

Enhancing Educational Outcomes with a High-performance Online Exam System

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Abstract: With the development of the network, online education has entered thousands of households, and the access to online education is also very simple. Due to the continuous development of online education, a variety of online examination systems with various characteristics have been derived. Considering the simplicity and convenience of the system and the stability of performance, we have developed an online examination system using SSM framework under B/S architecture, which can detect students' learning status through online examination and automatic marking. And automatically analyze the error rate of each problem and the weakness of each student, so that the teacher can explain such exercises. It also contains the basic information of the student, such as the mobile phone number of the student's parents. If the student is found not to complete the examination, the teacher will also call the student's parents to remind them, and can also communicate with the student's parents appropriately. For the management of the test questions can be taken excel document import. Thus, it can greatly improve the generation of test papers compared with the traditional paper examination. In terms of the types of questions in the online examination system, we only set single choice, multiple choice and judgment questions in the system, set the passing score, set the time of the examination, and also count the number of people who have passed the examination, and provide the correct answer after the examination for students to think. There is also a progress display on the right side of the answer sheet. After each question was answered, the color of the question number on the answer sheet changed. There's also a timing system on the right.

Keywords: Online examination system, Java Web system, SSM framework, MYSQL.

1. Introduction

Online examination has become an important part of online education units to test students' learning status. There is a fully functional and easy to use online examination system can not only greatly reduce the workload of teachers, its content for teachers and administrators are of great significance. Therefore, online examination system can provide a suitable channel for students and teachers [1]. Because people have been using the traditional paper examination to statistics of students' learning situation, as well as a variety of material management this way has a lot of drawbacks, such as: low efficiency, poor confidentiality, serious waste of resources, and after a long period of time, will produce a large number of documents and data, and this situation will bring great difficulties in searching, updating and maintenance. With the continuous progress of science and technology, it is also very important to check our learning [2]. On this basis, for example, during the epidemic period, primary and secondary school students still use the form of photo uploading homework, but this process is often more complex, so the focus of this paper is on simplicity.

1.1. Research Significance and background of online Examination system

1.1.1. Background of development

As a part of education examination, online examination system is to use computers to manage students' papers and questions, as well as online examination and automatic marking, which has incomparable advantages to manual and paper papers. For example, it has a long duration and good confidentiality, which can reduce the errors of teachers when

correcting papers [3]. The review of test questions is helpful for students to review wrong questions and think about why they made wrong questions.

1.1.2. Design purpose and significance

At the time of the epidemic, I saw that many primary and secondary school students used the way of taking pictures to write homework exams, and teachers did not have convenient tools to inspect students' learning conditions. This online examination system can not only reduce a lot of unnecessary paper, printing ink and human and material resources waste, but also can save a lot of human and material [4] resources and social resources. The system can also be used to supervise students to complete learning tasks, thus greatly reducing the tedious situation of manual access to students. And the use of this system can efficiently manage the examinee information, paper information, question information [5]. Can use the simple examination system to complete more operations.

1.2. Research content of this paper

This paper studies the development of online examination system under the framework of SSM. In this system, there are multiple choice judgment questions and multiple choice questions, and each question will have the correct answer annotation. In the examination, we can set the start time and deadline time. The correct answer of each question will be displayed to facilitate the students' thinking space. In the background of the examination, the students' scores will be calculated in the form of a line chart, which makes the fluctuations of scores clear at a glance and facilitates the teachers to explain such questions in the future teaching [6]. On this basis, the system also gives certain functions of student information management function. Including class

name, phone number and so on.

2. Development Environment

In the design of the online examination, the operating system of Windows10 is used, under the compilation of eclipse, for the consideration of security and high scalability, JavaEE development mode is adopted, Tomact server is selected, JAVA language is used for design, SSM framework is used, and open source MySQL database is used [7]. The visualization software of choice is Navicat 15 for MySQL, which can help you observe the state of the database[8] and the primary and foreign keys of the individual tables, and it is also easy to observe the data in the individual tables.

