



# Design and Implementation of Interactive Platform for Mental Health Promotion Based on Mobile Internet

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**Abstract.** This paper focuses on the prevention and treatment of the increasing psychological and mental diseases. The number of people suffering from psychological and mental diseases has exceeded that of cardiovascular and cerebrovascular diseases, respiratory diseases and malignant tumors. Mental health is an indispensable part of human health. Hospitals strengthen the construction and development of mental health knowledge by means of informationization. Develop an interactive platform for mental health promotion, which is mainly based on mobile Internet technology. This paper introduces the interactive platform for mental health promotion from the following aspects of functional requirements of APP, the core framework of APP software, the hardware configuration of hospital, and software security testing. The construction of this platform is the effective expansion of the “online virtualization” in Suzhou Guangji Hospital and Suzhou mental health center. Using mobile Internet, cloud platform, intelligent APP and other means of informatization, we are committed to the prevention and treatment of mental health, so as to protect the public’s mental health.

**Keywords:** Cloud Platform · Software Architecture · Mental Health

## 1 Introduction

We are in a fast-paced period of social transformation, and the pressure of social competition is great, which makes people’s psychological diseases become increasingly prominent [1, 2]. Therefore, the role of psychology in the national economy and people’s livelihood is gradually valued. At present, psychological diseases and mental diseases have surpassed diseases such as cardiovascular and cerebrovascular diseases, respiratory systems and malignant tumors [3]. Every year, about 1.6 million people have social problems caused by psychological problems. Therefore, it is extremely urgent to guide and treat mental illness [4].

Strengthening the construction and development of mental health knowledge by means of informationization is an important content of deepening the reform of medical and health system, maintaining and promoting people's physical and mental health, an inevitable requirement of comprehensively promoting the rule of law, innovating social governance and promoting social harmony and stability, and is of great significance for building a healthy China, a country ruled by law and a safe China [5–7]. In recent years, there is a shortage of mental health professionals in Suzhou, and the technology and ability of mental health services need to be improved. Psychological counselors and institutions have no laws and rules to follow and lack supervision; The mental health promotion and management system is imperfect, and the city mental health center has not been established yet, which can not meet the increasing demands of the masses for multi-level mental health services. It is urgent to establish a perfect mental health promotion and service system which is suitable for the actual situation in Suzhou [8].

Suzhou Guangji Hospital has established Suzhou Mental Health Center and Psychological Crisis Intervention Center, and is committed to improving mental health service capacity. In 2017–2019, Guangji Hospital has built a mental cloud hospital platform so as to improve the government's mental health service efficiently. In 2020, "Suzhou Mental Health Regulations" has been promulgated to promote the standardized and comprehensive development of mental health services [9, 10].

At present, the most important task is to enable the majority of patients with mental illness to be exposed to the publicity and popularization of mental health and receive basic treatment and rehabilitation services. Suzhou Guangji Hospital will focus on the prevention and rehabilitation of mental illness in the next stage [11, 12]. The cloud platform for mental health promotion will be built with mobile Internet as the medium. Developing mobile Internet interactive platform APP for mental health promotion, making great efforts to publicize and popularize mental health knowledge, and adopting comprehensive prevention and treatment measures such as drug treatment, psychological counseling, rehabilitation training and social services, will help patients participate in social life and promote the rehabilitation of patients with mental and mental diseases.

The interactive platform for health promotion is mainly designed in three versions according to three types of users, including public version, medical version and management version [13–15]. Specific functions are as follows:

Public version: publicity module; Expert consultation module; Non-interactive consultation module; Psychological self-test module; FM radio station; Encyclopedia of diseases module; Drug price publicity module; Service price publicity module; Map service module; Course learning module; The meter early warning monitoring module is used for data early warning; Integration module; Medication reminding module; Suggested complaint module [16, 17]. Medical version: the medical service module corresponding to the public version. Management platform: article push management module; Psychological self-test management module; Alert view for individual users; Make statistics on users' data; Feedback collection module [18–20].

