Information Teaching Management System of College Employment Guidance Course Based on Hybrid Architecture

Qinghui Ma(✉), Shuang Wang, and Fei Wang

College of Humanities and Information, Changchun University of Technology, Changchun 130122, China
maqinghui2022@163.com

Abstract. At present, the information-based teaching management system of college employment guidance course can not meet the urgent needs of students' employment information. Therefore, this paper proposes an information-based teaching management system of College Employment Guidance Course Based on hybrid architecture. The business requirements of the employment management system are analyzed from the perspective of users, and the functional modules of the system are abstracted. The system architecture is designed by using the browser / server three-tier architecture mode, and the functions of the system are realized by using PHP technology, Java language and other computer programming technologies. The employment information related to students and enterprises is stored through mysql, and the employment status over the years is analyzed to provide an important reference basis for the employment guidance of the school. The experimental results show that this system is suitable for most networks and will not be hindered by the firewall in the process of use, so it has a wider scope of application and richer data collection.

Keywords: Hybrid architecture · Employment in colleges and universities · Employment guidance · Guidance courses · Information teaching · Teaching management · Management system

1 Introduction

The 21st century is an era of all-round development of information. In this era of opportunities and challenges, China's higher education management should also make innovation. The Internet is playing a more and more important role in today's era. The graduate education information management system based on the Internet is also promoting the standardization and systematization of College Students' information management, thus showing more advantages in accessing and analyzing information [1]. In the current stage of College Students' information management system in Colleges and universities, a college students' information management system based on campus network and by means of interconnected information transmission of various colleges and departments

W. Fu and G. Sun (Eds.): eLEOT 2022, LNICST 453, pp. 430–444, 2022.
https://doi.org/10.1007/978-3-031-21161-4_33

has been generally formed [2]. The development and application of information management system is the inevitable trend of College Students' management development in Colleges and universities, and the college students' information based on campus network is effectively managed, It helps to promote the improvement of education and teaching quality and plays a more important role in promoting the standardization of College Students' education and teaching management [3].

Reference [4] designs an employment guidance course management system based on the Internet of things [4], and uses the service-oriented Internet of things architecture to build an employment guidance course management system including five aspects: client, client and application At the application end, the course scheduling and course selection are realized through the teacher course scheduling module and the student course selection module. Through the information management model of the employment guidance course based on the Internet of things in the infrastructure and service end, the employment guidance course management information resources are integrated and analyzed in combination with the information perception function, and the integration results are transmitted to the public information server of physical education course management through the Internet of things, so as to share the effectiveness of information data. This method can effectively improve the efficiency of information collection, But the acquisition accuracy is low.

In view of the above problems, this paper designs an information-based teaching management system of College Employment Guidance Course Based on hybrid architecture. This project also has important guiding significance for professional teaching management and employment guidance, as well as for strengthening school teaching management and accelerating the process of educational informatization.

2 Hardware Design of the Information Teaching Management System for College Employment Guidance Courses Based on Hybrid Architecture

Generally speaking, most application systems simply use B/S or C/S architecture, but on special occasions, B/S and C/S architectures are mixed. B/S is an architecture used in many projects at present. The browser mode makes it very convenient for users. Users can access the URL through the Internet anytime and anywhere to perform corresponding tasks. Upgrade and maintenance are also more centralized. The C-side of the C/S architecture has very strong processing capabilities, and is stronger than browsers in terms of interactive performance and security. It is suitable for centralized office locations and the user's range of use is relatively stable [3].

According to the teaching practice of colleges and universities, this article has developed and designed a college employment guidance curriculum information teaching management system based on the mixed mode of C/S and B/S. The management module is a subsystem with high requirements for system security and interaction, strong professionalism, and large data processing volume. Therefore, the C/S mode is adopted to set up functions such as course setting, student grouping and score management; and for students online course selection module, Students have a wide range of changes, frequent changes in functions, and relatively weak requirements for information interaction,

so the B/S mode is used to set up functions such as student selection, course selection result query, course content query, password modification, and experiment score query.

The system database uses the MYSQL database system, the B/S architecture is developed with Dreamweaver and PHP language, the C/S architecture is developed with the DELPHI compiler environment, and the DbxMYSQL and ADO technology are used for programming.

