The Design of Interactive English Online Education System Based on B/S Structure

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Abstract. Aiming at the problem that the signal attenuation rate obtained by the existing online education system is too large, a free speech interactive English online education system based on B/S structure is designed. The hardware part uses single chip microcomputer as the main controller, expands the interface outside the sensor, and designs the hardware circuit structure. B/S structure is built in the software part, the online interactive algorithm of free speech interactive English is constructed, and the system design is completed. After setting up the system test environment, the traditional system and the online education system designed in this paper are tested. The results show that the signal attenuation rate of the online education system designed in this paper is the smallest.

Keywords: B/S structure · Free speech interaction · English online education · Signal attenuation rate

1 Introduction

Online education refers to the use of advanced digital methods to convert text, pictures, and videos into data that can be stored and converted, and transmitted via the Internet, which is convenient and efficient interactive teaching. With the rapid development of information technology, the coverage and transmission rate of the Internet have increased substantially. This has laid a solid foundation for the large-scale application of P2P technology in video transmission, which can transmit smooth video remotely and interact with low latency. On the one hand, the development of the fixed network has broken the technical bottleneck of the popularization of online education. On the other hand, the rapid deployment of domestic 5G mobile communication technology has also pushed the large-scale promotion of online education to a new peak [1]. The online education system, also known as the distance education system, is a product of the information age. Its characteristics are: to achieve personalized and efficient teaching methods that teach students in accordance with their aptitude. It is a revolution to the traditional teaching mode; it breaks through the limitations of traditional "face-to-face" teaching. The seeker provides a way of learning with scattered time, free arrangement of learning, resource sharing, a wide geographical area, and interactive learning.

W. Fu et al. (Eds.): eLEOT 2021, LNICST 390, pp. 118–129, 2021.
https://doi.org/10.1007/978-3-030-84386-1_10

Compared with traditional education, online education has many outstanding advantages. The latter has wide coverage, high resource sharing, low deployment cost, and supports personalized teaching. At present, in order to promote the healthy development of online education, the state has issued a series of regulations, standards and preferential policies to create a standardized and active promotion environment for the development of the online education system. It is foreseeable that online education will develop substantially. As an emerging field, whether in terms of system or technology, online education has many topics that need to be discussed in depth. Among them, how to achieve a resource-sharing, scalable and highly interactive online education system is the future of online education The key to rapid development [2]. The innovation of the research is that modern distance education is a new form of education with the development of network technology and multimedia technology. It is the third generation of distance education after correspondence education and radio and television education. Its implementation makes learners not limited by time and place, which greatly facilitates students' learning.

2 Online Education System Hardware Design

2.1 Design the Main Controller Structure

The single-chip microcomputer is used as the main controller to control and process some special educational interactive calculation processes. Design the input environment indicator unit and output unit. The two units carry the input and output of virtual reality technology. The overall hardware design circuit frame diagram is shown in Fig. 1 below:

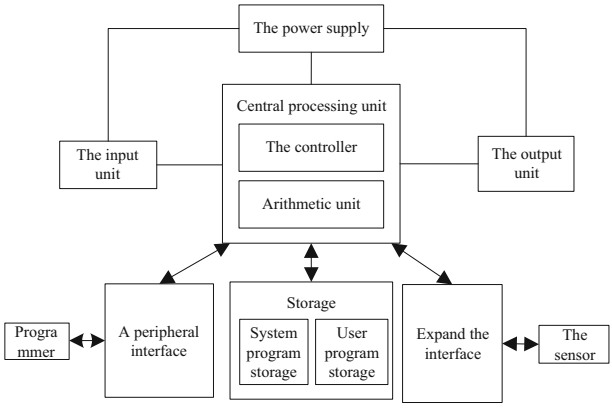

Fig. 1. Hardware composition diagram

According to the above Fig. 1, the hardware of the design system mainly designs the central processing unit, memory, input/output interface, design equipment, communication interface and power supply. The controller adopts a microcontroller based on a single-chip microcomputer. The single-chip microcomputer has a simple structure

and powerful programming function, which can carry continuously changing English interactive data.

