Design of Tibetan Vocabulary Online Learning System Based on Multi-terminal Integration

Min Li[1(✉)] and Nan Li[2]

[1] School of Literature, Capital Normal University, Beijing 100048, China
lm44695@163.com
[2] Boda College of Jilin Normal University, Siping 136000, China

Abstract. Provide auxiliary tools for Tibetan vocabulary learning, and solve the problems of long response time and poor application performance of existing online learning systems. Using the multi-terminal fusion technology, the optimized design of the Tibetan vocabulary online learning system is realized from the three aspects of hardware, database and software functions. Adjust the connection mode of the server, and modify hardware devices such as embedded processors and resource collectors. Use the optimized system circuit to connect hardware devices to complete the optimization of the hardware system. Collect Tibetan vocabulary online learning resource data, and connect each database table according to the logical relationship between the data. With the support of hardware devices and databases, set permissions for different users and choose the online learning mode of Tibetan vocabulary. Use multi-terminal fusion technology to achieve resource integration. Realize system functions such as Tibetan vocabulary learning information retrieval, online interactive practice, and online testing. Through system testing, it is found that the operating success rate of the designed system reaches 99.2%, and the response time is less than 6000ms. And through the application of the design system, the students' Tibetan language scores have been significantly improved.

Keywords: Multi-end integration · Tibetan vocabulary · Tibetan learning · Online learning system

1 Introduction

The Tibetanlanguage is the Tibetan branch of the Tibeto-Burman family of the Sino-Tibetan language family. It is distributed in 5 regions in China's Tibet Autonomous Region and Qinghai Province, Ganzi Tibetan Autonomous Prefecture in Sichuan Province, Aba Tibetan and Qiang Autonomous Prefecture, Gannan Tibetan Autonomous Prefecture in Gansu Province and Diqing Tibetan Autonomous Prefecture in Yunnan Province. Tibetan is mainly divided into three major dialects: U-Tsang dialect, Kham dialect, and Amdo dialect [1]. Tibetan areas have a large proportion of the Tibetan population and a high proportion of farmers and herdsmen. The transportation here is inconvenient and education is backward. In contrast to ordinary Chinese-based distance

W. Fu and G. Sun (Eds.): eLEOT 2022, LNICST 453, pp. 211–228, 2022.
https://doi.org/10.1007/978-3-031-21161-4_17

education, minority education in Tibetan areas faces language barriers. Tibetan language belongs to the Tibeto-Burman language family of the Sino-Tibetan language family. In addition to the Tibetans in my country, some people in Nepal, Bhutan and India also speak Tibetan. Tibetan language is a hot topic of linguistic research at home and abroad. Vocabulary is the basis for analyzing and understanding sentence structure and meaning. Learning vocabulary is beneficial for learning the Tibetan language. Therefore, online learning of Tibetan vocabulary is also very active, and it is getting more and more attention.

In order to solve the teaching problems of students in Tibetan areas, an online learning system for Tibetan vocabulary was designed and developed. In view of the current needs of education in Tibetan areas and the inevitability of social development, develop and build a Tibetan/Chinese online learning system to adapt to my country's national conditions and social development. It plays an extremely important role in improving the educational situation in Tibetan areas. The accumulation of Tibetan vocabulary plays a key role in improving the level of Tibetan language ability. Vocabulary is one of the basic elements of language. Vocabulary can help people effectively carry out all communication activities, such as listening, speaking, reading, and writing. It can be said that the level of a person's Tibetan language proficiency often depends to a certain extent on the amount of vocabulary the person has mastered. Lexical meaning is the basis for navigating the entire semantic system, so an online learning system and model for Tibetan vocabulary is designed. It is not only a foundational knowledge project, but also a very important basic theoretical research.

With the development of the Internet, online education has become more and more popular. Online education refers to the method of content dissemination and rapid learning through the application of information technology and Internet technology. Compared with traditional education, online education has the characteristics of high efficiency, convenience, low threshold and rich teaching resources. Based on the above characteristics, coupled with the promotion of "Internet+", online education platforms have emerged, and their scale has gradually opened up, and has won the favor of the capital market. Modern distance education is a new educational mode that uses multimedia technology and computer network to achieve autonomous and interactive learning. However, in the current distance education platform, due to the lack of technical means and unified standards, different platforms use different document formats and develop their own resource systems independently. System platforms, data structures, databases, type definitions, resource descriptions, and the final storage form of resources vary widely. This has resulted in the current situation that online resources are scattered, information islands and resources are not standardized. In this situation, although there are a large number of educational resources, it is difficult to reuse and share resources due to the opaque format of resource files and the inability to extract information. Moreover, it is difficult or even impossible to modify and maintain the resources after the resources are released, let alone to effectively retrieve the relevant resource information, all of which result in a great waste of resources. The fundamental reason is the lack of a unified standard and effective means to describe resource metadata and its content structure. In order to solve the operation problems of the current Tibetan vocabulary online learning system, multi-terminal fusion technology is introduced.

