Research Article

Performance Evaluation of Badminton Trajectory Error Based on Wireless Sensor Network

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The successful holding of the Olympic Games has made the attention to sports continue to rise. China’s badminton has always been at the forefront of the world, and since badminton became an Olympic sport, it has been tasked with winning gold medals. Because the entry of badminton is simple, badminton has a solid mass foundation in China. Badminton has a very high fitness, confrontation, and fun, with speed as the core and stability, accuracy, ruthlessness, and liveliness as the main tactical style. In professional competitions, athlete’s prediction of badminton’s trajectory is of great significance to the performance of the game, so the prediction of badminton’s trajectory is very important. This paper aims to study the performance evaluation of badminton trajectory error analysis based on wireless sensor network. It is expected to predict the trajectory of badminton with the help of wireless sensor network technology, reduce the prediction error, and improve the game performance. Sensors in WSN communicate wirelessly, so network settings are flexible, device locations can be changed at any time, and wired or wireless connections to the Internet are possible. This paper analyzes and compares the commonly used dynamic target capture algorithms, compares the advantages and disadvantages of this wireless sensor network, combines the flight characteristics of badminton, and analyzes the error of its trajectory. Aiming at the vision system in badminton monitoring, the application research on the side detection, tracking, and trajectory prediction algorithm of flying badminton in the two-dimensional image plane video stream is completed. The experimental results of this paper show that the error of using the wireless sensor network is 2 cm and the trajectory error of not using the wireless sensor network is 8 cm. It can be seen that the trajectory extraction error using the wireless sensor network strategy is small.

1. Introduction

With the continuous advancement of technology, wireless communication and mobile connections appear frequently in life. The development of the micro-motor system makes the wireless sensor network emerge as the times require, and its own advantages have brought about great changes in the modern information field. Wireless sensors have the characteristics of flexible deployment, strong reliability, convenient expansion, and good economy. Target tracking is the focus of wireless sensor network research, and the positioning of specific targets in the monitoring field has become the focus of tracking applications. How to accurately predict the trajectory of badminton, as a sports competition, plays an important role in improving the performance of the game. Therefore, it is very necessary to combine wireless sensor network with badminton trajectory prediction. Combining wireless sensor networks with badminton trajectory prediction can model and predict the trajectory of the ball on the field in real time to give spectators better experience of the game, and it can also help athletes do better target training offline.

The accurate prediction of the trajectory of the target object can adjust the follow-up strategy in time and improve the efficiency of work. Cheng and Zhao proposed a manipulator inverse solution algorithm based on MQACA-RBF networks. They improved the 2-opt local optimization and demonstrated the significant accuracy advantage by
comparing the simulation results of the 6R manipulator with those of the motion trajectory [1]. Zhang et al. used kinematic equations to track the motion patterns generated by the continuous motion of RFID tags. RFID tags can identify a single very specific object, instead of only identifying one type of object like barcodes, and can read data through external materials. Motion patterns can be applied to re-construct trajectories of noisy datasets while suffering from data errors or packet loss. In the pattern recognition method, linear geometry and linear complex can be used to distinguish motion types and obtain geometric parameters. The analysis of geometric parameters helps to achieve efficient and high-precision reconstruction of trajectories. They evaluated the performance of the scheme through extensive experiments. The results have shown that gestures can be fully recognized with little impact on the system [2]. Recently, emerging noninvasive or minimally invasive motion capture methods can be used for on-site kinematic measurements with minimal disruption to ongoing work. Each of these methods has advantages and disadvantages in terms of kinematic measurements due to the sensors and algorithms used. Seo et al. evaluated the performance of vision-based and angle-measuring sensor-based methods. The experimental results found that the vision-based method had an error of about 5–10 degrees in body angle, while the angle-measuring sensor-based method had an error of about 3 degrees in measuring the body angle in various tasks. Results have shown that these methods are applicable to a variety of ergonomic approaches to identify potential safety and health risks, where some errors in motion data do not significantly affect their reliability [3]. Although these theories have explored trajectory prediction, they are less relevant to badminton.

