

# Design and Implementation of Kidney Stone Prevention and Treatment Information Management

Xiuxiu Wei<sup>1</sup>, Zhaoming Huang<sup>1,2\*</sup>

<sup>1</sup>*School of Information and Management, Guangxi Medical University, Nanning, Guangxi, China*

<sup>2</sup>*The First Affiliated Hospital of Guangxi Medical University, Nanning, Guangxi, China*

*\*Corresponding Author.*

**Abstract:** The arrival of the big data era has led to higher requirements for information systems and their management. In order to strengthen the information management of kidney stone prevention and treatment. We developed a WeChat program for kidney stone prevention and treatment information management, using SpringBoot as the framework, B/S mode and MySql as the database running in the background. The system mainly includes the following functional modules: home page, personal center, doctor management, user management, health information management, health assessment management, online message, system management and other functions. The design and application of the information management system for kidney stone prevention and treatment have been completed. The end-users of the system are able to acquire the knowledge related to kidney stone control and prevent kidney stone disease through this system.

**Keywords:** WeChat Mini Program; Prevention and Treatment of Kidney Stones; Spring Boot; MYSQL; B/S

## 1 Introduction

### 1.1 Background

Calculus of kidneys (kidney stones) refers to kidney stones that are formed in the renal calyx, renal pelvis and the connection between the renal pelvis and the ureter, and its composition mainly consists of substances such as calcium salts, oxalates and uric acid, and its formation is mainly related to living habits, dietary structure, metabolism ability and other factors. Kidney stones are more likely to damage the kidneys directly than stones in other parts of the body. Early

diagnosis and prevention are therefore very important. Studies have shown that kidney stones, in addition to causing symptoms such as severe pain in the patient's lower back and abdomen, often lead to a variety of complications, untreated complex kidney stones may eventually lead to the loss of renal function, or the occurrence of fatal urinary sepsis or even triggering septic peritonitis leading to shock, often causing urinary tract obstruction, local injury, infection, and renal tissue is replaced by adipose tissue and thus lead to renal failure, uremia and other Serious diseases <sup>[1]</sup>. The prevalence of kidney stones in western countries is 5%-15% <sup>[2]</sup>, in China, an epidemiologic study counted the prevalence of kidney stones in Chinese adults in recent years, in a randomized survey of 9,310 Chinese people, 600 people were diagnosed with kidney stones, of which 288 were male patients and 312 were female patients. The prevalence of adult kidney stones in China was 5.8%, with a prevalence of 6.5% in men and 5.1% in women. Accordingly, it can be estimated that there are about 81.2 million adult kidney stone patients in China, of which about 52.78 million are male and 41.41 million are female <sup>[3]</sup>." The incidence of kidney stones shows a continuous increasing trend, and the age gradually tends to be lower. The treatment methods of kidney stones include surgical resection, medication, urinary tract dilatation and other ways, but there are problems such as unstable efficacy, high recurrence rate, etc. Health education is supposed to belong to a treatment method, which is a social, scientific and practical work. After health education, patients have acquired knowledge of disease prevention and control, and enhanced self-care awareness <sup>[4]</sup>, so it is of great theoretical and practical significance to carry out research on prevention and treatment information management.

## 1.2 Domestic and Overseas Research Situation

### 1.2.1 Current Status of Domestic Research

At present, the research on information management of kidney stone prevention and treatment has become a field of great concern. In this context, scholars at home and abroad have carried out extensive and in-depth research and accumulated a large amount of valuable experience and data.

Most scholars in the current study found that for the prevention and treatment of kidney stone patients, firstly, it is necessary to strengthen publicity and education and implement preventive measures [5]; secondly, personalized treatment should be carried out according to the specific conditions of different patients. As far as research methods are concerned, most scholars use epidemiological research methods to the information management of kidney stone prevention and treatment, which can realize the screening of risk factors for the development of kidney stones [6]. Other scholars have carried out detailed investigation and analysis on various aspects of patients' disease cognition, treatment beliefs, and living habits through questionnaires and in-depth interviews [7].

### 1.2.2 Current Status of Foreign Research

In foreign countries, there are corresponding studies on the management of information on the prevention and treatment of kidney stones. The Canadian Urological Association (CUA, Canadian Urological Association) has introduced a clinical practice guideline on kidney stones, which includes the prevention, treatment and follow-up of kidney stones [8].

