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ANALYSIS OF FAIR DECISION IN CRICKET – DECISION REVIEW SYSTEM

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Abstract

Proper decision is crucial while playing cricket. A small error can change the game's outcome because a bad choice can have a big effect and lead to injustice. The decision review process, which aids the umpire in making calls such as runout, LBW, stump out, not out, and so forth, is the main topic of this essay. with the help of an excellent camera. The decision review system is capable of making choices on stump out, runout, and other matters. The graphical user interface (GUI) of DRS is developed using Tinker. The Umpire Decision Review System (UDRS) is a strategy used in cricket and other sports to circumvent the contentious judgements made by on-field umpires over whether or not to call a batsman out. The accuracy of UDRS is roughly 90%. Various video replays and Super Slow Motion are only two of the specialised simulations it uses. In a dynamic system of contact protocols, fielding captains, television umpires, batsmen, and on-field umpires are all tools. In order to help the umpires, assess the case, the Third Umpire DRS will make use of the live camera. To ascertain the result of the initial decision, he will be able to make use of features like reviewing, pacing the case slowly, pacing it quickly, and pacing it very slowly. It will make the process of making decisions clearer and simpler.

Keywords: Decision review system, Hot-spot, Snickometer, Ball-tracking

1.Introduction

Decision Review System (DRS) is built with the help of technology, formerly known as UDRS, which helps umpires to make correct decisions in cricket. A decision made by the on-field umpires can be challenged by the players (known as a Player Review), and even for any decision on-field umpires may refer the third umpire (known as an Umpire Review). Television re-plays, ball tracking and prediction technologies, microphones to pick up minuscule noises created when the ball strikes a bat or pad, and infrared imaging to pick up temperature changes when the ball hits a bat or pad are the key components that have been used. Prior to DRS, a mechanism that had been in place since November 1992 allowed on-field umpires to send certain of their decisions to a third umpire so that they could be reviewed via television replays. The official DRS system was first used in a Test match in 2008, One Day Internationals (ODI) in January 2011, and a Twenty20 international in October 2017. Technology to detect the line and player referral have been integrated into the operations of several other sports, such as tennis and high-profile international football, since cricket adopted DRS. Moreover, statistics from other sports have consistently shown that the use of DRS has resulted in more accurate umpiring decisions than its absence. Expecting 100% accuracy in DRS is ludicrous because, in any event, 100% accuracy requires technology. Even if the accuracy percentage only marginally rises—as it most certainly did, from 90.3% to 95.8%—there is still a strong case for using DRS.

2. History of Decision Review System

Prior to DRS, a mechanism that had been in place since November 1992 allowed on-field umpires to send certain of their decisions to a third umpire so that they could be reviewed via television replays. Goal-line technology and player referral have been integrated into the operations of numerous sports other than cricket, such as tennis and high-profile international football, since cricket adopted DRS. The International Cricket Council (ICC) publicly adopted the Player Referral mechanism on November 24, 2009, during the first Test match between Pakistan and New Zealand at the University Oval in Dunedin. The mechanism has been tried in an India vs. Sri Lanka match in 2008. It was initially used in ODI during England's January 2011 tour of Australia [1]. ICC originally mandated that the UDRS be used for all ICC approved matches, but both teams later had to consent to its use. ICC has decided to continue developing this technology and to try to incorporate it into every ICC event.

The ICC modified the lbw protocols in October 2012, swelling the fringe of error when the ball reaches the batsman's pad. In July 2016, the regulations underwent another revision that reduced the level of ambiguity. Ireland and South Africa played their first ODI match under the new rules in September 2016. In September 2013, the Indian Cricket Board announced that a team's allotment would be reduced to two for a trial period starting in October 2013, following an innings of 80 overs in Test matches. Prior to this, a single inning could only have two failed reviews for each club. [2]. During Australia's ODI series against South Africa, which started in November 2014, the field umpires' remarks were also shown on television. Every time they review a decision, the TV umpire and field umpire can be heard communicating.

