Design and implementation of comprehensive sign monitor based on Internet +

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Abstract: Along with our country has accelerated into the aging society, the majority of the elderly medical and health problems, the shortage of medical resources, difficult to see a doctor, long cycle and other problems become increasingly prominent. In order to provide the elderly with better and more convenient health status monitoring, this paper proposes a comprehensive sign monitor based on Internet +. In this paper, the overall design framework of the comprehensive signs monitor is studied, STM32 processor is used as the CPU, and the physiological significance and measurement methods of each physical sign parameter (blood oxygen, blood pressure, body temperature, etc.) are introduced. It allows doctors to obtain patients' health data remotely, analyze patients' health status, and achieve timely prevention and diagnosis and treatment, which provides great convenience for doctors and patients.

Key words: blood oxygen; Blood pressure; Wireless transmission; Internet +

1. Research background and significance

According to the Outline of the National Medical and Health Service System Planning (2015-2020), statistics show that the number of beds of medical institutions in eastern China is 40% of the total number in the country, while the number of beds in western China is only 29%. And the number of medical and health institutions in the east is about 42,000 more than that in the west. At the same time, the number of doctors in the east is three to four times higher than that in the west. Therefore, both quantity and quality of high-quality medical resources are excessively concentrated in developed areas, which will inevitably lead to low efficiency of medical work. In addition, influenced by China's policies and other aspects, China has an aging society, the health care of the elderly will be a huge potential market, there is a lot of room for development in the future. Therefore, family medical monitoring can solve the difficulty of seeing a doctor and timely prevention purposes. As mentioned above, the medical monitors on the market at present, whether it is high-end medical monitoring equipment or portable low-end monitoring equipment, have defects in family and community monitoring. In addition, considering that there is a strong correlation between the physical signs parameters, the monitor that can only monitor a single parameter can not meet the needs of family use. The new trend of the development of home monitor equipment is to monitor a variety of physiological characteristics parameters such as blood oxygen (SPO2), blood pressure (BP), heart rate (P) and electrocardiogram (ECG) at the same time. The monitoring of these parameters is helpful for doctors to give timely and effective treatment to patients in home emergency care and monitoring.

Therefore, the purpose of this paper is to design a comprehensive functional, convenient to carry, low power consumption, suitable for family use based on the Internet + comprehensive sign monitor, which can simultaneously monitor blood oxygen, blood pressure, body temperature, heart rate and other data. Data can not only be visually viewed on the display screen, but also can be stored and viewed through the Internet platform. The threshold alarm is set on the Internet platform, and when the data is abnormal, the message can be pushed to the mobile client, so that the doctor can evaluate and judge the user's health remotely, achieve the purpose of prevention or treatment plan, and realize the requirements of health monitoring.

2. Research status at home and abroad

The research technology of the monitor can be traced back to 1962 when the first medical electronic medical equipment came out in North America, and the monitoring medical equipment began to attract attention from all over the world. In recent years, digital analog electronic technology, computer application technology, digital signal processing and other technologies have advanced by leaps and bounds, coupled with the large demand for clinical monitoring, and a variety of monitors have also been recognized by medical units, so a large number of monitor products began to enter the domestic and foreign markets.

At present, most of the research on medical monitoring technology is devoted to the following aspects: 1. Physiological signal extraction technology. Many scholars are studying the non-invasive continuous monitoring technology. For example, Japanese scholars proposed to measure blood pressure indirectly by the correlation between pulse wave conduction speed and blood pressure, and proposed to estimate blood pressure by detecting and analyzing pulse wave, which can not only get rid of the shackles of the cuff, but also realize continuous measurement, but has not been used in clinic so far. 2. The development of new sensors. At present, many research institutions are developing a new type of sensor, with a sensor can extract a variety of physical parameters, can reduce the number of sensors. In addition, in terms of materials, in order to reduce the skin discomfort caused by the electrode or sensor, the Institute of Materials of Shanghai Jiao Tong University is studying a kind of imitation skin electrode similar to human skin. In terms of blood oxygen sensors, in order to achieve higher measurement accuracy, researchers in various countries have increased the number of wavelengths in addition to two, and even up to eight wavelengths. 3. Miniaturization and wireless. Adopt the module combination scheme to make the functions diverse and intelligent. Wireless data transmission is adopted to reduce the connection between modules. This scheme can also be applied to remote monitoring, which is an inevitable choice with the rapid development of network technology. 4. The combination of "supervision" and

