Design and Implementation of a College Evaluation System for Undergraduate Education Based on UML

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Abstract

Evaluating the operation of undergraduate education in colleges is a main task presently conducted by the Chinese Ministry of Education. This paper introduces a computer software system to assist this complex work. The system is analyzed and designed with the help of UML modeling language. The paper presents the system design, important pieces of detailed design, and some issues of system implementation.

Keywords: college evaluation system, undergraduate education, UML, software system design

1. Introduction

The Chinese Ministry of Education is conducting an evaluation program for undergraduate education in higher education institutions, mainly including universities and colleges. The evaluation is a full check of the operation of undergraduate education in many universities and colleges [1, 2, 3].

The evaluation process has been shown to be extremely complicated system engineering and a tremendous amount of work to be done, because of the great variety in disciplines, histories, and localities.

In order to release the burden of the evaluation work and make the evaluation more objective, setting up an appropriate computer system is a good idea and meaningful. This paper reports such a system building upon UML (Unified modeling language) introduced by the authors recently.

UML defines a perfect suite of rules and graphics symbols to assist the analysis and description of objects and their relations. With the help of UML, models can be relatively easily established based on functional requirements, flow charts, and class structures in a problem.

The remainder of this paper is organized as follows: Section 2 introduces the design paradigm we chose; Section 3 demonstrates the system design; Section 4 shows representative pieces of detailed system designs; Section 5 shows a typical interface page; and finally the summary is presented in section 6.

2. Software design paradigms

In software engineering, different methodologies have been proposed and practiced to deal with the all hard issues in software development. The main and widely accepted concept is the software development life cycle model, in which software development process is divided into 5 broad phases: (1) planning and defining, (2) analyzing, (3) designing, (4) implementing, (5) running and maintaining.

The generally accepted software development life cycle models include: waterfall model, prototyping model, rapid application development model, evolutionary software process model, intelligent model, agile development model, and the fourth generation technique [4].

Each model has its own advantages and disadvantages, so in practice, for a given system, analyzers and developers often choose one model as their main model and mix other models together to find a right scheme.

Evolutionary software process model [5] can be classified further into incremental model, spiral model, component assembly model and concurrent development model.

In our design, we chose incremental model, also called iterative model as our main model. In incremental model, a basic requirement is defined first, then an initial design and implementation is conducted, and next a subsequent requirement with some additional functions is defined with more implementation work. This process is preceded iteratively until a final expected system is achieved.

3. System design

Our system is composed of three main subsystems: (1) college overall management subsystem, (2) Information input subsystem, and (3) Information output subsystem.

In this section, we will report the analysis of teacher information management as a typical analysis. Other detail analysis is omitted here and it can be found in our whole project report.

3.1 Events and Requirements

Taking teachers' information management as an example, the events includes: adding, deleting, and revising the information; editing self-assessment supporting information; documents uploading. The reports needed for teachers includes: self-assessment report, various statistical report, detail report of specific information, and comparative reports with some other teachers [6].

3.2 The E-R diagram

Database analysis constitutes a main part of the whole subsystem analysis, for which the E-R diagram is the preferred tool. For the teachers' subsystem, the database E-R diagram is shown in Fig. 1[7].

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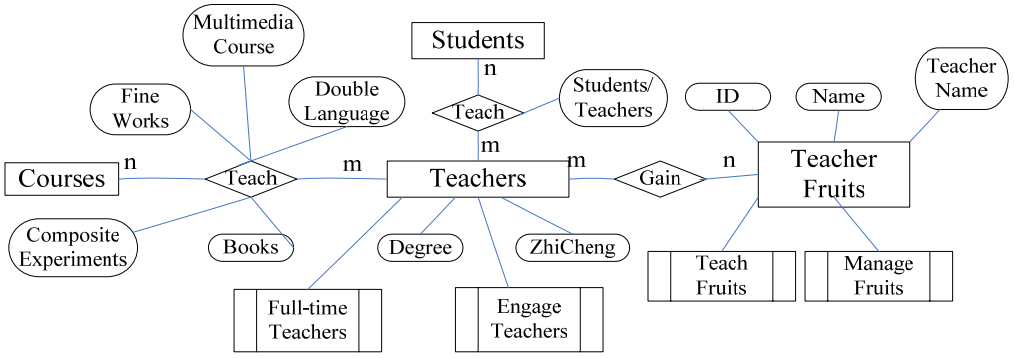

Figure 1.**Teachers E-R Diagram**

3.3 Use case

To verify the usage of a system, use case diagram is often suggested. Virtually, use case diagram is the extension of events diagram being aimed to record the support for all the functions in the system [8].

The main use case diagram is shown in Fig. 2.

4. Detailed system designs

Before the coding work, we need detailed system designs, which include the detailed class design and the detailed database design, among others.

