

Design and Implementation of a Family Private Medical Health Intelligent Management System

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Abstract: With technological advancements, traditional medical models have been unable to meet people's demands for personalized and convenient medical services. Consequently, the family private medical system has emerged. This system aims to achieve health data monitoring, disease prevention, and personalized medical management for family members. The system is developed using framework technologies such as Spring Boot and Vue, with MySQL as the data storage tool. It enables real-time monitoring of health data, dietary and exercise recommendations for diseases, personalized health management, online consultation, and interactive communication with medical experts, thereby enhancing the convenience and personalization level of medical services.

Keywords: Family private healthcare; Personalized healthcare; Convenient healthcare

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1. Introduction

Population aging and chronic diseases are pressing issues in China. Health management needs further promotion and optimization to better control and prevent the occurrence of related diseases. With technological advancements, people's demand for personalized and convenient medical services has gradually become prominent. Traditional medical models face a series of challenges, such as uneven distribution of medical resources, difficulties in accessing medical care, and challenges in managing chronic diseases^[1]. Against this backdrop, the family private medical health intelligent management system has emerged. This system aims to combine advanced information technology with medical services, utilizing intelligent hardware and software applications to monitor family members' health data, prevent diseases, and provide personalized medical management services. The family private medical health intelligent management system allows family members to record and track their own health data in real time, such as weight, blood pressure, heart rate, blood sugar levels, etc., as well as enables them to share this data with other family members and medical professionals. It not only can enhance the health management skills of family members, but also holds promise for alleviating the pressure on traditional healthcare

systems and improving the efficiency of medical resource allocation ^[2].

2. System analysis

2.1. System architecture analysis

The family private medical health intelligent management system adopts a front-end and back-end separation architecture, mainly consisting of three major components: the user module, the doctor module, and the back-end administrator module. Each module has multiple functional sub-modules. The structure of the user module includes functions such as user registration and login, personal center, appointment submission, expert consultation, browsing, and posting. New users need to complete registration before using the system for the first time, while registered users can log in directly using their username and password. After logging in, users can enter the main interface to operate various functional modules. No system operations are available in the unlogged state.

The doctor-side module includes functions such as responding to inquiries, approving appointments, modifying personal center settings, logging in/registering, receiving and replying to messages, browsing and posting community posts, etc.

In the module structure of the backend administrator system, administrators need to log in successfully to the backend management system before they can enter the backend homepage. If you do not require an account, you may log out of the backend. Additionally, you can manage departments, users/doctors, topics, role permissions, diet recommendations, exercise recommendations, and disease management from the backend.

2.2. Key technologies

- (1) Spring Boot: Spring Boot is a tool that facilitates developers in building and developing new Spring applications ^[3]. With its features supporting the creation of standalone Spring applications and embedded Servlet containers, as well as automatic configuration, preset functionality, and no code generation, Spring Boot is not only an excellent framework but also a robust and comprehensive ecosystem. It provides developers with a wealth of tools and resources, enabling them to build excellent applications quickly and efficiently ^[4].
- (2) Vue: Vue is a popular JavaScript front-end framework used to create interactive user interfaces. Its simple design and flexibility make it one of the favorite tools for many developers. Utilizing the MVVM architecture, Vue effectively separates the data model, view, and view model, providing a more convenient development experience for developers ^[5].

3. System design

This system is developed into two parts: the web front-end and the back-end management system, utilizing a B/S architecture. The web front-end is designed for users and doctors, offering front-end functionalities such as appointment scheduling, information inquiry, personal information modification, and post browsing. The back-end management system is intended for administrators, employing the Vue framework for page design and rendering, and building backend services based on the Spring Boot framework.

The backend is developed using the Java language, adhering to a three-tier architecture consisting of the control layer, business logic layer, and data persistence layer. The control layer is responsible for front-end and

back-end data interaction, receiving requests from browsers or mini-programs and forwarding them to the business logic layer^[6]. In addition to providing services to the control layer and executing specific business processes, the business logic layer can also interact with the data persistence layer. The data persistence layer, implemented by MyBatis-Plus, is primarily responsible for implementing synchronous operations between data and the database.