Advances in sensor technology have led to increasing research into sensors. Luo et al. focused on minimizing energy consumption and maximizing network lifetime for data relay in one-dimensional (1D) queuing networks. They followed the principles of opportunistic routing theory and made multi-hop relay decisions that optimize the energy efficiency of the network based on the distance between sensor nodes and the difference in their remaining energy. Opportunistic routing is a routing protocol used in wireless multi-hop networks. It can make full use of the broadcast characteristics of wireless networks to transmit data. It also changes the structure of IP packets and adds multiple destination addresses. Extensive simulations and practical tests have shown that this solution is significantly more energy efficient and wirelessly connected than other existing WSN routing solutions [4]. Cheng et al. focused on flood tree construction considering duty cycle operation, minimum delay, and energy efficiency for unreliable wireless links. The duty cycle is the ratio of the time the load or circuit is on to the time the load or circuit is off, expressed as a percentage of the on-time. They devised a distributed minimum-delay energy-efficient flood tree (MDET) algorithm to construct energy-optimal trees. Simulations have shown that MDET achieved transmission delays comparable to minimum-latency flooding with transmission costs only 10% more than the lower bound, which achieved a good balance between flooding delay and energy efficiency [5]. Sheng et al. proposed a new approach to minimize the energy consumption of processing applications in MWSN while meeting certain completion time requirements. In addition, for networks with multiple mobile wireless sensor nodes, they proposed an energy-efficient cooperative node selection strategy to provide a trade-off between fairness and energy consumption [6]. Although these theories have expounded the related theories of sensors, they have limited relevance to badminton positioning and poor practicability.

As a competitive event, badminton uses scientific means to predict the movement trajectory, which is conducive to improving the performance of the game. According to the research, the trajectory prediction error without using wireless sensor network technology is greater than 5 cm, while the trajectory prediction error using this technology is less than 3 cm. It can be seen that the use of wireless sensor network technology can reduce the trajectory prediction error of badminton; when the YOLOv3 network is used for trajectory prediction, the accuracy is 95.4% and the time consumption is 21 ms; and when the wireless sensor network is used for trajectory prediction, the accuracy is 98.5% and the time consumption is 4.7 ms. According to the data, the wireless sensor network has obvious effects in terms of detection speed and accuracy and is suitable for badminton trajectory detection.

2. Wireless Sensor Network and Badminton Trajectory

With the promotion of electronic embedded technology and communication networks, wireless sensor networks have also attracted a lot of attention [7]. WSN has the following characteristics: limited system hardware resources, limited power supply capacity, self-organization, no center, and dynamic topology. Usually WSN nodes are arranged near the detection target by aircraft or manually. These nodes form a wireless network through self-organization, collect target information in the coverage area through cooperation, and then transmit the collected data to the base station through multi-hop relay [8, 9]. Sensor nodes monitor the detection objects, and end users can effectively configure and manage the sensor network through node management [10]. Figure 1 shows the architecture of the wireless sensor network.

The total node is the interface between the sensor network and the external network, and the communication between the management node and the wireless sensor network is realized through network protocol conversion.

The wireless sensor network is composed of a large number of sensor nodes, and it also includes the positioning function according to the actual application needs. The sensor node can directly monitor the detection target without engineering processing, which reduces the related steps before use [11, 12]. The sensor module is mainly used for perception, which can convert the relevant physical information in the environment into electrical signals [13]. The sensor node consists of sensing module, data processing,
communication module, and power supply module. Figure 2 is a block diagram of the wireless sensor node.

General sensor nodes are relatively small in size, and most of the energy is supplied by batteries. If the energy of the sensor node is exhausted, but the energy cannot be obtained from the battery due to various environmental factors, the node will stop working [14, 15]. In order to understand the relative energy consumption of the sensor, we investigated the relative situation of different parts of the node.

According to the situation in Figure 3, we have investigated the energy consumption of different nodes of the sensor. According to the specific data, the energy consumption of the sensor is 2 mW, the energy consumption of the processor is 3.3 mW, the energy consumption of the transmitting part is 14.6 mW, the energy consumption of the receiving part is 12.1 mW, the energy consumption when idle is 14.6 mW, and the power consumption is 11.6 mW when idle and 1.9 mW when sleeping. From this data, it can be seen that most of the energy consumption of sensor nodes is concentrated on the communication module; the energy consumption is the largest during data transmission and data reception, followed by the idle state; and the lowest energy consumption is in the sleep state [16, 17].

The efficient and reliable data transmission of wireless sensor network is the key technology to realize its function. With the promotion of sensor networks and the optimization and upgrading of related technologies, users have higher and higher requirements for data transmission reliability. But the nodes in WSN are not infinite, when the energy of the node decreases, the related function of the node will decrease. Once the node is abnormal, the entire network structure will change, the monitoring of the target object will have errors, and the effectiveness of data collection will be reduced. Compared with wireless networks, the hardware resources and power energy of wireless sensor networks are limited and will be affected by unpredictable factors such as the surrounding environment; the density is high and the scale is large. Figure 4 shows the related construction of the network structure.

