

Research Article

Related Biological Factors of Mobile Sensor Network Technology on Sprint Performance

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Node localization and temporal synchronization, as two key parts of each self-organized and localization-aware wireless sensor network (WSN), have been a key topic for research and applications. The initial prototype of the sensor network is the same as that of the local area network. All nodes are connected by wires, and there is a central control node. All nodes transmit data to the central node point-to-point. With the development and progress of wireless communication technology, the current sensor network has developed into a WSN. Without a central node, all nodes can communicate with each other; so, it is natural to develop positioning technology in WSN. Node positioning in wireless sensor networks refers to the process in which sensor nodes determine the location information of other nodes in the network through a certain positioning technology based on the location information of a few known nodes in the network. The principle of positioning is purely geometric in mathematics. With the in-depth promotion of WSN in the application field, there are more and more requirements for high precision positioning, the higher the positioning accuracy, the higher the requirements for network time synchronization, and the problem of node clock synchronization and high precision positioning of the node can be studied together. Solving the problem of node clock synchronization can further provide support for node positioning in a variety of different environments. As a new ultrabroadband (UWB) carrier-free communication technology with nanoscale temporal resolution, it has been widely used in high-precision node positioning systems in recent years, UWB technology is the most advanced noncarrier wireless communication technology that uses bandwidths above 1GHz and uses nonsine wave narrow pulses from nanoseconds to picoseconds to transmit data. Therefore, it occupies a very wide spectrum. UWB technology has the advantages of low system complexity, low transmit signal power spectrum density, insensitive to channel fading, and high positioning accuracy. It is especially suitable for high-speed wireless access in dense multipath places such as indoors, providing a technical basis for the engineering implementation of high-precision positioning algorithms. However, the current situation of Chinese track and field events has not kept pace with the development of Chinese competitive sports, and even the level of individual events has a gradual decline. Therefore, it is very meaningful to study the relevant biological factors that affect sprint performance. This article analyzes the related biological factors that affect the performance of the sprint, combines the knowledge of physiology to analyze the training methods that appear in the sprint from the physiological perspective, and analyzes the related biological factors that affect the performance of the sprint. This article chooses to divide them into men's group (3 groups) and women's group (3 groups), with 4 people in each group. Experiment proved that after the experiment, these are the following factors: the fatigue of the nervous system, the technical difference of sprinting, the change of muscle fiber enzyme activity, the order of muscle fiber cross-sectional area and muscle activation, and the recruitment of muscle fiber types. Impact P value less than 0.05, which shows that the factors that affect sprint performance are complex, and the biological factors that affect step length can be studied through anthropometry. The impact of step frequency on sports performance is very important.

1. Introduction

After years of research and development, WSN has moved from the forefront of technology to large-scale applications. WSN has been given mature applications in many aspects of life and work, covering civil areas including environmental monitoring, medical care, disaster monitoring, smart home, logistics tracking, and the Internet of Things. At the same time, WSN also has great military application value and has been promoted and used in international antiterrorism, military electronic investigation, target positioning, real-time target monitoring, and short-distance communication support. With its innate advantages of convenient deployment, low cost, flexible networking, strong real-time, and complete functions, WSN is rapidly expanding to deeper research fields and wider application fields. The use of scientific training methods and monitoring methods to improve the effect of sports training and improve sports performance has become one of the important development directions of sports. As we all know, track and field is one of the oldest sports events and the event with the largest number of giant gold medals in the Asian Games and Olympic Games. All developed countries in competitive sports in the world regard track and field events as the strategic focus of sports development. Track and field has always been the most intense competition and the most competition events in the olympics and professional games. Track and field events are the foundation for the development of other events. The development of track and field events will directly affect the status of a country or region in the international sports arena. It will also have an impact on the development of other competitive sports and national fitness activities in a country or region. At present, an important reason for the slow application of mobile WSN is that the development of low-cost, rapid configuration, and accurate positioning mobile positioning system is not perfect, while most of the existing WSN positioning systems cannot meet the requirements. Most existing WSN positioning systems rely on additional hardware conditions or offnetwork infrastructure, only for static, well-equipped, or relatively expensive wireless sensor networks, while mobile WSNs for node location change, and WSN has strong network dynamics. Due to energy, environment and other issues, the sensor nodes will die, or due to the mobility of the nodes, new nodes will be added to the network, thereby using the transmission media to interconnect the physical layout of various devices; that is, the topology of the entire network dynamic changes occurs and cannot reduce work efficiency or even fail completely; the current WSN positioning technology focuses on solving small network scale and local relative positioning problems for specific applications, while the research of large-scale mobile WSN positioning is very inadequate. Therefore, it is an urgent need for the in-depth development and promotion of application of WSN to study the basic problems such as more convenient temporary positioning, more efficient information acquisition, and node positioning in mobile WSN.

Mobile wireless sensor network as an important direction of WSN research, compared with traditional WSN,

has more obvious advantages, such as convenient deployment, less anchor nodes, flexible networking, automatic adjustment location, mobile WSN in the Internet of things fine management, dynamic real-time monitoring, warehouse cargo flow management, and fire rescue firefighters, and underground flow personnel application field has an irreplaceable role [1]. Therefore, mobile WSN based on anchor node movement receives more and more attention and gradually becomes the main trend of WSN development and application. The development time of foreign sprint projects is earlier than that of China, the research in this field is also more advanced, and these studies are mainly concentrated in some countries with strong track and field strength such as Europe, America, and Russia. These experts and researchers have conducted in-depth research on sprinting and have achieved a series of research results. According to Haugen's systemic training in the high altitude zone, the athletes' body characteristics showed an increase in the number of red blood cells, an increase in maximum oxygen uptake, and aerobic metabolism. After further physiological and biochemical tests, the athlete's body was closely related to the specific ability of sprinting. The number of mitochondria also increased [2]. Petrakos et al. believe that sprinting should pay attention to maintaining the principle of gradual progress while increasing the training measurement, and the principle of balance should be maintained in the content of training, and the diversity of means should be emphasized [3]. Graham-Paulson et al. believe that focusing on the role of speed training, emphasizing that training content is arranged for the purpose of increasing speed in each period and implementation stage of training, which is also an important concept in sprint training [4].