The data function module is designed. The data function module is designed as an education data module, an exchange module and an online education module. The three modules collect data separately and then perform digital-to-analog conversion. The three modules are uniformly connected to the data transmission unit to facilitate unified transmission and unified processing of the converted data [3]. In order to ensure the safety and reliability of the processing process, the sensor adopts the SP12 multifunctional sensor. The internal clock of the sensor is designed. Two oscillators are placed inside the sensor. The low-power oscillator with an oscillation frequency of 2.5 kHz is placed in the internal clock. An oscillator with an oscillation frequency of 2 MHz is used in the data function module.

Under the sensor structure shown in the figure above, the sensor is connected to an external expansion interface to help input actual educational data to the central processing module. The external input part of the central processing module is connected to the computer keyboard, and the keyboard inputs data to complete the input of the design data. The memory is designed into two modules, the system program memory and the user program memory. The system program memory is mainly responsible for storing the system data obtained by the programmer, and the user program memory is designed to record the data of teaching interaction. Using a hard disk drive with a capacity of 2G, control its single-disk capacity to 512M. Design the hardware circuit structure, and finally complete the design of the system hardware.

2.2 Design the Hardware Circuit Structure

The system circuit part is mainly designed for clock circuit, reset circuit and power circuit. When designing the clock circuit, a magnetic bead FBI needs to be connected in series with the input end of the power supply to filter out high-frequency noise on the signal line and power line, and reduce the impact of spikes on the system [4]. Connect a filter capacitor C44 between the power supply and ground to filter out the interference of the noise signal, and then connect a 33Ω resistor in series with the output to filter the signal to ensure the output of a high-level clock signal with a duty cycle of 50%. The clock signal circuit The connection diagram is shown in Fig. 2 below:

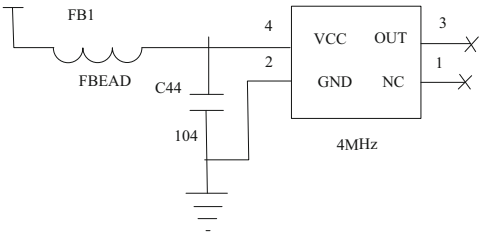

Fig. 2. Clock signal circuit connection diagram

The reset circuit uses the power management chip TPS3307-33, connects the pins SENSE1, SENSE2, and SENSE3 on the chip. The threshold voltages of the design pins

SENSE1 and SENSE2 are 4.55V and 2.93V respectively, and the voltage of the SENSE3 pin is designed to be 1.25V. After the two pins SENSE1 and SENSE2 are divided by resistors R19 and R20, they are connected to the SENSE33 pin. The connection of the reset circuit is shown in Fig. 3 below:

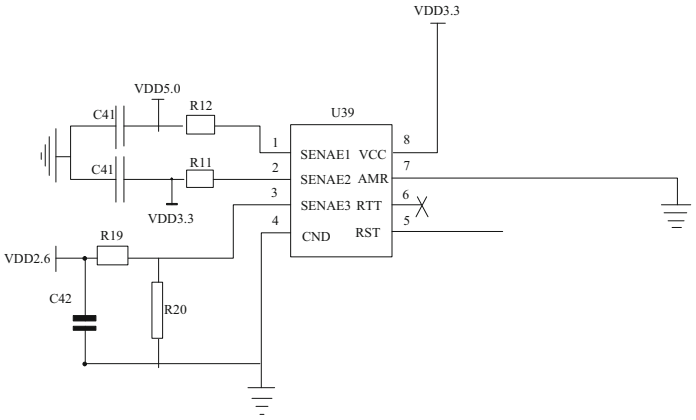

Fig. 3. Reset circuit design diagram

When designing the circuit of the power supply part, the external power supply inputs a DC voltage of 9–12V, and the analog digital 5.0 V voltage supplies power to the digital device, and the reference voltage in the reset circuit is adjusted to a high-precision voltage. In order to prevent a relatively large change in the operating current of a component, causing disturbance to other parts, power is supplied to the driving part of the component separately [5]. The remaining part of the voltage is transformed by a

