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Wechat Mini Programs Empower Interactive Disability Assistance Platform

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Abstract*—To enhance the quality of life of the disabled population, the extensiveness and real - time nature of social disability - assistance services are of great significance. It is crucial to construct a convenient and powerful disability - assistance platform. This paper presents a construction plan for the "Mini - Program - Empowered Interactive Cloud Platform for Disability Assistance", and puts forward specific construction strategies regarding the platform's functional architecture, interaction mode, and cloud - service support system.By integrating various disability - assistance resources and services, and leveraging the convenience of mini - programs, this platform breaks through multiple limitations such as time, space, and language in disability - assistance services, enabling efficient interaction and precise connection among multiple entities including the disabled, volunteers, and service organizations. This platform can basically meet the diverse needs of the disabled in aspects such as daily life and social interaction, effectively facilitating the better integration of the disabled population into society, and providing strong support for the informatization and digitization development of the disability - assistance cause.*

***Keywords*—** *Disability assistance; Technology helps the disabled; Interactive; Peoples with disabilities; Accessibility*

I. Introduction

The white paper Equality, Participation and Sharing: 70 Years of Protection of the Rights and Interests of Persons with Disabilities in New China released by the State Council of China points out that the total number of persons with disabilities in China is more than 85 million, and it is conservatively estimated that the number of persons with disabilities in China in 2030 will reach 10,000,000 people. [1]In the digital era, the rapid development of information technology has profoundly affected all areas of society, and the cause of helping people with disabilities has also ushered in new opportunities and changes. However, there are still many deficiencies in the existing service model for helping people with disabilities, such as poor information flow, low accuracy of service docking, and limited social interaction among people with disabilities.[2]

In order to improve this situation, this paper aims to construct an interactive disability assistance platform, which breaks down the barriers of traditional disability assistance services by integrating advanced information technology and disability assistance services. [3]The main research includes an in-depth analysis of the diverse needs of people with disabilities and the current situation of the supply side of disability services, based on which the functional architecture of the applet is designed, covering the core modules of accurate demand release and matching, personalized service customization, and barrier-free social interaction. Through the development of the prototype system and continuous modification and improvement to optimize the performance of the platform, we will ultimately achieve the goal of improving the efficiency and quality of assistive services, promoting the better integration of people with disabilities into social life, and promoting the development of the cause of assistive services in the direction of intelligence and efficiency.

II. System Design

A. System Functional Requirements Analysis

Disabled people are widely distributed in society, and there is diversity in terms of the type, degree, age and geographical area of disability. When designing products, it is necessary to take into account the characteristics and needs of each group of people to make targeted design, in order to provide more convenient, efficient and caring services. [4]

As a result, users are divided into two categories when designing the system: helpers (individuals, organizations) and recipients. Recipients are broadly categorized into the following groups: visually impaired, hearing impaired, physically impaired, and mixed impaired.

B. System Design

This project adopts the B/S (Browser/Server) structure of the database front-end platform building mode. the B/S structure is characterized by ease of use, low cost, adaptability, easy deployment and maintenance. The overall framework of the system is shown in Figure 1、2.

Fig. 1. Framework diagram of the interactive disability assistance applet system

C. System Technology Stack

The technology stack used in this system is as follows:

Front-end development: Use the JavaScript language, WXML (WeiXin Markup Language), and WXSS (WeiXin Style Sheet) for interface design and interaction logic implementation.

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Back-end development: using PHP (Hypertext Preprocessor) and JavaScript language, using SSM (Spring, Spring MVC, Mybatis) framework for business logic processing and data persistence.