At this stage, Chinese sprint event is in a downturn, and the management model of sports teams is relatively old and lacks a certain degree of scientificity; the coaching level and theoretical and cultural qualities of the sports team's coaches need to be strengthened and improved and should be gradually reformed in the future development, existing management system, and absorbing advanced training methods. Rumpf et al. collected the relevant results of the world's sprint training methods, selected representative training methods, and carried out classification analysis and comparative research on various methods from the perspectives of the time, background, and characteristics of various methods [5]. De Hoyo et al. believe that physical function is the prerequisite for the excavation of athletes' ability. The level of its level will directly affect the improvement of sports quality and the performance of technical and tactical levels and then affect the further improvement of sports performance, technically strive for economy and effectiveness [6]. Laird et al. believe that the continuous running and natural running training methods of sprint training are aerobic training methods. These methods are characterized by low intensity and large exercise measurement; although, such training methods are very helpful to improve the endurance of athletes [7].

The biological factors that affect sprint performance are complex and diverse. Traditionally, it has been thought that sprint performance is mainly determined by genetic genes,

and sports training has little effect on performance. However, in addition to being greatly restricted by genetic factors, human exercise capacity is also affected by environmental factors. This article has made certain statistics and analysis on the sprint performance and investigated and analyzed various main factors that affect the sprint. The main reasons for the development of sprinting are studied, and the countermeasures for the development of sprinting are tried to provide a theoretical basis for the brilliant and sustainable development of sprinting again.

2. Related Biological Factors Affecting Sprint Performance

2.1. Sports Fatigue

2.1.1. Sprint Fatigue. Sports fatigue can be divided into aerobic fatigue and anaerobic fatigue. Anaerobic fatigue refers to peripheral and local muscle fatigue caused by short-term vigorous exercise. There is basically no or very little oxygen involved. It is also called acute fatigue [8, 9]; aerobic fatigue refers to localized fatigue caused by prolonged exercise. Like sexual chronic fatigue and general fatigue, there is sufficient oxygen to participate in the exercise process, also known as chronic fatigue.

There are also many methods for detecting sports fatigue. Here are some methods for detecting and judging sports fatigue. In the observation method, you can judge the athlete's fatigue status by asking the athlete's self-feelings and observing their sports reflections and some external performances [10]. The body carries on long-term intense exercise. The pH value in the blood drops because the pH value is the most important indicator for judging the acid-base balance and regulating the degree of compensation in the body. It can reflect the result of the combined effects of respiratory and metabolic factors in the body. The pH value is too low or too high. It can seriously affect the body's biological functions, including various enzyme systems, electrolyte transport, and cell metabolism. This indirectly reduces the pH value in saliva. With the development of science and technology, EEG, EMG, etc. have gradually been applied to the assessment of human fatigue, especially the application of EMG, which has become very common in foreign countries and has become popular in China. Its characteristic is that it can be real-time. Monitor the discharge of muscles during human exercise, so as to understand the body's fatigue status. Electromyography refers to the bioelectric patterns of muscles recorded with an electromyography instrument. It is of great significance to evaluate people's activities in man-machine systems. It can monitor the discharge of muscles in the process of human exercise in real time, so as to understand the fatigue state of the human body.

2.1.2. Research Progress of Anaerobic Fatigue. Anaerobic fatigue refers to peripheral and local muscle fatigue caused by short-term vigorous exercise. There is basically no or very little oxygen involved in the exercise process. It is usually called acute fatigue [11]. Under normal circumstances, most

tissues and organs of the body have sufficient oxygen supply; so, the body rarely conducts anaerobic metabolism to supply energy. However, during strenuous exercise, due to the limitation of the cardiopulmonary function, the body cannot provide it in a short period of time. The body provides sufficient oxygen, and the muscles are in a relatively hypoxic state. At this time, the body's energy supply mainly depends on the creatine phosphate and ATP stored in the body, as well as the strengthening of anaerobic glycolysis.

2.1.3. Research Progress of Aerobic Fatigue. Aerobic fatigue is relative to anaerobic fatigue. Aerobic fatigue refers to local chronic fatigue and general fatigue caused by prolonged exercise. There is sufficient oxygen to participate in the exercise process. The fatigue caused by aerobic exercise can cause changes in the body's internal environment and produce physiological reactions. With the development of science and technology in recent years and the in-depth study of aerobic fatigue, in-depth research on the physiological mechanism of human aerobic fatigue using high-tech precision instruments has been widely carried out at home and abroad [12–14]. Understanding the physiological mechanism of fatigue can promote sports training. Coaches and athletes will adjust the training program according to the level of exercise and then carry out antifatigue training, delay the time of fatigue, and achieve the purpose of improving sports performance. Aerobic fatigue and aerobic capacity are related, because in aerobic exercise, when the human body exerts its maximum aerobic exercise capacity, it is accompanied by aerobic fatigue.

2.1.4. Fatigue Recovery. The human body will produce a certain degree of fatigue under different exercise loads. This is a physical state in which various tissues and organs of the human body and exercise ability are temporarily reduced, and it is a normal physiological change and psychological response. By consulting the existing domestic literature, it is found that the current research on fatigue recovery after exercise is mainly focused on the methods of fatigue recovery, and there are relatively few studies on the physiological characteristics of the fatigue recovery process [15, 16]. Therefore, the research on the characteristics of physiological changes during the recovery period after exercise is of great significance for recovery methods and scientific sports training.

2.2. Sprint and Human Motion Tracking Technology

2.2.1. Automatic Recognition of Human Joint Points in Moving Images. Research on moving images without marking points, that is, without identification points, mainly includes three methods: human motion tracking based on the contour feature point method.

