



Design of Management Accounting Online Teaching System Based on Virtual Simulation Technology

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Abstract. In view of the low security of the management accounting online teaching system, this paper puts forward the design of the management accounting online teaching system based on virtual simulation technology. The overall module of management accounting online teaching system is designed by using virtual simulation technology. Combined with the detailed design of online classroom module, video management module, course management module and user management module, the design of management accounting online teaching system is realized. The test results show that the online teaching system of management accounting based on virtual simulation technology meets the expected results and has higher security.

Keywords: Virtual simulation technology · Management accounting · Online teaching · System design

1 Introduction

With the vigorous development of the Internet and multimedia technologies, the online education industry began to emerge [1]. With the help of the Internet, computer technology and multimedia technology, the new teaching mode has a significant and far-reaching impact on the overall structure of education, and is a trend for online education in the future.

Traditional offline classroom teaching requires teachers and students to co-exist in a classroom, and online education through the network and multimedia to break the traditional teaching methods. Teaching and learning are fully decoupled because of the use of audio, video, documents, and other things that can be stored permanently online. Teachers and students do not need to teach in class at the same time. As long as teachers record the content into video and audio, and upload the corresponding courseware, students can learn through these materials at any time and any place. In traditional teaching activities, teaching resources, especially those of high quality, are often concentrated in large and medium-sized cities, famous universities and colleges, small cities and remote areas, especially in rural areas where the economy is backward, and teaching resources are extremely scarce [2, 3]. The imbalance of economic development leads to the imbalance

of education level, and online education is to break the imbalance through the Internet and multimedia technology. Through online teaching, quality teaching resources can be shared across the country. In the traditional teaching, teaching progress, teaching content and all other things are under the control of teachers, students can only passively adapt. In the online teaching environment, students can freely control their learning progress according to their ability and understanding of the learning content, and can freely choose the courses according to their interests and characteristics, which can fully mobilize their active initiative. The content of the traditional curriculum is often stable, which makes it easy to disconnect from the rapid development, often the teaching of learning has long been outdated and obsolete [4]. Online teaching can be updated at any time to learn the content. With the help of Internet technology, the latest cutting-edge information and technology can quickly become teaching content. At the same time, the teaching method is no longer limited to the simple course explanation, and can be rich in teaching activities through multimedia technology.

Online education has a variety of different means of teaching technology. The technical platform, no matter what kind of teaching methods need stable operation, good scalability, reasonable cost-effective online education products. New Oriental School has made it clear that it will be a provider of educational content in the future, rather than an online platform, because education is a non-standardised product compared to the established vertical search industry, and because educational institutions differ in their structure. At present, the online education industry on the market model and technology, it is difficult to completely replace the offline learning effects and experience.

Based on the above research background, this paper applies virtual simulation technology to the design of management accounting online teaching system, and designs four parts: online classroom module, video management module, course management module and user management module respectively. Finally, the overall performance of the design system is verified by performance test.

2 Overall Module Design of Management Accounting Online Teaching System

The goal of this paper is to create a virtual classroom like a real classroom, where teachers and students can fully interact with each other, including video and audio communication, using a whiteboard (the blackboard of a real classroom) to demonstrate and write, and being able to practice and explain exercises on the spot. Make students feel as if they are immersed in an offline church, instead of learning by themselves, and are unable to solve difficult problems in time. Teachers can also timely understanding of students' acceptance of knowledge, and according to the circumstances at any time to adjust the progress of lectures. In this way, both in teaching and learning, can achieve good results.

Interactive teaching is one of the most important functions of our system, but as a complete online teaching system of management accounting, it should also provide such functions as course management, course content production and uploading, course assessment, etc. [5].

As a teacher, we can complete the management accounting curriculum planning, courseware management, exercise assessment, and can also carry out on-site teaching

and after-the-fact teaching. Basically, there is a need to cover the teaching and assessment functions of a teacher throughout the course from start to finish [6]. As students, they may add corresponding courses to this system, participate in management accounting online classes at the prescribed time for interactive teaching, and in some cases (for example, teachers and students are absent due to business), they may watch the teaching of previous courses or relevant materials through the on-demand system. Students can practice the exercises under the assessment system and submit the exercises to the teacher for feedback. Specifically, the functions that this system should include are shown in Fig. 1.

