Theoretical Derivation of Student Basic Signal Monitoring System Based on Software Engineering

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Abstract. At present, in China’s higher education institutions, with the rapid progress of software engineering theory, this paper adopts the signal monitoring system method and derives the mathematical analog signal strength monitoring system. It is optimized in combination with the software engineering wearable system. By using the heart rate acquisition module to improve the performance, using the temperature acquisition module empirical formula, and finally through the software engineering statistical comparison analysis, it is proved that the student basic signal monitoring system has a significant effect and can play a role in preventing students from fainting or sudden death, a positive effect.

Key words. Software engineering, wearable, basic signal, monitoring system.

1. Introduction
Modern physical education has an increasing demand for teaching auxiliary equipment, and the introduction of advanced artificial intelligence products has become an inevitable trend of traditional physical education in colleges and universities. In the university’s traditional physical education model, the application of wearable artificial intelligence products improves the efficiency of the teaching process of teachers and students, and greatly saves the energy and time of communication between teachers and students through more convenient and efficient electronic information transmission methods. To some extent, it has improved the teaching quality of universities. Modern technology is gradually changing people’s lives. The sports industry is the core support of China’s national fitness strategy and the development of competitive sports. The sports industry is now in China with historical opportunities for innovation, reform, and brand building, intelligent, digital, and networked and popularization will be the new development direction of the modern sports industry [1]. The performance of competitive sports or the practice effect of physical education depends on the way and method of exercise, and the reasonable monitoring of human health reflects the guiding role of scientific exercise. At present, the physique and health level of college students is on a continuous decline. Therefore, our country attaches great importance to the popularization of sunshine sports. Tracking and monitoring the physique of college students is an important task for all colleges and universities throughout the year. Through the continuous introduction of wearable artificial intelligence products, the physical monitoring of college students and the implementation of scientific management of their sports activities are of far-reaching significance to the promotion of college campus sports.
2. Hardware and software design of smart wearable software engineering equipment for sports and body temperature monitoring

2.1. Hardware design
The hardware of smart wearable software engineering equipment includes 8 parts: Blue-NRG, temperature and humidity sensor, acceleration sensor, display, alarm indication module, feedback control module, auxiliary communication and power supply. The hardware design of smart wearable software engineering equipment must not only meet the needs of exercise and body temperature monitoring, but also ensure low power consumption and low cost. Blue-NRG with low power consumption is used as the core processing end of data transmission, and a data acquisition platform composed of temperature and humidity sensing equipment and acceleration sensors is built on the periphery. The collected data is displayed on the surface of the smart wearable software engineering equipment through the display, and the alarm is passed [2]. The instruction and feedback control module controls data such as exercise conditions and human body temperature within the set range. In order to ensure the integrity of data transmission, an auxiliary communication module has been added. The hardware structure diagram of the smart wearable software engineering equipment is shown in Figure 1.

2.1.1 The design of the wearable health data collection terminal. The wearable health data collection terminal collects the user’s personal physiological health indicators, mainly collecting the user’s heart rate indicators and exercise volume during exercise; the ARM processor is used as the terminal controller to configure the heart rate The sensor SON7015 and the pedometer acceleration sensor MMA9555LR1 collect physiological health parameters, and transmit the collected data to the mobile smart terminal for data summary processing through Bluetooth or ZigBee wireless communication module.

2.1.2 The design of mobile smart terminals. Mobile smart terminals are mainly used to aggregate and process user health parameters collected by the collection terminal, and then upload the data to the cloud server for data analysis and processing through mobile network, Wi-Fi and other communication methods; According to the different system modes, mobile smart terminals adopt different hardware solutions to meet the needs of individual users and group users [3].
2.2. Software design
The human body temperature and exercise steps collected by the hardware are transmitted to the mobile phone terminal via Bluetooth in real time. After the monitoring software is processed, the human body temperature and other data change curves are drawn on the mobile phone terminal to realize the non-surface display of the smart wearable software engineering equipment connected to the Bluetooth mobile phone. The software process is shown in Figure 2.

![Software flow diagram](image)

**Figure 2.** Software flow

### 2.2.1 Design and construction of smart wearable device monitoring platform
It is mainly through the linear layout and frame layout of the layout management centre to realize the user platform or interface design. In this process, first use Linear Layout to describe the linear layout, and then arrange the components in the space one by one. Linear Layout can arrange the components in the horizontal direction, and can also realize the vertical arrangement of the components; then use the Frame Layout frame layout space for each the components added to the interior construct a blank area, which can also be called a frame. Each sub-component occupies a frame in the space [4]. All the frames mentioned above will complete automatic alignment and other related operations based on the gravity attribute.

### 2.2.2 Deal with the monitoring event accordingly
The target object monitored by the system will carry out different types of operations on the software platform, and different actions will generate a corresponding event command signal, which is transmitted to the mobile phone port via Bluetooth, and then the mobile phone will give a corresponding response based on different the user handles the corresponding event corresponding to the operation.
2.2.3 Bluetooth communication. As the main communication method of function scheduling, Bluetooth API can synchronize the collected data to the mobile terminal to complete the point-to-point communication task.

3. Functional design

3.1. Information collection module
The system information collection module uses a digital acceleration sensor as a chip for system acceleration measurement. Figure 3 shows the internal circuit structure of the digital acceleration sensor. The three-axis acceleration sensor can convert the physical quantity of acceleration change into an electrical signal, then the electrical signal is converted through AD and then digitally filtered, the measurement result is transmitted to the processing centre, and finally connected to the transmission data through the SPI and IIC bus.

