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To cite this article: Zhang Bo *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **233** 022001

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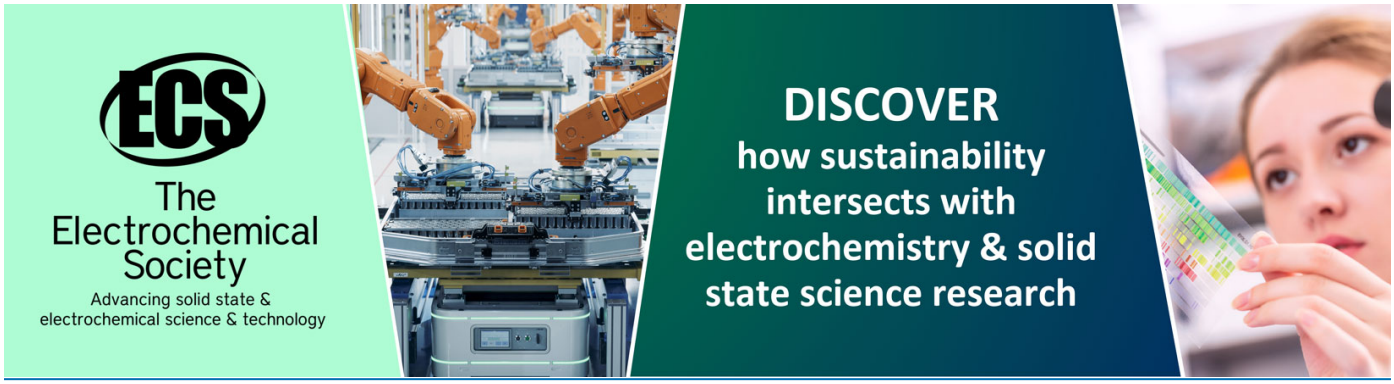

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Design of Intelligent Home Monitoring System Based on WeChat Public Platform

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Abstract. This paper studies the current intelligent fitness system and proposes an intelligent fitness system based on WeChat public platform. The whole intelligent fitness system is divided into two parts: device control system and Web application system. The device control system platform adopts STM32F103 as the core, and expands many circuit units such as photoelectric switch module, bluetooth module, sensor module, motor module and external storage module. Keil software was used to write device control program to realize data acquisition and control of the underlying equipment. The Web application system is developed by using the Java language and SSH technology framework. Implement user registration, analysis reports, sports and fitness guidance and other functions on the WeChat client, and parsing the message events pushed by the user.

1. Introduction

With the improvement of people's living standards and quality, people are paying more and more attention to the management of their own health and families' health. People are eager to find a platform or system that can manage their own health in a fast-paced life. At present, the design cost of the current implementation method is relatively high, and the management system contains a relatively simple content. It is only responsible for collecting data and analyzing specific data. It does not provide an intelligent, systematic and professional analysis report and fitness program for people[1]. Aiming at this shortcoming, this paper designs an intelligent fitness system based on WeChat platform, Ethernet and mobile network communication technology, and Tencent cloud server. The system can detect the vitals data, cardiopulmonary function and muscle strength of human body, and can formulate a professional systematic and guiding exercise fitness program according to the test result, so that the user can modify the fitness plan according to the evaluation results.

2. System overall design

The WeChat-based smart fitness system is divided into three parts: the underlying data acquisition and control system, the WeChat public platform and the service system are built on the Tencent cloud server, and the software system includes the WeChat mobile terminal. The overall function of the system is shown as follows: the user scans the two-dimensional code of the device with WeChat, then the device starts working, and the PC data collection end uploads the measurement data of the detecting device 1, 2, ... n to the cloud server, and the cloud server returns to the WeChat client; The exercise device sends the collected data to the cloud server through the PAD end. At the same time, WeChat users can view the detection analysis report and exercise fitness guidance program on the WeChat client; the system management user group can also manage the user and device through the computer browser access

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management system. The overall functionality of the system requires two aspects: device control system and web application system. The overall function of the system is shown in Figure 1. The data acquisition and control system and the Tencent cloud server transmit data through HTTP network. The cloud server then interacts with the WeChat mobile terminal through the WeChat public platform interface.

