Amplified Acquisition of Physiological Signal in Human Body Communication

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Abstract

Human physiological signal communication attracts many researchers today. However, the acquisition accuracy of sensing signal in human body monitoring system is not high enough. In this way, an amplification acquisition method of human physiological sensing signal is studied in this paper. Detailedly, when the physiological sensing signals such as blood pressure, heart rate and body temperature are collected by physiological sensors, the weak signal is amplified by the amplification circuit through both the preamplifier and the reverse amplifier circuits. The current amplified signal is converted to digital signal by the A/D conversion device of micro control unit, and the digital signal is filtered by the embedded discrete FIR algorithm in DSP. Afterwards, the filtered digital signal is displayed on LCD display interface to realize the effective acquisition of human physiological signal. Experimental results show that the acquisition accuracy of this method is more than 99%, and both the networking, connection and acquisition time are all less than 50ms, which fully indicates that the proposed method has a high practical application value.

Keywords: Human physiological signal, Sensing signal, Amplification acquisition, Amplifier circuit, A/D conversion

1 Introduction

In recent years, the number of people who died from heart diseases has increased year by year. Timely detection and prevention of diseases in advance can achieve good control of various chronic diseases. The world's population aging problem is serious, long-term and sudden diseases need to be found and controlled in time. Today, human health monitoring is extremely important because monitoring and analyzing human physiological signals can timely detect and prevent abnormalities [1]. Hospital monitoring equipment has the defects of expensive and bulky [2-4], which cannot meet the daily detection of human body. In this way, the wearable, convenient and easy-carried monitoring system is of high necessity since they can realize the monitoring of human physiological signals without affecting people's normal life. Today, the physiological signals are of great significance to the monitoring and prevention of chronic diseases [5], and can be applied to disease prevention and health monitoring of individuals and families, saving social medical resources and medical costs with strong applicability.

At present, there are many researches on human physiological information acquisition. VivoMetric has developed a human physiological monitoring system that can collect human physiological parameters. The system is mainly used to monitor human ECG signals and human physiological status by mobile terminals; The MIThril project from the Media Lab studies the context-aware wearable computer platform. It applies human-computer interaction technology to the researched wearable monitoring system, and uses wireless communication to extract the physiological sensing information and use it to provide the patients "memory glasses" that can realize situational perception. Fraunhofer IZM researched the sensory shirt with soft electrodes placed inside to collect human ECG signals, which can monitor various physiological parameters such as blood oxygen, blood pressure, and body temperature. In China, the Air Force Institute of Aviation Medicine of the People's Liberation Army has studied equipment that can monitor body temperature, ECG signals, and heart rate.

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Related research scholars have proposed the use of multi-node and reflective methods for physiological signal extraction, which has high scalability and can realize the monitoring of many physiological parameters.

Because Zigbee technology has various benefits such as the high transmission rate, low cost, low power consumption and long communication distance, it can meet the needs of sensor signals in human body communication. In this way, the proposed method applies the amplified acquisition technology to the sensor signals in human body communication with simple operation, intelligence and wide coverage by using Zigbee technology to validate the sensor signals in human body communication, which fully considers the noise interference in the process of acquisition of sensor signals and uses discrete FIR algorithm to improve the acquisition accuracy of sensor signals.

Overall, in order to further improve the collection and transmission performance of human physiological sensing signals, a research on amplification and acquisition technology of signals in human body communication is proposed. The research route is as follows:

(1) Human body physiological sensors are used to collect physiological sensor signals such as blood pressure, heart rate and body temperature of the human body.

(2) According to the collected physiological sensing signal in human body, the amplifying circuit is used to amplify the tracked weak signal through both the preamplifier and the reverse amplifying circuit. Then, by amplifying the AD conversion device of the micro-control unit, the signal is digitally converted.

(3) The acquired digital signal is filtered by the embedded discrete FIR algorithm in the DSP, and the filtered digital signal is displayed on the LCD display interface to realize the effective collection of human physiological sensor signals.

2 Amplification and Acquisition in Human Physiological Sensing Signal communication

2.1 Architecture of ENlarge Acquisition Technology

The amplified acquisition technology is applied to the acquisition of signals such as human heart rate, body temperature and blood pressure. The wearable photoelectric pulse sensor is used to collect the pulse waveforms of the finger and the arm arteries [6]. When blood pressure is obtained, the tracking distance is fixed, the sampling accuracy and frequency are adjusted freely [7]. The collected physiological signals in human body are converted into digital signals by the AD conversion device of micro-control unit, and the acquired digital signals are used to validate the processing and analysis of physiological data in human body. Zigbee technology is also used for transmission and communication of signals.

