



Design and Development on an Accessible Community Website of Online Learning and Communication for the Disabled

Jingwen Xu, Hao Chen, Qisheng Ye, Ting Jiang, Xiaoxiao Zhu, and Xianwei Jiang^(✉)

School of Mathematics and Information Science, Nanjing Normal University of Special Education, Nanjing 210038, China
jxw@njts.edu.cn

Abstract. Education for the disabled is a social issue that cannot be ignored. Nowadays, due to the impact of COVID-19 and the rapid development of information and communication technology, online learning has become the mainstream way for people to acquire knowledge. In China, the number and proportion of the disabled receiving higher education are low. To let the disabled receive better online higher education, we should build a perfect accessible online learning environment. In order to realize this idea, we mainly studied and analyzed the current situation, design principles, and development technology of accessible educational websites, and designed and developed “Zhihai”, an accessible community website of online learning and communication for the disabled. “Zhihai” is committed to solving the difficulties of online learning for the disabled and making contributions to special education. It aims to meet the requirements of strong pertinence, complete functions, high quality accessibility, and a good user experience so as to truly make its contribution to the construction of special education and improve the online learning situation for the disabled.

Keywords: Accessibility · website design and development · educational website · online learning

1 Introduction

1.1 Research Background

Domestic Research Status

In 2019, novel coronaviruses are spreading rapidly across the globe, posing a threat not only to humans and economies but also to human lives. At this time, computer-aided diagnosis models based on deep learning with high generality were born. Particle swarm optimization was used to create Pso-guided Self-tuning Convolutional Neural Networks (PSTCNN) [1], allowing the model to automatically tune hyperparameters and select hyperparameter combinations in a targeted manner to obtain solutions that

are closer to the global optimum in a stable manner. The increasing pressure of diagnostic challenges brought on by a lack of available resources for global medical care can be effectively relieved by hyperparameter tuning of models using optimization algorithms, which is quicker and more efficient than traditional methods. Not only that, there are also applications of artificial intelligence in the medical field: the part of VGG-16z with extracted high-level abstract features and the designed fully connected layer together form a preliminary COVID-19 intelligent assisted diagnosis model based on migration learning [2], iteratively train the diagnosis model using the COVID-19 training set, continuously optimize the parameters of the fully connected layer network, and finally train a COVID-19 intelligent assisted diagnosis model based on migration learning of the VGG-16 convolutional neural network. The transfer learning-trained COVID-19 assisted diagnosis model has high reliability, can quickly give doctors diagnostic references, and can increase work productivity.

Applying a deep learning-based computer assisted system to online learning under the influence of the epidemic would be beneficial, while also taking into account the accessibility of online learning for people with disabilities and focusing on their educational needs. Statistics show that there are more than 600 million people with disabilities worldwide. According to research, there is a significant disparity between the demand for software used by the visually impaired and how it is currently used. The demand for visually impaired people to use online learning, travel, and job-hunting software is high, but the usage rate is very low. For example, the software that reads the screen cannot accurately extract the text information from the image, the software is incompatible with the auxiliary software, and there are other issues. It is clear that there are still issues with using accessibility on the Internet, and the level of accessibility realization is not ideal. According to an online survey, the majority of domestic special education websites suffer from serious shortcomings in four categories: compatibility, operability of interface components, comprehensibility of content and control, and perceptibility of web content [3]. In general, there are a number of issues: the website's functionality is imperfect; the website's content is sparse, out-of-date, and of low professional caliber; the accessibility level for special users, such as the blind and deaf, is poor and cannot satisfy their needs to independently access the Internet. In order to provide accessible navigation mechanisms that let particular users find the specific information they need on the site quickly and accurately; web developers must understand the needs of particular groups of people and adopt a needs-based approach.

Take "Smart Learning" as an example of domestic deep computer-aided learning systems: by establishing keywords and language patterns, combining with artificial intelligence analysis, and using deep learning and big data analysis of students' learning, the learning assistance system realizes personalized, knowledge map-based diagnosis, assists students in locating the source of their errors, and pushes out corresponding micro-lesson explanations and moderately challenging questions. To securely categorize data and make it accessible, the Educational Clustering Big Data Mining System (ECBDMS) is proposed to integrate the Cognitive Web Services-based Learning Analytics (CWS-LA) system. In comparison to other existing methods, the performance gain, prediction rate, clustering error rate, learning rate, and prediction accuracy are significantly higher [4].

Although some researchers have recently begun to pay attention to this issue, there are still few studies that are specifically focused on the design and development of web accessibility. Instead, they tend to focus on the values, solutions, and evaluation of web accessibility. Accessibility of educational websites is another objective of China's contemporary web education technology standards. However, the standard system is difficult and specialized for website design, development, evaluation, and maintenance personnel in primary and secondary school campus networks to use because it is intended for businesses creating web education platforms, resources, and software. Therefore, more detailed theoretical guidelines and benchmarks to direct the creation, advancement, assessment, and upkeep of accessible educational websites appear to be required [5].

Overseas Research Status

The Section 508 Web Content Accessibility Rule of the United States government, which has been in force since June 2001, consists of 16 major rules: Provide text equivalents; require the synchronous operation of equivalents; avoid irreplaceability of colors; avoid irreplaceability of style sheets; provide additional text links for server-side image mapping; provide client-side image mapping identity; use complex table title attributes for row and column headings; provide shelf headings to reduce screen flicker; provide plain text mirror sites; use scripting language for barriers; detail accessibility applets and plug-ins; design accessibility tables; provide navigation; ignore features; and give users sufficient response time [6].

For global deep learning support systems: In contemporary education and e-learning, Smart Web Interaction Modeling for Teaching and Learning (SWISW), based on artificial intelligence, has been proposed abroad to categorize students according to their learning abilities, ensuring that students using machine learning techniques have appropriate and high-quality learning objects. Local weights, linear regression, and other methods have also been introduced to predict students' learning performance on the platform [7]. Foreign experts have also suggested a new distributed framework for the context-aware recommender system called DAE-SR (Softmax regression based on deep self-encoding). The program emphasizes user-item-based communication and offers personalized recommendations. The proposed DAE-SR classifier outperforms and is more reliable when compared to other models thanks to the proposed strategy of this recommendation system, which achieves better accuracy, precision, runtime, and recall [8].

Web developers and major U.S. Internet companies have studied web accessibility design. As well as suggesting design strategies for accessibility in terms of page structure, images, text, color, links and navigation, forms, and interactions, they have also proposed strategies for content, navigation, and data entry in web pages. The web development designers also offered design models and techniques for accessible educational websites for the blind to improve websites' accessibility from all angles, as well as a list of ten design errors and bad habits that frequently result in less accessible websites.

1.2 Research Significance

Barrier-Free Design

A set of actions taken by architects and designers in the planning and construction

processes that take into account the needs of people with various functional impairments, such as the elderly, children, and people with disabilities, is referred to as “barrier-free design”. Barrier-free design, which is not intended for a specific group of people, enables a larger group of people to have full access to the environment, facilities, transportation, and information and communication technologies. The ability of the environment to lessen or stop the development of new usage-related barriers is referred to as “ease of use”.

