# Player Analysis Technology Approval report

## eyes$^3$ for Tennis PRO


**Test code:** PAT-19-021

**Serial no:** n/a

**Software versions:**
eyes3 for Tennis PRO v3.0 for iOS

**Firmware version:** n/a

**Issue date:** 6 November 2019

**Objective:** To test and evaluate eyes$^3$ for Tennis PRO Player Analysis Technology according to Rule 31 of the 2019 Rules of Tennis.

**Result:** Approved

## SUMMARY


The eyes$^3$ for Tennis PRO system (the "eyes$^3$ system") consists of one, or more, smartphones (Apple iPhone 7 or newer running Apple iOS 12 or newer) used as data capture devices, one control device (an Apple iPad or iPhone running Apple iOS 12 or newer) as a user interface, cloud-based servers and the eyes$^3$ app (installed on all devices).

The eyes$^3$ app uses the back-facing cameras of the data capture devices to identify the court markings and the ball. From these are calculated the court boundaries, ball trajectories and the location of ball impacts in relation to the court markings. The eyes$^3$ app on the control device manages the data capture devices via a cellular or Wi-Fi network. The eyes$^3$ app permits a user to input match details and displays match scores, ball flight trajectories, ball impact locations, the results of line-call reviews and video replays. Coaching information available on the control device includes ball velocities, ball spin rates and impact locations.

Restrictions on the access by a player to the eyes$^3$ system during periods when coaching is not and is allowed are as follows:

| COMPONENT | NO COACHING | COACHING |
|---|---|---|
| Data capture devices (iPhones) | Not permitted | Permitted |
| Control device (iPhone or iPad) | Not permitted | Permitted |

NOTE Approval does not attempt to, nor does it in fact, establish the accuracy or reliability of data or fidelity of its transmission, including (but not limited to) the provision of 'in'/ 'out' decisions for the purposes of line-calling.

## MAIN COMPONENTS

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

| COMPONENT | FUNCTION(S) |
|---|---|
| Data capture device (e.g. iPhone) | Identify court markings and ball positions; analyse and transmit data |
| Control device (e.g. iPhone or iPad) | Receive, transmit and communicate (display) data |
| Cloud-based servers | Receive, store, analyse and transmit data |

Table 1. Description of the components of the eyes[3] system.

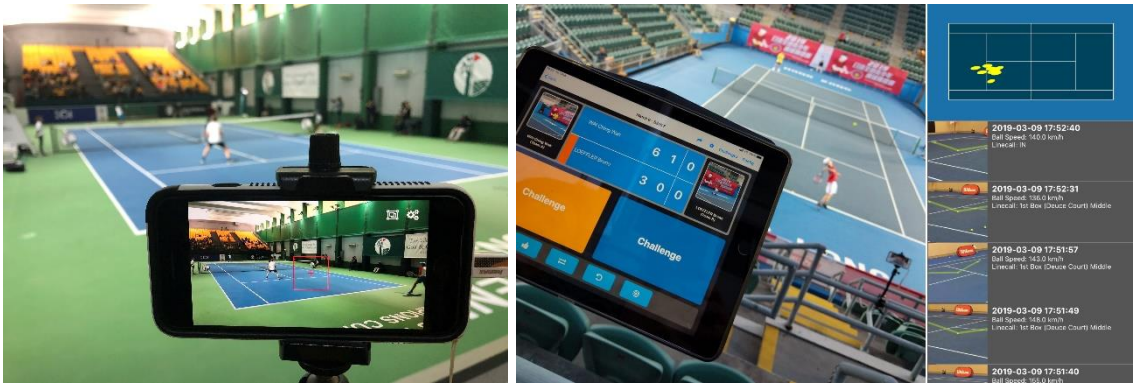


Figure 1. Components of the eyes[3] system: data capture device (left) and control device (right).

## DATA CAPTURE AND TRANSMISSION

Data capture devices are positioned around the court boundaries to provide coverage of the total playing area. Figure 2 shows the recommended positions for the data capture devices when eight devices are used.

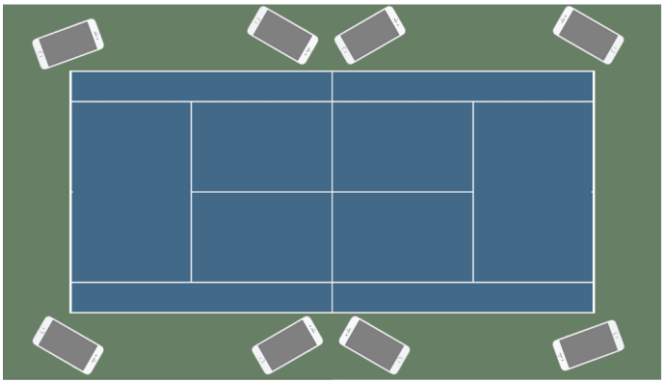

Figure 2. Recommended position of eight data capture devices.

