Emerging Technology in Human Kinetics and Sport: Advantages and Disadvantages of Using Hawk-Eye Technology

Uzor, Theresa Nkiru, Ujuagu Nonye Ann, & Uwa Anthonia Chinyere

Department of Human Kinetics Nnamdi Azikiwe University, Awka and Nwafor Orizu College of Education, Nsugbe, Anambra State

ABSTRACT

This paper presents an integration of Hawk-eye technology in Human kinetics and sports and its limitations. It highlighted an overview of Hawk-eye technology, how it functions, benefits, and its application by different sports to officiate. It also highlighted some of the advantages and disadvantages of using Hawk-eye technology such as lack of qualified personnel to handle the equipment and in some cases, due to obstructions or limited camera coverage, there may be gaps in the data captured among others. The paper made some useful conclusions as well as recommendations that will improve current sports technological innovations in Human Kinetics and Sports.

Keywords: Human Kinetics, Cameras, Hawkeye technology, innovation, Sports

INTRODUCTION

Technology is an ever-evolving process and has been largely unidimensional in nature. Technology is making significant changes in sports- changes that are global, effective and most of the times, positive; improving the quality of game in terms of safety, competition and access for both the players and the fans. Hawk-eye is one of the most commonly used technologies in the various sports. It has been put to a variety of uses, such as providing a way to collect interesting statistics, construct very suggestive visual representations of the game play and even helping viewers to better understand the umpiring decisions. The Hawk-eye is one such technology which is considered to be really top indentation in various sports (Madhukuara & Nayan, 2022).

Ever since its inception in the early 90-s, video analysis has become an increasingly popular tool in the world of sports. It offers a range of benefits for the development of young athletes. With technological progress, it has become easier to record, analyze, and share videos, making video analysis more accessible to everyone. While video analysis can help professional and young athletes to develop their skills and improve their overall performance, it also comes with its own set of challenges and limitations. In this blog, we will explore the benefits, challenges, and effective implementation of video analysis for young athletes in sports.

Hawk -Eye is the most ultra-modern tool employed in any sport. Hawk-Eye first made its name in Cricket Television broadcast, yet the brand has multiform into Tennis, Snooker and Coaching. It is currently developing a system for Football. Hawk-Eye is the only ball-tracking device to have passed stringent ITF testing measures (Singh Bal & Dureja, 2012). It is accurate, reliable and practical. Hawk-eye is one such technology which is considered to be really top notch in various sports. Hawk-eye offers a unique blend of innovation, experience and accuracy that has revolutionised the sporting world. The basic idea is to monitor the trajectory of the ball during the entire duration of play. This data is then processed to produce life like visualizations showing the paths which the ball took. Such data has been used for various purposes, popular uses including the LBW decision making software and colourful wagon wheels showing various statistics in cricket (Howe, 2020).

Hawk-eye basically is the combination of sports and engineering background brain with manipulate the things and create illusion in the field of sports (Andrew, 2023; Singh Bal & Duraje, 2012). This type of excellent technology provides to us in the new world of graphics to view the crucial decision in very easy manner. In Soccer, it uses the size of goal mouth to determine the size of soccer ball in the ball tracking process. Hawk-eye technology captured the cricket balls, tennis balls; soccer ball, snooker balls and movement of players and

in the future, it covers the game of badminton and basketball. There is also an attempt to automatic detect off-side situation in soccer (Wood, 2021). This paper attempts to explain the intricate details of the technology which goes behind the Hawk-eye, advantages and disadvantages.

