Design of Personalized Employment Guidance System for College Students Based on Big Data

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Abstract. In view of the traditional system using personality test for employment guidance, which leads to one-sided guidance results, outdated system design architecture and low operation efficiency, this paper designs a personalized employment guidance system for college students based on big data. After designing the system hardware to collect the information of students' employment environment, the system framework is designed based on B/S structure. Tptmf algorithm is used to recommend employment resources for users. After analyzing the system requirements, the database is designed to realize the system functions. The simulation results show that the response time of employment guidance system using big data is short, and the highest server occupation is only 11%, which is feasible.

Keywords: Big data · College students' employment · Personalized employment guidance · System design

1 Introduction

With the deepening of the popularization of higher education and the continuous optimization of the labor and personnel system in China, how to ensure the employment rate and employment quality of college students after graduation has become one of the common concerns of major universities. In addition to giving students high-quality professional education, comprehensive employment guidance is also essential. The difficulty of College Students' employment is one of the main contradictions in the domestic labor market at present. It is the common responsibility of students, schools and society to help college students achieve successful employment to the maximum extent. Compared with those who have work experience, college graduates are obviously weak in job hunting. First of all, fresh graduates lack professional quality, which is manifested in their lack of work experience, unclear career goals, and unclear what they will do and want to do. As a result, they are at a loss in front of many positions. Secondly, there are some problems in college students' values on employment. In terms of job-hunting attitude, they are either arrogant and rude, or pessimistic, passive and unwilling to bear hardships. Thirdly, college students lack the necessary skills of application and interview. It is not difficult to see from the interview occasions and job fairs that the effectiveness

W. Fu et al. (Eds.): eLEOT 2021, LNICST 389, pp. 301–310, 2021.
https://doi.org/10.1007/978-3-030-84383-0_26

of the interactive communication between them and employers is poor. The traditional employment guidance system has no scientific classification system because of its complicated employment information and lack of classification characteristics [1, 2]. But the current employment situation is grim, how to grasp the accurate information in an effective time, has become a major problem for graduates. In addition, the whole picture of employment situation is not enough in the guidance system, and the lack of statistical information leads to students' wrong judgment of their own employment expectations, and the employment situation is not ideal.

Colleges and universities have employment guidance centers to provide relevant services for students. With the rapid development of the Internet, a lot of education and guidance work has begun to be carried out on the Internet, serving students, teachers and schools [3]. In the Internet era, the rise and application of big data provides an opportunity to provide personalized guidance for college students' employment. The role of big data is to predict. At present, big data has been widely used in various fields of politics, commerce and society. As a frontier, colleges and universities can provide personalized employment guidance for college students by using the advanced technology of big data. After designing the system hardware to collect students' employment environment information, the system framework is designed based on the B/S structure. The Tptmf algorithm is used to recommend employment resources for users. After analyzing the system requirements, design the database to realize the system functions. In this paper, through the research on this topic, we hope to provide ideas for colleges and universities in using big data for personalized employment of college students, and make contributions to solve the problem of difficult employment of college students.

2 Hardware Design of Personalized Employment Guidance System for College Students Based on Big Data

The hardware design of student employment personalized guidance system mainly uses big data analysis module and student employment operation environment module for data collection, to get the information of student employment operation environment and network environment, and then carries out real-time information transmission control on the collected information of student employment operation environment. The structure of the hardware part of the guidance system is shown in Fig. 1 [4].

This paper uses the technology of student employment operation environment to collect the information collection module of student employment. At the information collection end, an electronic tag card is loaded on the interactive information terminal of each student employment guidance. In addition to the above collection part, in order to enhance the comprehensiveness of the collected information, radio frequency technology is used to identify the identity information of students, so as to obtain more detailed employment information of students. In order to reduce the energy consumption of the system, the mc9s08ac60 chip is selected as the data acquisition module. The chip has 8-bit hcs08 central processing unit (CPU), CPU clock is 40 MHz, internal bus frequency is 20 MHz, support HC08 instruction set and bgnd instruction; memory is equipped with 60kb on-chip flash memory, 2 KB on-chip RAM; optional clock source includes crystal oscillator, resonator, external clock or internally generated clock, through ICG module

