Design and Research of Mobile Terminal-Based Heat Monitoring and Management System

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Abstract: With rapid development of economy and technology, people's life style has changed significantly. Specifically, physical activity has been greatly reduced while the consumption of fast food and processed food has increased, and then the obesity has become more and more common and serious problem. In order to solve this problem, a heat monitoring and management system based on mobile terminals is proposed and realized. By embedding the heat monitoring and management module into mobile terminals, the proposed system allows users to facilitate their weight management regardless of time and space.

Keywords: Mobile Terminal, heat monitoring and management system, weight management

1. Introduction

With the rapid development of Chinese economy and technology, people's living standards are increasingly improved accordingly. The Obesity as a hot spot has been paid more and more attention to by the public. According to the latest data released by the "Report on Nutrition and Chronic Diseases of Chinese Residents (2020)", over 50% of adult residents in China are overweight or obese, ranking first in the world, and the ratio is still on the rise [1]. However, due to the influence of multiple factors such as diet, living habits, external pressures and etc, many people have no idea how to solve the obesity problem, and how to change the current status quo. Diseases caused by obesity, such as high blood pressure, diabetes, heart disease, and etc, have added a lot of trouble to human beings as well.

Given the above situation, various weight loss drugs and weight loss softwares are emerging in the market[2]. Recently, the relationship between Internet industry and health care service has become more and more close. It is imperative to develop a mobile terminal-based intelligent monitoring and health management calorie monitoring and management system to help lose weight.

2. System Requirements and Design

2.1 Demand analysis

Demand analysis is also known as software requirements analysis, system requirements analysis or requirements analysis engineering. Through questionnaires, market research, online inquiries, and consultation with relevant experts, and then in-depth research and analysis, developers can accurately grasp the specific requirements of users and projects, such as functions, performance, and reliability, and finally effectively fulfill user's requirements. In practice, the functional requirements of the software we acquired are divided into the following four parts.

1) Home module: Display calorie intake records, food calorie query window and calorie table of several commonly used foods.

2) Logging module: Display calorie consumption records and online exercise records.

3) Motion module: Show some recommended indoor and outdoor sports courses.

4) User module: There are user management functions such as logout, login, and account switching. The account switching is used to switch user's account to youth mode, and can receive APP update, maintenance messages on help and feedback.

2.2 Systematic design

In order to realize the intelligent monitoring of heat and the health management of users, the hardware of system includes two parts, data collection terminals and a PC server. The the client APP installed in the mobile terminals collects food pictures and transmit them to the PC server. Then the server analyzes the data, and transmits the results to the client for users' reference. If the results exceed the presetting threshold value, the system will issue a page banner notification to remind users. In addition, the outdoor sports data is recorded through the GPS positioning system, and user's health data obtained by the client is uploaded to the server through the 4G network. The server is responsible for analyzing and processing the user's health data for multiple periods, as shown in Fig. 1.
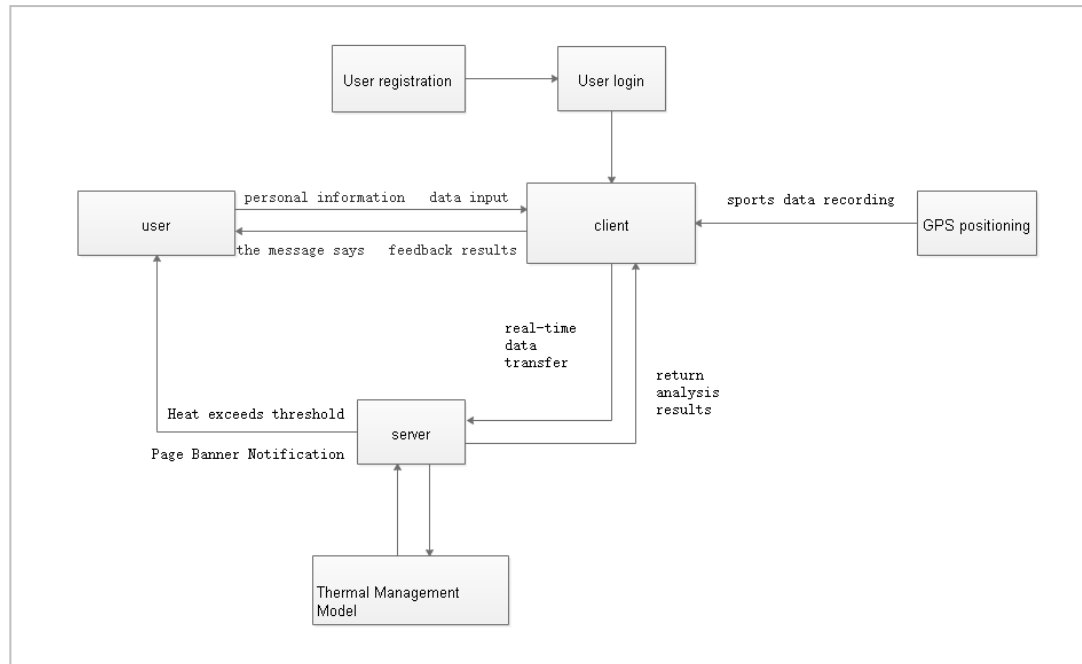