An Overview of Hawk-Eye Technology

Hawk-eye technology is the most ultra-modern tool employed in any sport. It was first used by Cricket, but later on, many other sports also started using it. According to Uzor, Ikwuka & Ujuagu (2023), Hawk-eye technology is a sophisticated computer system used in cricket, tennis, and other sports to track the course of the ball visually and present a moving image of the path that is most likely to occur statistically. Hawk-eye technology was created by Dr. Paul Hawkings and it was developed by the engineers of Roke Monor Reseach limited (Harrod Sport, 2018). As the name suggests, this technology uses 6-7 high-end cameras positioned above the field of play like a birds-eye view to follow and acquire a clear picture of the ball from different angles; this powerful and robust combination assures that no shot is missed to win the game. Hawk-eye technology has been in use since 2006 in tennis and is more accurate than a judge's eye (Ciletti, 2020). It provides 3D animation of the path of the ball. Though this mechanism is not all invisible, as it also makes little errors but they can be ignored as they are very minimal, and this is the reason they are considered the second option in sports. In the game of cricket this is used to aid the LBW (Leg Before Wicket) decision because it is the first and the only ball tracking system which is available in the game of cricket (Madhukuara & Nayan, 2022). It was first used by Cricket, but later on, many other sports also started using it. The basic idea is to monitor the trajectory of the cricket ball during the entire duration of play. The data is then processed to produce lifelike visualizations showing the paths which the ball took.

How Hawk-Eye Technology Works

As the name sounds, Hawk-Eye uses 6 high-speed expert vision processing cameras which are located round the ground and calibrated. It is like a birds-eye view to analyze the flight and trajectory of an object being used in sports competition. All Hawk-Eye systems are based on the principles of triangulation using visual images and timing data provided by a number of high-speed video cameras located at different locations and angles around the area of play (Jayalath, 2021). For tennis there are 10 cameras. According to Abshire (2023), this technology uses the two "Mat" broadcast cameras and calibrates them so that the visual is often always overlaid within the right place. All cameras have "anti-wobble" software to deal with camera motion. When a ball is bowled, the system is in a position to automatically identify and find the ball within each and every frame of video from each camera. By combining the positions of the ball in each of the camera frames, the 3d and 4d positioning of the ball is measured through-out the delivery. The delivery is broken down into two independent components: delivery to bounce and bounce to impact (Howe, 2020). By measuring the position of the ball at multiple frames the speed, direction of travel, post and pre bounce, swing and dip are often can be calculated for that specific delivery. The system can also interpret these interactions to decide infringements of the rules of the game (Uzor, Ikwuka & Ujuagu, 2023). The system generates a graphic image of the ball path and playing area, which means that information can be provided to judges, television viewers or coaching staff in near real time. It is one of those pieces of technology that the game of cricket considers to be absolutely top notch.
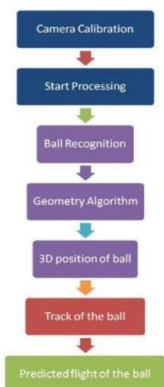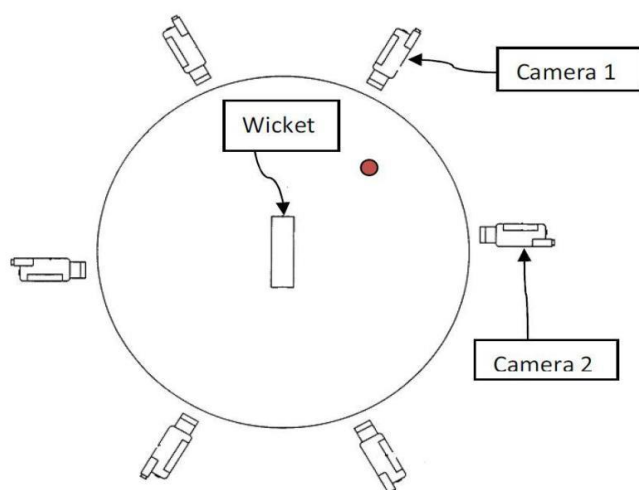
Hawk-Eye Flow Diagram

Fig 1: Source: http://singularityhub.com/wp-content/uploads

Fig.2: Ball Positions: Source: http://singularityhub.com/wp-content/uploads

Benefits of Hawk-eye Technology

Using Hawk-eye technology has many benefits (Uzor, Ikwuka & Ujuagu, 2023; Andrew, 2023) which includes the following thus:

1. Hawk-eye technology is accurate, genuine, reliable and practical. Everyone in every sporting event expects and demands it to be a part.

2. Hawk-Eye Technology is much more add more accurate and precise than the before human eye and helps to take an error-free decision in cricket, tennis, rugby league, football and baseball.

