Design of medical database information query system based on Android

ZHU Yan-Chen[1], Du Jian-Qiang [2]*, Li Zhi-Biao[3], Zhong Guo-Yue[4],Deng Chun-Sheng[5]

{dddd24616563@163.com[1],zhuyc126@163.com[2*],dingqin201703@163.com[3],

zyj201707@163.com[4],hy20160401@163.com[5]}

[1,2,3,5]School of Computer, Jiangxi University of Traditional Chinese Medicine, Nanchang 330004, China;

[4]Research Center for Traditional Chinese Medicine Resources and National Medicine, Jiangxi University of Traditional Chinese Medicine, Nanchang 330004, China;

Abstract. Aiming at the problem that the traditional national medicine database information query system is easy to produce data redundancy in the actual query, which leads to the long query time of the query system, an Android based national medicine database information query system is designed. BrainLink single chip microcomputer is selected as the processing core, and the hardware part is designed by analyzing the controller, development board and circuit connection part. The software part designs the web architecture, uses the app program to interact with the user, calculates the redundant weight value of the system data, according to the size of the weight value, uses the soap serialization envelope object to describe, and completes the implementation of the query system on Android. The experimental results show that: compared with the traditional query system, the query time of the national medicine database information query system based on Android is the shortest.

Keywords: Android;National medicine database;Information Service;WEB architecture;

1 Introduction

Ethnic medicine refers to the medicine used by ethnic minorities in China, guided by the theory and practice of traditional medicine of the ethnic group. It is an important part of the traditional medicine treasure house. Its function and value in disease prevention and health protection have attracted wide attention at home and abroad. Therefore, the modernization research of national medicine is not only related to the development of national medicine itself, but also has great significance for enriching the treasure house of traditional Chinese medicine resources, improving the level of effective and comprehensive utilization of resources, and realizing the sustainable utilization of traditional Chinese medicine resources [1]. There are many kinds of ethnic medicine. There are some reports that there are about 8000 kinds of ethnic medicine in China, accounting for 85% of Chinese herbal medicine resources.

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According to published ethnic medicine monographs and published literature, there are about 5500 kinds of ethnic medicine. As an industrial resource, ethnic medicine has gone through a long history of accumulation and systematic excavation. After the founding of the people's Republic of China, the party and government attached great importance to the inheritance and development of national medicine. From the "national health work plan for ethnic minorities" approved by the culture and Education Committee of the Government Council in December 1951 to the guiding spirit of the 18th National Congress of the Communist Party of China on supporting the development of traditional Chinese medicine and ethnic medicine, it is clear to vigorously develop ethnic medicine. Due to the large quantity, variety and wide distribution of ethnic medicine, it is difficult to integrate and query the information of ethnic medicine resources.

With the development of mobile Internet, the original web application of B / S architecture is gradually transplanted to the mobile platform. Under the net platform, generally through the web service technology provided by Microsoft to provide interface services to the outside world, it is convenient to realize service mobility. In this paper, a national medical information query system is developed by using the existing web service interface and Android platform to meet the needs of national medical researchers to obtain national medical information [2-3].

At present, in the aspect of hospitals, the trend of information management has begun to take shape. Some large hospitals and enterprises have begun to invest in the development. It is urgent to design a national medical data query system. In order to realize information sharing and reduce physical labor, the research of this topic has a very practical social significance .

2 Hardware design of information query system of national medicine database

2.1 Controller and development board

BrainLink single chip computer is selected as the processing core of the controller, which receives and processes the index data related to the query system [4]. The port of the single chip microcomputer is allocated to realize the control function of the single chip microcomputer. Before the allocation, the brainLink single chip microcomputer has four groups of I / O ports (P0, P1, P2 and P3) according to the I / O drive of the single chip microcomputer. The pull-up resistors are respectively connected at the eight pins of the I / O port to ensure that all the internal output transistors of the ports are in the cut-off state and the lower transistors are in the open state. Control two pull-up resistors in parallel at port P0 to ensure the output of "0" and "1" processing instructions. The connection diagram of single chip microcomputer when it is used as the output port is shown in the figure below:

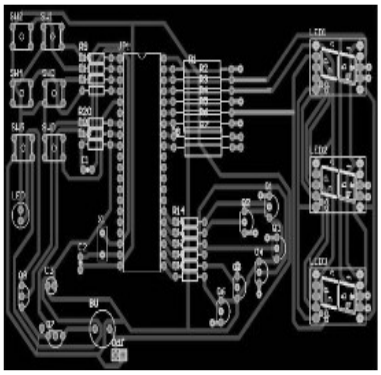


Fig. 1. Wiring diagram when P0 group port of single chip microcomputer is used as output

As shown in Figure 1 above, group P0 port is connected to the circuit driving the LCD display, group P1 port is used to store the input national medicine data, group P2 port controls the LCD display driving signal of the query system, group P3 port is used to query the change of system information, and the specific allocation of I / O port is shown in the table below:

Table 1 I / O port distribution of single chip microcomputer

Serial number	I/O port	Allocation function
1	Group Q0	Provide data signal for LCD display
2	Q1.0 pin	Receive display output
3	Q1.1 pin	Receive data signal output
4	Q 1.2 - Q 1.4 pin	Provide driving signal for LCD display
5	Q 1.5 pin	Driver chip controller
6	Group P2	Drive control chip
7	Q 3.2 - Q 3.4 pin	Receive key input
8	Q 3.5 pin	Receive controller output

According to the port function shown in the above table, connect each port of the chip, design the control circuit of the controller, the left side of the single chip is mainly connected

with the power circuit, the right side is connected with the clock circuit and the reset circuit. In the actual work of single-chip microcomputer, it is defined as a machine cycle when the single-chip microcomputer accesses the memory from Rom. the internal oscillator of single-chip microcomputer is used to store the query data of a machine cycle. The xtal1 and xtal2 ports of the oscillator are used as the input / output ports of the oscillator. The xtal1 port of the oscillator uses internal and external clock mode to connect a quartz crystal, and then the external is equipped with a capacitor to form a parallel resonance circuit, so that the internal oscillation circuit generates self-excited oscillation [5].

ARM processor is selected as the processor of development board, and its 32-bit reduced instruction set processor architecture is used to be compatible with multiple 8-bit and 16 bit devices. The chip uses S3C2440 microprocessor, which is a 16 / 32-bit RISC embedded microprocessor integrated with ARM920T core. It supports 400MHz main frequency, up to 522mhz. Using an LCD display, connect the Ethernet RJ-45 interface. Connect the three serial ports, USB host, USB slave B and PWM control buzzer respectively, and connect the 34 pin GPIO pin of the expansion interface of the development board. Finally, it is connected to the bus interface of 40 pin system. The actual development board is shown in the figure below:

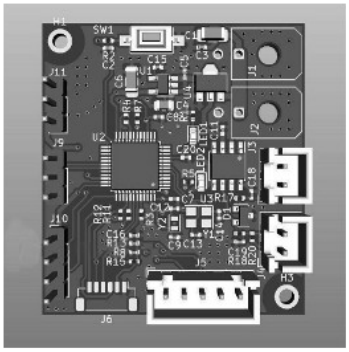


Fig. 2. Circuit board actually connected

As shown in the figure above, the RF module of the development board uses the open ISM frequency band with an effective working range of 433 / 868 / 915MHz, uses the frequency modulator integrated inside nRF905 chip to realize the conversion of different query instructions, and uses the receiver with demodulator on chip to receive the frequency of different conversion instructions [6]. Using power amplifier, different database can be called with the same instruction. The 32 byte data of the control command is received and sent by the regulator, the transmission rate is adjusted to 50kbps, and the external 433MHz antenna is set to receive the data of the query command.

A s003nrf905 wireless data transmission module is set in the control and development

board. The working frequency range of the data transmission module is adjusted from 422.4mhz to 473.5mhz. 512 communication channels are built in to meet the control mode of multi-point communication and frequency modulation grouping. The SMA interface is used to connect the external antenna to enhance the function of sending and receiving the query command signal.