Multi-terminal fusion is a technology that fuses resource information of multiple different ports. In order to realize the effective integration of Tibetan vocabulary information, reduce the coupling degree of system modules, and enhance the maintainability and flexibility of the system. In order to improve the teaching function and application performance of the Tibetan vocabulary online learning system.

2 Design of Hardware System for Online Learning of Tibetan Vocabulary

2.1 Server

The optimally designed Tibetan vocabulary online learning system sets up three different types of servers, including registration server, proxy server and redirection server. The registration server can know the system users registered in its area in time, and the proxy server is responsible for receiving the request sent by the user agent. Send the request to the corresponding server according to the network policy, and respond to the user according to the received response. Proxy servers are mainly used to forward SIP messages. It initiates requests on behalf of UAC and returns responses to UAC, and is a SIP entity that acts as both a client and a server. Each domain of the Tibetan vocabulary online learning system has a corresponding proxy server. When the user agent called by the calling party is in the domain controlled by the proxy server, the proxy server queries the registration server, finds the address of the called party, and forwards the request to the called party. When the user agent called by the calling party does not belong to the domain controlled by the proxy server, the proxy server queries the proxy server address of the domain to which the called party belongs. And route the request to the next-hop proxy server address until it is forwarded to the proxy server of the domain to which the called party belongs [2]. The redirect server is used to return the user's new location to the caller when needed. Redirect servers help locate SIP user agents by providing selectable locations that connect to the user's location. It does not emit any behavior to locate the target agent. And only return the possible location information of the target agent, and the caller can call again according to the new location obtained.

2.2 Embedded Processor

The optimally designed Tibetan vocabulary online learning system based on multi-terminal fusion selects the C*CORE model processor to replace the traditional processor equipment. The processor executes instructions with a 4-stage pipeline: instruction fetch, instruction decode/register file read, execute, and register file write-back. These 4-stage overlapping operations allow most instructions to be executed in a single clock. The structure of the C*CORE processor is shown in Fig. 1.

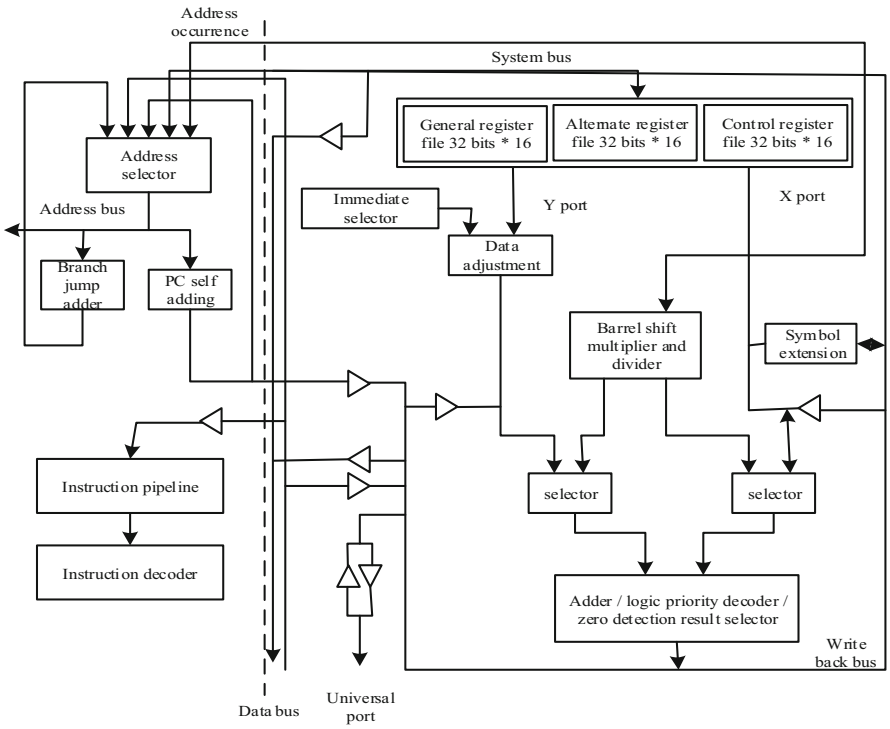


Fig. 1. C*CORE model processor structure diagram

The C*CORE processor adopts a pipelined RISC structure and uses the AMBA bus as the carrier, which accommodates many of the same performance enhancement measures and specific implementation technologies as the desktop RISC processor [3]. The processor adopts a 32-bit load/store reduced instruction set computer architecture with a fixed 16-bit instruction length. The strict load/store structure eases the control complexity. Using a fixed 16-bit instruction encoding technique significantly reduces the memory bandwidth required to maintain high-speed instruction execution. The relatively short 16-bit instruction code achieves the purpose of reducing memory power consumption [4]. The data selector in the processor can select a specified combinational logic circuit from a set of input signals and send it to the output terminal according to the given input address code. Multiple data selectors can ensure efficient system processing efficiency when processing a large amount of Tibetan language information. The carefully selected instruction set makes the code density and overall memory efficiency of the C*CORE structure exceed that of the CISC structure. In addition, C*CORE also adopts measures such as fully static design, dynamic power management and low voltage operation to reduce power consumption. Dynamic power management includes two measures: dynamic clock and low power consumption. C*CORE uses dynamic clock management method to automatically power down the internal function modules that do not need to operate clock by clock. C*CORE has 3 low-power operation modes, namely Wait, Doze and Stop, which are entered by executing corresponding instructions.

