



# Player Analysis Technology Approval report

## PlaySight™ SmartCourt

**Test code:** PAT-13-003

**Serial no:** n/a

**Software version(s):** 3.8.8

**Firmware version:** n/a

**Issue date:** 10 February 2014



**Objective:** To test and evaluate PlaySight SmartCourt Player Analysis Technology according to Rule 31 of the 2014 Rules of Tennis.

**Result:** Approved

### SUMMARY

Multiple cameras fixed around the court are used to capture images of play. The cameras are connected to an on-court kiosk which houses a personal computer (PC) and touchscreen display. Software on the kiosk PC reconstructs the ball and player position and trajectories in three dimensions from the camera images.

Players must log in to the PlaySight server, via the kiosk, to start data capture. Information displayed on the kiosk is dependent on the operation mode selected. A 'Tournament' mode, which can only be selected by the club/event administrator (not the players), limits the information displayed to the players' names and match time, and disables the audio.

Coaching information, such as match statistics and virtual replays, are displayed on the kiosk in other operation modes and available on internet-enabled devices after logging out from all modes. Players automatically share data with their opponent in all modes.

Restrictions on the access by a player to PlaySight SmartCourt components during periods when coaching is and is not allowed are as follows:

COMPONENT	NO COACHING	COACHING
Video cameras	Permitted	Permitted
On-court kiosk (Tournament mode)	Permitted	Permitted
Auxiliary device (e.g. smartphone)	Not permitted	Permitted

## MAIN COMPONENTS

The main components of the system are described in table 1 and depicted in figure 1.

COMPONENT	FUNCTION(S)
Video cameras	Capture images of play
On-court kiosk	User-interface to start/stop data capture, transmit, communicate, store and process data
PlaySight server	Store and process data
playsight.com website	Communicate data
Auxiliary device, e.g. smartphone (optional)	Communicate data via playsight.com

Table 1. Description of the components of the PlaySight SmartCourt system.



Figure 1. Components of the PlaySight SmartCourt system (from left to right): video camera; on-court kiosk; auxiliary device (smartphone).

## DATA CAPTURE AND PROCESSING

Four high-frame-rate (50 Hz) cameras, and one web-camera, are mounted at fixed locations around the court to capture images of play. Each camera is connected via Ethernet cable to an on-court kiosk. The kiosk has a touchscreen user-interface and a 'control' personal computer (PC), which is secured inside the kiosk.

At least one of the players (up to a maximum of four) must use the kiosk to log in to their PlaySight account (which is held on the PlaySight server) with their username and password. The player(s) can then select the main mode – singles, doubles or group – and then the operation mode for PlaySight SmartCourt:

1. Video only (i.e. no tracking information available)
2. Drill (serves or strokes)

3. Match
4. Debrief (post-match/drill analysis)

In addition, the tennis club/event administrator can activate a Tournament mode, which disables the on-court selection of other modes (see figure 2). Tournament mode is applied via the club page of the playsight.com website, which is accessed using a username and password. Only the administrator can deactivate the Tournament mode.

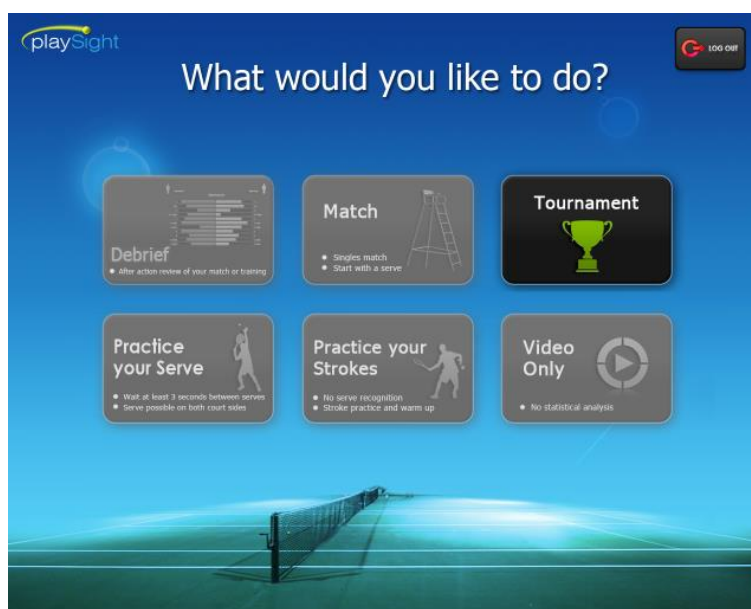


Figure 2. Kiosk display showing available modes when Tournament mode is applied, i.e. no modes other than Tournament mode are enabled.

Once the mode has been selected, the system is ready to record and process images of play captured by the cameras. The control PC in the kiosk collects and stores raw image data from the four high-frame-rate cameras mounted in each corner of the court. Proprietary software on the control PC reconstructs the trajectories (in three dimensions) of the ball and the players relative to the court, and automatically tags the activities on the court (as events). The fifth camera, mounted at one end of the court, is used to provide video replay.