With the development of the national economy, people’s living standards continue to improve, and the attention to sports in daily activities is also increasing. Badminton is a high-tech and high-speed competitive sport, because it is easy to love by all ages. Badminton can develop people’s flexibility and coordination, promote physical activity, and effectively improve the function of the respiratory system and vascular system. Modern badminton was introduced to China at the beginning of the last century, when it was mainly used for fitness and entertainment. Until the founding of New China, badminton ushered in new development, especially in the field of competitive badminton. While learning foreign advanced techniques and tactics, players gradually determined the direction of training based
on their own characteristics. The outstanding performance of badminton players has also given the world a new understanding of China. With the successful holding of the Olympic Games and the introduction of the national sports consumption policy, the society’s enthusiasm for sports has increased, and the number of people participating in various sports has also increased, which has promoted the development of badminton.

In a competitive sport, the most important thing is to achieve results during the competition. In badminton competitions, professional athletes move very fast. In order to achieve excellent results, it is very important to accurately predict the trajectory of badminton. The trajectory of the shuttlecock is affected by its initial speed, its direction, and the force when flying in the air. Figure 5 shows the badminton trajectory prediction related modules.

In badminton, the flying range of the shuttlecock is too large, so how to accurately predict the landing point of the shuttlecock is very important. Moving object detection is based on the method of video stream, segmenting the foreground and background of the image, determining the position and texture features of the object, and statically describing the moving object. Figure 6 is a block diagram of a common algorithm for capturing badminton.

\[
F(a, b) = \begin{cases} 
2, & \text{if } |K(u) - K(u - \Delta u)| > U, \\
0, & \text{otherwise}
\end{cases}
\]  

(1)

In the above function expression, if it is \(F(a, b) = 2\), it means that it is a dynamic target at this time, and if it is \(F(a, b) = 0\), it means that it is a static background.

\[
K(a, b, u) = K(a + \Delta a, b + \Delta b, u + \Delta u).
\]  

(2)

Equation (2) represents the visual perception caused by object motion. It mainly predicts the moving speed and direction of the object by calculating the brightness of the target pixel.

\[
K(a + \Delta a, b + \Delta b, u + \Delta u) = K(a, b, u) + \frac{\rho k}{p a} \Delta a + \frac{\rho k}{p b} \Delta b + \frac{\rho k}{p u} \Delta u.
\]  

(3)
Equation (3) indicates that the distance over which the object moves is very short.

\[
\frac{-pk}{\rho u} = \frac{pk}{\rho a} p + \frac{pk}{\rho b} r.
\]  

The method of predicting object motion according to brightness is called optical flow method, and (4) represents its basic function expression. The optical flow method uses the change of pixels in the image sequence in the time domain and the correlation between adjacent frames and calculates the motion information of objects between adjacent frames according to the corresponding relationship between the previous frame and the current frame.

\[
Wr = s.
\]  

In order to capture the high-speed moving badminton, the corresponding points are described, and its basic form is shown in (5).

\[
r = (W^T W)W^T s.
\]  

The optimal solution obtained by the least squares method is the position of the optical flow of the point in the region.

\[
F(a, b) = \begin{cases} 
2, & |K_m - K_{m-2}| \geq U, \\
0, & |K_m - K_{m-2}| < U.
\end{cases}
\]  

In (7), \(U\) represents the binarization threshold, and the pixels whose \(F(a, b)\) is 2 are the foreground.

\[
G_{z,u+2} = (2 - \mu)G_{z,u} + \mu K_{z,u}.
\]  

The ideal background modeling is through a video stream with no moving objects, where \(\mu\) is a constant between 0 and 2.

\[
\theta_{z,u+2} = (2 - \mu)\theta_{z,u} + \mu K_{z,u},
\]  

\[
\sum_{z,u+2} = (2 - \mu) \sum_{z,u} + \mu(K_{z,u} - \theta_{z,u}).
\]

Equations (9) and (10) represent a single Gaussian distribution model, which needs to be strictly fixed with a noise-free background when adopting this method.

