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Design of an Intelligent Acquisition System for Athletes' Physiological Signal Data Based on Internet of Things Cloud Computing

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Abstract
The application background of physiological signal research focuses on education and research in the fields of life sciences, clinical diagnosis and monitoring applications, and is an important content in the field of biomedical engineering. The development and use of intelligent physiological signal acquisition systems have also become the current life science research One of the hot spots. The acquisition and processing of physiological and medical signals is an important technology in biomedical engineering, which provides a necessary benchmark for the research of sports physiology and medicine. This article aims to provide some ideas and directions for the research on collecting physiological signal data of athletes under the cloud computing environment and the application of Internet of Things technology.and mainly introduces the design of the intelligent acquisition system of physiological signal data of athletes under cloud computing. This paper proposes an intelligent acquisition method for athletes' physiological signal data under cloud computing, including the design of power frequency filter and the energy model of the TDMA protocol system, which is used to conduct research experiments on the design of an athlete's physiological signal data intelligent acquisition system under cloud computing. The experimental results of this article show that the average collection accuracy rate of the system is 97.01%, the test of the intelligent acquisition system shows that the stability of the system is very high, and the accuracy rate is high, which can better collect the physiological signal data of athletes.

Keywords Cloud computing · Physiological signals · Intelligent systems · Data collection

1 Introduction

The rapid economic development has greatly promoted the development of information technology. In the past ten years, cloud computing technology has entered people's field of vision, and many cloud service platforms have emerged, and these platforms have been widely used in many fields. At the same time, the Internet of Things technology is also booming with the advent of the information age. The development of the Internet of Things has spawned a large number of industrial industries. At the same time, the application of the Internet of Things technology has brought convenience to all areas of life and promoted people, society and Natural coordination, harmony and development. Cloud computing is a new type of commercial computing model, which evolved from the development of distributed computing, parallel computing, virtual computing and other technologies. Compared with traditional networks, cloud computing compares networks with large resource pools. People can follow their own the need to obtain resources from the large resource pool of the network.

Physiological signal parameters are important indicators for evaluating the functional state of the human body. Each parameter contains a lot of information on vital characteristics, and is an important basis for clinical diagnosis and daily monitoring. Common human physiological signals are: brain electricity, eye electricity, myoelectricity, electrocardiogram, stomach electricity, body temperature, blood oxygen saturation, respiration and so on. These physiological parameters are important means for the diagnosis and treatment of cardiovascular and cerebrovascular diseases, neurological diseases and cognitive disorders. Therefore, long-term, accurate and reliable collection and monitoring of multi-parameter

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physiological signals can not only obtain the patient's physiological and pathological status information in time, but also provide clinical diagnosis basis. At the same time, the data of various physiological signals is very important. The value of clinical research. The development of modern science and technology and its application in the field of sports research have provided sports researchers with more advanced research methods and methods. Nowadays, with the increasingly fierce competition in world competitive sports competitions, how to improve the level of sports technology and performance as soon as possible has become the key research content of sports scientific research departments in various countries. Therefore, the focus of future sports testing equipment research lies in how to use advanced science and material technology to maximize the potential of human sports and promote continuous improvement of sports performance. Data can be obtained accurately through testing the athlete's movement process, which is convenient for future research.

Chen X believes that mobile edge cloud computing is a new paradigm that can provide cloud computing functions at the edge of the pervasive radio access network close to mobile users. Chen X first studied the problem of multi-user computing offloading in mobile edge cloud computing in a multi-channel wireless interference environment; based on the game theory method to achieve effective computing offload in a distributed manner; distributed computing between mobile device users The offloading decision problem is formulated as a multi-user computing offloading game; the structural properties of the game are analyzed, and it is proved that the game accepts the Nash equilibrium and has limited improvement properties; then Chen X designed a distributed computing shunting algorithm, which can be implemented Nash balance, the upper limit of the convergence time can be obtained, and the efficiency ratio of the centralized optimal solution can be quantified according to two important performance indicators; finally the research is further extended to multi-user computing in a multi-channel wireless competition environment Uninstall the scene. This research is not practical [1]. Zhang R found that with the vigorous development of the cloud computing industry, users can easily and flexibly use computing resources. In order to attract customers with various needs, most infrastructure-as-a-service cloud service providers offer several pricing strategies, such as pay as you go, pay less per unit when you use more, and pay less when booking. In his research, Zhang R introduced how cloud brokers can help a group of customers make full use of the volume discount pricing strategy provided by cloud service providers through cost-effective online resource scheduling, and proposed a stack-centric online random scheduling algorithm. Theoretically proved the lower limit of its competition ratio. The research is more one-sided [2]. Yan Q believes that due to the essential characteristics of cloud computing, there are more and more distributed denial-of-service attacks in cloud computing environments. With the development of the latest software-defined networks, cloud-based software networks are designed to overcome distributed denial in cloud computing environments. Service attacks provide new opportunities. There is a contradiction between the defined software network and distributed denial of service attacks. On the one hand, the operation of the defined software network (including software-based traffic analysis, central control, overall network visibility and dynamics), on the other hand, requires Solve the security of SDN itself, and there are potential distributed service vulnerabilities between SDN platforms. Yan Q discussed the new trends and characteristics of cloud computing distributed denial of service attacks, and provided a comprehensive investigation of the defense mechanism of using software-defined networks to defend against distributed denial of service attacks. This research is not suitable for popularization and application in practice [3].