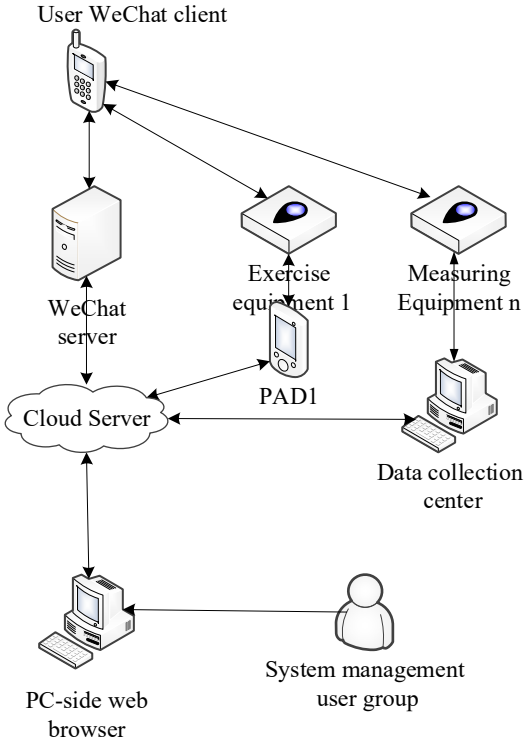

Figure 1. System overall function diagram

3. Equipment control system design

3.1. Equipment Control System Hardware Design

The constructed device controller system can realize the analysis of the commands sent by the host computer, and control the motor rotation or data acquisition according to the analyzed data. The core microprocessor of the system selects STM32F103, based on this, integrates displacement sensor, motor drive module, Bluetooth communication module, E2PROM external storage module and H2010 photoelectric sensor module[2, 3]. Figure 2 is a general block diagram of the system hardware.

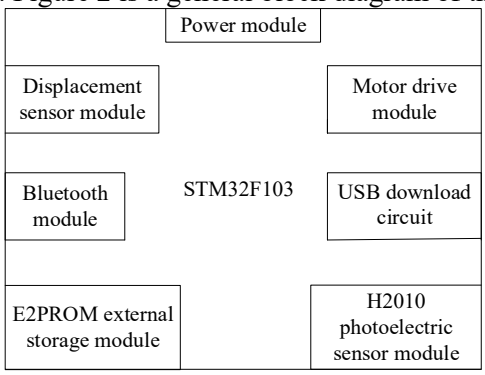

Figure 2. Overall block diagram of the hardware system

3.1.1. Circuit design of displacement sensor module unit

In this design, the displacement sensor is selected by Shanghai Texun Electronic Technology Co., Ltd. KTC-250 rod linear displacement sensor, KTC-250 standard linear displacement sensor, suitable for absolute measurement, the stroke length is 250mm. This type of sensor has good resolution and repeatability. The KTC-250 standard linear displacement sensor has 4 pins. Pin 1 is the input voltage positive, pin 2 is the output voltage, pin 3 is the input voltage negative, and pin 4 is the ground pin. The connection between the KTC-250 linear displacement sensor and the MCU is shown in Figure 3.

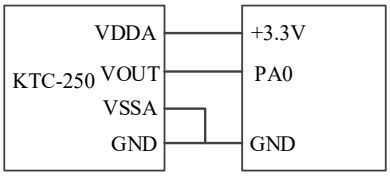

Figure 3. KTC-250 linear displacement sensor working principle diagram

3.1.2. Circuit design of slot type photoelectric switch module unit

The photoelectric sensor module selected in this design is the H2010 slot photoelectric sensor module. You can know that the forward current of the infrared light-emitting tube should not exceed 50mA. The forward current selected in the circuit design of this photosensor is 5 mA, and the voltage drop of the forward transistor is 1.5 V, thus:

$$R_0 = \frac{U - U_1}{I_0} = \frac{3.3 - 1.5}{5 \times 10^{-3}} = 360\Omega \quad (2\text{-}1)$$

In the formula (2-1): 3.3V is the power supply voltage; 1.5V is the forward voltage drop of the infrared light-emitting tube.

When the slot groove H2010 intermediate light photosensor is blocked kind, phototransistor ICEO = 100mA; no physical occlusion, phototransistor ICEO≈0.7mA. In order to allow the phototransistor to work normally in the on or off state, select R11=20KΩ. The software sets the PA4 of STM32F103 as the input pin, and the interrupt starting mode is the rising edge trigger. Under normal conditions, the H2010 slot type photoelectric sensor is blocked. At this time, the input voltage of the PA4 pin is 0V (low level), when H2010 When the slot photoelectric sensor detects that a light hole has passed, the input voltage of the PA4 pin is 3.3V (high level), and the interrupt is triggered[2]. The connection between the H2010 slot photoelectric sensor and the MCU is shown in Figure 4.