Figure 1: System Architecture Diagram

In addition, the system is a mobile terminal monitoring and management APP designed on the latest MUI framework[7]. The MUI is a high-performance front-end framework. It does not depend on any third party JS library, which make it suitable for the cross-platform development including Android, iOS Appstore, common mobile browsers, major app stores, streaming apps and WeChat H5. The size of compressed JS and CSS files are only slightly more than100K and 60K.

The overall framework design of this APP mainly includes the realization of the front-end framework and the back-end server. In details, it uses the front-end framework to design the interface and the back-end server to build the back-end service, so as to realize the reading and analyses of data. The system development and design environment is:

1) Operating system and development platform: Windows 10, MUI version 3.7.1;

2) Project version management tools: Git、NPM;

3) Development tools: Sublime Text 3;

4) Server: Nginx;

5) Online system: Linux operating system;

6) Development Framework: MUI 3.7.1+B/S.

The process of system establishment is elaborated as follows. First of all, MUI framework is used on the page with CSS technology and using AJAX to retrieve the data. Secondly, the development platform uses NPM development tools and Sublime Text 3 to write a text. Thirdly, We use Linux operating system and Nginx to make the product online. To conclude, The front-end uses the MUI 3.7.1 framework and Axios based on Ajax to interact with the back-end server. The system uses Nginx and Tomcat for reverse proxying to achieve high concurrent user access to the supervisory system.[3]