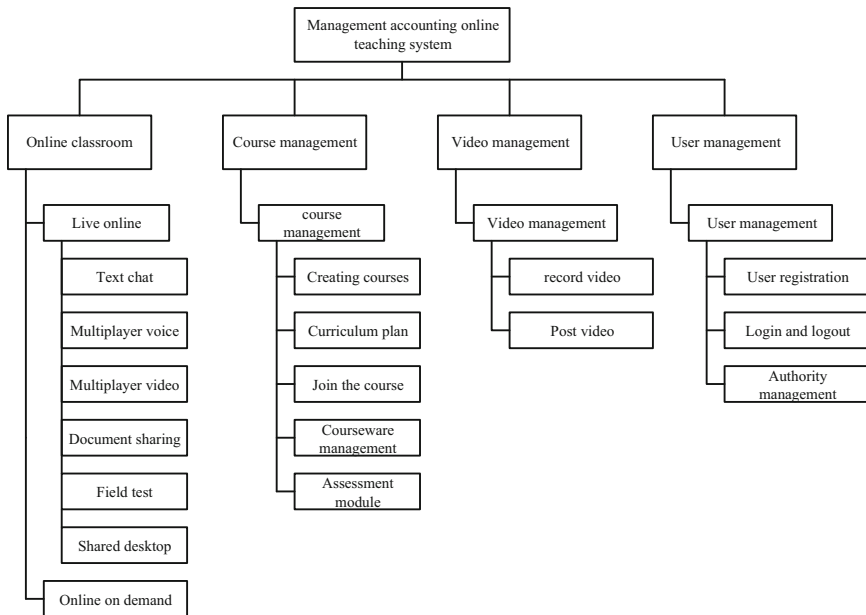


Fig. 1. Function module diagram of online teaching system

2.1 Detailed Design of Online Classroom Module

Red5, as the core server, needs to handle the real-time interaction of all clients. It needs to support the functions of instant text chat, voice chat, video chat, document presentation, etc. In the online live broadcast of accounting [7]. The application architecture of the server is shown in Fig. 2.

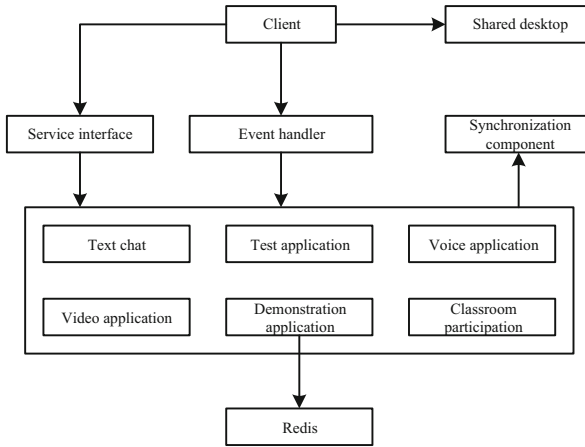


Fig. 2. Application architecture diagram on the Red5 server

The functions of each module are explained as follows:

Clients

That is, the Flash client, the user live module online interface to interact directly. It needs to interact with the server to synchronize the state of this client to other clients.

Event handlers

Used to handle client access and exit, as well as installation of various applications and synchronization components.

Service interface

It is primarily responsible for the client's remote method scheduling (RPC), which enables the client to invoke the server's methods as if they were local methods.

Synchronization components

The purpose of the synchronization component is to synchronize all clients, using share-Object to update and synchronize state between clients and servers. ShareObject, which is a shared object, is divided into local and remote shares. Synchronization components use remote shared objects, so that state updates on one client can be synchronized directly to other clients via the server shared object.

Desktop sharing

The Desktop Sharing Component, which provides the ability to transfer the presenter client desktop and associated operations to other clients, is implemented in detail below.

2.2 Detailed Design of Video Management Module

Video management is mainly video recording. In the management accounting online teaching system, video recording is widely used, and the system mainly solves two major problems: some students are unable to attend the course on time due to time constraints; students still have doubts and want to watch the course video again [8] after the completion of the course.