Figure 1 shows the architecture of amplified acquisition technology of sensor signals for human body communication in this paper.

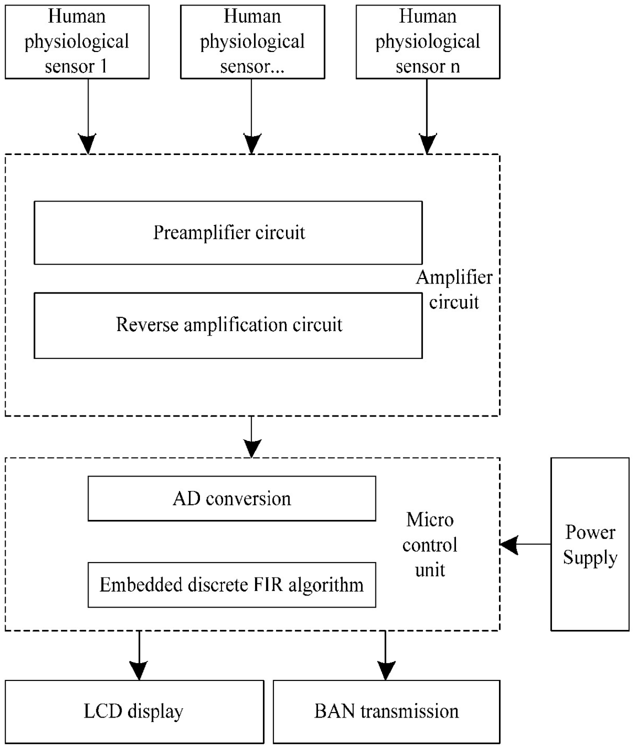


Figure 1. Architecture of amplified acquisition technology

The sensor signals in human body communication are validated by Zigbee technology. The front interface is a physiological sensor of human body. The collected signals are sent to the micro-control unit by using an integrated signal conditioning circuit. The micro-processing unit reserves many interfaces, which can randomly add physiological sensors. It is with high scalability, miniaturization and integration of acquisition of physiological signals in human body. The physiological sensor of human body is connected with the micro-control unit circuit through wiring [8-10]. Meantime, the micro-control unit validates AD conversion, digital filtering and analysis of physiological information in human body. The terminal node of Zigbee and processor of micro-control unit use SPI protocol to transmit data. The physiological parameters in human body are received by Zigbee nodes, and then send to the coordinator nodes using wireless communication protocol. Finally, the coordinator nodes transmit the data to the server.

2.2 Amplifier Circuit

The amplifier circuit converts the current signal output by the physiological sensor of human body into a voltage signal, and amplifies it. The change of the input power of the four-quadrant detector affects the amplifier circuit [11]. In fact, when the input power is in a range of 10nW-100μW, the weak signal can be amplified and the accuracy of acquisition signals can be improved.

A two-stage amplification method is used to validate the amplification of circuit. Firstly, a preamplifier circuit is used to convert the current signal to a voltage signal. Then the voltage signal is output by the reverse transimpedance amplifier circuit which can validate the fixed gain. The output of the obtained voltage amplifier circuit is made to meet the requirements for the range of analog input signal of A/D.

2.2.1 Preamplifier Circuit

The collected signal is a physiological signal in human body, which is relatively weak. The amplifier circuit is required to have the characteristics of wide dynamic range, low noise and high gain. The output impedance of signal physiological source in human body is required to be matched with the noise characteristics of the preamplifier, and a higher common-mode rejection ratio is used to obtain the best noise characteristics [12]. The selected amplifier should have characteristics of high stability, high precision, strong interference capability and low noise. When the amplifier is used in a high-gain transimpedance amplifier circuit, the bias current is required to be low, which makes the caused DC bias of the output in the amplifier circuit is low.

OPA376 is selected as the amplifier for acquisition of sensing signals in human body. The amplifier has the characteristics of high-gain stability, low noise and low temperature drift. The maximum bias current and the input offset voltage of the amplifier are 10pA and 25μV, input noise voltage and input noise current are 7.5nV and 2fA.

The pro-auto gain transimpedance amplifier circuit is shown in Figure 2.

The control lable dynamic range of gain in the transimpedance preamplifier circuit is 70-130dB. The analog switch is used to switch the gain of the amplifier circuit. The gain of the circuit is affected by the on-resistance of the analog switch, and low on-resistance can reduce the influence. The type of the analog switch is ADG1604, and the typical on-resistance and off-leakage current of the analog switch are 1Ω and 0.1nA. Compared with the feedback resistance, the analog switch has a lower effect on the amplification factor. Then, FPGA is used to control the analog switch [13]. After the physiological signal in human body is converted by A/D, FPGA receives the signal and adjusts the control signal of analog switch according to the signal size. It connects the analog switch by one of the circuits to switch the gain of the amplifier circuit. Thus, the amplier circuit has high adaptability to different ranges of input signal.

