

Design and development of curriculum objectives achievement analysis system based on OBE

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Abstract

As a method of educational reform, the concept of OBE (Outcome-Based Education) emphasizes the orientation of students' learning results and is committed to cultivating students' comprehensive ability. This system adopts the B/S (Browser/Server Architecture), MVC (Model View Controller Architecture) development modes and uses MySQL as the database based on Python language and Django framework. This system implements the management of the support matrix for graduation requirements in the curriculum system, and analyzes and visualizes the degree of achievement of curriculum objectives. This paper aims to develop curriculum objectives achievement analysis system based on OBE concept, it can help colleges and universities assess students' achievement of graduation requirements. Through the system, colleges and universities can gain a better understanding of student learning outcomes for the various curriculum objectives, and to provide targeted continuous improvement measures.

Keywords

Outcome-Based Education, Engineering education, Curriculum evaluation.

1. Introduction

In the current field of education, education reform and quality assurance have become the focus of global attention. Traditional educational evaluation methods mainly focus on test scores. Judging the mastery of subject knowledge only through grades is not detailed and comprehensive enough, neither can colleges and universities understand the true level of students, but also ignores the comprehensive quality and subject ability of students. Now education in many countries has also begun to reform. Some researchers gradually turn to the teaching model based on results-oriented education (Outcome-Based Education, OBE for short). The OBE philosophy emphasizes student learning outcomes and ability development, which putting student learning and assessment first. It focuses on the development of students' comprehensive literacy, creativity, critical thinking and problem-solving skills to train talents to meet the needs of modern society. The introduction of OBE concept is a new way of thinking and solution for the reform of education industry.

However, implementing the OBE teaching model is not easy. Traditional methods of teaching assessment often rely too heavily on standardized exams and pen-and-paper tests, It is unable to fully assess students' comprehensive abilities and learning outcomes. In addition, Teachers and students also have some difficulties in understanding and applying OBE. Thus, developing a system that can accurately assess student learning outcomes has become an important topic in the field of education.

Based on the concept of OBE, this system designs a small system which can serve the professional certification system of engineering education and takes course evaluation as its main function. It aims to provide teachers and students with a comprehensive tool for assessing student learning outcomes by combining advanced information technology and educational assessment methods, use this tool to help teachers design and implement teaching activities

and provide real-time feedback on student learning outcomes. Meanwhile, students can systematically understand their learning progress and development direction, so as to better plan their learning and improve their ability.

2. System Implementation Techniques

2.1. Front-end technology

Front-end development mainly involves technologies such as HTML、CSS and JavaScript, adopted jQuery, bootstrap framework, the echart visual gallery was used too.

HTML/CSS/JavaScript are known as the native front end triplet. HTML is a markup language used to define the structure and content of web pages. CSS is a style sheet language used to control the appearance and layout of web pages. The real programming language is JavaScript, for the front-end page, it can manipulate all the content of the front-end page, and add logic to make it more operational.

jQuery is a front-end library, which can also be said to be a JavaScript function library, encapsulating a variety of JavaScript function code, so that developers can easily manipulate DOM elements; Many animation effects are built in; Provide a variety of page events to enhance event handling. There is also an easy way to implement AJAX, which makes it easier to implement dynamic content loading in Web applications and simplifies the way you work with JavaScript code.

Bootstrap is a popular front-end development framework for developing responsive, mobile-first websites and applications. It provides a wealth of styles and components that reduce developer workload and help developers build responsive and modern websites and applications.

Echart is a visual chart library based on JavaScript, with rich built-in components, it is suitable for various data visualization scenarios, and has good compatibility and scalability.

2.2. Back-end technology

This paper adopts B/S(Browser/Server Architecture) and MVC(Model-View-Controller Architecture) development model. Based on python language, Django framework is used for back-end development, and MySQL is selected as the database.

B/S Architecture technology is a technical architecture used to build web-based applications. Through the collaboration of server and browser, Web applications can be developed, deployed and run. It provides a wealth of tools and components that make application development more efficient and flexible, with good scalability and performance.

On the basis of B/S, this paper choose the MVC software architecture pattern, which promotes code decoupling and modularity by dividing the application into separate models, views, and controllers. Therefore, it can improve the reusability, maintainability and extensibility of the code, and also provide a good user experience and flexible user interface, which is flexible, extensible and easy to test and maintain.

Django is an open source Python Web framework for the rapid development of high-performance Web applications. It provides a simple and easy-to-understand project structure that makes teamwork and code maintenance easier. Through MVC(Model-View-Controller), this paper have separated data logic, business logic, and presentation logic to make the organization of the code clearer and easier to expand and maintain. At the same time, it provides a wealth of features and plug-ins that enable developers to build Web applications more efficiently. It also provides common functional components for user authentication, form processing, data validation, etc. reducing developer duplication. It provides built-in security measures that effectively protect application security, and reduces the developer's security is also its advantage in this area of work. Django is a powerful, easy-to-use, and secure Web

development framework. Through its simple project structure, rich function library and efficient development methods, developers can quickly build high-performance Web applications.

