

TITLE OF THE INVENTION

BADMINTON SHOT ASSESSMENT SYSTEM

TECHNICAL FIELD

The invention relates to the technical field of a sport action control, in particular to an assessment system of shot quality in badminton game.

BACKGROUND OF THE INVENTION

In recent years, badminton has become one of the most popular sports because of the advantages of comparatively fewer restrictions on site, ease of learning and lower cost of playing the game. However, there is no good method to assess badminton shot quality while playing the game, and badminton shot assessment is the most important step in having a good game or an important factor to acknowledge the performance of the players.

A current assessment method of shot quality of badminton is based on very subjective judgment of individual coaches. As such, there is almost not possible to have an objective way of assessment standard quantifiable metric to grade the development of a badminton player and/or the performance of the players.

This invention is a step in creating an objective standard to grade badminton players and systematically guide the progress of the trainee. A vision AI based assessment system will provide an objective metric based assessment of the shots quality the trainee can produce, and an objective of the assessment system can be used to improve the competitive level of badminton players.

European Patent Publication Application EP06794064A relates to sport action control and assessment device, particularly one applicable to competition games using a ball or the like that must cross or impact an enclosed space to simulate or obtain a game point, characterized in that an enclosed space is controlled by means sensing the presence of ball or the like which detect and hold in an inspectionable memory the spatial characters of the point where the ball or the like has crossed the enclosed space.

China Patent Application CN201910872553.9 discloses system and method for detecting height of hitting point of badminton serving, wherein the height detection system processes color image data in image data frame by frame, identifies the position of the badminton ball in

each frame of image, superposes all frame images to obtain the motion track of the badminton ball, judges the hitting point during serving of the badminton ball according to the motion track of the badminton ball, carries out coordinate mapping on the color image of a color image sensor and the depth image of a depth sensor, and records the depth value of the hitting point during serving of the badminton ball. The method provides objective basis for judging whether the serving is wrong or not by a judge, which greatly reduces the calculation process and simplifies the operation process, thereby improving the operation speed.

China Patent Application No. CN109684919A discloses a shuttlecock faulty serving method of discrimination based on machine vision characterized by comprising a video image frame sequence when sportsman's service is acquired, which is pre-processed by motion detection when the mesh for improving system effectiveness is reached ; a classifier training being carried out by establishing shuttlecock image data set and extracting LBP digital picture feature when determining service the position of shuttlecock. The relative angle of racket is positive and negative to determine whether service is received and distributed when calculating service using OpenCV, and establishing the relation equation between shuttlecock top graph picture point and intersection point picture point, calculate the terrain clearance of penalty mark to Judge whether waist of serving a ball.

China Patent Application CN202110065312.0A discloses badminton service violation alarm device and method. The method provides a badminton service violation alarm device which characterized in that, badminton service violation alarm device is provided with: a support plate; supporting columns are fixed at four corners of the top wall of the supporting plate, supporting boxes are fixed at the top ends of the four supporting columns, the alarm body is arranged on the outer top wall of the supporting box, a rectangular limiting hole is arranged in the middle of the top wall of the supporting box, a clamping block is fixed at the bottom end of the alarm body, the clamping block is movably sleeved in the limiting hole, limiting grooves are formed in the side walls of the two sides of the clamping block positioned in the supporting box, a movable hole is arranged in the middle of the bottom wall of the supporting box, a vertical connecting column is movably sleeved in the movable hole, the bottom end of the connecting column extends to the lower side of the supporting box and is fixedly connected with a horizontal pressing plate, the top end of the connecting column extends to the inside of the supporting box and is fixedly connected with a lifting block, and a vertical spring is connected between the inner bottom wall of the supporting box and the bottom wall of the lifting block; badminton service violation alarm system still is provided with: the shooting module is used for acquiring squint image data of a ball sender when the ball is sent by utilizing

the shooting equipment; the image data processing module is used for processing the acquired image data; and the distance calculation module is used for calculating the distance between the ball holding height of the ball sender and the ground based on the processed image data.