"protection". At present, the monitoring equipment are monitoring and alarm devices, and can not independently care for patients. For example, when the patient is found to have respiratory dysfunction, the oxygen generator can be automatically opened.

In summary, with the advent of the aging society, the multi-sign monitor, as a derivative of the sunshine industry of the medical industry, will move more quickly to thousands of households. If the "Internet + medical" can be realized, it can conform to the pace of The Times, and there will be a broad space for development.

3. Design technical requirements and structure

1. Technical requirements for system design

This design based on the Internet + comprehensive signs monitor, mainly for family use, so should have the following design requirements:

(1). Small and portable. It is mainly different from the monitors used in the hospital in the past, which is convenient to move and carry and reduce unnecessary trouble.

(2). Simple operation. Because the operator may be some ordinary people, so strive to operate simple.

(3). High precision. After all, only high precision values can have reference significance. Therefore, when designing, should take into account the factors of system instability and exclude. The measurement accuracy of blood oxygen saturation should be ±2%. Blood pressure is generally measured in a range of 0-200mmHg. Temperature measurements vary between 35-42 ° C and are accurate to 0.1 ° C.

(4). Safety of medical electrical equipment. The circuit design should be reasonably grounded, and the isolation circuit design should meet the medical electrical safety standards.

(5). Strong anti-interference ability. Because of its characteristics, biomedical signals are very easy to mix with all kinds of noise and interference, and even drown it in the noise. In order to ensure the practicability of the system (that is, it can detect useful signals in most environments), it is necessary to enhance the performance of the system in anti-interference.

2.Design structure

According to the design requirements, the hardware circuit is mainly divided into the following modules: CPU minimum working circuit, blood oxygen module, blood pressure module, body temperature module, LCD display module, Wifi module, button and so on.

Data acquisition end has 3 modules: blood oxygen module, including sensor and filter amplifier circuit, communication using SPI and CPU connection; Blood pressure module, and the CPU connection parts are: one is the ordinary IO port connection, to control the air pump and solenoid valve action, the second is to send the blood pressure sensor through two AD into the CPU; The body temperature module, including the sensor and filtering and amplifying circuit, and then connected with the CPU AD. The key and LCD module are connected to the CPU through IO. The Wifi module is connected to the CPU via USART. The overall system structure block diagram is shown in Figure 1.