Information Accessibility

The main focus of China’s socialist modernization process and a key component of its information development plan is information accessibility. In order to advance the humanitarian spirit and safeguard the legitimate rights and interests of people with disabilities, it is essential to actively promote the development of information accessibility and make it possible for them to engage in social activities on an equal footing. This is not only a concrete example of social development and progress in the modern era.

1.3 Article Frame

The rest of this essay is structured as follows: Sect. 2 details Zhihai’s design concepts and the design principles of an accessible website. Section 3 creates the website’s architecture, including its overall structure, the functions of each module, and its database. The implementation of the website’s key technologies, such as the video player, navigational shortcuts, speech-to-text technology, and pop-up generation technology, is described in Sect. 4; The entire essay is concluded in Sect. 5, which analyzes Zhihai’s social significance.

2 Design Ideas

2.1 Follow the Design Principles of WCAG 2.0

In February 1997, the World Wide Web Consortium (W3C), the most authoritative and influential international neutral technical standards body in the field of Web technology, established the Web Accessibility Advocacy Group (WAI) to promote accessibility implementation. It was not until December 2008 that the W3C released the final version of the Web Content Accessibility Guidelines (WCAG 2.0). WCAG 2.0 provides Web designers and developers with a set of non-technical guidelines and success criteria designed to ensure that Web content is properly accessible and usable by people with disabilities.

WCAG 2.0 provides the foundation for web accessibility with four principles: perceptibility, operability, comprehensibility, and robustness. In perceptibility, information and user interface components must be presented to the user in a perceptible manner; in operability, user interface components and navigation must be operable; in comprehensibility, information and user interface operations must be understandable; and in robustness, content must be robust enough to be credibly interpreted by a wide variety of user agents (including assistive technologies) (see Fig. 1).

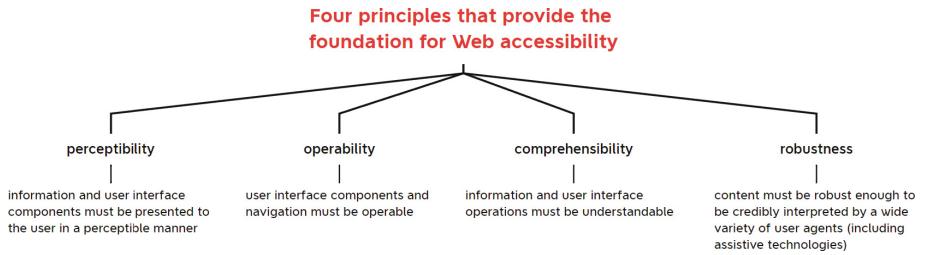


Fig. 1. Four principles that provide the foundation for Web accessibility

Web accessibility design should consider four important factors: structure, technology, content, and browsing. For the structure factor, the accessibility design of web content structure and board planning should be considered; for the technology factor, the accessibility design of processing web content, document language technology, program language technology, media technology, and input/output device technology should be considered; for the content factor, the accessibility design of text information and multimedia information of web pages should be considered; for the browsing factor, the accessibility design of each web browsing structure should be considered (see Fig. 2).



Fig. 2. Four important factors of web accessibility design

2.2 Design Objective

Main Objective

The goal of this paper is to design and develop “Zhihai”, an accessible community website of online learning and communication for the disabled, in response to the needs of disabled learners who wish to pursue online education.

A B/S model architecture is planned for the website in order to give users a more convenient access environment. Visit Zhihai to browse a plethora of comprehensive learning resources that include text, audio, and video in a range of formats to suit the needs of various users. Additionally, users can upload and share their own educational materials and take advantage of a private personal space where they can make notes or compile educational resources uploaded by other users. Zhihai will tag and categorize the uploaded content, and it will add content relevant to the user’s interests to the homepage.

During user registration, Zhihai enabled a dual-view mode to distinguish between special users and regular users. Regular users can socialize with people with disabilities while also benefiting from the many and varied learning resources available. Zhihai will also inform visitors about disability culture. Special education will have a greater cultural impact as a result of which more people will be interested in, comprehend, and support disability culture. Additionally, they will be able to empathize with it and get rid of old prejudices against people with disabilities.

Zhihai is divided into categories for special users, and depending on the unique circumstances of each type of user, the problems are specifically addressed with reference to WCAG 2.0. For example, adding the function of text-to-speech for visually impaired users and adding audio to text and video captioning for hearing impaired users. When used by a user who is blind or visually impaired, the speech-to-text conversion function applies speech and natural language processing technology in computer software systems, and the user can quickly find the place he or she wants to go by using navigation shortcuts; when used by a user who is deaf or hard of hearing, the user can benefit from the audio data-to-text conversion service and the video captioning service.

The Objective of Additional Module

On the external moral level, college students are more accepting of people with disabilities as a group, while on the unconscious implicit level, college students are more likely to associate people with disabilities with negative terms and have significant negative attitudes toward people with disabilities. By offering special education-related courses in higher education institutions to convey knowledge about people with disabilities, the negative attitudes of college students toward people with disabilities will be changed to some extent when they are indirectly exposed to them by means of the courses. In addition, college students who have interacted with people with disabilities for longer periods of time also show more positive outward expressions toward people with disabilities, which further demonstrates the importance of increasing contact with people with disabilities in changing negative attitudes toward them [9].

Therefore, Zhihai has created the “The Bridge of Stars” communication community for the disabled. People with disabilities who use this community can share the challenges they face and express their ideas in real time. Caring individuals and people with disabilities can also engage in lively discussion about current events, which can aid in deep understanding and help others solve their own challenges and express their own views. Users can share great learning strategies, exchange learning experiences, etc. in the community. In order to introduce themselves to more people, they can also share details of their private lives. People with disabilities can communicate more effectively thanks to “The Bridge of Stars” community, which can also increase their learning and communication options and opportunities for equality.

Sign language is the use of gestures to simulate images or syllables to form certain meanings or words according to the changes in gestures. It is a kind of hand language for people who are hearing impaired or unable to speak to communicate with each other and exchange ideas, and it is the main communication tool for deaf people. The use of sign language still has a number of problems, though. To begin with, there is a lack of consistency in the categories of sign language and sign language gestures used in deaf education and deaf life in China. While school staff and students use Chinese

sign language, local sign language is used by the community. Information exchange is seriously hampered by this inconsistency. According to the survey, the majority of deaf school teachers, students, and deaf adults in society believe that a universal sign language should be established, and the book “Chinese Sign Language” has served as a tool for this purpose on a national level. To address the issue of divergent sign languages, it is essential to create and promote a well-established national common sign language [10].