Human Motion Tracking Based on Template Matching. There is an error measurement of the error value, and the error measurement is based on the normalized absolute error value [17]. The error metric of two pixel blocks based

on the crosscorrelation function is defined as

$$\text{CCF}(p, q) = \frac{\sum_{k=1}^m \sum_{l=1}^n S(k, l) T(k+p, l+q)}{\left[\sum_{k=1}^m \sum_{l=1}^n S^2(k, l) \right]^{1/2} \left[\sum_{k=1}^m \sum_{l=1}^n T^2(k+p, l+q) \right]^{1/2}}. \quad (1)$$

Matching criterion is as follows: search area represents the best pixel matching block [18]. The error metric based on the normalized mean square error value is defined as

$$\text{MSE}(p, q) = \frac{1}{mn} \sum_{k=1}^m \sum_{l=1}^n [S(k, l) - T(k+p, l+q)]^2. \quad (2)$$

Matching criterion is as follows: the pixel block corresponding to the largest $\text{MSE}(p, q)$ ($-w \leq p \leq w$), ($-w \leq q \leq w$) in the search area represents the best pixel matching block [19]. The error metric based on the normalized absolute error value is defined as

$$\text{MAE}(p, q) = \frac{1}{mn} \sum_{k=1}^m \sum_{l=1}^n |S(k, l) - T(k+p, l+q)|. \quad (3)$$

Search area represents the best pixel matching block [20]. The method of dynamically determining the search area, the basic principle, is track the location of the center of the area at time n :

$$\begin{aligned} x_n &= v_{n-1}(x)t + \frac{1}{2} a_{n+1}(x)t^2, \\ y_n &= v_{n-1}(y)t + \frac{1}{2} a_{n+1}(y)t^2. \end{aligned} \quad (4)$$

Among them,

$$\begin{aligned} v_n(x) &= \frac{S_n(x) - S_{n-1}(x)}{t}, \\ a_n(x) &= \frac{v_n(x) - v_{n-1}(x)}{t}. \end{aligned} \quad (5)$$

The radius of the search area is as follows: the search area radius is defined as

$$R_4 = |V_3| + |V_3 - V_2|. \quad (6)$$

Motion Tracking Based on Human Body Model Matching. The basic idea of motion tracking based on human model matching is to predict the state of the next frame based on the human motion model, then generate a certain representation of the human pose based on the median value of the predicted state, and use this representation to match the underlying features extracted from the image. According to the matching results, the current pose parameters are estimated [21, 22]. Since global search cannot be used to find the optimal posture, generally speaking, some approximate initial values are obtained first, and then search is performed

near the initial values:

$$N = \sum_j S(x_j). \quad (7)$$

Normalize $S(x_i)$, namely,

$$h(x_i) = \frac{S(x_i)}{N} = \frac{S(x_i)}{\sum_j S(x_j)}. \quad (8)$$

In fact, the histogram is the probability distribution of a certain feature. For grayscale images, the histogram is the probability distribution of grayscale. When all the values of the features in the image cannot be taken, some zero values will appear in the statistical histogram to make

$$\begin{aligned} H(p) &= [h(x_1), h(x_2), \dots, h(x_n)]. \\ \lambda(x_i) &= \sum_{j=1}^i h(x_j) \end{aligned} \quad (9)$$

Therefore, the cumulative histogram of the image is defined as

$$\lambda(P) = [\lambda(x_1), \lambda(x_2), \dots, \lambda(x_n)]. \quad (10)$$

Assuming that the image size is $X = \{x_{nm}\}$, the histogram of the generalized image is a two-dimensional histogram.

$$(X, Y) = \{(x_{mn}, y_{mn})\}_{M \times N} \quad (11)$$

Human Motion Tracking Based on Contour Feature Points. The vector derived from the Zernike moments of all gaits in a gait cycle can form a new feature matrix, and finally the square difference vector of the feature matrix is calculated as the identification feature vector of the gait cycle:

$$D_k(x, y) = \begin{cases} 255, & \text{if } |F_k(x, y) - B_{k-1}(x, y)| > T \\ 0, & \text{otherwise} \end{cases}. \quad (12)$$

At present, based on these three commonly used methods, a variety of improved methods have been produced. The normalized detection window is used as input, and the gradient in the horizontal and vertical directions is calculated through the gradient operator. The calculation method is as follows:

$$\begin{aligned} px(x, y) &= H(x+1, y) - H(x-1, y), \\ py(x, y) &= H(x, y+1) - H(x, y-1). \end{aligned} \quad (13)$$

Among them, $px(x, y)$ and $py(x, y)$, respectively, represent the horizontal gradient and the vertical gradient magnitude of (x, y) at the pixel point in the sample image. The

gradient of pixel (x, y) in the sample is defined as

$$G(x, y) = \sqrt{px^2(x, y) + py^2(x, y)}. \quad (14)$$

The gradient direction of pixel (x, y) in the sample is

$$\text{orient}(x, y) = \frac{\arctan(x, y)}{px(x, y)}. \quad (15)$$

Construct a gradient direction histogram for each cell unit in the image, and the amplitude of each pixel on the component interval is

$$V_k(x, y) = \begin{cases} G(x, y), & a(x, y) \in \text{bin}_k \\ 0, & a(x, y) \notin \text{bin}_k \end{cases} \quad 1 \leq k \leq 9. \quad (16)$$

In order to eliminate the influence of light and other effects, the histogram of the same block is normalized to obtain the histogram of the block.

$$f(C_i, k) = \frac{\sum_{(x, y) \in C_i} V_k(x, y) + \varepsilon}{\sum_{(x, y) \in B} V_k(x, y) + \varepsilon}. \quad (17)$$

$f(C_i, k)$ represents the proportion of the cumulative intensity of the k interval in the block B to which C_i belongs in a certain unit C_i , where $i = 1, 2, 3, 4$.

2.2.2. Human Motion Tracking. There are already some solutions for human motion tracking. However, there are still limitations in the simplicity of the tracking method, the feasibility of regional tracking, the intelligence of the algorithm, and the accuracy of the tracking results [23, 24].

Limitations of Gateway Determination. Because the human body has the characteristics of uniform chromaticity and no obvious feature points, the traditional matching algorithm based on the pixel gray difference at the joint points has certain difficulties in target recognition and location positioning.