2.3 Tibetan Vocabulary Learning Resource Collector

In the process of collecting and sorting out, the Tibetan language is divided from three aspects: the distribution of the number of Tibetan entries, the frequency and frequency of the vocabulary. The function of this division is mainly in two aspects: one is the construction of a Tibetan vocabulary corpus as a computer Tibetan information processing system to serve Tibetan information processing. The second is to serve as a reference book for Tibetan language learning and a basic resource for Tibetan language research, for Tibetan language learners and researchers. The structure of the optimally designed Tibetan vocabulary learning resource collector is shown in Fig. 2.

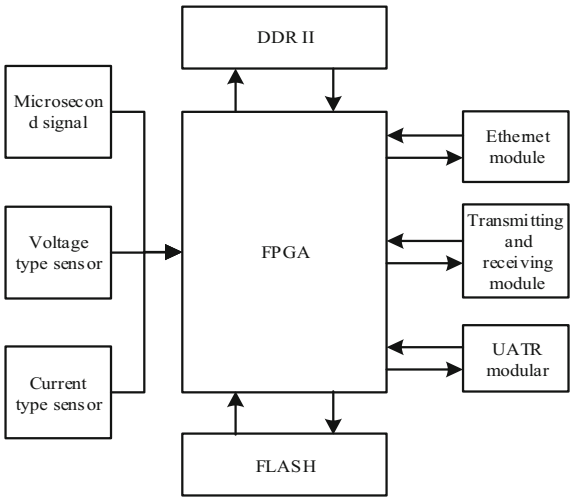


Fig. 2. Structure of Tibetan vocabulary learning resource collector

As can be seen from Fig. 2, FPGA is the core element in the collector. The component consists of programmable input and output units, configurable logic blocks and other parts. The main task of the programmable input and output unit is to meet the driving and matching requirements of the input/output signal. For this purpose, the I/O in the FPGA is divided into different type groups. These type groups meet different electrical characteristics and can be flexibly configured in the software. The storage unit of the programmable input and output unit module introduces signals into the interior of the FPGA. At this time, the holding time of the external signal can be 0 by default. There are many groups of IOBs in FPGA, and the interface standards corresponding to banks of different interface voltages are also different. There is one and only one interface voltage for the same bank, but the VCCOs of different banks can be different [5]. To facilitate management and adapt to multiple electrical standards, only ports of the same electrical standard can be connected together. The configurable logic block is the basic logic unit in the FPGA. The number and characteristics of CLB vary with different chips, and the same place is that there is a configurable switch matrix consisting of 4–6 inputs, selection circuits and flip-flops. At the same time, the flexibility of the matrix is also

very high, and it can better handle combinational logic, shift registers or RAM through its configuration. In addition to the need for each CLB module to be implemented as combinational logic and sequential logic.

2.4 System Circuit Design

Power Circuit

The 5 V DC power supply is selected, and the 5 V input DC power supply generates a stable 5 V output voltage through a special voltage regulator. Then the obtained 5 V stable voltage is converted into the required 3.3 V through the corresponding voltage regulator. The optimized design result of the power supply circuit is shown in Fig. 3.

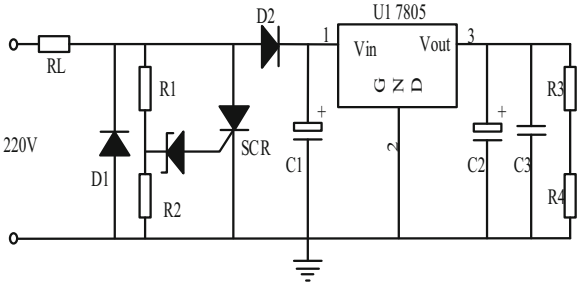


Fig. 3. System power circuit diagram

Through the optimization of the power supply circuit, stable power support can be provided for different hardware devices in the hardware system.

Clock Design

The whole high-speed acquisition system is completed under certain timing control. If the timing is wrong, the function of the system cannot be realized. The maximum sampling rate of the system is 32MSPS. In the optimally designed multiple interactive sharing system of electric power special teaching course resources, the highest sampling frequency of AD converter is 32MSPS. The clock frequency required by SDRAM is 200 MHz, so the system clock is selected as 50 MHz. Use the PLL in the FPGA to achieve the clock frequency required by each module by dividing, multiplying or shifting. The system clock is realized by a 50 MHz active crystal oscillator. Compared with the passive crystal oscillator, the clock signal output by the active crystal oscillator is more stable and of good quality.

