

Research and Development of Android Client and Server Information Interaction Framework

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Abstract—Nowadays the information technology and mobile terminal equipment are developing rapidly, how to develop mobile applications more effectively has become a really hot topic. This paper mainly focus on the research and design of information exchange between Android client and web server and the framework of data transmission, build an architecture model of this kind of system, discussed a variety of information exchange mechanisms between client and the server, analyzed the interaction theory and data transfer format in detail. In the end, this paper takes the design of "user information management system" as an example to carry on the program design and development, analyze and explain the system to verify the accuracy of it. This paper has a very important significance to the development of the application program and the information interaction design between then and the server.

Keywords—Android Client-server; System Frame; Information Interaction

I. INTRODUCTION

With the rapid development of Android mobile terminal equipment and information technology, people's study, life and work has been changed a lot. At the same time, with the rapid development and popularization of Android mobile terminals, smart phones are gradually widespread used all over the world, and on the one hand, it has brought revolutionary changes and unprecedented convenience to people's daily life. It is an important channel to obtain external information for human beings and is conducive to shorten the distance between the individual and the outside world, and people can know what is happening in the world without going outside. On the other hand, the mobile office is more and more popular with the increasing demands of people, people can handle the related work regardless of time and place, this enhanced the work efficiency. All these have led to the rapid expansion of mobile App application development market, but also caused the increasingly fierce competition in the technical research of Android mobile terminal, and as the important role for the real-time data synchronization and information sharing between the mobile terminal equipment and server, the interaction pattern between the client and the server is very important.

The data displayed on the mobile phone interface are realized through real-time synchronization between the network and server data, such as a database query, modify

functions. Meanwhile, the Android system is an open source operating system based on Linux [1], it is mainly used for the development of mobile phone system and widely loved by people since its launch. However, in the mobile phone desktop system, the Android client constantly interact with the server access to real-time data, which makes the application takes up less space at runtime. So the research on the interactive system framework and interaction principle between the android system and the server has very important significance.

II. SYSTEM FRAMEWORK

The system design of the interactive type between the Android client and the server is mainly based on the C/S design structure and combined the three layers framework design theory to design and develop the system. C/S is the frame mode of client/server [2]. The client is mainly used to realize the interaction with users and receive the user's requirement, and send messages to users through the interface information, it is the crucial approach for users to obtain system function and the system message. Relatively, the server is prevailingly responsible for the responses and processing of user's requirement, then return the processing result to client [3]. The server mainly contains the communication server and the database server, and the interactive figure between the client and server is shown as Fig.1.

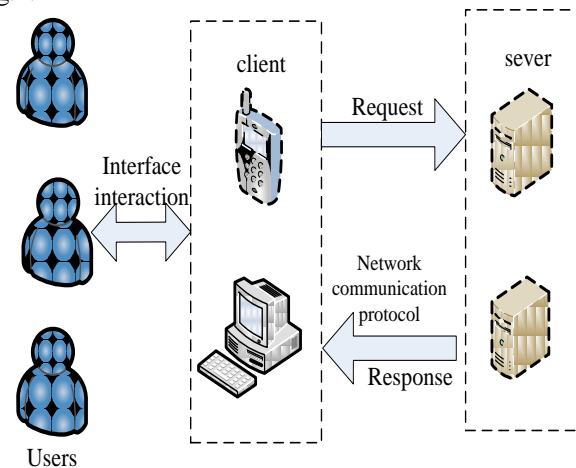


Figure. 1 System architecture diagram.

Combining the technical characteristics of the Android development technology and the web server development technology, and integrating the three layer design theory [4], the interactive system could be divided into three layers: interface layer, logic layer and the data layer. The main responsible functions of each layer is shown as Fig. 2. In the Fig. 2, the system interface layer is adopting the XML layout of Android system and various view module to complete the interface design, and the layout method contains the linear layout, relative layout, absolute layout, table layout and single frame layout. Meanwhile, the logic layer is mapping the communication server of the system, it completes the business logic of the system and functions to connect the database. Relatively, the data layer is mapping to the database server, it realizes the data persistence in the system and improves the safety and practicality of the system.