## 2 Software Functions

The interactive platform for health promotion is mainly designed in three versions according to three types of users, including public version, medical version and management version. Specific functions are as follows:

**Public version:** publicity module; Expert consultation module; Non-interactive consultation module; Psychological self-test module; FM radio station; Encyclopedia of diseases module; Drug price publicity module; Service price publicity module; Map service module; Course learning module; The meter early warning monitoring module is used for data early warning; Integration module; Medication reminding module; Suggested complaint module.

**Medical version:** the medical service module corresponding to the public version.

**Management platform:** article push management module; Psychological self-test management module; Alert view for individual users; Make statistics on users' data; Feedback collection module.

The psychological cloud platform is also an important part of building an Internet hospital in Suzhou Guangji Hospital. From the perspective of disease control, if you and your family have mental health-related problems (such as anxiety, nervousness, fear, poor mood, sleep disorder, etc.), don't rush to seek medical treatment, but consult the professional doctor team of our platform online for free at the first time. Doctors will respond as quickly as possible to protect the health of you and your family.

## 3 Architecture Design

The hardware configuration of this platform is based on the existing hardware network architecture design of the hospital. The hardware service architecture design of APP is shown in the diagram.

The main technology used in the mental health promotion platform is MVC technology. Based on the above requirements, APP was developed. The mental health promotion platform APP includes the following sections:

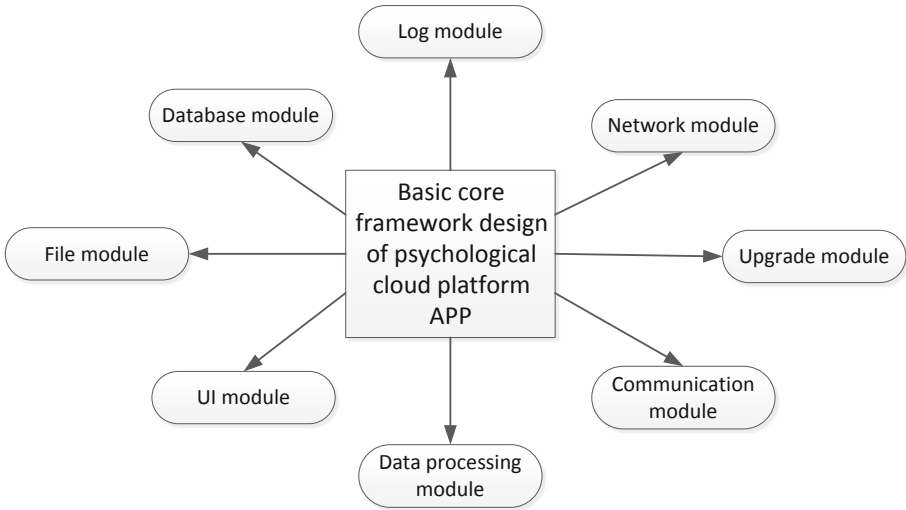
**Server Side:** Compiling interface protocol documents, setting up server environment, designing database and compiling API interface.

**APP Side:** The interface diagram development of APP is based on UI design drawing. After UI development is completed, the server API is docked, and the corresponding logic code is written at the functional level at the level of obtaining server interface data.

**Web Management End:** According to the business logic of the front end, the back end will have corresponding functions to match it, and it is also necessary to write functional logic codes. The core framework is shown in Fig. 1.

Extensible modules are reserved in the architecture design, and in order to improve the response speed of page access, we strictly follow the idea of component-based web development in the front-end design:

- (a) front-end: vue, a minimalist MVVM framework, is selected as the component framework, which can maximize code reuse and achieve the purpose of data-driven



**Fig.1.** Schematic diagram of cloud platform APP core framework

view; The matching vue-router controls the page jump through the page routing to achieve the switching effect similar to APP. SASS pretreatment is adopted in CSS compilation, which can ensure clear code hierarchy and fast iteration.