China Patent Application CN102890781A, entitled "Method For Identifying Wonderful Shots As To Badminton Game Video" discloses a high-level semantic analysis of a badminton game video. The analysis is carried out under the premise of finding out all whole game shots in the badminton game video. Sportsmen are detected and tracked at the stage of high-level semantic analysis; the actions, the amount of exercise and the game time of each round of the sportsmen are analyzed, and the wonderful degree, namely a weighted average value of the following four factors including the amount of exercise, ball saving times identified by the outlines of the sportsmen, smash times identified by the outlines of the sportsmen, and the smash times identified by an angle point movement track, and a few of shots with the maximal wonderful degree are selected as the highlight shots.

The vision and detection system run on modern smart devices of the present invention. As a result, coaches can make use of the assessment system without procuring specialized and expensive hardware. This significantly lowers the barrier to adoption and the portable screen eliminates the environmental challenges a vision based assessment system may have. An environment conducive for assessment can now be conveniently setup at any time.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a badminton shot assessment system which is a system to create an objective standard to grade badminton players, and systematically guide the progress of the trainee in a badminton game.

Yet another object of the present invention is to provide a badminton shot assessment system which is a vision AI based assessment system that can provide an objective metric based assessment of the shots quality by trainee.

A main object of the present is to provide a badminton shuttle shot assessment system for badminton players/trainee comprising

- (a) a vision system (10) including a plurality of smart devices (12, 14, 16) being placed strategically in a badminton court having a front court and a backcourt for capturing action of badminton shuttle shots of the players/trainee around the badminton court;
- (b) a detection system (20) having vision processing power with customized machine learning capability for tracking motion of the badminton shuttle shots and being capable of producing relevant metrics regarding the badminton shots;
- (c) a real time grading system (32) for assessing the metrics from the detection system (20) on the badminton shuttle shots by the player/trainee, assigning a score to each of grading criteria, and aggregating a final overall grade for the shuttle shots; wherein the grading criteria is configurable to suit individual player/trainee;
- (d) Online and App user interface (23) of a tablet/laptop (40) digitally linked up with the vision system (10), and the real time grading system which provides a coach to access to the scores of the grading criteria and the aggregating of the final overall grade; and
- (e) Quantitative data store (36) for storing the metrics, the grading criteria, the grades of the shots of the players/trainee as a source of analysis for common weaknesses.

Yet still another object of the present invention is to provide a badminton shot assessment system , wherein the smart devices include a front court smart device (12) for detecting a shuttle shot net crossing and landing at the front court; a feeder smart device (16) to detect serving of shuttle shot; and a backcourt smart device (14) for detecting the shuttle shot which lands on the backcourt.

A further object of the present invention is to provide a badminton shot assessment system, wherein the grading criteria include clearance of the shuttle shot when the shuttle passes over a badminton net at the badminton court; flight duration of the shuttle; trajectory of the shuttle; and landing zone of the shuttle.

Another object of the present invention is to provide a badminton shot assessment system, further comprises a portable screen (50) to block out any backlight directed to the vision system (10) and the detection system (20) and a shuttle feeder (18) located in a position within the badminton court to supply shuttle serving to the player or trainee.

Still yet another object of the present invention is to provide a badminton shot assessment system, wherein the detection system (20) is provided with machine learning capability to track

the shuttle shot in motion and produces relevant metrics regarding the shuttle shot at points of interest, and the assessment of the shuttle shot is updated into the real time grading system (32) for further processing.

A further yet another object of the present invention is to provide a badminton shot assessment system, wherein the system uses metrics from the detection system after the system has assessed the grading criteria configured by the coach for a particular type of shot, and is then assigned a score to each grading criteria and aggregate a final overall grade for the shot, and a grade is displayed in real time.

Another object of the present invention is to provide a badminton shot assessment system, wherein the online and App user interface is provided with settings to fine-tune criteria of a shot assessment of a player/trainee and the on the online and App user, a coach is able to see in real time each criteria of the player/trainee and the grade for each shuttle shot assessment, wherein the coach digitally sets an ID of the player/trainee and the type of shots being assessed for the player/trainee.

Still another object of the present invention is to provide a badminton shot assessment system, wherein the type of shots includes loop, net, drop, smash and/or the combination thereof.

Yet a further object of the present invention is to provide a badminton shot assessment system, wherein the quantitative data store is used to store quantitative data of the player/trainee for reviewing in the grading criteria and for adjustment of the grading criteria thereof, and wherein the quantitative data is a source of analysis for common weaknesses for the player/trainee.

Another object of the present invention is to prove a badminton shot assessment system, wherein the blind spots and physical limitations human assessors may have in assessing the quality of a shot are eliminated.