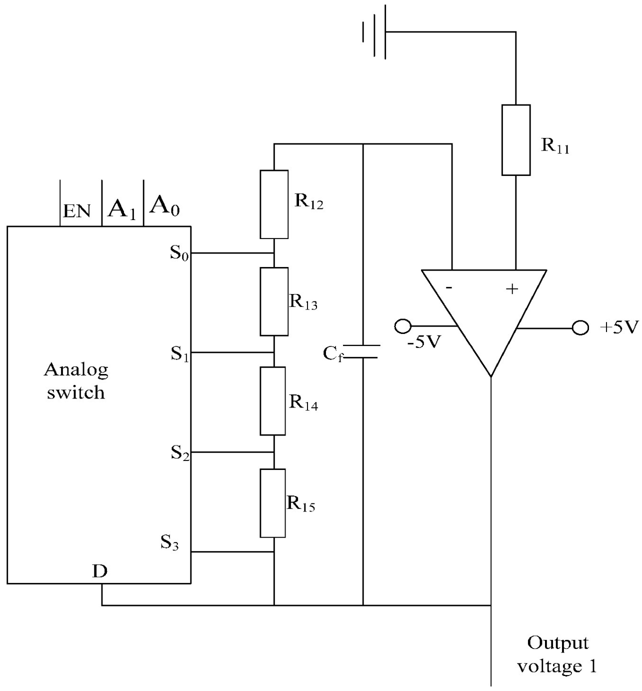


Figure 2. Automatic gain transimpedance amplifier circuits

Parasitic capacitance may be formed at the input of the amplifier. The parasitic capacitance and feedback resistance form a log network during the conversion of I/Vtransimpedance amplifier circuit. It causes the lag of the phase of output voltage, and the lag phase causes parasitic oscillations, which makes the stable acquisition of sensor signals poor. It uses the advanced compensation technology to compensate the phase [14-16], which improves the stability of the transimpedance amplifier circuit, which connects the compensation capacitor in parallel to both ends of the feedback resistor to ensure sufficient phase margin of the amplifier circuit during the process of signal acquisition.

2.2.2 Reverse Amplifier CIrcuit

The voltage signal is usually a negative output by the transimpedance amplifier circuit. The reverse of the voltage signal can be obtained to use the second-stage amplifier circuit. Then, the circuit needs to fit the requirements for the signal range of analog input of A/D [17]. On the basis of adding the RC low-pass filter circuit and the second-stage reverse amplification, the out-of-band noise can be effectively suppressed by the RC low-pass filter circuit, so the output signal has a higher signal-to-noise ratio [18]. The second-stage reverse amplifier circuit is shown in Figure 3.

The voltage signal outputting by the transimpedance amplifier circuit can be amplified 14dB gain processed by the reverse amplifier circuit, and the range of total gain of the amplifier circuit processed by the second-stage reverse amplifier circuit can be 95dB-160dB.

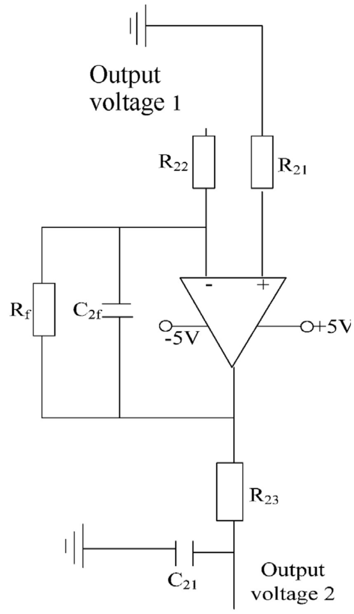


Figure 3. Reverse amplifier circuit

2.3 Embedded discrete FIR in DSP

In order to further improve the acquisition accuracy of sensing signals in human body, a filter is added on the reverse amplifier circuit, which filters digitally to the collected signals in human body [19].

