Player Analysis Technology Approval report

Zenniz

Test code: PAT-16-015

Serial no: n/a

Software versions:
1.1 (Linux)

Firmware version: n/a

Issue date: 6 January 2017

Objective: To test and evaluate Zenniz Player Analysis Technology according to Rule 31 of the 2016 Rules of Tennis.

Result: Approved

SUMMARY

Multiple microphones fixed around the court are used to capture audible events in play. The microphones are connected by cables to a central unit which houses a touchscreen user display and loudspeaker. Audio signals generated by ball impacts on the court and racket are detected by the microphones and used to reconstruct ball trajectories in three dimensions.

Players must log in to the Zenniz server, via the touchscreen display, to start data capture. Information shown on the display is dependent on the mode selected. An 'ITF match' mode, which can only be selected and deselected by the club/event administrator (not the players), limits the information provided to: the players' names, scoreboard, serve speed and (optionally) line-call 'in'/'out' decisions.

Coaching information, such as match statistics and virtual replays of rallies, are displayed on the touchscreen display in other operation modes and available on internet-enabled devices. Players automatically share data with their opponent.

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

COMPONENT	NO COACHING	COACHING
Microphones	Permitted	Permitted
Touchscreen display (ITF match 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)
Microphones	Capture audible events in play.
Touchscreen display (central unit)	Start/stop data capture, transmit, communicate, store and process data.
Zenniz server	Store and transmit data.
zenniz.com website	Communicate data.
Auxiliary device, e.g. smartphone (optional)	Communicate data.

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

Figure 1. Components of the Zenniz system (from left to right): microphone; touchscreen display; auxiliary device (smartphone). Not to scale.

DATA CAPTURE AND PROCESSING

Multiple (typically 30) microphones are mounted at fixed locations around the court (see figure 2). Each microphone case is 8 × 5 × 1.7 cm in size. The microphones are connected by a cable (on each side of the court) to a central unit. The central unit processes data from the microphones and houses a 15-inch touchscreen user display and loudspeaker (see figure 1). Audio signals generated by ball impacts on the court surface and racket are detected by the microphones and used to reconstruct ball trajectories in three dimensions.

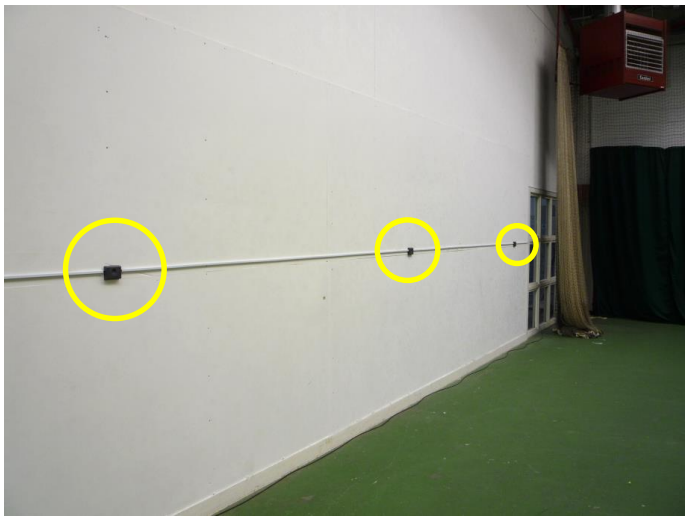

Figure 2. Three Zenniz microphones (circled) mounted on the wall at the side of the court.

At least one of the players must use the touchscreen display to log in to their Zenniz account (which is held on the Zenniz server) with their username and password.

The following modes are displayed on the main menu of the touchscreen display (see figure 3):

1. Match – play a practice match with all session data available on screen.
2. ITF match – play an official match with data visibility limited in accordance with coaching restrictions.
3. Rallies – hit rallies or serves without specific constraints or targets.
4. Strokes – practice strokes with defined target areas.
5. Serves – practice serves with defined target areas and optional announcement of serve speeds.

The tennis club/event administrator can activate the ITF match mode. ITF match mode is applied via an administrator account on the Zenniz server, which is accessed using a username and password. Only the administrator can deactivate the ITF match mode.

