

Data Analyzer Based on Middle School Students Physical Health

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Abstract

With the popularization of education, higher requirements are put forward for the physical quality of middle school students, and their physical health becomes the focus of parents. The data analyzer can monitor the physical indicators of middle school students according to the characteristics of their physical indicators, combined with intelligent induction equipment. This project consists of two parts: detection module and wearable device. The detection module uses AT89C51 microcontroller as the core, and the wearable device uses MSP430 microcontroller as the core. The instrument integrates data collection and analysis, based on the national physical health standards, and can accurately judge the current physical quality of middle school students, which makes up for the instability of traditional measurement methods, and has a certain market value.

Keywords

Physical health of middle school students; High school entrance examination; Intelligent analysis; AT89C51; MSP430.

1. Introduction

Physical health has increasingly become the focus of society. With the provincial Department of education proposed to include physical education subjects into the scope of junior high school and high school academic level examination, coupled with the improvement of the Ministry of Education's requirements for middle school students' physical health standards, physical quality of middle school students has become a common concern of parents. At present, although some scientific and technological means can meet the requirements of monitoring the relevant indicators of human body, few are really suitable for the physical health monitoring of middle school students. The data analyzer in this paper can improve the physical quality of middle school students and promote them to develop a healthy lifestyle through the intelligent analysis of various physical indicators of middle school students.

2. Research Status and Market Analysis

2.1. Research status

2.1.1. Foreign research status

The United States began to pay attention to the physical condition of its citizens after the 1980s, and there were different indicators and contents of physical tests in different periods. With the continuous development of physical fitness research, people's understanding of physical fitness also changes, so the indicators and content of physical fitness test are constantly changing and developing. The main test indicators are: cardiopulmonary function, muscle strength and endurance, body flexibility and so on. At present, the fitness evaluation system of middle school students in the United States is FITNESSGRAM, which mainly includes body fat content, endurance, strength and endurance level. The comprehensive evaluation is not recognized in the evaluation, but three health grade standards are made for each project, namely, "no health risk", "need to promote" and "with health risk". This kind of standard is not a "relative standard" based on people's average level, but an "absolute standard"

based on individuals' basic needs for indicators. Although such absolute criteria are closely related to human health, the significance of absolute criteria depends on whether the third party organizations are in line with people's health goals and exercise requirements when compiling indicators. The evaluation of FITNESSGRAM is mainly aimed at individuals. Due to the differences between individuals, sometimes the compilation of test indicators cannot fully and accurately evaluate individual health.

2.1.2. Domestic research status

In China, the physical health assessment system was not developed until the early 21st century. In order to better understand the physical indicators of Chinese middle school students, the Ministry of Education launched the V1.0 version of national middle school students' physical health data reporting software in 2007, and the latest version is V1.2 [2]. The software only focuses on the physical health data management and macro statistical analysis of middle school students. It lacks the evaluation of data and cannot give suggestions according to the index data of middle school students. In recent years, the physical health condition of Chinese teenagers has been decreased. The Ministry of Education proposed to include physical education subjects into the scope of the junior and senior high school academic level examination, and people began to use some scientific and technological devices to monitor themselves, thus the birth of the smart bracelet. At present, the relatively well-known brands in China are Xiaomi, Huawei, OPPO and so on. Since the beginning of the 21st century, smart bracelets have emerged rapidly. Although people have a high degree of recognition of the bracelet, but for now, bracelets have the same function, the homogeneity problem is serious, and the monitoring of physical indicators is not perfect. In addition, there are some deficiencies in the wristband equipment for middle school students, which cannot monitor their physical conditions in sports in real time. In general, the study of physique health of middle school students in our country can not meet the demands of physical exercise, and it is unfavorable to improve the enthusiasm of middle school students to participate in sports.