The window function is used to design the FIR filter, and the Kaiser function is selected to validate the FIR filter of the acquisition of sensing signals in human body [20-26]. The formula of the Kaiser window is as follows:

$$w(n)=\frac{I_0(\lambda)\left(1-(1-\frac{2n}{n-1})^2\right)^{\frac{1}{n}}}{I_0(\lambda)} \quad \textbf{(1)}$$

In formula (1), λ and N represent the shape parameter and filter length, which are determined by the stopband attenuation, $I_0(x)$ denotes the first kind of zero order Bessel function. The expansion formula of the power series of $I_0(x)$ is as follows:

$$I_0(x)=\sum_{r=1}^{\infty}\left[\frac{(x/2)^2}{r!}\right]^2 \quad \textbf{(2)}$$

By using w_P and w_S denote the passband frequency and stopband frequency, and A denotes the value of stopband attenuation. The process of designing a low-pass filter with the above parameters is as follows:

(1) Δw (width of filter band) and w_C (passband frequency) are set as ideal conditions. The calculation formula is as follows:

$$w_C=\frac{w_P+w_S}{2} \quad \textbf{(3)}$$

$$\Delta w=w_S-w_P \quad \textbf{(4)}$$

(2)denotes the value of stopband attenuation, which can obtain (the filter length) and (shape parameter). The formula is as follows:

$$N=\begin{cases}\frac{A-7.84}{13.25\Delta w/2}+1 & A>20dB\\ \frac{0.911}{\Delta w/2}+1 & A\le 20dB\end{cases} \quad \textbf{(5)}$$

$$\lambda=\begin{cases}0.1101(A-8.6) & A>50dB\\ 0.5731(A-20)^{0.4}+0.07775(A-20) & 20\le A\le 50dB\\ 0 & A<20dB\end{cases} \quad \textbf{(6)}$$

(3) The formula for obtaining (the sample response) of (Kaiser Window function) is as follows:

$$h[n]=h_d[n-r]w[n]=\frac{\sin[w_c(n-r)]}{\pi(n-r)}w[n] \quad \textbf{(7)}$$

In formula (7), r is the filter order. Through the above process, the filtering processing of the amplified acquisition of sensor signals in human body communication is validated[27-30]. And the accuracy of the collected sensor signals of human body is improved.

3 Results

In order to verify the effectiveness of the amplified acquisition technology of sensor signals in human body communication, the method in this paper is applied to the body monitoring system. The system can display physiological data of human body, collect heart rate, blood pressure, body temperature and many other physiological signals. The indexes of various physiological parameters of the system are shown in Table 1.

Table 1. Indexes of physiological parameters

Index	Number
Range of blood pressure/mmHg	10-300
Accuracy of blood pressure/mmHg	±6
Range of heart rate/(number/min)	40-190
Accuracy of heart rate/%	±5
Accuracy of temperature /°	0.5
Range of temperature /°	0-50

3.1 Blood Pressure Data acQuisition

Ten adults with normal cardiovascular function and good health were selected as testers. Two testers were randomly selected to collect their blood pressure under normal condition. In order to verify the accuracy of the sensor signals in human body collected by the method in this paper, the blood pressure collected by the method was compared with the blood pressure of electronic sphygmomanometer. And the comparison results are shown in Table 2.

Table 2. Comparison of blood pressure under normal condition

Number of testers	Test time	The proposed method		Electronic sphygmomanometer	
		Diastolic Blood Pressure/mmHg	Systolic Blood Pressure/mmHg	Diastolic Blood Pressure/mmHg	Systolic Blood Pressure/mmHg
1	8:30	86	126	85	124
1	8:40	84	125	83	126
1	8:50	82	124	83	125
1	9:00	83	126	84	128
1	9:10	81	128	82	126
1	9:20	81	126	82	127
2	8:30	75	118	76	120
2	8:40	76	116	78	118
2	8:50	71	121	72	123
2	9:00	78	118	79	119
2	9:10	73	119	75	121
2	9:20	82	115	81	116

The experimental results in Table 2 show that the pulse rate of arterial blood pressure obtained by using the method in this paper to collect sensor signals in human body is similar to the result of the electronic sphygmomanometer. It indicates that the blood pressure data in the physiological parameters collected by the proposed method has higher accuracy, which can meet the requirements of acquisition accuracy of sensor signals in human body. The accuracy of blood pressure data using the proposed method is within 3mmHg, which meets the accuracy requirements of blood pressure measurement.

3.2 Heart Rate Data Acquisition

It uses the method in this paper to collect the heart rate and body temperature obtained by the sensor signals in human body of two testers, and compares them with the heart rate monitor and the mercury thermometer. The comparison results are shown in Table 3.