The innovations of this paper are: (1) Proposed the algorithm of power frequency filter design and the energy model of the TDMA protocol system; (2) Proposed the athlete's physiological signal collection technology; (3) Designed the athlete's physiological signal data cloud computing collection system.

2 Intelligent collection method of athlete's physiological signal data under cloud computing

2.1 Main physiological signals

2.1.1 EEG signal

The EEG signal is composed of the sum of the postsynaptic potentials produced by a large number of neurons at the same time. It records the changes in the electrical waves during brain activity. It is the total reflection of the electrophysiological activities of the brain nerve cells on the cerebral cortex and skull surface [4].

2.1.2 ECG signal

The heart contracts all the time. The cardiomyocytes of the heart are excited first, and in this process, tiny bioelectric currents are generated. The electric current spreads to different parts of the body along with the body medium, so there may be differences in the surface area between parts. After the current is collected, amplified and processed, it can be displayed as an ECG signal [3]. The electrode patch is placed on the surface of the body, the two sides of the machine are connected by wires, and the potential difference is recorded in sequence according to the activation time of the heart, thus forming a smooth continuous curve, called an electrocardiogram. The ECG signal is weak, low frequency, susceptible to interference and random changes [5].

2.1.3 EMG signal

Electromyography (EMG) is the supersaturation of motor unit action potentials across multiple muscle fibers across time and space; surface electromyography (sEMG) is the combined effect of surface electromyography and skin neuron generation activity. Compared with EMG with needle electrode, sEMG has the advantages of non-invasive and simple measurement [6]. Therefore, sEMG has important practical significance in clinical medicine, ergonomics, rehabilitation medicine and sports science.

2.1.4 Skin signal

Usually 2.6 million sweat glands secrete sweat on the surface of the human body, and many conductive ions are found in the sweat [7]. There are many ways to measure the electrical skin signal, most of which are to place two electrodes on the subject's finger and connect them to the meter with high sensitivity through wires. It is found that when stimulated by light and sound, the current will change rapidly. At this moment, the potential difference is the electrical signal of the skin [8, 9].

2.1.5 Respiratory signal

The respiratory system is a general term for organs that exchange air between the human body and the outside world. The main function of the respiratory system is to exchange the air inside the human body with outside air, which is mainly manifested as exhaling carbon dioxide and inhaling oxygen [10]. In the process of breathing, as the chest wall muscles relax, the thorax alternately deforms to change the degree of tension and expansion of the belt. This change is converted into a voltage change output by the device, which is the breathing signal in the physiological signal [11].

The electrocardiogram signal has the characteristics of weak, low frequency, susceptible to interference and random changes, so it is generally appropriate to use it as an experimental object.

2.2 Power frequency filter design

Classic digital filters are divided into two types: IIR and FIR. The amplitude-frequency response curve of IIR digital filters converges quickly. The order required to achieve the same performance is less than that of the FIR filter. However, the FIR filter is simple to calculate without feedback, and Able to achieve linear phase [12, 13]. The frequency of the ECG signal is 0 ~ 100 Hz, and 90% of the energy is concentrated within 35 Hz, so a FIR digital low-pass filter is designed here with a sampling rate of 200 Hz and a 50 Hz notch function. Due to the limitations of the performance and real-time requirements of mobile devices, a compromise between efficiency and performance was adopted in the design, using a 4-point FIR smoothing filter, which is a commonly used low-pass filter for processing physiological signals [14]. The typical FIR filter difference equation is:

$$y(n) = \frac{1}{M}\sum_{i=0}^{N-1} b_i x(n-i) \tag{1}$$

Among them, M and N represent the number of acquisitions, and i is the filter coefficient.From the above formula, the transfer function of the FIR filter can be obtained by Z transformation as:

$$H(Z) = \frac{1}{M}\sum_{i=0}^{M-1} b_i z^{-i} \tag{2}$$

Substituting $Z = e^{jw}$, the frequency characteristic formula is obtained as:

$$H\left(e^{jw}\right) = \frac{1}{M}\sum_{n=0}^{M-1} b_i e^{-jwn} \tag{3}$$

The difference equation of the 4-point smoothing filter designed by MATLAB is:

$$y(n) = (x(n) + x(n-1) + x(n-2) + x(n-3))/4 \tag{4}$$

The transfer function is:

$$H(Z) = \frac{1 + Z^{-1} + Z^{-2} + Z^{-3}}{4} \tag{5}$$

Substituting $Z = e^{j\theta n}$, the frequency characteristic formula is obtained as:

$$H\left(e^{j\theta n}\right) = \frac{1 + e^{-j\theta n} + e^{-2j\theta n} + e^{-3j\theta n}}{4} \tag{6}$$

The amplitude-frequency characteristics can be calculated as:

$$\begin{aligned} \left|H\left(e^{j\theta n}\right)\right| &= \frac{1}{4}\left|1 + e^{-j\theta n} + e^{-2j\theta n} + e^{-3j\theta n}\right| \\ &= \frac{1}{4}\left|\left(e^{-j\theta n} + e^{j\theta n}\right) + \left(1 + e^{-2j\theta n}\right)\right| \\ &= \left|\cos(\theta n)\cos(\theta n/2)\right| \end{aligned} \tag{7}$$

