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The Research on Optimization of Badminton Sport Competition Environment-Hawkeye Instant Replay

Xiaofeng Su[1], Pingping Liu[2,*], Li Guo[3]

[1]College of Arts and Sciences, Shanghai Maritime University, Shanghai 201306, China

[2]Capital University of Physical Education and Sports, Beijing 100191, China

[3]School of Kinesiology, Shanghai University of Sport, Shanghai 200438, China

Abstract: **With the development of badminton games, both fans and athletes are all put forward higher requirements for fair judgment. However, it is difficult to solve all disputes fairly due to the limitation of human vision. Therefore, the introduction of Hawkeye is the key to solve above problems. This paper is divided into three parts; the first part introduces the working principle of Hawkeye briefly, and the necessity of introducing Hawkeye technology. The second part mainly discusses the current problems existing in Hawkeye. The last part makes suggestions to solve the problem existing in badminton sport. Finally, we can draw the conclusion that Hawkeye technology will be more widely used in sports field. Meanwhile, with the maturation of Hawk-Eye technology, this technology will certainly achieve very well application in other sports.**

Keywords: Badminton umpire; Hawkeye; Application

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*Corresponding Author: Pingping Liu, 6488572@qq.com

1. Introduction

The official name of the Hawkeye is “instant replay system", in fact, its technical principle is not complicated. This system consists of 8 or 10 high-speed cameras, four computers and a large screen [1]. First of all, three-dimensional space is divided into “mm” unit by means of computer calculation; then, capture the basic data of trajectory from different angles by using high speed camera; the data generate three-dimensional image through computer calculation [2,3]. Finally, the large screen presents the motion paths of badminton clearly by using real-time imaging technology, the whole process taken no more than 10 seconds. It is usually used for television.

2. Methods

Modern athletic sports competition such as badminton match is fiercer and fiercer. Visual illusion lead to umpire’s misjudgment, visual illusion caused by constantly improvement of technology and athlete’s performance level, such as whether hit the ball over net or not. This paper hope that the introduction of Hawkeye technology can make the match more justice, enhance the ornamental of badminton match. Therefore, Hawkeye is introduced into badminton games have realistic significance.

Badminton is a kind of netting confrontational sports; there are many similarities compared to tennis, such as small volume, small space, the ball shuttle and fierce competition, etc. As a result, smaller volume with faster velocity, in addition to the athletes’ technical level and accuracy increasing, the speed of ball smash more than 200km/h, it is harder for line judge to judge precisely. In recent years, part of disputes listed following table.

Table 1 The disputes over receiving illegal in badminton tournament

Time	Event	Player	controversy
2002	Pusan Asian games	Taufik hidayat-Sun Shengmo	Taufik hidayat was found to illegal receiving
2006	Hong Kong open competition	Taufik hidayat-LinDan	Taufik hidayat quitting the competition because of unfair penalty

During badminton competition, there are a lot of disputes caused by driving violation penalty; the best way to solve this problem is introduce Hawkeye technology. However, introduce Hawkeye technology faces the following problems.

3. Results and Discussion

Hawkeye technology is monopolized by few huge companies, thus form the production and price monopoly. Rent a week long Hawkeye instant replay system cost thousands of dollars, expensive price raise the cost of the game running seriously. In addition, Hawkeye companies have monopolized Hawkeye technology and made huge profits, they do not sale technology and equipment, only leasing. Under the background of disequilibrium, many games cannot

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afford to rent such expensive Hawkeye system.

Table 2 The disputes over violation in badminton tournament

Time	Event	Player	controversy
2009	East Asian games	LinDan- Cui Haozhen	Lin was sentenced to illegal violations
2009	China masters	Gerd- Mrs Parker	Gerd was found to illegal violations

3.1. Technical problems

Although Hawkeye technology is widely used in badminton games, but this technology is far from perfect. Higher speed of badminton smash and shorter distance badminton ball flight put forward higher requirements for the performance of Hawkeye system. Hawkeye technical obtain descent point rules according to the aerodynamics calculation by measuring the ball motion trajectory. Tennis' surface is smooth and regular, but the aerodynamic characteristics of badminton are more complicated compared with the tennis, so it is restrict the widely use of Hawkeye technology in badminton games.

