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Design and Implementation of International Trade Virtual Experiment Platform

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Abstract. Because of the problems that the current virtual experimental platforms focus on a single situation and small number of compatible users, a virtual experimental platform for international trade is designed. The platform uses desktop virtual reality technology to build the platform, modular to construct it. The platform has improved the international trade course system. Finally, compared with the existing virtual experiment platform, the results show that the designed International Trade Virtual Experiment Platform has more compatible users and faster response speed.

Keywords: Virtual Experiment Platform, international trade, modular, compatibility, stability

1. Introduction

Education currently faces the challenge of adapting to very rapidly changing environments due to technological developments [1]. Virtual Reality (VR) can assist solve this problem. VR can help students understand abstract topics and increase student motivation [2] as well as having a positive impact on the learning outcomes of students' behavior skills training [3]. And VR can enhance self-efficacy and knowledge [4]. However, it has become evident that VR has yet to be implemented in daily teaching routines [5][6]. What's more, it is often hard to customize and integrate into standard educational contexts [6][7].In recent years, many scholars have also designed virtual experimental platforms for many fields to improve the ability to evaluating physical education[8], help the students learn math [9] and farming culture [10].What's more, VR improves fire safety awareness[11]. However, there is very little discussion about the virtual experimental platforms of economics and management. They basically focus on imitation of all the internal conditions and processes of enterprises, such as operation, finance, management and so on. This study focuses on the subject of international trade, sets up macro-market economic data and simulates the real environment. It allows students to participate in international trade, and have a better understand the theory they learned.

2. Research Method

VR technologies encompass a range of digital tools that are used to immerse the user in a digitally-generated world. Scientists categorize VR into three types: 1)

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non-immersive (desktop): the images are delivered by a screen even if there are 3D images. It is the most common and inexpensive form of VR; 2) semi-immersive (projected): images and effects are projected on a wide big screen, immersion is increased but the level of interaction is affected; and 3) fully Immersive VR: this is the most expensive and the most famous VR [12]. This study uses the desktop virtual reality system to design the virtual experiment platform of international trade. The desktop virtual reality system uses the web technology to realize the online access and operation system. Desktop virtual reality technology takes the display as a tool for external display to show the virtual environment to the visitors. It uses the mouse, keyboard and other output devices for simulation, mainly focusing on giving visitors visual experience and immersive plots. Its cost is low. It is not limited by space and time.

3. Construction of Virtual Experimental Platform Based on Web Technology

The existing virtual experimental platform basically has the phenomenon that too many compatible users will cause the platform to slow down or even crash. In view of this problem, the platform designed in this study will be aimed at solving this situation. In order to improve the number of compatible users, the user framework is designed in this study. Users are divided into administrators, students and teachers, which interact with each other. The administrators manage the platform to ensure the secure operation of the platform. Teachers share resources and use platforms to teach. Students learn through assignments and resources assigned by the teachers.

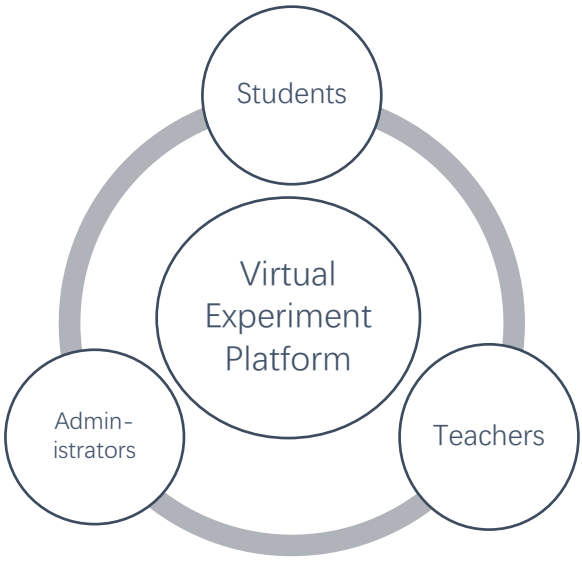

Figure 1. Users' structure chart

From Figure 1. Users' structure chart , the framework and database will be refined, and the platform will be modular. And in the process of user interaction, virtual reality technology is used to enhance the practicality of the platform.

3.1. Platform Framework Design

According to the user structure diagram in Figure 1, the modules are planned in an overall way to build the basic framework of the platform. In order to ensure the rationality of the platform framework, we design the following framework.