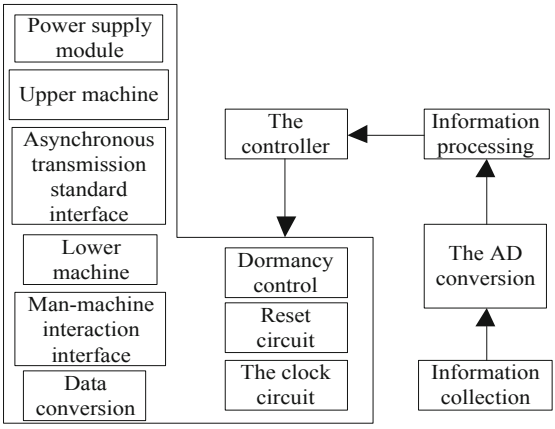

Fig. 1. Hardware architecture of personalized employment guidance system

for precision NVM adjustment [5]. The chip supports background debugging system, has breakpoint function, and allows single breakpoint setting in the process of online debugging (adding two breakpoints to the on-chip debugging module); the on-chip online simulation (ice) debugging module includes two comparators, nine trigger modes, eight depth FIFOs, and two control modes, Storage stream changes address and pure event data, supports label and forced breakpoint, and supports up to 32 interrupt/reset sources. The CRC unit supports fast cyclic redundancy check for memory. The main reset pin and power on reset (POR) · reset, IRQ and bkgd/MS pins of the chip have internal pull-up devices to reduce the system cost of customers. Fm1722 chip is used to read student identity information. The chip adopts 0.6 μm CMOS EEPROM process, supports type A/type B contactless communication protocol at 13.56 MHz frequency, iso15693 protocol, Mifare icode 1 and various encryption algorithms. Communication with other modules through serial port [6–8]. In the data processing module, the characteristics of students' employment status information are analyzed through the buffer, and the remote transmission control of personalized employment guidance information is carried out in the upper computer module.

Based on the hardware part of the system designed above, the software part of the system is designed by using big data technology to provide system function support.

3 Software Design of Personalized Employment Guidance System for College Students Based on Big Data

3.1 System Framework Design

The personalized employment guidance system for college students will use B/S structure to construct the system. Because B/S structure can operate in any place without installing specific software, the design of the system will adopt B/S structure, combine Internet and Intranet, take asenet as the platform, and realize data storage and call by connecting SQL Server database in the background. The system structure is shown in Fig. 2 [9].

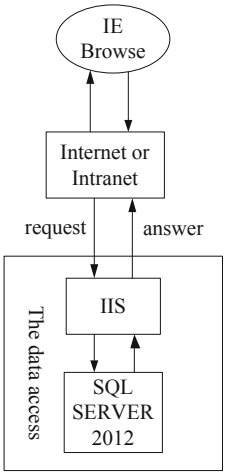

Fig. 2. System logic architecture

Personalized employment guidance system for college students is to manage and guide the employment information of college students. Through the demand analysis and detailed analysis and summary of user feedback, it is determined that the system mainly needs to achieve the following basic functions. They are the management of the basic information of the employer; employment policy and the latest trends; employment guidance function; data query.

3.2 Personalized Employment Information Recommendation

This paper uses ttlmf algorithm to recommend employment information according to the collected employment information and employment preference tag. The flow chart of ttlmf algorithm is shown in Fig. 3 [10–12].

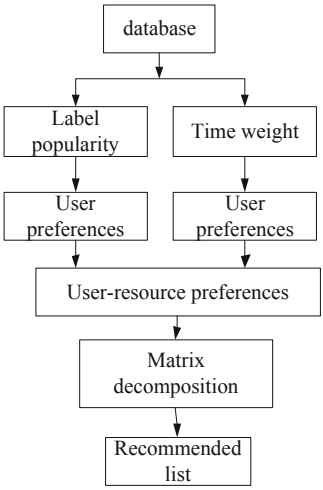

Fig. 3. Personalized employment information recommendation process

This section is divided into two parts: one is the user's preference for employment information resources based on tag popularity; the other is the user's preference for employment information resources based on time weight. According to the definition of tptmf algorithm: the more times a label is labeled by users, the more popular the label is to the users. This paper defines the popularity of tag t_i for user u as follows:

$$Popularity_{u,t_i} = \frac{\text{Freq}_{u,t_i}}{\sum\limits_{t_i \in T(u)} \text{Freq}_{u,t_i}} \tag{1}$$

Among them, the tag that user u has operated is represented by $T(u)$, and the number of times user u has used tag t_i is represented by Freq_{u,t_i}.

