Advanced Materials Research *Online: 2014-02-27*
ISSN: 1662-8985, Vol. 898, pp 590-593
doi:10.4028/www.scientific.net/AMR.898.590

Research on Individual Monitoring System Based on PLC Technology

Zhu Mengzhong[1,a], Xu Jingwen[2,b], Liu He[3,c], Shi Yang[4,d]

[1] No.7350 RenMin Street ChangChun,China

[2] No.755 XinFa Square ChangChun,China

[3] The 23rd Floor HuaMao International Building,No4888 RenMin Street ChangChun,China

[4] No.3777 GongNong Road ChangChun , China

[a] zmzrenew@163.com, [b] 64643470@qq.com, [c] 110266650@qq.com, [d] 58644961@qq.com

Keywords: Monitoring; Individual Monitoring; PLC

Abstract. The paper presents modern PLC's network to Physiological parameter monitoring technology. In this paper a founding method and implement of the system for personal and real-time monitoring is described, including the operation of the whole system. The tests demonstrate that the system is stable, reliable as well as high timely and accuracy. This paper accords with the trend that the network is becoming the new development direction of Measurement Technology and Instrument. While the abnormal incidences happen, the system can immediately give an alarm automatically, in order to save the valued time for patients' first aid. The system can monitor the patients continuancely for 24 hours. Just take the very small device of data collection and wireless transmission subsystem, the Patients can move freely in a certain area.

Introduction

At present，it appears some community medical monitoring meters in the market ,they may gather the parameters of heart electrical signal, the blood pressure, the blood oxygen degree of saturation and so on. But they majority have unitary functions, can only simultaneously gather some physiological parameter, and these instruments gather the data cannot or can only save limitedly in its own memory. Most importantly they cannot carry on the correspondence with the computer, and they does not suit big sample time gathering, also they have other malpractices such as portable and so on.

In home, it had already some articles to put forward this concept of community medical monitoring system. But these community medical monitoring systems mainly based on the technical of blue tooth, GPRS and so on, and they have good and bad points respectively. The power line has high speed, takes the transmission carrier by the electric power transmission line, these merits that other technologies cannot also have. Because the power line takes the transmission carrier by the low pressure or the high pressure, this uses directly in the medical monitoring, it will give the guardianship objects some certain dangers. In order to avoid this kind of situation, this system has introduced the wireless communication technology; it causes the guardianship objects to be separated from the low pressure or the high-pressured danger[1][2].

The overall concept of Individual real-time monitoring unit[3][4]

The structure of individual real-time monitoring unit divides into user terminal module, correspondence module and guardianship center module. It bases on the power line correspondence and the wireless communication along with the healthy signal monitoring unit. It has mainly realized to gather the pulse and body temperature parameter of the guardianship objects, and has carried on the preservation to these parameters and processes correspondingly, then demonstrates the result through the corresponding indicating lamp. Moreover the user may transmit the parameter to the guardianship center server through the different operations, so that the doctors in the guardianship center's can give the corresponding solution measure. In addition, it also has the ration

storage space and the computer serial port, the goal is to serve well for the user. The total diagram of the system is as shown in Figure 1[6].

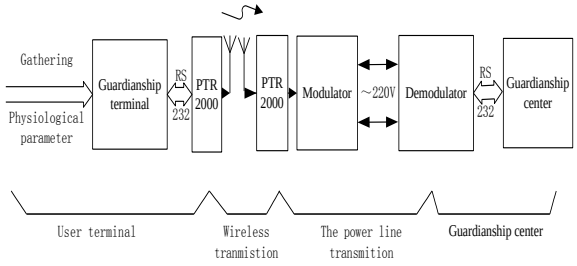

Fig.1 Individual real-time monitoring system diagram

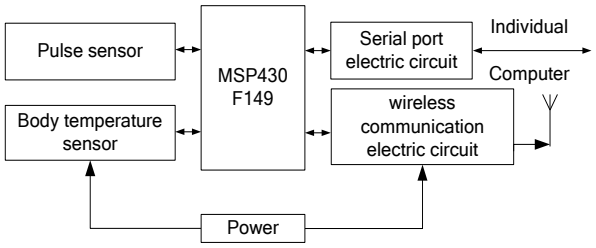

Fig.2 User terminal module diagram

Hardware design

(1) The hardware design of user terminal module

The user terminal module hardware takes MSP430F149 as a core, and it connects guardianship parameter gathering electric circuit, wireless communication electric circuit, Serial port electric circuit and so on. The connection of hardware is as shown in Figure 2.

1) Parameter gathering electric circuit

This part is composed of the pulse sensor and the body temperature sensor. The pulse sensor mainly uses the HK-2000A sensor, and the body temperature sensor uses the DS18B20 sensor, they connect with the monolithic integrated circuit I/O mouth separately.

2) Wireless communication electric circuit

This part is composed of PTR2000. It mainly transmits the guardianship parameter to the power line, carries on the correspondence with the guardianship center indirectly.

3) Serial port and power circuit

This part uses the RS232 electric circuit; it connects the user terminal module and the local personal computer. In order to sharpen the ant-jamming ability for the user terminal, wireless communication electric circuit and other electric circuit are supplied power separately in power source's design.