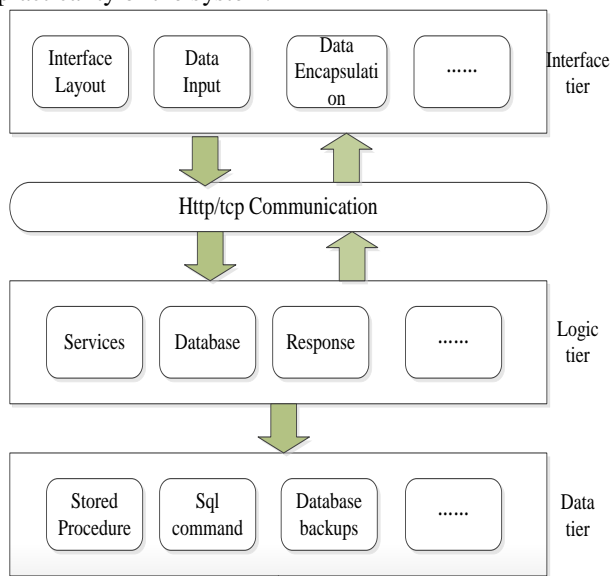


Figure. 2 Functional diagram of each level.

III. ANDROID CLIENT AND SERVER INFORMATION INTERACTION MECHANISM

A. Interaction Mechanism

The interaction and transmission of information between client and server are realized by network protocol, where connection methods like HTTP, TCP/IP are used commonly. When using TCP protocol to establish the connection, it needs to go through three times of handshake. After the three times of handshake between the client and the server, data transmission will start and it also need four times of handshake to break the connection. However, the HTTP protocol needs the server to response the every request , and after request, the connection will be automatically released [5].

The interaction mechanism using HTTP protocol to establish the interaction is shown in Fig.3. Meanwhile, in the high version of Android system, the interaction between the client and the server can't be carried out in the main

program. It is necessary to create new threads and rewrite the run() method. By creating a HttpClient object to establish a connection, a request will be sent to the server, and the Client's request mainly contains two different types: get and post, achieved by creating HttpGet objects and HttpPost objects respectively. On the server side, it is dealing with the request through the doGet() / doPost() method in the HttpServlet class, and getting the java.io.PrintWriter output stream object out by response object, then printing data in the specified format by the out.println() method. After the client gets the data returned by the server, the connection is closed. Then client resolves the data and displays it to the user interface through relevant component.

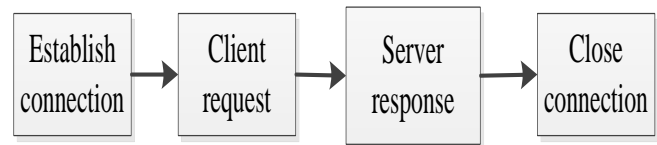


Figure. 3 HTTP interaction mechanism.

Another commonly used communication method is socket communication. Socket communication is the way of interaction between client and server based on TCP/IP protocol. Socket utilizes listen, accept, send, write and other basic operations to achieve the interaction between the client and server. The biggest difference between HTTP communication and socket communication is that HTTP communication uses "request response mode", namely establishing connection channels on request. In the HTTP communication method, when the client sends a request to the server, the server can return data to the client. While socket communication is to establish a connection which is able to can transmit data directly between the two sides, and when the connection is hold on, information could be pushed actively and client do not need to send a request to the server every time.

B. Data Transformation Format

Data transmission plays a very important role in the interaction between the client and the server. It can effectively save the time and shorten the development period of the developer by using the correct data transmission. Taking HTTP protocol as an example, there are 2 main methods used in data transmission.

1) Transfer via URL:

For the get request method of HTTP protocol, the data parameters are directly added to the URL parameters for transmission. This transmission mode is convenient relatively but there are some problems in data security.

2) Transfer through container:

When using the post method of HTTP protocol, data need to be stored in the container for encapsulation, which makes the data is not easy to be intercepted and decoded in transfer process of the cross platform, so as to improve the security of data transmission.

According to different functional requirements, there are many kinds of data transmission format, such as the XML, HTML, Text, Json and other ones. Among them, the returned content of XML is the XML document, and the HTML is the pure HTML information, the contained script tag will be executed when the DOM is inserted. The Text format returns a plain text string, and Json data format is a lightweight data interchange format[6], which uses a completely independent language text format. Json adopts the structure of "name / value pair", which greatly improves the readability of the data. When the data transmission is a set of values, the data will be converted into Json format can reduce the complexity of the program, which creates a great convenience for developers.

IV. IMPLEMENTATION AND ANALYSIS

User information management is an integral part of almost every system. Taking the user information management system as an example, this paper completes the design of the login module and the user information management module, and realizes the on-line management of user information through the interaction between the client and the server. The client is developed under environment of Eclipse with a ADT plug-in tool, while the server is developed by the web project way. System development tools and environment configuration are shown in table 1.