In addition, some foreign studies have focused on the use of information technology tools to improve the prevention and treatment of kidney stones. For example, researchers at the University of California, Los Angeles developed an online platform called Kidney Stone Risk (Kidney Stone Risk), which helps doctors develop more accurate diagnosis and treatment plans by collecting patients' relevant information and health data; Yu Liu et al. at the University of Michigan Medical School can establish an accurate kidney stone risk assessment through data mining technology model to guide patients' prevention and treatment.

In addition, some studies have explored the application of information management for kidney stone prevention and treatment in mHealth. For example, researchers at the University of Cologne, Germany, have developed a smartphone-based kidney stone prevention and treatment application, through which users can record their health conditions and medication use, and the system can also provide users with some advice on health management and kidney stone prevention.

## 2 System Analysis

### 2.1 System Feasibility Analysis

The use of WeChat small program development can reduce the workload and improve efficiency. So it is of great significance and value to develop this small program, and the following feasibility analysis is carried out from the technical, social, economic and operational aspects.

#### 2.1.1 Technical Feasibility

The front-end of this system uses WeChat small program, the background development selection of java language, with the continuous development and innovation of mobile Internet technology, java has become the next generation of Internet Web standards. Database selection using mysql database is mainly used to create and maintain information. For the front-end development requirements should have the advantages of perfect functionality, easy to operate, etc., and the requirements of the back-end database is to be able to establish and maintain the unity and integrity of the data and information.

Small program has the function comparable to APP, but also has the unique advantages of no installation and uninstallation, use the unique advantage of leaving, the use of a better experience, welcomed by users. Many domestic researchers have already paid attention to the huge development potential of WeChat applets in the field of disease management, and have applied WeChat applets to the self-management of patients with diseases, health education, decision-making assistance, case management, remote monitoring, continuity of care and other medical services, and many researchers have shown that it not only improves the ability of patients' self-management, but also improves patients' adherence to self-management.

### 2.1.2 Social Feasibility

Kidney stone is a common disease, which not only brings physical pain to patients, but also brings certain economic burden to families and society. Information management for kidney stone prevention and treatment can be popularized to a wider group. By establishing an Internet platform, patients and doctors can communicate and consult on the Internet anytime and anywhere, improving patients' understanding of the disease and participation in prevention. Finally, the social feasibility of information management for kidney stone prevention and treatment also requires the support of the government and society. The government can promote the establishment of informationization platforms in medical institutions through financial and policy support, and vigorously promote Internet medical care, so that more patients can benefit from the information management mode.

### 2.1.3 Operation Feasibility

The system is not only simple and visualized interface, but also the use of the mouse and keyboard can realize the amendment, deletion, addition and other operations of the relevant information. Since the system is simple and easy to work with, it takes only a small amount of time for first-time users to get started. Therefore, the system is operationally feasible.

### 2.1.4 Economic Feasibility

The development of the "Kidney stone prevention and treatment information management" WeChat applet requires only an ordinary computer, and the cost is very low. The use of this system software can realize faster and more efficient health information management, and at the same time can effectively save human resources and management resources. Therefore, the "Kidney stone prevention and treatment information management" WeChat program is fully economically viable.

## 2.2 System Requirements Analysis

### 2.2.1 System Functional Requirements Analysis

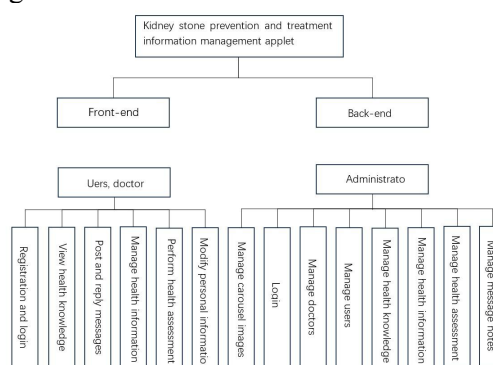
Through the survey of user requirements, it is clear to understand the requirements of this design, which must satisfy the different usage needs among administrators, users and doctors. For the above three target groups, according to the different purposes of use, each user corresponds to different functional positioning.

(1) The main functions of the user's WeChat terminal are: user registration and login system; view health knowledge; user online messages, post messages; users can post their health information online, providing doctors to assess; users view their health assessment information; user personal center to modify personal data; exit login.

