Research Article

Design of Sports Training Data Monitoring System Based on Wireless Internet of Things

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With the development of the times and the continuous improvement of science and technology, people’s living standards are getting better and better, living conditions are getting more and more abundant, the infrastructure of cities is becoming more and more perfect, the comprehensive strength of the country is constantly increasing, and the speed of development is also increasing fast. However, under conditions of continuous development, the physical health of adolescents and children has not improved, the physical fitness of adolescents has declined, and many problems have appeared [1, 2]. According to the National Health Survey in recent years, we can see that the obesity rate of adolescents and adults has increased significantly, and more and more people are plagued by obesity [3]. At the same time, we can see from the data that the physical health problems of college students today are prominent, the physical fitness level of college students has dropped significantly, and the downward trend is more obvious. These problems deserve our attention [4]. College students are at the center of the youth group and account for a large proportion of the number of young people. The development of a country and the future are inseparable from the development of young people. Young people are a powerful driving force for the improvement of the country’s comprehensive strength [5]. Therefore, a young person with

1. Introduction

With the development of the times and the continuous improvement of science and technology, people’s living standards are getting better and better, living conditions are getting more and more abundant, the infrastructure of cities is becoming more and more perfect, the comprehensive strength of the country is constantly increasing, and the speed of development is also increasing fast. However, under conditions of continuous development, the physical health of adolescents and children has not improved, the physical fitness of adolescents has declined, and many problems have appeared [1, 2]. According to the National Health Survey in recent years, we can see that the obesity rate of adolescents and adults has increased significantly, and more and more people are plagued by obesity [3]. At the same time, we can see from the data that the physical health problems of college students today are prominent, the physical fitness level of college students has dropped significantly, and the downward trend is more obvious. These problems deserve our attention [4]. College students are at the center of the youth group and account for a large proportion of the number of young people. The development of a country and the future are inseparable from the development of young people. Young people are a powerful driving force for the improvement of the country’s comprehensive strength [5]. Therefore, a young person with
development potential should not only focus on cultivating good quality and achieving better results but also focus on cultivating a healthy body and a stable mental state. Only by combining these aspects will the future of young people be brighter, the development will be faster, and the strength will be stronger [6].

Through relevant data surveys, we can find that today’s fitness system and health model have not received much attention. People use the Internet, high-tech digital systems, and intelligent related equipment to exercise and improve their own health [7]. The level of understanding of them is low, so sometimes you will encounter situations where you do not know how to train or what kind of exercise is suitable for you. Therefore, the effect of training is not very good, and the effect of physical exercise cannot be achieved. There are also people who suffer physical damage due to blind training and overtraining [8]. The sports training system is mainly composed of the central component of each equipment and the main part of each fitness method. The central component and related systems are connected using Internet technology, the central system is the main component, and the other fitness systems are supplemented [9]. Through the bottom-up data collection of each layer of the real situation, the final data collection can be achieved, and it can also be compared with historical data. The fitness system can also directly affect those who want to exercise [10].

