Advanced Referral Systems— Scrapping the Pain of Wrong Decisions

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IN the Beijing Olympics 2008, a controversial judgment led to the elimination of Sarah Stevenson in the Taekwondo competition. The judges had not counted a scoring shot. Following her appeal, however, video replays led to the decision being reversed and she went on to win a Bronze Medal.

The second cricket test between India and Australia in 2008, played in Sydney, is equally controversial. Australia won the match by 122 runs but the result could have been different if the umpires hadn't made as many as 9 wrong decisions in the match.

Since an error in judgment can rob a sportsperson of a medal, much work has been done in the field of referral technologies over the years. Although there are still improvements to be made in these technologies, these are being looked upon as an advantage as they promote correct decision making.

Here are some technologies that have made sports richer by several orders of magnitude.

Video Assistant Referee

The Video Assistant Referee (VAR) is the latest football assistant referee that reviews decisions made by the head referee with the use of video footage and a headset for communication. The referee informs the VAR, or the VAR recommends to the referee that a decision should be reviewed. The video footage is reviewed by the VAR, who advises the referee via a headset what the video shows. The referee could decide to review the video footage himself on the side of the field of play before taking the appropriate decision, or the referee could accept the information from the VAR and take an appropriate decision.

Goal Line Technology

Goal Line Technology system based around sensors in the ball and goal frame

Goal Line Technology (GLT) in football has been implemented to track the position of the ball in relation to the goal line to eliminate incorrect decisions by referees. This technology uses a magnetic field to track a ball, inside of which is a suspended electronic sensor. Thin wires carrying electric current are buried around the penalty area and behind the goal line to form a grid. A moving ball impacts the uniform magnetic field due to the interference between the copper wires and the magnetic field. The ripple is transmitted through the grid to a computer, which decides whether the ball crossed the line or not. A confirmed break-in is instantaneously followed by a goal alert on the referee's watch. Goal–line technology also assists ice hockey referees to decide whether the ball was in or out.

Stump Mic and Camera

The Stump Camera is a small TV camera stuffed inside a hollow stump. The camera views through a small window on the side of the stump via a mirror. These cameras help generate a unique view of play for action replays specifically when a batsman gets bowled. A stump mike is also used to receive the sound waves and helps the umpire whilst taking decisions when the batsman nicks the ball.

Snickometer

Known as Sniko, the technology is used in televising cricket to graphically analyse sound and video and show the noise frequency to find out whether the ball touched the bat before going to the fielder. The Snickometer is frequently used by third umpires to take decisions on a complex catch appeal. The shape of the frequency helps the umpire to find out if the ball touched the bat on the way through to the wicketkeeper. If there is a sound of leather on willow, which is usually a short sharp sound in synchrony with the ball passing the bat, then the ball has touched the bat. Other sounds such as the ball hitting the batsman's pads, or the bat hitting the pitch, and so on, tend to have a fatter shape on the sound waveform.

Hot Spot

A Hot Spot Bat hit the pad

Hot Spot came into play after the Snickometer was reportedly considered not accurate enough. This technology uses infra-red imaging system and shows a bright spot where contact friction from the ball has elevated the local temperature. It uses camera on both the ends of the ground and provides information based on the heat friction generated by a collision.
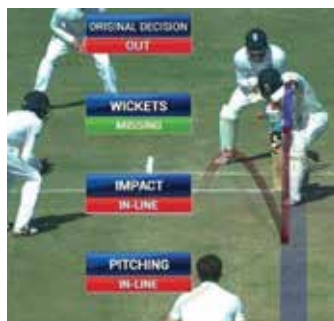
Ball Tracking System or Hawk-eye
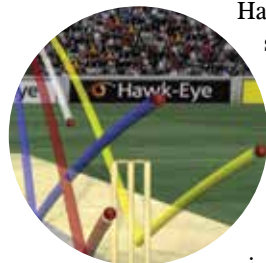
Hawk-eye was invented in 2001 to show the trajectory of the ball once delivered from the bowlers' hand. It uses cameras aligned under the stadium roofs and generates a three-dimensional representation of the trajectory of the ball. It is used to track the trajectory and for judging LBW decisions.

Decision Review System (DRS)

Decision Review System is the modern day method for correcting or reviewing the on-field umpire's call. The DRS takes into account the Snickometer, Hotspot and Hawk-eye while providing a conclusive decision whether the decision stands or not.

LED Stumps and Bails

Though an expensive technology, LED Bails are used to help the umpires make a precise decision when it comes to decisions regarding run-outs. The bail glows when it is dealt with an impact. It has a sensor, a microprocessor and a low-voltage battery.