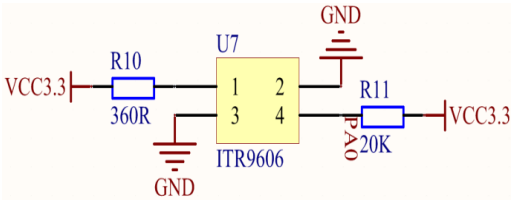

Figure 4. KTC-250H2010 trough photoelectric sensor working principle diagram

3.1.3. External memory module unit circuit design

The external storage module unit is used to store the data collected by the sensor, mainly the gear position of the oil resistance exercise device and the displacement of the hydraulic cylinder. The memory chip selected in this design is E2PROM, which is a memory chip that does not lose data after power failure. The E2PROM chip selected for this design is the 24C02 type. The memory space of this model is 2K, and there are 8 pins. The function description of each pin is shown in Table 1:

Table 1. E2PROM memory chip pin description

Pin name	Description
A0,A1,A2	Device address selection

SDA	Serial data address
SCL	Serial clock
WP	Write protection
Vcc	-1.8V~6.0V working voltage
Vss	Ground end

According to the pin parameter description in the table, the circuit connection diagram between the E2PROM and the main control chip STM32F103 can be obtained, as shown in figure 5.

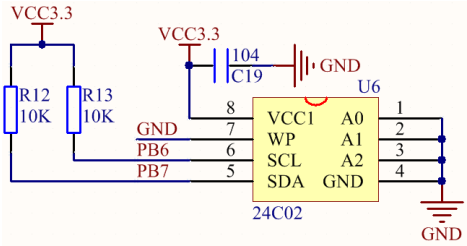

Figure 5. USB interface schematic

3.2. Equipment Control System Software Design

After the device control system is powered on, the system initialization is first performed. After the system is initialized, the gear position of the hydraulic cylinder is reset, and then the serial port detection mode is entered to monitor whether the serial port receives the command sent by the user, and if the user's instruction is received. The system will perform different operations based on the corresponding instructions. Figure 6 is a flow chart of the main program of the MCU controller.

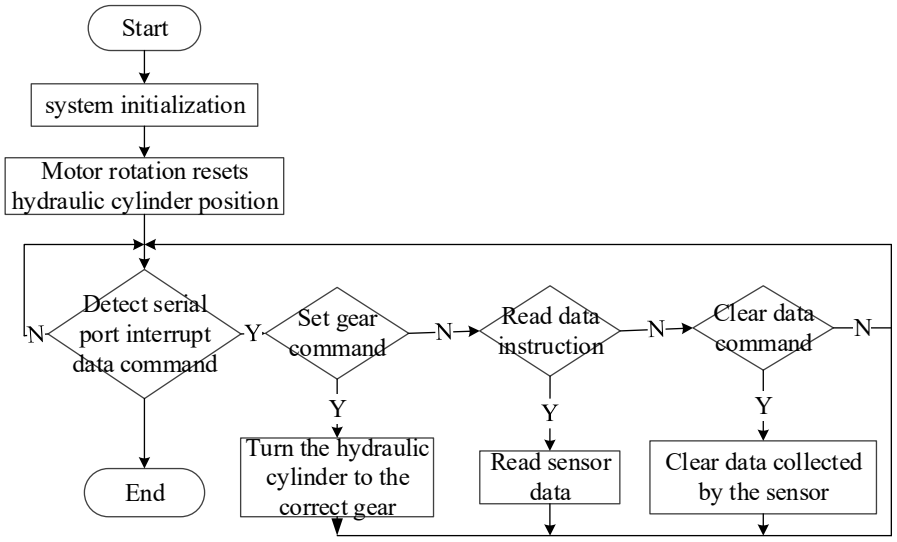

Figure 6. MCU controller main program flow chart

4. Web application system

4.1. Web application system function definition

It can be known from the overall function of the system that the web application system is convenient for the system administrator to manage the basic information, detection report information and device information of the user in the background, and to facilitate the user to view the data of the exercise

program on the WeChat client[4]. The web application system is divided into two parts: the background management system and the member WeChat client.

