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Use of Technology in Tennis, Football and Cricket

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Abstract - *Over the years, technology has been slowly introduced in various sports to improve different aspects of playing the sport. It is widely used to assist referees and umpires of various sports. The use of technology in sports ensures that the sport is fair by helping the referees and umpires with details which can be missed by the naked eye. This makes sports in which teams win by fine margin more interesting for the spectators.*

The fairness of sports which is ensured by the use of technology is also transferred to the players of the sport as they know any attempt to make the game unfair will be caught using technology and it also helps improve sportsmanship among players.

Key Words: Sports Technology, Tennis Technology, Cricket Technology, Football Technology, Hawk-eye, Goal-line Technology, VAR, Video Assistant Referee, Foam Technology, DRS, Third Umpire, Decision Review System, Hot Spot, Snick-o-Meter

1. INTRODUCTION

Using technology in a sport gives it a set of tools to improve itself and to make the sport fairer. Technology used in one particular sport does not necessarily mean that it is exclusive to that sport. There have already been instances of a sport adapting a technology from another sport.

The first instance of use of technology of one sport to another was when the "Hot Spot" technology which was earlier only used in Lawn Tennis was introduced to Cricket. Two infrared cameras on opposite sides of the court above the field of play that are continuously recording an image is required to implement Hot Spot. The same technology was later used in a different sport i.e. Cricket. In Cricket Hot Spot system is used to determine whether the ball has struck the batsman, bat or pad. A bright spot usually shows where the ball is hit. The technology is used to enhance the umpire's/referee's decision-making accuracy.

Technology in sports not only help the referees or the umpires, it also improves the viewing experience of spectators. The most common technology that has been adapted by most sports is the "Instant Replay" technology. Instant Replay allows us to watch a recent incident of a sports match. Instant Replay is possible because the video which is broadcasted live is also recorded at the same time. Instant Replay has a lot of possibilities, like assisting referees with decision making or replaying an incident just for the spectator's / viewers pleasure. Various tools are used to represent statistics into graphics such as augmented reality(AR) to make the viewing experience of the spectators more engaging.

2. TENNIS

2.1 Hawk Eye

All Grand Slam tournaments of tennis provide line review system which uses Hawk Eye ball tracking system. The players can use this system to evaluate debatable line calls.

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.[1] The tennis hawk eye system uses up to ten cameras. The system rapidly processes the video feeds from the cameras and ball tracker.[1] The system uses something called data store which is used to store a 3D blue-print model of the playing area/ court and also stored in it are the rules of the game.

In each frame sent from each camera, the system identifies the group of pixels which corresponds to the image of the ball. It then calculates for each frame the position of the ball by comparing its position on at least two of the physically separate cameras at the same instant in time. A succession of frames builds up a record of the path along which the ball has travelled. It also predicts the future flight path of the ball and where it will interact with any of the playing area features already programmed into the database.[1] The system can also interpret these interactions to decide infringements of the rules of the game.[1]

The invention of this system was made by a British person Paul Hawkins. The first instance of use of hawk eye in television coverage was in the year of 2001 at sporting events such as Test cricket, and it was eventually used in the sport of tennis to help officials of tennis to help judge and decide close line calls.

The ATP Masters Series tournament Nasdaq-100 Open which was held in Miami was the primary tour event to formally use this technology. The Grand Slam tournament US Open of the year 2006 was the first ever Grand Slam tournament to use this system, followed by the Grand Slam tournament, Australian Open of the year 2007. At the Australian Open, solely the matches of center court utilize this technology.

[2]The current rules under which Hawk-Eye is used:

• Each player receives 2 challenges per set to review line calls.

• If the player is correct with a challenge, then the player retains the same number of challenges. Effectively they have an unlimited number of correct challenges to make.

• If the player is incorrect with a challenge, then one of the challenges is lost.

• During a tie-break, each player will receive an additional challenge.

• Challenges may not be carried over from one set to another.

Although before the use of Hawkeye, players have maintained that they instinctively understand when a ball is in or out, the proof to date has not been conclusive. Of all the challenges made by the players that have been created, succeeding rulings made by the Hawkeye system have shown that only 46% of the decisions made are correct.

Officials judging the Grand Slam tournament of French Open have thus far refused to use this technology, as the unique characteristics of the clay court doesn't warrant it. Every ball played in the match will make a mark on the clay surface, it is possible for the match official to get out and have a look at the place where the ball was struck to work out if the ball was in or out, therefore avoiding the necessity of hawk eye.