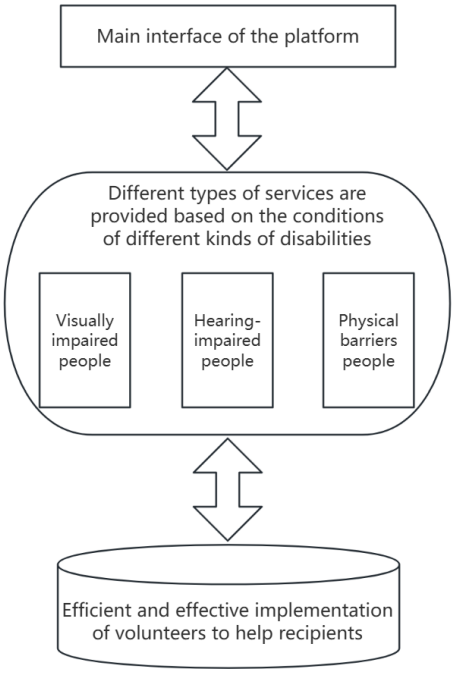

Fig. 2. Service model diagram

Database: Using MySQL for database storage and management.

III. Algorithm Design Framework

A. Needs analysis and data collection

User needs are collected through questionnaires and interviews. The information data of disabled persons include personal information, type and degree of disability, and living needs. Service resource data covers service items, service scope, service time, etc. of various service organizations. Volunteer data includes volunteers' skills, service time, and service intention. [5]

B. Design of Matching Algorithm

Content-based recommendation algorithm: preprocessing the text of the demand description and the service items on the volunteer side; using the TF-IDF algorithm to calculate the text similarity and generate the recommendation list.[6] The specific operations are as follows:

1. Text pre-processing: the open-source tool HanLP will be used to cut the continuous text into independent words, after the word separation to remove the deactivated words in the text, such as 'the', 'is' and other words without practical significance in order to reduce the interference of the noise on the results of the recommendation.
2. Feature Extraction and Vectorisation: The TF-IDF (Term Frequency-Inverse Document Frequency) algorithm is used to extract features from the preprocessed text. The importance of words is measured by calculating the frequency of words in the document and the inverse document frequency in the corpus. The text is transformed into TF-IDF vectors, and a numerical representation of the text is constructed and represented as a high-dimensional vector.
3. Text Similarity Calculation: Use cosine similarity to calculate the similarity between the user demand text and the volunteer text, according to the similarity score of the service items are sorted to generate a recommendation list, and the items with the highest similarity will be matched first.

Skills and needs matching algorithm: Knowledge graph technology is introduced to construct a correlation graph between volunteers' skills and the needs of people with disabilities. [7] When a disabled person puts forward a demand, the graph search algorithm is used to quickly locate volunteers with corresponding skills in the knowledge graph.[8] The specific operation is as follows.

1. Knowledge mapping: key entities are extracted from the database, such as volunteer skills (e.g., 'sign language interpreter', 'psychological counselling'), recipient needs (e.g., 'sign language service', 'complex terrain navigation assistance'), and so on. 'Complex terrain navigation assistance"), and so on. The relationships between the entities are extracted through rule matching, and the extracted entities and relationships are finally stored in the graph database.
2. Graph search algorithm: Upon receiving a service request, the system first identifies the associated nodes in the knowledge graph and then uses the graph search algorithm to locate the volunteer nodes linked to the demand nodes in the knowledge graph.

IV. Design of Real-Time Communication Algorithm

Audio and Video Synchronisation Algorithm (Timestamp Synchronisation Mechanism): Adds precise timestamps to audio and video packets at the sending end, and synchronises the audio and video streams at the receiving end according to the timestamps. By calculating the difference between the arrival time of the audio and video packets and the timestamp, the playback order and delay are adjusted to ensure that the audio and video playback remain synchronised. [9-10]

1. Generation and addition of timestamps: the acquisition phase adds precise timestamps (with millisecond precision) to each audio and video packet at the sending end, and the encapsulation phase embeds the timestamps in the header information of the packet.
2. Synchronisation at the receiving end: parsing the timestamp information in the packet to obtain the estimated playback time of each frame. The receiving end maintains two buffers (audio buffer and video buffer), which are used to store audio and video frames that have not yet been played and sort the frames according to the timestamp.
3. Synchronisation mechanism: The receiver determines whether the current frame should be played by calculating the difference between the arrival time of the audio/video packet and the timestamp. If the difference is small (within the error range), the frame will be played in the order of the timestamp, while if the difference is large, the delay will be adjusted. If the playback time of a frame has already expired, the frame is directly discarded to avoid accumulating delay.