3.1. System functional structure

The functional module diagram can assist system designers in clearly understanding the various functions that the target system should achieve, and categorizing and summarizing them. By analyzing the system's front-end functions, various functional modules of the system can be identified, providing guidance for design and implementation work. The business process of the front-end part of the analysis system is shown in **Figures 1** and **2**.

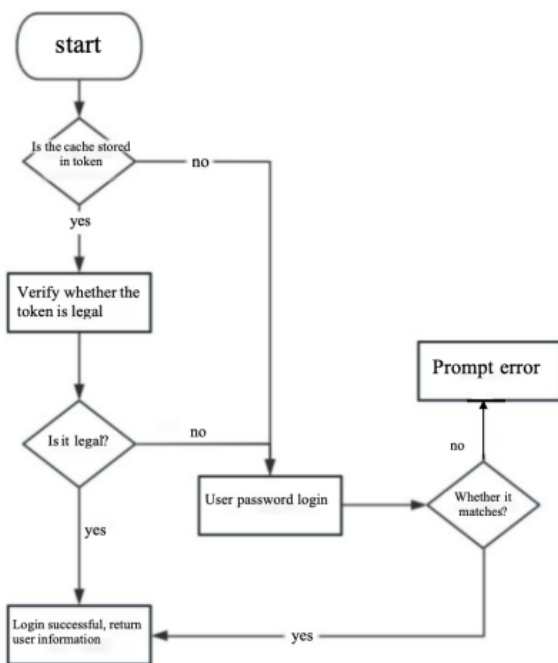


Figure 1. Login business process diagram

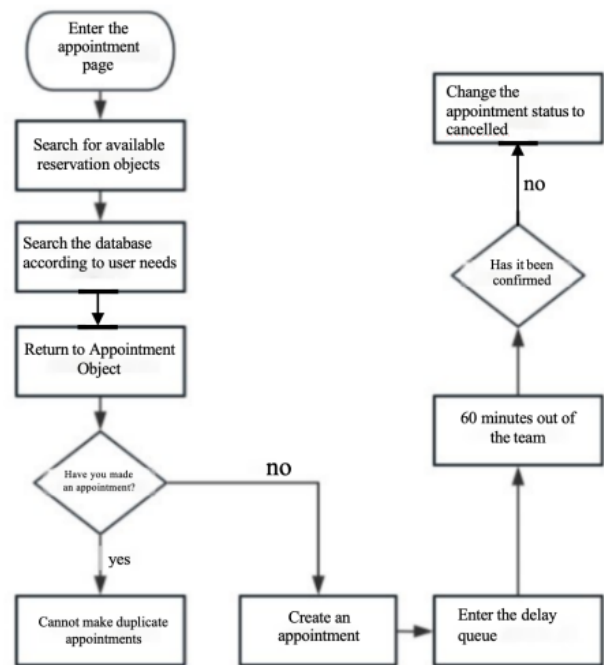


Figure 2. Appointment business process diagram

3.2. Database design

- (1) Conceptual model design: Based on the aforementioned functional module design, the database of this system encompasses entities such as users, administrators, doctors, diseases, appointments, and information.
- (2) Physical structure design: The database name of the system is “health management,” and a total of 22 tables have been designed. Based on the business functional requirements, the system includes user tables, doctor tables, administrator tables, appointment tables, etc. The sample data table is shown in **Table 1**.