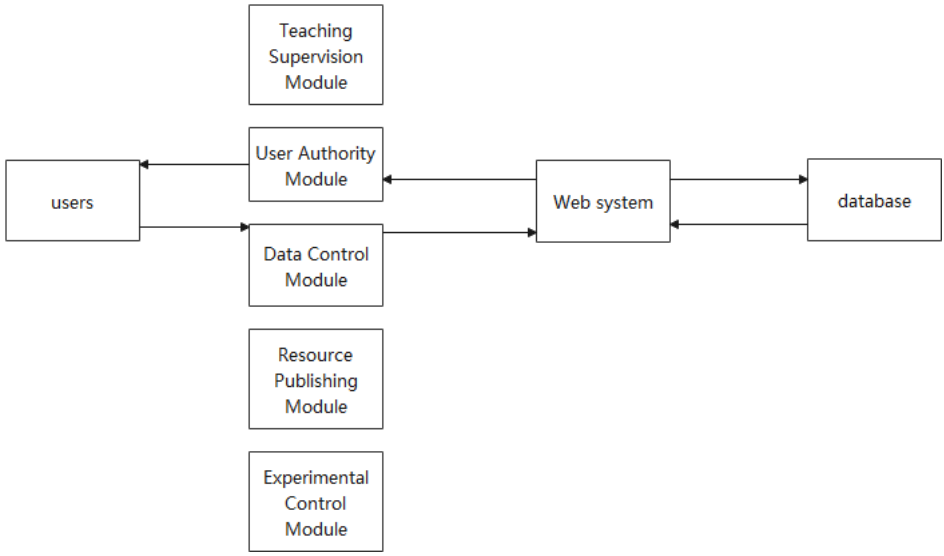

Figure 2. International Trade Virtual Experiment Platform frame diagram

As shown in Figure 2, the framework is divided into four parts: users, module, Web system and database. The users use the system through the module. The module transfers the user usage information to the Web system. The network management system transfers the information to the database. The database feeds the situation back to the Web system. The Web system gives the situation to the user through the module. The modules are divided into user authority module, teaching supervision module, experimental control module, data control module and resource publishing module. The modules affect each other. The modules are all built around the experiment. Students do experiments through the experimental control module. The experimental data is collected by the user authority module and then collated into a report. Report is feedback to the teaching supervision module. Resources released by teachers before the experiment are control by the resource publishing module. Resources data during the experiment is also collected by the data control module. Modules are designed according to the user framework. It can meet users' needs, and to a certain extent to expand the number of compatible users.

3.2. Design of Platform Database

The platform will store the macroeconomic data that has been debugged in advance in the database, and the modified data will also be temporarily stored in the database. Only after the above process can the set situation be simulated. It can be seen that the platform can run normally. It is the key to simulate the situation. In the design of the platform database, this study chooses SQL Server 2013 as the database development software,

and the generated database as the database of the platform. The function of the database is to save, modify the information and maintain the stability of the platform. We must ensure that it conforms to the following principles of database design: the design of the data table is normative; Fewer data tables; Fewer fields in the table.

According to the principles mentioned above, this study sets up corresponding data tables to facilitate unified data management. The data input by the users is planned through the data table, which provides convenience for the subsequent data management.

3.3. Design of Platform modular

Some virtual instrument with an instrument function is encapsulated as a module. Using the modular virtual experimental unit, different experimental objects can be analyzed by the same experimental system. This helps to develop the students' ability to draw inferences from one example. Experimental resources are saved. The International Trade Virtual Experiment Platform is divided into five modules: user authority, teaching supervision, experiment control, data control and resource publishing. The following figure describes the modules and their functions.