2. Related Work

In the current era, people’s physical health is getting less and less attention. The way people use the Internet, high-tech digital systems, and smart equipment to improve their health has not been popularized. There are also a series of problems, such as low level of understanding. In order to solve the above problems, literature successfully designed a green platform ITTHP that can exercise through the Internet and promote the health of the whole people through practical exploration [11]. This platform uses a Bluetooth system to connect fitness equipment and related systems through signal transmission so that while the machine is operating, it uploads the time and calories consumed by the person using it to the mobile phone or computer to achieve fitness, entertainment, and informationization, and there will be dedicated personnel to compare the information uploaded by people and the information of people’s previous physical conditions [12]. Finally, according to each person’s different physique and different situations, users will be provided with more personalized and accurate fitness plans and diet plans. Through further exploration, literature successfully designed a series of network intelligent digital collection systems, and this system is mainly used in gyms. It includes human body and mind perception system, network system capable of collecting data, data collection system, and comprehensive analysis application system [13]. The main function of the perception system is to measure the body-related conditions of the fitness person and the pressure that the body can bear [14]. The network system converts the obtained customer information into useful data, transmits it to the relevant computer server, and then transmits it to the staff after sorting. The application system is mainly for data storage and extraction functions [15]. Literature puts forward a problem that needs to be solved urgently. Nowadays, fitness equipment is relatively single, and users are not interested in using it. The newly designed fitness equipment combines modern high technology, which can first verify the user’s identity and then provide a personalized mode. Since the new system combines the simulated reality technology, it can give users a better experience, so it is more attractive [16, 17]. The system can not only guide people’s fitness methods but also record the data and results of people’s exercise in real time, avoiding the disadvantage of poor communication with users and making fitness equipment more personalized and digitizing. We specifically use treadmills as an example. The treadmills under the new technology have added embedded technology, perception technology, and automatic collection technology, which can verify people’s identities, collect statistics during and after exercise, make fitness distribution of functions between the equipment, fitness people, and fitness coaches more reasonable [18, 19], and increase the communication between the three to maximize advantages, diversify exercises, and make data more accurate.

3. Principle Analysis of Sports Training Safety System Based on Human Dynamics

3.1. Human Arm Motion Analysis. Bring the relevant position of the connecting rod into the formula established according to the coordinate system, and the transformation law can be obtained. The specific relation formula is as follows:

\[ i^{-1}T = \text{Rot}(z, \theta_i) \times \text{Trans}(0, 0, d_i) \times \text{Trans}(a_i, 0, 0) \times \text{Rot}(x, a_i). \]  

(1)

The specific explanation of the above formula is as follows:

\[
\begin{pmatrix}
    c\theta_i & -s\theta_i & 0 & a_{i-1}c\theta_i \\
    s\theta_i & c\theta_i & 0 & -a_{i-1}s\theta_i \\
    0 & c\alpha_{i-1} & -s\alpha_{i-1} & a_i \\
    0 & s\alpha_{i-1} & c\alpha_{i-1} & d_i
\end{pmatrix}
\]

(2)

In order to study the impact of the sports training system on people, we need to introduce the D-H model to calculate the transformation law between the human arm joints and the joints. We bring the relevant collected human arm joint change data into the following formula:

\[ R^{\text{TH}} = \mathbf{T}_{i-1} \times \mathbf{T}_i. \]  

(3)

The specific calculation process of the above formula is as follows:

\[
\begin{pmatrix}
    \mathbf{T}_1 = \text{Rot}(Z_1, \theta_1)\text{Trans}(l_1, 0, 0) \\
    \mathbf{T}_2 = \text{Rot}(Z_2, \theta_2)\text{Trans}(l_2, 0, 0)
\end{pmatrix}
\]

(4)

When we perform shoulder-related exercises, the most commonly used sports equipment is the shoulder press. When people use this type of exercise equipment to
exercise, their arm movements are carried out on a relatively inclined horizontal surface, including up and down or back and forth, two modes of exercise. Combining the above conditions, we need to fix the positions of the two rods. If in the coordinate system we have established, where people are located is the origin of the coordinate system, when the inclination of the arm and the ground is 30 degrees, we can bring relevant data into the formula to observe the result:

\[
b_{\text{base}} = \text{Trans}(0, 0.22, 1.1) \cdot \text{Rot}\left(x, \frac{-65}{180\pi}\right)
\]

\[
r_{TH} = \begin{bmatrix}
    c_1c_2 & -s_1s_2 & 0 & l_1c_1c_2 + l_1c_1 \\
    0.42s_1s_2 & 0.42c_1c_2 & 0.91 & 0.42l_2s_1s_2 + 0.42l_1s_1 + 0.22 \\
    -0.91s_2s_2 - 0.91s_2 & 0.42 & 1.1 - 0.91l_1s_2s_2 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\]  (5)