The ICC decided to deploy one reviewer per team for all upcoming ICC World Twenty20 events in February 2017. The first Twenty20 tournament to use the technology was the 2018 ICC Women's World Twenty20. It was utilised in a T20 match for the first time in the Pakistan Super Competition 2017 elimination phases. In the Australia vs. India Twenty20 International series in October 2017, It was the first time that DRS was used [3]. The new ICC regulations came into effect in November 2017 and stipulate that after 80 overs in Test matches, there would be no more top-up re-views and each team will only have two unsuccessful reviews every inning. Due to unclear evidence, the "umpire's call" is a decision in which the on-field umpire's assessment is upheld; nevertheless, teams would no longer lose an LBW review as a result. In 2020, the COVID-19 epidemic presented logistical issues that led to a temporary suspension of the necessity to appoint impartial match officials. This change resulted in an increase from two to three unsuccessful reviews every test innings due to the likelihood of occasionally having less experienced umpires on duty. On June 1, 2023, the "soft-signal" regulation that umpires employed to refer catches was abolished since it was "unnecessary and at times confusing" [4].

3. DRS Procedure

Determining a batter's leg before wicket in the event of an appeal entails a number of assessments. Firstly, was the ball in line with the stumps? Second, was the batsman going too far down the pitch in his stride to make a wise decision? Last but not least, did he utilise his pads specifically to block the ball? Depending on how the on-field umpire rules, either the batsman or the fielding captain may ask for a third umpire to review the

judgement. When the on-field umpire at the bowler's end indicates with a square that mimics a TV screen, the third umpire will examine the call. The third umpire confirms that it was a legal delivery before going over the replays to see if it was a caught behind. The terms Ultra-edge (also known as snickometer) and Hotspot refer to the gadgets that are used to detect if the ball touched the bat before coming into contact with the pad (if a leg before wicket call is made) or was caught by the wicketkeeper. If the ultra-edge does not reveal a nick, the third umpire evaluates the impact and applies ball-tracking algorithms to verify if the ball is truly projected to hit the stumps. One of three outcomes could ultimately result from the third umpire's decision: (i) "out," (ii) "not out," or (iii) "inconclusive" evidence. Once the third umpire has transmitted the verdict, the on-field umpire signals that the batsman is out. The third umpire negates his first call by touching each shoulder with the opposing hand before signalling out if his on-field colleague is forced to fix his mistake. DRS incorporates the following technologies:

3.1 Ball-tracking Technology

This device uses multiple cameras to track the trajectory of the ball. By following the ball's route from the point of release to the point of bounce, it becomes easier to predict where it would have gone if it hadn't impacted the batsman or any other object. The massive Japanese electronics company Hawk Eye was developed in 2001 and released for sale in September 2010; Sony acquired it in March 2011. To chart the virtual course of the ball, a constant real-time feed from the six strategically positioned cameras across the stadium is needed. To record the pitched delivery and generate data points, every camera needs to be operating at a specific frame rate [5]. The third umpire employs this technology when a ball is reported for leg before wicket (LBW) and is carried upstairs to verify if the ball was indeed hitting the stumps or if the batsman's leg prevented it. Ball tracking is achieved with object tracking and object detection. Object detection is one of the most fascinating concepts in computer vision. It is important in a wide range of fields, such as space exploration, sports, defence, and other fields. Here are a few fascinating instances of object defence and detection in space:

- Target marker with self-action
- Deploying robots in lifelike simulations to rescue people in hazardous situations
- Locating Space Debris

It can be summarised as follows:

Localization + Image Classification = Object Detection

Object detection is the process of locating an object in a picture. Similar to an image classification challenge, object detection also requires the extra task of localization, or figuring out where an object [6]. Object tracking is a particular application of object detection. It just has to do with da-ta vids. Object tracking locates and identifies an object in a movie by analysing each frame. Object tracking becomes tricky when a movie is using object detection on every frame.

Fig. 1. The third umpire uses ball tracking equipment to assess the ball's impact and follow its trajectory on the stumps.

3.2 Hot-spot Technology

This device uses thermal imaging cameras to detect heat generated by friction. By showing the area of the ball's contact with the bat or pad, it can help determine whether a batsman is out or not. Using infrared imaging technology, the Hotspot system determines if the ball has struck the batsman, bat, or pad. The two cameras capture every delivery made during the game; they are usually placed close to each bowling end. Any alleged nick or bat/pad incident can be verified by measuring and identifying the amount of heat generated when the ball strikes another object in the captured infrared image. Next, on a computer-generated negative image, the point of contact is emphasized as a red/white friction "hot spot". It enhances the decision-making of the relevant team when it is used by the on-field umpire.