In order to conform to the idea of software development, "high cohesion, low coupling", the system architecture of this APP is based on the ASP.NET three-layer mechanism in the way that each functional module is divided into presentation layer (UI), business logic layer (BLL) and data access layer (DAL) three-tier architecture. Each layer uses interfaces to access each other. The entity class (Model) of the object model is used as the carrier of data transfer between each layer. Among them, the presentation layer mainly realizes the input and output of system data. Moreover, The middle business layer makes logical judgments and execution operations on specific functions. It feeds back the processing results to the presentation layer UI implementing software functions. Besides, the data layer mainly implements operations such as adding, deleting, modifying and querying data, as shown in Fig. 2[6].
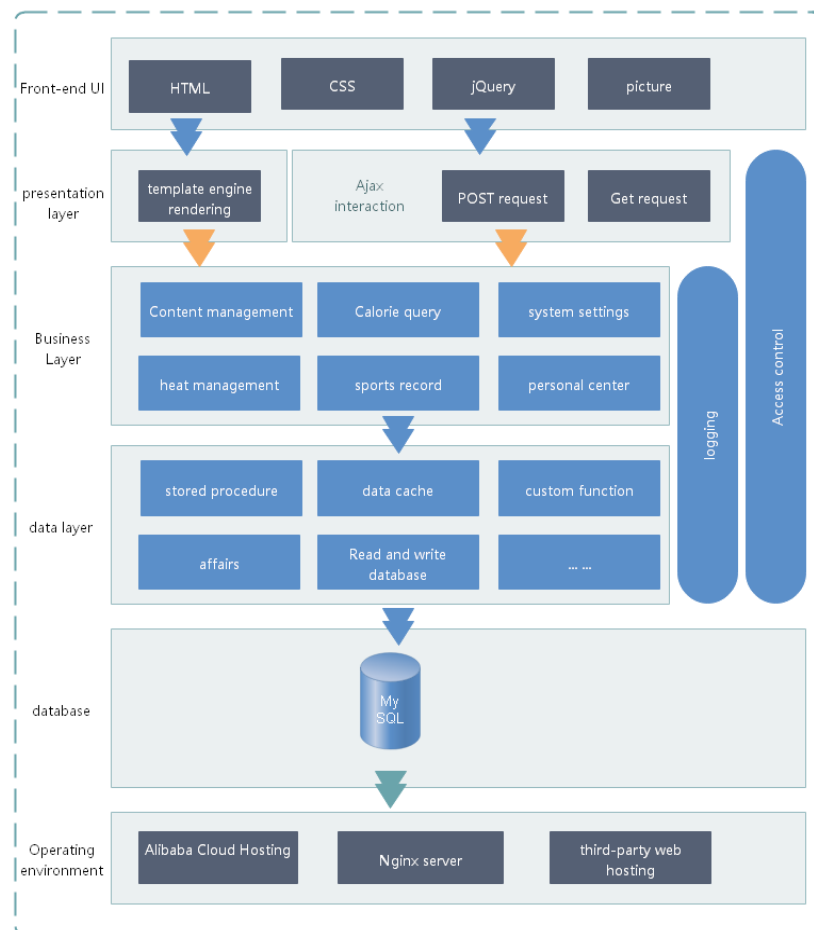

Figure 2: Schematic diagram of heat monitoring and management APP system architecture

3. Functional module design

3.1 Front-end functional module design

We name the calorie monitoring and management APP system "calorie health", taking the interface displayed by the iOS system as an example. As shown in Fig. 3, the user-oriented "calorie health" can provide a variety of healthy recipes and fitness training for users. On the one hand, the calorie query of food is quick and accurate. The training plan can be combined and arranged for different groups of people, various equipment and stage fitness goals. In short, the selection range is relatively wide. On the other hand, it can record the progress of exercise and calorie consumption. The atmosphere of video and background music gives users an incentive with the whole process of voice supervision. Sports can not only perform real-time positioning, but also share fitness results. We can take pictures to record changes every day, sharing with friends and encouraging other people. Therefore, in the "calorie health" sports community, fitness is no longer a lonely persistence.
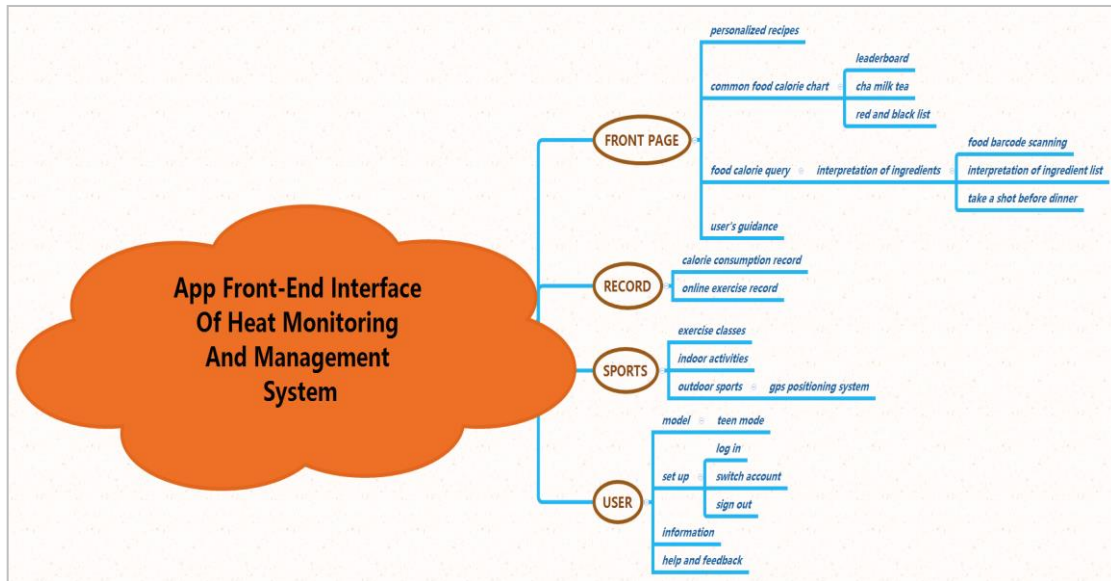
Figure 3: Schematic diagram of the front-end interface of the heat monitoring and management APP

