



Player Analysis Technology Approval report

Rigour ACEye

Test code: PAT-24-032

Serial no: n/a

Software versions:

User interface: v3.0 (30/06/23)

Firmware: v3.0 (30/06/23)

Issue date: 29 March 2024

Objective: To test and evaluate Rigour ACEye Player Analysis Technology according to Rule 31 of the 2024 Rules of Tennis.

Result: Approved



SUMMARY

The Rigour ACEye system (the “System”) is a camera-based system with the capability to provide match footage alongside ball and player tracking data. The System can be used to provide line calls, match stats and training games. A kiosk located to the side of the court contains the power and processing unit for the cameras as well as speakers to communicate real-time line calls. Players can interact with the system via a touch screen interface located at the top of the kiosk.

Players must log in with a WeChat account to use the System before selecting one of the game modes. Coaching information, such as match statistics, ball speeds and bounce locations are available to view on the kiosk at any time when using a non-match play game mode. Players can access all match statistics and camera replays post-match via their online profile.

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

COMPONENT	NO COACHING	COACHING
Cameras	Permitted	Permitted
Kiosk	Match mode only	Permitted
Speakers	Permitted	Permitted
Auxiliary device (e.g. phone, tablet)	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)
Cameras	Capture images of play
Kiosk	Selection of game modes and system interaction
Speakers	Communicate 'out' calls
Video and analysis servers	Process, store, and transmit data
Auxiliary device (e.g. phone, tablet)	Display data

Table 1. Description of the components of the ACEye system.



Figure 1. Components of the ACEye system (from left to right): High speed tracking camera; kiosk unit; video capture camera. Not to scale.

DATA CAPTURE AND PROCESSING

The System consists of four high-speed cameras (100 fps) mounted around the perimeter of the court on the existing infrastructure or purpose-built mounts. Two further cameras are mounted behind the centre of each baseline to capture video footage. The cameras are connected via cables to a kiosk unit located courtside. The kiosk is the control centre of the System with inbuilt server for saving and processing the camera images as well as providing the interface (via touchscreen) and feedback (via speakers) for the players.

The kiosk server uses the location of the ball, players and court lines to calculate ball and player trajectory data. The data calculated includes:

- Ball speed
- Ball spin
- Forehand or backhand
- Serve speed
- 'in' or 'out' call
- Over the net height
- Shot coordinates
- 3D trajectory of the ball
- Player court coverage
- Video playback

Players must log into their account to use the System. A series of game modes are then available for the players to select.

There are three operating modes available to players using the System:

1. Competition mode - during the match, they can raise disputes and have the device complete challenge experiences. After the match, players can view the technical statistical results of the game.
2. Training - custom tennis training subjects, such as serving, receiving serves, high-pressure net play, baseline depth, etc. After the training, the system can obtain data on the number of hits, success rate, and distribution of landing points.
3. Evaluation – assessment mode in a drill-based format to provide a proficiency score.

For times when no coaching is allowed, the system can be switched to match mode which restricts the system to only show information that is permitted (Figure 2). The system can only be switched back to practice mode with use of a password.

If a player chooses to end the session, data capture is stopped. Data can then be viewed on the kiosk or via their ACEye account on an auxiliary device.

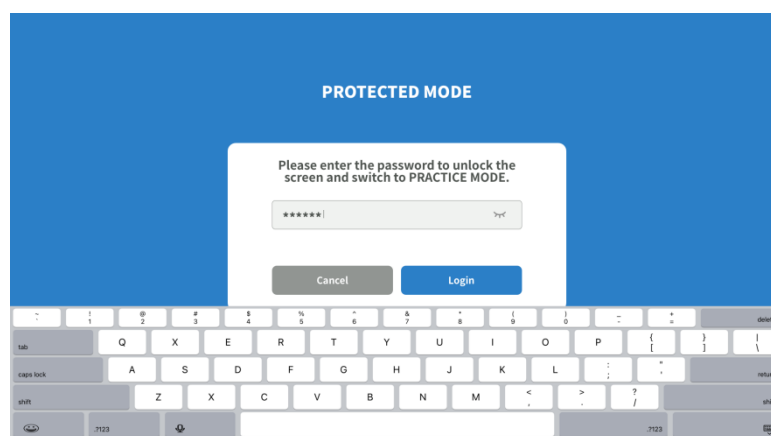


Figure 2. Password protection pop-up box to switch between practice and competition modes.

COMMENTS

Start/stopping data capture is player driven. No external internet connection is required to operate the ACEye system as the processing of data is done on-site. No assistance from human operators is required to run the system.

If the System is not connected to a network, session data will not be transmitted to the cloud and will not be accessible remotely post-session.

Player accounts can be viewed by a third party, such as a coach, who the player has given designated access.

DATA COMMUNICATION

Real time statistics are available to view on the ACEye kiosk or on an auxiliary device (e.g. tablet). Information includes:

1. Match data
 - a. Serve data - success rate, double fault, serve box landing zone, average speed, average spin speed, average serve over the net height, bounce point diagram.
 - b. Receiving data - Success rate of receiving service, number of hit nets, out of bounds, maximum receiving speed, average receiving speed.
 - c. Hitting data - Success rate, number of hit nets, out of bounds, maximum hitting speed, average hitting speed, height of ball over the net broken down by forehand/backhand, bounce point diagram.
2. Training data - Landing area scores, faults: the number of balls out of bounds and hit net, court zone impact areas.
3. CTN Assessment - Statistics of hitting depth, volleying depth, hitting accuracy, serve score, return run score, stability and other data per the CTN criteria.

The device will call shots 'in'/'out'. This information is communicated to players via the speakers in the ACEye kiosk. There is an option on the kiosk to challenge any of the shots recorded, which shows a close-up 3D visualisation of the ball hitting the court.

Players automatically share data with their opponent (if the opponent is also logged in).

COMMENTS

No coaching information is presented on the kiosk when in match mode. Coaching information is displayed on the kiosk in other modes.

Coaching information is available through the WeChat mini-app: 智能网球 (Intelligent Tennis). Therefore, players must not have access to devices that may have the app installed, such as smartphones or tablets, 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:

Beijing Rigour Technology Co. Ltd
No. 11 Guangming Rd.
Tianyu Building Rm 506
Dongcheng Dist.
Beijing
China

Date received: 7th August 2023

Report prepared by: David Cole

Report authorised by: Jamie Capel-Davies

Revision number: 0

Please note:

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