Through the recording and broadcasting system, not only improve the utilization of learning resources, but also meet the demands of students to study independently according to their own time.

Teachers use the system to open the camera recording video. The video will be saved in the system, and uploaded to the corresponding courses, students can watch the on-demand class online.

Teachers request recordings via Nginx and upload the corresponding documents to the Tomcat server, which delegates document conversion and communicates with the Redis server via Redis messages. The Red5 streaming media server interacts directly with the Flash recording client to process user input video streams.

The overall architecture of the video recording is shown in Fig. 3.

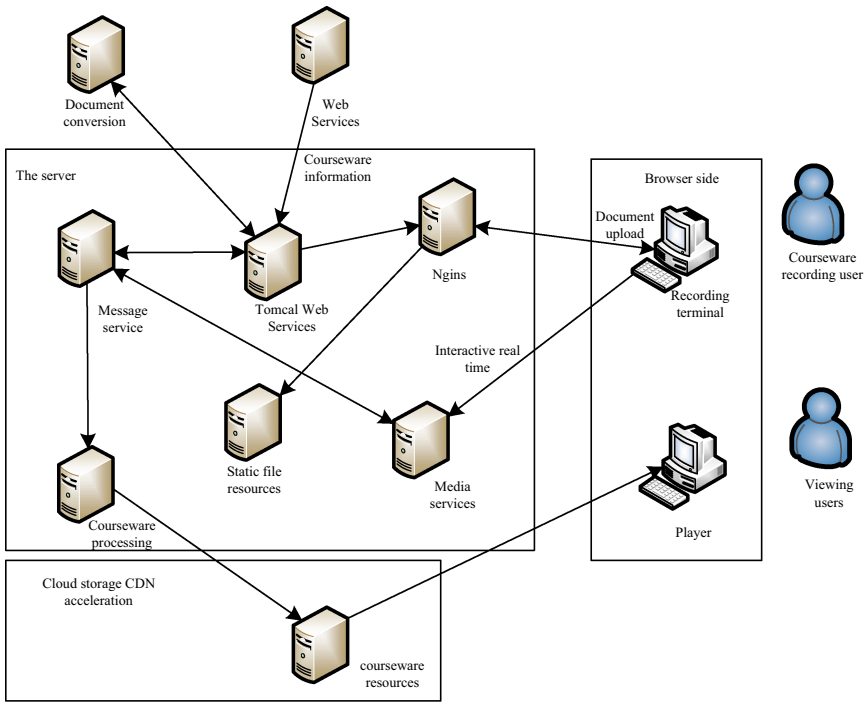


Fig. 3. Architecture diagram for video recording

The recorded video will be uploaded to the cloud storage service after being processed by the Ruby courseware processing module, and other users can access the cloud courseware resources for on-demand [9].

Video recording and broadcasting, on the whole, is divided into five stages: collecting, archiving, grabbing, publishing and on-demand.

1. Collection stage: the collected events in the chat, document demonstration, electronic whiteboard, video, voice and other modules shall be sent to the server message bus

in real time. Media builds push video, audio, and desktop sharing streams to the server side.

2. Archiving stage: subscribe to events in the message bus, archive them to a file or database, and extract the original media files to a specified location without affecting the class.
3. Crawling and processing stage: extract original events/media files, based on configuration rules, transcode operations, and process them into multi-specification media packages. In the future, editing functions can be supported, such as cutting and deleting part of the contents, and monitoring and operation of the processing process can be supported.
4. Release stage: release the generated courseware to the designated location based on the configuration and make local backup.
5. On demand stage: used for viewing customizable courseware through Flash client on demand according to downstream system media specifications.

Video recording can record the content of the teacher's lecture, which provides convenience for storing teaching resources. Video-on-demand is beneficial to students' learning and provides them with a wealth of resources. Students can choose their own learning time to study.