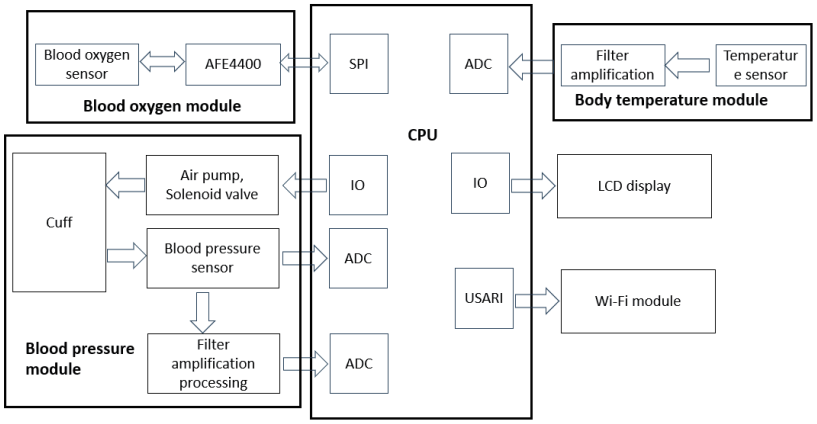

Figure 1 Overall system structure block diagram

4. Overall hardware design and software flow

1. Overall hardware design

At present, there are many kinds of commonly used cpus, including 51 cores, ARM series, etc. These cpus can meet the functional requirements of this design. Comprehensive function, cost, power consumption, volume factors, and I am familiar with the STM32 series of chips during my graduate school, so this design uses the STM32F407 chip of ST company as the CPU, to achieve the blood oxygen signal, blood pressure signal, body temperature, heart rate collection and calculation, and through the LCD display, Wifi wireless transmission and other functions.

The core of STM32F407 is a 32-ARM Cortex-M4 processor, and its clock is as high as 168M. It has 144 pins and 114 IO ports. Three 12-bit AD (up to 24 external measurement channels); And up to 17 communication interfaces, including 6 serial ports and 3 SPI interfaces. From the above performance, this chip can fully meet the requirements of this design.

For LCD display module, the principle diagram of STM32 and its circuit connection is shown in Figure 2. STM32 will display the

collected data on the LCD, considering that the display is only the value of the collected data, the screen is relatively simple, so choose 2.8 inch (240*320) resistance screen display.

Because this design currently uses 3 modules for data acquisition, so use 3 keys, KEY1 is used to start the blood oxygen measurement program, KEY2 is used to start the blood pressure measurement program, KEY3 is used to start the temperature measurement program.

2. Design the flowchart of the program

For the total system, the main frequency of the system is set first, and then through a series of module initialization, sensor data acquisition is determined by key judgment, and after STM32 processing, it is displayed on the LCD, and the collected sensor data is sent through Wifi.

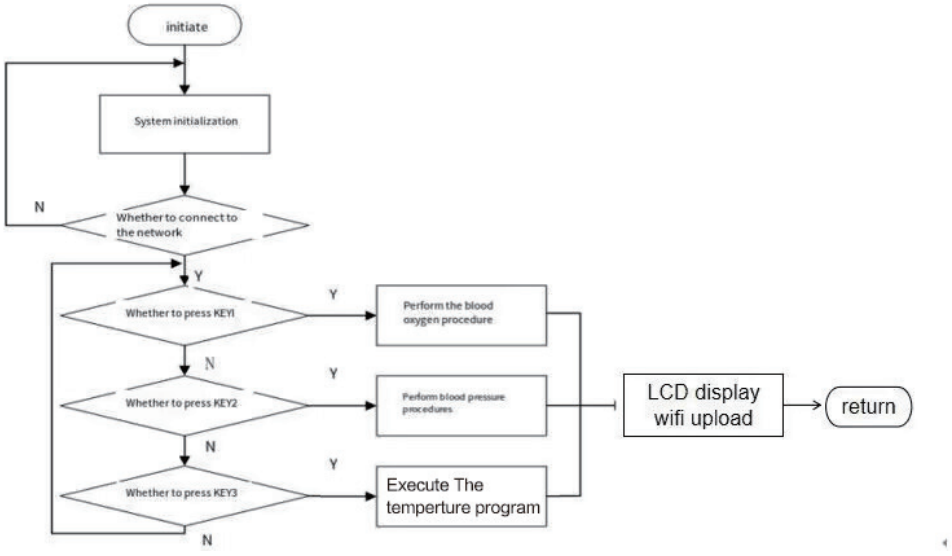

FIG. 2 Overall program flow chart

5. Summary

The goal of this paper is to make a comprehensive sign monitor based on the Internet + to measure blood oxygen, blood pressure, heart rate and other parameters, and communicate with the Internet through the wireless module, and then network with the mobile phone terminal. It can play a certain advantage and role in the elderly family monitoring, community medical care and so on. With the arrival of the aging society, the multi-sign monitor, as a derivative of the sunshine industry of the medical industry, will move more quickly to thousands of households. And the medical industry based on the Internet + can better adapt to the pace of The Times. So the research of this paper is of great significance to the society.

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