Table 3. Comparison of collected heart rate

Number of testers	Test time	Heart rate/min^{-1}		Body temperature/°	
		The proposed method	Heart Rate monitor	The proposed method	Mercury thermometer
1	8:30	79	78	36.8	36.7
1	8:40	77	76	36.7	36.6
1	8:50	76	75	36.5	36.5
1	9:00	75	76	36.4	36.5
1	9:10	78	77	36.5	36.4
1	9:20	76	77	36.8	36.9
2	8:30	83	84	36.7	36.8
2	8:40	89	90	36.5	36.7
2	8:50	86	84	36.6	36.7
2	9:00	84	86	36.8	36.6
2	9:10	85	87	36.6	36.6
2	9:20	86	88	36.7	36.8

The experimental results in Table 3 show that the accuracy of the heart rate and body temperature collected by the method in this paper is higher. The error of the collected heart rate with the proposed method is within two beats in one minute. The error of the collected body temperature is within 0.2°. It effectively verifies the acquisition performance of sensor signals in human body of this method. Through the collected physiological sensor signals, the diagnosis and treatment of chronic diseases in human body can be validated. The amplified acquisition technology of sensor signals in human body communication, which uses Zigbee technology to validate data transmission, is convenient for doctors to analyze and guide the collected physiological data of human body, then monitor the human body health constantly.

Under the above experimental data, the overall experimental scheme is set as follows: physiological signal acquisition accuracy, throughput, sampling period, signal acquisition quantity, communication efficiency and time performance as the experimental comparison indexes, and the proposed method is compared with multi node method and reflective method.

3.3 Comparison of Physiological Signal Acquisition Accuracy

When the body monitoring system works at the rated acquisition rate, the conversion accuracy of discrete subsamples determines the acquisition accuracy and the limit of the system accuracy, which is the accuracy of analog-to-digital converter. Acquisition accuracy refers to the difference between the actual output and the theoretical output of the body monitoring system. The sum of all errors in the system determines the acquisition accuracy of different methods. The results are shown in Figure 4, which are the acquisition accuracy of the sensor signals in human body of 10 testers through the method in this paper.

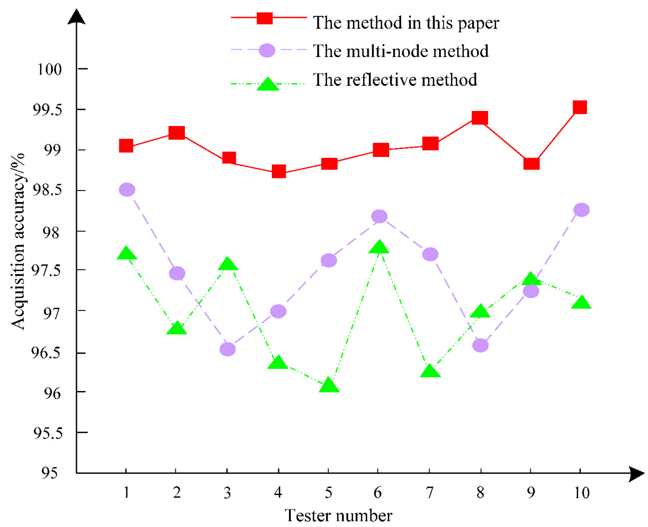


Figure 4. Comparison of acquisition accuracy

The experimental results in Figure 4 show that the acquisition accuracy of the physiological sensor data in human body of the testers using the method in this paper is higher than 99%. The acquisition accuracy using the other two methods is lower than 98.5%. The results effectively verify that the method in this paper has a high acquisition accuracy of physiological sensor data in human body.

3.4 Throughput Comparison

Throughput rate, passing rate and sampling frequency determine the acquisition rate of sensor signals in human body collected by different methods. The acquisition rate refers to the number of acquisition completed by the input analog signal in a unit time under the condition that the accuracy index is met. It is the number of sub-samples collected by each channel of the system per second. The results collecting throughput rate with different methods are shown in Figure 5.

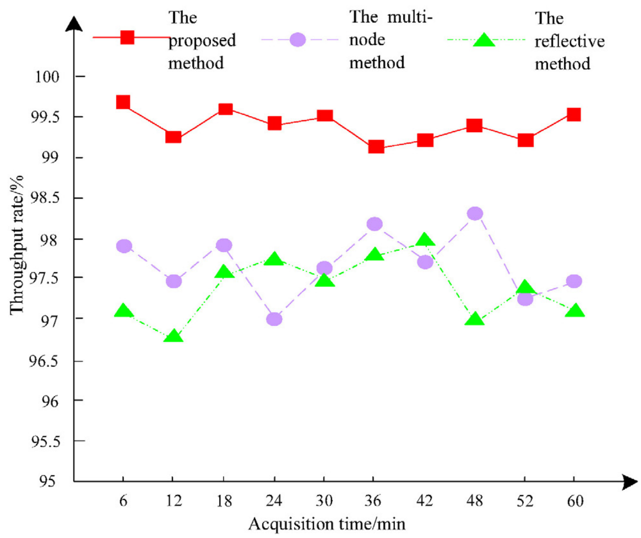


Figure 5. Comparison of throughput rate with different methods

The experimental results in Figure 5 show that the method in this paper collecting sensor signals in human body has a high throughput rate. The throughput of this method is higher than 99%. The throughput rate collecting by the other two methods is lower than 98.5%. It effectively verifies that the method in this paper has a higher throughput rate. When applying the method in this paper to the body monitoring system, it can improve the transmission rate of the system.