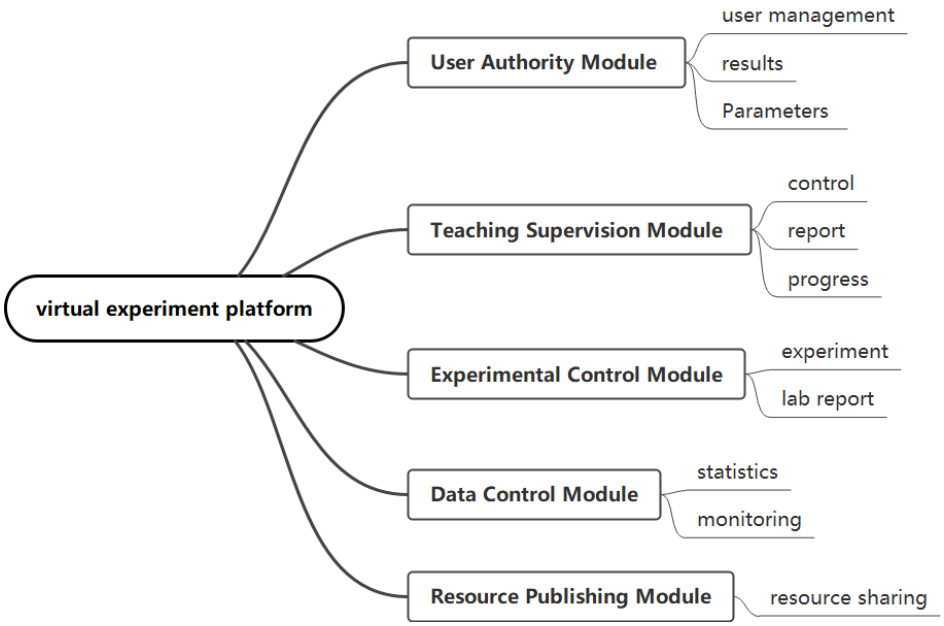

Figure 3. International Trade Virtual Experiment Platform modularization

- User Authority Module. Students can join the class through the course code sent by the teachers. The students can also join the virtual experiment platform by introducing the list of information into the system. The teachers can help students better understand the knowledge in the class by publishing the experiment. At the same time, the teachers made the simulated situation closer to reality through parameter restriction. Students' experimental process will also be systematically recorded, organized into a report, and sent to the teachers. Administrators have the highest authority and can create courses.

- Teaching Supervision Module. Teachers can use the system to assist teaching. It is also as a review tool after class. Teachers publish experiments and quizzes in class to understand students' mastery. Students' completion of the quiz will also report back to the teacher. The teachers can better grasp the teaching pace through the error rate and other data. At the same time, students' completion of assignments will also be reflected in the course progress, so that teachers can understand the situation.
- Experimental Control Module. Teachers can add, delete experiments, prolong the experiment time and so on. And the experiment situation will be plotted into a report.
- Data Control Module. The administrators can monitor the operation of the platform through the platform data feedback. And they can use the data to identify problems of the platform.
- Resource Publishing Module. Teachers and students can upload resources to achieve resource sharing.

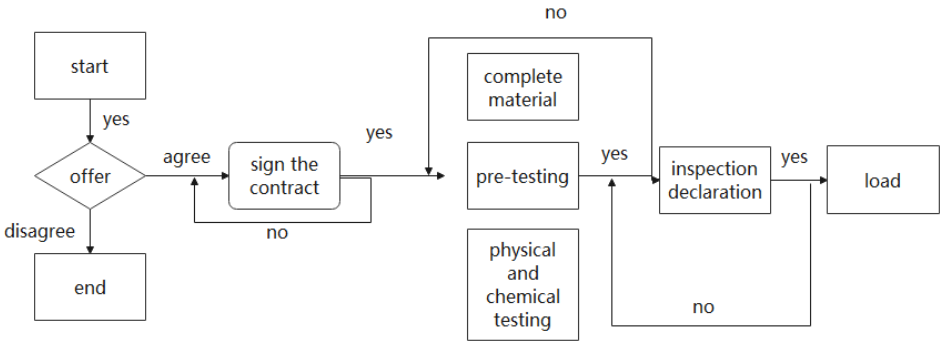

Figure 4. Enterprise export trade interaction diagram

This study takes the enterprise export trade interaction process as an example to illustrate. Users scheme quotation of the production according to the needs of customers. The quotation plan shall be approved by the manager, sales director, etc. and shall be quoted to the customer within the authority. After the customer accepts, the contract is signed and the company begins to produce. Materials are complete before products can be made. After internal pre-testing and finished products through physical and chemical testing, they go to customs broker to check their products. After the inspection, the company can load. After the installation is completed, it can be shipped to the customer.

4. Experimental Results

Modularization solves the problem of poor compatibility of existing virtual experimental platform. It is known that the key to platform stability is the number of users and the number of servers. R is used to represent the platform stability; x is used to represent the remaining user capacity. B is used to represent the number of remaining users, and c is used to represent the number of website servers, then:

$$R = \frac{b}{x} + c \tag{1}$$

Since the remaining user capacity x cannot be obtained directly, the following formula is used to predict the remaining user capacity x, where x_0 represents the initial

user capacity.

$$x = x_0 - \frac{b}{R-c} \tag{2}$$

Administrators can use the preceding formula to monitor the user capacity and avoid system crash. In order to ensure that the International Trade Virtual Experiment Platform is more stable than the virtual experimental platform on the market, this study does an experiment. The stability of the platform is illustrated by comparing the concurrent data of users. The technology used in the test is black box technology, and the key to the test is the number of people they can be compatible with.

4.1. Operating Environment

In this experiment, the first thing is to build an operating environment. The establishment of operating conditions includes server, operating system, database, etc.

4.2. Sample Run

This study takes the number of run-time users as a sample run. Assuming 10 runs, this study sets the maximum and minimum number of users per run in advance. The pre-set sample data is substituted into the virtual experiment platform. The maximum number of compatible users between the two platforms is compared.