3 Database Design of Tibetan Vocabulary Online Learning System

Database design is an important part of Tibetan vocabulary online learning system design. While the design of the database table follows the database theory, it must be able to use development tools to realize the functional requirements put forward by users in

various aspects. When designing the database, it is necessary to minimize the hardware overhead and maximize the running speed, efficiency and performance stability of the system. The background of the system adopts MySQL database, which is connected to the database through JDBC. There are 11 data tables in the more important tables in the database. They are curriculum table, vocabulary table, video table, course classification table, etc. According to the overall functional structure of the system, comprehensively analyze all the required data objects and their access plans and structures, and design the background database.

Designing a database means creating an optimal database schema and establishing a database and its application system under a given application environment. It can effectively store data and meet the application needs of users to the greatest extent. Conceptual model is the core of database design. It uses entity-connection method to accurately complete the modeling of the information world. And because this model is closer to the way of human thinking, it is easy to be accepted by users. When solving practical application problems, an entity-relationship model should usually be designed first, and then converted into a data model. According to the logical relationship between the various entities of the learning system, the system database table is designed. Taking the Tibetan vocabulary data table as an example, the construction results are shown in Table 1.

Table 1. Tibetan vocabulary data sheet

Field name	Field description	Type of data	Is it nullable
Tibetan_id	Vocabulary ID	Integer(8)	No
Tibetan_spell	Vocabulary spelling	Text(20)	No
Tibetan_yinbiao	Vocabulary Phonetics	Text(6)	No
Tibetan_meaning	Vocabulary definition	Text(20)	No
Tibetan_picture	Vocabulary pictures	Blob(200)	Yes
Tibetan_example	Vocabulary example	Text(100)	No
Tibetan_voice	Vocabulary pronunciation	Blob(120)	No

Similarly, the construction results of other information tables in the database can be obtained. And according to the logical relationship between the information, complete the design of Tibetan vocabulary online learning system database. In addition, the Tibetan vocabulary learning system is running in real time, so the data in the database table needs to be updated in real time.

4 Software Function Design of Tibetan Vocabulary Online Learning System

With the support of hardware equipment and database, through the design of multiple modules such as user classification and management, learning mode determination,

learning resource collection and processing, etc. Completed the design of the software functions of the Tibetan vocabulary online learning system.

4.1 System User Design

The users of the Tibetan vocabulary online learning system can be divided into three categories: ordinary students, teachers, and system administrators. The management of system users is mainly used to ensure that users can access the system within a certain authority and perform legal operations. In this module, executable operations include user registration application, data review, and permission settings. After filling in the form and submitting the system, it will be reviewed by the system administrator, and the registration will be successful after passing. The flowchart design of the user management module is shown in Fig. 4.

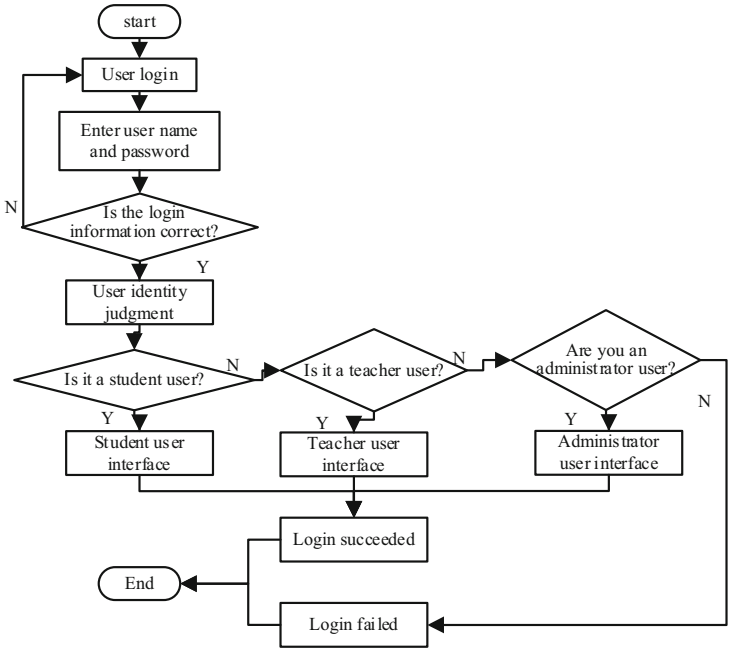


Fig. 4. User management module flow chart

Student users can register on this website through their mailboxes. After registration, users can enter the system learning platform according to the registered mailboxes and passwords to perform related operations. Student users can view the four modules of course, community, article, and personal center on the homepage. In the course module, users can view course information and comment information, and join courses of interest according to their interests. The community module includes questions asked by other users, and users can view and answer questions from other users. In the article module, users can view articles written by other users, and users can also publish articles. In

the personal center module, users can modify personal information and passwords, and can view the user's courses, articles, concerns, questions, etc. Teacher users can register on this website through email. After registration, teacher users can enter the system learning platform according to the registered email address and password to perform related operations. The functions of teacher users include personal center management, course management and other operations. In the personal center is the maintenance of personal information and the maintenance of my articles. Course management includes the maintenance of video information and comments, video transcoding and statistics on student learning. Administrator users include operations such as user management, feedback management, message push, course management, article management, and community management.