Hot Spot uses two infrared cameras positioned at different points on the ground. When a ball collides with a glove, pad, bat, or the ground, for example, these cameras detect the heat produced by friction. By sending a series of negative, black-and-white images into a computer and using a subtraction approach, the exact position of the ball's point of contact can be found. Whether the ball struck first, that is, whether the pad or the bat was struck first and was subsequently collected by a member of the fielding team or captured in front of the stumps, is one of the most difficult decisions to make when determining whether a batsman is out when the ball hits the pad, the bat, or both [7]. If the ball hits the bat first and then the pad, the hitter can be out caught but not LBW. If the ball strikes the pad in front of the stumps or in line with the stumps, the batsman may be out LBW but not caught. If the ball strikes the pad and then the bat, a fielder may catch it and declare the hitter out LBW or out caught. Since the batsman's pad and bat are often in close proximity to each other, it may be challenging to visually determine which was struck first. Hotspot technology, however, can usually provide an answer to this query.

Fig. 2. Thermal imaging identifies an area on the bat based on a change in temperature.

Fig. 3. A spike is identified by the snickometer by means of the sound waveform as the ball is crossing the bat.

3.3 Snickometer Technology

This apparatus detects minuscule sounds made when the ball hits the bat or pad. A cricketing gadget called Snickometer, or Snicko, senses if the ball edged the bat ahead of a potential dismissal, like a catch or leg before wicket. This is achieved by having an attached sensitive microphone near the stumps play back the video of the ball hitting the bat frame by frame while displaying a waveform that depicts the oscilloscope's soundwave. Real Time Snickometer (RTS), a more recent version that is currently in use, speeds up the process considerably because it does not require human synchronisation for each tape segment. It might be useful to ascertain if the batter made contact with the ball, edged it to the wicketkeeper, or slips. Originally, the broadcast team would attempt to determine whether the umpire made the correct decision and whether the ball actually struck the bat. The third umpire utilises it for DRS reviews to determine if the ball struck

the bat in cases where the batsman may have edged a ball that was caught behind or in leg before wicket scenarios where the player is not out lbw if the ball struck the bat (or glove) before it struck their body [8]. It fulfils this purpose in tandem with Hot Spot.

3.4 Ultra Edge Technology

This device, which combines audible and visual data, determines if the ball has touched the bat, which is an improvement over Snickometer. The implementation of the state-of-the-art technology has been approved by ICC after tests and verifications. This technology has undergone extensive testing by engineers at the Massachusetts Institute of Technology (MIT). Numerous cameras positioned on the field and in the vicinity are used by this system, in addition to microphones placed inside the stumps. The wicket mics pick up a particular sound that the ball produces as it makes contact with the bat and display it on the tracking screen. The stump mic allows you to distinguish between the sound made by the bat and the pads [9]. For a visual representation, the cameras at either end of the pitch track the ball as it approaches the bat. The microphone records the sound of the ball striking the bat, which is then transmitted onto an oscilloscope. This oscilloscope displays the sound energy as observable waves that we can detect if the bat nicks the ball. All it does is determine whether the batter is out.

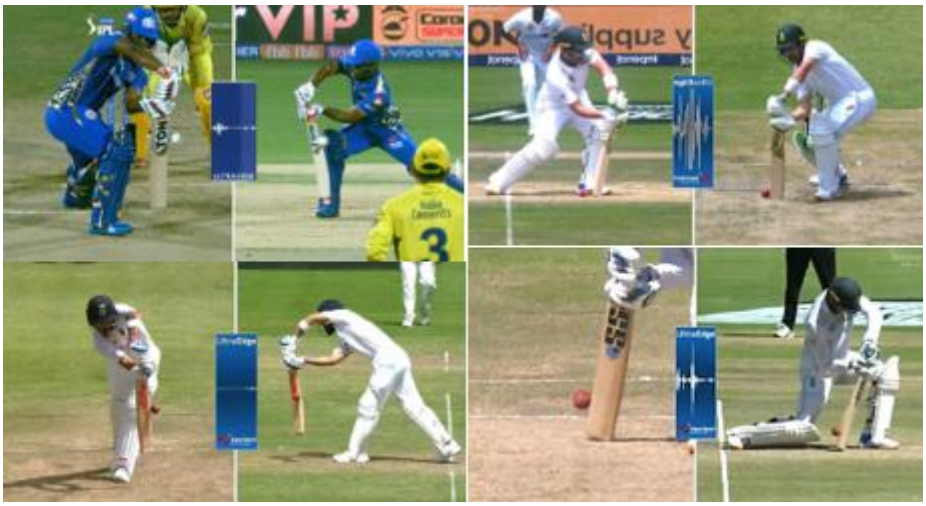

Fig. 4. The status of the batter-out or not-is determined using ultra-edge technology.