Limitations of Area Tracking. Due to the complexity of sports, each link of the human body is always doing variable acceleration during the movement, and the speed and direction of the movement are constantly changing. Traditionally, only the movement of the previous moment is used to predict the next moment. The method of exercise situation is not feasible [25, 26]. Visible side joint points enter the contour line of the human body, the occlusion of invisible side joint points, the mutual influence between different links, etc. and make a major deviation in the joint point recognition process, so that subsequent points determined based on this point will be unable to determine, interrupting the recognition process.

Limitations of Simplicity and Accuracy. Although motion tracking based on human body model matching has advantages in the stability of recognizing joint points when the image quality is poor, it also has application complexity and inaccuracy in joint recognition due to individual differences. Although the improvement of automatic scaling is adopted, the proportion of each link has been determined

after the model is established [27, 28]. Due to individual differences, the model cannot be completely consistent with the moving human body, and certain errors will occur. The traditional method of determining joint points directly from the contour line feature points is easy to apply, but the contour features are not obvious due to poor image quality, especially the method of determining the feature points based on the contour line curvature. It cannot even be recognized [29, 30].

In order to meet the requirements of fast feedback and easy operation of sports technology analysis and provide easy-to-use digital images for the subsequent automatic recognition of the joint points of the moving human body by the analysis system, this study uses the first segmentation of the ghosted moving human body and then removes it by filling. In image ghosting and reframe, the processed moving human body is merged with the background, and finally, an image without ghosting and shaking is obtained [31, 32]. The flowchart is shown in Figure 1.

3. Experimental Design of Related Biological Factors Affecting Sprint Performance

3.1. Test Subject. Here, we select 24 sprinters from the School of Physical Education of X University as volunteers for this experiment, including 12 males and 12 females. The performance of sprint depends on the acceleration ability of the athlete, the maximum speed of the athlete, and the ability of the athlete to maintain the maximum speed. From a biological point of view, running speed mainly depends on two variables, step length and step frequency. At the same time, I did not use the questionnaire survey method. After modifying the test questions, expert evaluation, and the initial measurement, Table 1 was formed, the prediction test was carried out, along with the project analysis and the reliability and validity test, the test scale was formed, and the formal survey was carried out for analysis and discussion.

3.2. Experimental Method

3.2.1. Interview Method. In the process of research, interviews and telephone interviews were conducted with first-line coaches of sprint events and experts with rich experience in sprinting in colleges and universities to further understand the actual situation of sprinting and the main factors affecting the development of sprinting today. Consult relevant experts in sports scientific research, fully exchange opinions on related issues in the paper, and put forward scientific and reasonable suggestions for research.

3.2.2. Questionnaire Survey. This study uses the methods commonly used in social survey research to test the questionnaire, and make supplements and modifications based on the results of the test, and then issues the questionnaire. From the design ideas of the questionnaire to the final determination and review of the questionnaire, it is all carried out and completed under the guidance of relevant experts and scholars. When assessing the formal questionnaire, the experts agreed that the questionnaire question setting and

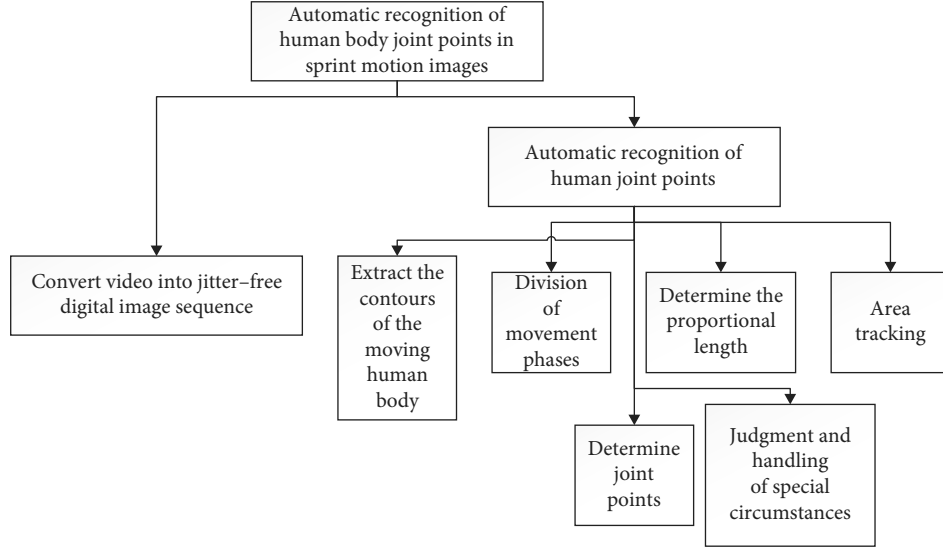


FIGURE 1: Flow chart of automatic recognition of human joint points in sprint motion images.

TABLE 1: Data sheet of basic conditions of experimental subjects.

Group	Average age	Training years	Average weight	Average height	
Women group	A	20.1 ± 1.5	0.82	64.4 ± 5.5	165.5 ± 2.3
	B	19.8 ± 1.6	0.73	63.9 ± 5.4	164.9 ± 2.3
	C	19.9 ± 1.2	0.67	64.9 ± 4.2	165.6 ± 1.6
	D	20.5 ± 1.2	0.70	74.6 ± 9.8	172.4 ± 4.6
Men group	E	20.1 ± 1.4	0.65	75.7 ± 9.6	173.1 ± 3.2
	F	19.9 ± 1.5	0.68	72.4 ± 10.6	174.8 ± 5.7

content setting can accurately reflect the actual development of sprinting.

3.2.3. Comparative Analysis. A series of statistical analysis of the test data of the subjects participating in this experiment is carried out to analyze the results, and valuable suggestions are provided for related biological factors that affect the performance of sprinting.