2.3 Detailed Design of Course Management Module

Curriculum management module mainly includes creating curriculum, setting curriculum plan, joining curriculum, courseware management and assessment system, etc. Note that the system does not have the function of "deleting curriculum". The main consideration is that, even if a curriculum is completed, it is necessary to retain for review or review, etc., basically there is no need to delete a curriculum; and the only need to delete a curriculum may be to create the curriculum information errors, etc., but this can be modified by re-editing the curriculum, and there is no need to delete the curriculum. No deletion function is provided to ensure that "erroneous deletion" will not occur from the system; and if some special circumstances do occur and a course is to be deleted, it can be deleted by directly manipulating the back-end database by the system administrator, but the function will not be open to general users [10].

Creating courses is a feature that is visible only to the administrator/teacher role. Teachers can create courses through this function, and give courses associated courseware (PPT, video, etc.).

When creating the course, the associated courseware is optional, and some courseware can be associated with the courseware when it is created, or can be associated with the courseware after the creation. When creating a course, you can choose to import the list of students for the course, or you can add students after the course has been created, or you can add students through student application and teacher approval.

The specific implementation process for creating the course is shown in Fig. 4.

Joining the course is a function that students need to use. Students can apply to join a course after they have selected it from a list of courses. After the teacher approves the application, they can join the course, see the details of the course, watch and download the courseware, and then watch the course online or on demand.

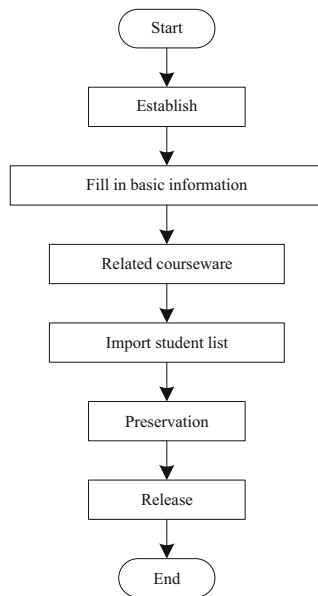


Fig. 4. Course management flowchart

The flow chart of students joining the course is shown in Fig. 5.

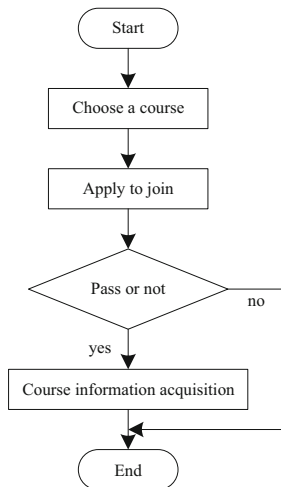


Fig. 5. Student participation flowchart

The process of joining the course is simple. If the teacher approves the application, the students can get the information about the course, watch the VOD and download the courseware at any time. If the approval does not pass, the process ends. Students can contact their instructor offline to find out why or to reapply.

2.4 Detailed Design of User Management Module

User Registration Module

User registration function we mainly use its Baidu user unified registration program, registration function needs a total of five corresponding interfaces. Including a session service interface, get the recommended user name interface, SAPI registration interface three.

The steps are as follows: register the data verification interface, obtain the recommended user name interface, apply for sending the SMS verification code interface, verify the verification code and user registration interface, and session service interface.

Session Service Interface Usage: Since the user should be logged in directly after the registration is completed, a parameter named bduss will be returned when the authentication code and the user registration interface return the successful status. After this parameter is used to request Session Service Interface, aid, username and other information will be returned, and then the user can be logged in by transmitting the successful information, aid and username to the client.

User Logout Module

Login and logout module is one of the most used modules in this teaching system. If the user wants to get the corresponding privilege, he must login to authenticate before he can get the privilege. Teachers, students, and administrators use their own usernames and passwords to verify their identities and whether they have permissions. The system login schematic is shown in Fig. 6.

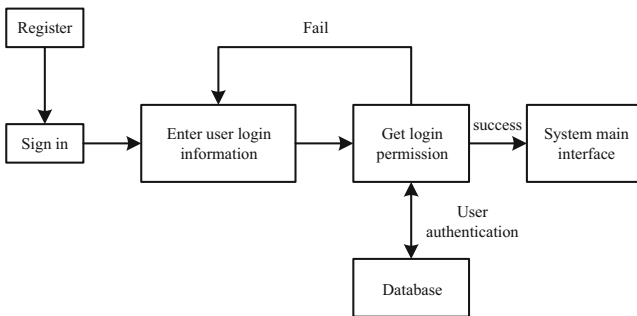


Fig. 6. User login schematic

The user login module is divided into three parts.