(2) Connection module hardware design

The connection module hardware is composed of the wireless communication electric circuit and the power line communication circuit，structure reference diagram as shown in Figure 1. The power line communication circuit is mainly composed of the modulator electric circuit and the demodulation electric circuit. Because these two circuit structure is the same, I only introduce modulator electric circuit.The modulator electric circuit composes of the signal transmission electric circuit, the signal accepting circuit and the zero crossing detection electric circuit and so on, Structure drawing as shown in Figure 3.

1）Signal transmission electric circuit

Transmission electric circuit constitutes by a low pass filter and a power amplifier. The function of the low pass filter is that filtrating high frequency signal ingredient and smoothing DAC output signal. Power amplifier's output connects on the power line through a coupling transformer. Filter's band width is decided by the use carrier frequency. The request of the power amplifier is that obtains 1-2Vrms signal level under 2~100 ohm's impedance after process transformer. Moreover, LME2200C supports the half-duplex working pattern. When transmits uses, the power amplifier is open, but when receive, closing the power amplifier to enhance the receive impedance.

2）Signal accepting circuit

In receive circuit, the signal which obtains after the coupling transformer delivers the internal amplifier to enlarge, then after piece outside bandpass filter delivers to the chip RXIN input, and the data packet is received by the internal receiver.

3）Zero crossing detection electric circuit

The zero crossing detection electric circuit outputs a square-wave signal, its rise is along in power frequency signal zero crossing places. This signal serves as LME2200C the SYNC lock input, and it is as receiving and dispatching synchronization datum.

Software design

The software design of this system includes user terminal software design, correspondence software design and guardianship center software design.

1）The software design of user terminal

User terminal MSP430F149 through temperature, pulse sensor gathering temperature and pulse, after making corresponding processing, and transmit to the guardianship center to demonstrate through the wireless transmission connection module and the power line connection module. Procedure flow chart is as shown in Figure3.

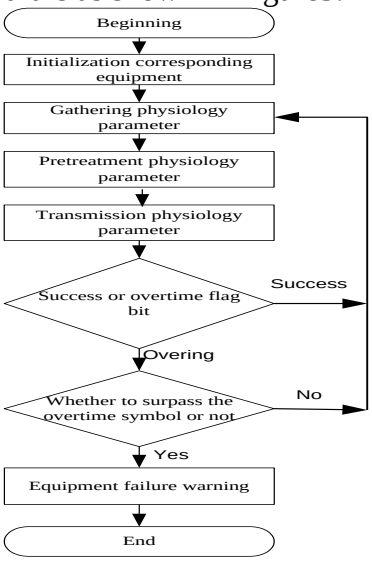

Fig.3 User terminal flow chart

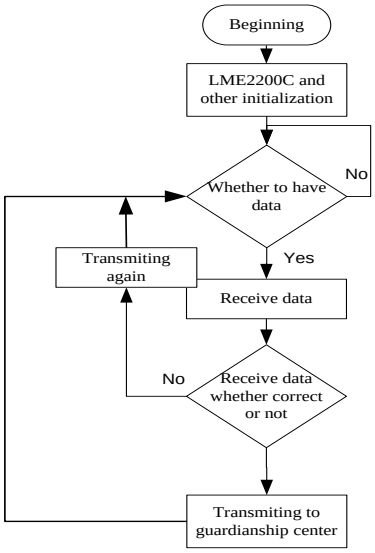

Fig.4 Demodulator flow chart

2） The software design of correspondence

The correspondence software primary cognizances real-time receive user terminal sends the data, and making this data to corresponding compress. Then it transmits to the guardianship center through the modem. Procedure flow chart is as shown in Figure4.

3）The software design of guardianship center

The guardianship center software supposes mainly divides into the database part, the network part and the diagnosis and the statistical part. The overall system uses the multi-thread programming, namely a master line and many vice-lines. And the main thread is responsible to manage to system's operation, such as various parameters establishment and so on; the data receive and the guardianship data's diagnosis and the information statistics use the independent vice-thread to complete separately. Procedure flow chart is as shown in Figure5.

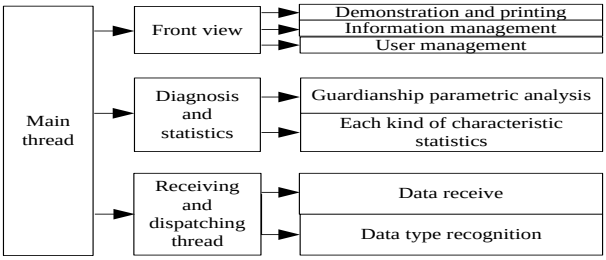

Fig.5 Software flow chart of guardianship center

Simulation and actual[7]

In this system experiment, it has carried on the function introduction and the performance confirmation to the laboratory design of the system development board.

Concluding remark

This article aims at the insufficiency in the current traditional community medical monitoring system. It has designed a new family medical monitoring system which collects computation technology, the power line technology, the wireless technology and the sensor technology. Proved after the experiment, this system is operation stable reliable, timeliness strong, high accurate and maintainable.

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