Anyone who has seen a match live on TV where they have used the hawk eye system may have observed that the ball appears to be elongated once it is projected on the court surface. This could be explained by visualizing the ball pounding the ground with a large amount of topspin, that it genuinely spun onward on the ground and as a result disfigured so much that it levelled on the ground. The marking does not ought the need to have the precise surface area of the cross-section of the ball to specifically represent the contact.

3. FOOTBALL

Football is looking at joining the twenty first century, looking at various technologies for the goal line to decide if the ball passes over the line or not

Use of Technology in sports is increasing at a very fast pace, though the sport of football has been slow to include some form of technology that other sports have.

3.1 Soccer Goal Line Technology

There was an immense need for goal-line technology in football, notably as there are various examples where the TV replay has been able to show wrong decisions by the referee, where a ball has or has not crossed over the goal line, and therefore a goal was given or not given. Technology in cricket, tennis and American Football has successfully implemented, and generally the fans have embraced it.

There are many options which are available tu use as goal line technology. The International Football Association Board (IFAB) had a long trial period to make sure that they got it right before they implemented any system.

The following four criteria was desired for a successful goal-line system:

• The technology ought to solely apply to goal-line decisions.

• The system should be hundred percent accurate.

• The signal sent to the referee must be instantaneous.

• No one but the match officials receive the signal.

There were three leading choices that were regarded for football to be used as goal line technology. FIFA granted a license to third goal-line technology manufacturer, German firm Cairos, along with the Hawk-Eye system and GoalRef systems the permission for use at the 2014 World Cup and the 2013 Confederations Cup, both of which were held in the country of Brazil in the year 2013.

Smart Ball system

A promising prospect has been a "smart ball" loaded with a detector suspended within, jointly developed by German companies Cairos Technologies and Adidas athletic clothing and shoe company. The companies' technology uses a network of receivers around the field designed to track the ball's precise position in real time - as well as precisely once it's fully crossed the goal line. That data would be transferred to the referee in less than a second to a watch-like device worn by them.

Hawkeye system

This system which was developed by the UK company Hawk-Eye had a very successful trial and was the leading candidate out of the other systems in development. Hawke-Eye had already been accustomed to help in making decisions in the sport of tennis as well as cricket. The Football version of the system was substantially trailed and had performed effectively in the test environment. The Hawk Eye system which uses three cameras targeted on every goal-line, and each of them take video footage at 600 frames per second. Hawk-Eye has the means to grant a conclusive decision on whether the football has fully crossed the goal line or not, and transfer this information to the main referee less than one second. The referees of the top tier English football league also known as the Premier League use headsets to communicate with each other, the signal is easily transferred to them. The other leagues have to use other methods such as a watch to receive incoming signals.

Goal Ref system

The Goal Ref goal detection system has been developed by the company Fraunhofer IIS. This is a radio-based system that uses low-frequency magnetic fields to decide if the ball has completely passed over the goal line or not. There are two magnetic fields deployed on the ground, one is installed near the goal area by using coils attached to the goalpost and the other one is created around the ball by using a passive electronic circuit embedded in the ball. The information is

properly exercised and then transferred to a wirelessly connected device worn by the referee and a message is shown in less than a second.

A camera-based system (like Hawk-Eye) was found to be best. In 2013 FIFA announced that a camera-based system, GoalControl, would be used at the 2013 Confederations Cup. The trial was successful, and the GoalControl system was confirmed for the 2014 FIFA World Cup. GoalControl-4D uses 14 high-speed cameras located around the pitch and directed at both goals.[3] In 2013 the English Football Association announced that Hawk-Eye would be used in the 2013-14 Premier League season.

3.2 VAR - Video Assistant Referee

FIFA first used video replays (Video Assistant Referee or VAR) at the World Cup in Russia in 2018 to assist with referee decisions. This followed successful trials over the preceding couple of years. The types of calls that can be reviewed by VAR are goals, penalty decisions, red card decisions, and mistaken identity in awarding a card. The video assistant referee sits in front of multiple computer screens and reviews instant video replays of all the major events and if there is a clear error, they can transfer that information to the main referee using the wireless radio to a headset worn by the main referee.

In 2018, VAR was incorporated into the Laws of the Game by football's lawmakers, the International Football Association Board (IFAB).

3.3 Foam Technology

Referees using a spray which contains a vanishing foam one of the new technology which is used in football, which became renowned at the 2014 Brazil World Cup. The first use of this technology in international football was when it was trialed at the 2013 FIFA U-20 World Cup, 2013 FIFA U-17 World Cup and 2013 FIFA Club World Cup. This spray is a temporary foam applied by the referee on the field to supply a visible marker to be used by both players of the game and referees to point the minimum distance on the pitch that members of the opposing team should stay from the ball throughout a free kick, also from the spot where the kick will be taken.