2.3 Energy model of TDMA protocol system

The TDMA protocol system divides each time element into multiple time slots, and allocates a certain number of time slots to each slave node to send signals. The node does not send It is dormant when signaled. Each node in the network

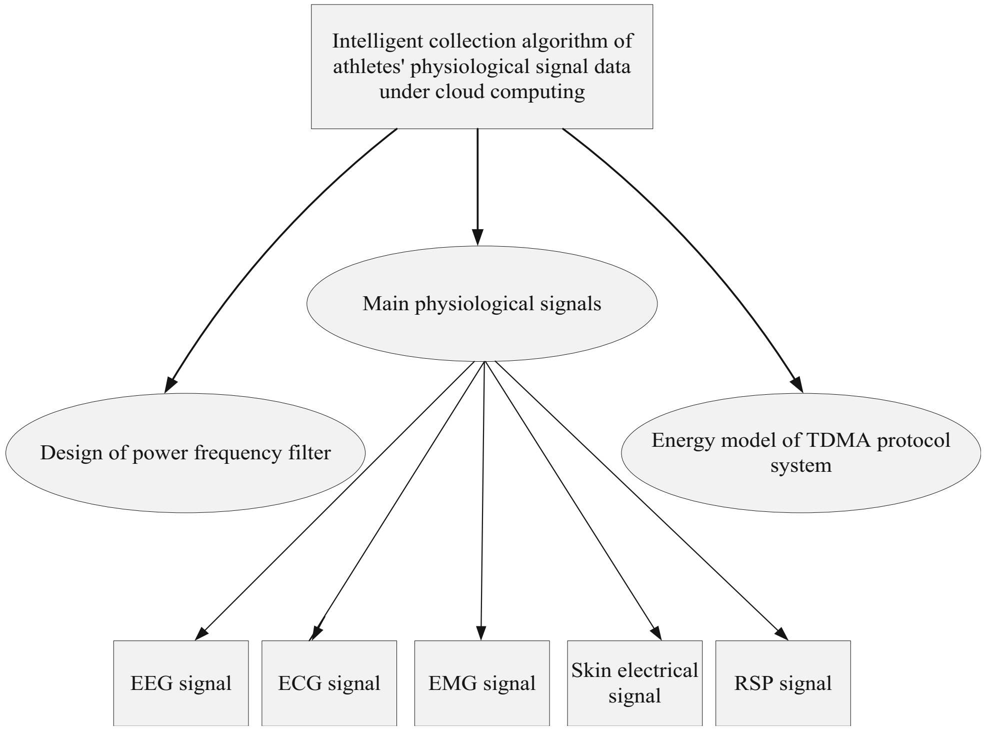


Fig. 1 Part of the technical process of this method

has a precise time point, and is synchronized with the time of the master node, thus forming a unified system clock [15]. The division of TDMA network time slots in a multi-node system is determined by the physiological signals collected by the nodes, and the efficiency of the network must be considered [16].

In the TDMA protocol, the application scenarios are as follows; the master node sends control frames to all slave nodes in turn, and then the slave node sends data and responds to the master node. The slave nodes do not communicate with each other, thus comparing the system transmission specific Bit energy consumption in terms of data volume [17]. Assuming that the total number of bits to be transmitted in the system is C, the number of system data packets m can be expressed as the following formula, where S_{ds} represents the unit of data frame length:

$$m = \frac{c}{8 \times S_{ds}} \tag{8}$$

In the multi-node communication process, we use S_{tm} to represent the length of the polling data frame sent by the master node, and r to represent the data throughput during human body communication [18]. Then the time T_{tm} of the master node sending the control frame has the following formula:

$$T_{tm} = \frac{S_{tm}}{r} \tag{9}$$

After receiving the request frame, the slave node responds to the master node [19]. Assuming that S_{cs} and S_{ds} are the control field and data segment in the response frame, the time T_{ts} for sending the response frame from the node to the master node has the following formula:

$$T_{ts} = \frac{S_{ds} + S_{cs}}{r} \tag{10}$$

Assuming that the average bit error rate of the human body communication system is BER, the data packet is retransmitted in the case of packet loss [20]. Then the probability of successful system data packet transmission can be calculated as:

$$p = (1-BER)^{S_p \times 8} \tag{11}$$

Where S_p is the number of bytes in the data packet during transmission. Considering that the node enters the standby mode when not sending or receiving data, combined with the above formula, the energy consumed by the network to successfully transmit a data packet is:

$$E_{t1} = \left[N \times \rho_r \times T_{tm} \times \frac{1}{p^2} + \rho_t \times T_{ts} \times \frac{1}{p} + \rho_{id} \times T_{ts} \times (N-1)\right] \tag{12}$$

Among them, N is the number of slave nodes in the system. ρ_r, ρ_t, ρ_{id} are the received signal, transmitted signal power and idle power of the node respectively [21].