The B/S system structure carries on the huge data processing through the browser, uses the Web technology, it has the advantages of simple and fast development and maintenance, strong sharing, and low cost. Its applications can be stored in the Web server as dynamic and static web pages, which are convenient for users to access through a browser. When the user sends a request on the client side, the B/S structure uses the Web server to process the operating data, and then feeds back the processing results to the browser. The B/S structure has a strong data concentration function [4].

The B/S system structure has better compatibility, and all the installation, maintenance and other tasks of the application software of its structure run on the server. Through this system, users can directly run all the functional modules in a browser to realize the "zero client" mode, which is convenient for system operation and upgrade. The B/S architecture lays a realistic foundation for system development, because it provides unified services for the online and networking of various different application services.

The management information system adopts the "zero client" model of this structure, which effectively organizes the internal structure relationship, so that the computer can become the client of the system, provide the quality of service, and realize the relationship of querying internal information under limited conditions. Realize all business information circulation and management work within the organization, increase the functional scope of the application system, effectively combine related network resources, and reduce the workload of program operation and processing to a certain extent. In

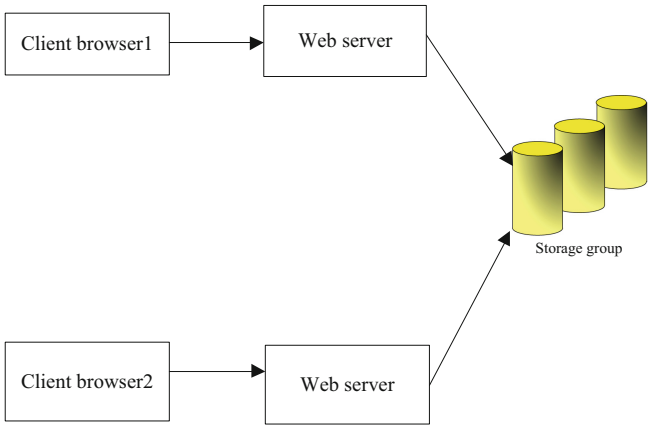

Fig. 1. B/S architecture

addition, the combination of the application system of the B/S architecture and the Internet also makes it possible to realize some new enterprise computer applications (such as e-commerce, cloud computing). The B/S system structure is shown in Fig. 1 above.

Observing Fig. 1 we can see that this system adopts the B/S architecture, uses the lightweight Tomcat 6.0.2 as the application server, and SQL Server 2005 as the backend database. Choose MyEclipse 6.0 as the development tool, and use Struts2 + Spring + Hibernate framework for web applications, and combine Flex, Ajax, JavaScript and other technologies for system design and implementation. Among them, SSH is a multi-tiered Web application architecture that integrates the three currently popular Java Web open source frameworks, Struts2, Hibernate, and Spring, to build a flexible and easy-to-expandable multi-tiered Web application. Struts can be divided into Strutsl framework and Struts2 framework. Struts2 is a combination of WebWork + Struts. With WebWork as the core, it uses the interceptor mechanism to process user requests and allows the user's business logic controller to be separated from the Servlet API. This design also It enables the business logic controller to be completely separated from the Servlet API [6].

This system adopts the Struts framework, is responsible for receiving information from users, and controlling the process to return results to users. Hibernate is responsible for persisting relevant information in the database. Spring provides an IOC container for the system, and transfers the dependency between objects to Spring to control, avoiding excessive program coupling caused by hard coding. The multi-layer architecture improves interface performance and business The logic, database operation and other functions are completely separated, which greatly reduces the coupling and influence of each other, thereby achieving loose coupling and good scalability and maintainability. The adoption of this framework also facilitates subsequent maintenance and secondary development, and saves costs.

After researching and analyzing Struts2, Hibernate and Spring, an information management platform is developed based on these three framework technologies. This information management platform is a new management platform for the school's examination management personnel, teaching secretaries of various teaching units, teachers, and students. In the Web system part, it adopts the multi-frame structure of Struts2 and Spring + Hibernate, which is functionally divided into the presentation layer, the persistence layer, the business layer and the domain layer. The presentation layer uses the Struts2 framework, the business layer uses the Spring framework, and the data persistence layer is implemented with the Hibernate framework. The operation database is converted into an operation object and the database operation is encapsulated. The web architecture of the system is shown in Fig. 2.