4.2 Choose Tibetan Vocabulary Online Learning Mode

The learning mode of the optimally designed Tibetan vocabulary online learning system is a blended learning mode, which can be divided into three modules: front-end analysis, teaching activities and learning evaluation. According to the needs of blended learning, the teaching process can be reasonably designed by analyzing the characteristics of learners, learning objectives and learning content. Learner Analysis: Analyze the characteristics of learners, existing learning level, learning habits, learning ability and learning autonomy. Analysis of learning objectives: What kind of objectives does teaching need to make learners achieve, and the results are clear, specific, and quantifiable. This is the guidance of teaching work and an important indicator of teaching evaluation. Analysis of learning content: Closely combine the knowledge learned by students with the characteristics of students, stratify the teaching content, and pay attention to the order, structure and rationality of the teaching content. The design of teaching activities in the blended learning model is mainly divided into three steps.

First, the design of pre-class teaching activities: lets students learn through the intelligent learning platform before class, and for the content that they do not know. Or the pronunciation of Tibetan characters can be learned through the speech synthesis system on the intelligent platform, and questions and feedback can be given. At the same time, teachers can monitor students' learning by viewing the learning records. Then carry out the design of teaching activities in the class: on the basis of traditional teaching, teaching is carried out according to the learning situation of students before class. And answer the questions based on the questions of the students before the class. Finally, the design of after-school teaching activities is carried out: teachers assign homework on the intelligent platform, and students complete it after class [9]. Teachers can also provide targeted and personalized tutoring according to students' learning situations. The evaluation of students' learning should be examined from multiple aspects. The learning mode realizes evaluation diversification through online and offline learning evaluation, including teacher evaluation, self-evaluation, and intelligent platform evaluation. Evaluation is not the ultimate goal, but to reflect the students' learning status to motivate students' learning status and improve learning efficiency. Its advantage is to provide guidance and help with students' learning, so as to improve the learning effect.

4.3 Collection and Processing of Tibetan Vocabulary Resources

Use web crawler technology to collect Tibetan vocabulary resources in the network environment, when the web crawler program starts. During initialization, a pre-set initial URL seed will be obtained from the seed queue. Transfer the obtained URL seed into memory for DNS domain name resolution. Then download the parsed IP address web page, and perform HTML parsing on the downloaded web page through the parser. Analyze the HTML tags and organization information as much as possible to obtain the address, title, author information, abstract, date and other information of the web page. And extract the new URL in the web page. Deduplicate new URLs and remove already crawled URLs, then add them to the queue of pending URLs. Perform the above steps again, starting with removing the top URL from the list of URLs to be crawled. The output result is the resource collection result of Tibetan vocabulary learning. On this basis, the principal component analysis method is used to reduce the noise interference signal in the initial information. Suppose the time series of Tibetan vocabulary information collected in real time is:

$$x(t) = \hat{x}(t) + n(t) \tag{1}$$

In formula (1), $\hat{x}(t)$ and $n(t)$ are effective learning information and noise information. There are the following relations defined:

$$\begin{cases} y_j(t) = \mathrm{s}_i \; x_i(t) \\ \mathrm{A}_y = \mathrm{yy}_j^2 \end{cases} \tag{2}$$

Among them, s_i is the orthogonal transformation matrix, A_y is the covariance matrix of the main element, and the main element $y_j(t)$ is the projection of the delay vector on the characteristic vector. The time average of the pivot variance is the pivot of the reconstructed signal covariance matrix, which represents the projection of the signal with unequal energy in each direction. Then the signal-to-noise ratio at different rotation coordinates can be expressed as:

$$\eta = \frac{\left\langle y_j^2 \right\rangle}{\left\langle n^2 \right\rangle} \tag{3}$$

A subset of principal components with a large variance corresponds to a large signal-to-noise ratio. A subset of principal components with a smaller variance corresponds to a smaller signal-to-noise ratio. Reconstructing the state space using the q subsets of pivot elements with maximum variance results in a reconstruction with a greatly improved signal-to-noise ratio. That is, the noise reduction processing of the initial information is completed. In order to define vocabulary difficulty more precisely, it is necessary to determine the vocabulary difficulty determination formula. Using the three factor parameters of word frequency, length, and degree of harmony of phonetic writing, the proposed difficulty determination formula is as follows:

$$b_i = F_i \times W_1 + L_i \times W_2 + H_i \times W_3 \tag{4}$$

The variables F_i, L_i and H_i are the word frequency parameter, length parameter and harmony degree parameter of the i-th Tibetan vocabulary, respectively. W_1, W_2 and W_3 are the weight values of vocabulary parameters. Tibetan vocabulary is classified and stored according to its difficulty level. The above-mentioned Tibetan vocabulary resource collection and processing flow is shown in Fig. 5.