For the master node, the energy consumed by the network to successfully transmit a data packet is:

Table 1 Experimental steps in this article

Design and research experiment of athlete's physiological signal data intelligent collection system under cloud computing	3.1	Athlete's physiological signal acquisition technology	1	Physiological signal acquisition
			2	Safety
	3.2	Design a cloud computing collection system for athletes' physiological signal data	1	System development platform construction
			2	OpenStack cloud management platform
			3	Data acquisition module

$$E_{t2}=\left[\rho_r\times T_{tm}\times\frac{1}{p^2}+\rho_t\times T_{ts}\times\frac{1}{p}\right] \quad (13)$$

Therefore, the total energy consumed by the system to transmit m data packets can be calculated as:

$$E_t=(E_{t1}+E_{t2})\times m \quad (14)$$

Then the bit energy consumption of the TDMA system is:

$$E_{tc}=E_t/c \quad (15)$$

The method part of this article uses the above method to design and study the intelligent acquisition system of athlete's physiological signal data under cloud computing. The system can be divided into several templates. The specific process is shown in Fig. 1.

3 Design and research experiment of Athlete's physiological signal data intelligent collection system under cloud computing

3.1 Athlete's physiological signal acquisition technology

3.1.1 Physiological signal acquisition

From a macro perspective, the human body's physiological signals can be divided into two categories: active signals that the human body generates spontaneously during normal processes, such as: ECG, EEG, blood pressure, etc.; applied to the human body from the external environment and detected by the human body as Passive signals of the medium, such as ultrasound, X-rays generated by X-ray generators, etc. Active physiological signals can be divided into electrical signals and non-electrical signals [22, 23]. Therefore, the collection of active physiological signals can be divided into the following five types.

Table 2 Common mode signal measurement

Experiment number	Uic(V)	Ac(*10–4)	Uoc(mV)
1	2.00	1.24	916.124
2	2.00	1.13	916.113
3	2.00	1.35	916.135
4	2.00	1.46	916.146
5	2.00	1.57	916.157

1) Electrical quantity, potential; such as ECG, brain electricity, etc.
2) Mechanical quantity, vibration (heart sounds, pulse, heart shock, skew, etc.), pressure (blood pressure, internal pressure of trachea and digestive tract, etc.), force (myocardial tension, etc.) [24].
3) Calorimetry, temperature (body temperature).
4) Optical quantity, light transmittance; such as photoelectric pulse, blood oxygen saturation, blood cell count, etc.
5) Chemical quantity, blood PH value, blood gas, blood sugar, etc. [25].

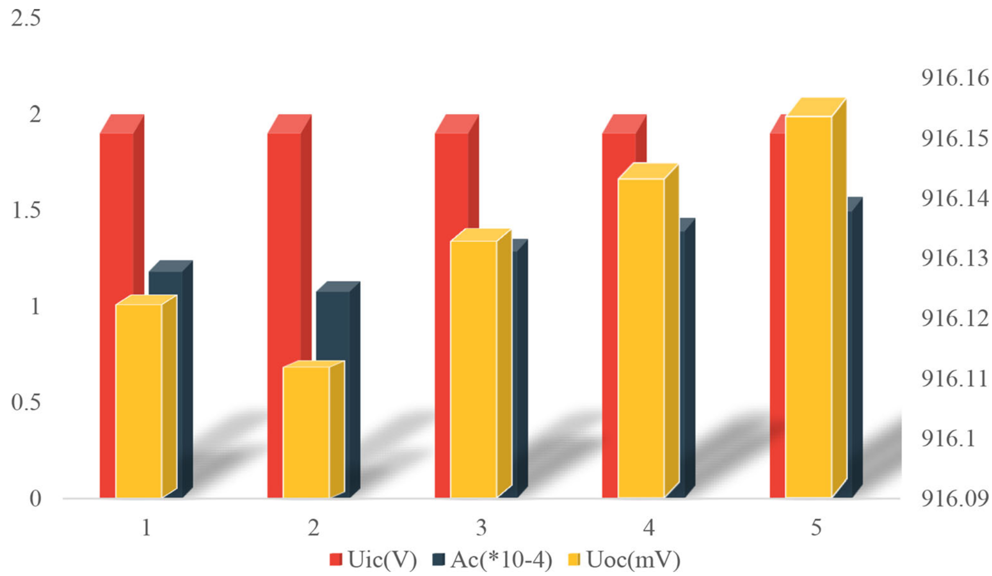
Collecting the data of these victory signals requires the use of biomedical sensors. According to the different physiological signals, biomedical sensors are roughly divided into: For the bioelectric signals collected in the human body, the bioelectric signals mainly include neuroelectric signals, electromyographic signals, and ECG signals And eye electrical signal; can be used to monitor respiratory physiology, blood pressure, heart rate, heart rate, blood saturation and body temperature; physical signal sensor; blood ion concentration, pH, urea, blood sugar and other physiological parameters [26].

3.1.2 Security

Safety is an important principle for detecting physiological signals of athletes. In order to collect the physiological signals of athletes, most medical electronic devices have direct contact with the human body, and some even have to be implanted in the human body [27].

1) Non-toxic: As a part of medical equipment that is in direct contact with the human body or even implanted in the human body, the materials used must

Fig. 2 Common mode signal measurement



be completely non-toxic, harmless to the human body, will not cause damage to the human body, and will not cause the athlete's normal physiological activities Adverse effects [28].