(2) The main functions of the doctor's WeChat terminal are: the doctor registers and logs in to the system; the doctor can also view the health knowledge and messages, and post messages online; the doctor can view the health information submitted by the user, and submit health assessments online; the doctor can view his or her own assessment history; and log out.

(3) The main functions of the administrator are: the administrator enters the account to log in the background; the administrator modifies the password and account information; doctor management: add, delete, modify, and query the information of registered doctors; user management: add, modify, delete, and query the information of registered users; health knowledge management: add, modify, delete, and query the information of the system's health knowledge; and online message management: Modify, delete and query the online message information of users; health information management: delete and query the health information of users; health assessment management: delete and query the health assessment information of users; add and delete the rotating chart; exit the system.

The structure diagram obtained based on the functional modules of the system is shown in Figure 1:



**Figure 1 System Functional Structure Diagram**

### 2.2.2 System Business Process

The user enters the applet login interface and fills in the user type, user name and password

according to the interface prompts to login. The system database stores user information such as user name and password, so when the user name and user type do not match, or the user name or password is wrong, the user cannot log in correctly and cannot enter the system. Different types of users enter the main window interface is different, the relevant menus and function modules are also different, the user can click on the relevant menu or link to operate the corresponding functions. As shown in Figure 2

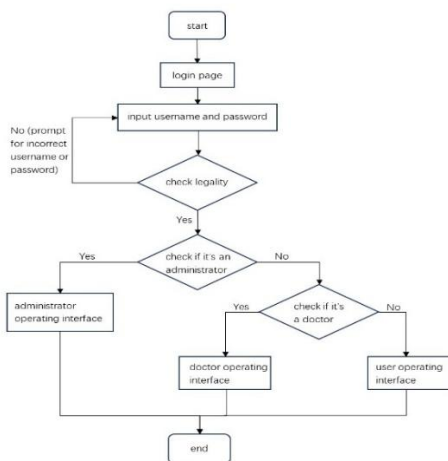


Fig. 2 Overall flow chart of the system

### 3 System Design

#### 3.1 System Architecture

The system mainly consists of: the user side and Web server back-end, Web server back-end using tomcat server to build, using Java and MySQL database, developed a back-end management system, and developed API and interface files.

#### 3.2 System Database Design

Database design is the key to the database in each system, and the advantages of database design will make the system more efficient, as well as the realization of each logical function. Therefore, the design of the database must start from the actual needs of the system in order to make it more perfect to the function of the system.

The 3 tables included in this system are:  
 user table (yonghu): this table mainly stores the user's username, password, name, gender, avatar, cell phone number and other 8 fields. Where id is the key field. See Table 1  
 (1)Doctor Form (yisheng): This table mainly stores 9 fields, including the doctor's job number, password, doctor name, gender, profile picture, doctor title and contact number. Where the id is the key field. See Table 2.

Table 1 User Table

Field name	Type (length)	Field description	major key	Windows default
id	bigint(20)	major key	major key	
yonghuming	varchar(200)	user name		
mima	varchar(200)	password		
xingming	varchar(200)	name		
xingbie	varchar(200)	gender		
touxiang	varchar(200)	head sculpture		
shouji	varchar(200)	cellphone		
addtime	timestamp	creation time		CURRENT_TIMESTAMP

Table 2 Doctor's table

Field name	Type (length)	Field description	major key	Windows default
id	bigint(20)	major key	major key	
yishenggonghao	varchar(200)	Doctor work number		
mima	varchar(200)	password		
yishengxingming	varchar(200)	Doctor's name		
yishengxingbie	varchar(200)	Doctor gender		
yishengzhaopian	varchar(200)	Doctor photo		
yishengzhichen	varchar(200)	Doctor title		
lianxidianhua	varchar(200)	contact number		CURRENT_TIMESTAMP
addtime	timestamp	creation time		

(2)Administrator Table (users): This table mainly stores 5 fields including administrator name, administrator password and role. Where the id is the key field. See Table 3.