4.3. Results Analysis

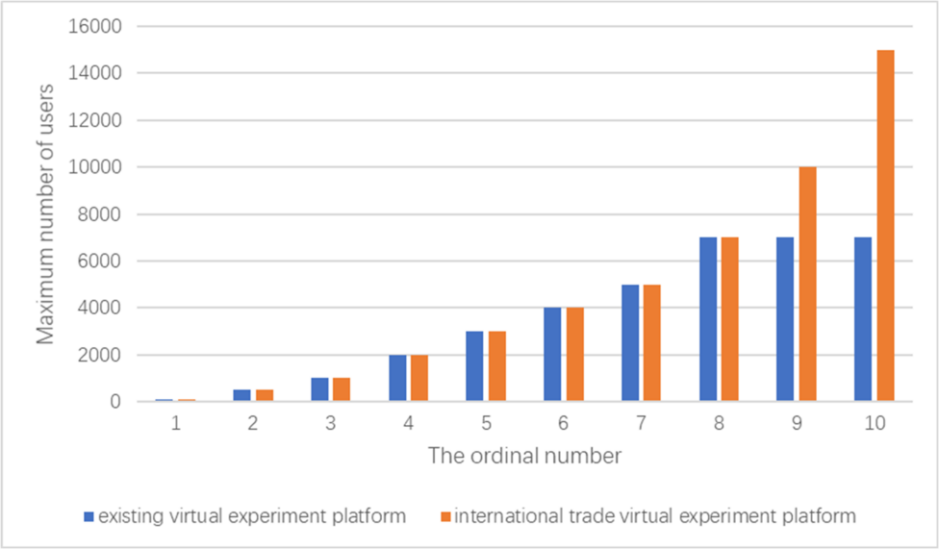

Figure 5. Maximum number of users on two platforms

From the above run, you can see when the number of users is small, both platforms can run smoothly. On the eighth run, the existing virtual experimental platform began to collapse. After the number of users is cleared, the 9th and 10th runs are carried out respectively. The existing virtual experimental platform crashes, but the International

Trade Virtual Experiment Platform can still run smoothly. Therefore, the International Trade Virtual Experiment Platform is relatively stable.

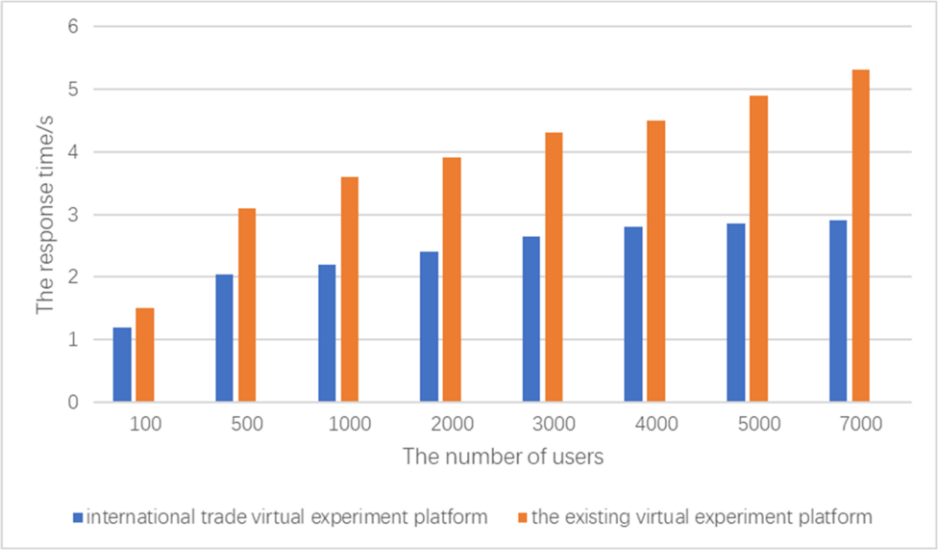

Figure 6. Response time for the same number of users on two platforms

As shown in Figure 6, the response time of the platform designed in this paper is less than 3 seconds under different user numbers. The response time of the existing virtual experimental platform increases as the number of users' increases. Thus, the International Trade Virtual Experiment Platform is more stable.

5. Conclusion

Using the International Trade Virtual Experiment Platform for teaching, students are immersed in the relevant situation. In the process of the experiment, students can choose the role of the government, enterprises and other roles independently. This helps students to experience the behavior decision-making of different subjects. In addition, the experiment can increase the motivation of students to learn and tap their interest and potential. Moreover, compared with the existing virtual experiment platform, the performance of the International Trade Virtual Experiment Platform is better and the running time is more stable.

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