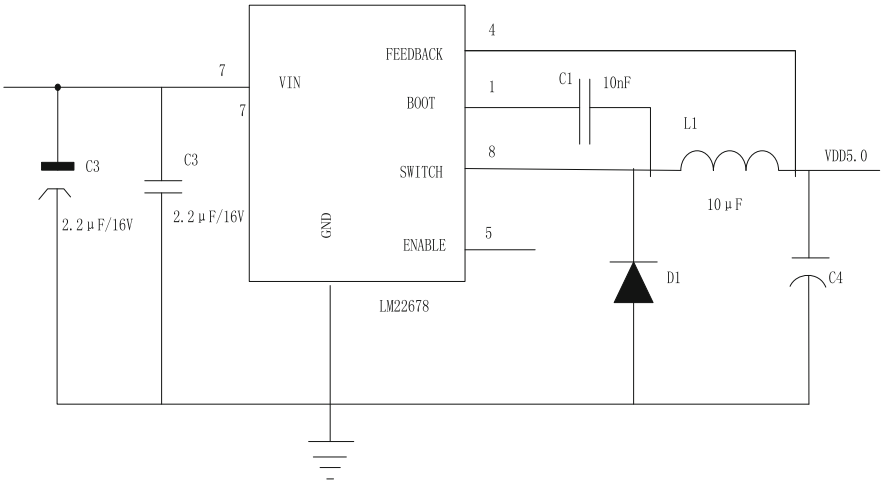

Fig. 4. Power supply circuit

linear regulator on the basis of 5.0V. The detailed system power circuit design is shown in Fig. 4 below:

After designing the hardware of the main control part of the system, connect the designed three-part circuit to complete the design of the hardware part of the online education system.

3 Online Education System Software Design

3.1 Build B/S Structure

The B/S structure is the browser and server structure [6]. The user's working interface under this structure is realized through the WWW browser, and only a small part of the transaction logic is realized by the front end. The main transaction logic should also be realized on the server side, forming the so-called three-tier 3- The tier structure, the designed database structure is shown in Fig. 5 below:

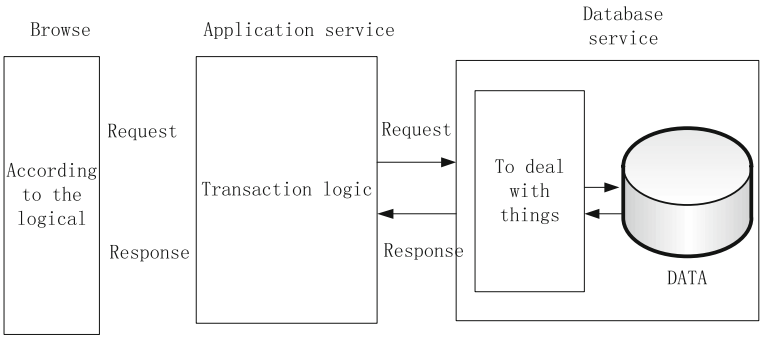

Fig. 5. Set B/S structure

Under the B/S structure built in the above figure, the client is located on the first layer, which is different from the client in the C/S structure. The client only retains a web browser (such as IC or Navigator, etc.). There is no need to store any applications, and in the C/S mode, each user must install the application on the client before using it, configure the parameters of the client, and provide information about the server [7]. At the same time, users also need to participate in the maintenance and management of the client software. If the user's working platform is different, then the corresponding Client terminal must be specially developed according to the characteristics of different platforms [8]. Located in the second layer is the application service layer, which is composed of one or more servers. The Web server is also in this layer. The function of Java Application Server is to process the business logic in the application. This layer has excellent scalability, The number of servers can be adjusted at will according to the needs of the application to prevent object sharing conflicts, avoid object call failures, ensure the granularity and availability of objects, and manage the life cycle of objects. The biggest feature of the Browser/Server structure is that the client unit adopts the browser, which eliminates the time consumed when calling the database [9, 10].