4.2. Member WeChat client function module design

Member WeChat client functions include member registration, member payment, user scan code, report query, questionnaire survey, and event analysis. Users need to register for membership before using the Sports Health Control and Management System. Member payment refers to the payment of certain remuneration when using the sports health control and management system. The size of the remuneration depends on the membership period. User scan code means that the user needs to scan the device's QR code to open the device when using the system device. The report query refers to the member users' inquiries about the test report information, exercise fitness guidance program and psychological rehabilitation suggestions. Questionnaires included psychological questionnaires and physical rehabilitation questionnaires. The event parsing function is to parse the user's push event. In this system, the user's push events are: subscribe to the public number, scan the device QR code, click on the public number menu[5].

The event parsing function is completed on the third-party server developed by WeChat public account, and the event parsing flowchart is shown in Figure 7.

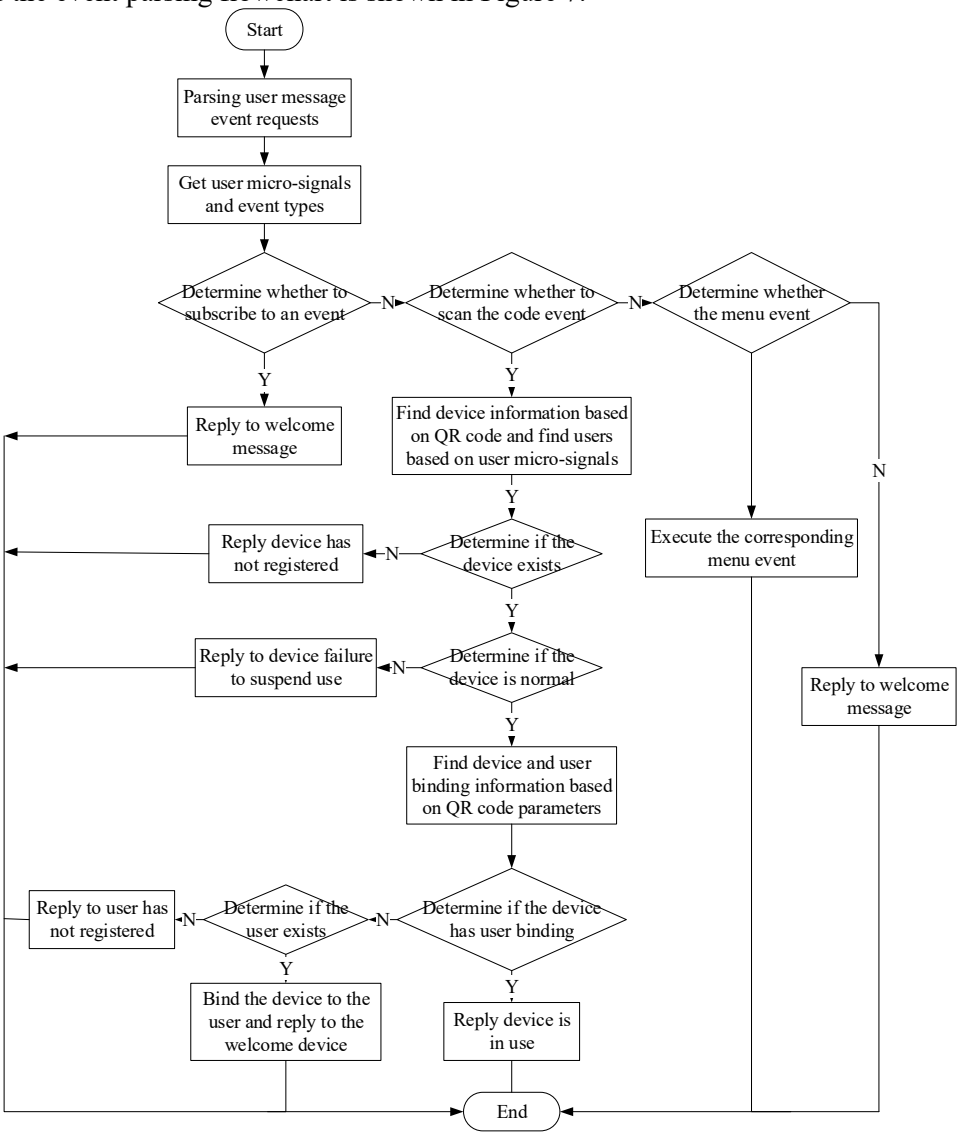

Figure 7. Event analysis flow chart

The event type of the message and the user's micro-signal are obtained by parsing the message event pushed by the user; then determining the type of the message event, and executing different commands according to the event type[6].