Therefore, Zhihai has developed a sign language field module that combines sign language interpretation, a sign language dictionary, sign language recognition, and sign language learning specifically for the deaf-impaired and sign language enthusiasts. Users can query the sign language corresponding to words through the sign language dictionary and get detailed explanations of gestures in multiple forms, such as text, pictures, and videos, or they can use the sign language translation function to query the sign language corresponding to sentences and paragraphs of text and generate sign videos. This site also supports sign language recognition by getting the camera function to recognize and translate gestures. Moreover, the field of sign language encourages users to use sign language to create videos, sign language dances, sign language teaching videos, and other interesting content that can play a promotional role to encourage more people to understand and love sign language and, in turn, help to reduce sign language differences, allowing for more accurate and unrestricted sign language communication.

As shown by the analysis of national employment statistics for people with disabilities between 2016 and 2020, the vast majority of these people continue to work primarily in flexible employment and agricultural farming. A number of issues affect the employment of people with disabilities, including a low employment rate, unequal pay for the same work, a disconnect between ideal and actual employment, significant issues with sustainable employment, and a need for improvement in the social environment for employment. In order to address these issues, we should strengthen ideological and political education to lay a solid ideological foundation for the proper employment of college students with disabilities, focus on skills training to cultivate multidisciplinary talents, strengthen employment guidance to improve employment skills, and strengthen employment psychologies. Finally, we should deepen the reform of higher special education and give it full play in addressing the employment of disabled people [11].

Zhihai provides career learning guidance for people with disabilities. Professional assessments like the MBTI Occupational Personality Test and the Hollander Occupational Interest Test can be used to identify a test-taker’s occupational interests and personality tendencies, assisting them in selecting a career path that aligns with their interests. In addition to this fundamental function, it also offers disabled people functions like analysis of their employment situation and recommendations of job sites to strengthen employment guidance and provide an effective way to find a job. Vocational education is an important discipline in the employment of people with disabilities, and Zhihai will strengthen the construction of vocational education and employment psychology education to improve the employment skills and resilience of people with disabilities and contribute to their employment.

People with disabilities are part of a population with poor mental health, which is frequently accompanied by psychological issues like emotional instability, loneliness, low self-esteem, sensitive and suspicious self-esteem, and a certain amount of complaining

psychology [12]. Therefore, it is important to encourage the improvement of the mental health of people with disabilities. Through appropriate mental health initiatives for people with disabilities or the development of a psychological service system, it is important to encourage people with disabilities to have a complete and accurate understanding of who they are and to be guided in how to appropriately and timely handle stress and negative emotions in their lives [13].

As a result, the mental health module will take the shape of a tree hole, enabling users to more easily confide in one another and express their emotions. Various relaxation features, such as therapeutic graphics, decompression radio, and calming pure music for the hearing and visually impaired, are also available in the special zone. Mental health services are crucial for fostering a thorough and accurate understanding of oneself in people with disabilities.

3 Architecture Design

3.1 Overall Architecture Design

B/S Architecture

The website uses a sharing and cross-platform architecture system based on the B/S model. The fundamental concept is to use a Web browser to run the client application and make use of the services the Web server offers to realize data interaction with the back-end database. There is no need to take into account complex client-side maintenance issues because the B/S model does not require users to install any software in order to realize web pages for corresponding architecture system operations. Because developers only need to focus on designing and developing the back-end server side and do not need to take into account the collaboration between various clients, the B/S model architecture is more flexible, easy to extend, and maintainable than the traditional C/S model. Moreover, because the B/S model is cross-platform, users can easily use different browsers like Google, Firefox, IE, etc., which lowers the maintenance and operation costs of the entire architecture system.

Without the need for client applications, the B/S architecture of the software operating system enables users to quickly access a variety of information through a Web browser. Users can access information and use any device more easily thanks to this architecture. Using Internet servers and backend databases, we are able to access a large number of information resources and interact with data. Users can load the necessary program from the web server to quickly complete a task when it needs to be run locally. The Web server will assign the relevant instructions to the corresponding server for processing, and after execution, it will pass the results to the client so that it can continue its work. The web server interacts with the backend database throughout the process by offering services to make sure the user can use any device and has the benefits of flexibility, ease of expansion, and maintenance.

The detailed working principle of the B/S architecture is shown in Fig. 3:

Its related workflow can be summarized as follows:

First, the user needs to submit the form through the relevant page of the browser in order to obtain the required information. To make sure the form is accurate and

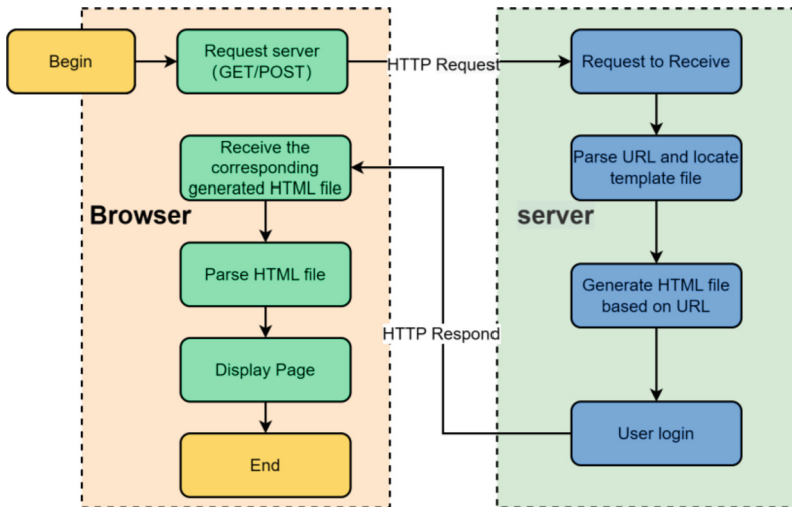


Fig. 3. The detailed working principle of the B/S architecture

complete, the user must also send a client request and wait for a reply from the client before submitting the form.

The server can respond quickly to the user's needs after receiving a request from the browser and processing it appropriately.

When the server receives the user's request for data, it responds instantly and updates the corresponding browser with the outcome.

The corresponding HTML file is created based on the user's reflection when the user is presented by the web browser, making it easier for the user to complete the operation [14].

Website Deployment Architecture

The operating system adopts a B/S three-tier architecture, including three tiers of servers, such as the web platform, application services, and database. For the client side, which can only be accessed by connecting to a LAN or by using a simple browser, there are no special requirements. Because they consume a lot of bandwidth and system resources, the architecture designates a separate server to manage images, audio, and video resources. The web platform handles user requests and passes them to the application service layer, which handles business logic and obtains back-end data. The goal of the image server and audio/video server is to achieve load balancing and capacity expansion while reducing the initial system resource occupation. The architecture addresses the issue of a large number of images, audio, and video resources used for online browsing and playing occupying system resources and bandwidth, and it offers users better quality, effective, and convenient information services.