A further yet object of the present invention is to provide a badminton shot assessment system, wherein a vision and detection system are employed and run on modern smart devices. Therefore, the system does not need to procure specialized and expensive hardware, and accordingly, the system significantly lowers the barrier to be applied and put to use.

The details of one or more variations of the subject matter described herein are set forth in the accompanying drawings and the description below. Other features and advantages of the

subject matter described herein will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing a badminton shot assessment system setup in accordance with the present invention;

Fig. 2 is a schematic view showing a shot assessment topography in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to system to provide an objective standard to grade badminton players and systematically guide the progress of trainee of badminton. A vision AI based assessment system will provide an objective metric based assessment of badminton shots quality the trainee can produce.

The subject matter of the present invention is described with specificity herein. However, the description itself is not intended to limit the scope of this proposed invention. Rather, the inventors have contemplated that the claimed subject matter might also be embodied in other ways, to include different devices or combinations of devices similar to the ones described in this disclosure, in conjunction with other present or future technologies.

In accordance with the present invention, as shown in Figure 1, there is shown a setup of a badminton shuttle shot assessment system for badminton players/trainee. The shuttle shot assessment system comprises (a) a vision system (10) including a plurality of smart devices (12, 14, 16), a detection system (20) within the smart devices (12, 14, 16). The plurality of smart devices, namely the front court smart phone (12), the back court smart device (14), and the feeder smart device (16) are being placed strategically in a badminton court having a front court and a backcourt, at each side of the court, for capturing action of badminton shuttle shots of the players/trainee around the badminton court.

In the preferred embodiment, the detection system (20) is provided with vision processing power with customized machine learning capability for tracking motion of the badminton shuttle shots and is capable of producing relevant metrics regarding the badminton shots. The assessment system further comprises (c) a real time grading system (32) for assessing the metrics from the detection system (20) on the badminton shuttle shots by the player/trainee,

assigning a score to each of grading criteria, and aggregating a final overall grade for the shuttle shots; (d) Online and App user interface (23) of a tablet/laptop (40) digitally linked up with the vision system (10), and the real time grading system (32) which provides a coach to access to the scores of the grading criteria and the aggregating of the final overall grade ; and (e) a Quantitative data store (36) for storing the metrics, the grading criteria, the grades of the shots of the players/trainee as a source of analysis for common weaknesses. Both the real time grading system (32) and the quantitative data store (36) are two components forming an online system (30).

As shown in FIG. 1, the front court smart device (12) is placed at a distance of about 1-3 feet away from the point of intersection between the centre line of the badminton court and the Double sideline of the badminton court, and the smart device (12) video records the shuttle shots landing within the area of the front court. The back court smart device (14) is positioned at a distance of about 1-2 feet away from the single back service line of the badminton court, and video records shuttle shots landing on the backcourt of the badminton court. The feeder smart device (16) is positioned at one side of the Double sideline outside the badminton court and is approximately at the middle of the half court which can video record a servicing shuttle shot of a player/trainee.

In a preferred embodiment of the present invention, a shuttle feeder (18) or the like is provided to the badminton shuttle shot assessment system, wherein the shuttle feeder (18) functions as shuttles serving of consistent quality for a particular player/trainee who is undergone assessment to return. It is imperatively that the player/trainee to be assessed with shuttle serving of consistency. The quality of shuttle serving consistency includes shuttle speed, landing zone of the shuttle, number of serves, frequency and others attributed in supporting by the shuttle feeder (18) which can be pre-configured by coaches and be remotely programmed into the shuttle feeder (18).

Generally, the coaches remotely control the shuttle feeder (18) if the player/trainer has ad hoc assessment. In the preferred embodiment the feeder smart device (16) is served as a visual feedback control of the shuttle feeder (18). For example, if there is a malfunction in the shuttle feeder (18) the feeder smart device (16) will stop the assessment process and will only resume to the process again when a shuttle from the shuttle feeder (18) is correctly served to the player/trainee

In the present invention, the front court smart device (12) is used for detecting a shuttle shot net crossing and landing at the front court. The feeder smart device (16) is used to detect

serving of shuttle shot; and the backcourt smart device (14) is used for detecting the shuttle shot which lands on the backcourt.

