HAWKEYE AND AUTOMATIC SCORING IN TENNIS

TEAM MEMBERS:

M Aadhavan Nambhi, V Hari Prasad, S Jeyasoorya, S B Shriram.

ABSTRACT :

The project is about implementing Hawkeye technology in tennis. Its actual use in tennis tournaments is checking whether the call by the umpire (challenged by one of the players) is correct or not. But we are thinking of implementing it for every point played. By doing so we can eliminate the need for a human umpire. The software and hardware together will play the role of an umpire.

Firstly we will be trying to implement it with two camcorders in a small area of coverage and generate the 3d model for that area and 3d trajectory of a ball moving in that area. Then we will be proceeding to implement it in a larger area(probably our tennis courts) with an increased number of camcorders. We are planning to use a maximum of six camcorders.

MOTIVATION:

The tennis matches in the institute(ITO,GCs…) are 3 setters from the quarters. It is another student who is umpiring the match. He/she might have some important work which may require his/her presence during the time at which the match was scheduled. So we just thought if we somehow create a system that plays the role of an umpire, then what is required during the match is just a laptop and the hardware components of the system.

MAJOR COMPONENTS:

6 camcorders(60 to 100 fps), cables connecting them to the laptop.

COST:

As of now we are unable to predict the cost for our idea. But we think we can manage it.

PLAN OF ACTION:

We are expecting to complete the project in four to five weeks' time.

- ➢ First week – Studying and preparing everything required for the implementation. The learning part includes image processing(finding the ball in each frame produced by each camcorder), generating the 3d position of the ball from the multiple 2d images obtained, predicting the 3d trajectory of a moving object(in our case it's the ball) given its positions at different instants and about the related software and also about camcorders positions and their calibrations for obtaining better accuracies.
- ➢ Second week – Implement the idea with two camcorders(as mentioned in the abstract).
- ➢ Third, fourth and fifth week – implement the idea in a larger area(as mentioned in the abstract).

FUTURE IMPROVEMENTS POSSIBLE:

This system can be used to achieve virtual reality. It can be used to create a simulator for tennis and also for other sports like cricket, football, billiards..

REFERENCES:

http://www.thenakedscientists.com/HTML/interviews/interview/1000345/,
https://www.academia.edu/5606615/Seminar_Report_On_Hawk-Eye_,

https://en.wikipedia.org/wiki/Hawk-Eye, https://www.youtube.com/watch?v=XhQyVnwBXBs, .
And some other websites.

Getting 3-d position of a point from 2 images:

We tried getting 3-d image of a point from two 2-d images captured from phone camera placed at some distance apart(camera lens' principal axis were parallel and camera was moved in a plane perpendicular to that axis to get two images)(Most simple position of two cameras to get 3-d position of a point). We found its position by using the position of a reference point, its images' coordinates in two captured pictures and the required points' coordinates in two captured pictures.

The result we got was,

Reference point's coordinate: (10.2,32,-3.5) in cm

Camera coordinates:(0,0,0), (14,0,0) in cm

Coordinates of reference point in image: (203,-121.5) and (-86,-128.5) in pixels

Coordinates of required point in image: (136,-114.5) and (-133,-123.5) in pixels

Calculated coordinates of required point: (7.34,34.37,-3.54) in cm

Actual coordinates of required point: (7.4,35,-3.5) in cm

And also, we were able to calculate the distance between the camera using data of

reference point as 14.5 cm.

They almost match and we think that we will be able to apply the same method (with

modifications to take into account the angle between the cameras) to locate the 3-d position

of any point in space using 2 cameras.