MySQL is a popular open source relational database management system, It has a wide range of applications and excellent technical characteristics. It provides high performance data storage and query, supports transaction processing and replication mechanism, and has good scalability and reliability. MySQL has a rich ecosystem of tools and plug-ins, as well as powerful security and rights management features. With optimized indexing, partitioning, and sharing techniques, MySQL is able to handle large amounts of data and high concurrent access. At the same time, it follows standard SQL syntax and is compatible with other databases, making data migration and application development more convenient. MySQL is a powerful, stable and reliable database management system, widely used in various types of application development, and has a huge user community and rich resources support.

The overall technical architecture of the system is shown in Figure 1.

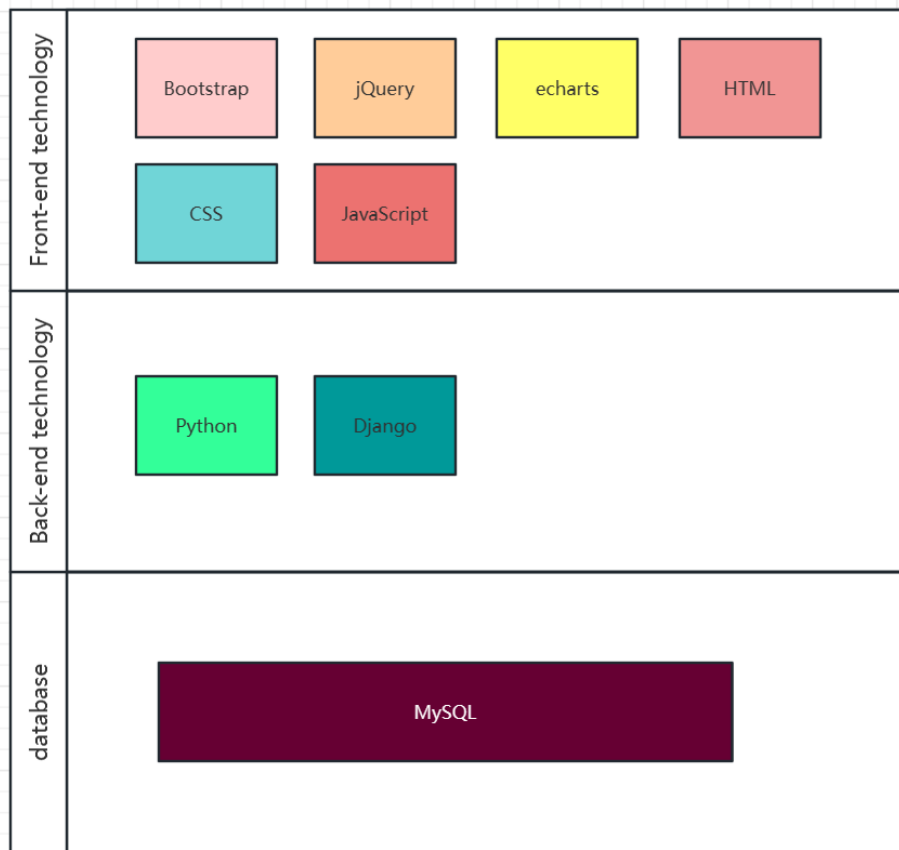


Figure 1 The overall technical architecture of the system

3. Overall structure and function design of the system

This system adopts B/S Architecture(Browser/Server Architecture), compare to C/S Architecture, which require the corresponding client program to be installed on each client, B/S Architecture are more convenient and efficient. B/S Architecture is a common architecture for web applications. Under the B/S architecture, this paper adopted the Model-View-Controller architecture. This architecture pattern separates the logic, data and user interface of the

application, which is convenient for team cooperation development, and has high scalability and reuse.