3.2. The influence on athletes

Badminton is a kind of sport that need high energy for athletes, expect for considering the impact of line sight, umpires and audience, one more thing, athletes should consider is challenge the Hawkeye. At the same time, success or not will have great influence on their mood, this will certainly distract players' attention; affect their technical level and the ornamental of badminton games. Frequently challenge Hawkeye will definitely affect athletes' emotion and state and the integrity of the game. Many times, the outcome of one important game is likely to determine the fate and future of an athlete. The introduction of Hawkeye technology will greatly reduce the false judgment and greatly change the controversial situation that caused by umpires' naked eye. It will also play a very active role in promoting the development of badminton games.

3.3. The optimization of cost problems

(1) International badminton games have the ability to pay such high cost, of course, it is easy to solve, but it is difficult for local competition to pay such high fees. In fact, local games can import Hawkeye technology by providing advertising services at favorable prices or providing services at discount price, try to establish mutually beneficial and win-win cooperation mechanism. From the hardware, we can consider installing move Hawkeye, thus reduce cost, makes it possible to use Hawkeye in big event technology; from the software, boost the corresponding skills, database methods for the coaches and athletes to analyze. The marketing strategy makes the Hawkeye technology can be more accessible.

(2) In addition, take the system operator employment with certificates to reduce operating costs. One of the functions of Hawkeye is to help the umpire to make fair and precise judgment. Since enable the Hawkeye can reduce even cancel the line judge, replacing it with Hawkeye system operators. The training of electronic line judge is in accordance with the pattern of training referee. Executive qualifications can be determined by specialized tests and practice matches. This can not only reduce operating costs per game, but also improve the executive conference standard and electronic line judge level.

Table 3 the disputes over in or outside ball in badminton tournament

Time	Event	Player	controversy
2010.3.25	Switzerland super match	LinDan- Gerd	Gerd's fair ball was found to be foul ball, Lin Dan was lost.
2010.5.10	Thomas cup	LinDan-Park sung-hwan	Two foul ball dispute frustrated park sung-hwan' confidence, finally, lost the game
2014.9	Korea Incheon Asia Games	Lindan-Lee chongwei	During the Incheon Asian Games, due to not applying Hawk-Eye replay system, causing the behavior that umpire corrected line judge, leading to Lin Dan fell racket, causing race delay; time was 17:49 seconds.

3.4 .The optimization of Hawkeye technology

Badminton venue taken is as high as thousands of frames playback per second, namely, high speed camera focus on the bottom boundary [4]. Staff nearby umpire is responsible for the recording and transmitting to the umpire when needed, the judge umpire according to the picture, as a result, the Hawkeye system and the current television technology in common. Therefore, system of badminton Hawkeye has no technical problem, perhaps because it is something new, people more or less feeling nervous about it, but it also shows that people pay more attention and expectation. Hoping the system can eliminate the technical problem and prove the existence of its practical significance with the passage of time.

3.5. The optimization of the influence on athletes

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First, fair and objective judgment is the key to solve the problem, for the right judgment, athletes don't have any question, only when their judgment is contrary to referee's did the athletes put forward to challenge the Hawkeye. So, only in an objective and accurate judgment environment can ensure the smoothness of the game and precise judgment. 3D images will be sharply rising the badminton competition' fairness and ornamental. In addition, the increasingly fierce competition of modern competitive sports has a higher request for athletes to grasp the rhythm, adjust their mood, using the existing condition and the communication ability [5].

To sum up, the usages of Hawkeye systems not only improves badminton games' ornamental significantly, but also improve players' self-cultivation and competitive level. It is can be said that high-tech judgment will make the badminton sport more exciting and popular.

4. Conclusion

Due to its incomparable advantages, Hawkeye technology is gradually infiltrated in various sports events, Hawkeye technology does reduce the probability of misjudgment to a certain extent, make the game more fair, the effects it bring has been seen by all of us. With the development of science and technology, the progress of the society and the raise of people' ornamental level; take high-tech as an auxiliary means among the judges will be absolutely become more and more popular.

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