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V. System implementation

A. front-end implementation

The front-end development adopts the native technology stack of WeChat applet, which mainly includes WXML, WXSS and JavaScript. WXML is used to build the page structure, WXSS is used to define the page style, and JavaScript is responsible for user interaction logic and business logic. Fast response and smooth interaction of the user interface is achieved through multiple technologies.

In order to enhance user experience, especially for visually impaired users, the front-end implements accessibility features. For example, visually impaired users can quickly enter the platform through quick gesture operation, and the voice assistant function is automatically enabled. The voice assistant is able to guide users in real-time to carry out operations, such as navigation, information query, and so on.

B. back-end implementation

The back-end is developed using the SSM framework with clear responsibilities for each layer to ensure high cohesion and low coupling of the system. The overall architecture is divided into four layers:

Dao layer: responsible for adding, deleting, modifying, checking and controlling database access, encapsulating SQL statements.

Service layer: Handles business logic, such as demand matching and volunteer scheduling.

Controller layer: responsible for request forwarding and process control.

View layer: combined with the front-end, responsible for the display of data and user interaction.

C. Database implementation

The database was designed using MySQL with a user information table and a service record table as shown in Table 1 and Table 2.

TABLE I. User information sheet.

Data Item Name	Data Type	Length	Integrity Constraints
Service Order Number	varchar	20	Key
Initiator ID	varchar	10	
Service Provider ID	varchar	10	
Start Time	varchar	100	
Service Time	varchar	100	
Service Evaluation	varchar	100	

TABLE II. Service Record Sheet.

Data Item Name	Data Type	Length	Integrity Constraints
User ID	varchar	10	Key
Password	varchar	10	
Contact Information	varchar	15	
Service Identity	varchar	100	
Service direction	varchar	100	
Service area	varchar	100	
Service time	varchar	100	

VI. Partial Pseudo-Code

This code is an example of receiving a user request - matching the best volunteer.

```
// User submits a service request
  // Get user information
  // Parsing the user request
  // Store the request in the database.
  // Return the generated request ID
// Match volunteers
  // Get service request details
  // Get a list of all available volunteers
  // Initialise the best matching volunteers
  // Iterate through the list of volunteers and calculate the match score
    // Calculate the match score between the volunteer's skills and the user's needs.
    // Update the best matching volunteer
  // Return the best matching volunteer
```

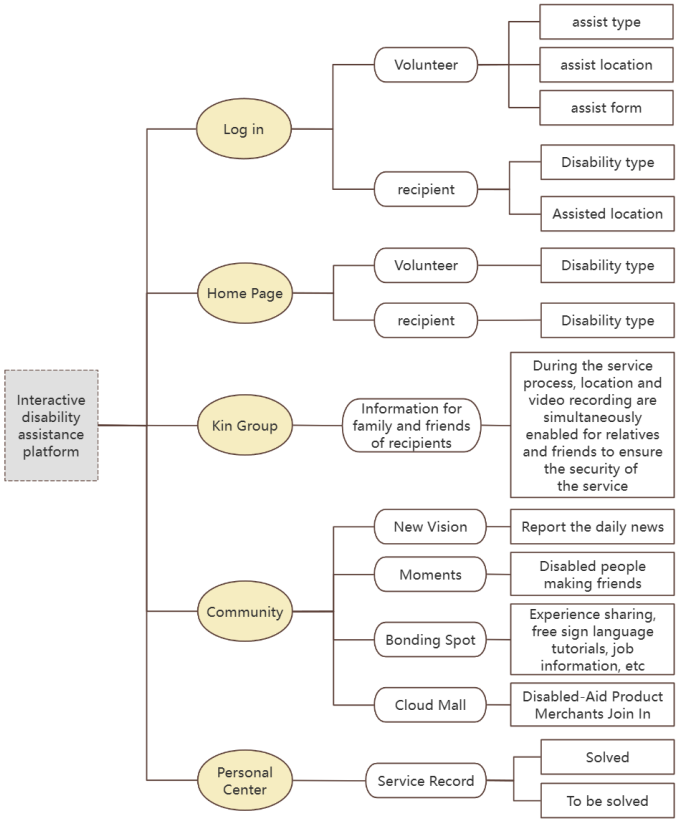

Fig. 3. Functional module diagram of the interactive disability applet

Algorithm 1:

Input:UserProfile u,RequestText r.
Output:BestVolunteerID

```
1 :  Main()
2 :    Store u & r in DB → appID;
3 :    req ← P reprocess(r) volunteers ← F etchAvailableV olunteers();
4 :    bestScore ← −∞;
5 :    bestV ol ← ∅;
6 :    foreach v ∈ volunteers do
7 :      vT ext ← P reprocess(v.serviceDescription);
8 :      simcontent ← T F IDF (req, vT ext)
9 :      graph ← LoadKnowledgeGraph();
10 :     simskill ← GraphSearch(req, v.skills);
11 :     totalScore ← 0.6 · simcontent + 0.4 · simskill;
12 :     if totalScore > bestScore then
13 :       bestScore ← totalScore;
14 :       bestV ol ← v.id;
```

```
15 :        end
16 :    end
17 : return bestV ol
```

VII. FUNCTIONAL DESIGN

A. Login Module

The functional modules of the applet are distributed as in Figure 3, and after logging in, you will enter the selection interface as in Figure 4.

1. Select language. Choose to use Mandarin or dialect. Dialect users are matched with corresponding volunteers through provincial, municipal and district (county) zoning, which can make the service process smoother and the content more accurate.
2. Choose identity. For users with normal body functions, they can choose 'I am a volunteer' to register as a volunteer on the platform, and the platform will send SMS/call to mobile phones to notify them when someone needs the service, and provide online help for other disabled users. For visually impaired, hearing impaired and mobility impaired users, they can choose 'I need help', and the platform will incorporate the information into its database and match them with appropriate volunteers in subsequent use.
3. Choose the direction of service. Volunteers choose the direction of volunteering in this interface, such as preferring to help the visually impaired, the hearing impaired, or helping people with mobility problems in the neighbourhood by area. Recipients in this interface to select the direction of assistance, such as the need for vision, hearing, mobility and other aspects of help.
4. Select service time. Volunteers choose the time period in which they can provide volunteer services in order to categorise users in subsequent use. The platform will not contact the volunteer outside the filled volunteer time period; if there is no volunteer in that time period, the volunteer will choose a nearby time period to send a text message to confirm whether the other party can provide help.
5. Select Service Area. This option is designed to help blind people who have difficulty in travelling or who encounter obstacles in travelling to their current place of residence (or the area where the service is needed/can be provided). This option is designed to help blind people who have difficulty in travelling or who have difficulty in getting around. Users in the corresponding area are matched by zones. In official use, you can call the nearest volunteer for help through GPS location.

B. Main interface module

The initial categorisation of recipients is done through the 'Select' operation. The interface of the platform home page is shown in Figure 5.

1. Visually impaired users: when encountering difficulties, they can tap the platform through shortcuts (such as shortcut gestures that have been set, home button, multiple long presses of the off button, etc.) After entering the platform, the voice assistant is automatically turned on to guide the user's operation, and the user can contact the volunteers through voice recognition. When the match is successful, the camera is automatically turned on, and the volunteer side will receive the disabled user's screen and provide services for each other. [11]
2. Hearing-impaired users: start the platform while automatically turning on the intelligent assistant to convert the surrounding sound and dialogue into text. [12] If there is a further need you can open the camera through the homepage - click on match to match the volunteer to analyse the dialogue in combination with the scene. [13]
3. Mobility-impaired users: After matching with the volunteer successfully, both parties will communicate, and then the platform will confirm the information of both parties. After confirmation, the platform will send the recipient's location to the volunteer, and at the same time, the recipient and the volunteer can choose their own way to provide real-time guidance.
4. After connecting, the interface is shown in Figure 6, clicking on the other side of the screen to zoom in, clicking on the microphone icon to change the video into voice, clicking on the text icon to send the text to the other side, clicking on the camera icon to flip the lens, and clicking on the hang up to end the call. For visually impaired users, all icons need to be double-clicked twice to take the next action (anti-touch).
5.