- 1) User operation interface: mainly the graphic interface and logical design that the user operates, and the password can be checked;
- 2) Database: MySQL is used, and the server uses Tomcat;
- 3) Java class: Realize the operation of adding, deleting, changing and checking database.

User logoff is the operation to log off the system after the user has successfully logged on. So, when you logoff, you will check whether the user is logged on or not. If it is logged off, you can log off the system.

3 Test Analysis

3.1 Functional Testing and Analysis

After the completion of the development, through the most basic test cases to verify whether the system can meet the needs of online teaching system.

Before testing, the test environment should be configured. The deployment of the test environment should be configured according to the requirement of online deployment, and the real online scenario should be simulated.

Online Classroom Module

Online classroom is mainly divided into online live streaming and online on-demand. The main test points of online live streaming are text chat, audio and video chat, document sharing, on-site testing and desktop sharing. The main test point of online on-demand is on-demand video. The testing method adopts role-based method to test the corresponding functions. Teachers use these tests as shown in Table 1.

Table 1. Teacher test case table of online broadcast module

Serial number	Input	Expecting results	Result
1	Upload handouts in handout management	Use the handout correctly after uploading successfully	In line with expectations
2	Teacher opens mic voice	Mic sound is turned on	In line with expectations
3	Adjust mic volume	Mic volume changes with the adjustment	In line with expectations
4	Turn on the headset	The headset is turned on	In line with expectations
5	Adjust the sound level of the headset	The sound of the headset changes with regulation	In line with expectations
6	Select to turn on the camera	It can collect the camera information of teachers	In line with expectations
7	Turn off the camera	Show teacher's default Avatar	In line with expectations

(continued)

Table 1. (continued)

Serial number	Input	Expecting results	Result
8	Click Share desktop	Teacher desktop shared	In line with expectations
9	Use the tools in the toolbar to write and draw	The operation is successful and can be displayed correctly	In line with expectations
10	Some students raise their hands and the teacher clicks on it	Students can speak	In line with expectations
11	Some students raised their hands and the teacher refused	Students are not allowed to speak	In line with expectations
12	Enter text in the discussion area	Students can view the teacher's speech	In line with expectations
13	Click to view online students	Show all online students	In line with expectations
14	Select upload document in data area	The document can be uploaded successfully	In line with expectations

The main test used by students is shown in Table 2.

Table 2. Student test case table of online live broadcast module

Serial number	Input	Expecting results	Result
1	Students click the "handout" button	View the handout of the teacher's current speech	In line with expectations
2	Click preview	Preview the entire handout	In line with expectations
3	Turn on mic sound	Mic sound is turned on	In line with expectations
4	Disable mic	Mic sound is disabled	In line with expectations
5	Adjust mic volume	Mic volume changes with the adjustment	In line with expectations
6	Turn on the headset	The headset is turned on	In line with expectations
7	Mute the headset	The headset is muted	In line with expectations
8	Adjust the sound level of the headset	The sound of the headset changes with regulation	In line with expectations

(continued)

Table 2. (continued)

Serial number	Input	Expecting results	Result
9	Select to turn on the camera	It can collect students' video information	In line with expectations
10	Turn off the camera	Show the default picture of the student	In line with expectations
11	Students click and raise their hands	The teacher looked up the students who raised their hands	In line with expectations
12	In the discussion area, students input text to send	Speech sent successfully	In line with expectations
13	Click to view online students	Show all online students	In line with expectations
14	Click download in the data area	The document can be downloaded successfully	In line with expectations
15	Enter the answer and submit the test	Upload the answers to the teacher	In line with expectations

The conclusion is drawn through the test, and the online classroom module test is passed.

Video Management Module

The main function of video management is to record and release video. The specific test is shown in Table 3.