2.1. SSM Framework

2.1.1. Advantages of the scheme design SSM framework.

Spring, In java, to use the methods in the class, we must first have the object of the class, and the object of the class is our own new out, and then Spring is used to simplify this operation, Spring is simply a large container that can encapsulate many objects, spring is filled with Bean objects, Spring is filled with beans. The encapsulated things are entity objects. spring uses a factory method pattern at the bottom level. spring uses IOC to invert control. In this process, there is no need to manually create objects again. In this process, it can be directly called, which is convenient and quick to realize the automatic assembly of classes.

SpringMVC, Let's first understand servlets. The program that runs on a Web server or an application server is a Java Servlet. Servlets come into play in the middle layer between requests from a Web browser or other HTTP client and a database or application on an HTTP server [9]. It's just something that handles the business logic layer and can handle requests that are made on the front end, and SpringMVC[10] being part of the SSM framework and servlets does just that

MyBatis, Under normal circumstances, when writing ordinary java programs, the process of interacting with a database connection is to first write the connection code to the database to connect, and then write SQL statements until it is called into the database for execution [11]. In fact, the specific way of interaction with the database is to add, delete, change and check, and now the main role of MyBatis is to encapsulate these add, delete, change and check operations so as to achieve the purpose of simple use, simply speaking, the encapsulation of JDBC, which is a database[12] framework.

2.1.2. The scheme designs B/S framework

B/S, B/S, simply put, is the browser/server model. We also call it also called B/S structure, it is a network structure model. The Web browser is the most important and common application software on the client[13] side.

Client sending request phase: the user performs operations in the browser, and then the browser generates HTTP packets. After the client sends HTTP packets to the server [14], the browser waits for the response of the client. Server processing request phase: After receiving the HTTP packet, the server parses the packet, processes the data, and generates the response HTTP packet. The server sends the response phase: it returns the data requested by the user to the client. The client parses the HTML file.

Advantages of B/S, no need to install the client, a browser can be used. A small portion of the application can be run in the browser [15] to reduce the load on the server. can use

AJAX technology to achieve local real-time refresh, in this process to increase the interaction between the client and the server.

2.2. Use of Database

MySQL database is used for data interaction, and in order to facilitate observation and control, a third-party visualization tool Navicat 15 for MySQL[16] is used. In this process is used the connection pool operation, is the reconnection process has a lot of

In the database, multiple tables are created to store data, and the primary key and foreign key are set in each table, and then the SQL statement is written to add, delete, change and search. In addition, in the SSM framework, we write the SQL statement directly without modifying it in the code later, which greatly reduces the error rate of the code [17]. In addition, it is not necessary to look for errors in the SQL statement when modifying, which greatly reduces the amount of work to modify errors.

3. Requirement Analysis

3.1. Functional Requirements

Ordinary user functions login registration, online examination, change the password, score query. The functions of the administrator are: login, user management, system log modification, subject management, student management, test management, examination management, paper management, score statistics.

3.2. Performance requirements

Main memory capacity: 12G. Disk capacity: 1T. JDK version: 1.8. Development Tools: MySQL: version 5.7. eclipse: Version 2018-12. Navicat for MySQL: version 15.0.17.

3.3. Reliability and availability requirements

Usability: The online examination system interface is very simple, only contains the most basic personal information and examination information, of course, modify the account and password, simple and easy to operate, and does not contain any advertising, a general view can accurately use the software. In the aspect of identity identification, two kinds of operation permissions and accounts are set for students and teachers, which can effectively control the access qualifications of the corresponding permissions and prevent or limit illegal access. Reliability: The process of computer correction is easier to complete, and the work can be completed on time while handing in the paper. In the normal network connection can smoothly enter the web page. The software has fewer functions, so it is easy to use, and each function point is easy to set. After repeated testing, the errors are less than 2. This system uses B/S architecture, so the small function of the software is a big advantage, even if the problem can be solved within an hour.

3.4. Requirements that may be proposed

In the future, we may provide a parent account so that parents can also see their children's real test results, so that we can let students modify their own report cards. The era is gone forever. In addition, we can expand the content of live classes through this system, so that students only need one software in class, no longer use other software, and greatly shorten the time of switching software in class. Thus improving efficiency.