The spray can consist of 4/5th water and 1/5th butane gas with little amount of surfactant. When released from the can, the butane expands due to pressure changes, forming small drops of butane covered with water. [4] Eventually the butane evaporates, leaving only water and surfactant residue on the ground. The marks disappear after about one minute. [4]

4. CRICKET

In Cricket information that was once considered extra which were provided by the TV networks are now integrated into the decision referral system (DRS), such as hawk-eye and hot spot, and also snick-o-meter.

Over the years, cricket has incorporated into the sport a number of the most recent technological advancements. Some of the innovative technology that are being used currently are discussed below.

4.1 Third Umpire

Before this technology was used, there were only two umpires i.e the main umpire and the leg umpire. The third umpire was later introduced to supplement the two umpires on the field. The third umpire is equally qualified, and sits off the ground with access to TV replays of certain situations (such as disputed catches and boundaries) to advise the central umpires.[5] The on field umpires constantly communicate with each other using wireless headsets. The third umpire was mostly asked to judge if a player is runout or not, for which he uses instant video replays and determines the outcome without consulting the other two umpires.

4.2 Decision Review System (DRS)

This sport has also joined a few other worlds sports and have implemented an umpire referral system in most of the international matches. A system like this was first tried in the year 2008 in a Test series between Sri Lanka and India. Unlike the sport of tennis where the challenge and referral decisions are definite by using the hawk-eye technology, the cricket referral system is judged by the third umpire and can be less fault tolerant. The particular method to use it may become different and develop, however when it was initially introduced, this is the particular method that was used.

Players are granted the permission to challenge conclusions made by the umpires on the field, after which the TV official examines them and declares the correct result. A team can challenge any decision made by the umpire up to three failed challenges. This is applicable for all innings of Test Cricket, One Day Cricket and T20 Cricket. The option to exercise this rules rests with the batsman who is the recipient of the umpire's original call or the captain of the fielding side. This is done by making a "T" sign with both forearms at shoulder height. Various technologies are used by the third umpire to gain information to make the final decision.

It is a great way to maintain the fairness of the game and sounds nice for the players and viewers at home, however the pressure is on the umpires. In reality, the method really takes a lot of time and can distract people from the game. Hence problems still exist which need to be improved, but the referral system is a great step forward for cricket.

4.3 Hawkeye

It is a computer based system initially used in the year 2001 for showing the trail of a cricket ball. It is an essential tool in cricked and is used by TV networks around the world to guarantee the umpire's decisions. The DRS uses this technology for ruling LBW decisions.

4.4 Snick-o-Meter

An extremely receptive microphone situated in one of the stumps on both ends of the pitch, which can receive the sound if and when the ball scrapes the bat. This technology is merely used to provide television audiences extra information and to point out if the ball hit the bat or not. A real time Snick-o-meter is in the development stage to aid the umpires by giving them the benefit of listening to the sound of ball scraping the bat or the pads in real time. It will supplement the Hot Spot Technology.

4.5 Hot Spot

The hot spot technology is largely used to evaluate whether the ball has hit the bat, specifically when there is a small scrape. If there's contact, the minute amount of heat generated makes a spot visible and is stipulated by a difference to that area of the bat. Two cameras which are infra-red cameras are used, which are positioned at both ends of the pitch. These cameras sense and measure heat from friction generated by a collision, such as ball on pad, ball on bat, ball on ground or ball on glove. Using a subtraction technique, a series of black-and-white negative frames is generated into a computer, precisely localizing the ball's point of contact. [6]

3. CONCLUSIONS

Using technology in the sport of Tennis, Football and Cricket have become important to both the participants of the games and the spectators of the game. It has improved the fairness of the sport as well as kept the spectators entertained be it the ones watching it live at the stadium or the ones watching it at the comfort of their home.

Recent times have shown us that the participants as well as the spectators of the sport have become more receptive to the introduction of new technology if it improves the fairness of the sport and reduces the margin of error of the human eye. With already a number of technologies being used, introduction of newer technology will be easier.

REFERENCES

[1] VIDEO PROCESSOR SYSTEMS FOR BALL TRACKING IN BALL GAMES esp@cenet Patent document, 14 June 2001

[2] https://1220hslopentennis.wordpress.com/the-rules/

[3] "Fifa snubs Hawk-Eye in favour of German goalline technology". The Guardian. Guardian News and Media. 2 April 2013. Retrieved 4 April 2013.

[4] https://www.firstpost.com/topics/hot-spot-51667.html

[5] BBC World Service Outlook 28'7/14 The story behind football's magic foam

[6] http://sportstechinformations.blogspot.com/