The real data obtained in the coordinate system is

\[
r_{TH} = \text{base} \cdot \begin{bmatrix}
    0 & 0 & 1 & 0 \\
    0 & 0 & 0 & 1
\end{bmatrix} = \text{Rot}(Z_1, \theta_1) \\
\text{Trans}(l_1, 0, 0) \cdot \text{Rot}(Z_2, \theta_2) \cdot \text{Trans}(l_2, 0, 0).
\]  (6)

Bring the relevant data into the DH system to get smaller data:

\[
r_{TH} = \begin{bmatrix}
    c_12 & -s_12 & 0 & 0.24c_12 + 0.31c_1 \\
    0.42s_12 & 0.42c_12 & 0.91 & 0.22 + 0.1s_12 + 0.13s_1 \\
    -0.91s_12 & -0.91c_12 & 0.42 & 1.1 - 0.28s_1 - 0.21s_12 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\]

\[
\begin{align*}
c_1 &= \cos \theta_1, & s_1 &= \sin \theta_1, \\
c_2 &= \cos \theta_2, & s_2 &= \sin \theta_2.
\end{align*}
\]  (7)

Since the shelf of the referral equipment can only be composed of one component, we can only build a change matrix. Of course, we still have to calculate on the basis of the DH system, so we can describe the motion formula of the relevant machinery as

\[
r_{TH}' = \begin{bmatrix}
    c_3 & -s_3 & 0 & l_3c_3 - 1.5 \\
    0.36s_3 & 0.36c_3 & 0.93 & 0.36l_3s_3 + 0.17 \\
    -0.93s_3 & -0.93c_3 & 0.36 & 1.3 - 0.93l_3s_3 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\]  (10)

Bring in

\[
r_{TH}' = \begin{bmatrix}
    c_3 & -s_3 & 0 & -1.5 + 1.1c_3 \\
    0.36s_3 & 0.36c_3 & 0.93 & 0.17 + 0.41s_3 \\
    -0.93s_3 & -0.93c_3 & 0.36 & 1.3 - 1.1s_3 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\]  (11)

We can make adjustments to relevant data, such as changing the angle at which the exercise equipment is placed or the angle when the human body moves, perform a more realistic measurement of the equipment, and finally get the end space displacement curve, as shown in Figure 1.

According to the angle that the human body and the machine can rotate when moving, we count the angle and the recording angle of each rotation of the machine lever device and input the relevant formula to obtain the rotation angle and the recording angle of the arm joint during the movement. Then, we calculate the difference between the two rotation angles and finally obtain the corresponding rotation speed of the human body joint. Then, we bring the data of the rotation angle of the human arm into the differential calculation so that we can get the specific situation of the change of the rotational acceleration of the arm joint. The specific data selection and experimental results change are shown in Figure 2. Figure 2(a) shows the angle of the joint, Figure 2(b) shows the angular velocity of the joint, and Figure 2(c) shows the angular acceleration of the joint.

3.2. Human Dynamics Analysis. If we decompose the weight of the human arm, the weight distribution of the front arm and the back arm of the human is the same, and we can record the relevant quality data as $c_1$ and $c_2$. The formula for calculating the mass of the forearm is as follows:

\[
\text{Figure 1: Recommended end space displacement curve.}
\]

\[
\text{base} = \text{Trans}(-1.5, 0.168, 1.29) \cdot \text{Rot}\left(x, \frac{-69}{180\pi}\right).
\]

