

# Hot Spot Technology in the Sport of Kabaddi

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**Abstract:** In the sport of Kabaddi, which is a contact sport, any touch and the number of touches by a raider will reward him with points. These touches are judged by the online referee and the team is rewarded with certain points accordingly. The main problem that crops up in this sport is the slightest of touches which go undetected by human eye and can cost the game for an attacking side. In this case, the technology can replace manual umpiring decisions. Hot spot is one such technology which is an infrared imaging system used in sports like cricket, where infrared cameras are placed in opposite directions and record the images of the ongoing match continuously. These cameras sense the heat from the friction generated by a collision, such as tap on the body, ground, etc. Using a subtraction technique a series of black and white negative frames are generated into a computer, precisely locating the point of contact.

**Keywords:** Hot spot, infrared imaging system, friction, series of black and white negative frames.

## I. INTRODUCTION

Recent achievements in thermal acquisition systems have led to improvements in the capabilities of thermo-graphic methods for the non-destructive inspection of metallic and non composite panels. In most cases pulsed transient thermography involves heating the surface of a target structure for a short period of time followed by the capture of the thermal decay using an infrared camera. Present day systems enable the recording, storage and processing of hundreds of digitized images at a very fast rate. The thermal images are typically analysed for the presence of hot spots which may indicate the existence of noise or defects. Noise of sub-surface is produced due to increase in the local temperature caused by friction or touch or collision. A thermal infrared camera detects infrared energy and converts it into an electronic signal, which is then processed to produce a thermal image and perform temperature calculations. Thermal imaging cameras have lenses, just like visible light cameras. But in this case, the lens focuses on waves from infrared energy onto an infrared sensor array. Thousands of sensors on the array convert the infrared energy into electrical signals, which are then converted into an image.

Hot Spot uses technology developed in the military for tank and jet fighter tracking. [2] The technology was founded by French scientist Nicholas Bion, before being worked upon by many companies in Paris and being bought and adopted by the Australian Nine Network. [3] The technology was adapted for television by BBG Sports, the Australian company responsible for the Snickometer, in conjunction with Sky Sports. [2]

The technology was first used during the first Test match of the 2006-07 Ashes at The Gabba, on 23 November

2006. [4] The ICC announced that Hot Spot images would be available for use as part of its ongoing technology trial during the second and third Tests (March 2009) in South Africa. The system was to be available to the third umpire in the event of a player referral. [2] For the 2012 season BBG Sport introduced a new generation of HOT Spot using the very high performance SLX-Hawk thermal imaging cameras [5] provided by UK based Selex ES. These cameras provided sharper images with improved sensitivity and much less motion blur than earlier HOT Spot technologies.[6] As a result, the latest HOT Spot system is able to detect much finer edge nicks than in previous seasons, essentially ending all earlier doubts about the capability of the technology. Following the success of this updated HOT Spot system, BBG Sport and SELEX Galileo (than Selex ES, in turn merged in Leonardo-Finmeccanica since 2016) signed an exclusivity agreement for the supply of SLX-Hawk cameras for HOT Spot in cricket and other sports. [7]

Similarly in the sport of Kabaddi, any touch on the opponents' body, increases the local temperature due to friction and is detected by the Hot Spot technology and an alert message is sent to the online and TV referees.

## II. METHODOLOGY

Figure 1 shows the Kabaddi court. It is rectangular in shape and is divided into 2 halves, one for hosting the two competing teams. There are referees who stand at the end lines to monitor and judge the ongoing match. The decisions taken by these referees are manual and may lead to conflicts. This is where technology can intervene and referral systems can be deployed. Figure 2 shows the

placement of IR cameras and monitoring/control room in the same court as shown in figure 1. The cameras are placed along four sides of the rectangular court facing each other in opposite directions. They record the proceedings of the game in real time. Figure 3 shows the block diagram of Image acquisition, processing and output unit of the Hot Spot system.