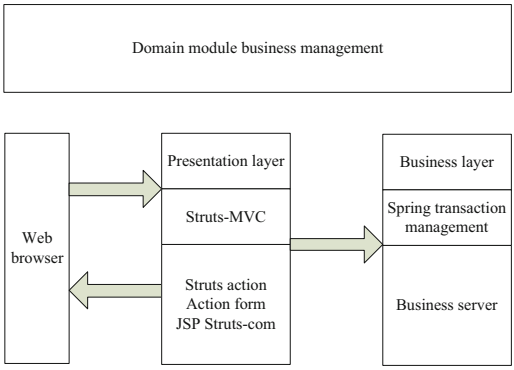

Fig. 2. Schematic diagram of Web architecture

According to Fig. 2, the successful application in the information management platform has verified the feasibility and reliability of this multi framework combined development technology [7].

2.1 MySQL Database

The MySQL database storage method has a strong correlation. At the same time, these related data information are stored in different types of tables, rather than in a large data warehouse. The data processing speed is enhanced through the associated characteristics. MysQL belongs to a "structured query language", that is, a standardized access language. The MySQL data management system has obtained the GPL (GNU General Public License). With the advantages of small size, fast processing speed, cost reduction and open source, more and more people choose MySQL as website data. The reason why the college graduate employment management service system uses MySQL database is precisely because it has the following characteristics:

1. Good performance, strong security, genuine, free, and open source. It is written in C and C++, and tested with various compilers to ensure that the source code can be transplanted.
2. Cross-platform, good compatibility, support AIX, FreeBSD, HP-UX, Linux, Mac OS, NovellNetware, OpenBSD, OS/2 Wrap, Solaris, Windows and other operating systems; compatible with mainstream WEB servers such as Apache and IIS.
3. APIs are provided for multiple programming languages. There are mainly C, C++, Eiffel. Java, Perl, PHP, Python, Ruby and Tcl APIs.
4. Supports multi-threading, using the core thread's complete multi-threading. If there are multiple CPUs, it can conveniently use these CPUs and make full use of CPU resources. Provide multiple database connection methods such as TCP/IP, ODBC and JDBC, and provide management tools for managing, checking, and optimizing database operations.
5. Not only can be used in a client–server network environment with an independent application, but also can be embedded in other software to provide multi-language

support, such as GB 2312, BIGS in Chinese, Shift JIS in Japanese, etc. Can be used as data table name and data column name.
6. Provide management tools for managing, checking, and optimizing database operations.
7. Optimized SQL query algorithm, SQL function is implemented using highly optimized class library, and it runs very fast. Generally, after the initialization of the query is completed, there is no memory allocation, which effectively improves the query speed.
8. It can handle large databases with tens of millions of records.
9. Provides transactional and non-transactional storage engines, and can support multiple storage engines.

Mysql database data synchronization and PHP session sharing. These two technologies are very critical in server clusters or reverse proxy load balancing of squid and nginx. Mysql database one-way synchronization has also become a Mysql database backup. In the college employment management service system, the synchronization and sharing of data is the key information source for data summary analysis. The data synchronization and PHP session sharing can be used to organize data resources. The principle of mysql database data synchronization: mysql database data synchronization is synchronized through the log, the operation of the database will be recorded in the log, and then the system synchronizes the database data according to these operation logs [8].

2.2 Hierarchical and Authority Management of Employment Management Module

The structure of employment management module is shown in Fig. 3 below:

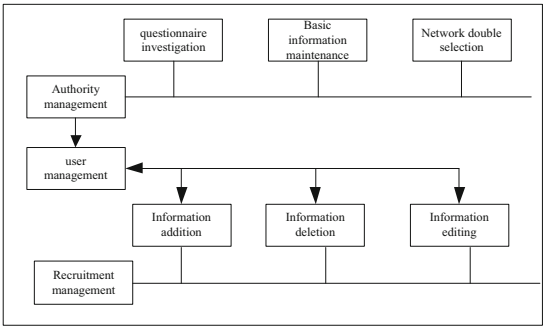

Fig. 3. Employment Management Module

According to Fig. 3, college graduates, employment managers at all levels, enterprises and institutions and other participating users of the system can realize user management, graduate job search, unit recruitment, employment form application, employment progress declaration, graduate file management and other businesses after logging into the system. The system adopts the hierarchical and sub authority management method.