2) Low-voltage power supply: Like the power supply of medical instruments, low-voltage should be used as much as possible. If a high-voltage power supply (such as 220 V) cannot be used, the power supply control circuit should be designed to reduce the voltage when conditions permit. AC power supply below 24 V or DC power supply below 50 V [29].
3) Logic circuit design and wiring: Through reasonable circuit design and layout, the distributed capacity between the electrical components and the metal shell (or the metal part of the shell) can be minimized. At the same time, reasonable wiring can shorten the length of the wire, and can further reduce the bias current between the power cord and the metal shell (or the metal part of the shell), use the position of the insulating object to choose a larger insulation to reduce the resistance type The conduction current.
4) Complete isolation: make full use of the isolation circuit, and reasonably use photoelectric coupling or acoustic-electric coupling to isolate the large potential or potential from the human body.

Table 3 System input noise measurement

Experiment number	Upp (uV)	Upp` (uV)
1	0.941	0.917
2	1.039	0.885
3	0.894	0.764
4	0.956	0.837
5	0.803	0.651

3.2 Design a cloud computing collection system for athletes' physiological signal data

3.2.1 Construction of the system development platform

This system is a cloud computing athlete's physiological signal acquisition system, based on the OpenStack cloud management platform. In order to achieve the compatibility of the acquisition system and the cloud management platform, the system adopts Python language for development. Eclipse supports the development of Python language, therefore, choose Eclipse as the development tool. The development environment of the system is Linux system. The Linux environment uses the Ubuntu operating system. You only need to use the Shell statement to install Eclipse in the system to obtain the installation files from the network and install them directly on the machine.

3.2.2 Construction of OpenStack cloud management platform

The cloud computing platform system based on OpenStac is divided into control nodes and computer nodes. The Nova element simultaneously performs key presses to maintain the connection with the keystone on the control node.

All server nodes must have a kernel that supports KVM and Xen virtual machines, and the kernel must support NBD, full NAT and filter liptables. All servers must run the qpidd service, the control node must run and start the myscid, httpd, libirtd, NTP server system services, and the computer node must start the NTP server, MySQL client and libvirtd system services.

Define each component that uses MySQL as database storage, and specify the IP, port number, user name, and password of the MySQL server to be used, and define qpid as an intermediate messenger.

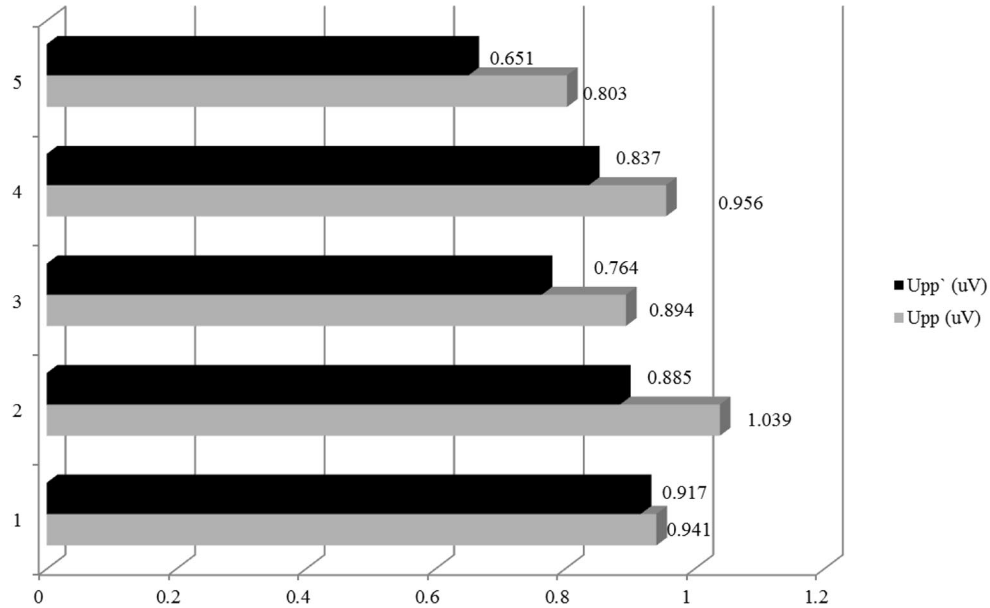


Fig. 3 System input noise measurement

The control node runs the intpd server, and the computer node runs the intpd client. Only in the NTP /etc./NTP.conf client configuration file, setting the IP address of the control node can ensure that the time of all servers is the same as the time of the control node.

3.2.3 Data acquisition module

In the athlete's physiological signal collection scheme, three functions are defined: get_node_info, start and get_devices. get_node_info is responsible for collecting distribution threads and collecting usage information data. It is a key function to realize data collection. The start function is responsible for periodically collecting virtual machine usage information, which fulfills the requirement for the physiological signal collection system to cyclically monitor in the background service. get_devices can query and obtain device information such as the corresponding disk and network card during virtual machine configuration through parameter instances, paths, and keywords, and return all device information of the virtual machine in the form of strings.

Table 4 System software and hardware execution time

Experiment number	Hardware execution time/ms	Software execution time/ms	Hardware speedup
1	2117.46	46.31	45.72
2	2149.61	42.16	50.99
3	2251.32	51.32	43.87
4	2094.51	48.47	43.21
5	2217.21	50.29	44.09

The data items collected by the collection system include virtual machine UUID, timestamp, CPU utilization, memory utilization, disk name, disk utilization, disk read rate, disk write rate, total disk volume, network card name, network card upload Speed, total number of network card uploads, network card download rate, total network card downloads. Some of the data items can be directly obtained through the Libvirt API interface, while some other data items need to use some calculation methods to realize the data calculation and obtain the usage data information.