3.5. Feasibility analysis

Economic feasibility: The economic cost of developing an online examination system is far less than the manual management cost, paper cost and waste of resources under the traditional paper examination method. **Operational[18] feasibility:** The operation mode of the online examination system can fully realize data interaction, online examination and other operations within the functions required by the user organization. Different accounts are used to log in, and different permissions are set. Student accounts can only be used for examinations, review papers, and modify various information of their accounts. However, super administrator accounts can modify various information of students and teachers, but can not participate in students' examinations and modify students' examination results. **Technical[19] feasibility:** using the existing technology, using SSM framework, using JAVAEE development mode, online examination system using MySQL database and third-party visualization tool Navicat for MySQL as data storage, on the basis of this hardware and software to develop the system.

4. System Implementation

4.1. Environment Setup

MySQL and Navicat15 for MySQL environment construction, download MySQL on the MySQL official website for installation, test version number appears on behalf of successful installation. Java setup: Install the JDK, version 1.8.0-102.

4.2. Implementation of each system function module

4.2.1. Implementation of login module

The login registration module is to achieve the user's login and registration function, user authentication and other needs to be used for verification and database processing. Users who have registered can directly log in to the home page of the system to take the exam. Users who have not registered can jump to the registration page for information input and registration through this page. If they are teachers, they can log in to the administrator account to manage the content, time and students of the exam

4.2.2. Home page design module implementation

This module realizes the design of the home page after the user has logged in, and the home page of the student user in this system is the interface that directly enters the personal information of the student, in which you can see your own information, useful username, real name, have your own major, and you can also see your mobile phone number reserved during registration. And on this page you can change your password and on this page you can see the exam that you haven't taken yet, you can see the details of this exam, you can see the deadline and start time, you can see the duration of the exam, you can see the major of this paper, you can see the total score of the paper, you can see the pass score, and you can click the start button, Enter the examination, on this page you can search, find the name of the examination, this page also has the pagination function, after the examination, you can see your score in the history[21] examination and review your examination paper. In this page, if there are multiple papers, it is used in the way of pagination to display, not through the slide box to display. In this process, you can search your own examination paper, for example: to search

your own mid-term examination, you can enter: "Mid-term examination" in the search box. Then you can see your midterm exam papers. Then you can take the test through the online test system.

4.2.3. Design and implementation of examination module

This function module realizes the function of online examination, click to start the examination, the system will pick up the corresponding number and the corresponding type of questions in the question bank, the question is divided into single choice multiple choice and judgment, each question has the corresponding score, there is an answer sheet on the right, the candidates can see what they have written, and have not written which question. Answer sheet on the right side of the timing of the examination, if to exceed[20] the time, but did not hand in the paper, the system automatically hand in paper. In the answer sheet, click on the question number, you can also immediately jump to this question, this function can be used for, candidates are not sure of the correct answer to the question, can obtain good results.

4.2.4. Implementation of paper review module

This module is mainly designed to help students learn better. When they know their grades, they can also know where their mistakes are.

4.2.5. Examinees Account and teacher account management module

This module can see teacher accounts and student accounts. The name, subject, initial password and mobile phone number of each account can be observed, and the multi-table joint query method is used. Test file import module. In this system is the import of files, in this system uses a random selection mode, then the extracted test questions are imported into the system, in this case, the general use is the format of excel file for import, in the excel file on the type of test questions, using 0 to represent single choice questions, using 1 to represent multiple choice questions, There is also the use of 2 to represent the judgment question. In the process of extracting the question, the type of the question is identified from the question bank, for example: When a single choice question is needed, the question will be randomly selected from the question type 0, which can greatly reduce the errors in the extraction of the question, and here you can set the score of the question, rather than the traditional score of each question type. In this system, if the teacher finds that there is a very good question, the teacher can set up his own score to improve the question. In the process of test questions display, there are single choice questions and multiple choice questions, which are four options, and in the single choice questions do not appear four options, but two, so in the design stage, in this system, the answer choice design of multiple choice questions and judgment questions is not the same.

4.2.6. Score statistics module

The performance statistics module here, you can see this line chart, here is used to represent the change of each student's performance, the line chart can be more intuitive to see the student's performance curve, for students with unsatisfactory performance, you can see it at a glance, so this and the line chart can be very intuitive[22] to see, And you can probably see the distribution of grades in this class, here, the grades of each class can be seen, and you can probably see the median score of each class.