3.1.1 The home module

The search bar of the home page module is clearly set without advertisements. When at searching mode, it displays "Recently Searched", "Food Recommendation List", and "Everyone is Searching", which respectively satisfies the user's need to record frequently-chosen foods, recommends fresh food, and provides universal search that follows the trend. The overall preview is shown in Fig 4[4].
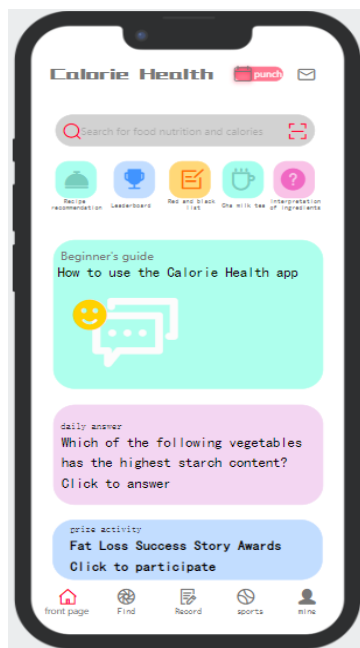

Figure 4: Overall preview

It is mainly used to display the common food calorie table and provide the function of food calorie query. The specific amount of food ingested each time can be clearly recorded. Through the analysis and suggestions of healthy diet, the app can recommend the best dietary structure to users in three aspects as follows:

(1) It provides a diet analysis function, through which the user can obtain the three-meal ratio and the intake scores in that day, and then get suggestions of the three nutritional ratios.

(2) Through the "Which Foods have the Most Nutrients" function, users can view the content of the three major nutrients in each dietary food, and the recommended list of food supplements related to nutrients.