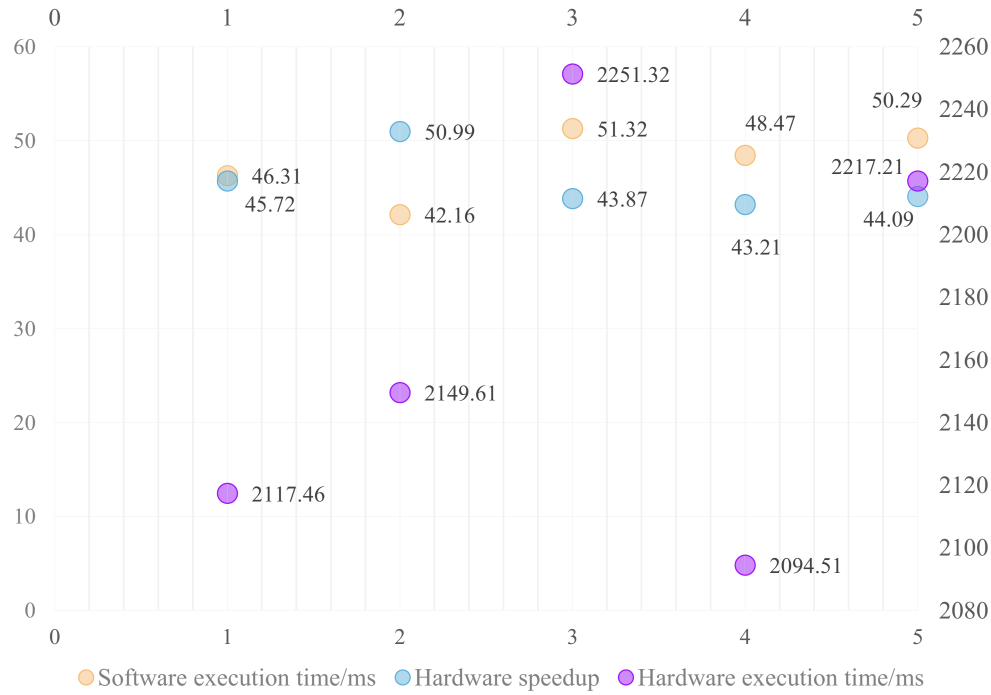
This part of the experiment puts forward the above steps for the design and research experiment of the intelligent acquisition system for athletes' physiological signal data under cloud computing. Design and research according to the skin information mentioned above, the specific process is shown in Table 1.

4 Intelligent collection of athletes' physiological signal data under cloud computing

4.1 System performance test analysis

(1) In order to test the common mode rejection ratio of the equipment, refer to the requirements of the standard JJG954–2000 "Digital EEG and EEG Topography Apparatus" for common mode amplification test. Use a signal generator (model SDG-1025) produced by Siglent to generate a 10 Hz sine wave with an input signal Uic of 1Vpp peak-to-peak value, then read the recorded data from the device and convert it into the actual collected voltage value Uoc according to the formula, and

Fig. 4 System software and hardware execution time



calculate Out the magnification Ac. The test results are shown in Table 2 and Fig. 2.

According to the table data and the above formula calculation, the common mode rejection ratio of the device is about 107 dB. Within the normal range (it is 110 dB in TI's ADS1299 data sheet), the device can effectively suppress the common mode input signal and reach the brain. Requirements for the collection of other physiological signals such as electricity, myoelectricity, and ECG.

(2) In order to test the input noise of the equipment, refer to the standard JJG954–2000 "Digital EEG and EEG Topography Apparatus" for the input noise test, short-circuit the input terminals of the amplifier to the ground, run the equipment and record the collected data After 75 s, read the recorded data from the device and convert it into the actually collected voltage value according to the above formula, and calculate the maximum peak-to-peak value of the noise Upp. In practical applications, a 0.1 ~ 30 Hz will be used in the upper computer program Band-pass filter, so the test also calculated the maximum peak-to-peak value of the noise Upp` after passing the filter. The specific test results are shown in Table 3 and Fig. 3.

Table 5 System power consumption measurement

Experiment number	U (V)	I(mA)	P(mW)	Ilow(mA)	Plow (mW)
1	4.61	51.12	172.31	42.66	145.09
2	4.23	53.23	169.57	39.81	141.72
3	5.07	49.61	178.12	43.17	138.76
4	4.85	48.12	180.61	40.21	135.48
5	5.14	52.34	183.64	47.36	133.92

According to the table data and the above formula calculation, the average value of the maximum peak-to-peak value of the input noise of the device is 0.927 uV. In actual applications, the data will pass through a digital filter, and then the maximum peak-to-peak value of the input noise Upp` average value is 0.811uV. The physiological signal acquisition circuit of the device designed in this design has extremely low input noise and can meet the acquisition requirements of other physiological signals such as brain electricity, myoelectricity, and eye electricity.

(3) Compare the execution time of 3000 test data on software and hardware respectively, count and organize relevant data, as shown in Table 4 and Fig. 4.

It can be observed from the chart that the process of software execution requiring more than two thousand milliseconds can be completed on the hardware in only tens of milliseconds, and the minimum hardware acceleration ratio is 43 times.

