A Study on Hawk Eye Technology

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Abstract—These days, Hawkeye technology is one of the most commonly used technologies in sports. It falls in the category “Tecathlon Technology in sports”. Nowadays we commonly see visualizations and attractive graphics in cricket analysis shows. These include wagon wheels, pitch maps, reliable software predictions for Leg before wicket. It is also seen very commonly that important decisions, during the course of the game, sometimes go wrong due to human error in judgment. These decisions can alter the way the game progresses. There is a lot of image process, plenty of mathematical calculations and other aspects of engineering which need to be used in order to permit for the event of such a sturdy and reliable system. The paper attempts to explain all these aspects in some detail.

Keywords—BWF, OUT.

I. INTRODUCTION

Hawk-eye is that the name of a line-calling system that traces a ball’s mechanical phenomenon and sends it to a virtual-reality machine. Hawk-Eye uses six or a lot of computer-linked tv cameras located round the court. The computer reads in the video in real time, and tracks the path of the ball on each camera. These six separate views are then combined together to provide an correct 3D illustration of the trail of the ball. The Hawkeye system was invented by a young British computer user Paul Hawkins, and was launched in 2001. It was initial employed in tv coverage of sporting events like take a look at cricket, and has now reached the stage of being used by officials in tennis to assist in adjudicating close line calls. The Nasdaq-100 Open in Miami was the primary tour event to formally use the technology. The 2006 US Open was the primary sweep event to feature the system, followed by the 2007 Australian Open. the Australian Open, only centre court matches utilize the technology.

II. WORKING

Hawk eye is that the name of a line line of work system, which traces a ball’s trajectory and sends it to a Virtual reality machine. It is a complex computer system which works via 6 or 7 high performance camera normally positioned in predefined places around the stadium. These cameras track the ball from different angles the video from the cameras is triangulated and combined to create a 3 dimensional representation of the trajectory of the ball. It is accurate within 5mm but is usually trustworthy as an impartial second opinion in sports. Cricket could be a ball game compete at intervals a preset space. A system comprising of video cameras mounted at specific angles can be used to take pictures. These footage ar then wont to find the position of the ball. The images are then place along and superimposed on a preset model to create an entire visualisation of the mechanical phenomenon of the ball. The model includes, in this case, the pitch, the field, the batsmen and fielders etc.
For this to be possible, we need to sample pictures at a really high rate and so would like economical algorithms which may method knowledge in real time. Such technologies are wide used these days in varied sports like court game, table game that additionally fall with in the class of ball games played within a restricted area. Our discussion can largely contain applications that specific to the sport of cricket, but in some cases, we will mention how similar techniques are applied in other games. Shows the flow of hawk eye technology. It started with the calibration of the cameras. This is required to deal with the problem about the non-uniform distance of the cameras from the playing area due to various sizes of the pitch. The next step is to start processing the video input which we get from the cameras. In each of the images obtained, the first aim is to find the ball in it. Once this can be done, a geometric algorithm is used to look at multiple images (which are 2D) and then combine them cleverly to get the co-ordinates in 3D space. This process is now repeated for multiple times each second (typically at the speed of one hundred times per second). Thus, we’ve the position of the ball in 3D space at many moments in every second. The final step is to method these multiple positions and realize an appropriate fitting curve that best describes the flight of the ball. As we’ve sampled the positions of the ball at terribly short time intervals, the flight of the ball may be terribly accurately determined. The Hawk-Eye system is predicated on triangulation principles that build use of visual pictures and temporal arrangement knowledge provided by high-speed video cameras placed at strategically locations and angles round the house.