Next, get a more specific formula:

\[
r_{TH}' = \text{base} \cdot A_3 = \text{base} \cdot \text{Rot}(z_3, \theta_3) \cdot \text{Trans}(l_3, 0, 0),
\]

\[
r_{TH}' = \begin{bmatrix}
    c_3 & -s_3 & 0 & l_3c_3 - 1.5 \\
    0.36s_3 & 0.36c_3 & 0.93 & 0.36l_3s_3 + 0.17 \\
    -0.93s_3 & -0.93c_3 & 0.36 & 1.3 - 0.93l_3s_3 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\]

\[
\text{Bring in}
\]

\[
r_{TH}' = \begin{bmatrix}
    c_3 & -s_3 & 0 & -1.5 + 1.1c_3 \\
    0.36s_3 & 0.36c_3 & 0.93 & 0.17 + 0.41s_3 \\
    -0.93s_3 & -0.93c_3 & 0.36 & 1.3 - 1.1s_3 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\]
The mass calculation formula of the back arm is

\[
c_2 = \begin{bmatrix}
    l_1 \cos \theta_1 + 0.5l_2 \cos(\theta_1 + \theta_2) \\
    l_1 \sin \theta_1 + 0.5l_2 \sin(\theta_1 + \theta_2) \\
    0
\end{bmatrix}.
\]  \quad (13)

is calculated by

\[
c_1 = \begin{bmatrix}
    0.5l_1 \cos \theta_1 \\
    0.5l_1 \sin \theta_1 \\
    0
\end{bmatrix}.
\]  \quad (12)

\[
\dot{c}_1 = \begin{bmatrix}
    0.5l_1 \dot{\theta}_1 \sin \theta_1 \\
    0.5l_1 \dot{\theta}_1 \cos \theta_1 \\
    0
\end{bmatrix},
\]

\[
\ddot{c}_1 = \begin{bmatrix}
    0.5l_1 \ddot{\theta}_1 \sin \theta_1 + 0.5l_2 \left(\ddot{\theta}_1 + \ddot{\theta}_2\right) \sin(\theta_1 + \theta_2) \\
    0.5l_1 \ddot{\theta}_1 \cos \theta_1 + 0.5l_2 \left(\ddot{\theta}_1 + \ddot{\theta}_2\right) \cos(\theta_1 + \theta_2) \\
    0
\end{bmatrix}.
\]  \quad (14)

and followed by

Figure 2: Arm joint motion curve.
\[
\ddot{c}_1 = \begin{bmatrix}
-0.5l_1 \left( \ddot{\theta}_1 \sin \theta_1 + \dot{\theta}_1 \cos \theta_1 \right) \\
-0.5l_1 \left( \ddot{\theta}_1 \cos \theta_1 + \dot{\theta}_1 \sin \theta_1 \right) \\
0
\end{bmatrix},
\]
\[
\dddot{c}_2 = \begin{bmatrix}
-\dot{l}_1 \left( \dddot{\theta}_1 \sin \theta_1 + \dddot{\theta}_1^2 \cos \theta_1 \right) - 0.5l_2 \left( \dddot{\theta}_1 + \dddot{\theta}_2 \right) \sin \left( \theta_1 + \theta_2 \right) + \left( \dddot{\theta}_1 + \dddot{\theta}_2 \right) \cos \left( \theta_1 + \theta_2 \right) \\
-\dot{l}_1 \left( \dddot{\theta}_1 \cos \theta_1 + \dddot{\theta}_1^2 \sin \theta_1 \right) - 0.5l_2 \left( \dddot{\theta}_1 + \dddot{\theta}_2 \right) \cos \left( \theta_1 + \theta_2 \right) - \left( \dddot{\theta}_1 + \dddot{\theta}_2 \right) \sin \left( \theta_1 + \theta_2 \right) \\
0
\end{bmatrix}.
\] (15)

The equation for calculating the force of the forearm is as follows:
\[
f_{0,1} - f_{1,2} + f_1 = m_1 \ddot{c}_1, \tag{16}
\]
\[
m_{0,1} + \frac{1}{2}f_{0,1}l_1 - m_{1,2} - \frac{1}{2}f_{1,2}l_1 = I_{cl}e_I. \tag{17}
\]

The calculation equation about the force of the rear arm is as follows:
\[
f_{1,2} - f + f_2 = m_2 \dddot{c}_1, \tag{16}
\]
\[
m_{0,1} + \frac{1}{2}f_{0,1}l_1 - m_{1,2} - \frac{1}{2}f_{1,2}l_1 = I_{cl}e_I. \tag{17}
\]