This significantly raises the site's overall performance. The website deployment architecture diagram is shown in Fig. 4:

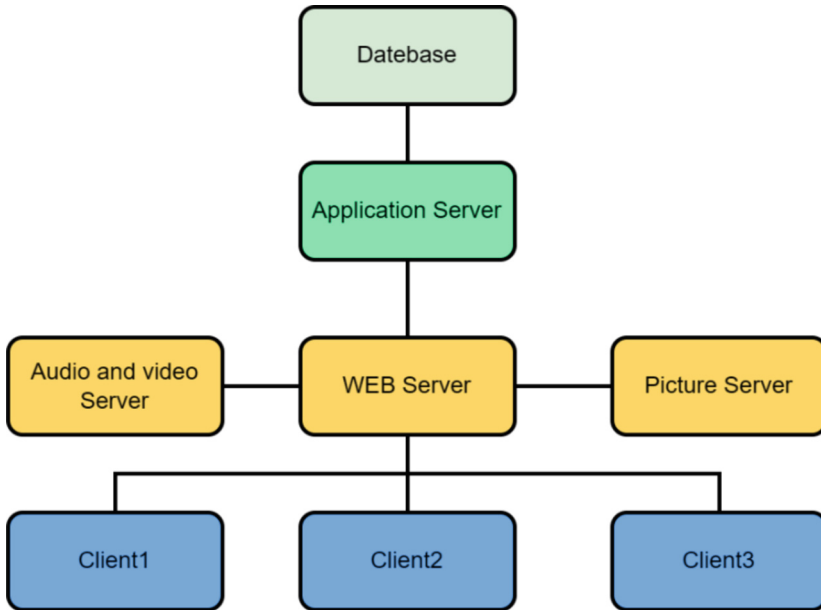


Fig. 4. The website deployment architecture diagram

3.2 Module Function Design

Functional Architecture

The goal of Zhihai, a learning website for both regular and disabled users, is to address the issues that the majority of disabled users face when trying to learn online, including their inability to comprehend information quickly and accurately, as well as to popularize knowledge related to disability culture for regular users. Users can choose to browse the learning materials or access the four additional modules of the website: The Bridge of Stars, Sign Language Field, Career Planning Module, and Mental Health Module. The website implements the corresponding functions as indicated by each module in the figure, and the functional architecture of the website is shown in Fig. 5. The basic functions of each module are shown in Fig. 6.

Home Page Design

The homepage includes accessibility functions, a search bar, a special education business news propaganda poster, a rotation chart of the most popular recommendations, a functional partition, a personal center, a creation center, a recommendation of excellent works, etc. After going through a number of processes like data mining and data screening, only works with a strong sense of meaning and that adhere to socialist core values will be shown on the home page.

Design of Additional Modules

Additional modules include the Bridge of Stars module, the Sign Language Field module,

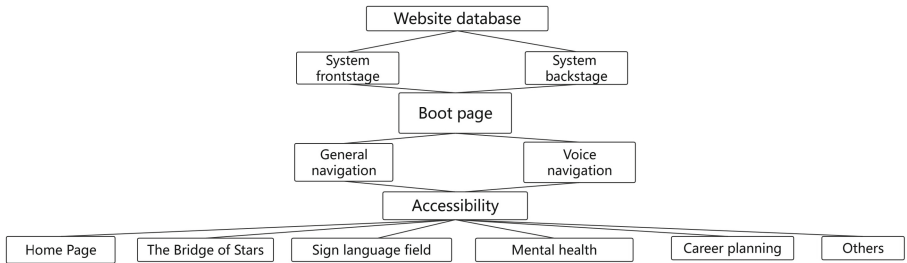


Fig. 5. The functional architecture

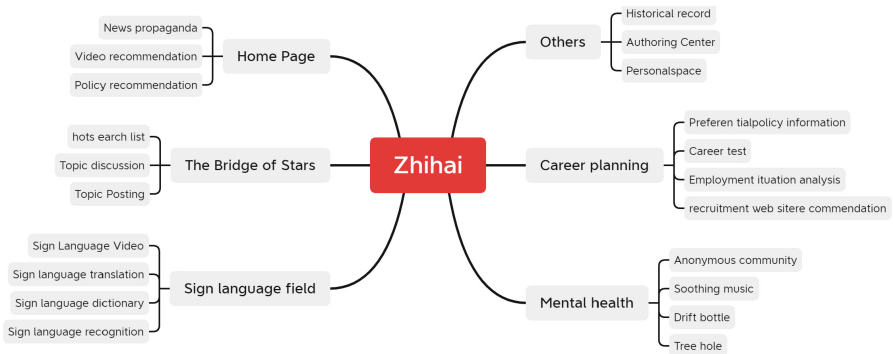


Fig. 6. The basic functions of each module

the Career Planning module, and the Mental Health module. After clicking on it, you can navigate to the corresponding partition.

The Bridge of Stars

A ranking of the hotness of the topics discussed in the Bridge of Stars community, known as the Hotlist, is included in the community. We can quickly learn about current hot topics that are important to the special education industry through the Hotlist, which also allows users to post and discuss topics. We can also quickly comprehend the social context of special education.

Sign Language Field

In order to assist sign language users in communicating and learning, as well as to address the issue of sign language enthusiasts who struggle with the language and are unsure of where to start, a module called Sign Language Field was developed. It has sign language dictionary, sign language translation, sign language recognition, and sign language video functions. A sign language action breakdown diagram or sign language video will be displayed in response to the user’s translation of a sentence into the dialog box. A sign language dictionary can help with the challenge of switching between words and phrases written in Chinese characters and sign language. The sign language recognition function means that users can access the device or activate the camera to make sign language gestures, and the dialog box will display the corresponding meaning.

Career Planning Module

The Career Planning Module includes four major functions: career testing, employment situation analysis, recruitment website recommendation, and preferential policy information. The occupation test includes well-known tests such as the Holland Occupation Interest Test and the MBTI test, which help users analyze their own personalities and make reasonable recommendations. The employment situation analysis function is based on the results of data statistics to provide a reference for users. The recruitment website recommendation function is according to the users' preferences and the recommended rating. Preferential policy information is collected from various well-known special education platforms and official government documents to help the disabled obtain employment.

Mental Health Module

The Mental Health Module aims to give users who are introverted and lonely a place to talk. The mental health module contains four functions: tree hole, drift bottle, soothing music, and anonymous community. The tree hole function is to release psychological pressure by speaking his mind. The drift bottle function is a whisper from one star to another. Soothing music can help users relax. Anonymous communities allow people to communicate freely.

Others

Other links include history, the authoring center, and personal space, which are designed to help users better use the site's features.

Background Administrator Privileges

Role-based access control (RBAC) is the foundation for Zhihai's background permission. Users, administrators, and super administrators make up the bulk of website users. A permission is an action that is permitted on a particular object, similar to how an administrator might review a user's published article, a user's uploaded video, their identity information, etc. Depending on whether the operation role possesses this control permission or not, the operation may be approved or denied (see Fig. 7).

Administrators and super administrators are the two operational objects. Specific tasks, like work review, video recommendation, rotation picture setting, etc., are under the administrator's control. The super administrator is able to add and remove administrators and has the same rights as an administrator (see Figs. 8, 9 and 10) and Table 1.