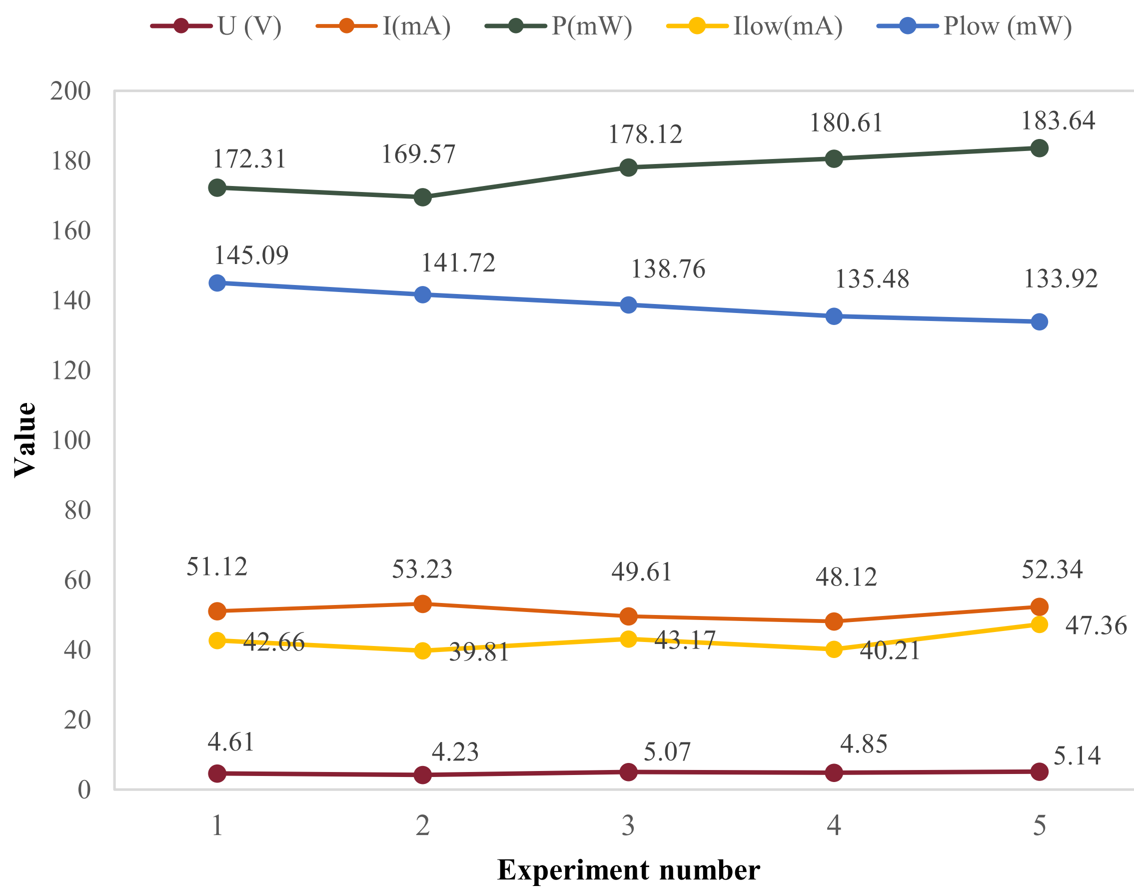


Fig. 5 System power consumption measurement

(4) This test power consumption experiment adopts the power supply mode of the power supply (model: PSM-3004) produced by Gwinstek. The simulated lithium battery provides a voltage U of 3.6 ~ 4.2 V, and reads the full work of the power output (display and Bluetooth). Modules are in the on state) current value I and low-power working (display and Bluetooth module are both in off state) current value Ilow, to measure the device's full working power consumption P and low-power working power consumption low. Draw the test results into charts, as shown in Table 5 and Fig. 5.

Calculated from the chart data, the power consumption of the device in the fully working state is about 176.85 mW, and the power consumption is about 138.99 mW in the low-power

Table 6 Comparison of the original signal and the signal after filtering the baseline drift

Time	Signals with baseline drift	Baseline signal	Physiological signal filtered by sliding window
0.5	1.71	1.45	1.62
1	1.68	1.56	1.54
1.5	2.46	1.12	2.33
2	1.64	1.09	1.53
2.5	1.69	1.46	1.64
3	2.57	1.54	2.49
3.5	1.72	1.16	1.52
4	1.70	1.07	1.61
4.5	2.63	1.57	2.51
5	1.78	1.36	1.58