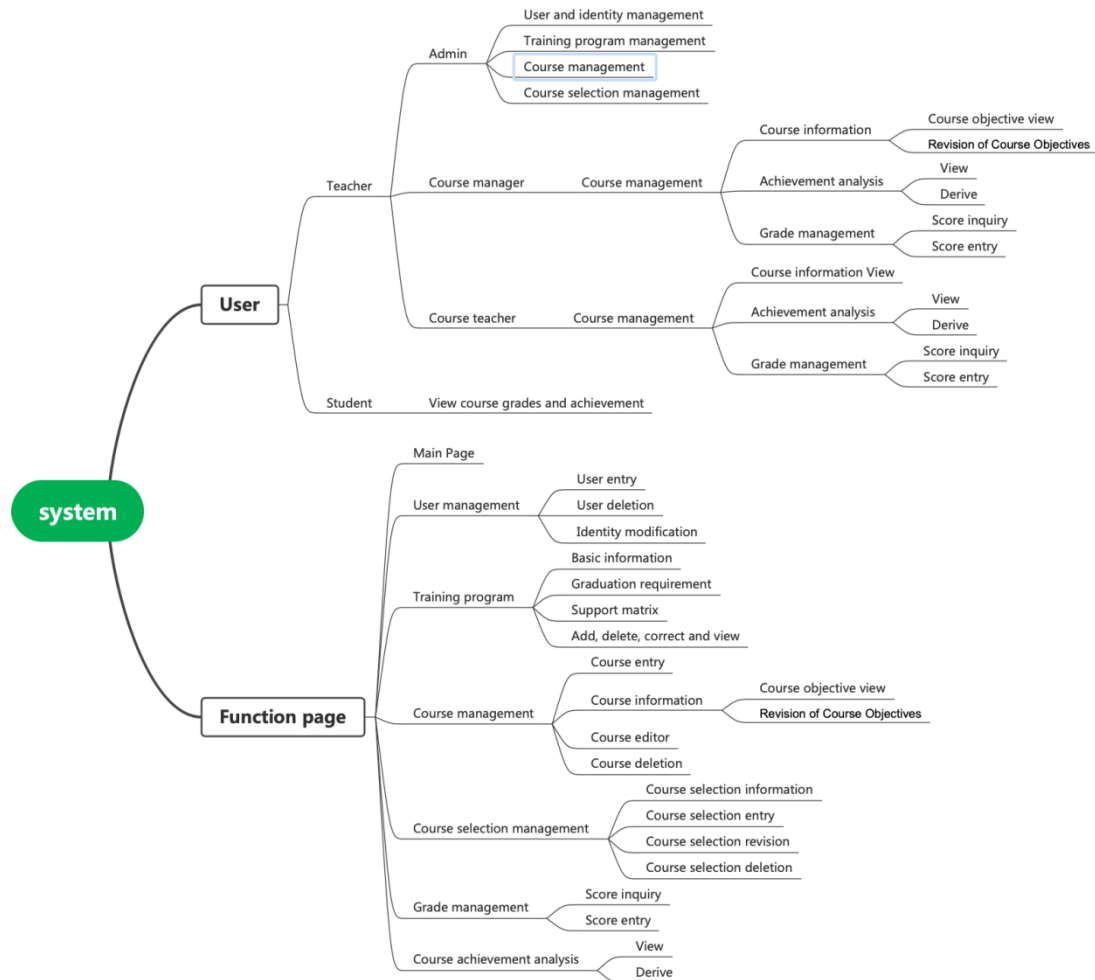


Figure 2 Functional design drawing overall view

This system is similar to the educational administration system, but it is actually biased towards an evaluation and analysis system. According to the concept of OBE and the current status of education reform, this paper uses a teaching evaluation method based on the completion degree of curriculum objectives. The director of major can use this system to decompose graduation requirement indicator points through the training plans. The course leader clarifies the course objectives and assessment methods for each course, and the course teacher can input course grades to achieve analysis of course achievement. Compared to traditional evaluation methods, the teaching evaluation method based on the completion of course objectives in this paper are more conducive to understanding students' graduation achievement and continuous improvement.

The system can be divided into two types of users, teachers and students, and teachers can be divided into three types: administrators, course leaders and course teachers. In this system, different identities correspond to different authority functions. Specifically, as a system manager, the administrator can first manage users and user identity; in addition, he is also responsible for the management of training plans, which can be entered and modified; in addition, he is also responsible for course management, which can be entered, modified and deleted. Finally, he is responsible for the management of teaching and course selection of teachers and students. The course leader has the authority to manage the course. Although he cannot enter the course and modify the basic information, he can edit the course objectives, which is extremely important. In addition, as a teacher, the course leader has the authority to

manage the grades and can enter and view the students' courses and check the achievement of the course objectives. Teachers have limited access to information about the courses they teach, as well as information about the grades of those courses and the achievement of course objectives. As a student, you can only check your grades and achievements in your courses. On the back end, the system will verify the identity of each operation to ensure that there will be no possibility of identity overstep.

4. Database design

4.1. Database selection

In terms of overall design, this system involves multi-user, multi-function, that is, interaction between multiple tables, so this system uses relational data MySQL.

4.2. Database design objective

Database is one of the core components of a system and plays an extremely important role in a system. All the data used by the system, all the data generated by the user will be stored in the database. As the center of data storage and management, database needs to organize, access and maintain data. Therefore, when designing the database, in addition to considering the requirements and designing the database table structure according to the requirements, how to make the database efficient, convenient and reliable is also a problem that cannot be ignored. Therefore, this paper have carried on the database design.