Table 3. Test case table of video management module

Serial number	Input	Expecting results	Result
1	Click video recording	The video starts recording	In line with expectations
2	Click stop	Recording pause	In line with expectations
3	Click save	Save the current recording	In line with expectations
4	Click publish	The recorded content can be published	In line with expectations

The conclusion is drawn from the test, and the video management module has passed the test.

Course Management Module

Courseware management module is mainly a module that teachers and administrators can operate. The main test function points are to create and edit courses, create course plans, manage courseware, and arrange and correct homework. The teacher's specific test is shown in Table 4.

Table 4. Teacher test case table of curriculum management module

Serial number	Input	Expecting results	Result
1	Create a new course and input the relevant information about the course	Successful new courses	In line with expectations
2	After the creation is successful, click publish	Publish successfully, front desk students can view the course	In line with expectations
3	Create new courseware and input relevant information of courseware	Courseware created successfully	In line with expectations
4	Online classroom selection recording and broadcasting	Producing recording and broadcasting courseware	In line with expectations
5	Click on course management	Get course list	In line with expectations
6	Click courseware management	Get courseware list	In line with expectations
7	Click Create course plan and submit	The front desk can see the course plan	In line with expectations
8	Click to assign homework and ask questions	Students can see homework information	In line with expectations
9	Click to correct the assignment	See the homework and input the comments	In line with expectations

The administrator specific test is shown in Table 5.

Table 5. Administrator test cases of course management module

Serial number	Input	Expecting results	Result
1	Create a new course and input the relevant information about the course	Successful new courses	In line with expectations
2	After the creation is successful, click publish	Publish successfully, front desk students can view the course	In line with expectations
3	Create new courseware and input relevant information of courseware	Courseware created successfully	In line with expectations
4	Click on course management	Get course list	In line with expectations
5	Click courseware management	Get courseware list	In line with expectations
6	A course is suspended in the course management	The course has been taken off the shelves	In line with expectations

The test results show that the user management module has passed the test.

User Management Module

The user management module is mainly the entrance to the system. If you want to get the corresponding permissions, you need to go through this module. The detailed test is shown in Table 6.

Table 6. Test case table of user management module

Serial number	Input	Expecting results	Result
1	Registered users	Login was successful	In line with expectations
2	Enter the student's user name and password to log in	Login successful, enjoy the corresponding rights of students	In line with expectations
3	Enter the teacher's user name and password to log in	Login successful, enjoy the corresponding authority of the teacher	In line with expectations
4	Enter the administrator user name and password to log in	Login successful, with the corresponding authority of the administrator	In line with expectations

(continued)

Table 6. (continued)

Serial number	Input	Expecting results	Result
5	Enter the wrong user name and password	Login failed, you can view the basic information about the platform	In line with expectations

The test results show that the user management module has passed the test.

3.2 Safety Test and Analysis

Since the teaching system is a product developed externally, it is necessary to carry out security test on it. In the process of testing, we mainly find security loopholes and their repair, as shown in Table 7.

Table 7. Statistics and repair of security vulnerabilities

Vulnerability types	Specific description	Repair situation
Information leakage vulnerability	The interface leaks the user's email address, which does not conform to the passport security specification	Fixed
Arbitrary file upload vulnerability	The interface allows arbitrary files to be uploaded. Although they are stored in BCS, attackers can upload HTML, resulting in persistent storage XSS, phishing, etc.	Fixed
CSRF attack vulnerability	Multiple interfaces do not defend against CSRF attacks. Csrffilter has been written before, but it is not applied to all data writing interfaces	Fixed
Storage XSS vulnerability	The main reason is that rich text does not filter out dangerous tags and attributes, which leads to JS code execution during display	Fixed
Privilege bypass vulnerability	URL access control and resource usage control	Fixed
Http401 phishing vulnerability	Since the SRC source of rich text img is not judged, attackers can introduce malicious addresses	Fixed

After security testing, the existing security problems of the system have been repaired to meet the online requirements.

4 Conclusion

This paper proposes the design of management accounting online teaching system based on virtual simulation technology. Through the detailed design of the online classroom module, video management module, course management module and user management module, the research of this paper is realized. The results show that the system has higher security.

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