3.3 Database Design

We design the database by analyzing the requirement function using ER diagrams because the website function business is too big and complex. This database design has a total of seven entities: user entity, story entity, file entity, article entity, administrator entity, role entity, and operation menu entity.

Among them, "user entity" and "operation menu entity" do not need to depend on any other entity, so they are strong entities. The other entities can exist independently at any time, but they all depend on the user as an entity, so they are weak entities. A

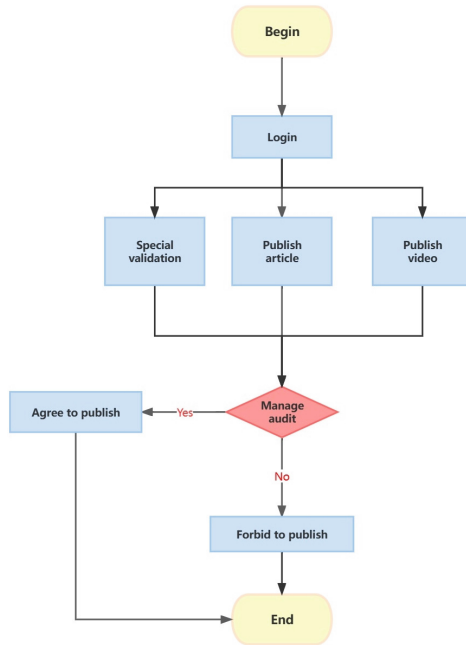


Fig. 7. Flow chart of the audit

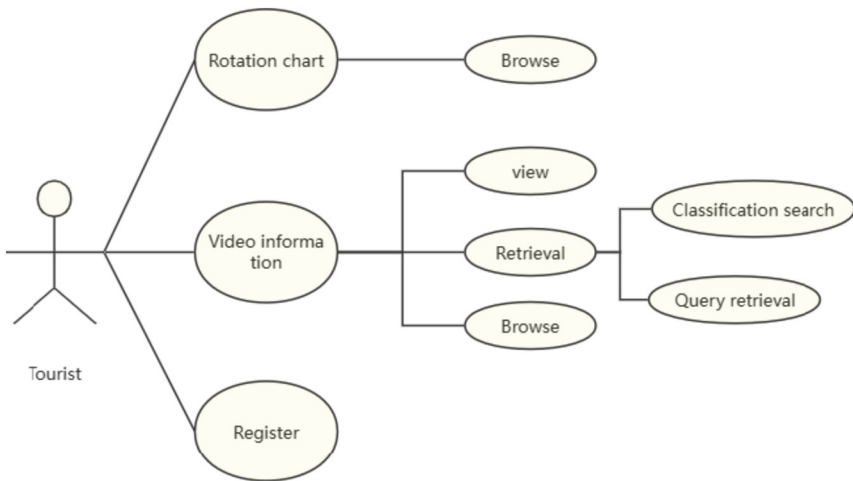


Fig. 8. Use case diagram for frontend visitors

straightforward ER model can be created using these components and the functional relationship prior to the entity, as shown in Fig. 11:

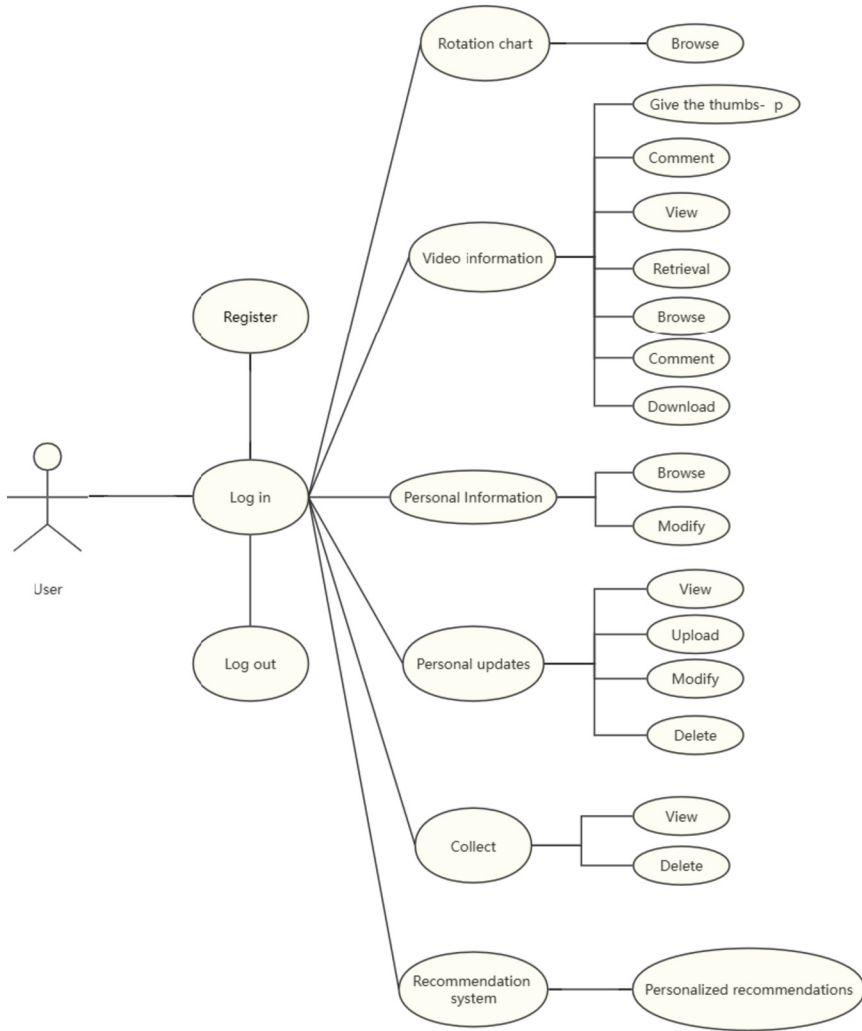


Fig. 9. Use case diagram for frontend users

Users and administrators do not interact directly because the frontend and backend are components of two distinct operational ends. There are 7 entities and 5 relationships in this ER model:

1. Users can post/like/collect/comment multiple stories.
2. One story can contain only one file or only one article.
3. One administrator can only have one role.
4. One role can have more than one operation menu, at the same time, one operation menu may be included by more than one role.