Table 1. User table (tb_user)

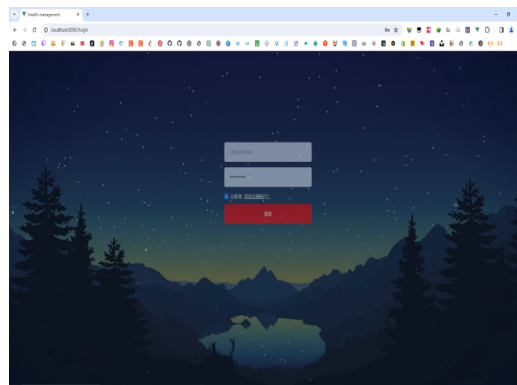
field	type	Allow to be empty	default value	Remarks
id	varchar(32)	no		User ID
username	varchar(32)	yes	NULL	Username
password	varchar(32)	yes	NULL	password
card_no	varchar(32)	yes	NULL	ID card
name	varchar(16)	yes	NULL	Name
sex	varchar(2)	yes	NULL	gender
age	int	yes	NULL	age
phone	varchar(32)	yes	NULL	telephone
allergy	varchar(255)	yes	NULL	Allergy history
taboos	varchar(255)	yes	NULL	Drug contraindications
address	varchar(255)	yes	NULL	address
Img	varchar(128)	yes	NULL	avatar

4. System implementation and testing

- (1) Design and implementation of login and registration pages: On the registration page, the background of the page changes over time. First, select the user type, which includes two roles: user and doctor. When the user enters a username, the system will detect in real-time whether that username has already been registered. If it has already been registered, the system will immediately prompt the user that they cannot register and ask them to enter another username. If the username is available, the system will ask the user to enter a password.

The login page, as shown in **Figure 3**, has a background that changes over time, and it contains two fields for username and password information.

- (2) Design and implementation of home page: The homepage of this system is relatively simple. At the top, there is the system's logo, navigation bar, and user avatar. In the middle section, there is a brief introduction to the system's content, as well as a quick link to the appointment page. At the bottom, there is a brief introduction to the system's functions, as well as a quick link to the consultation page. The design diagram is shown in **Figure 4**.