3. It offers an eccentric blend of experience, innovation and accuracy that has revolutionized the sporting world.

4. This technology has reduced the players and spectators' criticism of the match referee's decision.

5. By analyzing the movement of the balls through this technology, the umpire can take an error-free decision quickly when the game is going on.

6. Hawk-Eye offers an eccentric blend of experience, innovation and accuracy that is the sporting world.

7. Hawk-Eye is much more accurate and precise than the Human Eye.

Advantages of Hawk-eye Technology

1. Hawk-Eye technology is considered to be one of the most accurate ball-tracking technologies available in cricket. It uses a combination of multiple cameras and complex algorithms to track the path of the ball. The system is capable of providing accurate information about the trajectory, speed, bounce, and spin of the ball.

2. Hawk-Eye's accuracy has been extensively tested and validated over the years. It has been found to be highly precise, with an estimated margin of error of less than 5 millimeters. This level of accuracy has made Hawk-Eye the preferred technology for many cricket tournaments and governing bodies, including the International Cricket Council (ICC).

3. Compared to other technologies such as Virtual Eye or Ultra Edge (used for DRS decisions), Hawk-Eye is often considered more reliable and accurate. However, it's worth noting that no technology is infallible, and there can still be some level of subjectivity or variation in interpretation when it comes to close decisions in cricket.

Disadvantages of Hawk-eye Technology

While Hawk-Eye technology is highly accurate in most scenarios, there are a few limitations and scenarios where its accuracy may be affected:

1. **Lack of Qualified Personnel to handle Hawk-eye Technology:** Teachers, Coaches and Referees need to be trained and skilled to handle this computer system**.** Some personnel in Human kinetics and sports are striving to acquit themselves with the use of smart phones. Talk more of computer systems with many cameras, it requires expertise. Hawk-Eye's unique problem-solving expertise is also deeply ingrained in VAR technology, a technology at the forefront of Hawk-Eye's offering, used in international football tournaments (Anik, 2018). The original issue with the introduction of VAR as a concept into football was communication. During the match, the referees and video assistant referees must constantly be in communication with each other using intercoms, deciding together when the best time to stop play is. This can lead to less accurate predictions or incomplete information about the ball's path.

2. **The Cost Implications**: Hawk-eye technology uses a number of cameras, typically six or seven, that are positioned above the playing area to track the path and trajectory of balls. Hawk-eye technology consists of numerous cameras ranging from 6-7 installed above the field of play to analyze the flight and trajectory of balls. These cameras are very costly and expensive to purchase; therefore, not everybody can afford this technological sport equipment.

3. **Lack of complete data**: Hawk-eye relies on multiple camera angles to track the ball's trajectory accurately. In some cases, due to obstructions or limited camera coverage, there may be gaps in the data captured. This can lead to less accurate predictions or incomplete information about the ball's path.

4. **Tracking on Uneven Surfaces**: Hawk-eye's accuracy can be affected when the ball interacts with uneven surfaces, such as rough patches or cracks on the pitch. These irregularities can cause unpredictable variations in the ball's behavior, making it challenging for the system to accurately predict its trajectory.

5. **Spin and Swing Variations**: Hawk-eye's accuracy can be influenced by the degree of spin or swing a bowler imparts on the ball. While the system accounts for spin and swing, there can still be variations and uncertainties, especially in extreme cases or with unorthodox deliveries.

6. **Limited Frame Rate**: Hawk-eye's accuracy depends on the frame rate of the camera footage. In some situations, such as very high-speed deliveries, the frame rate may not capture sufficient data points to accurately track the ball's movement, leading to potential inaccuracies.

7. **Calibration and Calibration Errors**: Hawk-eye requires proper calibration before each match to ensure accurate results. However, calibration errors or misalignment of the cameras can introduce inaccuracies in the system's predictions.