3.5 Comparison of Sampling Periods

The sampling period corresponds to the acquisition rate in the time domain, and the sampling period can effectively reflect the time requirement for the collecting a piece of data. The results of the sampling period with different methods are shown in Figure 6.

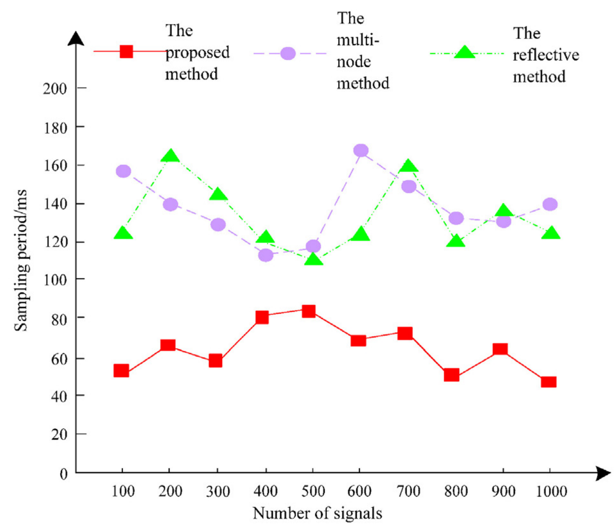


Figure 6. Comparison of sampling period with different methods

Table 4. Changes of dynamic range

Acquisition time/s	The Proposed Method/dB		The Multi-node Method/dB		The Reflection Method/dB	
	Dynamic Range	Instantaneous Dynamic Range	Dynamic Range	Instantaneous DynamicRange	DynamicRange	Instantaneous Dynamic Range
0	125	135	105	118	92	125
40	118	145	95	116	94	134
60	124	136	94	124	93	128
80	116	145	93	116	97	123
100	114	135	105	134	91	127
120	123	134	114	125	105	119
140	117	135	105	129	94	105
160	116	126	98	114	94	115
180	125	136	117	126	95	104
200	134	148	105	121	105	125

The experimental results in Figure 6 show that the sampling period of different signal quantities for collecting the physiological sensor data in human body by the method in this paper is less than 100ms. The sampling periods of multi-node method and reflection method are higher than 100ms. It verifies that the method in this paper has a higher acquisition rate.

3.6 Comparison of Signal Acquisition Quantity

The dynamic range of the signal refers to the number of decibels between the maximum amplitude and the minimum amplitude of the collected sensor signals in human body. The dynamic range of sensor signals in human body collected by different methods refers to the number of decibels between the maximum amplitude and the minimum amplitude by the first digit input. The maximum allowable amplitude and the minimum allowable input are respectively the minimum input amplitude at which the amplifier is saturated and the equivalent input noise level. When high-precision acquisition of physiological sensor data in human body is with a large dynamic range, the instantaneous dynamic range is another important indicator for evaluating the acquisition performance. The maximum value of the radio of the maximum frequency component amplitude to minimum frequency component amplitude of the sensor signals in human is the instantaneous dynamic range within a fixed time.

The results of dynamic range and instantaneous dynamic range with three methods are shown in Table 4.

The experimental results in Table 4 show that the dynamic range and instantaneous dynamic range of physiological sensor data in human body collected by this method are higher compared with the other two methods. The method in this paper can effectively validate the amplification of sensor signals in human body and improve the acquisition bandwidth of sensor signals in human body. The high acquisition performance can be applied to the actual monitoring of physiological signals in human body.

The number of physiological signals in human bodyis collected within 200s, which are collected by the method in this paper. The results compared with the other two methods are shown in Figure 7.

