

Construction of Java EE Project Case Database based on Automatic Code Generation

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Abstract—The project-based teaching helps to stimulate students' enthusiasm for learning and to improve their ability to solve practical problems. To a certain extent, the quality of the case database affects the quality of project-based teaching. This paper proposes a case database generation method based on code automation technology and implements a code automatic generation tool to complete case code reconstruction, which could ensure completing the construction of the case database quickly and with high quality.

Keywords—Project-based teaching; Code automation; Case database; Java EE

I. INTRODUCTION

With the development of vocational education reform, more and more attention has been paid to the practice teaching. The teaching method based on constructivism, such as project-based teaching and case-based teaching, is more and more mature. Project-based teaching is a teaching method [1], where the teachers allocate the project tasks, and the students are responsible for the complete project development. Through the complete process of participating in the development of the project, the students combine the theory and practice closely, and stimulate the enthusiasm of learning and improve the ability to solve practical problems. Therefore, more and more educators have paid attention to the project-based teaching [2-5].

In the project-based teaching of vocational colleges, project case resources are relatively old and lack of supply, especially for new cases closely related to students' surrounding life. In order to change the situation, the vocational colleges usually build case database through school enterprise cooperation mod, and convert the real project or training project into a project case which are suitable for higher vocational education. Enterprise projects are usually adopted the mature Java EE framework with a hierarchical development way. In general, after two-year studies of basic knowledge, the students of vocational colleges are still certainly far from matching the skills to the competencies required for the job. Therefore, it takes a lot of time to convert the projects when the case database is built through school enterprise cooperation mod. According to the students' ability, the enterprise project needs to be tailored into a practical case for the higher vocational students, which will seriously affect the case number of the case database.

"Java EE enterprise application and development" is the core course of the software technology major in higher vocational education. It has been set up on the basis of JSP dynamic web design course and Java programming course for improving the students' ability to analyze and solve problems, developing the occupational qualities of dynamic web project implementation technology and the software project development. It is necessary to let the students to master the professional skills and professionalism of Web programming, program testing, project implementation, and project maintenance based on Java EE technology through a large number of project case practices. The contradiction between the lack of cases and the goal of school curriculum become more prominent. How to develop a Java EE case library for higher vocational education quickly and efficiently has brought new challenges to professional teachers in Colleges and universities.

II. CASE BASE CONSTRUCTION SCHEME

It showed through the enterprise on-site investigation and study as well as questionnaire survey result that the dynamic web projects in the enterprise are mainly the management information system (referred to as MIS) associated with the operation of the database. Therefore, the cases in our case database are mainly based on the MIS. According to statistics, there are a large number of program codes related to the relational data model in the management information system, and the program codes related to the database are up to 50%~70%. And the database related codes are mainly providing Create-Read-Update-Delete (CRUD) access to domain information. So the codes have a very high similarity, and the code automation technology can be used to generate the project codes in the case.

The construction of case library is based on the idea of "job - typical tasks - teaching case" to develop Java EE teaching case library. Through the enterprise on-site investigation, survey of the vocational college graduates and survey of the recruitment web sites, we acknowledge that the students of the software technology major are mainly trained as the Web development engineers. And then the typical tasks of the Web development engineer are determined through in-depth investigation of the enterprises, especially the interview with the enterprise engineers. Through the analysis of typical work tasks, the knowledge points and skill points needed to

accomplish these tasks are determined. Finally, the case database is selected and constructed according to the knowledge skills. The project case is for the purpose of service teaching, so the case should contain as many knowledge points as possible.

A. Determining the typical work tasks of enterprise

The target post of Java EE enterprise application development course is mainly Java Web developer. The typical tasks of Java Web developer are: 1. accepting work tasks, understanding requirement analysis and outline design. 2. According to the assigned tasks and project development progress, carrying out detailed design of modules and interface design, and writing corresponding detailed design documents. 3. Designing the system interface, writing codes according to the specifications, and modifying and refining the module codes in time. 4. according to the progress of development, cooperating with the test engineer to do the software testing, and completing the modification of software bugs. In the code writing aspect, it includes the following tasks: the front Web interface design, data validity check, database access, Web request process implementing, enterprise business logic processing, and resource access control. Therefore, our cases should include requirements and summary design documents, as well as detailed design of document template, test document template and complete source code.

B. Identifying the points of knowledge and skill

On the basis of work task analysis, we will further determine the knowledge points and skills needed to accomplish these tasks. After analysis, we confirm that the knowledge points and skills are: mastering the development of dynamic web pages, using JavaScript to verify HTML data, using CSS style sheets to beautify pages, mastering the use of Spring MVC, mastering the use of Spring, mastering database operation with JdbcTemplate, and mastering service layer function development.