2.2. Market analysis

The product is mainly used by middle school students. From the aspect of competition, although some scientific and technological means can monitor the relevant indicators of the human body and seek some benefits for people, the accuracy is not high enough, and the data obtained is not comprehensive enough, and few are really applicable to the physical health monitoring of middle school students. From the policy point of view, according to the current national education planning, the proportion of physical education in the high school entrance examination will be higher and higher. In Anhui Province, the Department of Education issued the Implementation Opinions on Deepening the Integration of Physical Education and Promoting the Healthy Development of Adolescents. The guideline said the government should promote the coordinated development of cultural learning and physical exercise among young people, promote their healthy growth, sound personality and temper their will, and train socialist builders and successors with all-round development of morality, intelligence, physical fitness, beauty and labor. In terms of time, the physical health of middle school students has fluctuated in the past 30 years, which is far from the goal in the "Health 2030" plan [3]. In terms of form, the introduction of "Opinions" has a certain psychological impact on parents, and the physical indicators are becoming more and more concerned by parents. From the perspective of development, the continuous popularization of Internet and science and technology can provide strong support for products. To sum up, the product market development prospect is broad, has a certain market value.

3. Product Design

3.1. Product Positioning

The product is targeted at middle school students and is committed to improving the physical health index of middle school students. It has a broad development prospect. Nowadays, the proportion of sports in the high school entrance examination is more and more high. In order to strive for higher scores, middle school students often have unreasonable planning for physical exercise and are eager to succeed, which may cause certain harm to the body. The change of body function is a gradual, circular process. This data analyzer can solve the problem of excessive physical exercise in middle school students, allow parents to fully understand their children's physical indicators, and meet the requirements of PE high school entrance examination.

3.2. Product structure and function

The products are mainly divided into two parts: detection equipment and smart wearable equipment. The detection equipment is used to check the daily body function of middle school students. It is mainly composed of temperature sensor, gravity sensor and height detection device. The smart wearable equipment is used to detect the motion condition of middle school students. It is mainly composed of acceleration sensor, heart rate and pulse detection device and GPS positioning module.

When it is used for the first time, middle school students will stand on the detection equipment for detecting. The system will conduct intelligent analysis of middle school students' BMI according to the BMI scoring table [4] and upload it to the system. When middle school students use smart wearable equipment outdoors, the equipment is connected to the system. The background data will monitor the heart rate and pulse of middle school students in real time, and the system will send a warning if it exceeds the normal range. Finally, data will be integrated between the detection equipment and the smart wearable equipment. If the data is qualified, the system will give a report; if the data is not qualified, the system will send the data back to the parents. The specific flow chart 1 is shown as follows.

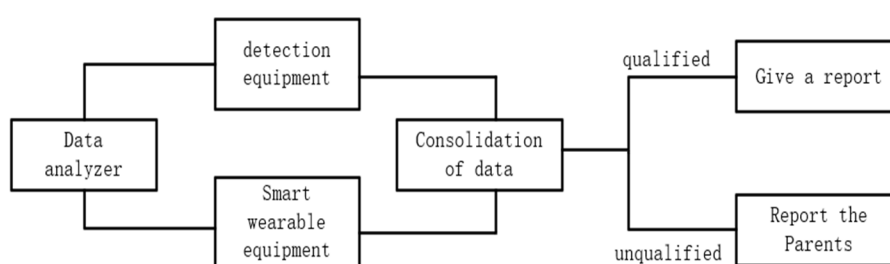


Figure 1. Product flow chart

3.3. Material

Detection equipment materials are generally required to be strong and durable. However, smart wearable devices have higher requirements for materials. In the process of exercise, the body will produce a lot of sweat, if the material selection is not proper, to a large extent, it will not only affect the normal operation of the equipment, but also affect the comfort of middle school students using the equipment. Middle school students have tender skin, so close-fitting fabrics should be healthy and comfortable [5]. At present, the commonly used materials on the market include TPU, TPE, medical TPEE, silica gel, etc., among which the most common is TPE. TPE material feels soft and smooth, better than silica gel and TPU, good wear resistance, easy coloring, simple molding and release, environmental protection and non-toxic, will not cause

allergies to human skin. And its hardness range is wide, the price is lower, you can consider using this material.

3.4. Principle of Operation

3.4.1. Detection module

Detection module is based on AT89C51 microcontroller, its internal functions are more, a total of 40 pins, 4 8-bit I/O ports, 2 16-bit timing/counter, an on-chip oscillator and clock circuit. Detection machine built-in camera, digital integrated temperature sensor DS18B20[6], gravity sensor, height measurement device, data transmission module, voice broadcast module. When a person stands on the machine and generates weight, it triggers the machine to work immediately. The sensor DS18B20 is used to monitor whether the body temperature of middle school students is normal. Weight through the gravity sensor, the signal amplifier is connected to amplify the signal, and then the amplified signal is converted to A/D to realize the measurement of weight. The data of the three modules are summarized and broadcast through the voice broadcast module. The camera is used for face information collection. Finally, the calculator calculates the BMI and uploads the data. The report is obtained through the comparative analysis of the database. The overall structure is shown in Figure 2.