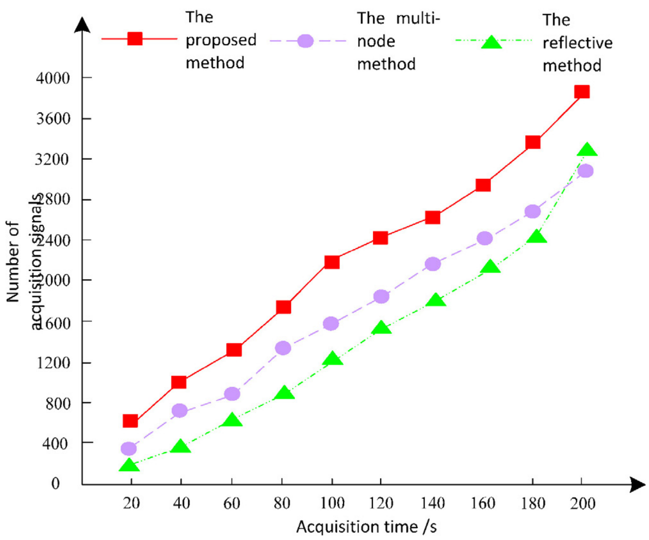


Figure 7. Comparison of quantity of signal acquisition with different methods

The experimental results in Figure 7 show that the number of sensor signals in human body collected by the method in this paper is significantly higher than that of the other two methods. It verifies that the proposed method has higher effective acquisition. According to the experimental results, the method in this paper is more convenient for doctors and guardians to analyse human body conditions based on sensor signals in human body, which is suitable to be widely used in collecting sensor signals in human body.

3.7 Comparison of Communication Efficiency

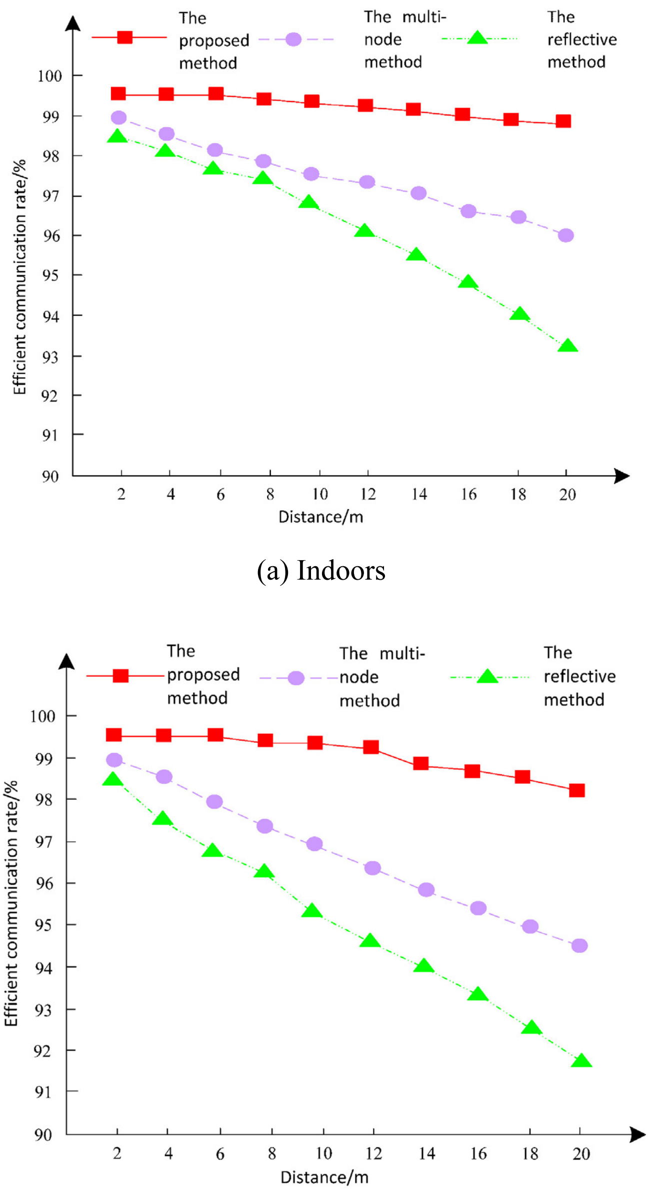
The method in this paper is applied to the body monitoring system. Zigbee technology is used to validate signal communication. The performance of collecting sensor signals in human body communication is extremely important. The relationship between the distance of collecting the sensor signals in human body communication and the bit error by the method in this paper is tested. Acquisition sensors of physiological signal are placed in various parts of the human body, and relevant data are recorded every 2 meters. The communication differences in the process of signal acquisition by the method in this paper are counted in indoor and outdoor situations. The ratio of the normal receiving data packets to all data packets sent by the physiological signal sensor with different methods is calculated under different distances. The results are shown in Figure 8.