Among them,
\[
\begin{align*}
\{ f_1 &= \begin{bmatrix} 0 & m_1 g \cos \beta & 0 \end{bmatrix}^T \\
\{ f_2 &= \begin{bmatrix} 0 & m_2 g \cos \beta & 0 \end{bmatrix}^T \\
\{ m_{0,1} &= m_1 = \begin{bmatrix} 0 & 0 & m_{11} \end{bmatrix}^T \\
\{ m_{1,2} &= m_2 = \begin{bmatrix} 0 & 0 & m_{22} \end{bmatrix}^T
\end{align*}
\] (18)

which is substituted into
\[
\begin{align*}
\begin{bmatrix} m_2 &= I_{cl}c_2 - \frac{1}{2} \left( m_2 c_2 - m_2 g \cos \beta \right) l_2 + m, \\
m_1 &= I_{cl}c_1 - \frac{1}{2} \left( m_1 c_1 - m_1 g \cos \beta \right) l_1 + m_2.
\end{bmatrix}
\] (19)

Among them,
\[
\begin{bmatrix}
l_1 &= \begin{bmatrix} I_1 \cos \theta_1 \\
0
\end{bmatrix},
l_2 &= \begin{bmatrix} I_2 \cos \left( \theta_1 + \theta_2 \right) \\
0
\end{bmatrix},
m_1 &= \begin{bmatrix} I_{1x} & 0 & 0 \\
0 & I_{1y} & 0 \\
0 & 0 & I_{1z}
\end{bmatrix},
m_2 &= \begin{bmatrix} I_{2x} & 0 & 0 \\
0 & I_{2y} & 0 \\
0 & 0 & I_{2z}
\end{bmatrix}
\end{bmatrix}
\] (20)

Combine the above formula to get
\[
\begin{align*}
\begin{bmatrix}
\dddot{c}_2 \\
\dddot{c}_2 - g \cos \beta \\
\frac{\dddot{c}_2}{\dddot{c}_2} \times I_{22} \sin \left( \theta_1 + \theta_2 \right) + m
\end{bmatrix} = \begin{bmatrix} I_{1x} \cos \theta_1 \\
0 \\
0
\end{bmatrix} + \begin{bmatrix} I_{1y} \sin \theta_1 \\
0 \\
0
\end{bmatrix}.
\] (21)

So the specific equation of Newton Euler about force is as follows:
to the strengthening of muscle strength, and some people exercise to increase lung capacity, so the exercise system must combine multiple aspects to plan the exercise mode.

The general exercise method has limitations. The exercise equipment is relatively single. During the exercise, we can only measure the amount that each person can do each time or each person per group, and the data collection is relatively incomplete. Under the new sports model design, we have added a new recording method to the original sports mode. We will check the speed of each exercise of each person, the highest point that the referral can reach, and the time between each referral or the exercise, monitor the heartbeat frequency and other aspects of the participants, and make relative adjustments to the planning of people of different ages, different physical conditions, and different exercise purposes.

During people’s exercise, people’s physical condition is not a static state but constantly changes with the time and frequency of the exercise and maintains a more continuous state during this exercise. Therefore, in the process of constant change, the new model can capture the changing process of people’s bodies and make timely adjustments. The specific data to be referred to are as follows.

3.3. Establish a Basic Exercise Prescription Generation Model. The relevant model designed in this experiment not only has the model foundation of the ordinary model but also makes relevant adjustments according to the development of the times. The main features are as follows.