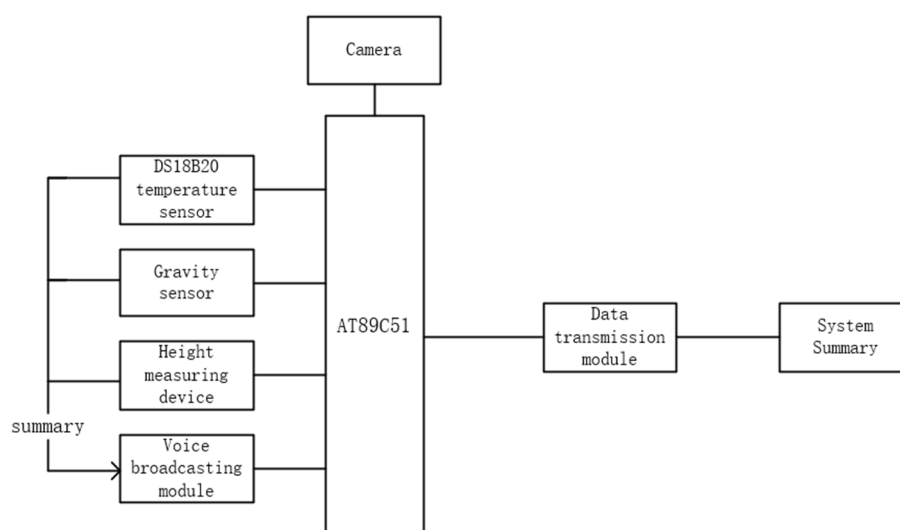


Figure 2. Structure diagram of detection module

3.4.2. Smart wearable device

The smart wearable device is based on MSP430 microcontroller, with multifunction hardware multiplier and clock system. According to the actual demand of middle school students, multiple circuits with different functions can be integrated on one chip. The wearable device has built-in acceleration sensor, photoelectric pulse and heart rate sensor, data transmission module, GPS satellite positioning system and buzzer. The heart rate and pulse detection device uses the photoelectric volume method to measure the data[7], and analyzes the exercise situation of middle school students through the system data. If the heart rate or pulse threshold is exceeded, the horn will sound to prompt. Acceleration sensor, clock system and GPS satellite positioning system comprehensively calculate the speed, mileage and time of movement of middle school students, upload the data transmission module to the system for summary, and generate index reports. When using, middle school students can wear the device on their wrists. Due to the small size of smart wearable device and the turbulence caused by movement, there will be some interference, resulting in errors in the measurement accuracy of

the device. So reducing turbulence plays a crucial role in measuring accuracy. To this end, the watchband with the human body friendly TPE material, when wearing the arm, easy and natural. The overall structure figure 3 is shown in Figure 3.