![Figure 3. The internal circuit structure of the digital acceleration sensor](image)

3.2. Data storage module
The Nand chip array organization is used to realize the data storage module design in the article. The storage space of the chip is 1G. Figure 4 shows the structure of the Nand chip array organization. The address line is an 8-bit bus, and the address input is 5 cycles. Combining addresses and commands and data, effectively saving chip space. In addition to data, address and commands, this chip also has WE, CE, CLE and other function control ports. Its main functions are chip, read and write, command latch, address latch, etc. It can load data during chip writing [5]. Chip data loading is determined by the program, and data programming is determined by the chip itself. The read and write speed is relatively fast and can effectively meet the system requirements. Figure 4 shows the interface design of a single chip.

![Figure 4. The structure of the Nand chip array organization](image)
3.3. ZigBee wireless communication module
ZigBee wireless communication module adopts DRF1605 ZigBee wireless transmission module. The DRF1605 ZigBee wireless transmission module can be connected to the USARTHMI serial touch screen through the UART serial port to realize the function of transmitting data signals. The DRF1605 ZigBee wireless transmission module can transmit signals up to 1600 meters. ZigBee network mainly has two types of nodes: master node and slave node. Each node can send and receive data. Since the biggest feature of this network is automatic routing, if the signal transmission distance is too far to be transmitted to the signal, it only needs to be Add a module in the middle to provide routing, and if a certain routing path is damaged, the network can automatically find a new path to achieve communication.

4. System Test
The human body is based on different ages, living habits and physical health, and its suitable living environment is also different. The comfort of the living environment has a certain impact on the physical health of the human body. Therefore, before implementing the system service platform design, a human body comfort model must be created [6]. Human comfort mainly includes various comfort models of environment and physiology, so as to realize the comprehensive combination of humidity, temperature, climate, region, and race, and realize the creation of human comfort models. Table 1 shows the evaluation models and parameters of human comfort contact.

| Comfort          | Physiological parameters/PP | Environmental parameters/EP | To meet the conditions |
|------------------|------------------------------|-----------------------------|------------------------|
| Comfortable      | HCRCSC                       | TSDC                        | PP=3                   |
| general          |                              |                             | EP=2                   |
| uncomfortable    | HCRCSC                       | TSDC                        | PP<3                   |
| Extremely        | HCRCSC                       | TSDC                        | PP<3                   |
| comfortable      |                              |                             | EP=2                   |

The network service platform is a medium for realizing service functions, and it has a particularly important role. When creating a network service platform, professional network design and servers should be used as the basis to create network service platform equipment, which can run on various functional modules of the service platform In, effectively realize user experience service and internal analysis of management personnel [7]. Under the above-mentioned experimental environment, the experimental results obtained are shown in Figure 5. In this paper, the smart wearable software engineering equipment system combines the display method of the wearable software engineering equipment surface display and the mobile terminal software system to draw the human body temperature and other change curves, which effectively reduces the false positive rate and improves the accuracy of the system response.
5. Conclusion
As a modern technological product, wearable devices will be loved by college students and have great development potential among college students. The use of wearable devices in physical education can effectively monitor various physical indicators of students in sports, grasp their physical fitness and physical fitness levels in physical education classes, and effectively avoid sports injury accidents, which is beneficial to sports Teachers reasonably grasp the intensity of classroom exercises, timely and accurately discover the shortcomings and deficiencies of students' technical movements, and provide guidance to correct them, so as to improve teaching effects and stimulate learning interest. Through processing and analysing a large amount of data collected by wearable devices, it also has certain guiding significance for evaluating the effect of physical education and innovating physical education models.

References
[1] Anliker, U., Ward, J. A., Lukowicz, P., Troster, G., Dolveck, F., Baer, M., ... & Vuskovic, M. AMON: a wearable multiparameter medical monitoring and alert system. IEEE Transactions on information technology in Biomedicine, 8(4) (2004) 415-427.
[2] Kong, X. T., Luo, H., Huang, G. Q., & Yang, X. Industrial wearable system: the human-centric empowering technology in Industry 4.0. Journal of Intelligent Manufacturing, 30(8) (2019) 2853-2869.
[3] Lee, Y. D., & Chung, W. Y. Wireless sensor network based wearable smart shirt for ubiquitous health and activity monitoring. Sensors and Actuators B: Chemical, 140(2) (2009) 390-395.
[4] Sung, M., Marci, C., & Pentland, A. Wearable feedback systems for rehabilitation. Journal of neuroengineering and rehabilitation, 2(1) (2005) 1-12.
[5] Kuzmin, A., Safronov, M., Bodin, O., Petrovsky, M., & Sergeenkov, A. Mobile heart monitoring system prototype based on the Texas instruments hardware: Energy efficiency and J-point detection. International Journal of Embedded and Real-Time Communication Systems (IJERTCS), 7(1) (2016) 64-84.
[6] Qureshi, F., & Krishnan, S. Wearable hardware design for the internet of medical things (IoMT). Sensors, 18(11) (2018) 3812-3819.
[7] Bi, Y., Lv, M., Song, C., Xu, W., Guan, N., & Yi, W. AutoDietary: A wearable acoustic sensor system for food intake recognition in daily life. IEEE Sensors Journal, 16(3) (2015) 806-816.

Figure 5. False positive rate curve