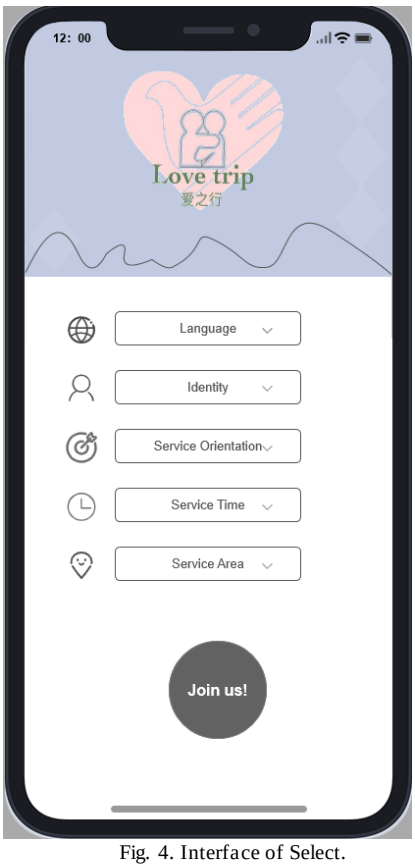

Fig. 4. Interface of Select.

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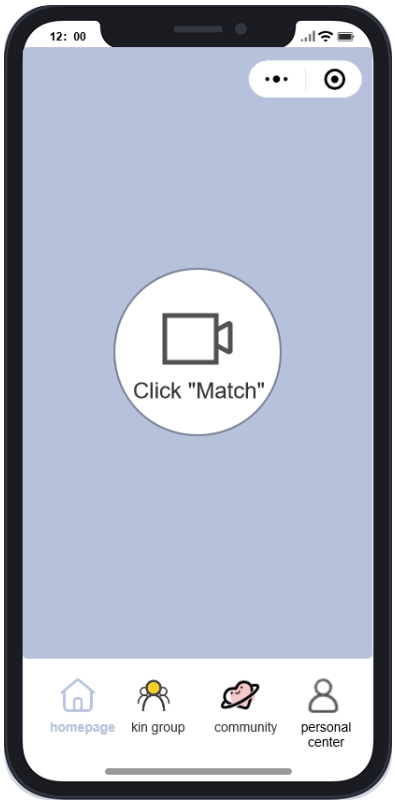

Fig. 5. Interface of the Platform home page.

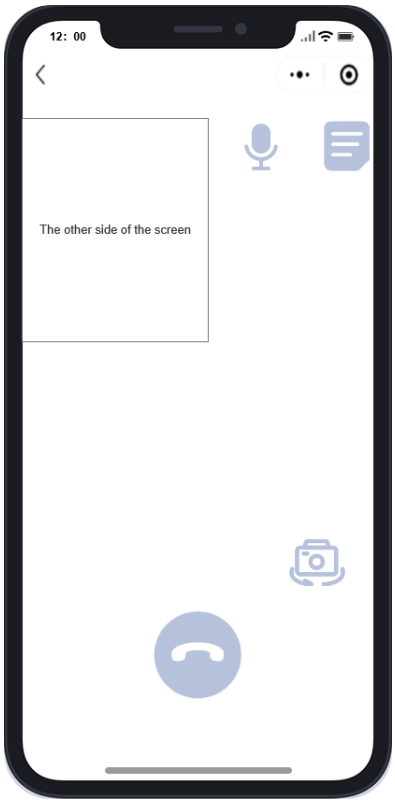

Fig. 6. Interface of the Contact connection.

C. Social and Personal Module

The Friends and Family interface creates a profile card (containing information about friends and family) through which friends and family can be contacted when necessary, and the platform sends the process locator to the Friends and Family members when the service is in progress to ensure the safety of the user. See Figure 7.

In the Modify Profile interface, users can change the language of use, shortcut gestures, service direction, region, and time. In the user feedback interface, users can select the scenario in which the problem occurs and ask questions, see Figure 8~9.