The model used in this experiment is a model with a personalized design for people of different age groups and people with different physical conditions. According to the different characteristics of exercise intensity that children, youth, adults, and the elderly can withstand, the exercise methods we recommend for each type of people are also different, and the exercise effects that can be achieved are also different. For example, for younger children or older people, we should use a less-intensity mode to exercise their cardiorespiratory capacity, muscle endurance, or flexibility so as not to have a bad effect on their bodies; for people and adults, they can withstand greater intensity and can exercise for a longer time, so we can relatively increase their cardiorespiratory capacity, muscle endurance, or flexibility exercises so that their exercise can produce a good effect. In addition, we must pay more attention to the problems of the body itself; that is, for people with heart disease, asthma, and other diseases, their exercise style will be very different from the exercise style of ordinary people; otherwise, there will be very serious consequences, which may be life-threatening.

Another point worthy of our attention is that although sports are good for people’s bodies, we still have to consider people’s subjective wishes and see where they want to perform specific exercises. For example, girls pay more attention to body shape adjustments, boys pay more attention

\[
m_{22} = \theta_1 \left( l_{22} + \frac{1}{4} m_2 l_2^2 + \frac{1}{2} m_2 l_2 \cos \theta_2 \right)
+ \theta_2 \left( l_{22} + \frac{1}{4} m_2 l_2^2 \right) + \frac{1}{2} m_2 l_2 \sin \theta_2 + \frac{1}{2} m_2 l_2 \sin (\theta_1 + \theta_2) \cos (\theta_1 + \theta_2)
+ \theta_1 \theta_2 m_2 l_2 \sin (\theta_1 + \theta_2) \cos (\theta_1 + \theta_2)
- \frac{1}{2} m_2 l_2 \cos \beta \cos (\theta_1 + \theta_2) + m,
\]

\[
m_{11} = \theta_1 l_{11} - \frac{1}{2} m l_1 \cos \beta \cos \theta_1 + m_{22}.
\]

After we know the specific machine composition, machine state, machine rotation speed, and machine force, we will combine the data with the R system. The relationship between the specific machine angle and the machine force is shown in Figure 3.

3.3.1. The Pressure on the Body during the Referral Process. In this experiment, we will use the most accurate RM system to represent the pressure that the body bears during the referral process. The pressure that each person’s muscles can bear is different, and the maximum bearing capacity of each person’s muscles is also different, so we have to collect the maximum number of times and the longest time that each person can exercise. For example, if the maximum weight recommended by a person is 30 kg, then the maximum strength recommended by him is 30 kg. These data correspond to each other. The specific data are shown in Table 1.

3.3.2. Maximum Referral Height. The measurement of the lifting height refers to a calculation method of how high people can lift equipment of different weights during the lifting exercise; that is, we need to focus on the movement process and distance of the equipment. We can divide the reference height into two categories: one is the height that can be reached each
time in the dynamic reference process, and the other is the maximum height that people can reach in the static time. Moreover, the arm length of people of different heights and genders is different, so the recommended height is also different. In the experiment, by analyzing the maximum value of the recommended height, we can get the relationship between it and the rotation angle of the motion machine, and finally, we can get the motion cycle data in real time.

3.3.4. Recommended Interval. It is best to keep the interval within a few seconds.

3.3.5. Recommended Number. For those who want to improve muscle power, the number of recommendations can be increased to about 10 as a group. This type of data is suitable for young people and adults with better health, but for the elderly, it is too intense, and the referral is not suitable for them, so we can adopt a strengthening strength training program, control the number of each group to about 10, and increase the interval of referrals appropriately. If middle-aged and elderly people want to improve muscle endurance, you can increase the number of recommendations to no more than 20 and practice repeatedly on this basis. The number of suitable exercises for different groups is shown in Table 2.

3.3.6. Interval between Exercises. We can divide the interval of each group of exercises into two types: one is the longer rest time, which can control the rest time within 3–4 minutes, and the other is the shorter each group exercise interval mode. The rest time is controlled between 40 and 50 seconds. Choosing a suitable rest method and a more flexible rest time can strengthen muscle training and improve the effect of exercise.