\[
Y(K_{z,u}) = \sum c_{o,z,u}H(\theta_{o,z,u}, \theta),
\]  

where \(c_{o,z,u}H(\theta_{o,z,u}, \theta)\) represents the \(o\)th Gaussian model and \(c_{o,z,u}\) represents the weight.

\[
c_{o,z,u} = (2 - \mu)c_{z,u} + \tau Q,
\]  

\[
\theta_{o,z,u} = (2 - \delta)\theta_{o,z,u} + \delta K_{u},
\]  

\[
\phi_{o,z,u}^3 = (2 - \delta)\phi_{o,z,u}^3 + \delta\phi_{3}(\theta_{o,z,u}, \theta).
\]  

In the above function, \(\tau\) represents the user-defined learning efficiency, and \(\delta\) represents the second learning rate.

\[
\delta = \tau H(\theta_{o,z,u}, \theta),
\]  

\[
c_{z,u} = \tau c_{z,u} + \tau Q,
\]  

\[
M = \text{argmin}(\sum c_o > \beta).
\]

According to the above function expression, the mean and variance of the unmatched model will remain unchanged, but the weights will become smaller. \(\beta\) is the threshold, and \(M\) is part of the background.

3. Wireless Sensor Network and Badminton Trajectory Experiment

Extracting accurate and real-time badminton trajectory is the primary prerequisite for badminton trajectory prediction. In order to collect accurate badminton trajectories, we extract three-dimensional coordinates from the badminton flight trajectory. It is used for multi-target camera calibration to obtain the mapping relationship between 3D coordinates. Figure 7 is a related structure diagram of the trajectory extraction system.
In the experiment, the positions of the cameras are diagonal to each other, and this placement method can ensure that the complete badminton movement trajectory can be collected in the trajectory extraction experiment.

According to the data in Table 1, in the experiment, in order to collect the three-dimensional motion trajectory information of the badminton, three cameras were used to capture the position. In the process of badminton trajectory collection, no calibration object is needed. Image acquisition is performed by moving the camera that is restricted by the motion mode, and the internal and external parameters of the camera are solved according to the image information and the known camera motion mode to complete the calibration process. According to its internal parameter matrix, it can be seen that the ghosting error is very small when the error analysis is carried out in the experiment. It can be seen that the experimental results of the internal and external parameter calibration of the three cameras are very ideal, and the collected badminton trajectory information has reference value.

According to the data in Table 2, the three-dimensional trajectory of the landing point of the badminton was captured. According to the data, the landing points of each group of badminton are within the specified range. However, according to the actual situation, it is found that most of the landing points of the badminton in Table 2 coincide with the physical coordinates of one of the cameras. It can be seen that errors in the process of badminton trajectory extraction are unavoidable, errors may occur in every link in the system, and the errors may continue to increase. In order to analyze the positioning accuracy of the proposed badminton trajectory extraction system, the relative distance between the table tennis balls is fixed, and the error analysis is performed by comparing it with the relative distance of the badminton shuttlecock extracted by the trajectory extraction system. According to this situation, an error analysis experiment is carried out to analyze the trajectory capture performance.

According to the data in Figure 8, different methods are used to compare and analyze the trajectory extraction of the shuttlecock, including both the position error of the shuttlecock during the first trajectory extraction and the total average error. First of all, from the position error of the badminton during the first trajectory extraction, in the first group of information extraction, the error of using the wireless sensor network is 2 cm, and the trajectory error of not using the wireless sensor network is 8 cm. It can be seen that the errors under the two methods are quite different. In order to prevent the chance of the experimental results, many experiments were carried out on the badminton trajectory error. In the second group of information extraction, the error of using the wireless sensor network is 1.9 cm, and the trajectory error of not using the wireless sensor network is 9 cm. In the third group of information extraction, the error of using the wireless sensor network is 2.3 cm, and the trajectory error of not using the wireless sensor network is 6 cm. In the fourth group of information extraction, the error of using the wireless sensor network is 3.1 cm, and the trajectory error of not using the wireless sensor network is 4 cm. In the fifth group of information extraction, the error of using the wireless sensor network is 1.1 cm, and the trajectory error of not using the wireless sensor network is 7 cm. According to the data of many experiments, the trajectory extraction error using the wireless sensor network strategy is smaller, and compared with the trajectory error situation without the wireless sensor network strategy, its performance is greatly improved.
From the perspective of the total average error, during the five experiments, the trajectory prediction errors without using wireless sensor network technology are all greater than 5 cm, while the trajectory prediction errors using wireless sensor network technology are all less than 3 cm. According to the comparison of the two sets of data, the use of wireless sensor network technology can reduce the trajectory prediction error of badminton.