C. Collecting project cases

We must include the above knowledge points and skills points in our project cases. The main source of the case is real business projects, which can be business projects or internal training projects of enterprises. When choosing a case, we must pay attention to the practicality and novelty of the case, as close as possible to the reality of the students' life, and let the students enter the case, so as to stimulate the interest of the students. Here we choose the following projects: online group buying system, online ordering system, online electronic shopping, knowledge management system and online book sales system.

D. Generating case database

After the selection of the enterprise project cases, the enterprise project must be reorganized, including the rewriting of the requirement documents of the project and the reconstruction of the project codes. Considering the similarity of the project codes, we use the template based code automation technology to regenerate the project codes, and the codes generated by the automation tool are more standard,

making the project cases more suitable for the knowledge structure and skill level that students have mastered at present.

The whole case database construction process is shown as shown Fig 1. Through automated code tools, case codes can be more standard, which will make the cases in the case database more standardized, and help to improve the quality of case database. When new cases are introduced in the case database, the teachers only need to write the project documents, and then generate case codes quickly through code automation tools to complete the construction of the case. Therefore, the construction scheme of Java EE project case database based on automatic code generation in this paper can improve the construction speed of case database, facilitate the introduction of new cases and update the existing cases, and can also reduce the workload of the case generation by the teachers. The code automation tool is the core of our case database construction scheme. Next, we will focus on the code automation tool of this article.



Fig. 1 Case database construction process

III. THE CODE AUTOMATION TOOL

Code automation technology is to generate application codes through computer software, reduce the work of developers, reduce the error rate of the program, and improve the development efficiency [6]. In this paper, we use code automation technology to help us generate project case database. There are mainly 2 kinds of code automation technologies [7-10]:

A. Template-based code generation technology

The codes are divided into the invariant part and the variable part, and written into the template files with different forms. According to the database table structure, the dynamic part is replaced by the code related to business logic by a template parser. Template-based code generation technology is relatively simple.

B. Model-driven code generation technology

The model-driven technology separates the model of the software system into a platform independent model and a specific platform model. The platform independent model is between the requirement analysis and the design, and is responsible for converting the requirements into the design, while the specific platform model is between the design and the coding. The purpose of the model is to convert the design into the code. This method can only generate general framework of application, and also requires programmers to do a lot of coding work.

We use template-based code automation technology to generate case codes. The code automation tool in this paper is mainly composed of four parts: data files, business rule files, template files and code generator.

Data files: we use the XML files to describe the database table structure (including field information in the database table, such as field type, field name, field size, primary key, foreign key, etc.), as well as the relationship between database tables. The database table will correspond to an entity class. In order to facilitate the generation of the entity class, the database table field will adopt a unified naming method, and the field names are connected by the symbol "-" between the words.

Template files: our case is based on Java EE technology. The case codes are divided into the controller (Action) layer, the service layer, the database access (DAO) layer, the view layer, and the entity model. We define the corresponding template files separately, and insert the invariant part into the template in the way of the static codes, and insert the variable part into the template with the form of "\${variable}".

Business rule files: for each function in a case, we need to define business rules. For example, we need to specify query conditions (Which data table fields are queried) and display fields by query results for a query functionality. For example, we need to specify which fields need to be displayed on the query page and which fields need to be inserted into the database table for an add functionality. The business rules files are also defined in the form of XML files.

Code generator: the code generator will read the data files and the business rule files, obtains the data table structures according to the data files, and generates the corresponding entity model. Then, business logic is determined according to the business rule files, and the controller, service layer, database access layer and view page code are generated. Code generator uses a template file content replacement method. For example, when creating a add functionality page, the code generator will produce a field list form needed to be added to the page based on the business rule file, then read a template file, replace the dynamic part with the field list form, and generate the add functionality page.

IV. CONCLUDING REMARKS

Project-based teaching is using a combination of theory and practice way, which is conducive to developing students' practical skills and improving students' ability to solve practical problems. The project-based teaching, taking the project as the carrier and taking the student as a center, fully arouses the enthusiasm of the students, and improves the students' professional skills and professional qualities through the completion of the entire project tasks. To a certain extent, the quality of the case database affects the quality of the project-based teaching. A high quality and content-rich case database can attract students' interest, stimulate students' enthusiasm for learning, and help improve students' understanding of the Web development engineer job in software enterprises.

Through the investigation on the Java Web programmer job of the software enterprise, typical work tasks are determined. We then analyzes the knowledge points and skills points needed to complete the typical work tasks, and selects the

appropriate enterprise project according to the knowledge and skill points, and combines the existing knowledge base of the students to customize and tailor the project. Finally, with the combination of data file, template file and business rule file, a code automation software based on Java EE architecture is developed, which can be used to reconstruct the code of the case project. The case database of this paper is based on the typical tasks of the enterprise. The project case is helpful to the training of the students' professional skills and professional qualities. At the same time, the code automation technology has been adopted to greatly improve the quality and speed of the construction of the case database.

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