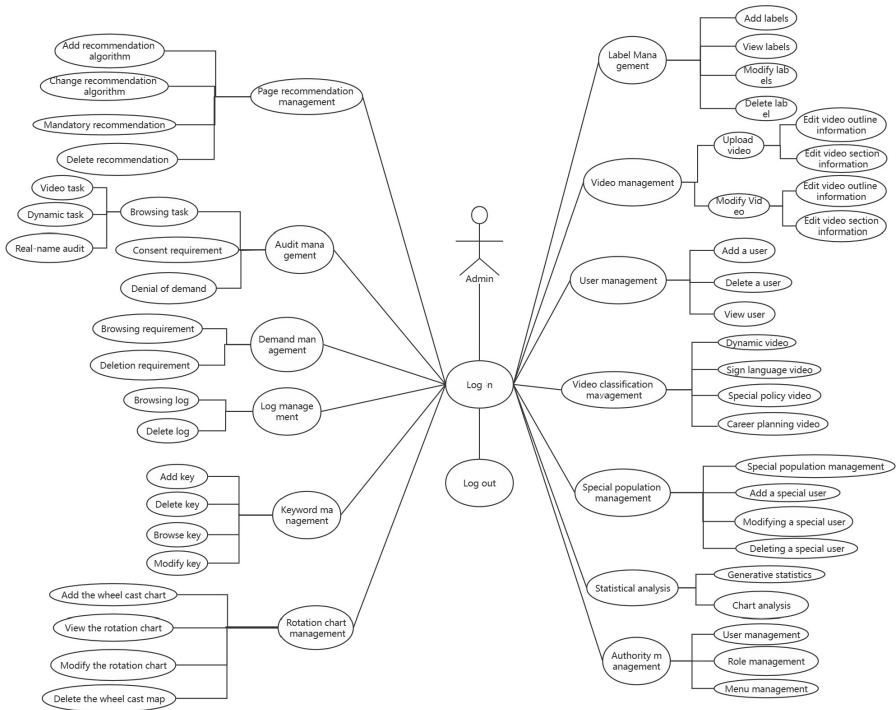


Fig. 10. Use case diagram for backend administrator

Table 1. Admin Menu

Function	Super Admin	Admin	User
View admin list	✓	×	×
Add admin	✓	×	×
Delete admin	✓	×	×

The business logic of the entire website can be understood using this straightforward ER model. Next, examine the characteristics each entity has:

1. User entity: includes user ID, account number, password, mobile phone number, nickname, avatar, education background, email, individual resume, address, date of birth, age, gender, and user type.
2. Story entity: includes story number, story type, release time, module number, story title, and audit status.
3. File entity: includes file number, file title, and file contents.
4. Article entity: includes article number, article title, and article content.
5. Administrator entity: includes administrator number, administrator name, administrator account, administrator password, and mobile phone number.

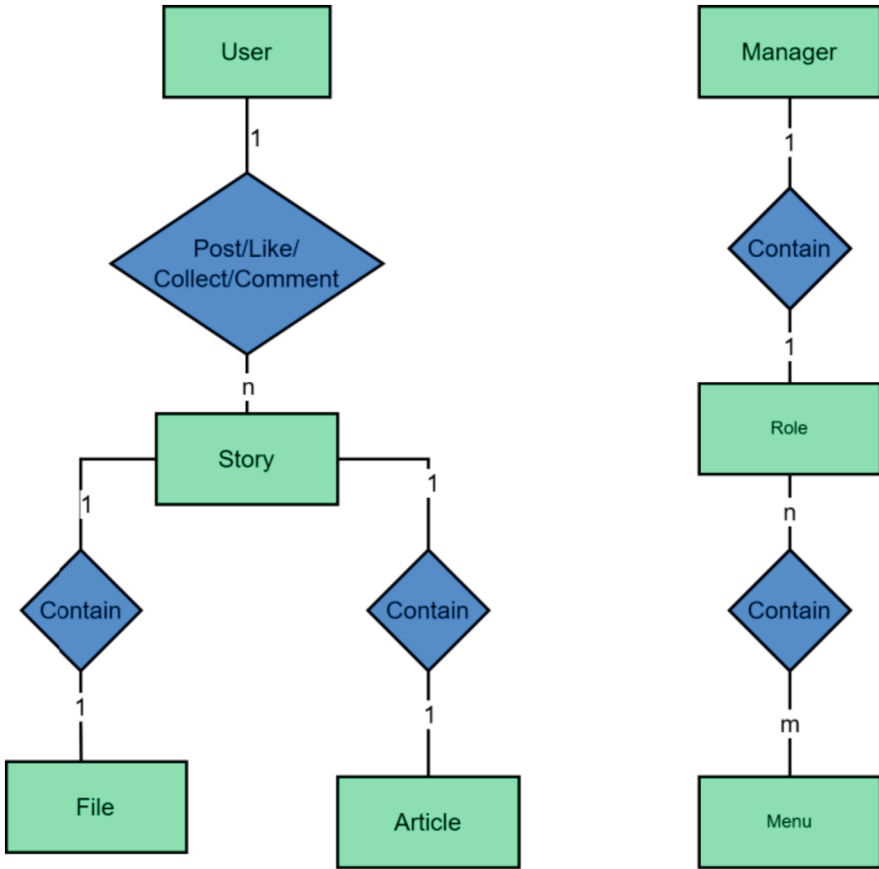


Fig. 11. ER model Diagram of the “user entity” and “operation menu entity”

- 6. Role entity: includes role number, role name, and status.
- 7. Operation menu entity: includes menu number and menu name.

After analysis, the ER model is obtained, as shown in Fig. 12:

Based on the above ER diagram model, it can be further translated into a specific database. The system uses a MySQL database with a total of 17 tables, which are designed as follows: user table, story table, file table, article table, message notification table, comment table, like table, collection table, collection classification table, history record table, data statistics table, recommendation classification table, administrator table, role table, role menu table, operation menu table, and audit table.

The user table is mainly used to store basic information about the user. It contains attributes such as user id, user account, username, nickname, password, and so on. The user table is shown in Table 2:

The story table mainly store basic stories published by users. It contains attributes such as story number, story type, release time, module number, story title, audit status, etc. The story table is shown in Table 3:

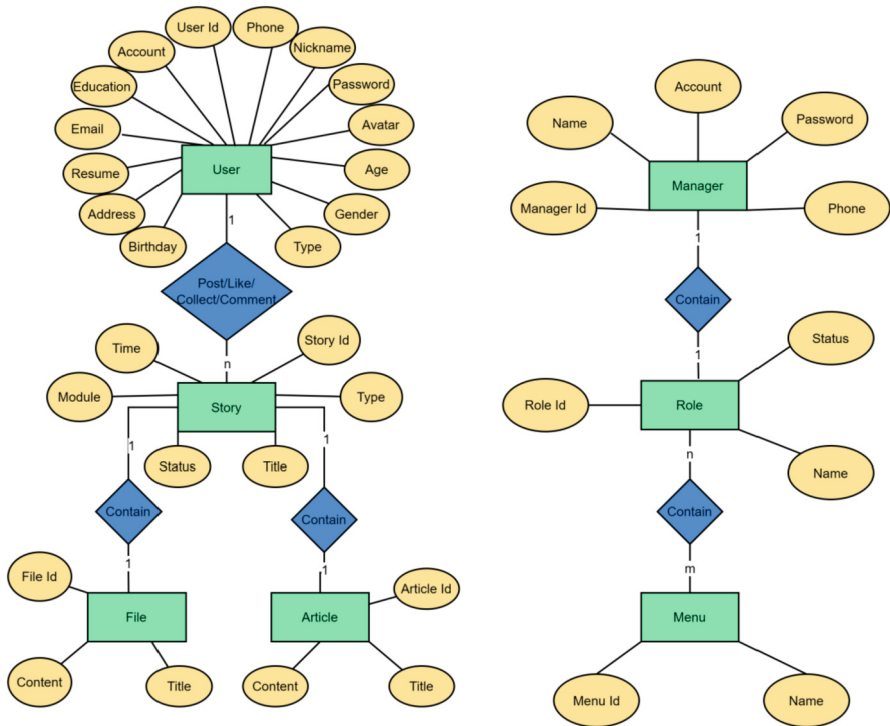


Fig. 12. Diagram of ER model for front and back end

The file table mainly stores the file information published by users, such as video and audio. It contains attributes such as file number, file title, file contents, and so on. The file table is shown in Table 4:

The article table mainly stores the articles and news information published by users. It contains attributes such as article number, article title, article content, etc. The article table is shown in Table 5:

The comment table mainly stores the dynamic comments made by users to other users. It contains attributes such as comment number, comment time, comment content, etc. The comment table is shown in Table 6:

The like table mainly stores the liking information dynamically made by users to other users. It contains attributes such as like number, like time, etc. The like table is shown in Table 7:

The collection table mainly stores the basic information of other users. It contains attributes such as collection number, collection time, collection classification, etc. The collection table is shown in Table 8:

The collection classification table mainly stores the basic information saved by other users. It contains attributes such as collection classification, creation time, classification name, number of collections, etc. The collection classification table is shown in Table 9:

Table 2. The user table

The user table		
user id	int	<pk>
user account	varchar(20)	
password	char	
nickname	varchar(20)	
avatar	blob	
education background	varchar(8)	
email address	varchar(255)	
individual resume	varchar(255)	
address	varchar(255)	
birth date	date	
age	int	
gender	char(1)	
user type	varchar(20)	
phone number	varchar(11)	

Table 3. The story table

The story table		
story id	int	<pk>
user id	int	<fk>
story type	varchar(20)	
release time	datetime	
module number	varchar(20)	
view permission	varchar(20)	
story title	varchar(255)	
audit status	int	

The history record table mainly stores the historical information that the user has browsed other users. It contains attributes such as record number, record time, etc. The history record table is shown in Table 10:

Table 4. The file table

The file table		
file id	int	<pk>
story id	int	<fk>
file title	varchar(255)	
file content	blob	

Table 5. The article table

The article table		
article id	int	<pk>
story id	int	<fk>
article title	varchar(255)	
article content	blob	

Table 6. The comment table

The comment table		
comment number	int	<pk>
story id	int	<fk1>
user id	int	<fk2>
comment time	datetime	
comment content	text	

Table 7. The like table

The like table		
like number	int	<pk>
story id	int	<fk1>
user id	int	<fk2>
like time	datetime	

The data statistics table mainly stores the data information that the user's story is affected by other users. It contains attributes such as data statistics number, likes, views, collections, comments, etc. The data statistics table is shown in Table 11:

Table 8. The collection table

The collection table		
collection number	int	<pk>
story id	int	<fk1>
collection classification	int	<fk2>
user id	int	<fk3>
collection time	datetime	

Table 9. The collection classification table

The collection classification table		
collection classification	int	<pk>
user id	int	<fk>
classification name	varchar(255)	
creation time	datetime	
number of collection	int	

Table 10. The history record table

The history record table		
record number	int	<pk>
story id	int	<fk1>
user id	int	<fk2>
Record time	datetime	

The recommended classification table mainly stores the basic data information of the basic classification of the user's story label on the homepage of the website. It contains attributes such as recommend category numbers, category titles, etc. The recommended classification table is shown in Table 12:

Table 11. The data statistics table

The data statistics table		
data statistics number	int	<pk>
story id	int	<fk1>
user id	int	<fk2>
likes	int	
views	int	
collections	int	
comments	int	
forwarding number	int	

Table 12. The recommended classification table

The recommended classification table		
classification number	int	<pk>
story id	int	<fk1>
user id	int	<fk2>
classification title	varchar(20)	

The message notification table mainly stores the basic data information sent between users. It contains attributes such as message notification number, user number 1, user number 2, message type, message content, etc. The message notification table is shown in Table 13:

Table 13. The message notification table

The message notification table		
message notification number	Int	<pk>
user number 1	Int	<fk1>
user number 2	Int	<fk2>
message content	varchar(20)	
message content	Text	

The administrator table stores basic information about the administrator. It contains attributes such as administrator number, administrator name, administrator account number, administrator password, phone number, etc. The administrator table is shown in Table 14:

Table 14. The administrator table

The administrator table		
administrator number	int	<pk>
administrator name	varchar(20)	
administrator account number	varchar(20)	
phone number	varchar(11)	
administrator password	varchar(16)	

The role table mainly stores information about the roles to which the administrator belongs. It contains attributes such as role number, role name, role status, etc. The role table is shown in Table 15:

Table 15. The role table

The role table		
role number	int	<pk>
administrator number	int	<fk>
role name	varchar(255)	
Role status	int	

The operation menu table mainly stores the operation information that can be performed in the system background. It contains attributes such as menu number, menu name, etc. The operation menu table is shown in Table 16:

Table 16. The operation menu table

The operation menu table		
menu number	int	<pk>
menu name	varchar(255)	

The role menu table mainly stores the relationship information between the role and the operation menu. It contains attributes such as role menu number, etc. The role menu table is shown in Table 17:

The audit table mainly stores record information about the actions performed by the administrator on the published stories. It contains attributes such as audit number, audit status, audit time, story number, etc. The audit table is shown in Table 18:

The database design clearly outlines the system database design process based on specific functional requirements and also displays each link's milestones. The database

Table 17. The role menu table

The role menu table		
role menu number	Int	<pk>
role number	Int	<fk1>
menu number	Int	<fk2>

Table 18. The audit table

The audit table		
audit number	int	<pk>
administrator number	int	<fk1>
story number	int	<fk2>
audit status	varchar(20)	
audit time	datetime	

design not only increases the website system's overall design effectiveness, but it also offers solid support for the system's future efficient and stable development. [15].

4 Implementation of Key Technologies

4.1 Video Player

Zhihai uses the powerful open-source video player Shaka Player, a very popular free open-source HTML5 video player. It supports adaptive-bitrate streaming protocols such as HLS and DASH without any plugins or Flash.

Shaka plays videos using open web standards such as MSE [16] and EME. It supports on-demand, live streaming, multi-time content, multi-DRM, and subtitles.