2.2 Circuit connection

Adjust the reset circuit of the single chip microcomputer system to the level switch reset mode, so that when the query system is connected to the power supply, the capacitor charging is in the short circuit state, and adjust the reset pin to connect to the high level. After the power supply is stable, the reset pin is grounded through the resistance, so that the capacitor can isolate the DC level. Redefine the pin function, as shown in Figure 3:

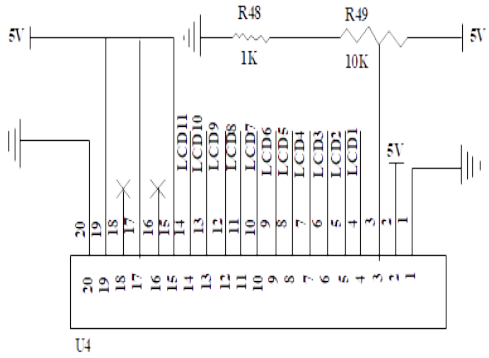


Fig. 3. MCU pin

As shown in the figure above, the pin function of the single-chip microcomputer is redefined, the bus bit of the crystal oscillator circuit is located on the same layer as the chip, and the "ground" network is used to surround it, so as to avoid laying the ground under the crystal oscillator. A 0.1 μ f decoupling ceramic capacitor is connected at each power pin to eliminate the high-frequency noise caused by the switch of IO port. Each pair of VCC and GND pins of the single-chip microcomputer are equipped with a capacitor with a short lead, and 64K ROM and 8K RAM are integrated internally to complete the design of the hardware part of the query system [7].

3 Software design of information query system for national medicine database

3.1 Design Web Architecture

The presentation layer (UI) in the web architecture is divided into web management end and Android client. The web management end is developed by asp.net 4.5, using IE browser to realize the interface with users, Android client is developed by Android technology, and using

app program to interact with users. The design business logic layer (BLL) is responsible for key business processing and data transmission. The operation and logical judgment of the database are processed in this layer. The processing of national medicine information and open web service interface of the system are processed in this layer [8]. The data access layer (DAL) is responsible for database access, mainly providing data for the business logic layer. The overall architecture design is shown in the following figure:

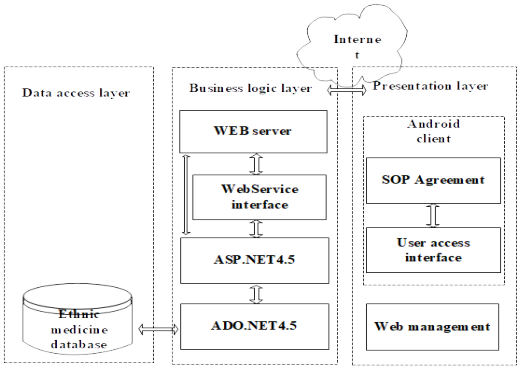


Fig. 4. Overall architecture layer of design

According to the requirements of the system, the system software is divided into two parts, one is web server, including system management module, role management module, user information management module, national medicine information management module, web service interface management module and other major functional modules [9]. The other part is Android client, including user registration module, personal information management module, query module by Chinese name of ethnic medicine, query module by ethnic medicine ethnic language and other sub query modules, as shown in the following figure:

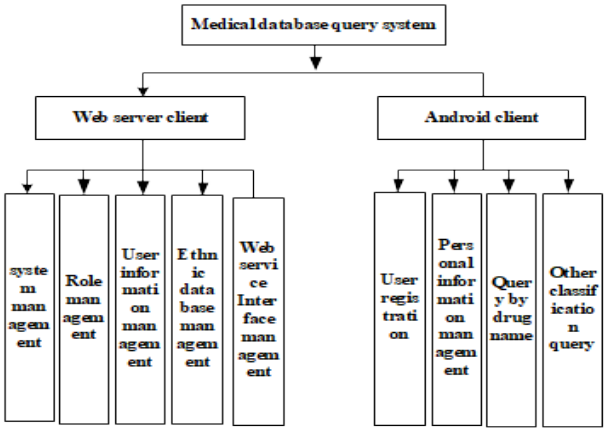


Fig. 5. System function module

According to the function module shown in the figure above, design the database of the system software part, complete the design of the information query module of the national medicine database, and then divide the database function of the web end to complete the design of the web architecture.