4.3. Background management function module design

The background management is implemented on the browser. Its main function is for system administrators and expert consultants. The system administrator can query and modify the basic information of the user, register and record the device information, and modify the device information. You can also query the user's test report and exercise program. At the same time, expert consultants can also query and modify the detection information and exercise program of member users in the background management terminal[7]. The main functions of background management include user login, member management, device information management, rights management and health knowledge base management. The participating roles include system administrators and expert consultants. The roles are different and the corresponding permissions are different. The rights management function is the system administrator's management of the expert advisory authority and the member user rights. The expert advisory authority includes the member report information management and the health knowledge base management, and the member user rights include the management of the user basic information. Table 2 shows the permission table of the system.

Table 2. System permission table

Field name (column name)	type of data	Description
Phonenumber	varchar	Mobile number (primary key)
Password	varchar	user password
permission	smalliant	User rights

The background management module is designed using SSH framework technology. The SSH framework of the system is divided into three levels: presentation layer, business logic layer and data persistence layer. The presentation layer corresponds to the View in the MVC mode, that is, the view layer; the business logic layer corresponds to the Controller in the MVC mode, that is, the control layer; and the data persistence layer corresponds to the Model in the MVC mode, that is, the model layer. The basic business process of developing the system by using the SSH framework technology is: in the presentation layer, mainly by the JSP page and the action, in the JSP page, the user sends an Action request to the ActionServlet through the interactive interface. In the Struts 2 configuration file struts-config.xml, the ActionServlet and its various Action business agents are defined. The ActionServlet forwards different page requests to different Actions. Then, in the business logic layer, Spring uses the IOC component to provide a unified business model interface for the Action, and at the same time provides the DAO business logic interface. In the data persistence layer, Hibernate is responsible for completing the data mapping, adding, deleting, and changing operations in the database[8, 9].

5. System test

Before conducting system testing, first pay attention to the WeChat public account. After the success, the public account will return to the WeChat user to pay attention to the success message. The user can scan the QR code of the mobile phone WeChat client to open and use the device. After using the device, the user can query the information such as the test report information, exercise fitness instruction plan and psychological rehabilitation advice by clicking My Sports on the WeChat client. . Figure 8 is the graph of test results.

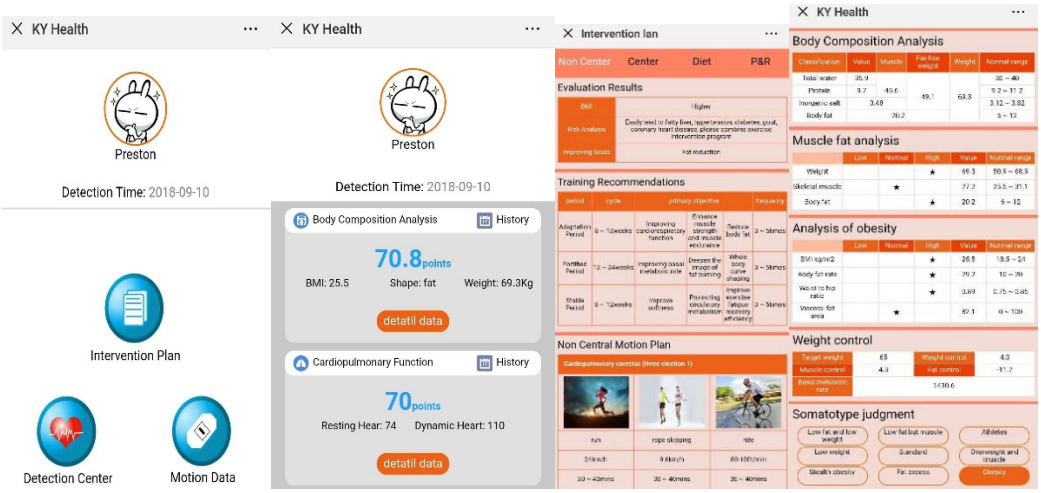

Figure 8. WeChat test interface diagram

6. Conclusion

The intelligent fitness system designed in this paper solves the shortcomings of the current fitness system without closed loop, realizes full automation, and develops a complete systematic and professional guiding exercise program for users. It solves the singularity of the previous data, realizes the integration of multiple data, and thus obtains systematic analysis. Users can view their own sports analysis results on the mobile phone WeChat client, and use the WeChat scanning device QR code to open the device for exercise exercise according to the exercise fitness instruction program.

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