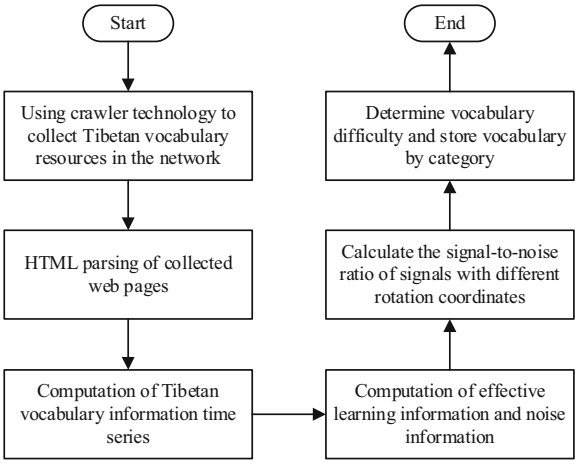


Fig. 5. Collection and processing process of Tibetan vocabulary resources

4.4 Utilize Multi-terminal Fusion Technology to Integrate Tibetan Vocabulary Resources

Based on the collected and processed Tibetan vocabulary resources, the fusion processing of vocabulary resources of different ports is realized from three aspects: data layer, feature layer and decision layer. Data layer resource fusion refers to the fusion directly carried out on the collected original data layer, and the unprocessed data obtained by each information source is synthesized and analyzed. Usually, a fusion method for unified operation of information resources is adopted. The information fusion of the feature layer is an intermediate link compared with the fusion of the data layer. The fusion of the feature layer first extracts the key features from the massive data information that has been widely collected before. And according to these characteristics, the information is scientifically organized and divided [10]. This level of fusion compresses the total amount of information through the feature extraction process performed in advance, helping users to quickly retrieve the required information according to their own needs during retrieval. At the same time, when browsing the information, it is more conducive to the user's understanding and mastery. Figure 6 shows the principle of feature layer information resource fusion.

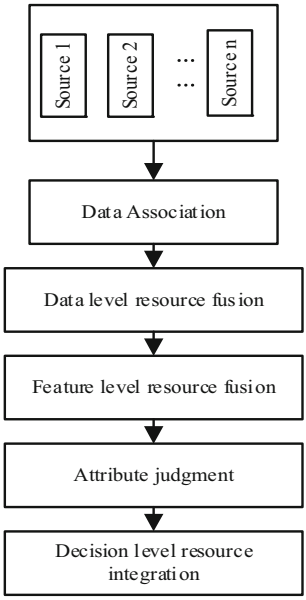


Fig. 6. The principle of feature layer information resource fusion

The information fusion of ASEAN information resources at the decision-making level is to coordinate the data of each document information source from a macro perspective. Through the analysis, extraction and fusion of data extraction features from different sources, it directly provides support for decision-making.

4.5 Retrieve Tibetan Vocabulary Learning Information

Tibetan vocabulary learning information and course retrieval is one of the important functions of the online learning system. Enter the keywords to be searched through the online learning front-end interface. Use formula (5) to calculate the similarity between the input keywords and the vocabulary words stored in the system memory.

$$sim = \sqrt{(x - x_0)^2} \tag{5}$$

In formula (5), x and x_0 are the input keywords and the Tibetan vocabulary to be matched, respectively. If the calculation result of formula 5 is higher than 0.9, the corresponding Tibetan vocabulary is directly output as learning information. Otherwise, it is necessary to match the next Tibetan vocabulary until the required learning vocabulary information is obtained.

4.6 Online Interactive Practice

The practical links are also different, among which the practical links such as reading and writing mainly focus on textual information. Through the direct processing of text data,

the interactive exercise function of the system is realized. Among them, listening and translation training is mainly based on students' autonomy. To train students' listening and translation skills, they can practice multi-theme, multi-knowledge and multimedia special skills. It has functions such as listening, translating and Chinese translation. In addition, in the process of oral pronunciation practice, the HMM model obtained by standard pronunciation training is used. The standard pronunciation here is selected from the matching pronunciation of the PEP textbook. At the same time, the corresponding language model is used for path search, so that the students' pronunciation is forced to align on the basis of the text. If the alignment result cannot be recognized, it means that the student's pronunciation content is too different from the target content, or the noise interference is too large. Then the grading or correction work at that time is meaningless, and the module will directly prompt the students to re-pronounce. By calculating the log-likelihood of each phoneme and weighting, the pronunciation score of each Tibetan word or phrase is obtained as the pronunciation score.

4.7 Online Study Test

Students always want to test their knowledge by some means after completing a certain study or learning task. The traditional method of examination is the final examination of each semester or various entrance examinations, or even certificate examinations. But this method is impossible to pass in Tibetan vocabulary learning. In order to enable users to complete the self-testing task at any time, the relevant functional modules of the learning test are designed and implemented. This module can add various Tibetan vocabulary test questions in advance, and use these examples as a question bank. After learning, students can enter the self-test module, and the system randomly selects test questions to realize the online test of Tibetan vocabulary learning.