SQL Server 2016 database is adopted in the database of web end, and multiple data tables are designed according to the functional modules, including passport information table, material attribute table, cultural attribute table, chemical composition table, intellectual property table, literature source information table, germplasm resource table, resource image description table, sharing utilization, user description, etc. [10]. Each data table is associated with the same field name, mainly forming a data relationship with the drug ID as a foreign key, and the main database table relationship structure, as shown in the following figure:

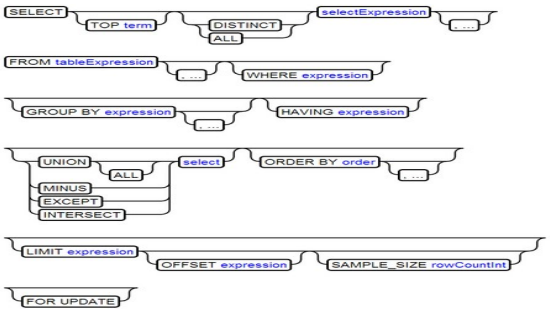


Fig. 6. Database table relation structure

Based on the above design, complete the design of the query system Web architecture, then calculate the data redundancy of the system in the web architecture, and complete the software design of the query system.

3.2 Calculate system data redundancy weight value

When using big data technology to calculate the weight value of various information in the national medicine database, the off-line calculation method is used to calculate the weight value of the national medicine information name in the national medicine database according to the analytic hierarchy process by using the Hadoop calculation mode. Firstly, a data redundancy judgment matrix is constructed, which is expressed as:

$$C = (v_{ij})u * u \quad (1)$$

Where, u is the number of horizontal and vertical lines in the matrix, and v_{ij} is the degree coefficient, which is generally taken as 1-10. Therefore, for the above formula (1), the degree of redundancy influence can be expressed as:

$$v_{ji} = \frac{1}{v_{ji}} (i, j = 1, 2, ..., n) \quad (2)$$

Normalize each column of data in judgment matrix C to get matrix C', add each row of C' to get vector c, and use sum product method to get the maximum eigenvalue of vector, and get:

$$\alpha_{\max} = \frac{1}{m} \sum_{i=1}^{m} \frac{W \times w^R}{v_{ij}} \quad (3)$$

Where $\alpha_{\max}$ is the maximum eigenvalue and R is the coefficient of the sum product method. Using the random consistency ratio WJ to judge the consistency of the largest characteristic root, the following results are obtained:

$$WR = \frac{WJ}{RJ} \quad (4)$$

Among them, WJ is the consistency index and RJ is the average random consistency index. Therefore, the final weight value of each information can be calculated according to the consistency index:

$$WJ = \frac{\alpha_{\max} - m}{m - 1} \quad (5)$$

In the above formula, m is the order of judgment matrix. The formula (3) and (5) are combined to synthesize the random consistency table to get: when matrix C meets $\mathrm{WJ} < 0.1$, the normalized eigenvector can be used as the weight vector, and the final result of formula (2) is the weight value of the weight value index of the final information. Repeat the above calculation process, and finally calculate all the weight values in the information base. Then, according to the size of the weight value, the database with large import weight value is arranged.

When importing the query database into Android port, first use PC port to import the jar package of the query system, ksoap2-android-assembly-3.6.2-jar-with-dependencies, then find the namespace of web service, the parameter method called and the URL in the WSDL file. Then generate the soap request information that calls the web service method, which is described by the soap serialization envelope object.

4 Experiment

4.1 Experimental preparation

The WEB server of the system uses the.NET Framework framework of Microsoft Visual

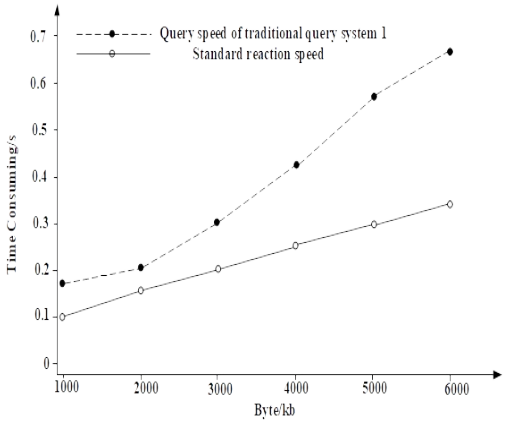
Studio 2015, and the development language uses C#. In order to make the system have a better interactive interface and user experience, Javascript program is also used in the development process. First log in and log in to the web server to change the personal password. When entering the password, there will be a password strength prompt.