The recordings from the IR cameras are fed to the Image acquisition unit. These thermal imaging cameras or infrared cameras have lenses, just like visible light cameras. But in this case, the lens focuses on waves from infrared band onto an infrared sensor array. Thousands of sensors on the array convert the infrared energy [1] into electrical signals, which are then converted into an image. The image processing unit, processes the acquired image through written instructions/ algorithms and the final image is displayed using output units such as monitors or printed onto paper for proof. The images are also recorded in the permanent memory or databases for re-examination in case of foul play.

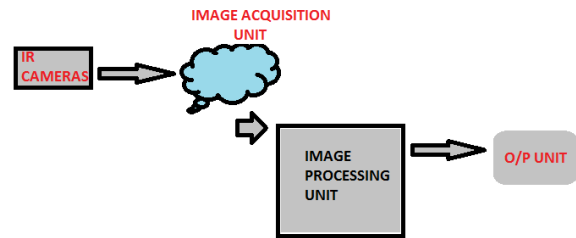


Figure 3 Block diagram of Image acquisition, processing and output unit of the Hot Spot system

### III. RESULTS AND FINDINGS

Figure 4 shows players competing in a Kabaddi match, and a raider is about to touch the defender and is captured in the IR camera.



Figure 4 Players competing in a Kabaddi match, and a raider is about to touch the defender and is captured in the IR camera

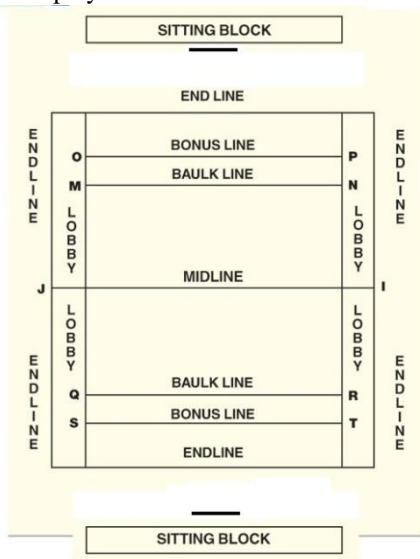


Figure 1 Kabaddi Court



Figure 5 Defender being touched by the raider and a Hot Spot developed on his body due to the touch

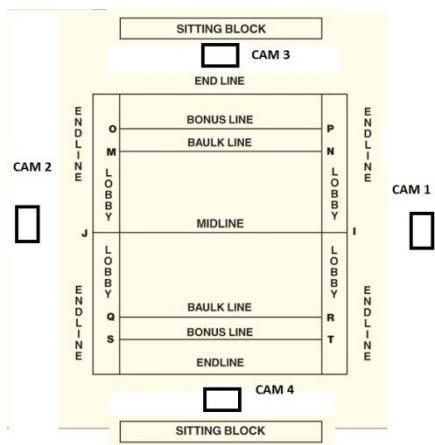


Figure 2 Placement of IR cameras and monitoring/control room in the same court as shown in figure 1



Figure 6 Defender being touched by the raider and a Hot Spot developed on his body due to the touch

Figure 5 and figure 6 show the defender being touched by the raider and a Hot Spot developed on his body due to the touch.

#### IV. DISCUSSIONS

Hot Spot technology is very accurate and is the ultimate solution to review the touches by a raider in the sport of Kabaddi. Hot Spot technology, even though claimed to be extremely accurate, is not used till date in the sport of Kabaddi. The main reason for this is its expense, \$6000 for the usage of two cameras per day and \$10000 for the usage of four cameras per day. But with the sport gaining popularity and with sponsorships for the game has made it possible for the game has made it possible for the board to make a potential deployment of this technology.

#### V. CONCLUSION

Accuracy in judging is very important and crucial in any sport or game. Any minor judging or umpiring errors can cost the game for a team. Kabaddi is one such sport where each point is very important and can change the game. In Kabaddi, where a touch point is involved, IR cameras can be deployed and Hot Spot technology can be utilized, so that slightest of the touches do not go undetected..

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#### BIOGRAPHIES



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