According to the data in Figure 9, different methods were used in the experiment to compare the trajectory prediction of badminton, and the time and accuracy of each method in predicting the trajectory were analyzed. First of all, in terms of the time used, when the YOLOv3 network is used for prediction in the experiment, the time consumption is 21 ms; when the YOLOv3-tiny network is used for prediction, the time consumption is 9.3 ms; when the YOLOv4 network is used for prediction, the time consumption is 18.5 ms. When the color segmentation method is used for prediction, the time consumption is 4.5 ms; when the wireless sensor network, used in this paper, is used for trajectory prediction, the time consumption is 4.7 ms. According to the data, YOLO series network detection time is too long, and the detection speed has obvious defects compared with the other two methods. YOLO series network is deeper, and they require a larger number of calculations at runtime, and they are not dominant in badminton trajectory prediction. It is worth noting that the traditional color segmentation algorithm has an advantage in detection speed over the wireless sensor network used in this paper.

Judging from the accuracy of badminton trajectory prediction, when YOLOv3 network is used for trajectory prediction, its accuracy is 95.4%; when YOLOv3-tiny network is used for trajectory prediction, its accuracy is 82.7%; when the YOLOv4 network is used for trajectory prediction, its accuracy is 97.6%; when the color segmentation algorithm is used for trajectory prediction, its accuracy is 70.3%; and when the wireless sensor network, used in this paper, is used for trajectory prediction, its accuracy is 98.5%. According to this data, YOLO series network detection accuracy is high. However, combined with its time efficiency, this method is not suitable for badminton trajectory prediction, and the color segmentation algorithm has an advantage in detection speed. However, its accuracy needs to be improved; especially when different colors of badminton are used, the detection accuracy shows a downward trend. The wireless sensor network used in this paper has obvious effects in terms of detection speed and accuracy, so it is suitable for badminton trajectory detection, and the error is small.

### 4. Wireless Sensor Network and Badminton Trajectory Error

Predicting the trajectory of the moving shuttlecock requires tracking the shuttlecock and obtaining the real-time coordinates of the shuttlecock. In this process, the accurate positioning of the badminton is very important, which is closely related to the subsequent prediction of the badminton landing.

$$w_t = \frac{M_U}{M_U + M_k}$$

Equation (14) expresses the recall rate, which is the proportion of the number of shuttlecocks that are correctly tracked.

$$w_t = \frac{M_U}{M_U + M_r}$$

### Table 1: In-camera parameter matrix and distortion coefficients.

| Category | Intrinsic parameter matrix | Distortion coefficient |
|----------|---------------------------|------------------------|
| 1        | \[ \begin{pmatrix} 1250 & 0 & 645 \\ 0 & 1260 & 525 \\ 0 & 0 & 1 \end{pmatrix} \] | \(-0.06\), \(-0.72\), \(-0.002\), \(0.002\), \(0.3\) |
| 2        | \[ \begin{pmatrix} 1330 & 0 & 625 \\ 0 & 1255 & 500 \\ 0 & 0 & 1 \end{pmatrix} \] | \(-0.03\), \(-0.12\), \(-0.004\), \(0.002\), \(0.35\) |
| 3        | \[ \begin{pmatrix} 1270 & 0 & 660 \\ 0 & 1240 & 550 \\ 0 & 0 & 1 \end{pmatrix} \] | \(-0.003\), \(-1.2\), \(-0.002\), \(0.005\), \(1.3\) |

### Table 2: Track point world coordinate values.

| Category | X (cm) | Y (cm) | Z (cm) |
|----------|--------|--------|--------|
| 1        | 415    | 243    | 160    |
| 2        | 432    | 240    | 163    |
| 3        | 440    | 247    | 158    |
| 4        | 439    | 245    | 159    |
| 5        | 445    | 244    | 160    |
Equation (15) expresses the accuracy rate, which is the proportion of the number of correctly detected badminton positions.

$$G = \frac{RT}{P}$$

(16)

In (16), the efficiency of prediction is expressed, wherein the number of processing frames is expressed, and the processing time is expressed.

In order to further analyze the performance of the wireless sensor algorithm for badminton tracking, the wireless sensor algorithm and the traditional classical tracking algorithms are compared and analyzed. The details are shown in Table 3.