MacCAM

Waterproof metal housing

LDR

Germany array led (IR distance 20-50M)

Pan rotate bracket (255° horizontal) controlled by software.

The MacCAM is a new piece of technology, consisting of slow motion cameras, used to broadcast instant replays of close or controversial landing shots on or near the baseline, often in Tennis. The MacCam technology helps in tracking the tennis ball and gives instant feedback to the referee whether the ball was hit in or out the baseline. The high-speed cameras operate at 1000 frames per second and rely on the actual sequence of images to see the ball striking the court. However, the system can only evaluate the baseline and not the sidelines or service line calls.

Electronic Line Judge
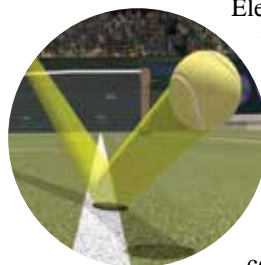
Electronic Line Judge is used in Tennis for calling when the ball hits the outer parts of the court. It enables the umpire to take a fair decision in the match whether the ball has landed on the court or not. It has a conductive tape to trace the landing of the balls on indoor tennis courts.

Cyclops
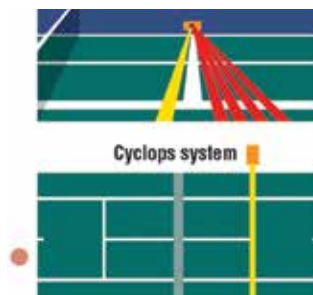
Cyclops system

Cyclops is an electronic system that could judge whether or not the serve is in or not. Before each point, the service line umpire activates the system. Around five to six horizontal infra-red beams are projected 10 mm above the ground. One beam covers the good side of the service line (correct service) and the other beams cover the fault side. When a ball hits the first beam, other beams are turned off. In case of a long serve, other beams will be turned off. An audible signal indicates a long serve.

Pointtracker

Pointtracker is a 3D application that allows the user to view a point from a set and see it based on various statistics. Each point can be viewed from different camera angles. These angles can be overhead, from the umpire's view, from the net or from the view of the players. Each point's service speed, return speed, winner speed can be known as the point progresses. The user can also adjust the number of shots that he wants to view at one particular time and the track of the ball as the rally progresses. Points can also be grouped based on aces, forehand winners, backhand winners, unforced errors and many more categories.

Piezoelectric Net Cord Sensor

This is a piezoelectric device that converts any vibrations that it detects into electrical energy thereby setting off a "beep" sound. This system is helpful to the umpires as it can monitor whether a serve should be called let or not.

SMART Replay

SMART Replay provides TV match officials with every angle of an incident, allowing complete control of all broadcast feeds and enabling decisions to be made quickly and accurately either on or off-site. It provides every angle of a player, team or opponent's performance live and post-event. All video recorded into SMART is time stamped meaning it can be synced with data feeds enabling effective and insightful analysis.

Vanishing Spray

Vanishing spray, also known as vanishing foam, is a substance applied to a football pitch in order to provide a temporary visual marker. It is used by the referee to indicate the minimum distance that the defending team may position themselves from the ball during a direct free kick, as well as to indicate the spot from where the kick is taken.

3Play

In Judo using 3Play technology, tournament referees and judges are now able to consult on match decisions to ensure accuracy. With 3Play, the referees don't need to interrupt the match but can see the match again, preparing clips from multiple angles so that they can thoroughly observe and make a proper decision.

Transponder Timing

Transponder timing (also called chip timing or RFID timing) is a technique for measuring performance in sports events. A transponder working on a radio-frequency identification (RFID) basis is attached to the athlete and emits a unique code that is detected by radio receivers located at the strategic points in an event. An antenna is placed at the start, finish, and in some cases, intermediate time points and is connected to a decoder. This decoder identifies the unique transponder code and calculates the exact time when the transponder passes a timing point.

Fully Automatic Timing System

Fully Automatic Timing (FAT) is a popular kind of sports timing that captures digital race results accurate to at least 1/100 of a second (0.01). Fully Automatic Timing systems require a start signal, running time, and capture device to be digitally synchronised to ensure accuracy. True FAT also requires the timing device to be activated automatically by a start signal, rather than manually (e.g., like with a stopwatch). The finish time must also be captured digitally to remove any human error or delays from the equation. Most importantly, the finish line results must be accurate to at least 1/100 of a second – but preferably to 1/1000 of a second or more.

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