**Figure 3.** Login page

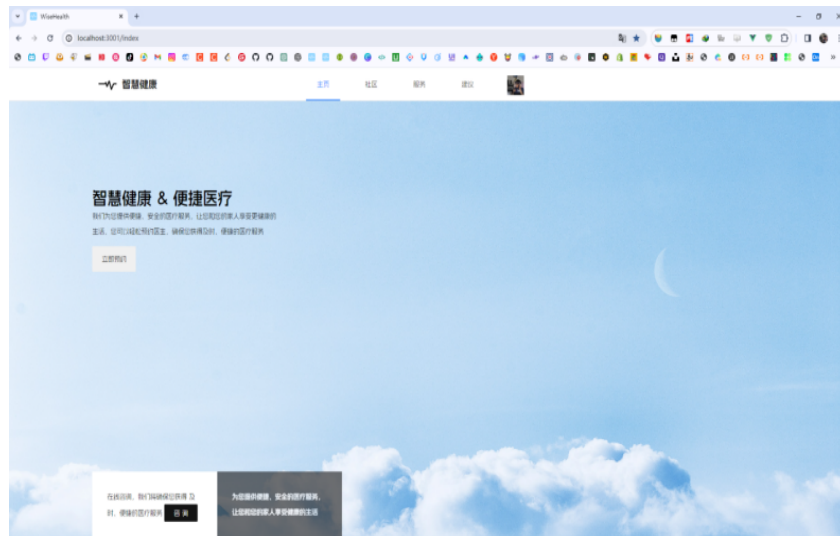


Figure 4. Home page

- (3) Design and implementation of information page: The information page is a drawer page on the right, divided into three sections from top to bottom, as shown in **Figure 4**. The first section is the header of the system, displaying the functional modules of the current page. The second section is the navigation bar, which contains four items, representing different types of information. The third section is the main body of the information, displaying all information entries of the current type. The list displays information such as name, avatar, the last message content, the time of the last message, and the number of unread messages. Clicking on the main body of the information can take you to the information details page, where all information content, as well as the sending time, can be displayed, and you can reply to the message. WebSocket is integrated, allowing real-time reception and sending of this information.
- (4) Design and implementation of appointment page: The appointment page consists of two sections, as illustrated in **Figure 5**. The left section is the main body of the appointment, where users can search for available doctor schedules based on appointment dates and subjects to make appointments. Users who have already made an appointment cannot make another one. The right section displays submitted appointment information, where users can access the details of the appointed doctor and appointment information, as well as cancel their appointment. After submitting an appointment, it requires the doctor's consent. If the doctor does not act on the appointment within 20 minutes, an email reminder will be sent to the doctor.
As shown in **Figure 6**, the appointment information filling page allows you to enter relevant appointment information, such as the appointment object, time, and appointment type. You can make an appointment for yourself or for your associated family members, making it more convenient.
- (5) Design and implementation of consultation page: The consultation page consists of three sections: left, center, and right.

