

Research on Intelligent Clothing for the Aged based on HT32F52352

Ying Xiong, Yinjia Miao

Chongqing College of Electronic Engineering, Chongqing, China

Abstract

In order to better solve the problem of care for the elderly, a wearable smart clothing for the elderly has been designed and developed. Combining traditional elderly clothing with electronic technology, HT32F52352 as the core chip, the heart rate sensor, temperature sensor, GPS module, GSM module, Bluetooth module, graphene heating module, lithium battery and other components into an intelligent system. This product has fall monitoring and alarm, heat preservation, heart rate data monitoring. The smart clothing meets the functional needs of caring for the elderly and realizes the combination of traditional care and technology.

Keywords

HT32F52352; Fall Monitoring and Alarm; Heart Rate Data Monitoring; Wearable Smart Clothes.

1. Introduction

According to the investigation report on China's urban and rural elderly living conditions of the statistical data show that in sixty-five years of age or older every year twenty-eight percent to thirty-five percent in the fall, and falls in the seventy years of age or older has increased to thirty-two percent to forty-two percent, the ratio of four percent to fifteen percent of the fall resulted in serious injury or accident Death. Now the old man because with age growth, and gradually decline, due to the function of the body occur in many disabled, sick and other psychological problems, and with the further development of science and technology, have been implemented using smart device remote monitoring of the old people's physical and psychological conditions, or the use of smart devices to assist the elderly daily life trivial is the most main intelligent endowment To show the method, and therefore a kind of smart clothing can provide elderly care services, the clothing can provide protection for the elderly's daily behavior

2. Overall System Design

This product is designed on the principle of healthy and safe life for the elderly and adopts modular design idea. The system is composed of hardware HT32F52352 core processing module, MPU6050 sensor, temperature sensor, heart rate sensor, and mobile phone terminal. Through the human body posture detection sensor, optical heart rate sensor, temperature sensor, GPS positioning module and other components to achieve product fall detection, health detection, loss prevention and other functions.

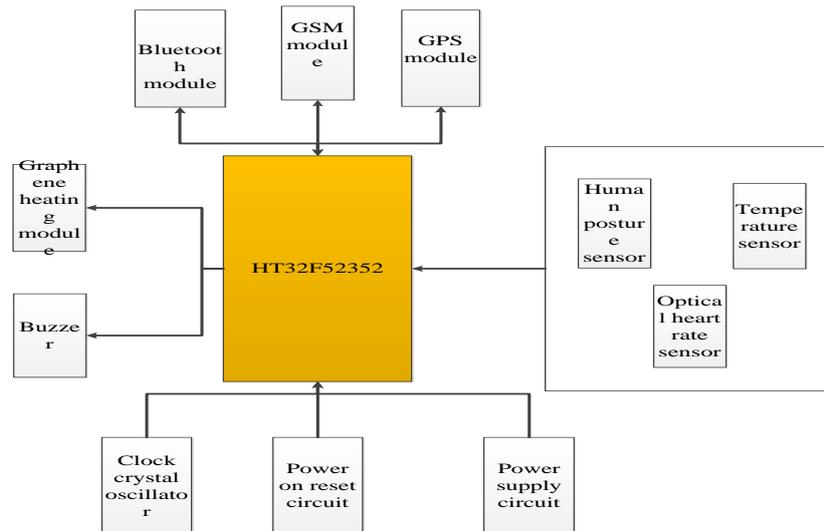


Figure 1. Run process

3. The Hardware Part

3.1 Master Chip Circuit

The main control chip adopts the 32-bit HT32f52352 chip, and its circuit includes crystal oscillator circuit and reset circuit.

3.2 GSM Circuit

GSM module is SIM800C, SIM800C module is a four-frequency GSM/GPRS module, support limit DC5V-18V wide voltage input; With power enable switch pin EN; Support lithium battery power supply interface VBTN 3.5-4.5V; Input supports mobile and Unicom cards Micro SIM cards.

3.3 GPS Circuit

The GPS module uses ATK-S1216F8-BD GPS, which is a high-performance GPS/ Beidou dual-mode positioning module.

Module S1216F8 module, small volume, excellent performance. The module can be configured through serial port into various line parameters, and saved in the internal FLASH, easy to use. The module comes with IPX interface and can use various active antennas. The module is compatible with 3.3V/5V level, which is convenient to connect various microcontroller systems.

3.4 MPU6050 Circuit

The MPU6050 consists of sensors. The MPU6050 is the world's first 6-axis motion processing sensor, which integrates a 3-axis gyroscope, a 3-axis accelerometer, and a data motion processor. The MPU6050 uses an ADC for the gyroscope and accelerometer to convert the analog amount it measures into an output digital amount. In order to accurately track the motion of MPU6050, the measurement range of the sensor is controllable by the user, so the threshold of the normal activity of the elderly can be preset according to their daily activities as the basis for judging whether they fall down. The MPU6050 sensor can not only detect the Angle value and acceleration value of human body in real time, but also integrate the attitude solver inside the module. With the dynamic Kalman filter algorithm, it can accurately detect the current human body attitude in the dynamic environment. MPU6050 can be used to detect the change of human body's Angle and posture characteristics in real time, find the difference between the change and the change of daily behavior, and improve the accuracy of anti-fall monitoring.