CONCLUSION

Despite these limitations, Hawk-eye is still widely regarded as a reliable and valuable tool in cricket, and its inaccuracies are relatively rare compared to its overall accuracy. It's important to remember that the final decision in cricket often involves human judgment and technology like Hawk-eye is used to assist and provide additional information to umpires and players. While the system is highly accurate, there have been instances where the ball has been incorrectly called as going outside the line of the stumps, leading to incorrect decisions. Additionally, the system is expensive to install and maintain, which can be a barrier for some cricket venues. There is still a long way to go, but we must believe that the technology applied to sports represents an open door to new arising knowledge and potentiation of the sports phenomena. There are several issues that the Human Kinetics and sports community should talk about in light of the quick development in technology used in sports and physical activity. To make the most of the new technology available, some jobs should also be redefined, and organizations should be reorganized. However, it's important to remember to follow any applicable confidential and ethical guidelines. The majority of our teachers lack the knowledge and expertise necessary to prepare our students for international competitions like the Olympic Games. No local teacher has the expertise to prepare students and athletes for such a competition.

RECOMMENDATIONS

1. Provision of adequate funds to ensure proper implementation and sustenance of the current technological

innovations

2. Upgrading of sports physical infrastructures and provision of additional facilities, which are grossly inadequate in most institutions should be vigorously pursued by the Federal Government.

3. These cameras need to be enhanced so they can follow the ball's three-dimensional trajectory correctly and with great precision.

4. Nigeria's curriculum reform should be aware of international innovations in the sports sector. The idea that general education and problem-solving education are better preparation for life than specialized training is becoming more prevalent in light of the world's present

5. The federal and state governments should accept their primary responsibility of funding the sports development section and through regular and adequate budgetary allocations to the sector in support of sports equipment and development programmes.

6. Moreover, some roles should be redefined and organizations should be restructured to take advantage of the new technologies provided.

REFERENCES

1. Abshire P. (2023). Sports: 20 technological advances you must know about. Accessed 2023. Available at https://www. carouselnews.com/sports-20-technological-advances
2. Andrew P. (2023). Technological advancements in sports. Accessed 2023. Available at https://www.techcabal.com/2021/06/23/ technological-advancements-in-sports
3. Anik, L. (2018). How soccer's video assistant referee (VAR) Influences belief in human referees. Competence. Behavioural Scientist.
4. Harrod Sport (2018). Hawk-eye Technology in sports. Retrieved from https://www.harrodsport.com/advice on 23rd June 2021
5. Howe, J. (2020). The NFL refusing to use Hawk-eye Technology for first Downs is the biggest mistake Imaginable. Retrieved from https://wwwbarstoolsports.com/blog/1646699/the-nfl-refusing to use hawk-eye technology for first downs
6. Hawkeye. Accessed 2023. Available at https://en.wikipedia. org/wiki/Hawk-Eye
7. Jayalah, L. M. (2021). Hawk-eye Technology used in Cricket. South Asian Research Journal of Engineering and Technology 3 (2) March- April 2021. Doi: 10.36346/sarjet2021.v03i02.002
8. Madhukuara, S. & Nayan, A. (2022). Hawk-Eye Technology in sports. International Journal of Research Publication and Reviews 3 (7) page 1650-1653. https://www.ijrpr.com
9. Powell, C. (2022). The Robots are coming: A1 Replaces Umpires at U.S. Open with Global Implications for job. Retrieved from https://i:cfr.org/blog/umpires-us-open-global-replaces-implications-jobs
10. Suriya, P. & Arumugam, S. (2020). Technology in Physical Education. Journal of World Academy of Informatics & Management Sciences (WAIMS). Volume 9, Issue 2 August, 2020
11. Singh Bal, B., & Dureja, G. (2012). Hawk Eye: A Logical Innovative Technology Use in Sports for Effective Decision Making. *Sport Science Review, 21(1/2)*, 107–119.
12. Uzor, T. N., Ikwuka, D. C. & Ujuagu, N.A. (2023). Hawk-eye Technological Innovation: Challenges and Intervention strategies in sports. Journal of Modern Educational Research. Open Access. https://www.doi.org/10.53964/jmer.2023003.
13. Wood, R. (2021). Technology in sports in Topend sports website, 2008. Retrieved from https://www.topendsports.com/resourses/technology.htm. Accessed 4/2/2021