According to the data in Table 3, in order to explore the tracking effect of wireless sensor network on badminton sports, it is compared with the traditional total target tracking algorithms. When the wireless sensor network is used in the experiment, the successful tracking rate of badminton is 95.2%, the failure tracking rate is 4.8%, and the processing efficiency is 11.1 frames/s. From this data, it can be seen that the tracking success rate of the wireless sensor network is relatively high. When the KCF tracking method is adopted, the successful tracking rate of badminton is 28.7%, the failure tracking rate is 71.3%, and the processing efficiency is 43.2 frames/s. When using the TLD tracking algorithm, the successful tracking rate of badminton is 19.3%, the failure tracking rate is 80.7%, and the processing efficiency is 6.5 frames/s. According to these two sets of data, the success rates of the two sets of tracking algorithms are not high, but the work efficiency of KCF is very high, indicating that the KCF work algorithm is not suitable for badminton trajectory tracking. When the DSN tracking method is used, the successful tracking rate of badminton is 83.5%, the failure tracking rate is 16.5%, and the processing efficiency is 7.1 frames/s. According to the
data, the success rate and processing effect of the DSN tracking method are relatively general. Compared with the wireless sensor network, there is a gap in both the success rate and the processing efficiency. Therefore, the wireless sensor network has certain advantages in the tracking of badminton sports.

The tracking of badminton sports requires not only the comparison of the tracking success rate and the positioning efficiency, but also the analysis of its accuracy, which is often referred to as center positioning. Different scenarios may have different effects on positioning, so different scenarios are used in the analysis. It is generally considered that if the center positioning error is less than 15 pixels, it is successful, and if it is greater than 15 pixels, it is considered that the tracking fails.

According to the data in Figure 10, the positioning errors of different algorithms are compared and analyzed. First of all, from the error situation of WSN and DSN, according to the data, when the experimental scene is a simple green wall, the error of WSN is 3.41 pixels, and the error of DSN is 3.64 pixels. When the experimental scene is a complex laboratory, the error of WSN is 3.64 pixels, and that of DSN is 13.2 pixels; the average error of WSN is 5.3 pixels, and the average error of DSN is 8.42 pixels. According to the data, the error of the two groups of algorithms in the simple green wall is smaller than that in the complex laboratory scene, so the complexity of the motion scene will affect the trajectory prediction of the badminton, and the simpler the scene, the smaller the prediction error, and vice versa. When the two groups of algorithms are compared horizontally, the error of WSN is always smaller than that of DSN, so WSN is more suitable for badminton trajectory prediction than DSN. From the error situation of KCF and TLD, according to the data, when the experimental scene is a simple green wall, the error of KCF is 3.2 pixels, and the error of TLD is 3.78 pixels. When the experimental scene is a complex laboratory, the error of KCF is 11.9 pixels, and the error of TLD is 9.3 pixels; the average error of KCF is 7.55 pixels, and the average error of TLD is 6.54 pixels. According to the data, the two sets of algorithms are in the same situation as the first two sets of algorithms, with small errors in simple scenarios and large errors in complex scenarios. And according to the comparison, in simple scenarios, the error of KCF is smaller than that of TLD, and in complex scenarios, the error of TLD is smaller than that of KCF. However, the error of the two methods is still larger than that of WSN. It can be seen that the WSN algorithm has high positioning accuracy for badminton tracking.

5. Conclusions

The problem of target tracking is very common in production and life, and even missiles can be intercepted with
the help of tracking technology, but these require precise tracking of the target and prediction of the flight path. Badminton is a sports event, and the tracking of its movement trajectory plays an important role in the performance of the game. As an emerging positioning technology, sensors play an important role in the field of production and life. Therefore, this paper aims to study the performance evaluation of badminton trajectory error analysis based on wireless sensor network. It is expected to predict the trajectory of badminton with the help of wireless sensor network technology, reduce the prediction error, and improve the game performance. According to the research, when the wireless sensor network technology is used in the trajectory prediction process, the efficiency and accuracy of trajectory prediction are greatly improved. Therefore, it is believed that the combination of wireless sensor network technology and badminton trajectory is beneficial to reduce the trajectory prediction error. Although some conclusions have been drawn in this paper, there are still shortcomings: the calculation process is relatively complex, especially in image processing, and it is expected that the calculation program can be simplified and improved in the future.

DataAvailability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest
The authors declare that they have no conflicts of interest.

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