Data capture is initiated by launching the eyes[3] app, installed on each data capture device. A user must log into the app using registered credentials and assign each data capture device to a new session (match). Once assigned, an automated court calibration is undertaken on each device.

A control device is added to the session, with functionality to control all data capture devices remotely. One data capture device can be nominated as the control device, or an additional auxiliary device (e.g. an iPad) can be used. The control device monitors the status of each device

in the session and can be used to assign additional users to the session, input match details (e.g. the score), and review challenged line-calls.

Once the session has been initiated and the calibration completed, the system will automatically capture ball data when play commences.

Data is transmitted between the devices using either a cellular or Wi-Fi network via the eyes$^3$ app. Only devices assigned to the session under the same user account can communicate with each other. Data is transmitted between the control device (via the eyes$^3$ app) and cloud-based servers using an internet connection. Data transmission uses the Hypertext Transfer Protocol Secure (HTTPS).

COMMENTS

Start/stopping data capture is player-driven. Transmission of data between the data capture devices and the control device are over either a cellular or Wi-Fi network using secure protocols. These limit the system's susceptibility to hacking.

Data are assigned to a registered user account via the eyes$^3$ app installed on data capture and control devices. The user account also permits access to the data via the eyes$^3$ cloud-based server, protecting against unauthorised access.

## DATA PROCESSING AND COMMUNICATION

The control device displays the current session and match information (players and scores). When a line-call review is selected, the control device displays a schematic of the court overlaid with the bounce locations from the last rally. Upon selecting a bounce location, the control device instructs each data capture device to process the relevant videos and calculate ball trajectory data. The ball trajectory data are transmitted to the cloud-based servers, which consolidate the results and calculate the outcome of the line-call review, ball velocity and spin rates. The data and video replay can be viewed on the control device.

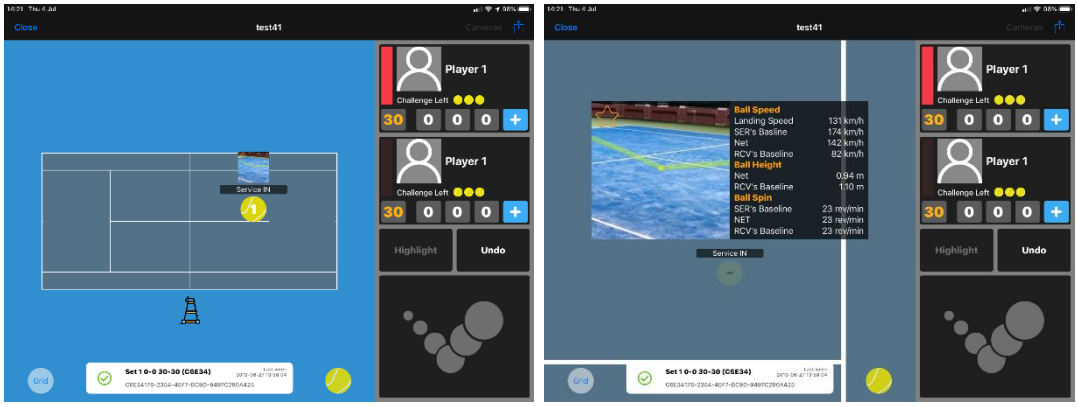


Figure 3. Bounce locations (left) and line-call challenge data (right) shown by the control device.

User profiles, match data, match videos, line-call challenge results and ball trajectory data are stored on the cloud-based servers. Match videos are also stored locally on each data capture device.

COMMENTS

When used solely for the purposes of data capture, the data capture devices do not have the means to communicate data collected. A data control device, which can be a nominated data capture device or an auxiliary device, is required for data transfer, processing and communication.

Coaching information is available on the control device. Therefore, players must not have access to the control device when coaching is prohibited.

## ADDITIONAL INFORMATION

**Client:**
Infinity Cube Limited
Tuspark
118 Wai Yip Street
Ngau Tau Kok
Kowloon
Hong Kong

**Date received:** 19 March 2019

**Report prepared by:** James Spurr
**Report authorised by:** Jamie Capel-Davies
**Revision number**: 0

**Please note:**
Approval does not attempt to, nor does it in fact, establish the accuracy or reliability of data or fidelity of its transmission, including (but not limited to) the provision of 'in'/ 'out' decisions for the purposes of line-calling.