3.5 Temperature Sensor Circuit

For this product, we need to sense the temperature of the body surface rather than the ambient temperature, without direct contact with the object sensor. For this reason, we chose MLX90614 non-

contact temperature sensor, which uses laser or infrared to calculate object temperature. The MLX90614 uses an advanced low noise amplifier, a 17-bit ADC and a powerful DSP element in the signal regulation chip to achieve high precision temperature measurement, which has the characteristics of small size, low cost and easy integration.

3.6 Heart Rate Sensor

The MAX30100 is a non-invasive, integrated pulse oxygen saturation and heart rate monitoring sensor solution capable of reading heart rate and oxygen sensors. It combines two light-emitting diodes, a photodetector, optimized optics and low-noise simulation signal processing to detect pulse oxygen saturation and heart rate signals. The communication mode is through IIC. Its working principle is through the infrared LED lamp irradiation, can get the heart rate ADC value.

3.7 Software Part

Fall monitoring and alarm: this product uses MUP6050, can monitor the human posture, calculate the human fall trend, so as to realize the elderly fall warning function, the system needs to set value range threshold according to the normal activities of the elderly, using the system through the elderly acceleration and displacement distance inertia related values, then transfer the value to the master chip, chip comparison data if the elderly have fall trend will trigger the alarm and the fall information to the designated contact through GPS.

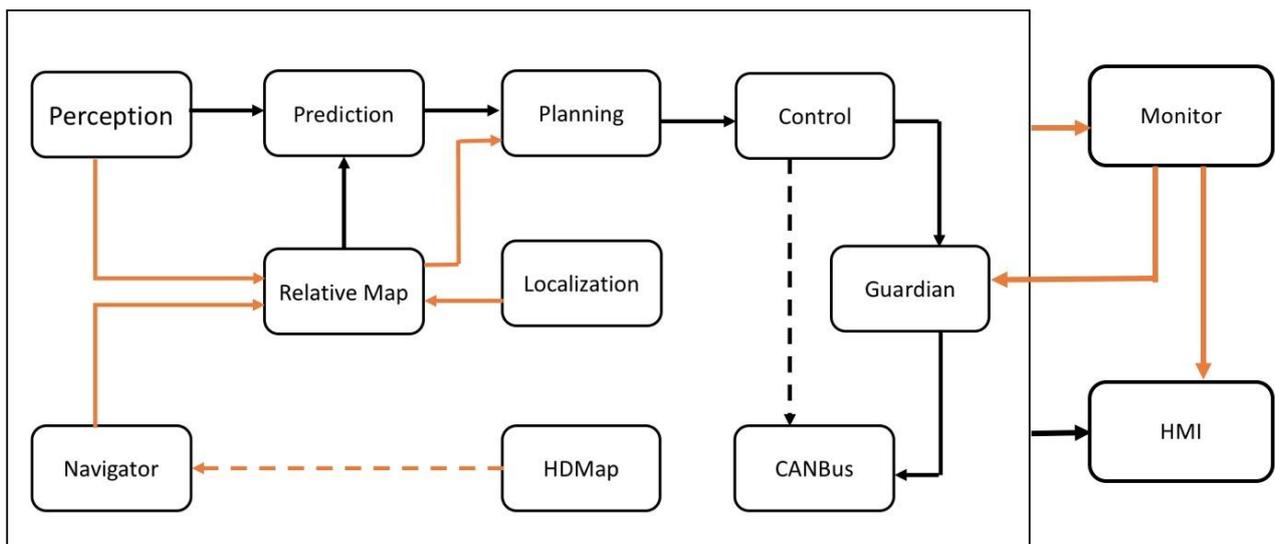


Figure 2. Operation principle of the software algorithm

Insulation and heat storage: the system temperature detection circuit includes an external temperature sensor and a built-in resistance, which can feedback the temperature in real time within a set time range, and can logically match with the predetermine value set by the user to ensure that the temperature is within the set temperature and allow the user to avoid skin burns caused by the user during the use process.

Heart rate data monitoring: the human health intelligent monitoring clothing system using HT32F52352 as the core microprocessor. The processor will cooperate with the heart rate sensor to extract and transmit the human physiological information data. The SCM will collect, process, display and wirelessly transmit the information provided by the sensor. Once an abnormal physiological information is found, the remote medical staff will receive the physiological information data for diagnosis. At the same time, the system will voice alarm and call emergency calls automatically.

Acknowledgments

Science and technology Research Project of Chongqing Education Commission in 2020, No. KJQN202003112.

References

- [1] Li Zidan, Wang Qiuhan. Design of intelligent anti-fall waistcoat for the elderly [J]. Clothing Guide, 201,10(01):82-86.
- [2] Rong hundred sichuan, Mr. Chen. Drop intelligent monitoring system based on bluetooth design [J]. Laser, 2019, 40 (07) : 32-34. DOI: 10.14016 / j.carol carroll nki JGZZ. 2019.07.032.
- [3] Xiao Wen-ke, Zheng Shi-chao, GAN Yan-xiong, Xu Ya-xin, Zhang Yi-jia, Wen Chuan-biao. Design and development of wearable Mugwort mugwort patch based on graphene far-infrared heating [J]. World Science and Technology-Modernization of Traditional Chinese Medicine, 201,23(10):3496-3502.