Then add the user window. The administrator can manually add other administrators to manage different national medicine data. The administrator can set the permissions of other users, or initialize passwords for other users. Because the user password system uses MD5 encryption, add new user / initialization user passwords, and input data according to the data provided by the members of the research group. The input data needs to be encoded when it is stored in the database, because the national language and characters cannot be queried and retrieved normally in the SQL Server database. In order to ensure that the Android client can retrieve the data correctly, the input national medicine data needs to be encoded.

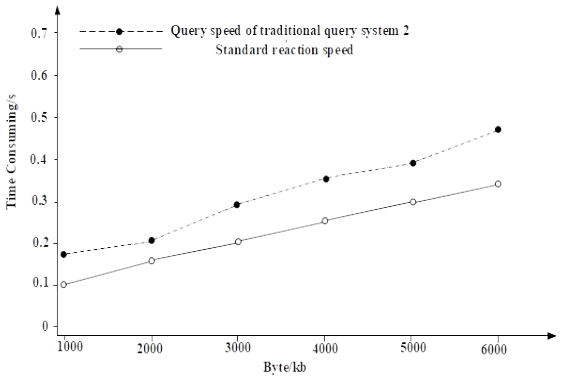
After coding and importing the national medicine data, use soap WSDL to communicate with web service to link web service server and Android client. After the preparation of the experiment, we use two traditional national medicine database information query systems and Android based national medicine database information query system to experiment, and compare the response speed of three systems.

4.2 Analysis of experimental results

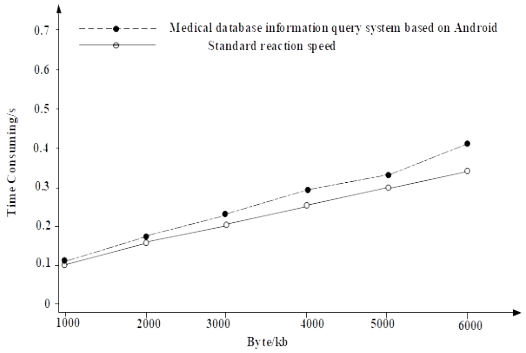
Based on the above preparations, take the bytes needed for each query of ethnic medicine information as independent variables, and finally the speed of the three query systems when actually querying ethnic medicine data information, as shown in the following figure:



（a）Experimental results of traditional query system 1



（b）Experimental results of traditional query system 2



（c）Experimental results of information query system of national medicine database based on Android

Fig. 7. Experimental results of three query systems

It can be seen from the above three experimental figures that for 1000-6000 bytes, the processing time of the standard query system increases by 0.05s with the increase of one thousand bytes, and the processing time of the traditional query system 1 increases unsteadily with the increase of bytes, resulting in data redundancy in the processing process. The traditional query system 2 increases with the increase of processing bytes, and the standard system The average difference of processing time is about 0.08s, and the data redundancy produced by the system is less. The final processing time of the national medicine database information query system based on Android is the same as the standard query time of the system, which basically does not produce system data redundancy. Compared with the two traditional query systems, it is more suitable for practical application.

5 Concluding remarks

This project develops a national medicine data information query system based on

Android platform by using a variety of computer technologies. After the system is completed, it will be deployed in the mobile intelligent terminal, which is convenient for users to carry around, which not only increases the way of national medicine knowledge dissemination, but also improves the efficiency of knowledge dissemination. This system provides convenient and quick learning tools for medical learners at home and abroad, provides good help for researchers to acquire professional knowledge of ethnic medicine, and provides powerful help for the dissemination, research and sustainable development of ethnic medicine. In the process of medical database information query, the problem of medical database information security is not considered, which leads to the decline of data quality. In the future, we will focus on the research of medical database information encryption technology to ensure the information security of medical database.

6 Fundprojects

National key research and development plan (2019YFC1712301),
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Tibet Autonomous Region Education Department College Young Teacher Innovation Support Plan Project (QC2015-67)

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