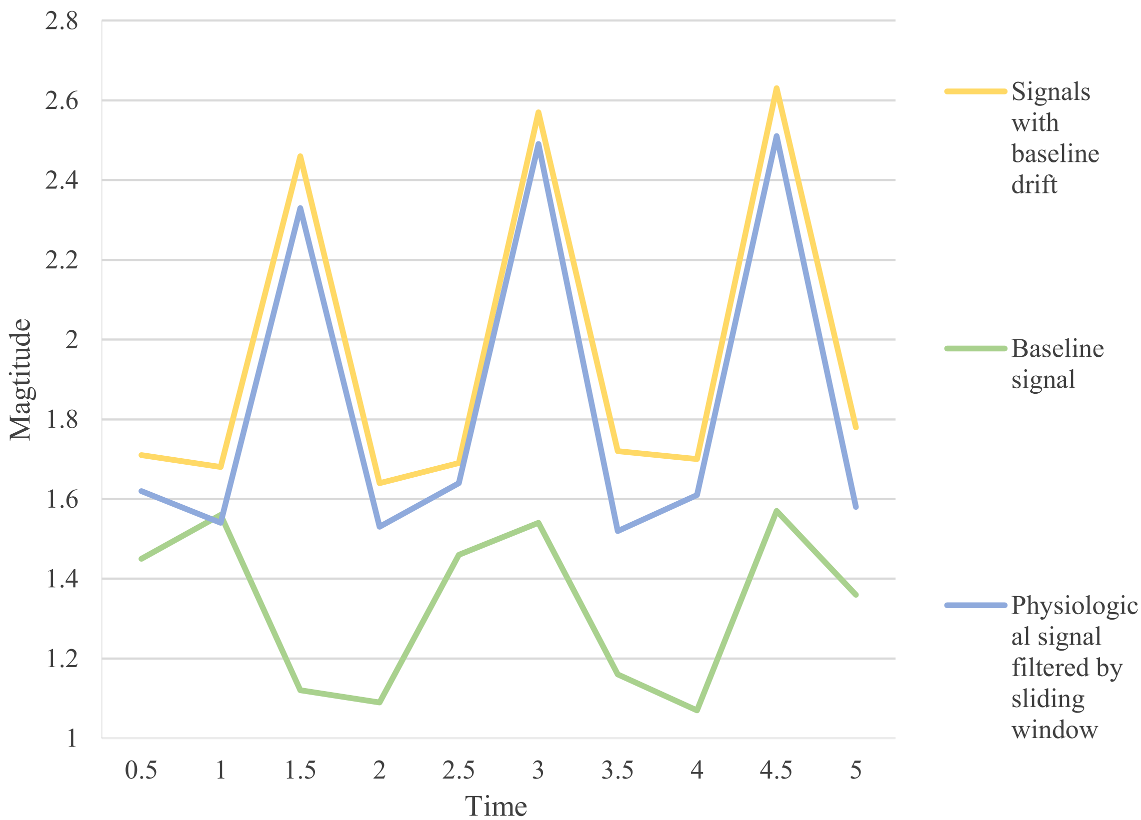


Fig. 6 Comparison of the original signal and the signal after filtering the baseline drift

working state. The low-power program can save about 21.41% of the power for the device. It shows that low-power programs play an important role in saving energy.

(5) In sliding window filtering, the most important thing is to determine the size of the filtering window 2 N + 1. If it is too narrow, the ST band and T wave may be filtered out. If it is too wide, the baseline wandering noise cannot be filtered out. Because the filtering is non-linear, the classic filter design method cannot be used, and the window size can only be determined by trial and error. Collect and analyze the comparison between the original signal and the signal after filtering the baseline drift, and draw it into a chart, as shown in Table 6 and Fig. 6.

Table 7 System acquisition accuracy

Experiment number	Acquisition signal accuracy
1	97.61%
2	96.42%
3	98.03%
4	95.87%
5	97.13%

It can be seen from the above figure that the filtering can extract the baseline drift and filter it out. The signal reference returns to the horizontal position, and the useful physiological signals are relatively well preserved. The delay in the transmission process is very short and will not affect the real-time Sex has a big impact. From the analysis of the program design, the median filter must be repeated many times to sort, and it is necessary to select a suitable algorithm to improve the processing efficiency.

4.2 System acquisition accuracy analysis

When the system collects signals, the accuracy rate is an important indicator. Therefore, the intelligent acquisition system needs to have strict requirements on data accuracy. This article has made a test to verify the accuracy of the data, and at the same time, combined with the long-term running experiment of the system power consumption test in 4.1, the accuracy of the system's collected signals is evaluated. The specific situation is shown in Table 7.

From the calculation of the data in the table, it can be seen that the average collection accuracy of the system for the five tests is 97.01%, and the collection accuracy of the system is relatively high. It can better serve the athletes' physiological signal collection and help to analyze the athletes' physiological signals to determine the best time for training and recuperation.

5 Conclusions

Under cloud computing, users only need to have the Internet to access writing-based applications and information without installation and maintenance. Enterprises and individuals can quickly and conveniently use the services provided by the cloud computing center at a low price. Cloud computing has a very large scale. Through the integration and management of a large number of computer groups, it provides users with powerful computing and storage functions. Cloud computing users can access application services anytime and anywhere through network terminal devices. In order to ensure the high reliability of the service, measures such as the use of isomorphic and interchangeable computing nodes, multi-copy fault tolerance and heartbeat detection are adopted, and related designs that remove redundant parts are adopted in terms of network connection and equipment use.

In order to realize the physiological signal collection function of athletes, this paper understands the generation mechanism and signal characteristics of physiological signals before designing. These physiological signals include electrocardiogram, brain electricity, myoelectricity, eye electricity, photoplethysmographic pulse wave, pressure pulse wave, galvanic skin response, respiration, body temperature, etc., and on this basis, determine the technical difficulties of realizing multiple physiological signal collection functions. After clarifying the design requirements and technical difficulties, the overall program design is combined with the requirements of modular expansion, intelligence, portable, and safety, and then analyzes the system design ideas of athletes' physiological signal collection, and selects the master control program and communication program.

The design idea of the cloud computing collection system for athlete's physiological signal data proposed in this paper is feasible in terms of application. However, there are still some problems in the actual mass production of this system, and there is still a lot of work to be further studied.

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