User preference for tags can be used to represent user u preference for employment information resource r. User preference for employment information resource based on tag popularity can be calculated by the following formula [13–15]:

$$\Pr e_{popu}(u, r) = \sum_{t \in T(u,r)} Popularity_{u,t} \tag{2}$$

Where, $T(u, r)$ represents the set of employment information resources r labeled by user u. User's interest is often temporal. In short, user's interest will change with age, grade, education level, time and other factors. Traditional recommendation algorithm ignores the influence of time on user's interest. The essence of this part is that user's preference will change with time, compared with the user's past According to the time of tag t_i on employment information resource r marked by user u, the time weight is calculated as follows:

$$TimeWeight_{u,r,t} = \begin{cases} \exp\left\{-\left(1 + \tau \frac{t_0 - t_{u,r,t}}{l_{time\,u,r,t}}\right)\right\}, l_{time\,u,r,t} \neq 0 \\ \exp\left\{-\left(1 + \tau \frac{t_0 - t_{u,r,t}}{l_{inter\,u,r,t}}\right)\right\}, l_{time\,u,r,t} = 0 \end{cases} \tag{3}$$

In formula (3), $l_{inter\,u,r,t}$ is a constant, according to the relevant literature, the default value is 1000; t_0 represents the latest time for the user to label, $l_{time\,u,r,t}$ represents the time difference, that is, the time interval between the user's latest use of label t_i and the initial use of label t_i. When the value of $l_{time\,u,r,t}$ is 0, formula (3) needs to use $l_{inter\,u,r,t}$ in the calculation Instead of the default value of, $t_{u,r,t}$ means the time when user u labels the employment resource as t_i [16–18].

Based on the above, we can use formula (4) to calculate the user's preference for resources which combines the factors of label and time.

$$\Pr e(u, r) = \delta \Pr e_{popu}(u, r) + (1 - \delta) \Pr e_{time}(u, r) \tag{4}$$

Through formula (4), we can get the preference matrix R, that is, the preference value of all users for all employment resources, where δ is the adjustment factor, and the value is between 0 and 1.

After obtaining the user's rating matrix $R_{m \times n}$ for employment resources, it can be decomposed into the product of two matrices through a specific vector dimension K. The matrix decomposition is as follows:

$$R_{m \times n} = P_{m \times K} \cdot Q_{K \times n} \tag{5}$$

The user characteristic matrix $P_{m\times K}$ and resource characteristic matrix $Q_{K\times n}$ can be obtained by formula (5), and the preference degree of user u_i for employment resource r_j can be predicted by the following formula (6).

$$\hat{r}_{i,j} = \sum_{f=1}^{K} P_{fi}^{T} \times Q_{fj} \tag{6}$$

The purpose of decomposing $R_{m\times n}$ is to find the optimal feature matrixes $P_{m\times K}$ and $Q_{K\times n}$. The essence of decomposing $P_{m\times K}$ is to minimize the error between the user's predicted preference value and the real preference value of related resources. If the feature matrix contains too large a value, there will be over fitting problem. Therefore, the over fitting term will be prevented to be added to the formula:

$$E = \left(r_{i,j} - \sum_{k=1}^{K} P_{i,k} Q_{k,j}\right)^2 + \frac{\beta}{2} \sum_{k=1}^{K} \left(P_{i,k}^2 + Q_{k,j}^2\right) \tag{7}$$

According to the real value $r_{i,j}$ in the training set, the feature vectors $p_{i,f}$ and $q_{i,f}$ are updated and optimized according to the negative gradient direction of the error $e_{i,j}$ between it and the predicted value.

$$\begin{aligned} p_{if} &= p_{if} + \alpha\left(2e_{i,j}q_{if} - \beta p_{if}\right) \\ q_{if} &= q_{if} + \alpha\left(2e_{i,j}p_{if} - \beta q_{if}\right) \end{aligned} \tag{8}$$

Among them, α is the learning rate, β is the regularization coefficient, repeated many times until the objective function E is less than a certain threshold, so as to obtain the characteristic matrix P and Q. Through formula (6) and the feature matrixes P and Q, we can predict the user's preference for the resources that have not been operated. The preference values are sorted from high to low, and the resources represented by the top n values are recommended to the user to get the recommendation list topn1. According to the user's preference and other feature tags, personalized recommendation of employment information and employment guidance related resources is completed [19–23].

3.3 System Database Design

Database design is the first mock exam of database logic in a given application environment. Based on this model, database and its application system are built to enable them to store and manage data effectively, and satisfy users' needs, including data manipulation and information management. In front of the functional analysis and module design.

On this basis, this paper designs the database of employment guidance system, and some database tables are shown in Table 1.

Table 1. Employment guidance database for College Students

Field name	Data type	Remarks
ID	int	Auto increment primary key number
title	nvarchar(50)	Title
leibie	nvarchar(20)	Category
createdate	datetime	Creation time
imgurl	nvarchar(50)	Written words
linkurl	nvarchar(50)	Picture
daleiid	int	Category number
jlid	Int	Auto increment primary key number
jlxm	nvarchar(10)	Full name
jlyx	nvarchar(50)	Mailbox
jlxx	nvarchar(50)	School
jlzy	nvarchar(20)	Major

According to the above database table, complete the database design of the system. So far, the design of personalized employment guidance system for college students based on big data has been completed.