5 System Test

The system testing process plays an important role in the guarantee of system function and performance, and can make the system more perfect. Therefore, after the system design and implementation are completed, it is necessary to conduct a comprehensive test on the function and performance of the system to determine whether the system meets the expected goals. This system test experiment will complete the test of the system from the aspects of function and performance, through the reasonable design of test cases, and carry out the detailed test process. In order to obtain accurate test results. First of all, it is necessary to configure the test environment of the system, mainly to connect the relevant hardware equipment and network environment. We set the operating value of the relevant parameters during the system operation, and complete the construction of the system development and test environment.

On this basis, the specific operation of each functional module is designed by combining a variety of test methods. In-depth analysis of each test case is carried out to determine whether the test results of each test case meet the expected requirements. Some of the set system function test examples are shown in Table 2.

Table 2. System functional test cases

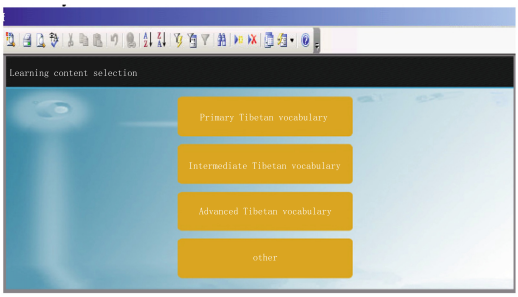
Use case number	Test case content	Prediction effect
1	User login	The user logs in to the learning system with the correct user name and password, and the main interface of the system is displayed
2	Set user permissions	The administrator grants corresponding permissions to different users
3	Tibetan vocabulary learning content selection	Choose study courses according to the difficulty level of Tibetan vocabulary
4	Teacher users upload Tibetan vocabulary learning resources	The system database adds corresponding learning resources
5	Student users retrieve Tibetan vocabulary learning resources	The system outputs search results related to keywords
6	Join a study course	Display and play Tibetan vocabulary learning videos or courseware
7	Online interaction	Student users submit questions in the interactive module and get a response within 24 h
8	Online test	Obtain the test paper, submit the test paper results, and get the test result query results within one week

In order to ensure the credibility of the experimental results, a total of 500 test cases were set up in this experiment. And divide them into 5 groups equally.

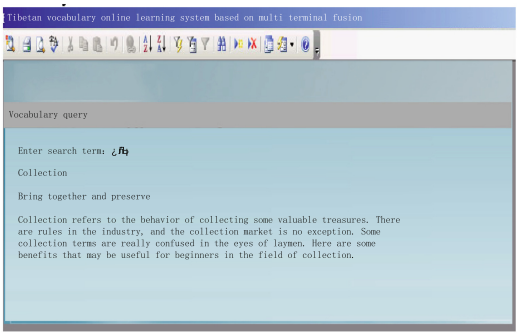
The optimally designed Tibetan vocabulary online learning system software based on multi-terminal fusion is written into program code and imported into the constructed system test environment. And then input the test cases in Table 2 to get the system function operation results. Figure 7 shows the test results of Tibetan vocabulary learning content selection and vocabulary query functions.

Set the quantitative test index of the system function as the function operation success rate. The numerical results of this indicator are as follows:

$$\chi = \frac{N_{suc}}{N_{all}} \times 100\% \tag{6}$$



(a) Tibetan Vocabulary Learning Content Selection



(b) Tibetan Vocabulary Search

Fig. 7. Tibetan vocabulary online vocabulary system operation interface

In formula (6), the variables N_{suc} and N_{all} are the number of use cases that the system function runs successfully and the total number of use cases set by the test experiment,

Table 3. System function test results

Experimental group	N_{suc}/piece	N_{all}/piece
1	99	100
2	100	100
3	98	100
4	99	100
5	100	100
6	98	100
7	99	100
8	100	100
9	100	100
10	100	100

respectively. In order to meet the system design and requirements, the default value of the success rate of setting the function operation is 95%. And it is required that the calculation result of formula (6) shall not be lower than the preset value. Through the statistics of relevant data, the system function test results are obtained, as shown in Table 3.

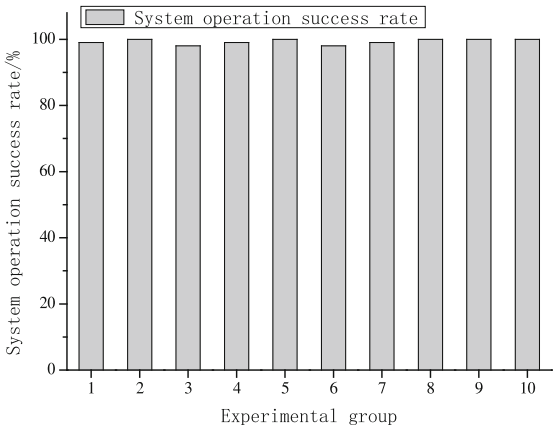


Fig. 8. Statistical results of the success rate of the system operation

Substituting the data in Table 3 into formula (6), the result of the system operation success rate obtained by calculation is shown in Fig. 8. The average calculation result of the system function operation success rate is 99.3%, which is higher than 95%. That is to meet the system functional design requirements. Because this multimedia learning tool for English vocabulary focuses on the application of teaching, rather than the pursuit of commercial value in the enterprise. Therefore, the performance test is mainly tested from two aspects: running performance and application performance. The test index of the running performance is the response time, and the numerical results are:

$$\Delta t = \mathrm{t}_{str} - t_{end} \tag{7}$$

In formula (7), t_{str} and t_{end} are the start-up time and result output time of the system function, respectively. The functional response time of the designed online learning system is required to be no higher than 6000 ms. In addition, the application performance of the online learning system is mainly to compare the changes of Tibetan vocabulary learning performance of the students before and after the application of the design system. The test results can be obtained directly through the extraction and statistics of the students' test data. After the calculation of formula 7 and the statistics of relevant data, the final test result of the system performance is obtained, as shown in Fig. 9.