3.2 Building an Interactive Algorithm

According to the needs of different online education users, the attributes of information-based teaching resources are delineated, and after the entities of the teaching resources are contacted by the ER diagram, they are converted to the selected DBMS record type [11, 12], which is constructed into a sub-mode, which is regarded as the interface between the application and the resource database summarizes the data at the interface and integrates it into a data set A to construct a data transfer function, which can be expressed as:

$$A(s) = \frac{\omega^2}{s^2 + Q} \tag{1}$$

Among them, s represents the data transmission time, Q represents the amount of transmitted data, and ω represents the buffer parameter. According to the above transmission process, assuming that the hardware structure has the same sensitivity to each incoming data, an attribute parameter r is set, and the quantity relationship of the parameters can be expressed as:

$$r^2 = (1 - e_{11})\left(1 + \frac{e_{11}(a_{11} + e_{21})}{2}\right) \tag{2}$$

Among them, e_{11} and e_{21} respectively represent the amount of data transmission at different moments, and a_{11} represents the sensitivity parameter [13]. Under the control of this attribute parameter, a shared signal delay parameter is set to form a fluent interactive attribute mode, which can be expressed as:

$$\begin{pmatrix} u_{k+1} \\ v_{k+1} \end{pmatrix} = P\begin{pmatrix} u_k \\ v_k \end{pmatrix} + E_2\begin{pmatrix} 1 & j \\ 0 & \kappa \end{pmatrix} \tag{3}$$

Among them, u_k represents the data stability parameter, v_k represents the data transmission speed, j represents the delay parameter, κ represents the sensitivity of the hardware structure to the data, k represents the signal transmission time, and P represents the fluent interactive attribute parameter[14]. Under the control of different signal transmission times, in order to unify the data mode of online education resources, the above processing acuity parameters and delay parameters are normalized. The processing process can be expressed as:

$$G = f\frac{T}{\kappa j} \tag{4}$$

Among them, f represents the operating frequency of the hardware component, and T represents the operating cycle. Set the above-mentioned work cycle as the actual interactive cycle, and send educational data to the system hardware structure according to this cycle [15]. Based on the above process, the design of the B/S-based interactive English online education system is finally completed.

4 System Test

4.1 Experiment Preparation

After the system is deployed to the cloud server, the operating environment and related test tools needed to achieve the most basic system functional requirements and system-related performance tests are as follows (Table 1):

Table 1. Test environment and tools prepared

Serial number	Name	Parameter
1	Server	CentOS 7.3, 1 core CPU, 2G memory, 1 Mbps bandwidth
2	Browser	Firefox 73, IE 11, Chrome 80
3	Operating system	Windows 10
4	Test machine	PC
5	Test tools	LoadRurmer

Under the test environment and tools shown in the table above, build the system test environment as shown in Fig. 6 below:

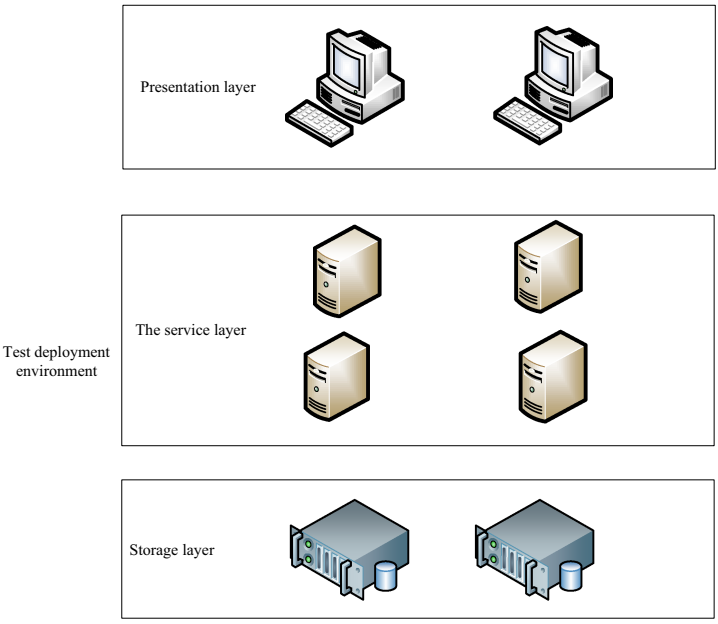

Fig. 6. The deployed test environment

In the test environment deployed in the picture above, the presentation layer is composed of the client Angular single-page application miepweb and the management Angular single-page application miepAdmin web, each of which deploys an instance, on the one hand, to provide access to static resources (the source code of the single-page application includes html, js, css, images, etc.) and on the other hand, each container has a request broker nginx service, which dynamically distributes requests to four MiepService containers, and the service layer is a cluster of four Miepakka services composed of four MiepServices. The storage tier consists of mongodb and EventStore database instances. After the software structure is debugged, experiments are carried out by using the educational system in reference [4], the educational system in reference [7] and the designed educational system to compare the performance of the three educational systems.

4.2 Experimental Results and Analysis

Based on the above experimental preparations, using the same test environment, using JMeter as the stress test tool, the input and query interfaces are used for stress testing, and the throughput and performance of the system are evaluated through the test for the insertion energy of one of the services. For the performance of writing API, we select the job title management of the course learning module for insert performance test. We use the constantly changing number of request threads, insert 2000 pieces of data for each test, and get the throughput rate of each insert to evaluate concurrent requests. The relationship between the number and the system throughput rate. Perform insert request stress test on /api/w/quiz. The set test process is shown in Fig. 7 below:

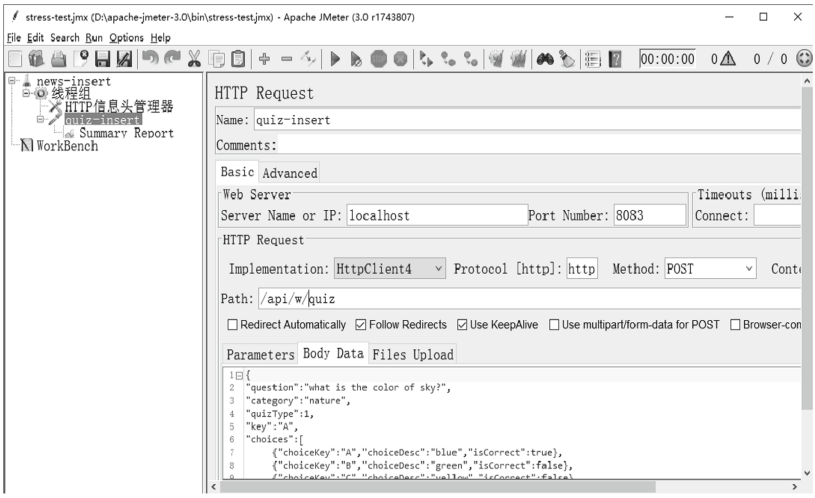

Fig. 7. The set test process

JMeter created a thread group to simulate the number of concurrent online users. We tested this using 20, 40, 60, 90, 120, 150, 180, 200, 220, 250, 280, 300, and configured the

calling server API at http request: http://localapi/host/quiw/quiz and the method used for the request was POST. Summary Repot is used to generate the results of the test, giving Throughput data. Under the three online education systems, the throughput results for the three education systems are shown in the following table (Table 2):

Table 2. Performance test results of three online education systems

Threads	Throughput (records/sec)		
	Reference [4] systems	Reference [7] systems	Education system designed in the article
20	11.3	14.5	17.3
40	8.6	13.2	17.8
60	11.1	12.6	17.9
90	8.9	13.7	18.7
120	10.9	12.9	19.5
150	10.7	13.6	18.9
180	10.7	13.2	18.5
200	11.7	13.5	17.7
220	11.1	13.9	16.9
250	9.8	14.8	16.2
280	11.3	14.6	15.3
300	8.6	12.8	15.3

From the values shown in the table above, we can see that under the control of the three online education systems, the load value generated by the reference [4] system is around 10.39, the throughput of the system is small, the throughput value generated by the reference [7] system is around 13.60, the throughput value is large, and the throughput result of the online education system designed in this paper is around 17.5. Compared with the two existing online education systems, the throughput value of the online education system designed in this paper is the largest and the data that can be processed is the largest.

