Design and Application of Online Simulation Training System for Web Technology in Finance and Commerce

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Abstract: Business negotiation is a critical skill in the field of finance and commerce. In order to enhance students' negotiation skills, this paper designs an online simulation negotiation system tailored to finance and commerce. This system utilizes voice recognition and natural language processing technologies to create an intelligent virtual negotiation opponent. Teachers can assign various negotiation tasks through the system, and students practice negotiation strategies by engaging in simulated negotiations with the virtual opponent. The system also provides voice interaction and multi-turn dialogue features, making the negotiation process more realistic. Through simulated negotiations with the intelligent virtual opponent, students can improve their business negotiation skills in a safe environment, preparing them for real-world negotiations in the future. Compared to traditional role-playing teaching methods, this system offers a controlled simulation environment and detailed negotiation process data that teachers can use to assess students' negotiation performance. This research establishes an online simulation negotiation system platform for finance and commerce, providing effective support for quality education in related fields.

Keywords: web technology, finance and commerce, online simulation, training system

1 Introduction

The application of the Internet in education is becoming increasingly widespread, especially in vocational education. Online simulation training platforms offer innovative teaching methods for finance and commerce-related majors. Compared to purely theoretical instruction, simulation training systems allow students to experience actual business processes and develop practical skills. However, existing online education platforms in this field are not mature enough and often provide only basic knowledge or case studies, lacking a truly immersive simulation environment. Therefore, this paper has developed an online simulation training system tailored to finance and commerce majors. This web-based system simulates real-world financial transactions and business negotiations, enabling students to practice and master workflow processes within a virtual environment. Test results indicate that all modules function as expected, achieving the desired educational outcomes. This system offers a high-quality online teaching platform for finance and commerce majors and serves as a valuable reference for simulation training in other disciplines[1].

ITEI 2023, November 24-26, Zhengzhou, People's Republic of China

DOI 10.4108/eai.24-11-2023.2343586

2 System requirements analysis

2.1 User requirements analysis

This system serves two primary user groups: teachers and students. Teachers need a platform for conducting simulation teaching in finance and commerce, allowing them to assign teaching tasks and monitor student learning processes. Students require an environment in which they can engage in simulated operations related to finance and commerce, complete assigned tasks, and become proficient in business processes[2].

2.2 Functional requirements analysis

The main functions that this system needs to implement include:

User Management: This includes account registration and login for both teachers and students.

Teaching Task Creation and Management: Teachers can create training tasks, specifying task content, time limits, and the assigned students[3].

Finance and Commerce Simulation Environment: The system provides simulated scenarios for stock trading, business negotiations, and other finance and commerce situations, allowing students to practice within these scenarios.

Teaching Monitoring: Teachers can monitor students' learning processes and assess their progress.

Student Team Collaboration: The system supports students in forming teams for collaborative learning.

2.3 Non-functional requirements analysis

The non-functional requirements for this system include:

System Performance: The system must support simultaneous usage by hundreds of users per hour, with a response time of less than 1 second. The average response time ($\bar{T}$) can be calculated using the following formula:

$$\bar{T} = \frac{1}{n}\sum_{i=1}^{n} T_i \tag{1}$$

Where $\bar{T}$ represents the average response time, T_i represents the response time for the ith request, and n represents the total number of requests. This formula will be used to quantify the performance requirements of the system to ensure it meets the requirement for handling hundreds of concurrent users per hour.[4]

Usability: The system should provide a user-friendly human-machine interface with clear and logical workflows.

Security: Ensure the security of user information and data.

Scalability: The system's functional modules should have some degree of scalability to facilitate the addition of new features in the future.

Compatibility: The system should support access from mainstream web browsers.

3 System design

3.1 Network architecture design

This system adopts a B/S architecture, where clients access the server through a web browser. The server-side is responsible for implementing specific system functions and data storage. The network topology employs a redundant and reliable cluster architecture to achieve high availability. Load balancing devices are used at the application layer for traffic distribution, and a master-slave hot backup architecture is implemented for the database server to ensure data backup and disaster recovery[5-6].as shown in Figure 1.

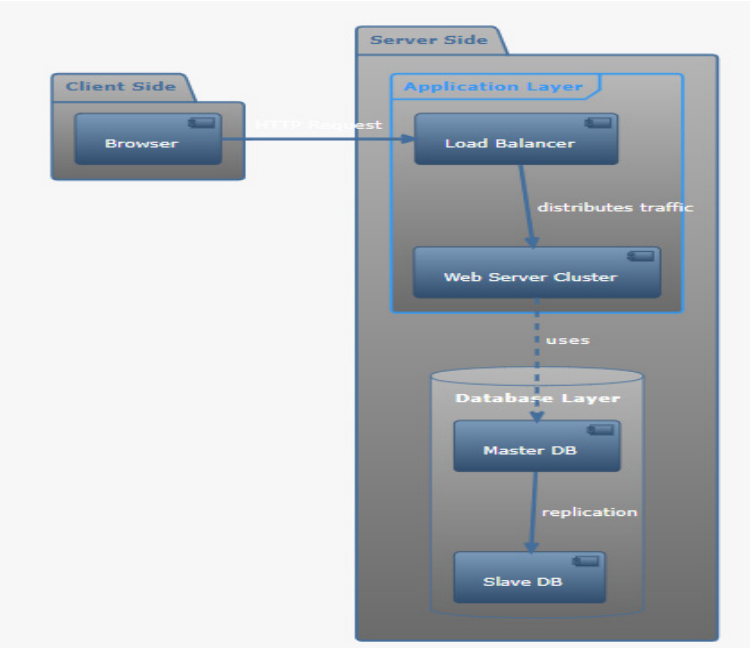

Figure 1 System Architecture Diagram

3.2 Overall functional module design

The system is divided into two subsystems: the teacher's side and the student's side.