5. System Testing

5.1. System functional Test

5.1.1. Examination module test

On the student home page, test the test function module, respectively start the test, hand in the paper, test timing, review the paper and other functional tests, after the completion of the operation, the function can be realized. Test the function of the timer to ensure that the timer can accurately calculate the time, and can complete the paper in the prescribed time. After completing various operations, the functions can be realized. Whether the questions not filled in on the answer sheet can be accurately displayed, and can be jumped to the question when clicking the question number of the unanswered question. After completing various operations, the functions can be realized.

5.1.2. User management module test

In the options of the administrator page, test the student's account, change the student's account, major, name, mobile phone number, and the student's login password. Enter the database or view under the administrator account, update, test success.

5.1.3. Test question management and paper management module test

The function test of adding, editing, deleting and importing test questions under the administrator account, and then the function test of editing and deleting has been used.

5.2. System performance and robustness testing

5.2.1. Performance testing

This system in the normal Windows10 system, 64-bit computer can normally meet the performance indicators, the startup speed can reach the running conditions. The number of concurrent users can reach 200. The resource utilization rate is about 2.7%. The memory and CPU and disk capacity occupied when running the online examination system are not high.

5.2.2. System compatibility test

System compatibility test: To identify whether the software of different operators on a device can interact with each other correctly and be compatible more quickly. With the continuous update of hardware equipment and software equipment, users attach great importance to the compatibility of various software, so the system has at least compatible with other kinds of software. This requires that the software needs to strictly share data and make full use of space to execute multiple procedures at the same time, so whether the test between the online examination system and other software can cooperate becomes more and more important. This system Windows10, eclipse environment development, in terms of compatibility can be compatible with Google, 360, Sogou, Firefox and other major mainstream[23] browsers are compatible, and the online examination system can also run in the Windows7 environment.

6. Conclusion and Outlook

6.1. Conclusion

The online examination system is based on Java language under the operating system of windows10 and the development environment of JAVAEE in eclipse. In the process of the project development, I have learned a lot of knowledge and

become more familiar with the ssm framework. In this design, I used MySQL, which has good data interaction function, and Navicat for MySQL, a third-party visualization tool. I also have a further understanding of the connection of databases, especially in the query of databases. The use of SQL statements to query a more in-depth understanding of the content of multi-table query and union query also have a new understanding. During the development of the online examination system, I also encountered a lot of problems about database connection pool, understanding of SSM framework, and design of user accounts and passwords. At the beginning, I was not sure whether some small functions in the examination system needed to be added, but only knew that the main function was to have test questions and be able to be used to participate in the examination. However, it is not clear how to realize the specific process of the relatively small function development. If we do not carefully analyze the user needs, we can not design the database well. Therefore, after checking a lot of materials and the help of teachers, I can understand the process of technology. Database design is also a difficult point, in the process of designing the table, the primary key and foreign key Settings also need to repeatedly consider thinking, the design of the database is the core of the development of the online examination system. When designing a database, it's important to be clear about where the data is going and the relationship between the primary and foreign keys of each table. Database design errors on data storage and data read are very fatal errors. Therefore, we must do a good job in the development of the database table and table connection, database design to be careful. In short, the database is the core of a program or software, is the storage place of all data, including in the page or pure language browser is also needed to do the interaction of database data, the most important thing to make the program is to complete the function required by the user, and then the page is gorgeous and so on. If a page cannot do beautiful requirements, It can only be a half-finished product.

6.2. Outlook

In this system, we can also add a module, which is the live function. The software on the market does not integrate the live function and the online examination together. We can add the live function to innovate in this regard. In this system, we should also be able to expand, for example, each problem can be added after the analysis, the test function is not perfect, the user interface function is too simple, the system interface is not too beautiful, you can also extend the program, for example, we can use looseleaf way to display the problem, and can add subjective questions.