The community interface provides users with content such as audio news and accessible films as well as channels for making friends. There are the following ideas for the supplemental follow-up of this section:

1. Co-operate with the government to publish recruitment information in the community
2. Co-operate with sign language training organisations to provide sign language teachers.
3. Co-operate with businesses to provide channels for the purchase of assistive devices for the disabled.
4. Regularly listen to highly discussed issues affecting the lives of people with disabilities and organise volunteer teams to solve them offline.
5. By region, the platform leads and endorses the call to organise volunteer teams to carry out regular and focused activities to help people with disabilities.

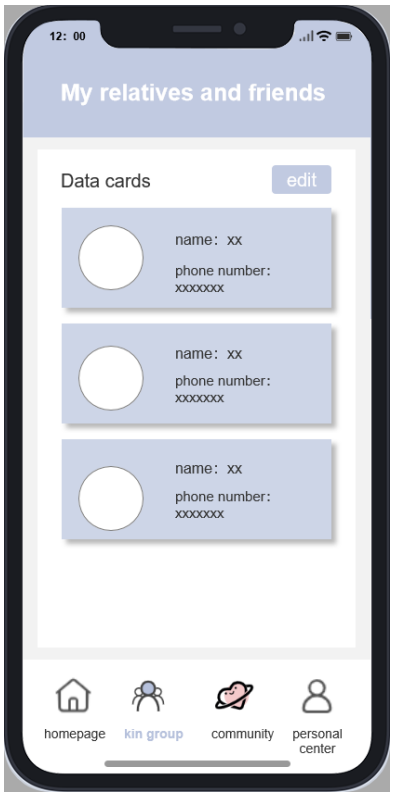

Fig. 7. Interface of the Kin Group.

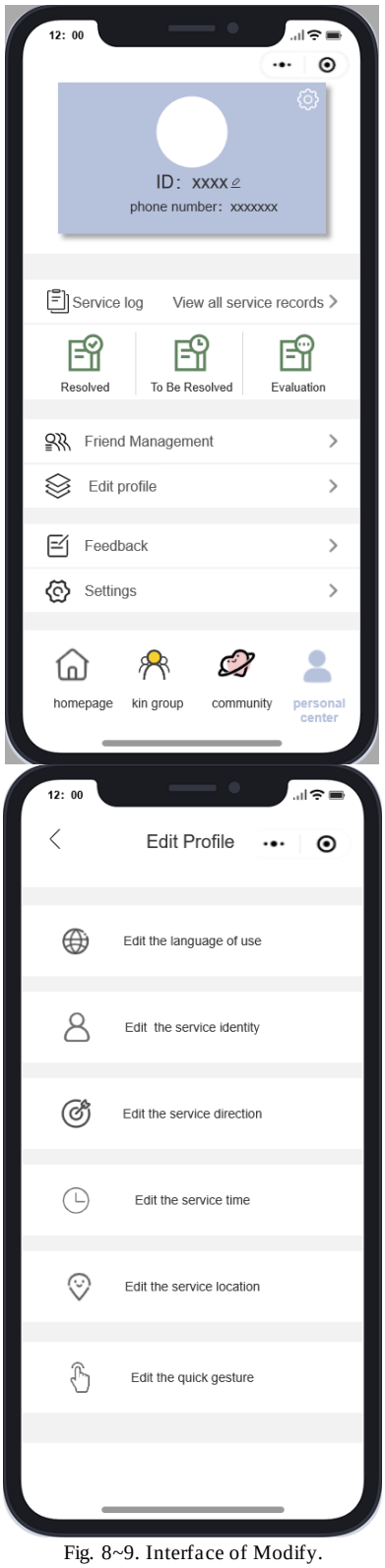

Fig. 8~9. Interface of Modify.

VIII. Concluding Remarks

Text Research's interactive platform for helping people with disabilities is based on the integration of advanced information technology, in-depth analysis of user needs, optimisation of service matching algorithms, in-depth discussion of user needs when helping users, and the realisation of precise release, personalised services and barrier-free social interaction. We look forward to future cooperation with local voluntary organisations associations, the Red Cross and other service organisations in different industries to enhance diversified services and meet the diverse needs of users. This project facilitates the daily life of special groups and pays attention to their mental health, helping them integrate into society and building a barrier-free environment.

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