Beach-Racket: A new sport born in Greece!

Short history

In **July 2006,** ten clubs with lots of love for the sea and passion for Beach-Racket, set up the H.A.B.R (Hellenic Association of Beach Racket), which acting as a federation has a single purpose: the recognition of Beach-Racket as an official sport.

H.A.B.R. after **4 years** of hard work **(2006-2010)** creates an objective score-counting system of the beach-racket game, minimizing the involvement of human factor on the score-counting method.

The big "weapon" on this effort is technology. **MOBICS**, after 2 years of research creates for H.A.B.R. the ultimate system for reliable measurements and results.

The system used on Beach-Racket games for measuring the speed of the ball and consequently the score, meets requirements such as accuracy, portability and fault tolerance.

In **March 2011,** the representatives of clubs, members of **H.A.B.R.** compile the first General Regulation of organizing and conducting competitions consisted of 41 articles, through collective and democratic processes. In **July 2011 the 1st Greek Championship of Beach-Racket** takes place. Since then 3 more Beach-Racket Championships have been organized with participants from many regions all over Greece. In late 2014, the Hellenic Tennis Federation recognized the efforts of the Beach-Racket community and accepted it as a sport that could eventually be recognized as an official Greek sport.

The Rules

Beach-Racket is played in a sand court with dimensions 11m length and 6m width. The court is divided in half by a 1.80 m wide strip.

The game is played by two or four players. Both in the duet and the quartet the players are not playing one against the other but as a team. Hence, the competition is between the teams. The game usually takes 10 minutes for duets and 20 minutes for quartets. The score

of a team is calculated as the sum of points, both positive and negative. Positive points are earned based on the speed of possible hits, which is recorded by electronic means, and is more than a base rate defined in advance (eg 60 km / h). Negative points are recorded manually after a dropped ball.

Therefore, the longer the ball stays on the air with strong hits and good defense, the most points are scored by the team. The games are supervised by referees who enforce the rules of the game in order for injustices to be avoided.

The basic equipment to play beach-racket is the rackets and balls (tennis type). The sport is also supported by technological equipment (*mobiXeyes*) for reliable score calculations.

System description

At the core of the sport, there is the *mobiXeyes* system, developed by Mobics. The system consists of two parts. One concerns the speed measurement system and the other concerns the score-counting and the mapping of statistics. The speed measuring system can operate autonomously (used for testing or configuration purposes) while the recording system can be used standalone for printouts, searches in scores, statistics etc.

The speed measuring system is based on state-of-the-art machine vision algorithms. Capturing information in the visible spectrum with 2 optical CCD sensors (cameras), we ensure that what is actually calculated, is exactly what the public sees.

The basic operating principle is to obtain consecutive frames between the cameras and a dark background positioned opposite to them. The video reception is perpendicular to the movement of the players. Then with stereoscopic computer vision algorithms the position of the ball is determined in 3D space (X, Y, Z coordinates) with great accuracy. By knowing two successive positions (x1, y1, z1 and x2, y2, z2), the distance the ball has gone through on a certain period of time is determined and the speed is calculated. The measurements are completely accurate (mean error less than 1%) and not affected by the path followed by the ball.

For the needs of the application it should be ensured that more than one frames are available in each roll (in order to find the difference between geometric points), which is achieved with special high frame rate cameras (operating at approximately 130 frames per second).
This means that for a ball hit of e.g. 120 km/h (which is actually quite strong), the position of the ball can be recorded more than 2 times, which is the minimum required for calculating its speed vector. The ball velocity is then used for calculating the score of the team.

Welcome to the exciting world of Beach-Racket!