3.3.7. Number of Recommended Groups. According to the relevant standards set by the country, we can strengthen training for adults and young people with better physical conditions. They can set the number of referrals to more than two groups, but it is best not to exceed four groups, and the intensity and speed of the referrals should not be too strong; for middle-aged and elderly people with relatively poor physical conditions and people who have just started to involve this exercise method, the number of referrals needs to be controlled within one group.

3.3.8. Training Frequency. In accordance with relevant national standards, we suggest that ordinary people should be able to set aside 1–3 days a week for physical exercise and at least one set of recommended exercises each time. If people need to do multiple press exercises in a day, the interval between two consecutive press exercises should not be less than 9 hours, and the muscles should be fully relaxed; otherwise, it will cause damage to the body. After several weeks of exercise, you can record your exercise results and compare with the previous data to see if there is a better and more suitable training method.

4. Sports Training Safety System Design Based on Embedded Software System and Internet of Things

4.1. System Overall Design. The method used in this experiment to collect data is mainly to use the monitoring system to collect exercise data in the gym. Different types of fitness equipment have different monitoring methods, which has changed the single type and relatively boring mode of the previous fitness equipment. Equipment is more carefully divided into two types: aerobic and anaerobic. Regarding aerobic equipment, its main function is to increase muscle endurance, explosive power, and so on. The main types are barbells, dumbbells, and so on, which mainly exercise

| Intensity selection | 1-RM indicator | Suitable for the crowd | Effect |
|--------------------|----------------|------------------------|--------|
| Larger-large       | 80%            | Experienced exerciser  | Power  |
| Medium-large       | 60%–70%        | Beginner               | Power  |
| Low-low            | 40%–50%        | The elderly            | Power  |
| Low-medium         | <50%           |                        | Endurance |

Table 1: Different groups are suitable for exercise intensity.
Table 2: Number of suitable exercises for different groups.

| Number of single group recommendations | People suitable | Effect               |
|----------------------------------------|----------------|---------------------|
| 8–12                                   | Adult          | Strength and explosiveness |
|                                       | The elderly    | Power               |
| 10–15                                  |                | Endurance           |
| 15–20                                  |                |                     |

Figure 4: Overall system structure.

Figure 5: Network topology diagram.
various parts of the body such as thighs, buttocks, and biceps.

The sports training system used in this experiment is a system that combines a variety of smart devices, which is both personalized and targeted and can make people feel interesting; the specific components of the sports training system built through the server are as shown in Figure 4.

When we apply the above training system to our lives, we will use related intelligent tracking modes to monitor people’s movement patterns and processes. The model connects the relevant equipment with the central processor through the network transmission system and then realizes the data transmission through the relevant website or platform. Use the Bluetooth system to connect the fitness equipment to the relevant system so that the machine can operate, and at the same time, it can also be used to upload people’s exercise time, calories consumed, and other related data to the mobile phone or computer, and special personnel will conduct a comparative investigation on the information and money storage status of the campus card. This chip is small in size, high in transmission efficiency, and easy to carry by students. Therefore, when each student holds the campus card, the related equipment in the campus card will be signal linked with the equipment installed in the school. This mode is wireless, which is very convenient and fast. In this way, we can collect the identity information and money storage status of the campus card through the web server. When the student ID is displayed on the computer screen, it proves that the student has swiped the card successfully.

4.3. System Hardware Design. After we have completed the design of various systems and functions, the ultimate goal is to apply them on the campus of the university to have a positive impact on the health of students. We install a chip with countless transmission systems in the student’s campus card. The chip is small in size, high in transmission efficiency, and easy to carry by students. Therefore, when each student holds the campus card, the related equipment in the campus card will be signal linked with the equipment installed in the school. This mode is wireless, which is very convenient and fast. In this way, we can collect the identity information and money storage status of the campus card through the web server. When the student ID is displayed on the computer screen, it proves that the student has swiped the card successfully.

4.4. Database Design. The software of the lower computer uses wireless technology to transmit various data. The main function of the upper computer software is to integrate and analyze the data transmitted to each other and then upload the data to the relevant website, and students can check it by themselves.