In the above experimental environment, set the command name and data size of Changyan Interactive English, as shown in the following table (Table 3):

Table 3. Set command name and size

Command name	Acquisition frequency/MHz	Data size/M
Instruction 1	50	4.9
Instruction 2	55	2.2
Instruction 3	60	3.2
Instruction 4	65	4.1
Instruction 5	70	4.9
Instruction 6	75	4.9
Instruction 7	80	4.4
Instruction 8	85	2.5
Instruction 9	90	2.5
Instruction 10	95	4.4

After transforming the instructions set in the above table in the three online education systems, calculate the data transmission speed of the three online education systems according to the response time of the instructions in the system, and the results are shown in the following table (Table 4):

Table 4. Data transmission time of the three education systems

Command name	Transmission speed/Mbps		
	Reference [4] systems	Reference [7] systems	Education system designed in the article
Instruction 1	16.6	34.9	42.3
Instruction 2	15.2	34.6	44.5
Instruction 3	21.9	29.6	38.1
Instruction 4	16.1	25.7	39.3
Instruction 5	15.6	32.4	43.5
Instruction 6	19.3	21.7	40.4
Instruction 7	18.1	33.9	42.4
Instruction 8	15.7	27.8	42.9
Instruction 9	15.4	30.2	37.2
Instruction 10	19.1	30.5	42.1

From the transmission speed shown in the table above, it can be seen that under the same transmission data size, the three online education systems showed different transmission capacities, and the average transmission speed in the reference [4] was about 17.3 Mbps, with a lower transmission speed compared with that in the table. The

average transmission speed of the educational system in reference [7] is around 30.1 Mbps, which greatly improves the ability of the drawing system to transmit data. The average transmission speed of the online education system designed in this paper is about 41.2 MBPS. Compared with the two existing online education systems, the actual transmission speed of the system is the fastest.

Keep the above experimental environment unchanged, set a signal interference of 1 to 10 m outside the three online education systems, and use an oscilloscope to measure the frequency of the collected signals under the control of different online education systems, and generate signals according to signal interference equipment at different distances Interference obstruction, the attenuation rate of the online education signal is calculated, and the final attenuation rate results of the three online education system signals are shown in Fig. 8 below:

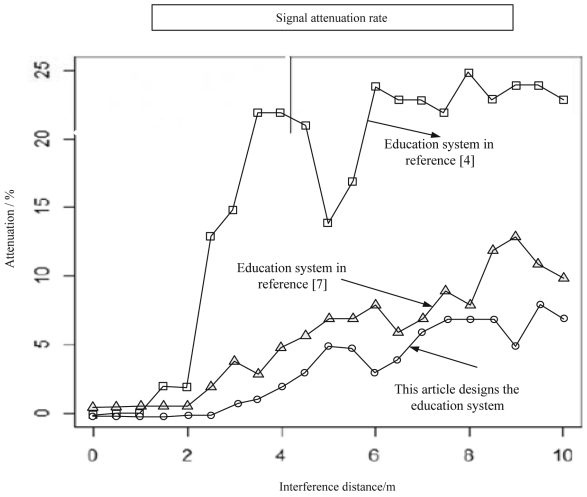

Fig. 8. The attenuation rate of the signals collected by the three online education systems

From the attenuation rate result shown in the figure above, the data signal collected by the education system in reference [4] has the largest transmission attenuation rate under different transmission distances. At a transmission distance of 10 m, the final transmission attenuation rate is 25%about. The online education system 2 in reference [7] maintains a relatively stable transmission attenuation rate between 0 and 4 m, but at a transmission distance of more than 4 m, the signal attenuation rate rises linearly, and the final attenuation rate is 10%about. The attenuation rate value of the education system designed in the article shows a stable change with the increase of the transmission distance. At a transmission distance of 10 m, the attenuation rate of the collected signal is about 5%, and the value of the attenuation rate of the transmitted signal is the smallest.

5 Conclusion

The future development trend of education is modern distance education. Distance education uses today's advanced communication technology and computer network technology to deliver multimedia data, audio, video and other information in non-real-time or real-time, in an interactive or visual form of distance education. As a teaching method, distance education will be used more and more by everyone. Therefore, its development will become more and more perfect.

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