3.3. Gather Data. Large trapezoid distribution is as follows:

$$r(x) = \frac{x-c}{d-c}, c < x < d. \quad (18)$$

Partially small trapezoidal distribution is as follows:

$$r(x) = \frac{b-x}{x-a}, a < x < b. \quad (19)$$

3.4. Statistical Data Processing Method. SPSS23.0 software was used for data processing. The formula in Formula (20) is

$$a = \frac{k}{k-1} \left(1 - \frac{\sum \sigma_i^2}{\sigma^2} \right). \quad (20)$$

4. Related Biological Factors Affecting Sprint Performance

4.1. Evaluation Index System Based on Index Reliability Testing. The results are shown in Table 2.

It can be seen from Table 2 that the changes in muscle fiber enzyme activity, the cross-sectional area of muscle fibers, the order of muscle activation, the recruitment of muscle fiber types, the nerve conduction velocity, the excitability of motor neurons, and the fatigue of the nervous system are compared with the data obtained. The impact of this experiment is acceptable ($\alpha > 0.7$).

4.2. Main Factors that Determine Sprint Performance

4.2.1. Analysis of Technical Differences in Sprint. Some studies have shown that there are technical differences between athletes and nonathletes. It is believed that the reason for the difference is caused by some anthropometric factors such as the angle of the joints, the length of the bones, and the length of the muscle fibers. The results are shown in Table 3. We make a bar graph based on this result, as shown in Figure 2.

The article sets a P value to check the results and compare them. P value (P value) is the probability of a sample observation result or more extreme result when the null hypothesis is true. The smaller the P value, the more significant the result. Through the paired sample t -test, it can be found that after the end of the experiment, the impact of sprint technology on sprint performance P value is less than 0.05. There is a significant difference, indicating that the reason for the difference is that the long-term training of the athletes leads to the ease of nerve activation. When running at maximum speed, nonathletes can only rely on increasing the step length, but it is difficult to increase the speed by increasing the step frequency. Further understanding of this issue still requires long-term research. The specific situation is shown in Figure 2.

TABLE 2: Summary table of reliability test results.

Category	Index combination	Alpha coefficient (α)
Women group	Changes in muscle fiber enzyme activity	0.8445
	Muscle fiber cross-sectional area	
	Order of muscle activation	
	Recruitment of muscle fiber types	
	Nerve conduction velocity	
	Excitability of motor neurons	
Men group	Changes in muscle fiber enzyme activity	0.7662
	Muscle fiber cross-sectional area	
	Order of muscle activation	
	Recruitment of muscle fiber types	
	Nerve conduction velocity	
	Excitability of motor neurons	
	Nervous system fatigue	

TABLE 3: Technical difference data sheet for sprint.

Attributes	Accelerate	Maximum speed	Maintain speed	Stride	Cadence	Time
A	1.84	8.23	6.54	1.23	2.07	13.67
B	1.83	8.10	6.82	1.37	2.10	13.85
C	1.98	8.32	6.47	1.32	2.28	13.62
D	2.32	9.77	7.19	1.65	1.98	12.19
E	2.24	9.86	7.07	1.57	2.04	12.42
F	2.29	10.02	6.98	1.64	2.29	12.28
P	0.021	0.018	0.010	0.010	0.005	0.005

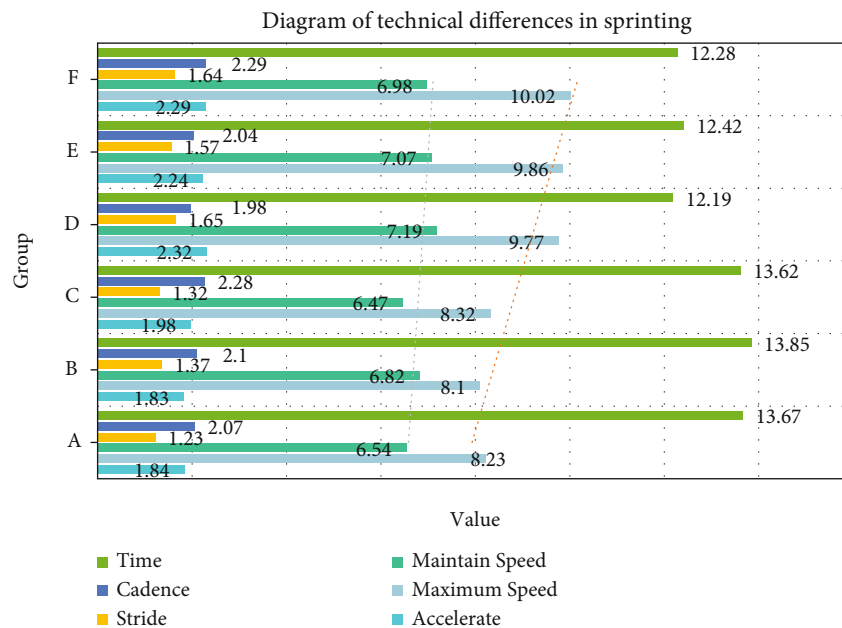


FIGURE 2: Diagram of technical differences in sprinting.

TABLE 4: Changes in muscle fiber enzyme activity and muscle fiber cross-sectional area data table.

Attributes	Muscle power	Contraction speed	Muscle recruitment	Muscle stiffness and elasticity	Tendon stiffness and elasticity	Joint stiffness and elasticity
A	2.12	3.23	3.85	5.48	5.35	6.90
B	2.27	3.08	3.87	4.96	5.47	7.24
C	1.81	2.97	3.90	5.32	5.26	7.50
D	2.46	3.67	3.94	4.94	5.40	7.13
E	2.39	3.79	4.22	5.12	5.18	7.29
F	2.37	3.72	4.48	4.99	4.95	6.87
P	0.043	0.037	0.032	0.027	0.035	0.042