(3) It can be recorded by scanning the barcode of food packaging, which greatly satisfies the user's pain points of saving time and effort when recording, and has a wide range of products, fast scanning, and excellent user experience. The function display is shown in Fig. 5.
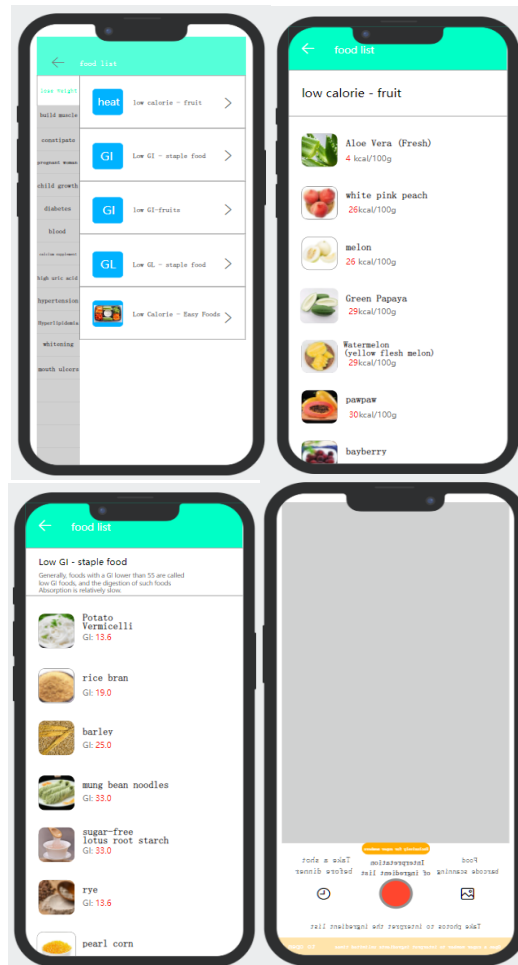

Figure 5: Home function display

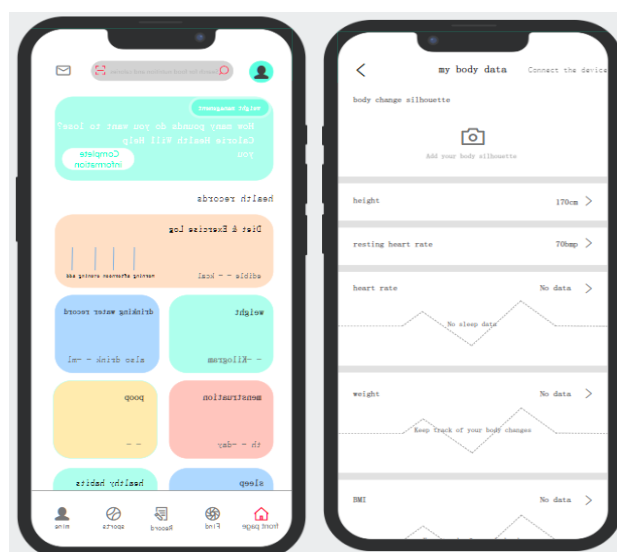### 3.1.2 The recording module

Figure 6: Recording function display

The recording module mainly exhibits calorie consumption records, online exercise records, and particularly the weight loss which can significantly stimulate users' confidence in losing weight and

increase user stickiness.

The records of diet and exercise are displayed in a column with the number of consumed calories meanwhile. Moreover, weight records are displayed numerically in a line graph. The concise effect of visualization provides sufficient information for users, and the function display is shown in Fig. 6.

3.1.3 The sports module

The sports module mainly shows indoor and outdoor sports and some recommended sports courses as in Fig. 7. The APP can directly record exercise data through smart devices, and thus it is convenient for users to manage exercise and diet[2].
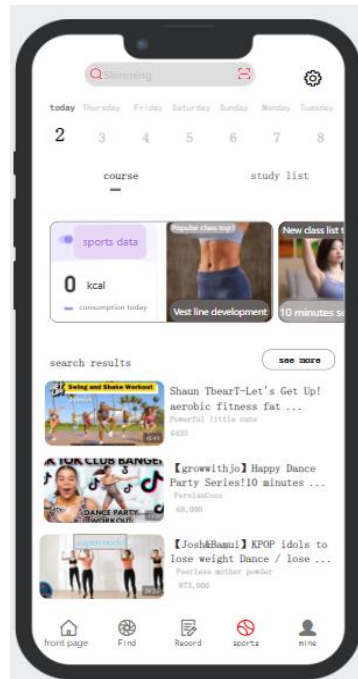