Table 3 The Administrator Table

Field name	Type (length)	Field description	major key	Windows default
id	bigint(20)	major key	major key	

username	varchar(100)	Administrator's name		
password	varchar(100)	password		
role	varchar(100)	role		manager
addtime	timestamp	creation time		CURRENT_TIMESTAMP

**4 System Implementation**

**4.1 System Function Implementation**

**4.1.1 Login Module**

The user or doctor first enters the account and password, selects the role type and then clicks the login button. The web page Script will first check whether the user name login has been filled in or not, if it has been filled in, the system will submit the data to the server in the background, and the server will automatically recognize whether the login information is correct or not. After successful login, the login interface will jump to the home page of the applet. When the account does not exist or the account password is incorrect, a prompt box will pop up to indicate that the account or password is incorrect and click Login to log in to the system.

**4.1.2 Registration module**

When the user clicks on "Register User", the user enters the registration page, fills in the relevant information and clicks on the Register button. When the user submits the form, the first step is to determine whether the Script script meets the basic requirements, and then submit the form data to the server. If there is an error, an error box will pop up on the registration page, asking the user to fill in the form again.

**4.1.3 Health Assessment Module**

Users can check the height, weight, heart rate, blood pressure, dietary habits, exercise habits and other information in the health assessment page, and the doctor can perform assessment operations.

**4.2 System Testing**

**4.2.1 Test Methods**

According to the actual needs, this project selects the black box test method with function as the main test direction, and follows some rules, the test to execute its implementation is based on the test case, and the test case is based on the requirements or specifications, and the test case is very critical before the hardware leaves the factory. In this topic, the main functions are selected as the test points for testing.

**4.2.2 User login module test**

The purpose of the test is to verify whether the function of the user login module in the kidney stone prevention and control information management system can meet the requirements and whether there are software bugs. In the test scenario, users of various types are logged in to the system to verify whether the system can read the relevant user information correctly. Table 4 shows the specific test types and items

**Table 4 User log-in module test table**

order number	test items	operating steps	test result	Use case type
1	users login	1. The administrator logs in with the correct user name and password 2. Users can log in with the correct user name and password 3. The doctor logs in with the correct user name and password	Prompt login success, jump to the administrator operation interface Skip to the user operation interface Skip to the doctor operation interface	1. positive example 2. positive example 3. positive example
2	users login	4. The administrator logs in with the wrong user name and password 5. Users log in with the wrong user name and password 6. The doctor logs in with the wrong user name and password	Prompt "User name or password error", jump to the administrator login interface Prompt "Username or password error", and jump to the applet login interface Prompt "Username or password error", and jump to the applet login interface	4. counter-example 5. counter-example 6. counter-example

**4.2.3 User and doctor management module test**  
The purpose of the test is to verify whether the

function of the user and doctor information module in the kidney stone prevention and

control information management system is perfect, whether it can meet the needs, and whether there is a software bug. Table 5 shows the specific use cases

**Table 5 users login module test table**

order number	test items	operating steps	test result	Use case type
1	add information	1. The administrator enters the relevant information of users and doctors in the system and click " Add 2. The administrator does not enter an information in the system, click Add 3. The administrator enters no information in the system	The system prompts "Add successfully" and displays aexample list of student information The system prompts, " XXmple cannot Empty, please reenter" The system prompts for mple "Please fill in the relevant information"	1. positive 2. counter-exa 3. counter-exa mple
2	remove information	4. The administrator selects the line of a user / doctor information and clicks Delete	The prompt Deleeds deleted and displays a user / doctor list	4. positive example
3	change information	5. The administrator selects the row where a user / doctor information is modified	The system prompts "modified successfully" and displays aexample list of a user / doctor	5. positive example
4	Query information	6. The administrator enters a user / doctor user name / doctor work number and clicks the "Query" button 7. The administrator does not enter any relevant information, click the "Query" button	The system displays a list of the specific user / doctor information The prompt is for Please enter relevant information	6. positive example 7. counter-exa mple

## 5 Summary and Outlook

In this paper, we used Java language, SpringBoot framework, and selected MySQL as the background database to design and complete the basic functions of the information management system for kidney stone prevention and treatment.

With the continuous development of artificial intelligence, big data and other technologies, the information management system for kidney stone prevention and treatment will also develop in the direction of more intelligent and more humanized. Specifically, in the future, the system will strengthen the ability to analyze and mine the condition data, automatically generate personalized treatment plans, and achieve intelligent push and reminders. At the same time, the system will also strengthen the docking and cooperation with medical institutions to provide patients with more comprehensive and convenient medical services. The system also plans to add more interactive functions and community building in the future to provide a more extensive and active communication platform for patients.

### Fund Projects

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