The experimental results in Figure 8 show the effective communication rate when the acquisition environment is indoors is significantly higher than outdoors through the method in this paper. The effective communication rate under the measurement range within 10meters is significantly higher than that more than 10meters. The effective communication rate of this method for collecting sensor signals in human body is higher than the other two methods under different distances. It is verified that the method of this paper has higher effective communication rate, which can improve the communication performance of the body monitoring system.

3.8 Time Performance Comparison

The results are shown in Table 5 with the network time, connection time and acquisition time of the sensor signals in human body of 10 testers using the method in this paper.

The experimental results in Table 5 show that the network time, connection time, and acquisition time are all less than 50ms using the method in this paper to collect physiological information in human body. The network time, connection time, and acquisition time are higher than 50ms using the multi-node method and reflection method. The acquisition time of the reflection method is higher than 200ms. It verifies that the method in this paper has high real-time performance for collecting physiological information in human body. The real-time performance is of great importance for understanding the human health status in real time. The experimental results effectively verify that the method in this paper has high real-time, which is suitable for collecting physiological information in human body that requires a high time delay.



(a) Indoors

(b) Outdoors

Figure 8. Efficient communication rates in different distances with different methods

Table 5. Comparison oftime performance

Number	The method in this paper/ms			The multi-node method /ms			The reflection method /ms		
	Network Time	Connection Time	Acquisition Time	Network Time	Connection Time	Acquisition Time	Network Time	Connection Time	Acquisition Time
1	15	35	49	58	82	126	72	125	269
2	13	26	42	59	84	135	81	134	284
3	16	27	43	85	86	165	76	182	236
4	17	24	46	43	83	187	73	135	208
5	18	28	48	61	76	124	64	123	265
6	16	26	45	58	81	136	46	124	278
7	15	21	42	61	76	129	75	125	268
8	17	28	46	67	82	134	79	116	234
9	19	29	38	68	83	158	81	128	275
10	13	24	45	69	86	137	91	134	298

4 Discussion

The amplified acquisition technology of sensor signals in human body communication. In the process of collecting sensor signals in human body, it is necessary to ensure the correctness of the acquisition method and the scientific and integrity of the collected signals. Then the confidence of monitoring physiological data in human body is improved to ensure the safety of the process in signal acquisition. The amplified acquisition technology is applied to the sensor signals in human body communication. And the Zigbee technology is used to validate the wireless of sensor signals in human body communication. The working frequency of Zigbee technology is 2.4GHz, which has a higher application. Zigbee technology is applied to the sensor signals in human body communication, and the main advantages are as follows:

(1) Low power consumption

Compared with other wireless sensor networks, physiological sensors in human body have higher power consumption requirements. They usually use batteries to power wearable sensor nodes. Zigbee can support sleep mode, with the advantage of low power consumption, lower activation time and lower networking time. One to two years of continuous working time can be achieved with the use of AA batteries. Bluetooth has a short working time. Wi-Fi has the largest power consumption in practical applications, which can only last a few hours used with physiological sensors in human body.

(2) Communication security

Zigbee has high communication security. When collecting sensor parameters in human body, the collected physiological data in human body is closely related to people's physical conditions. So the safety is of high significance. High privacy is required when collecting physiological data in human body. Zigbee can provide high authentication information and encryption to improve the security of communication networks.

(3) Network topology

Zigbee has three topological structures: mesh, star and tree. It has high network expansion performance. A single topology of Zigbee can set up 256 nodes, which can be applied to large-scale sensor network. Bluetooth technology only has a single network structure. And a single network can only accommodate a small number of nodes, which is not suitable for large-scale sensor network.

(4) Low cost

The monitoring of physiological data in human body is suitable for household health monitoring, so its low cost is extremely important. Zigbee has a lower cost and is suitable for collecting sensor data in human body.

(5) High transmission rate

The data transmission rate in the process of acquisition of sensor signals in human body is extremely important. The acquisition frequency and transmission rate of ECG acquisition in medical treatment are usually 200Hz and 72KB/s. The acquisition frequency of body temperature and blood pressure is low, and the data transmission rate is less than 10KB. Zigbee has a high transmission rate, which can meet the requirements of transmission rate of physiological sensor information in human body.

5 Conclusion

In order to improve the performance of human physiological sensing signal communication, the amplification and acquisition technology in human physiological sensing signal communication is proposed. The performance of the technology is verified from both theoretical and experimental aspects. The technology has low power consumption and high transmission efficiency in the amplification and acquisition of physiological sensing signal communication. It fully shows that the technology has high effectiveness in collecting human physiological sensing signals, can effectively avoid interference noise interference on human physiological sensing signals, and has high communication performance. In the future research work, we will focus on the transmission efficiency to meet the needs of efficient transmission.

Acknowledgments

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