4. DRS Application Process

DRS can function as an umpire or as a player review. Players may request that the third umpire consider a decision made by the on-field umpires during an umpire review, and on-field umpires may elect to consult with the third umpire during such a meeting.

4.1 Umpire Reviews

Often, the incident occurs in an instant. The following dismissal decisions may be re-examined by the Third Umpire at the request of on-field umpires:

If the on-field umpires cannot decide whether the batsman is out, they may ask the third umpire to decide if he has gone home. Additionally, if neither batter has advanced to the same end and the field umpires cannot determine who grounded first. An example of this is the Third Test that took place in 2006 between the West Indies and New Zealand.

The player gets caught and obstructs the pitch if both umpires voice their doubts. Occasionally, the ball may be caught by the fielder a few inches above the ground. If the umpire cannot see clearly or is unsure if the ball bounced before the fielder caught it, he may refer the call. The third umpire also confirms if the hitter hit the ball and whether the delivery was a no-ball; if the no-ball resulted in any dismissals, the player must be declared not-out.

The Third Umpire may also be requested by the on-field umpires to examine the following: boundary calls—which are used to assess whether a batter hit a four or a six. There are times when the ball bounces within the boundary rope by only one foot, giving rise to four runs. The umpire may speak with the third umpire to get clarification on whether this was a four or a six. A fielder may dive near the boundary to stop the ball from crossing it; four runs are declared if the fielder makes any simultaneous contact with the boundary and the cricket ball. The third umpire may also be contacted in such a situation [10].

4.2 Player Reviews

A defensive team can utilise the process to overturn a "not out" decision, or a batting club can use it to contest a "out" judgement. The batter who is being ejected or the captain of the fielding team initiates the challenge by making a "T" motion with their arms or their arm and bat. Only dismissals that were or could have been made, such as deciding whether a delivery constituted an LBW out or whether the ball was a valid catch (not contacting the ground prior to being caught by a fielder, but rather making contact with the batter's bat or glove) are eligible for a challenge.

The Third Umpire judges the play after it has been issued, accepted, and acknowledged. A set number of rejected reviews may be reached before teams begin referring people [11]. This limit is three denied review requests in a Test match; it is two denied review requests every inning in an ODI or Twenty20 international. A team in a Test innings was awarded two reviews after 80 overs, starting in 2013 and ending in September 2017. October 2017: The team will not lose its review if the DRS displays the "umpire's call," upholding the on-field decision.

4.3 Umpire’s Call

There was fear that on-field umpires would become little more than "glorified coat stands" as DRS became more prevalent in the game and decision-making systems expanded in sophistication and analysis. 'Umpire's Call' was de-developed by the ICC in 2016 in an effort to refine the system. The umpire's call This suggests that the on-field umpire's initial decision ought to be respected. The principles of the referral system state that the on-field umpire must make a "clear mistake" in order to reverse the decision. A leg before wicket (LBW) decision is considered to be clearly incorrect in a number of situations, including:

- Did the ball pitch towards the stumps or away from them?
- Did the batter strike the ball with his bat first?
- Did the ball strike the batsman's pad in line with the stumps?

Since there was no "clear mistake," according to the umpire's call, the original on-field decision should be upheld. Furthermore, if the initial decision is maintained as the umpire's call, the appealing team retains the review. In other sports where umpire's call is used, similar issues have arisen when very close calls (i.e., not a "clear mistake") are seen to have been made unfairly through the use of technological and forensic techniques.