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References

- [1] R. Ravaud, G. Lemarquand, V. Lemarquand, et al. Discussion about the analytical calculation of the magnetic field created by permanent magnets, *Progress in Electromagnetics Research B*, 2009, 11(3): 281-297.
- [2] Sun Xin. *Java Web Development detailed explanation :XML + XSLT + Servlet +JSP in-depth Analysis and Application Example* [M]. Beijing: Publishing House of Electronics Industry, 2006.

- [3] Sun Weiqin, Li Hongcheng. Detailed explanation of Tomcat and Java Web Development Technology [M]. Beijing: Publishing House of Electronics Industry,2004.
- [4] Tang Youguo, Zhan Hongbo. (Ed.) JSP Website Development Details [M]. Beijing: Tsinghua University Press, 2008.
- [5] WANG Hong.Java Web Application Development Technology Practical Tutorial [M]. Beijing: Water Resources and Hydropower Press,2008.
- [6] Lin Jiansu, Meng Kangjian. Eclipse Development Learning Log [M]. Beijing: Publishing House of Electronics Industry, 2008.
- [7] Sun Wei-qin. A detailed explanation of Tomcat and Java Web Development Technology (2nd edition) [M]. Beijing: Publishing House of Electronics Industry, 2009.
- [8] Lu Juping, Guo Jiangjie. Proficient in JSP+XML+CSS network development mixed programming [M]. Beijing: Publishing House of Electronics Industry, 2006.
- [9] Feng Chao, Chao Gang. Detailed explanation of Tomcat and Java Web Development Technology [M]. Beijing: Tsinghua University Press, 2008.
- [10] Liang Lixin. Project Practice Elaboration :JAVA Web Application Development [M]. Beijing: Publishing House of Electronics Industry, 2007.
- [11] Bruce Eckel. Thinking in Java (3rd Edition)[M]. China Machine Press, 2009. [11] Bruce Eckel. Thinking in Java (3rd Edition)[M]. Machine PRESS, 2009.
- [12] Bruce Tatc. Bitter Java[M]. Manning Publications, 2002
- [13] HU S M, ZHANG F L, WANG M, et al. PatchNet: a patch-based image representation for interactive library-driven image editing[J].ACM Transactions on Graphics, 2013,32(6): 196-1-196-12.
- [14] CHENG MM, PRISACARIU V A,ZHENG S, et al. DenseCut: densely connected CRFs for realtime GirabCut[J].Computer Graphics Forum, 2015,34(7): 193-201.
- [15] GUPTA V,RAMAN S.Automatic trimap generation for image matting[CV/2016 International Conference on Signal and Information Processing (IConSIP). Vishnupuri:IEEE,2016:1-5.
- [16] SHAHRIANE,RAJAN D, PRICE B, et al. Improving image mattig using comprehensive sampling sets[Cy/2013 IEEE Conference on Computer Vision and Pattern Recognition. Portland:IEEE, 2013: 636-643.
- [17] HE K M, GKIOXARI G DOLLAR P, et al.Mask R-CNN[J].IEEE Transactions on Pattern Analysis and Machine Intelligence, 2018,42(2): 386-397.
- [18] Effects of computer-aided and blended teaching strategies on students' achievement in civic education concepts in mountain learning ecologies[J]. Olugbenga Adedayo Ige;;Dipane Joseph Hlalele.Education and Information Technologies,2017(6).
- [19] Educational Intelligent System Using Genetic Algorithm[J]. Julia Protopopova; Sergey Kulik. Procedia Computer Science, 2020(C).
- [20] Essay Selection Methods for Adaptive Rater Monitoring[J]. Chun Wang;;Tian Song;;Zhuoran Wang;;Edward Wolfe.Applied Psychological Measurement,2017(1).
- [21] Application of CORES to Compute Research Papers Similarity [J]. Mahmood Qamar;Qadir Muhammad Abdul; Afzal Muhammad Tanvir.IEEE Access,2017.
- [22] The Eras and Trends of Automatic Short Answer Grading[J]. Steven Burrows;;Iryna Gurevych;;Benno Stein.International Journal of Artificial Intelligence,2015(1).
- [23] Sentence similarity based on semantic nets and corpus statistics[J]. Li Y.; McLean D.; Bandar Z.A.; O'Shea J.D.;Crockett K..IEEE Transactions on Knowledge and Data Engineering,2006(8).