4.1 The detailed class design

The main classes in our system include students, teachers, courses, and fruits, among others. Fig. 3 shows their main data members and member functions. For the case of simplicity, we ignored the more detailed members, although some of them are non-trivial [9].

4.2 Detailed database design

We have presented the E-R diagram of the system database design for the part of teachers in section 3.2. To implement this design, we select Microsoft SQL Server 2000 as the supporting database management system.

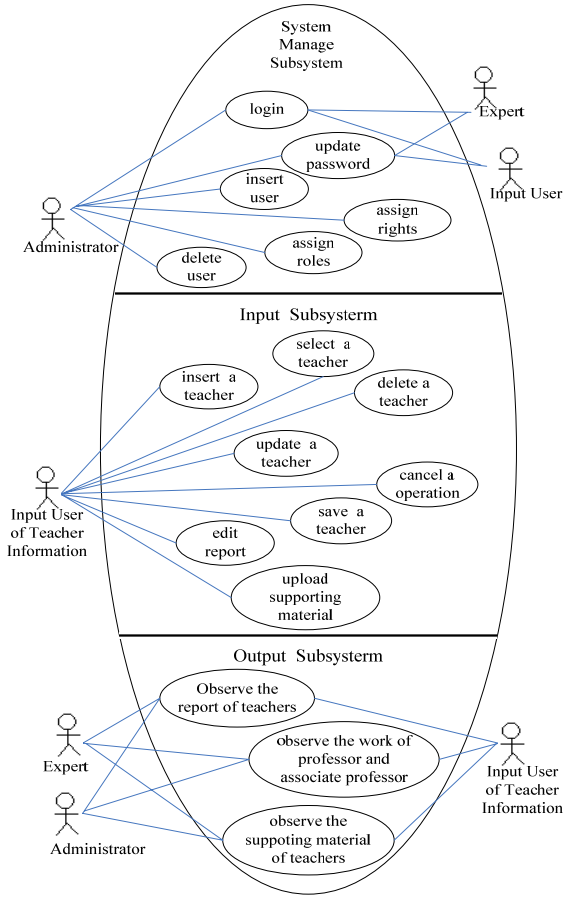

Figure 2.**The use case diagram**

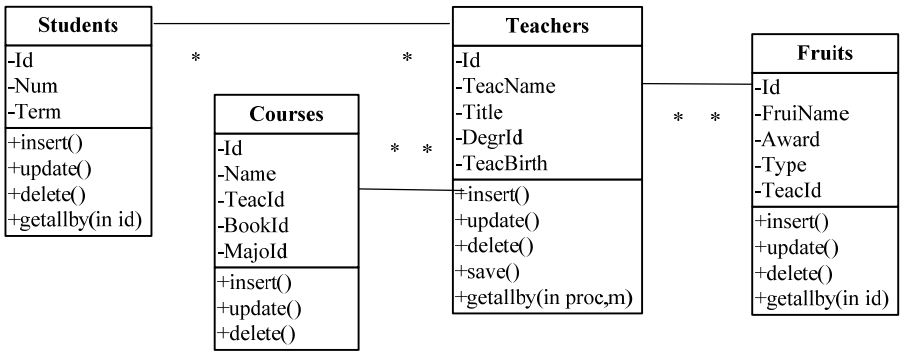

Figure 3.**The class diagram**

Table1. **Teachers**

column	type	full	default	notes
Id	Int	n		key
TeacId	char(8)			
TeacName	char(20)	n		
TeacEngage	char (1)	n	0	‘0’no, ‘1’yes
TeacBirth	char (6)	n		
DegrId	char(3)	n		foreign key
MajoId	char (6)	n		foreign key
TeacType	char (1)	n	0	‘0’teccher,’1 ’manageer

Table 2. **Teacher_course**

column	type	full	default	notes
Id	Int	n		key
CourId	char(10)	N		foreign key
TeacId	char(8)	N		foreign key
CourTerm	char(6)	N		
BookId	varchar (20)	N		foreign key
DLanguage	char(1)	N	1	‘0’no,’1’yes
Multimedia	char(1)	N	1	‘0’no,’1’yes

The essence of implementing database design lies in the guarantee of the data integrity, including entity integrity, referential integrity, and user defined integrity. Table 1 shows the teachers table design, and table 2 shows the teacher-course design, in which keys guarantee entity integrities, and foreign keys guarantee the referential integrities.