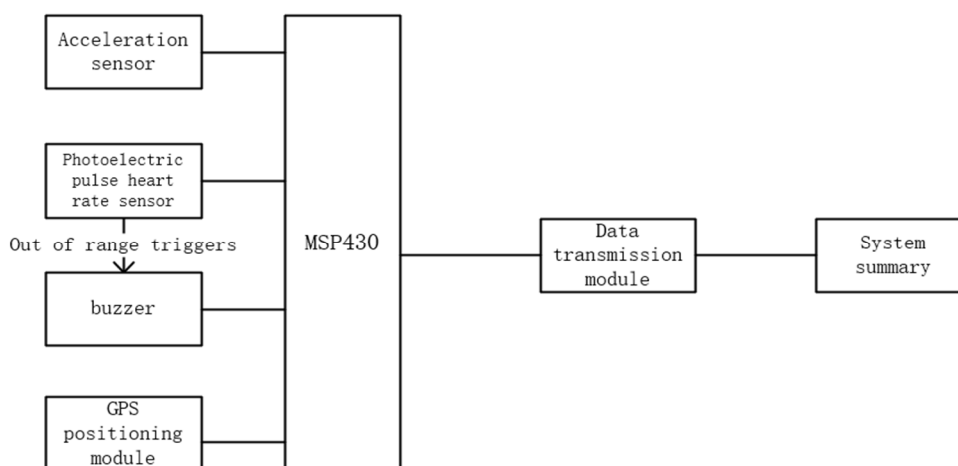


Figure 3. Structure diagram of smart wearable device

3.4.3. Data analysis and result display

The detection module calculates the body mass index and integrates it. Smart wearable device use portable electronic components to judge and analyze the human heart rate, pulse, breathing and the movement of middle school students while maintaining the comfort of the human body. Through the comparison with the national database, judge the middle school students' physical quality in which range. After a series of data analysis, the data analyzer will show the relevant conclusions about the physique of middle school students. If it is below or beyond the national health and physical standards [8], the system will show unqualified, and the situation will be fed back to the parents. If it is within the normal and reasonable range, the system will show qualified, and give indicator report.

4. Advantages and Expected Promotion Effect

The data analyzer is a physical health testing instrument for middle school students that integrates comfort, pertinence, integrity, advancement, integration and intuitiveness.

(1) Comfort. It refers to the comfort of wearing. Due to the particularity of middle school students, the skin is more sensitive than that of adults. The equipment is made of TPE material with high affinity to human skin, which can reduce the sensitivity of the skin of middle school students during the wearing process and improve the comfort of wearing.

(2) Pertinence. It refers to the pertinence of the service object. The service object of the product is middle school students. So far, middle school students' physical health still has serious problems such as overweight and obesity, poor blood pressure regulation function, and the growth of strength quality tends to stall. This product can effectively help middle school students improve the physical indicators. And the monitoring equipment for middle school students on the market is very limited, so this product has a good market prospect.

(3) Integrity. It refers to the completeness of monitoring. The whole set of equipment can monitor the middle school students' heart rate, blood pressure, body temperature and a series of human indicators, carry out all-round monitoring on the body of the middle school students, and analyze the current physical indicators of the middle school students according to the recent exercise data. If the relevant indicators are not met, the system will automatically feed back to the parents in time.

(4) Advancement. It refers to the advanced nature of the equipment. The instrument adopts advanced photoelectric pulse and heart rate sensor, uses infrared light to measure blood, and uses many advanced electronic equipment, memory and data processor.

(5) Integration. It is the integration of index data. The instrument processes and analyzes the recent data of various physical indicators of middle school students and generates the report of physical indicators of middle school students.

(6) Intuitiveness. It refers to the intuitiveness of the interface. The recent body index report of middle school students is presented by line chart, and the exercise data is evaluated according to the national standards of health and physique, so as to facilitate the parents of middle school students to have a systematic, intuitive and clear understanding of the physical condition of middle school students.

Based on the advantages of the product, the product has a remarkable promotion effect.

(1) Physical examination before physical education test for middle school students. The integrity of product monitoring and the integration of data can simplify the monitoring steps, but also allow students to better understand their physical conditions before the exam, improve their safety awareness; Advanced equipment also makes the product more representative, which can reduce the security risks of physical education exams.

(2) Daily use of school students. The intuitiveness of the product interface makes it easy for students to understand their current physical conditions; The comfort and practicality of the product can also make the middle school students have a better experience.

(3) Parents' safety management of their children. When middle school students exercise excessively, their heart rate and pulse are out of the normal range, the system will report to their parents, and parents will take appropriate measures to protect the middle school students.

(4) Enhance the physical quality of middle school students. The product can reflect the health condition of middle school students in time, remind them to take proper exercise, and play a certain role in supervising the physical condition of middle school students.

5. Conclusion

The physical quality index of middle school students has become the focus of parents' attention. The data detector will carry out intelligent analysis of the physical indicators of middle school students, which can be used for the physical detection of middle school students before the high school entrance examination, but also to meet the daily needs of middle school students. Through data processing, parents of middle school students can intuitively and clearly understand the physical condition of middle school students, so that the physical quality of middle school students is generally improved, and get rid of the sub-health state of the body. At the same time, it also takes into account the wearing experience of middle school students, and chooses materials that are friendly to the human body to make the wearers feel comfortable. And the practicability is strong, middle school students through the equipment exercise themselves, at the same time, can be in a better mental state into study and life.

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