The database includes the following information:

1. User-related information, such as name, gender, height, and weight. User information form is shown in Table 4.
2. Related information generated when the user exercises, such as data generated by raising or lowering the arm. User exercise record is shown in Table 5.
3. What is the effect produced by the user during the exercise, such as the force required to raise or lower the arm, and the overall effect after the completion of the press exercise. Exercise effect evaluation form is shown in Table 6.

5. Sports Training Safety System Test and Result Analysis

5.1. Lower Computer Installation and Performance Test. Design specific hardware facilities according to relevant data, and the bottom PCB design of the data acquisition terminal is shown in Figure 6. Top PCB design drawing of data acquisition terminal is shown in Figure 7.

We will take a school in a certain place as an example to practice the experimental model designed above and then see how effective it is. First, after the students have created their own accounts, they enter the correct user name and

| Types                  | ZigBee          | Bluetooth        | WiFi            | Z-wave           |
|------------------------|-----------------|------------------|-----------------|-----------------|
| Distance               | 10~100 m        | 10 cm~10 m       | 50~100 m        | 30~100 m        |
| Transfer speed         | 250 kbits       | 1 Mbps           | 1~11 Mbps       | 9.6/40 kbits    |
| Working frequency      | 2.4–2.483 GHz   | 2.4 GHZ          | 2.4 GHZ         | 908.42 MHZ      |
| Network time           | 10~30 ms        | 3~10 s           | 0~3s            | 10~30 ms        |
| Number of nodes        | 255/65535       | 7                | 32              | 255/65535       |
| Power consumption      | Lowest          | Lower            | High            | Very low        |

Table 3: Main features of several communication methods.
password to enter the corresponding interface, where they can formulate their own sports mode and sports goals according to their own situation, and they can receive the administrator-related notices, some practical health recommendations, and so on; the system can monitor the students’ exercise and avoid cheating. If students forget their account or password, they can log on to the relevant website to retrieve it, which is simple and convenient.

Secondly, after we let the teacher create his own account, they enter the correct user name and password to enter the corresponding interface and check the student’s movement through related functions.

Finally, the students created their own accounts. After entering the correct user name and password to enter the corresponding interface, they can view the schedule of each sports course and choose the course they like.

5.2. Analysis of Test Results. Through specific practice in a school in a certain area, we can know that the accuracy of the data is high, the network signal is better, the data transmission speed is faster, and the transmission distance is longer, which can cover the entire campus. After about 5 months of practical testing in a school in a certain area, no obvious problems were found. The information collection and network transmission functions are good, and the students’ evaluation is high.

6. Conclusion

In the era of rapid development of the Internet, intelligent technology has become a part of our life and has been applied to many fields; now, there are more and more high-tech emerging and developing; this paper mainly uses the embedded software to model the sports training system and studies the development of its security performance. We use the Internet to collect a large number of data and then

![Figure 6: The bottom PCB design of the data acquisition terminal.](image6)

![Figure 7: Top PCB design drawing of data acquisition terminal.](image7)
compare them with the traditional sports equipment data; we found that the new system is more personalized and professional and has scientific outstanding advantages and found out the shortcomings of the traditional mechanical equipment to avoid a similar situation in the new model. We have also independently established a wireless network signal enhancement system to ensure the real-time data collection and transmission and ensure that, even in the case of bad weather, our signal remains in a relatively stable state, without information loss and signal interruption. We have also installed and tested the system. Before the system is installed, we need to plan the installation plan and carry out a series of tests at the set point to test the ideal distance between the two points and the packet loss rate. After finding a good point, the whole system is installed to simulate the normal operation state, and the students will test it, including the system pressure test. For the upper computer, it also needs a large amount of access data to test the pressure of the web page. Before the system is officially put into use, it has been running in the school for five days. According to the student visits and the running status of the website, it evaluates the whole background server and analyzes the reasons.

Data Availability

The data used to support the findings of this study can be obtained from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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