The authority setting is strict and reasonable to ensure the real-time unity of system data, and the system implements strict responsibility monitoring on the authority of users at all levels.

2.3 Graduate Job Search Module

The structure of the graduates' job search module is shown in Fig. 4:

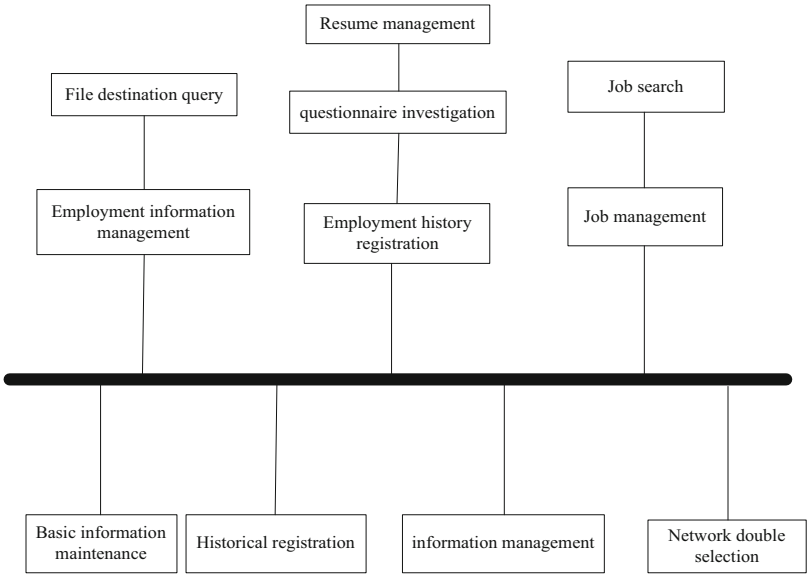

Fig. 4. The structure of graduates' job search module

Figure 4 is the student job search function module. After logging in to the system, students can post their resumes online, modify and maintain their resumes, etc., can query recent positions, and send job resumes to the company according to their intentions. If the other party needs an interview, You can conduct remote video interviews and online consultation. In the process of job hunting, you can participate in online questionnaire surveys, reply to corporate notices, and perform employment registration [9].

2.4 Employer Recruitment Module

The recruitment module of the employer is shown in Fig. 5 below:

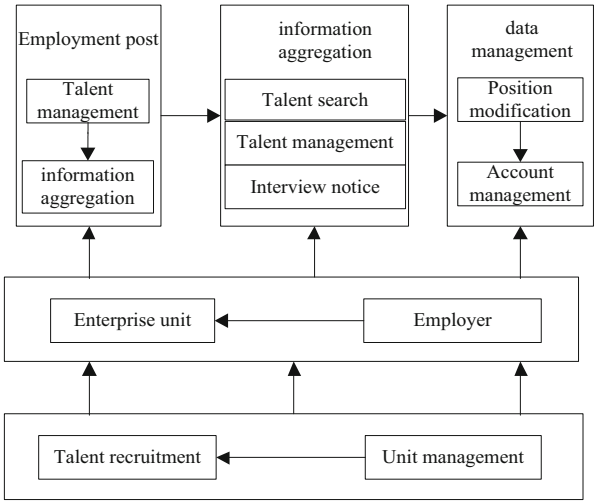

Fig. 5. Employer recruitment module

After the employer is registered online and approved, it can log in to the system to manage various information of the enterprise. The enterprise can change the position, the number of recruits, modify the treatment, etc.; You can also update the talent demand, that is, release the latest recruitment information at any time, such as the requirements for graduates' academic qualifications, degrees, gender, age, etc.; You can query the talent pool in the system, browse various talent information, and include the students who meet your requirements in the favorites; For some students who meet their own requirements, send an interview invitation or video interview invitation to directly answer students' relevant questions [10].