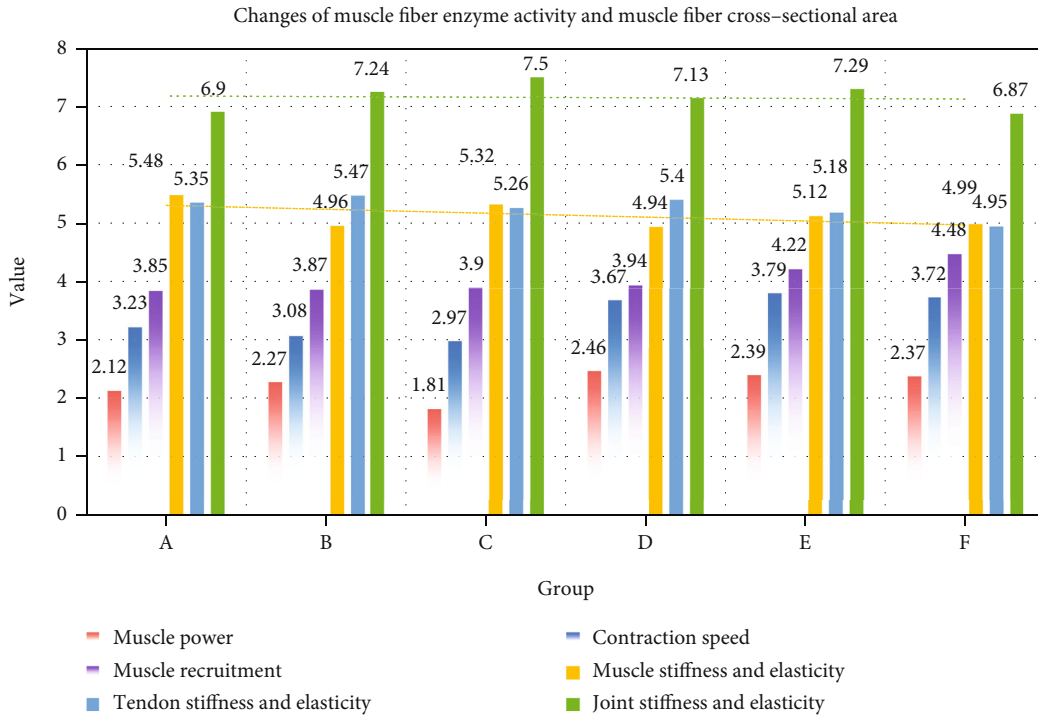


FIGURE 3: Changes of muscle fiber enzyme activity and muscle fiber cross-sectional area.

TABLE 5: The order of muscle activation and the recruitment data table of muscle fiber types.

Attributes	Contraction speed	Relaxation speed	Fatigue resistance	Power generation	Power output	Capillary density
A	5.01	1.95	2.5	2.81	3.41	5.12
B	4.12	2.19	1.32	4.15	3.12	4.91
C	3.84	3.02	1.88	6.2	4.83	4.8
D	3.45	5.52	2.59	5.65	5.19	4.82
E	4.87	4.32	3.7	6.53	7.03	7.79
F	5.23	5.62	4.52	3.25	6.85	7.32
P	0.010	0.012	0.014	0.012	0.018	0.008

4.2.2. Changes of Muscle Fiber Enzyme Activity and Analysis of Muscle Fiber Cross-Sectional Area. Speed training enhances the activity of anaerobic metabolism enzymes. Lactate dehydrogenase is a marker enzyme of sugar anaerobic metabolism. The activity of lactate dehydrogenase in fast

muscle fibers of sprinters is high, and the energy supply capacity of anaerobic metabolism of sugar is strong; ATP exists in myosin. In the process of muscle contraction and relaxation, ATP is broken down to provide energy, and the catalytic speed and efficiency of ATP in fast and slow muscle

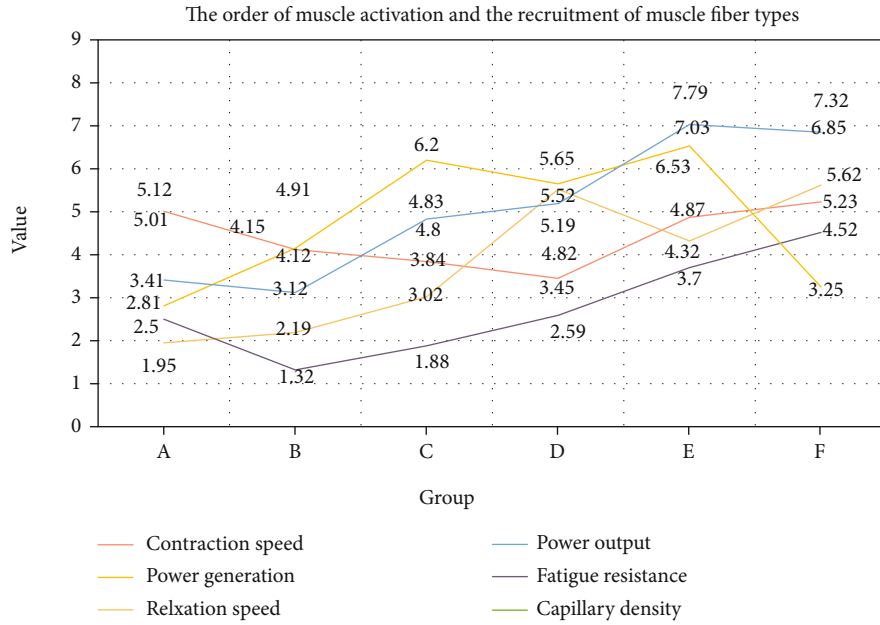


FIGURE 4: The order of muscle activation and the recruitment of muscle fiber types.

TABLE 6: Nerve conduction velocity data sheet.

Attributes	Membrane potential	Action potential	Polarization state	Active transport	Resting potential
A	2.44	2.29	2.66	2.85	2.62
B	2.82	2.68	3.32	3.29	3.26
C	2.9	3.25	4.28	3.89	4.25
D	4.42	4.49	4.91	5.41	4.86
E	5.23	4.93	5.17	5.15	4.97
F	5.37	5.3	7.11	7.23	7.26
P	0.010	0.010	0.010	0.010	0.010

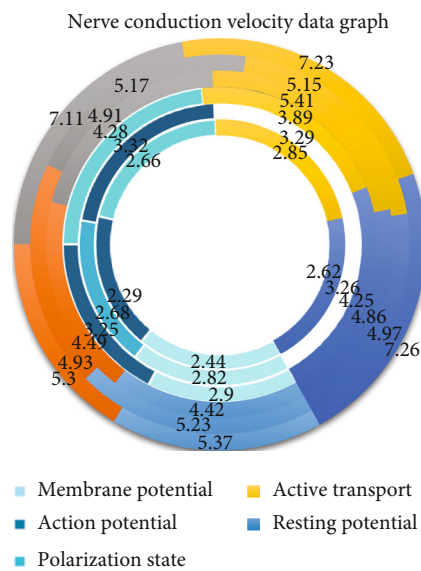


FIGURE 5: Nerve conduction velocity data graph.

fibers are different. The results are shown in Table 4. We make a bar graph based on this result, as shown in Figure 3.