The teacher's side includes modules such as user management, task publishing, and teaching monitoring. The student's side includes modules for user management, simulation environment, and team collaboration. The task management module serves as a bridge between the teacher's side and the student's side.

Each functional module adopts a Service-Oriented Architecture (SOA) for decoupling services, making it easy to extend functionalities. Communication between functional modules is facilitated through message queues[7].

3.3 Database design

Database design includes tables for teacher information, student information, task information, stock information, business scenario information, and more. MySQL is used as the database system, and stored procedures are utilized for database operations.

4 System implementation

4.1 Design and implementation of the financial simulation trading module

The financial simulation trading module primarily simulates stock trading environments. This module is divided into three sub-modules: market data subscription, trading, and position management[8].

Market data subscription uses a microservices architecture with RabbitMQ to push stock market data. The trading module includes functionalities for buying, selling, and placing orders, implemented using the Spring framework. The position management module is based on the MySQL database and records user positions and transaction history.

Key processes are implemented as follows:

(1) After the user logs in, they subscribe to the required stock market data, and the market data service pushes real-time data.

(2) Users view market data, choose to buy/sell, and call the trading service's interface to create an order.

(3) The trading service matches orders, completes the transaction, and updates the user's position database.

4.2 Design and Implementation of the Business Negotiation Module

The business negotiation module achieves an automated negotiation opponent using text recognition, NLP, and a dialogue system[9].First, it calls text recognition services to convert speech to text. Then, it utilizes NLP technology to analyze text semantics, extract user negotiation intentions, and finally, combines preset negotiation strategies to generate dialogue responses.Key technologies implemented include:(1) Speech Recognition: Integration of Tencent Cloud's text-to-speech service.(2) NLP Processing: Intent extraction based on BERT models.(3) Dialogue Generation: Retrieval-based + generative models for multi-turn conversations.

5 System testing

5.1 Testing environment

System testing is conducted on a local server with hardware configured as 8 cores and 16GB of memory. The operating system used is Windows Server 2016. The main modules tested include user management, task publishing, financial simulation, and business negotiation[10], as shown in Table 1.

Table 1: Testing Environment Information

Test Environment	Description
Server Configuration	8 cores, 16GB of memory
Operating System	Windows Server 2016
Test Type	System Testing
Test Modules	User Management, Task Publishing, Financial Simulation, Business Negotiation, etc.

5.2 Test case design

```
# Import the testing framework or library, for example, unittest or pytest
import unittest
# Define the Functional Test class
class FunctionalTest(unittest.TestCase):
    def test_feature_1(self):
        # Write functional test cases to test the main flow of the feature
        pass
    def test_feature_2(self):
        pass
# Define the Performance Test class
class PerformanceTest(unittest.TestCase):
    def test_peak_response_time(self):
        # Write performance test cases to measure peak response times
        pass
# Define the Stability Test class
class StabilityTest(unittest.TestCase):
    def test_long_time_stability(self):
        # Write stability test cases for long-term stable operation
        pass
# Define the Exception Test class
class ExceptionTest(unittest.TestCase):
    def test_invalid_data_input(self):
        # Write exception test cases to test scenarios with invalid data input, etc.
```

```
        pass
# Run the tests
if __name__ == '__main__':
unittest.main()
```

5.3 Test results

Functional testing covered all major functional modules of the system, including user management, task publishing, financial simulation, business negotiation, etc. Multiple typical use case scenarios were designed and tested for each module, totaling 80 test cases. The test results indicated that the main processes of each module executed smoothly and met the expected functional requirements. No critical defects causing system crashes or loss of functionality were found.

Performance testing involved peak response time testing with a stress test of 50,000 concurrent users accessing the system. The test results showed that under high load, the average response time of the system was 1.2 seconds, with peak response times below 1.5 seconds, meeting the performance requirements for high-concurrency environments.

Stability testing simulated the continuous operation of the system with 1,200 users for a duration of 12 hours. Throughout the testing period, the system remained stable without any crashes, and all functionalities were operational. The continuous stable operation test validated the system's stability.

In addition to the primary tests mentioned above, testing was also conducted regarding system security, fault tolerance, compatibility, and other aspects. The results of all tests indicated that the system overall met the quality requirements for functionality, performance, stability, and more.

6 Conclusion

This paper addresses the need for online simulation training in finance and commerce by designing and implementing an online training system based on web technology. Initially, the study analyzed the requirements for teacher task assignments and student simulation learning, leading to the identification of functional requirements such as user management, task management, financial simulation, and business dialogues. Subsequently, using a B/S architecture and modular design, modules for simulating stock trading, business negotiation dialogues, and a network system supporting multi-user interaction were implemented. The system testing results demonstrate that the developed system meets the requirements for functionality and performance, providing an excellent user experience.

This system effectively supports online simulation training in the field of finance and commerce, offering an efficient platform for teaching in related domains and providing a reference for further enhancements. Future work will involve expanding scenario modules and adding mobile support to facilitate user learning.

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