and defining the information architecture in modules of bearing information KBS was efficiently, the reuse of jQueryEasyUI can improve the speed of bearing information KBS development with modularity, based on meeting the goal of KBS, the efficiency could be improved.

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