- (b) Server: We have adopted node.js and NPM technologies, which adopt event-driven and asynchronous programming, and have the characteristics of light weight and high efficiency, which is very suitable for the real-time data request service of public apps in a dense distributed environment. The Webpack packaging tool packages resources and codes into a js file based on AMD/CMD specification to improve page loading efficiency. The design of the terminal follows the principle of single-page application, that is, all operations are implemented on one page without jumping back and forth, which gives consideration to both fast page loading and asynchronous resource loading, and effectively improves the user experience of the mobile terminal.
- (c) In the case of multiple application servers, the request is first processed by the intelligent load balancing server and dispatched to the server with good load. At the same time, the server will have a probability judgment on the request, and the high-frequency request from the same address or user will be rejected. Waterproof wall will judge the user’s behavior to a certain extent. If it is judged that it is a request sent by a robot program (such as high-frequency tapping password), it will directly discard the request for no service.
- (d) In principle, the system assumes that all user inputs are suspicious, so all user inputs will be basically checked by the filtering module to prevent some general attacks, such as SQL injection caused by illegal characters, buffer overflow, cross-site attacks and other harmful requests from being executed.
- (e) When accessing public information without user identification, a large amount of content will be directly served by the content buffer server program, and most requests do not need to call the database, which greatly reduces the pressure on the database. When accessing user-related information, users must register and log

in. In principle, real-name information and mobile phone binding verification are needed to ensure the validity of user information. When accessing sensitive information, consider using invoice barcode, user password or mobile phone verification code for secondary verification to ensure the privacy of sensitive information.

- (f) All business module codes do not directly access the database, but access the database through the data access mapping layer. The front end of the database is set with cache to reduce the access pressure of the database. At the same time, in the case of large traffic in the future, NOSQL cluster can be used to realize the cache. For the external data interface, we will use the flow control program (request frequency control) and the queuing system to ensure that the pressure on the external system will not be too high and ensure the availability of the software. In principle, the data gateway uses ciphertext encrypted by high-strength algorithm to communicate with the application server to ensure the security of data privacy.

On the premise of considering the application characteristics, the above-mentioned technical means have targeted the most efficient front-end technology combination at present, and achieved good results in page access, scalability, code reuse and so on.

## 4 System Security

With the increasing informationization of Suzhou Guangji Hospital, there are currently 20 servers with 50T storage and 600 computer terminals, as well as related medical information system (HIS), structured electronic medical record system (EMR), inspection system (LIS), nursing management system (NIS), ECG, PACS and OA systems. The applications of network layer and software layer are more and more complex, and the security risks faced by hospitals are correspondingly increased. How to reduce security costs and security risks is also an important task at present. Therefore, the application of mental health promotion platform based on mobile internet is also the key prevention object.

### 4.1 Authorized Data Security Gateway

The project application server will obtain data through the proxy of the data gateway. The data gateway has the following characteristics:

Authorized access control, including access source control (such as restricting IP address access) and visitor authentication;

The gateway is located in the hospital intranet, and only communicates with the project application server externally, and is set in the same virtual private network, which makes the gateway position more difficult to be directly contacted by the outside;

Data access function: special interface (white list interface) is used instead of universal interface, so that external access can only access authorized data, and one-way access is never two-way, thus avoiding the risk of unauthorized access to data caused by complex interface functions to the greatest extent;

When APP accesses, make a flow control strategy, and do flow buffering and client queuing for multi-client access in a short time. Prevent users from visiting storms and causing blows to the system;

The gateway equipment opens the management port and service port for access to the system. The management port is only released to the intranet client, and the service port is only open to the server.

All visits are recorded in data log for future reference.

## 4.2 Application Server

The application server of the project provides actual services for external mobile phone users. The server needs to have the following features for security design:

Authorized access control: for users who need to access personal information, mobile phone authentication is required, and real-name authentication is required to improve the information. Temporary tokens will be issued when users log in, and the data security gateway will issue corresponding data to the application server through temporary passes.