5. Accuracy and Dependability of DRS

If the team feels that the ruling should be reversed, the DRS can assist them in making the choice to ask the third umpire to step in. Human mistake is inevitable when an umpire has to make a hard decision in a split second to adjourn a batsman out or not out in an appeal for the LBW. Because the technology's judgements are final and cannot be reversed, its accuracy is frequently questioned. A cricket ball's spherical shape is not constant. A raised seam surrounds its equator, and as the game goes on, the imbalance between the two hemispheres gets more pronounced. The ball's trajectory could alter dramatically once it touches the ground. The bounce can be influenced by the ball's spin, hardness, texture, spin rate, direction, and seam placement in relation to the ball. One can bowl the ball as fast as ninety miles per hour, or ninety mph. The "swing," or aerodynamically generated curve in the ball's path, may also be affected by the variables discussed above. As a result, the DRS technology, which predicts the post-bounce trajectory based on the ball's pre-bounce behaviour, could contain a variety of measurement errors. Tracking and predicting the trajectory of the ball is the basic notion underlying the algorithms used in it. Since no measurement is ever exact, extrapolation is what makes predictions correct, and the quality of the data is one component that influences how accurate these extrapolations can be.The dislodged bails, which are two sticks placed on the stumps, may be included if a majority review is necessary and the outcome is doubtful. In these situations, the measurement error—which varies with every review—may be used to determine the ultimate conclusion [2]. Due to two factors—the small size of the bails and the difficulty of precisely judging the ball's conduct each time it crosses the wicket—DRS digitising will not be able to establish with certainty whether the ball would break the wicket in practice.

Since precision is impossible to achieve, the principle of imperfection in these kinds of measurements is a given error rate. Verifying the breaking of the stumps is the final step following the identification of the impact and the delivery path in a referral of the first decision. It is customary in experimental science to include a confidence range surrounding measurement errors. The experimenter's chosen confidence level and the error distribution's dispersion are the two variables that define the width of the confidence interval. If the distribution of mistakes is known, then each prediction can be associated with a confidence interval. To accomplish this, choose a confidence level, such 95 or 99 percent. According to the first, there is only a 5% chance that the error will exceed the 95 percent confidence interval's outer bounds, and according to the second, there is only a 1% chance that the error will exceed the 99 percent confidence interval's wider bounds. Another area where an erroneous decision may be made is the distance (the longer the better) between the batsman's point of impact on the pad and the wicket. An increase in the frame rate of the camera used to record the delivery will yield additional data points—predictions of the ball's trajectory. Since the cameras are generally believed to operate at 120 frames per second, a ball travelling at 80 mph would move one foot every frame without allowing for a precise estimation of how the ball would be delivered in that foot [8]. By mapping the ball's travel after the pitch and

aggregating all the gaps between data points, we may argue that ball tracking technology misses a lot of information about the ball's conditions. This limits the accuracy of the technology, but aside from human decision-making, this review system will surely be the focus of questions from numerous players and experts.

6. Conclusion

Given the power to declare a batsman out in a matter of seconds after essentially analysing a collected set of intricate procedural procedures in a high-stress environment, it is easy to say that this is a difficult job. Because there are so many variables in this game, many technologies are used nowadays with the simple objective of making these kinds of crucial decisions that determine the outcome of matches as accurate as possible. The decision review mechanism has elicited differing reactions from cricket boards across the globe. While some have graciously accepted it, others have voiced strong disapproval, citing the technology's trustworthiness. However, the DRS idea is now formally required to be applied in every international cricket match by the ICC. Therefore, in addition to the more traditional skills of hitting, bowling, and fielding, international cricket players also need to become proficient in the effective application of DRS, which is a fourth talent. A team runs the risk of losing the game if it does not take advantage of its options to review a decision. Another way DRS has changed the nature of the game is by making hosting an international cricket match much more expensive. Every day of international cricket, as we have stated, a substantial sum of money needs to be spent on DRS-related infrastructure. The fraction of successfully retracted reviews far outweighs this expense. The ICC calculated that the accuracy rate of umpiring decisions is about 90.3%, and the accuracy percentage after a review adjustment, or post review, is 95.8%. The improvement in the percentage of accurate decisions resulting from the usage of DRS is insignificant when weighed against the significant costs involved in its deployment. One could argue that funding more umpire training could result in a decision-making improvement that is comparable. DRS must advance due to technological constraints that prevent it from becoming more precise and the increasing popularity of this technology among viewers.

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