4.3. Database table design

Based on system functions and user requirements, 14 tables are set up in the design of the database of this system. Considering the function of each table comprehensively, the database tables should be divided into two categories: basic tables and associated tables. The basic table stores the first-hand information of the input, and the content of the table is what the input is. The associated table does not need to be manually input. When the information of some basic tables changes, the associated table will produce corresponding changes according to the information and the set algorithm. The details are as follows.

Database table design overview table

ordinal	Tablename	category	remark
1	Culture table	Basic table	Culture program information
2	Graduation requirements table	Basic table	Training program corresponding to graduation requirements
3	Course support index points table	Basic table	Graduation requirements corresponding to the course support index points
4	Curriculum table	Basic table	Course information
5	Course objective table	Basic table	Curriculum objectives corresponding to the curriculum
6	Teacher table	Basic table	Teacher information
7	Student table	Basic table	Student information
8	Assessment table	Basic table	The assessment method corresponding to the course
9	Usual score table	Basic table	Information about students' usual grades for a course

10	Experimental score table	Basic table	Information about students' usual grades for a course
11	Final grade table	Basic table	Information about students' usual grades for a course
12	Score table	Association table	Information about students' usual grades for a course
13	Personal objective achievement table	Association table	Information about the degree of achievement of each objective of a course corresponding to the student
14	Achievement of the overall objectives of the course table	Association table	Information on the degree of achievement of the overall objective of a course

4.4. Database detailed implementation

When using a database, the system does not directly manipulate the database, but uses the Django framework's built-in ORM(Object Relational Mapping) layer to design and manipulate the database, this allows developers to interact with database tables through Python classes without having to write SQL queries directly. At the same time, the ORM layer provides simpler and richer functionality to adjust the database structure and data directly through Python statements.

As mentioned above, the database tables of this system are divided into basic tables and associated tables. The data stored in the basic table is all entered and uploaded in the system, that is, generated system data and user data. The data of the associated table comes from the basic table data, which is calculated and stored by the set algorithm. The implementation of this feature relies on Django's signaling mechanism.

Django Signals is a powerful event-handling mechanism that allows different parts of code to communicate with each other when a particular event occurs. When an event occurs, the signal can trigger the execution of other code. In Django's model or ORM, signaling mechanisms trigger specific actions when events such as the creation, update, or deletion of a database model occur.

The system binds the associated table to the basic table, sets the signal, and when the basic table is updated or created, the corresponding associated table updates information or creates new data at the same time.

4.5. Database security

As mentioned above, this system uses Django's ORM for database operations, which effectively protects against SQL injection attacks in terms of information storage and user authentication. Instead of manually connecting SQL queries, developers use the apis provided by ORM to translate database operations into operations on Python objects, eliminating the possibility of directly executing malicious SQL code. In addition, Django has a powerful user authentication and authorization system built in, making user management more secure and convenient. By using the built-in User model and authentication view, user registration, login, logout, and password reset can be easily handled to ensure the security of user identity.

5. Conclusion

To sum up, this paper has successfully developed a curriculum goal achievement analysis system Based on the concept of OBE (Outcome Based Education). This system adopts modern B/S (Browser/Server Architecture) and MVC (Model-View-Controller Architecture)

development models, based on Python language and Django framework. Use MySQL as database support. Through this system, colleges and universities can more comprehensively assess students' learning and achievement of graduation requirements, and gain insight into their learning outcomes under various curriculum objectives. This provides institutions with targeted data and a more transparent and visual way to monitor student progress in order to develop and implement strategies to improve the quality of education.

References

- [1] Pan Ying, Hu Likun, Geng Kuihua et al. Construction and application of curriculum Goal Achievement Comprehensive evaluation Model based on OBE concept [J]. Higher Education Forum,2023(03):32-35. (In Chinese)
- [2] Peng Rensong. Graduation design information management system based on B/S development [J]. Journal of modern information technology, 2022, 6 (09) : 26 to 30. DOI: 10.19850 / j.carol carroll nki. 2096-4706.2022.09.007. (In Chinese)
- [3] Jin Yilin, Ke Haifeng. Based on engineering education accreditation of the course evaluation management system design and development [J]. Journal of computer age, 2020 (12) : 38-40 + 46. DOI: 10.16644 / j.carol carroll nki cn33-1094 / tp. 2020.12.010. (In Chinese)
- [4]Ghimire D. Comparative study on Python web frameworks: Flask and Django[J]. 2020
- [5]Broo D G, Kaynak O, Sait S M. Rethinking engineering education at the age of industry 5.0[J]. Journal of Industrial Information Integration, 2022, 25: 100311.