Through the paired sample *t*-test, it can be found that after the end of the experiment, the changes in muscle fiber enzyme activity and the cross-sectional area of muscle fiber have a significant difference in sprint performance. *P* value is less than 0.05, which indicates that the ATP activity is enhanced and the muscle fibers are fastened during muscle contraction. It can make full use of energy materials. Exercise training can increase the content of muscle fiber contractile protein; so, it can cause an increase in muscle volume and an increase in muscle fiber area, showing obvious special features. Long-term training for sprinters can increase the area of fast muscle fibers. These changes in muscle functions and morphology are conducive to the improvement of sports performance and were once considered to be the main factors determining sprint performance. The specific situation is shown in Figure 3.

4.2.3. *The Order of Muscle Activation and the Recruitment of Muscle Fiber Types.* As the movement speed increases to the maximum speed, the order of muscle activation changes

TABLE 7: Motor neuron excitability data table.

Attributes	Receptors	Sensory neuron	Interneuron	Effector	Postural reflex	Stretch reflex
A	2.35	2.11	1.91	2.16	2.29	2.29
B	2.26	1.99	1.82	2.31	2.47	2.3
C	3.9	4.66	3.84	2.27	5.4	3.52
D	3.32	5.77	4.86	5.61	4.44	3.59
E	7.02	4.55	5.08	4.35	4.44	6.19
F	5.39	7.36	7.3	6.88	5.09	4.91
P	0.008	0.004	0.004	0.008	0.008	0.004

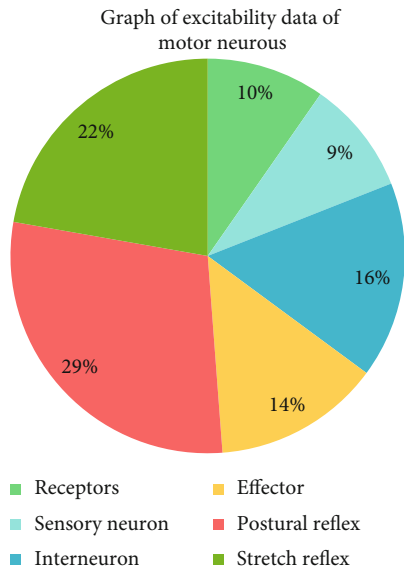


FIGURE 6: Graph of excitability data of motor neurons.

significantly. Various muscles are activated at different times. The coordination of active muscles and antagonist muscles helps to increase the speed of movement. These changes are related to sports training. The results are shown in Table 5. We make a line graph based on this result, as shown in Figure 4.

The order of muscle activation and the recruitment of muscle fiber types have a significant difference in sprint performance. The P value is less than 0.05, indicating that the muscles are not stimulated by the whole participating in work as a unit of muscle is not a unit of a single muscle fiber, but a unit of a neuron and a group of muscle fibers innervated by it. The innervation of muscle fibers is the main factor that determines different types of muscle fibers to participate in work. The nerves that innervate the fast-twitch fibers have a high excitability threshold and require a stronger stimulation to cause the fast-twitch fibers to contract. Therefore, the ability to rapidly recruit fast-twitch fibers has an impact on athletic performance. The specific situation is shown in Figure 4.

4.2.4. Nerve Conduction Velocity Analysis. Nerve conduction velocity means that the speed at which nerve impulses are transmitted to motor units is closely related to the time of

muscle contraction. At present, due to methodological reasons, the progress of this research has become extremely difficult. The results are shown in Table 6. We make a bar graph based on this result, as shown in Figure 5.

Nerve conduction velocity on sprint performance is significantly different. P value is less than 0.05, indicating that increasing nerve conduction velocity can increase the frequency of nerve impulses, thereby increasing the level of muscle activation, and has training adaptability. The specific situation is shown in Figure 5.

4.2.5. Excitability Analysis of Motor Neurons. The excitement of the motor nerve is closely related to the motor unit. Increasing the excitement of the motor neuron can make the muscle contract more forcefully and faster. The results are shown in Table 7. We make a bar graph based on this result, as shown in Figure 6.

The excitability of motor neurons has a significant impact on sprint performance. The P value is less than 0.05, which indicates that the excitability of suitable motor neurons is beneficial to improve sports performance. The excitability of motor neurons is usually evaluated by reflex. Reflex refers to a single synaptic reflex similar to the bond reflex. Measurement of reflex can provide information about the excitability of motor neurons; although, it is difficult to distinguish whether the excitability of motor neurons is genetic or decided by training, and the shortening of reflex is related to training. The specific situation is shown in Figure 6.

4.2.6. Fatigue Analysis of the Nervous System. The time of sprint competition is very short. In the past, it was thought that the fatigue of sprint was caused by the consumption of energy materials. At present, it is believed that the fatigue of sprint is mainly caused by nerve fatigue. The results are shown in Table 8. We make a bar graph based on this result, as shown in Figure 7.

Effect of the nervous system fatigue on sprint performance is significantly different. The P value is less than 0.05, indicating that the exact concept of nerve fatigue is difficult to define. The failure of spinal nerve connection partial inactivation of impulse transmission to the central nervous system, decreased excitability of motor neurons, temporary inactivation of some reflexes, and decreased sensitivity may affect nerves and cause fatigue. The fatigue of neuromuscular joints may prevent the activation of muscles. Sports

TABLE 8: Fatigue data sheet of the nervous system.