TABLE I. DEVELOPMENT TOOL AND ENVIRONMENT CONFIGURATION

Client	Eclipse8.5 ADT plug-in jdk1.7.0
Server	Tomcat6.0 myeclipse10.0
Database	Oracle10g

HTTP communication protocol is adopted in this system, and the connection between the client and server is realized via HttpClient. Due to the Android system version is 4.4.2 , the method of creating a new thread to establish the communication with the server must be used [7]. When client sends a request through the HttpGet method, the server responds it by the HttpServlet method of HTTP protocol, and after the analysis of the relevant parameters for the request of the client, the database is processed and the processed result is output to the client. The logic diagram of the program is shown in Fig.4.

Among the diagram, this system achieves the function of modify or delete a single record via the URL transmission mode, and in the case of many records in the transmission, such as read the whole user data of the system and display it in the list, achieving the aforementioned function through a URL splicing way may get more trouble, so it is better to use Json data format for transmission. Meanwhile, by using the fromJson and toJson in Google gson.jar package to complete the conversion between Json data format and list format, this system realizes a plurality data transmission at the same time.

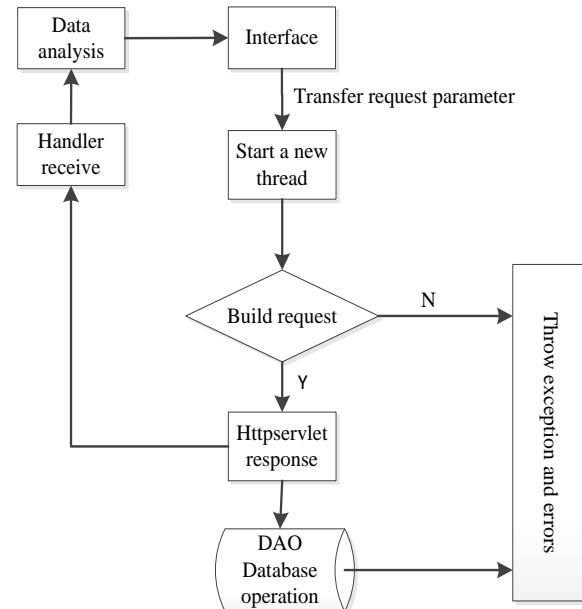


Figure. 4 Program logic diagram.

Combined with the above program design and logic analysis, as well as the design of the system database table, the design of the system Android client and server development is completed. This system adopted object oriented programming [8], and through the information interaction between Android client and web server, it realized the data management for the information stored by user, such as the addition operation, delete and modify operations. Finally, it realized the data synchronization and sharing between mobile phone client and server. System interface is shown in Fig.5, where the user information is simulated data and existed in the database.

V. CONCLUSION

This paper presents a system interactive architecture between the client and server. It combines the design concept of the popular three tier architecture and gives the three layer function diagram of the system. Besides, it also delivers detailed analysis of the interaction between the client and server protocol, and elaborates two commonly used communication mode and data transmission mode. On this basis, it realizes the design and implementation of the user information management system, makes an analysis on the system design of the logic process and the key technologies, and verifies the feasibility of the system through a system test.

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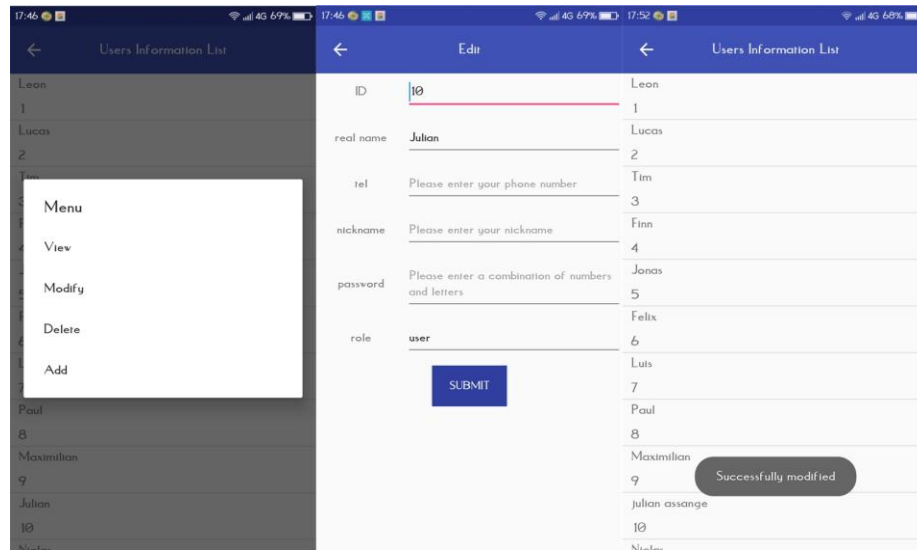


Figure. 5 System operation interface diagram