1. Use npm to download:

```
npm install shaka-player --save
```

2. Edit the HTML page and add a video element

```
<video id="video"
  poster=" // shaka-player-
demo.appspot.com/assets/poster.jpg"
  controls autoplay
></video>
```

3. Add the following script to your HTML page

```
function initApp() {
  shaka.polyfill.installAll();
  if (shaka.Player.isBrowserSupported()) {
    initPlayer();
  } else {
    console.error('Browser not supported!');
  }
}
function initPlayer() {
  var video = document.getElementById('video');
  var player = new shaka.Player(video);
  window.player = player;
  player.addEventListener('error', onErrorEvent);
  player.load(manifestUri).then(function() {
    console.log('The video has now been loaded!');
  }).catch(onError);
}
```

4. Add components to the view area

```
<shaka-
player class="video" :src="src" :poster="poster" a
utoplay></shaka-player>
```

4.2 Navigation Shortcut

The project uses asynchronous JavaScript events to respond to client requests [17]. Using Javascript scripts to set a combination of hotkeys is essentially getting the keyCode value of a key. If you want to add ctrl, alt, shift, and other quick keys, then add a ctrlkey, altKey, shiftKey, and other corresponding keycode values; the key is to get the value of the key code. Take the code below as an example:

```
<script>
  function hotkey() {
    var a=window.event.keyCode;
    if(( a==82)&&( event.ctrlKey )){
      readNext()
    }
  }
  document.onkeydown = hotkey;
</script>
```

4.3 Speech-to-Text

The Web Speech API allows you to integrate speech data into web applications [18].

The Web Speech API provides two different types of functionality in different directions: speech synthesis (Text-to-Speech, TTS) and speech recognition (asynchronous speech recognition).

Speech recognition involves three processes: first, the device's microphone is needed to receive speech; second, the speech recognition service checks the speech against a set of grammars (basically, grammars are the words you want to be able to recognize in a particular application); and finally, if a word or phrase is successfully recognized, the result is returned as a text string (there can be more than one result), and further actions can be set to trigger.

Text-to-Speech (TTS) is the process of receiving a text from an application that requires speech synthesis and then playing it back into the device's microphone.

The Web Speech API has a main control interface for this, called `SpeechSynthesis`, plus some other interfaces that deal with how to represent the text to be synthesized (also called "utterances"), what sounds to use to broadcast the utterances, and other related tasks. Similarly, many operating systems have a speech synthesis system of their own, and in this task, we call the available APIs to use the speech synthesis system.

Speech recognition involves three processes: first, the device's microphone is needed to receive this speech; second, the speech recognition server checks this speech against a set of grammars (basically, grammars are words you want to be able to recognize in a particular application); and finally, if a word or phrase is successfully recognized, the result is returned as a text string (there can be more than one result), and more behaviors can be set to trigger.

The Web Speech API has a primary control interface, `SpeechRecognition`, and several closely related interfaces such as `Representation Syntax`, `Representation Results`, and so on. Devices usually have a standard speech recognition system available, and most modern operating systems use this speech recognition system to process voice commands.

```

var SpeechRecognition = SpeechRecognition || webkitSpeechRecognition
var SpeechGrammarList = SpeechGrammarList || webkitSpeechGrammarList
var SpeechRecognitionEvent = SpeechRecognitionEvent || webkitSpeechRecognitionEvent

```

Chrome now supports speech recognition with prefixes, so you need to add something at the top of your code to ensure that the object used is correct in both Chrome, which requires a prefix, and Firefox, which does not.

After getting the references to the output div and html elements (which we can use later to output the results of the speech recognition diagnostics and update the background color of the application), we add an onclick event handler to enable the speech recognition service when the screen is clicked. This is done by calling the “SpeechRecognition.start()” method. The internal work of the forEach() method is to add a background color for each color keyword, so that it is intuitive to know what color the color keyword points to.

```

colors.forEach(function(v, i, a){
  console.log(v, i);
  colorHTML += '<span style="background-color:' + v + ';"> ' + v + ' </span>';
});

document.body.onclick = function() {
  recognition.start();
  console.log('Ready to receive a color command.');
```

Once speech recognition has started, there are a number of event handlers that can be used to follow up on the return of a result, and there is some piecemeal related information that can be manipulated in addition to the recognized result (see the SpeechRecognition event handler list). One of the most commonly used is “SpeechRecognition.onresult,” which is triggered when a successful result is received.

```
recognition.onresult = function (event) {
    var last = event.results.length - 1;
    var color = event.results[last][0].transcript;
    diagnostic.textContent = 'Result received: ' + color +
    '.';
    bg.style.backgroundColor = color;
    console.log('Confidence: ' + event.results[0][0].confidence);
}
```

4.4 Subtitle Generation

In the implementation of Web video live captioning, the first thing that comes to mind is Ajax technology polling. The principle of this technology is very simple, the client and the server will always be connected, and every once in a while to ask. The client polls to see if there is a new message. This way, there are many connections, one receiving and one sending. Also, each request sent would have an HTTP header, which would consume traffic and CPU utilization. Finally, we use Socket.IO, which has high performance, reliability, and speed as well as stability.

Socket.IO is a library that provides low-latency, bi-directional, event-based communication between clients and servers. It is built on top of the WebSocket protocol [19] and provides additional guarantees such as fallback to HTTP long-polling or automatic reconnection.

```
const express = require(' express ');
const app = express ();
const http = require(' http ').Server(app);
const io = require('socket.io ')(http);
const path = require(' path ');

app.use(express.static(path.join(_dirname)));

app.get('/', function (req, res) {
    res.sendFile("public/index.html");
..
```

When the server listens to the server-push event, the run function initializes the caption and then generates a caption that scrolls across the screen.

5 Summary

This paper designs and develops an accessible learning and communication community website based on the difficulties faced by the disabled in online learning. In terms of learning needs, website function construction, communication, career planning, and psychological needs, Zhihai not only meets the needs of general users but also provides practical help to special users according to their needs, solves problems, maximizes the selectivity and equality of special people in learning and communication, promotes the integration of disability culture, and truly understands, respects, and promotes disability culture [20].

The research results of this paper are as follows:

Firstly, this paper mainly elaborates on the development of web accessibility and also additionally analyzes various problems such as low acceptance of higher education for the disabled, a communication gap between ordinary people and the disabled, the low popularity of sign language, difficulties in the employment of the disabled, and frequent mental health problems among the disabled, etc. The design and development of Zhihai was carried out through sufficient research and investigation.

Second, Zhihai not only meets the requirements of accessibility and the online learning needs of the disabled, but also has several additional modules that can meet the needs of the disabled in many aspects, such as communication, employment, and the improvement of psychological problems.

As technology advances and evolves, more and more new technologies are being applied to the design and development of accessible websites. It is only through continuous learning and innovation that we can promote the ongoing development of accessible technology and create a more comfortable environment for the disabled.

The above research results are only a small step forward, and the practical process shows that there is still a lot of work to be done. For example, some disabled people have poor language ability and weak comprehension ability, and it is difficult to correctly understand the main meaning of knowledge, so they need to simplify and explain the information, but the simplification and explanation may lose part of the original information, which affects the transmission effect and reliability. In addition, the authority and professionalism of the knowledge of the disabled are demanding, it is difficult to update, and the production cycle for quality information is long. Knowledge-sharing sites for the disabled may contain certain sensitive information that, if left unprotected, may be vulnerable to attack, resulting in information leakage and personal data breaches.

In the future, we will likely continue to explore deeper questions, particularly by building on our current findings and expanding our research to cover a broader and more innovative range of topics.

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