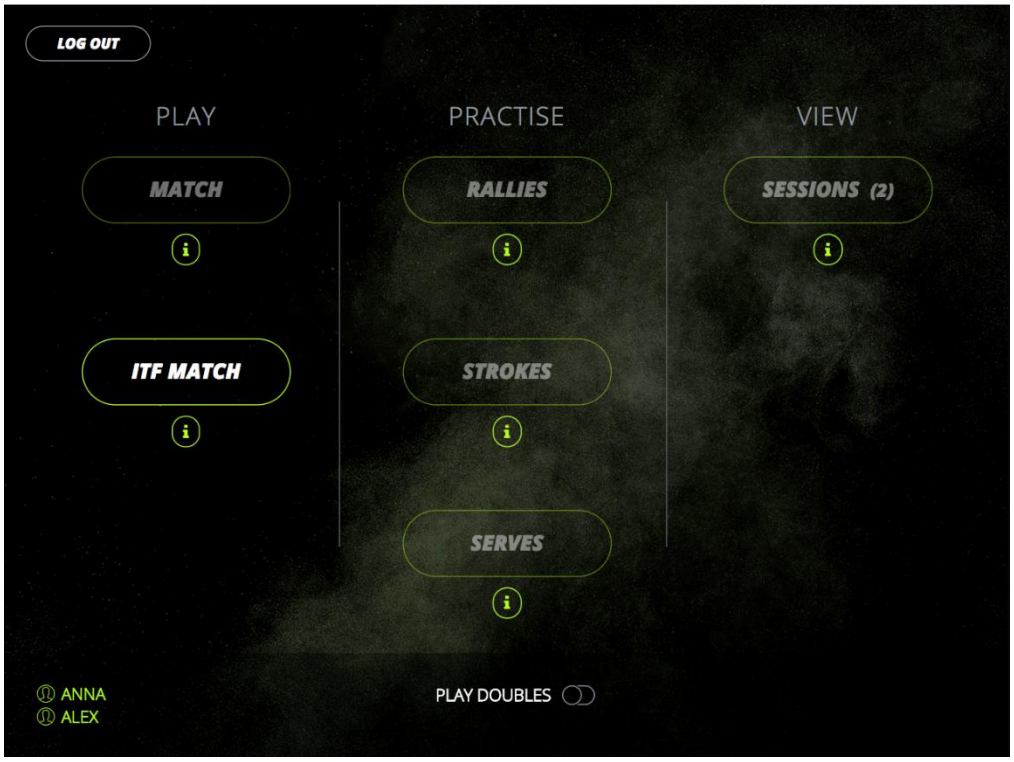

Figure 3. Touchscreen display showing main menu with ITF match mode applied.

In all operating modes, except for ITF match mode, the player(s) can select the view (to be shown on the display) from the following options:

1. Live view
2. Shot replay
3. Shot placement
4. Statistics

ITF match mode has two settings for the administrator to select (see figure 4):

1. Continuous – 'in'/'out' decisions made by the system are provided for each shot in real-time.
2. Challenge – players must select a specific shot to review the line call 'in'/'out' decision.

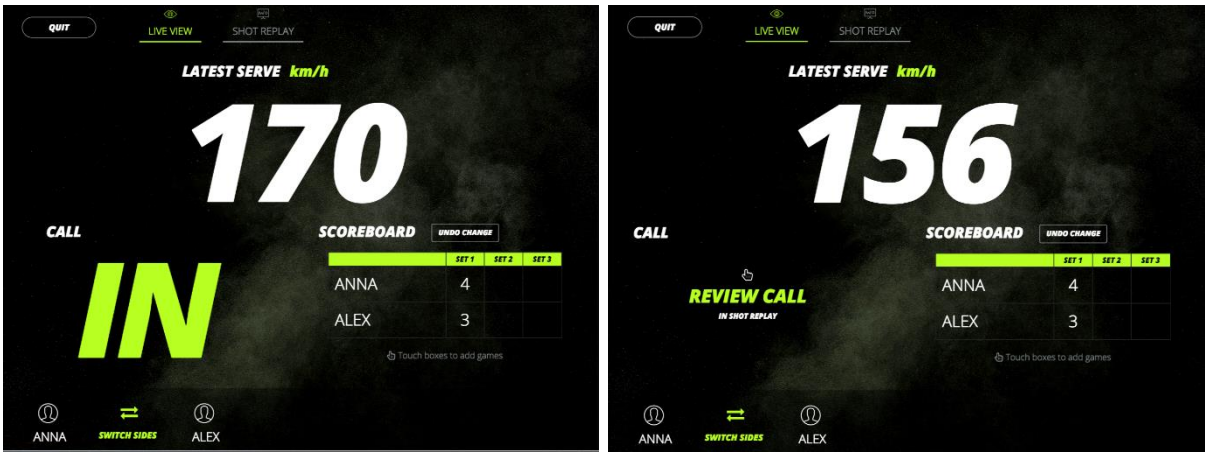

Figure 4. Touchscreen display showing continuous (left) and challenge ITF match modes.

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

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

Alternatively, the administrator can change the system settings to upload the data to the Zenniz server in real-time (i.e. data are immediately available on zenniz.com).

COMMENTS

Start/stopping data capture is player-driven. Starting data capture requires an internet connection for players to log in to the Zenniz server. No assistance from human operators is required to run the system.

Transmission of data between the microphones and the touchscreen display (central unit) is wired, limiting its susceptibility to hacking. Transmission of data from the touchscreen display to the Zenniz server is via an encrypted wireless or wired internet connection.

An ITF match mode can be applied to the touchscreen display by the club/event administrator, which prevents players from accessing other modes of operation. Players can only log in, log out, switch sides and receive or review line-call 'in'/'out' decisions while in ITF match mode.

DATA COMMUNICATION

The touchscreen display shows a real-time dashboard during play. The contents of the dashboard are dependent on the view selected:

1. Live view – speed of latest shot (and serve), rally length and 'in'/'out' decision.
2. Shot replay – list of shots played in the rally and their trajectories.
3. Shot placement – spatial distribution of shots played in the session.
4. Statistics – serve percentages, points won, rally length, speed of shots.

The user can adjust the volume of the loudspeaker on the touchscreen display for audio feedback indicating serve speeds, target areas hit (Strokes and Serves modes only) and

'in'/'out' decisions. Audio feedback is automatically muted (i.e. disabled) for the Challenge setting in ITF match mode.

Players can also access data generated during their playing sessions via zenniz.com using their log in credentials. The data for zenniz.com is provided by the Zenniz server. Information includes: points won; ball speed; location, time and type of each shot (serve, groundstroke, volley, drop shot); classification of winners/errors.

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

COMMENTS

Coaching information is displayed on the touchscreen display in all operating modes, except ITF match mode. Therefore, ITF match mode must be applied by the event administrator when coaching is prohibited.

Coaching information can be sent to the Zenniz server (and be available on zenniz.com) prior to the end of the match. Therefore, players must not have access to internet-enabled devices, e.g. smartphone or 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:
Zenniz
Metsänneidonkuja 6
02130 Espoo
Finland

Date received: 3 November 2016

Report prepared by: Jamie Capel-Davies
Report authorised by: James Spurr
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.