Selecting statistical data from the database constitutes one of the main tasks in a system, in which stored procedure plays an important role. The following code illustrates the jssk procedure we designed for selecting professors and associate professors in a whole and in part suggested by a parameter.

```
create procedure jssk
@m int as
begin
  -- insert data to middle-table jssk_mt
  insert into jssk_mt(courterm,alltotal,total,bili,alltotal55,
        total55,bili55)
        select courterm,alltotal, total,bili,alltotal55,
              total55, bili55 from #temp
  --if m=0，select data for all profs and associate profs
  if @m=0
        select courterm,alltotal,total,bili from jssk_mt
  --if m=1，select data for all profs and associate profs
        of age<55
  else if @m=1
        select courterm,alltotal55,total55,bili55
              from jssk_mt
  --delete the date in middle-table jssk_mt
  delete jssk_mt
  end
```

5. System implementation

To implement the system, we chose Microsoft C#.NET 2005 as the development platform. The system was implemented mainly in B/S architecture, so that it can be accessed anywhere on the Internet. It provides a portal with account control. The whole system consists of management subsystem, input subsystem, and output subsystem. In the following three sections, we’ll describe the implementation of the three subsystems.

5.1 Implementation of the management subsystem

The management subsystem is designed to perform two functions: user management and task management. The user management implements the function of user adding and deleting user, password management, access control management, and so on. The task management employs the work-flow model to carry out the definition, assignment, presentation and examination of tasks. Everyone can query the tasks of himself; administrator can be aware of the progress of the preparation of evaluation timely. Fig. 4 shows a typical page of the management subsystem.

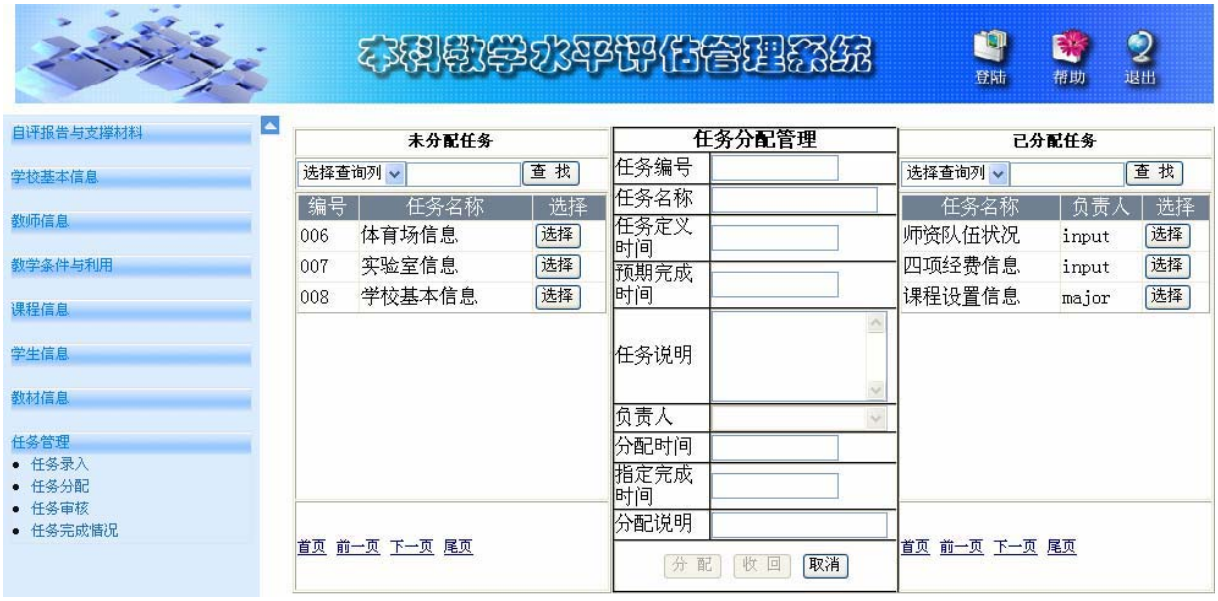

Figure 4.**A typical management subsystem interface**

5.2 Implementation of input subsystem

We divide the input information into following types: self-evaluation reports and supporting materials, college basic information, information of teachers, courses, students, texts and so on. Our system permits inputting the self-evaluation reports and supporting materials in items, and inputting detailed information in classified data, which is very flexible. Fig.5 shows the upload of supporting documents for professors and associate professors.

5.3 Implementation of output subsystem

We report the contents of observation in accordance with hierarchies of the evaluation process. The system provides clear and neat display reports such as documents, tables, and diagrams. For the objective statistical information, all a user needs to do is inputting the basic data; the rest work will be completed automatically, enabling the user free from tedious work. Fig. 6 shows the interface of a typical run of the output subsystem.

Figure 5.**A typical input subsystem interface**

Figure 6.**A typical output subsystem interface**

6. Conclusion

This paper presents the design and implementation of a computer software system for the purpose of assisting the evaluation program conducted by the Chinese Ministry of Education toward the operation of the college undergraduate education. We have showed the UML modeling of the system along with some detailed design and implementation. The system is now running in several colleges. Our next work is to study an integrated indices system to appropriately estimate the operation status of colleges. It can help to make the evaluation more objective and operational.

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