It can be seen intuitively from Fig. 9 that the maximum response time of the design learning system function is 5500 ms, which is lower than the preset value. And by designing the application of the online learning system, the average score of the research subjects improved by 8.6 points. It can be seen that the designed Tibetan vocabulary online learning system based on multi-terminal fusion has good performance.

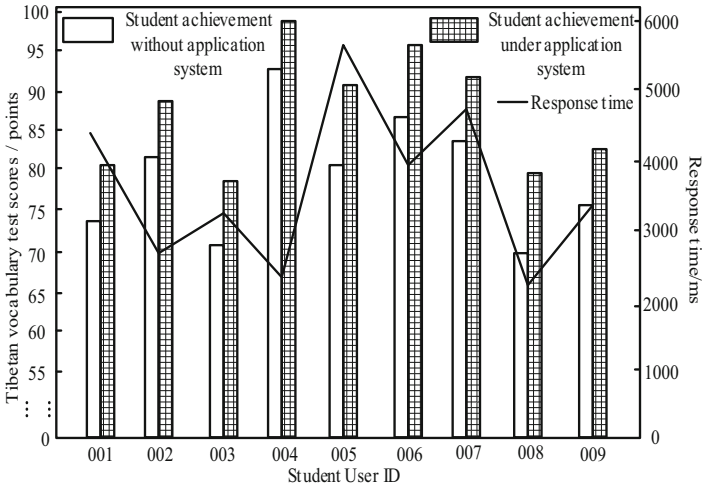


Fig. 9. System performance test results

6 Conclusion

Tibetan is one of the minority languages in China. The quality and effect of language education is an important factor to maintain the diversity of Chinese nationalities. In order to facilitate the online learning of Tibetan, to solve the problems of low power and long response time. In this paper, an online vocabulary learning system based on multi-terminal fusion is designed. Through the application of multi-terminal fusion technology, users can learn online at any time and any place, eliminating time and space barriers and reducing costs. With the support of hardware equipment and database, the system designed in this paper sets permissions for different users and selects online learning mode of Tibetan vocabulary. By virtue of its large amount of information storage, interactive and other characteristics, improve the efficiency of Tibetan vocabulary online education and learning. The success rate of the system is 99.2% and the response time is less than 6000 ms. The design of Tibetan vocabulary online learning system has made a basic arrangement for syntactic classification and tagging, automatic word segmentation, syntactic research, phrase research, machine translation, search engine and electronic dictionary compilation in the future Tibetan information processing field. It provides a new research method and means for the study of Tibetan literature in the future.

References

1. Li, M., Zhang, L.: Tibetan CSL learners' L2 motivational self system and L2 achievement. System **97**, 102436 (2021)
2. Sun, Y., Xia, T.: A hybrid network model for Tibetan question answering. IEEE Access **7**, 52769–52777 (2019)
3. Khysru, Di, K., et al.: Morphological verb-aware tibetan language model. IEEE Access, **7**, 72896–72904 (2019)

4. Sun, Y., Chen, C., Xia, T., et al.: QuGAN: quasi generative adversarial network for Tibetan question answering corpus generation. IEEE Access **7**(99), 116247–116255 (2019)
5. Yang, H., Chen, J., Zhan, X.: Research on chinese education for preparatory students based on diversified development. In: Hu, Z., Petoukhov, S., He, M. (eds.) International Conference of Artificial Intelligence, Medical Engineering, Education. LNCS, vol. 107, pp. 503–515. Springer, Cham (2021). https://doi.org/10.1007/978-3-030-92537-6_46
6. Wang, S., Mu, M.: Exploring online intelligent teaching method with machine learning and SVM algorithm. Neural Comput. Appl. **6**, 1–14 (2021)
7. Ho, W., Tai, K.: Doing expertise multilingually and multimodally in online English teaching videos. System **94**(3), 102340 (2020)
8. Qin, S., Wang, L., Li, S., et al.: Improving low-resource Tibetan end-to-end ASR by multilingual and multilevel unit modeling. EURASIP J. Audio Speech Music Process **2022**(1), 1–10 (2022)
9. Li, C.: Research on optimization and simulation of teaching resources equilibrium assignment in mobile network. Comput. Simul. **34**(02), 238–241 (2017)
10. Mei Z.: The Recognition of tibetan handwritten numbers based on federated learning. J. Artific. Intell. Pract. **4**(1), 1–12 (2021)