Research on Badminton Sports System Based on Wireless Sensor Network

Yunwei Li
Wanjiang University of Technology, MaAnShan, AnHui, 243031, China
*Corresponding author’s e-mail: lyw37102999@dingtalk.com

Abstract. Wireless sensor network is a self-organizing network system composed of nodes through multi-hop wireless communication. Deploying a wireless sensor network in the monitored area can complete sensing, data collection, and data processing in real time, and transmit the data processing results to the network terminal. This article studies the structure of the badminton sports system from the design perspective, and analyzes its technical characteristics and node software structure, wireless sensor network node structure, sports system architecture and functional characteristics. The system is deployed in the badminton sports venues to collect the movement parameters of badminton players in real time and perform timely and effective analysis to provide support for scientific decision-making in badminton training.

1. Introduction
The use of modern information technology to assist badminton sports training will help improve the level of badminton sports technology. Effective use of information technology means to improve the scientficity of badminton training can help improve the performance of badminton athletes and become an important content of research in the field of science and technology sports. Under normal circumstances, during badminton training, the coach observes the athlete’s technical movements through his eyes, judges the rationality of the movements based on experience, and proposes corresponding improvements. This qualitative analysis method relies on subjective observation ability to obtain exercise training information, and then processes the obtained exercise training information based on experience and logical thinking. Due to the certain limitations of judgment and analysis of action information, large errors are likely to occur, and susceptible to interference. Due to the uninterrupted nature of badminton sports training, a large amount of sports data information is continuously generated during the exercise process. These data have complex inherent rules. Therefore, modern technical methods are needed to collect sports data.

Gradually, applying real-time sports data network detection during badminton training can use information technology collection methods to obtain sports data in a timely manner, and extract data information that helps scientific sports decision-making from a large amount of data, so as to formulate scientific management of badminton sports training Decision-making belongs to the core content of developing sports informatization. The application of wireless sensor networks in badminton training can monitor various data indicators of athletes in real time, and make scientific and reasonable decisions on badminton training based on the analysis results of data indicators.

2. wireless sensor network
Wireless sensor network is a combination of multiple technologies, these technologies can effectively
cooperate to complete real-time perception of data information, Monitoring, acquisition, analysis and transmission. The three major elements of a sensor network include sensors, sensing objects, and observers. Wireless sensor networks integrate objective and physical world and logical information, change the way people interact with nature, and expand the existing network functions and the ability of humans to understand the world.

2.1. Network node structure
The sensor node is mainly responsible for the collection, processing, and transmission of data information, including five components. Expansion functions such as positioning, mobility, and energy supplement modules can be deployed on nodes according to requirements. The node structure of a wireless sensor network is shown in Figure 1.

![Figure 1. Node structure of wireless sensor network](image)

2.2. Software structure of network nodes
The sensor node is composed of a single-chip microcomputer or an embedded processor, and its software mainly includes an operating system, a low-level driver, a network communication protocol, a data collection program, an application program, a positioning and synchronization protocol, etc. The software structure of a wireless sensor node is shown in Figure 2.

![Figure 2. Wireless sensor node software structure](image)

![Figure 3. Wireless sensor network protocol architecture diagram](image)
The network communication protocol mainly includes two parts: the communication protocol and the network management. The most important part of the wireless sensor network software structure. The wireless sensor network protocol architecture is shown in Figure 3.

### 3. Badminton training system architecture

The wireless sensor network-based badminton sports system can quickly and adaptively establish a wireless network. The network can obtain athletes' movement information in all directions, quickly calculate the target position, and predict its state in real time. The monitoring center is responsible for collecting Gateway information, which accurately displays the target's motion trajectory and status information, and the system records and saves the target's position and status information in real time. The statistical data of the moving target is displayed in the system monitoring platform in a graphic form, and the data is analyzed to summarize the movement law of the monitoring target and provide data support for target prediction and tracking.

![Figure 4. Wireless sensor network target tracking system architecture](image)

### 4. Functions of badminton training system

When designing a badminton sports training system based on wireless sensor networks, it is necessary to effectively combine the movement data information of each sensor node, so as to improve the system's operating efficiency. Security design is an indispensable part of the system. When improving the security design of the system, it mainly includes system interface design, network status, and user data privacy protection. For the management of wireless sensor network badminton sports system, from the perspective of sports management, follow the objective laws of badminton sports training; Based on the existing wireless sensor network technology, the efficiency of badminton training is continuously improved from the aspects of planning, organization, coordination, control and innovation. At the same time, when designing the system, the basic needs of the badminton sports system, sports training objects, and managers; the functions of system information acquisition, analysis, storage, and transfer are continuously optimized to ensure that the system can correctly measure the basic indicators of badminton sports training, The system has strong practicability. The functional structure of the system is shown in Figure 5.

![Figure 5. Functional structure of the system](image)
5. Conclusion
In the process of badminton training, to achieve a high level of sports training results, a scientific training plan needs to be formulated to provide prerequisites for coaches to achieve their training goals. With the rapid development of modern information technology, the introduction of modern information technology in the development of badminton training plans can greatly improve the efficiency of coaches in statistics of sports training data; In a wireless sensor network-based sports system, quantify badminton players and related environmental information, design some parameters that reflect the exercise process and the effect of sports training, and collect parameter data during the exercise process to enable coaches to quickly grasp 3. Contrast and analyze the training and physical conditions of the athletes, and complete a systematic and detailed summary of the basic conditions of the badminton players. By collecting data on physical parameters such as strength, endurance, load, flexibility, and ECG strength, a comprehensive evaluation of the physical ability and training effect of badminton players. Collect the data that can reflect the athlete ‘s technical movements, capture the quantitative parameters of technical movements and enter them into the database, compare these technical movement data with the data in the expert database, and find the shortcomings of technical movements during the sports training process. After the coaches have obtained the comparison results of the sports technical data, as a data support, they make a targeted sports training plan. China's application of information technology in badminton training started relatively late. Aiming at the training data of badminton players, building a real-time monitoring network is currently in its infancy. This paper takes badminton as an application background and uses wireless sensor network technology to study a monitoring system to assist badminton training. Wireless sensor networks have many advantages, such as wireless connection, fast networking, and independence from training venues. Real-time monitoring of the sports parameters of badminton players will ultimately improve the scientificity and effectiveness of badminton training.

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