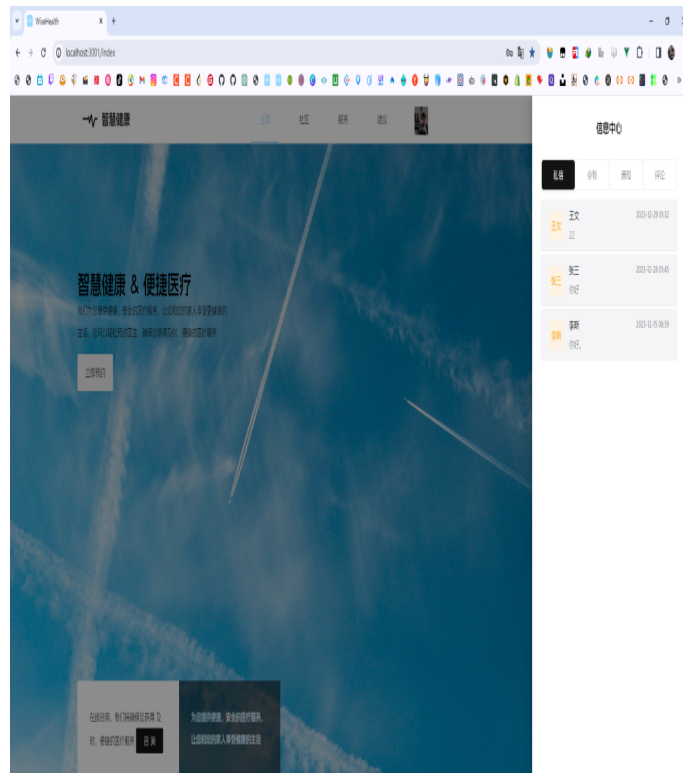


Figure 5. Information page

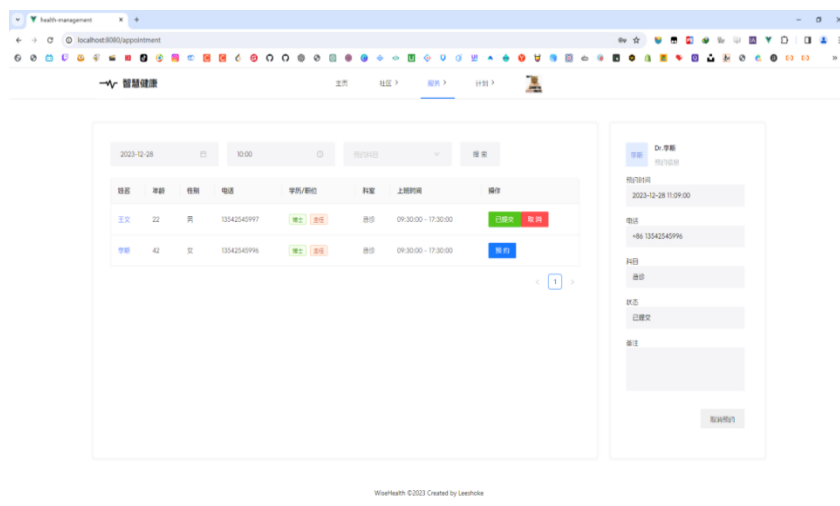


Figure 6. Reservation page

On the left side, you can search for the subject and doctor information you want to consult to find the consultation target. Clicking on the consultation target will add a conversation column, which can be displayed on the right side. The middle section can display the consultation history and information about the current consultation target. You can like doctors, and they are ranked according to the number of likes. The right side displays the information about the current consultation target, which can be remembered for further in-depth consultation.

(6) Design and implementation of community page: The consultation page consists of two parts: the header

and the content, as shown in **Figure 7**. The header serves as an identifier for the current page. In the content section, there is an option for sorting methods above. The default sorting is from the earliest to the latest time. The second option is to sort by popularity, with the most popular at the top. You can switch between these options as you like. There are also two hidden functions: search and post. Clicking the search button and participating will display the corresponding content. In the middle, there is a display of popular topics, with two labels: popularity and novelty. You can click to view all related posts for that popular topic, and you can also participate and interact with the topic. Next, in the content section below, you can like and comment for related interactions.

- (7) Design and implementation of dietary recommendation page: The dietary advice page consists of three parts: the left, middle, and right sections, as illustrated in **Figure 8**. The left part is the user's label, which can be changed according to their actual situation. It will provide personalized dietary recommendations for different users. The middle part can display the recommended and prohibited foods corresponding to the label, as well as detailed dietary suggestions. The right part can display the details of the recommended and prohibited foods.
- (8) Design and implementation of exercise suggestion page: The exercise suggestion page consists of three parts: the left, middle, and right sections, as shown in the design diagram in **Figure 9**. The left part is the user's label, which can be changed according to their actual situation. It will provide personalized exercise recommendations for different users. The middle part can display the recommended and prohibited exercises corresponding to the label, as well as detailed exercise suggestions. The right part can display the details of the recommended and prohibited exercises.
- (9) Design and implementation of personal center page: The personal center page consists of two parts on the left and right sides, with the design shown in **Figure 10**. The left section is the navigation bar, which includes options such as personal information, health information, linked accounts, my appointments, and family appointments. Users can view and edit their personal information, access detailed health information about themselves and their family members, and view their own and their family's appointments, enabling health information sharing.