4 Test Experiment

In this section, we will test the reliability of the system through simulation experiments.

4.1 Experimental Content

This experiment is a comparative experiment. The traditional college students' employment guidance system is compared with the personalized college students' employment guidance system based on big data designed in this paper. The traditional college students' employment guidance system is the control group, and the personalized college students' employment guidance system based on big data is the experimental group. In the process of experimental test, the only experimental variable is controlled to avoid interference to the results of comparative experiment. The experimental environment is as follows: processor Intel g7250 3.65 GHz; hard disk 280G; operating system: Windows 8; 8 G memory.

The contrast index of the experiment is the response time of the college students' employment guidance system at run time and the CPU occupation of the system server at run time. The reliability of the system is verified.

4.2 Experimental Results

When testing the system, the response time of the system is shown in Fig. 4. The relationship between the curves in the figure is analyzed to judge the response performance of the system.

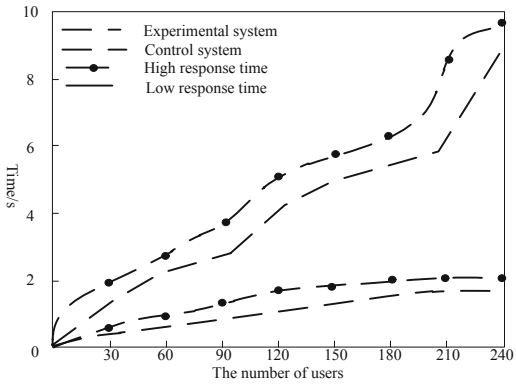

Fig. 4. System response time

According to the analysis of the curve in the figure above, compared with the highest system response time curve, the control group system is higher than the experimental group system; compared with the lowest system response time curve, the control group system is still higher than the experimental group system. It can be seen that the average response time of the experimental group is less than that of the control group. In addition, with the increase of the number of system users, the response time of the control group increased rapidly, while the response time of the experimental group remained relatively stable. It shows that the response performance of the experimental group is better.

When the system responds to different number of user service requests, the CPU usage of the server is shown in Fig. 5.

As can be seen from Fig. 5, with the increase of the number of users, the occupation of server CPU by the system in this paper keeps unchanged at first, then increases slowly, and no longer increases when it increases to 11%; while the occupation of server CPU by the traditional system has been growing, and the growth rate is faster and faster, up to 63.7%. It shows that the traditional system has poor server occupancy and limited system capacity.

To sum up, the personalized employment guidance system based on big data has the advantages of short response time and low system occupation.

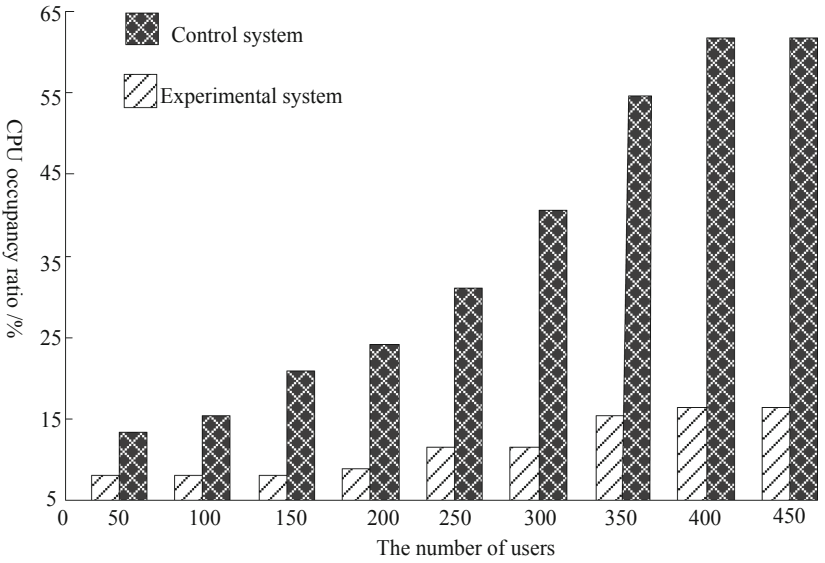

Fig. 5. CPU utilization ratio of server

5 Conclusion

With the development of economy and the progress of society, the demand for talents is increasing. It is an important task to improve the employment service for college students. In order to provide better employment guidance service, this paper designs a personalized employment guidance system for college students based on big data, and verifies the reliability of the system through comparative simulation experiments.

In this study, the system function development is not perfect, the system testing solution needs to be improved, and the communication function and information presentation form need to be enriched. I hope that the system research can have further development in depth and can provide a certain degree of help for college students' employment guidance.

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