2.5 User Authority Management of Employment Management Module

The administrator of this system mainly manages four types of users, as shown in Fig. 6:

According to Fig. 6, the four types of users include students, department administrators, class administrators and employers. The system administrator has the highest authority in the system, can add, delete and modify various users, and manage the rights of each user. The system administrator also plays the role of maintaining the system.

In this system, the administrators of schools and departments need to manage all kinds of information and of the system. Their main work is to be responsible for the maintenance and update of the system, user review, addition, deletion and modification of permissions, so as to avoid various adverse situations. In the remote video interview between students and enterprises, the interview process shall be monitored and managed to ensure the normal progress of the interview. After receiving the online questionnaires from students and enterprises, make statistical analysis on these data, find out the problems existing in current students or enterprises, feed back to both parties in time, monitor the safety of the system, and back up the data in time.

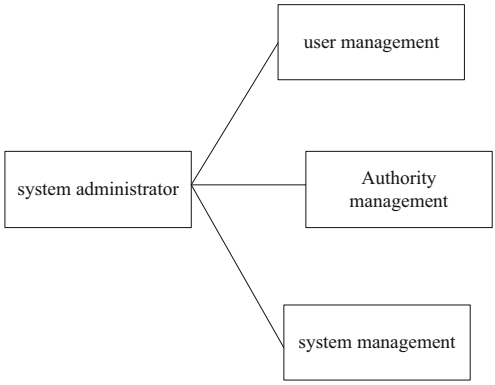

Fig. 6. Employment management work module

Graduates' information maintenance: the graduates' employment scheme is subject to secondary review and management. After being approved by the Department, the center administrator finally locks it, enters the employment scheme library, exports and reports the employment scheme. If the audit fails, call back the information and continue to verify the information.

Maintenance of enterprises and institutions: only approved enterprises and institutions have the right to recruit talents. Maintain and manage all recruitment information and position information.

Data analysis: dynamic management of various employment related data, automatic statistics and convenient operation.

Feedback tracking: conduct online questionnaire survey for enterprises, institutions and graduates, and automatically generate statistical results.

3 The Software Design of the Information Teaching Management System for College Employment Guidance Courses Based on the Hybrid Architecture

This system adopts B/S three-tier architecture, MySQL database, and PHP technology to achieve.

The premise of factor analysis is that the original variables should have a strong correlation, otherwise the factor analysis method cannot be used. Correlation test of initial variables. The first output is the correlation matrix about the initial variables. Assuming the original data matrix, the calculation formula is:

$$Y = \begin{bmatrix} Y_{11} & Y_{12} & \cdots & Y_{1p} \\ Y_{21} & Y_{22} & \cdots & Y_{2p} \\ \cdots & \cdots & \cdots & \cdots \\ Y_{n1} & Y_{n2} & \cdots & Y_{np} \end{bmatrix} \tag{1}$$

Among them, n is the number of samples and p is the number of observed variables.

Standardize the raw data:

$$X_{ik} = \frac{y_{ik} - \overline{y_k}}{S_k} \quad (\mathrm{i} = 1, 2, \ldots\ldots, \mathrm{n};\ \mathrm{k} = 1, 2, \ldots, \mathrm{p}) \tag{2}$$

In:

$$\overline{Y_k} = \frac{1}{n}\sum_{i=1}^{n} Y_{ik},\ S_k^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(Y_{ik} - \overline{Y_k}\right)^2 \tag{3}$$

Suppose the correlation matrix, the calculation formula is:

$$R = \begin{bmatrix} 1 & r_{12} & \cdots & r_{1p} \\ r_{21} & 1 & \cdots & r_{2p} \\ \cdots & \cdots & \cdots & \cdots \\ r_{p1} & r_{p2} & \cdots & 1 \end{bmatrix} \tag{4}$$

3.1 Graduate Login

Graduates can fill in their resume and information after logging into the system through their own account. Graduates can browse the recruitment information and various employment related news trends released by various employers on the web page at any time. They can also query the positions they need to apply for, online consultation and participate in questionnaire survey according to conditions. Graduate data can be imported directly from the school student information resource database.