During play, players can inform the system that they have switched sides using the touchscreen display 'Switch Sides' icon.

At the end of a session the player(s) can log out, or go back and start a new recorded session. Log out stops data capture and sends the session data to the players' personal account on the PlaySight server via a wireless or wired network internet connection with encryption.

## COMMENTS

Start/stopping data capture is player-driven. Starting data capture requires an internet connection for players to log in to the PlaySight server. Users are advised to start recording only when the match begins, to isolate the match statistics from the warm-up.

No assistance from human operators is required to run the system.

Transmission of data between the cameras and kiosk is wired, limiting its susceptibility to hacking. Transmission of data from the kiosk to the PlaySight server is via an encrypted wireless or wired internet connection and initiated by log out.

A Tournament mode can be applied to the kiosk by the club/event administrator, which prevents players from accessing other modes of operation. Players can only log in, log out, switch sides and start a new recording while in Tournament mode.

## DATA COMMUNICATION

The kiosk displays a real-time dashboard during play. The contents of the dashboard are dependent on the operation mode:

1. Video: player names (if logged in), time (since start of session).
2. Drill: player names, time, ball speed (maximum and average), player distance travelled, serve percentage.
3. Match: player names, time, serve speed, player distance travelled, ball 'in'/'out'.
4. Tournament: player names, time (see figure 3).

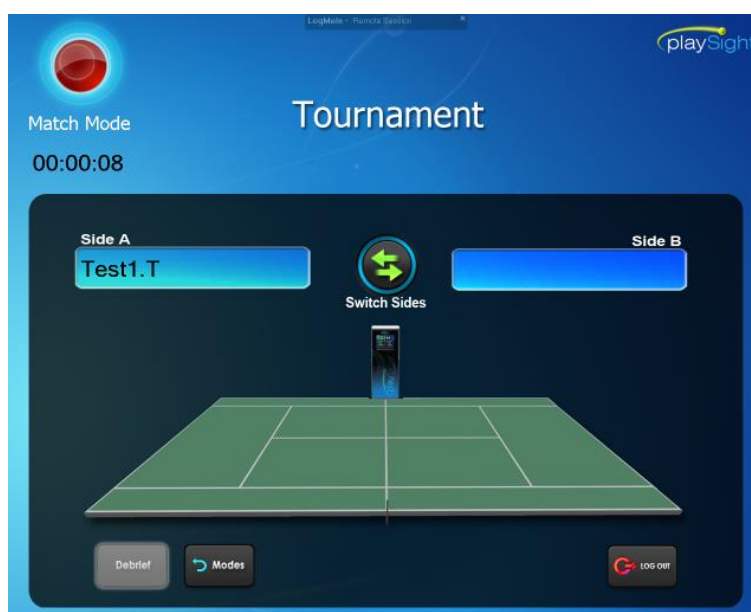


Figure 3. Kiosk display when Tournament mode is applied.

In Drill and Match modes, the user can enable/disable audio signals emitted by the kiosk indicating serve speeds and 'in'/'out' decisions. Audio signals are automatically disabled in Tournament mode.

In Debriefing mode, further information is available for sessions played in Drill/Match modes:

1. Automatic match statistics, including: points won; ball speed; distance covered by the players; location, time and type of each shot; estimation of calories consumed; classification of winners, unforced errors, forehands, backhands and net approaches.
2. Synchronised video footage from multiple viewpoints (also available for debriefing in video mode).
3. Virtual replay of the ball and players on the court in three dimensions from multiple viewpoints.

4. Event-based analysis (filtering of statistics/video/virtual replays by events in the session automatically classified by the system, e.g. aces served out wide by player 'A').

Players can access data generated during their playing sessions: video, match statistics, events and session history, via playsight.com using their log in credentials. The data for playsight.com is provided by the PlaySight server.

Players automatically share data with their opponent (if the opponent is also logged in). Players can choose to share their data with other PlaySight account holders, e.g. their coach, via playsight.com.

## COMMENTS

Coaching information is displayed on the kiosk touchscreen in Drill/Match modes. Therefore, Tournament mode must be applied by the event administrator when coaching is prohibited.

Players can log out at any time, hence data can be sent to the PlaySight server (and be available on playsight.com) prior to the end of the match. Therefore, players must not have access to internet-enabled devices, e.g. smartphone, laptop, when coaching is prohibited.

Players automatically share data with their opponent (if logged in). Consequently, a player can have access to data on their opponent at times when play is suspended, e.g. during a rain delay.

## ADDITIONAL INFORMATION

**Client:**

PlaySight Interactive Ltd  
9 Hatochna st.  
POB 2273  
Kfar Saba 44641  
Israel

**Date tested:** 12 December 2013

**Report prepared by:** Jamie Capel-Davies

**Report authorised by:** Stuart Miller

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