III. TRIANGULATION

Triangulation is the method of crucial the situation of some extent by forming triangles to that from best-known points. It involves angle activity instead measure distances. Purpose (the purpose) will then be mounted because the third point of a triangle with one best-known aspect and a pair of best-known angles. Hawk-eye takes two inputs:

A. Video provided by totally different (completely different) cameras placed at different places.
B. The speed of the ball. The system chop-chop processes the video feeds by a high speed video processor. This a part of the system may be further divided into major parts:

1) To spot the pixels of the cricket equipment in each image taken by the video cameras, associate algorithmic rules employed to find the pixels adore the ball within the image obtained. the knowledge that is employed so as to attain this can be the size and form of the ball. once this stage, we’ve got as output the x and y co-ordinates of the ball in every image.
2) Geometric Algorithm: the information of and co-ordinates from every camera is obtained by the Geometric Algorithm. Now, knowing the precise positions of the cameras in area, and therefore the co-ordinates of the ball in additional than one of the photographs, one will verify accurately the position of the ball. Hawkeye incorporates each image analysis and measuring system technology. It tracks the balls entire mechanical phenomenon, right from the point wherever it’s free by the bowlers hand, to the purpose wherever the ballplayer hits the ball.

I. Features:

The main options of hawk eye are:
• chase system. Video replay system.
• Tracking system – There are half-dozen high speed vision process cameras that track the ball from the bowler’s hand to ballplayer. The system can mechanically calculate the subsequent: - 1st it calculates the speed of the ball at the instant it leaves the bowlers hand, it then calculates the time interval of the ballplayer in response to the ball.
  o It additionally calculates the swing of the ball from the bowler’s hand to wherever the ball pitched.
  o wherever the ball was bowled from.
  o what proportion the ball bounced?
  o what proportion the ball deviated sideways off the wicket (i.e. seam or spin).
  o and eventually A prediction of wherever the ball would have passed the stump.

IV. APPLICATIONS IN SPORTS

1. CRICKET

LBW

Hawkeye Will Accurately Comprehend The Mechanical Phenomenon Of The Ball And Predict The Direction Of The Ball Victimisation Mathematical Calculations. This Can Be Wont To Decide Whether Or Not A Ballplayer Was Out. Thus, The System Determines The Precise Purposeat That the ball Affected The Ballplayer.
Victimisation the Mechanical Phenomenon Of The Bollocks Up To It Purpose, The System Predicts The Trail The Ball Would Have Taken Had The Ballplayer Not Been Gift With in The Manner. So One Will Understand The Lateral Position Of The Ball With Respect To The Stumps Moreover Because The Height Of The Ball At The Purpose Once It Reaches The Road Of The Stumps. The Figure Four Gives Associate Example Of The Mechanical Phenomenon Of The Ball Being Foreseen. Wagon Wheels: The Trajectories Which The Ball Has Taken After Being Hit By The Batsman Are Recorded By The Hawkeye System.

This is accustomed generate a graphic showing 1s, 2s, 3s, 4s, and 6s dead totally different colors for a ballplayer. These details allow the commentators, spectators and players to research the marking areas of the ballplayer and additionally choose if he has compete more shots along the turf or in the air. Such info is important for a fielding captain, who might alter his field placement in future matches to adapt to the hit pattern of a specific ballplayer.

3. Football
The a lot of anticipated line TECHNOLOGY is bit by bit brought into the foray within the game of soccer.

4. Badminton
After testing numerous instant-review technologies in recent months, the court game World Federation has contracted Hawk-Eye Innovations to provide instant-review services for the World Super series as well as for BWF Major Events. This includes Hawk-Eye’s popular graphics implementation which pinpoints the exact spot on which a ball – or in badminton’s case, a shuttle – lands. These are often shown in sports venues worldwide and broadcast.

V. CONCLUSION
Hawkeye technology is a great innovation, which puts technology to good use in the field of sports. The accuracy which can be achieved with the use of this system is making the authorities think seriously about reducing the human error component involved in important decisions. As the system runs in real time, there is no extra time required to see the visualizations and graphics. The system is additionally a good tool which may be utilized by players, statisticians, tacticians, coaches to analyse previous games and are available up with ways for sequent ones.

REFERENCES
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