3.2 Resume Management

After the system passes the review of the student source plan database, graduates can log in to the system through their student number as the user name and password of the login system, improve their personal electronic resume, including Chinese resume, English resume and video resume, publish job intention, register online and deliver resume. Generate graduates' resume information database. The management personnel of the employment center manage the information of graduates' job hunting and employment in the background. If the resume is not completed, graduates are not allowed to apply for a job. Only graduates who have completed the resume can apply for a job, so as to ensure the effectiveness of the employer's recruitment in the resume screening process.

The experimental process of publishing the personal resume module is to first log in to the personal job application interface through the registration number and password, fill in the job application resume, establish a connection through the Connection object, and then use SQL statements to call up the corresponding data fields in the resume table. Students can directly select Conditions, which can reduce the workload of students filling out resumes and system audits.

After the graduates enter the relevant module management of the job resume, they can adjust the content of the resume according to their needs and submit it to the system. After receiving this data, the system will first check whether the data is legal, such as

whether non-nullable data has been entered, and whether numeric data has been entered with characters. If the test finds that the data is not legal, then the wrong data will be eliminated, and the graduate will be discriminated against entering the wrong data. Then, the system will move the cursor to the corresponding input box and let the graduate enter the data again: If it is legal, the system makes the Connection object establish a connection, and then uses the Command object to manipulate the data through SQL statements, and retrieves whether the record exists in the database. The system will re-create the record and save the data in the database. Perform the update operation.

3.3 Job Search

Students can customize various query criteria to query positions, such as position category, province and city where the enterprise is located and post release time. After the system search, the results will be displayed on the web page. Graduates can click to understand the specific situation of the position, or directly click to post resume for online position, In this way, graduates can quickly find their ideal jobs. The system will record the data information of graduates' online job application and synchronously feed it back to the school administrator's background, so that the school administrator can dynamically grasp the dynamic data of graduates' job search and employment in time.

3.4 Contract Management

After graduates complete the job search and employment through the system, they can fill in the employment contract information in the background of the system. The system directly feeds back the employment registration data to the background of the school administrator system, which will be reviewed by the school administrator and the employment center administrator at two levels to lock the contract information and generate the employment scheme information database.

4 Experimental Research

4.1 Experimental Design

In order to verify the effectiveness of the college employment guidance curriculum information teaching management system based on the hybrid architecture designed in this paper, it is compared with the traditional web-based college employment guidance curriculum information teaching management system and the VOD-based college employment guidance curriculum information teaching management system. Experimental comparison.

Set the experimental parameters as shown in Table 1:

Table 1 Experimental parameters

Project	Parameter
CPU	Intel 5000 K 4.0 GHz
RAM	FurryDDR4
Software environment	Windows10
Memory capacity	8 GB
System voltage	200 V

According to the above parameters, three systems are selected for experiments, and the experimental results are shown in the figure below:

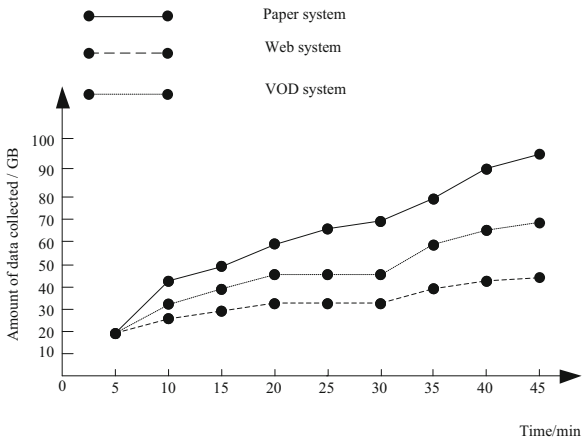

Fig. 7. Experimental results of data collection capabilities

According to Fig. 7, the data collection capacity of the information-based teaching management system for university employment guidance courses based on the hybrid architecture proposed in this paper is higher than that of the traditional web-based university employment guidance courses information teaching management system, and the VOD-based university employment guidance course information Teaching management system. The informational teaching management system of college employment guidance courses based on the hybrid architecture studied in this paper has strong information interaction functions. The internal components of the system have strong interaction functions. Through mutual cooperation and analysis of the interactive information of different network platforms, information integration is realized.. Compared with the traditional system, the internal components of the hybrid architecture system are smaller, so that the coordination of internal components will be more obvious. The system studied in this paper introduces the SOAP protocol, which is suitable for most networks, and

will not be hindered by firewalls during use, so the scope of application is wider and the data collected is richer.