The application server is in the external network and communicates with the data security gateway through the encrypted channel or virtual security network;

The server needs to cache certain information, such as doctor scheduling information, which can reduce 80%-90% of visits and greatly reduce service pressure when a large number of users visit;

For the mobile phone access interface, a special interface (white list interface) is made instead of a universal interface, so that only authorized data can be accessed for external access, and other data are restricted, thus preventing server vulnerabilities caused by complex interfaces as much as possible.

Log access function: logs of users logging in to access the server will be saved for future reference.

## 4.3 Firewall

An application firewall can be deployed at the boundary of the intranet to prevent malicious access from invading; At the boundary of the external network, a hardware firewall will be deployed in the computer room to prevent malicious access and violent attacks.

## 4.4 Mobile Phone Terminal

When all users register, they need to improve their real name information and bind their mobile phones before they can use the hospital function;

User identity verification: password, SMS for verification;

The sensitive information between the mobile phone and the server is exchanged with ciphertext, and the secondary authentication fee is used when the mobile phone accesses and uploads personal information and generates fee information, so as to ensure the security of the system and account.

## 5 System Test

The safety test of health promotion interactive platform is a very important one among many tests, especially in the protection of user privacy (patient privacy), medical information, medical records, patient charge records and patient expense accounts, etc. It

mainly tests the file access rights, network transmission level, component access, iterative upgrade and so on. The system protects user privacy (patient privacy) by checking whether the user name and password are stored locally, and checking whether the sensitive private information interacting with the server, such as chat information and bank account, is effectively encrypted. Level 1 saves configuration files and system files on external devices; If you need additional information stored in external devices, check whether it has been maliciously tampered with before each use. Whether the sensitive data information transmitted in the network is encrypted or not, the more important sensitive information should be encrypted and transmitted in TLS or SSL mode. Rights protection shall be carried out for Android system components, and any third-party application is prohibited from accessing and calling internal components of APP. If calling components must be provided, it is necessary to confirm whether the caller has made signature settings. For iterative upgrade management, check whether the upgrade package has been tampered with, and check its integrity and legitimacy to prevent the upgrade package from being hijacked and used.

## 6 Summary

The safety test of health promotion interactive platform is a very important one among many tests, especially in the protection of user privacy (patient privacy), medical information, medical records, patient charge records and patient expense accounts, etc. It mainly tests the file access rights, network transmission level, component access, iterative upgrade and so on.

Implementation effect of psychological cloud platform: By the end of 2021, there were 1,268 consultations on the cloud platform, 124,000 psychological self-help audio listening, 161,000 psychological assessments and 1.12 million views of online psychological counseling popular science materials and lectures. These data were constantly refreshed during the outbreak.

At present, the mobile internet interactive platform for mental health promotion has been officially launched and used, which has been an effective extension of the intelligent “online virtualization” hospital mobile platform created by Suzhou Guangji Hospital and Suzhou Mental Health Center, and citizens can download and log in through Android and IOS systems. It has the functions of popularizing knowledge, answering questions of international mental health scale, interactive psychological consultation and so on. Efforts to publicize mental health and popularizing mental health knowledge, multimedia and multi-platform publicity, combined with psychological counseling, drug treatment, rehabilitation training and social services and other comprehensive prevention and treatment measures will be conducive to the open management of patients’ participation in social life, and promote the rehabilitation of patients with mental illness. The psychological cloud platform is a medium, and the psychological assistance expert working group is an indispensable core force. They provide online consultation and answering questions for citizens through the mobile APP of “Psychological Cloud Hospital”. According to the professional answers to mental health problems, scientific popularization of mental health, mental health related knowledge. Suzhou Guangji Hospital and Suzhou Mental Health Center use mobile internet, cloud platform, intelligent APP and other information

means to assist the psychological assistance expert working group to devote itself to the prevention and treatment of mental health. To protect the public's mental health.

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