Attributes	Material metabolism	ATP consumption	CP consumption	Lactic acid accumulation	Tolerance	Nerve impulse
A	2.2	2.02	1.77	2.17	2.5	2.32
B	2.12	2.22	2.03	2.05	2.5	1.91
C	3.42	2.94	2.81	3.45	3.23	3.29
D	3.97	3.87	4.08	3.85	3.97	3.87
E	5.24	5.24	5.43	5.48	4.96	5.32
F	5.21	4.95	5.16	5.35	5.47	5.26
P	0.001	0.001	0.001	0.001	0.001	0.001

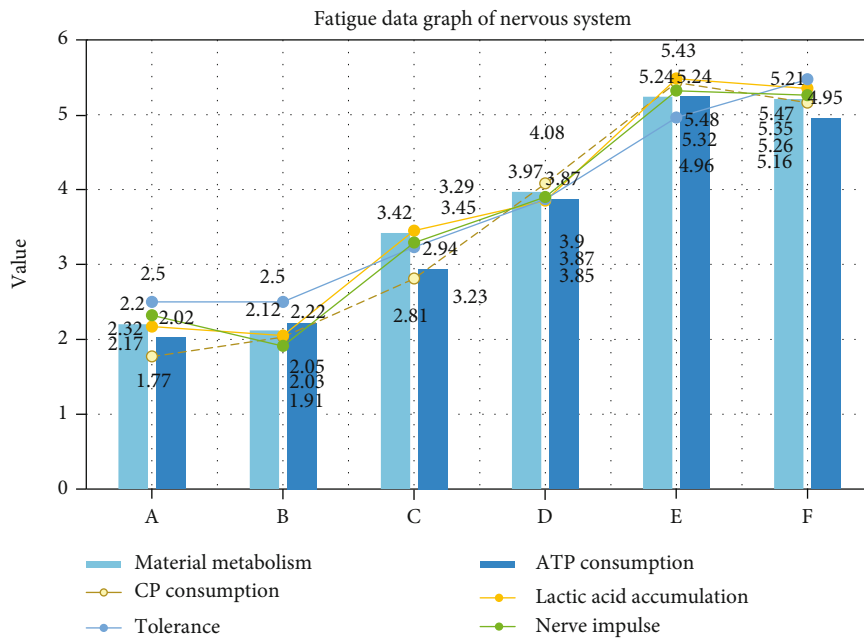


FIGURE 7: Fatigue data graph of the nervous system.

training can change these conditions, which is conducive to the improvement of athletes' performance. The specific situation is shown in Figure 7.

5. Conclusions

In the large-scale mobile WSN, its nodes have the characteristics of limited reference node resources, random deployment, large number of nodes to be positioned, dynamics, etc., In terms of cost, energy consumption, volume, etc., it is not realistic to install the GPS for all the nodes nor is the basic features of WSN; therefore, existing WSN localization algorithms cannot be simply ported to the nodes of mobile WSN; moreover, the existing WSN localization algorithm requires a high density of anchor nodes, reducing the cost of the whole system, considering the actual application requirements of WSN networking cost, positioning cost and positioning efficiency, and further study of the mobile WSN localization algorithm where the anchor nodes can be moved is needed. The factors that affect sprint performance are complex, and the biological factors that affect step length can be studied through anthropometrics. The impact

of step frequency on sports performance is very important. From some of the above studies, we can find that the biological factors that affect cadence are mainly from nerves. Although genetics determines the type of nerves, nerves are relatively adaptable to sports training. In short, in addition to the above factors, the conversion speed of excitement and inhibition of the sports center, the percentage of fast-twitch fibers in the muscles, and the coordination between the centers may affect the athlete's sprint performance.

Each section has different functions and completes the sensor nodes by cooperating with each other, the function of the sensor module is to monitor and collect various data such as sound, temperature, humidity, location, and communication in real time, and what type of data is collected is determined according to the actual needs and completes the digital-to-mode conversion of the signal at the same time. The processor module has simple processing functions, mainly cache the collected data information and send it to the wireless sensor network server or other sensor nodes, parse, and execute the received instructions or communication packets simultaneously. Wireless communication modules are generally responsible for receiving and sending

short-distance communication signals with very low power consumption and complete the sending and receiving work of various data packets. Energy supply modules generally use microbatteries to provide energy to each module of the sensor node. The energy supply is limited. There is still a certain gap between the subjects in this study in terms of explosive power and average muscle performance, but the anaerobic fatigue percentage AFI index is slightly higher than its average level, indicating that the subjects in this study are comparable to the national NCAA in terms of fatigue resistance. The average level of athletes is comparable. After 30 s Wingate exercise for about 10 seconds, the surface EMG index MPF drops sharply because the 30 s Wingate test is a short-term high-intensity exercise. This anaerobic exercise makes the muscles first use fast-twitch fibers to participate in energy supply, in order to maintain high load when fast-twitch fibers are fatigued movement. The ventilatory anaerobic threshold is the critical point at which the body's energy metabolism changes from aerobic metabolism to anaerobic metabolism during incremental exercise. The MPF of 8 muscles before the appearance of VT was relatively stable, and after the appearance of VT, the MPF showed a slow upward trend, indicating that the body may use fast-twitch fibers to participate in exercise when the body is converting from aerobic energy supply to anaerobic energy supply. Increase the high frequency part of the EMG power spectrum in the muscle, so it shows that the MPF has a rising trend.

This research takes sprint as the research object and adopts direct show technology to obtain images without ghosting and shaking. The computer automatically recognizes special moments, distinguishes different motion phases, and adopts corresponding determination methods for different joint points in different phases. Different tracking area centers and radii are adopted for each joint point in different time phases, and adaptive adjustment is performed to find a point equal to the feature point on the contour line around the joint point as the desired joint point. The computer automatically judges the motion images of the human body joints in special situations and successfully solves a series of problems such as the visible side joint points entering the human contour line, the occlusion of the invisible side joint points, and the influence of the hand on the hip joint determination. The comprehensive application of two methods of contour recognition and grayscale recognition improves the accuracy and efficiency of automatic recognition. While solving the automatic recognition of human joint points in sprinting, it will provide a theoretical research method and software platform for other sports.

Data Availability

No data were used to support this study.

Conflicts of Interest

There are no potential competing interests in our paper.

Authors' Contributions

All authors have seen the manuscript and approved to submit to your journal..

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