Figure 7: Sports function display

3.1.4 The user module

The user module has user management functions such as logout, login, and account switching. In this mode, the APP can be switched to youth mode, receive APP update and maintenance messages, and provide you help and feedback. The icons in concise layout are convenient for users to click according to their needs, as shown in Fig. 8[5].
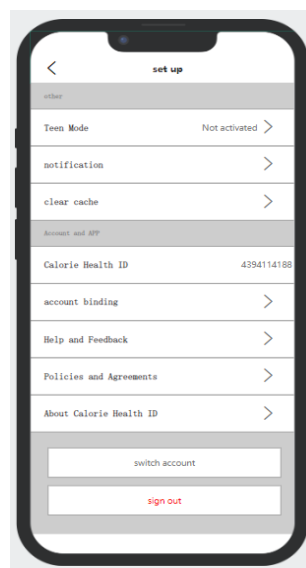

Figure 8: User function display

3.2 Back-end functional module design

Compared with front-end developers who need to know a range of tools to create user interfaces, backend developers typically use a completely different set of tools and skills. In order to complete their work efficiently, we have made a detailed design from three aspects as follows:

1) Data transmission function transfers JSON data through Ajax and data cross-domain on Nginx server.

2) APP leverages Nginx in the Linux operating system to release and go online. It can realize cloud access through Alibaba Cloud.

3) Git version management applies GitHub repositories and git version management tools to control code version.

3.3 Backend server design

The mobile terminal APP server is mainly considered from three aspects, i.e., the number of users, the type of transmission data and the function.

1) The number of users: Considering that this APP is a heat monitoring and management category, a large number of people may access it at the same time.

2) The type of transfer data: The main data of the mobile terminal APP is obtained from the server. The transmitted data is mostly JSON file type.

3) Functions: It mainly stores information such as pictures, videos and data related to users.

Based on the above three points, we choose the Nginx server as the APP server. Nginx solves the problem of high concurrency and achieves load balancing through asynchronous, non-blocking, epoll model and reverse proxy. Through the reverse proxy and epoll model, a large number of requests can be forwarded when they come at the same time. This APP can be configured directly in Nginx directly and allow the UI to directly access JSON files, which can meet the needs of users for monitoring system execution.

4. Conclusion

This paper introduces a heat monitoring and management APP system based on mobile terminals. The system includes four modules, i.e., home page, record, exercise and user, which includes calorie monitoring and management functions such as calorie intake record, food calorie query window, commonly used food calorie table, online exercise record and some selected exercise course recommendations. By using this system, users can manage their own health without temporal and spatial limitation while maintaining a normal BMI index. At the same time, it can popularize science of health knowledge. Through early preventive and control measures from obesity, the system can prevent the occurrence of chronic diseases, which is of great significance to safeguarding the health of users.

Acknowledgments

References

[1] "Report on Nutrition and Chronic Disease Status of Chinese Residents (2020)" released adult residents with overweight and obesity over 50%[J]. junior high school world, 2021(14): 61.
[2] Shi Xiaoxue. Research on the application of fitness APP in college students' extracurricular sports activities[D]. Nanjing Normal University, 2020. DOI: 10. 27245/ d. cnki. gnjsu. 2020. 001117.
[3] Zuo Weigang, Xu Quanfei. Design of edible fungus product safety information supervision and management system based on mobile terminal[J]. Chinese edible mushrooms, 2020, 39(08):

98-100+104.

[4] Hao Jie, Li Yuanhang, Wang Enlong. Sensor-based calorie pedometer design[J]. Information Systems Engineering, 2021(01): 126-127.

[5] Lily Chen. Calorie consumption calculation algorithm based on center of gravity displacement monitoring[J]. Journal of Southwest Normal University (Natural Science Edition), 2016, 41(07): 55-60.

[6] Lin Wenhuan. Design and Implementation of Intelligent Information System Based on Mobile Terminal[D]. Southwest Jiaotong University, 2010.

[7] Liang Qimeng. Design and implementation of medical information system based on mobile intelligent terminal[D]. Zhengzhou University, 2018.