4.2 Experimental Results

Data Collection Capacity
The experimental results of the user management function are shown in Table 2 below (Table 3, 4):

Table 2 Video management functions

	Test results
Expected results	Uploaded successfully
Hybrid architecture	Uploaded successfully
Web system	Uploaded successfully
VOD system	Upload failed

Table 3 Video playback function

	Test results
Expected results	Normal play
Hybrid architecture	Normal play
Web system	Playback failed
VOD system	Playback failed

Table 4 Download function

	Test results
Expected results	Download successful
Hybrid architecture	Download successful
Web system	Download failed
VOD system	Download successful

According to the above table, this article has conducted three tests, respectively for the video management function, video playback function and download function. According to the experimental results in the above table, it can be found that the three tests of the system proposed in this article, the test results are in line with the expected results, while the traditional web-based college employment guidance curriculum information teaching

management system and VOD-based college employment guidance curriculum The various functions of the information-based teaching management system have certain problems, especially in the function of video playback. The playback function of the traditional system is very poor, so it is very likely that the video cannot be played when the teacher is teaching., The download function of the web-based college employment guidance course information teaching management system is relatively weak, and the VOD-based college employment guidance course information teaching management system video management function is poor.

To sum up, the information-based teaching management system of College Employment Guidance Course Based on hybrid architecture designed in this paper has stronger data collection ability, can collect more data in a short time, stronger user management function and wider applicability.

5 Conclusion

This paper proposes an information-based teaching management system for college employment guidance course based on hybrid architecture. The system architecture is designed by using the browser / server three-tier architecture mode, and the functions of the system are realized by using PHP technology, Java language and other computer programming technologies. The employment information related to students and enterprises is stored through mysql, the employment status over the years is analyzed, the relevant matrix of the employment guidance course is constructed, the correlation test is carried out on the initial variables, and the original data is processed through standardization, Through factor analysis, this paper manages the teaching methods of employment guidance course in Colleges and universities. The experimental results show that the information collection ability of this method is strong, and verify the rationality of the platform.

Fund Project. Social science research project of Jilin Provincial Department of education in 2021 (Special project of employment and Entrepreneurship Management), entry name: Research on the curriculum system construction of career planning and employment guidance in Applied Undergraduate Colleges and Universities (Item No: JJKH20211449JY).

References

1. Yin, Q.: Architecture and application of cloud desktop based practical teaching management system. China Education Informatization **16**(01), 58-60 (2020)
2. Ling, Y.: Practice and thinking on informatization teaching of employment and entrepreneurship guidance course based on flipped classroom. Modern Vocational Education **226**(52), 26–27 (2020)
3. Ding, Y., Zhang, N., Li, Y.: College physical education course management system based on internet of things. Mobile Information Syst. **21**(2), 1–10 (2021)
4. Uthansakul, P., Khan, A.A.: On the energy efficiency of millimeter wave massive MIMO based on hybrid architecture. Energies **12**(11), 22–27 (2019)
5. Passalacqua, M., Lanzarotto, D., Repetto, M., et al.: Fuel economy and energy management system for a series hybrid vehicle based on supercapacitor storage. IEEE Trans. Power Elect. **34**(10), 9966–9977 (2019)

6. Wang, S.: The characters of teaching physical Qigong in coastal area based on geological management information system. Arabian J. Geosciences **14**(7), 262–278 (2021)
7. Xiao, L., et al.: Hybrid architecture design enhances the areal capacity and cycling life of low-overpotential nanoarray oxygen electrode for lithium–oxygen batteries. Journal of Energy Chemistry **46**(07), 260–267 (2020)
8. Yang, Y., Mei, Z., Zheng, B., et al.: Design of enterprise management system based on edge computing architecture. Mobile Information Syst. **18**(10), 1–12 (2021)
9. Zhang, W., Wang, J., Liu, Y., et al.: Reinforcement learning-based intelligent energy management architecture for hybrid construction machinery. Appl. Energy **275**, 115–121 (2020)
10. Gao, H.: Engineering training teaching based on virtual simulation technology. Computer simulation **37**(07), 391–393+408 (2020)