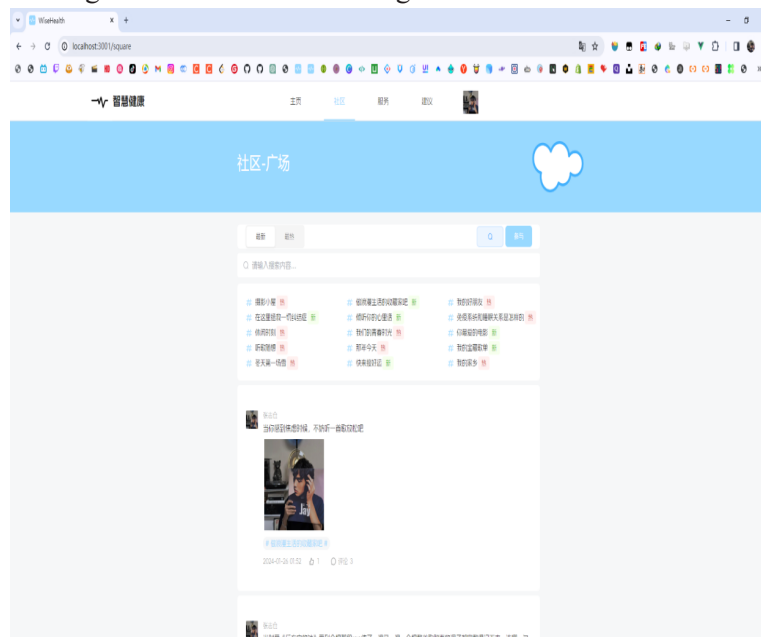


Figure 7. Community page



Figure 8. Dietary advice page



Figure 9. Exercise suggestion page

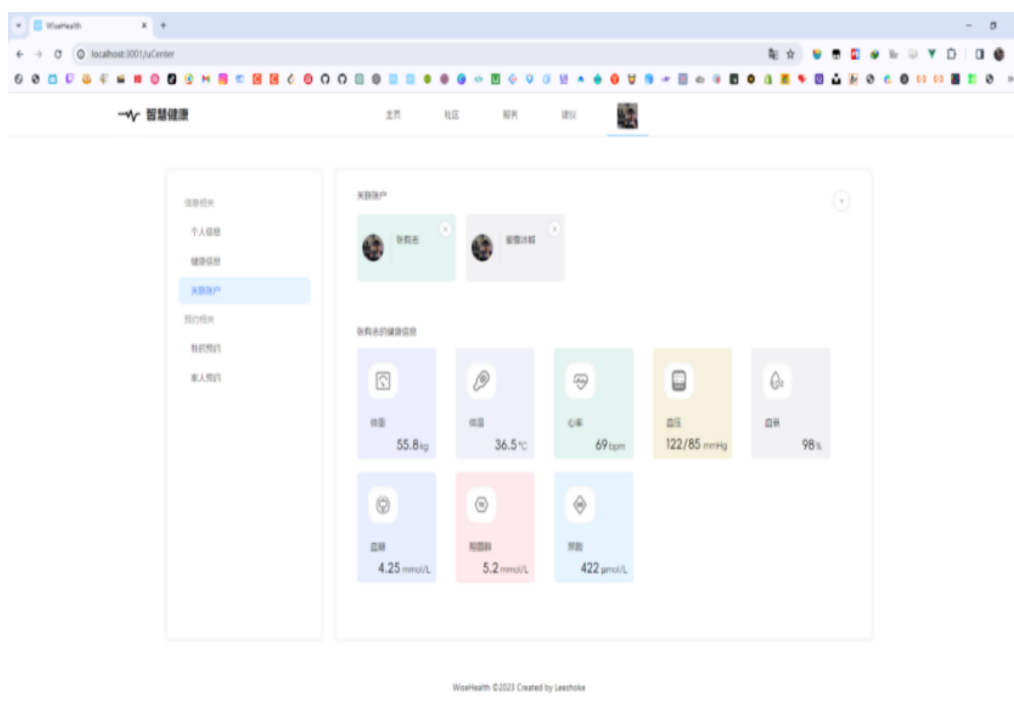


Figure 10. Personal center page

5. Conclusion

The family private healthcare system holds broad application prospects in today's society. It provides individuals with convenient and efficient health management tools, enabling them to independently monitor their health status at home and take corresponding measures. This trend not only saves time on medical visits and reduces waiting in queues, but also effectively alleviates the pressure on medical resources^[7]. This system also contributes to enhancing the quality of medical services. Through remote communication with doctors and medical institutions, individuals can obtain professional medical advice and guidance in a timely manner. Doctors can gain a more comprehensive understanding of patients' conditions and treatment outcomes, enabling them to provide more precise diagnoses and treatment plans. Additionally, this system helps reduce medical costs. Individuals can conduct self-monitoring and management of common diseases at home, which not only reduces unnecessary medical visits and expenses but also cuts down on additional costs incurred due to medical treatment, such as transportation and accommodation fees. Lastly, this system can also enhance health education and disease prevention, enabling users to acquire more information about disease prevention and healthy lifestyles, thereby enhancing their own health awareness and healthcare capabilities, and promoting the overall improvement of health standards. Therefore, this system aids in personal health management and brings positive impacts to the entire medical system, promoting the popularization and enhancement of medical services, achieving rational utilization of medical resources, and effective control of medical costs.

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Disclosure statement

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