Optionally, a portable screen (50) is employed and to be used in shuttle shot assessment depending on the environment of the badminton court in carrying out the short assessment, wherein a black screen creates a controlled consistent environment to the assessment system. The portable screen (50) is not needed if the backlight of the court is favourable for the vision system (10).

As shown in the figure, the vision system (10) which comprises of the plurality of smart devices (12, 14, 16) comprehensively captures what is happening all around the badminton court. The plurality of smart devices (12, 14, 16) acted as the vision system (10) and the detection system (20), wherein the detection system (20) includes a customized machine learning model, and the cameras of the smart devices (12, 14, 16) concurrently capture, at real time and minimally at a rate of 30 frames per second, critical moments of shot assessment. The vision system (10) in accordance with the present invention eliminates the blind spots, and physical limitations human assessors may have in assessing the quality of any shuttle shot.

The detection system (20) is part of the smart device which is functioned to track the shuttle in motion and produces relevant metrics regarding the shot at points of interest. The assessment of the shuttle motion will be updated into the real time grading system (32) of the online system (30) for further processing, as shown in FIG. 2.

In accordance with the present invention, the shuttle feeder (18) is located at a position where consistent shuttle can be supplied shuttle to the player or trainee under assessment.

FIG. 2 is a schematic view showing a shot assessment topography in accordance with the present invention. As shown in the figure, the vision system (10) and the detection system (20) of the plurality of smart devices (12, 14, 16) video records and detects respectively the shuttle shots and are linked to the online system (30) having the real time grading system (32) and the quantitative data store (36). A tablet/laptop (40) having an online interface (23) is also linked to the online system (30).

In the preferred embodiment of the present invention, the real time grading system (32) is used to grade a shuttle shot, and various criteria are taken into consideration in the grading process. These criteria include but not limited to:

- 1) Clearance of the shuttle shot when the shot passes over the net;
- 2) Flight duration of the shuttle shot;
- 3) Trajectory of the shuttle shot; and
- 4) Landing zone of shuttle shot.

In accordance with the present invention, after the assessor goes through the grading criteria configured by the coach for a particular type of shot, the system will use the metrics from the detection system (20), assign a score to each grading criteria and aggregate a final overall grade for the shot. The grade of the assessment will be displayed in real time on the online user interface (23), that is user's Tablet/laptop (40).

The online and app user interface (23) is part of the component of the shot assessment system. At the start of the assessment, the assessor, for instance the assessing coach, will digitally link up all the smart components as shown in FIG. 1, enters the ID of the trainee or selects from a list of the trainee/players, and selects the type of shots being assessed, for instance, loop, net, drop, smash, etc.

As the assessment progresses, on the online interface (23), the coach will see in real time how the trainee is doing for each criteria and the final grade for each shot.

App interfaces on smart devices will have settings to fine-tune the criteria of the assessment session (eg. criteria get more stringent from beginner, intermediate to advanced trainees).

The quantitative data of each player/trainee will be stored in the quantitative data store (36) of the assessment system in accordance with the present invention. Accordingly, in this way, if there is any review in the grading criteria, grades of past assessment can be adjusted accordingly.

The quantitative data collect can also serve as a source of analysis for common weaknesses. In many cases, backlight conditions of badminton courts, for instance, the backlight being too strong, may cause unfavorable challenging to visually assess badminton shots of a trainee or players. Accordingly, in another preferred embodiment, a portable screen (50) can be erected to block out the backlight which causes inaccurate badminton shots assessment by human assessors.

The portable screen (50) can be in any form which is able to cut off the backlight from directly shining onto the vision system (10) of the shuttle shot assessment system.

As illustrated in Fig 2, there is shown schematically shot assessment topography which illustrates the linkage among the components employed in the shuttle shot assessment of the present invention. The steps of assessment are as follows:

- 1) A user initiates an assessment session on the online interface. A session identity number will be created.
- 2) The user can then digitally link all smart devices in use by entering the session identity number into the App of the devices.
- 3) The devices as mentioned earlier are setup as illustrated in the FIG. 1. Onscreen markings are available to guide the setup of the devices.
- 4) If backlight condition is unfavourable to the video system, setup the portable screen to block the backlight.

The Results of the shuttle shot assessment will be presented on the web interface.

In accordance with the present invention, the shuttle shot assessment system has overcome the shortcomings of currently available shuttle shot assessment which is done manually between a coach and his trainees.

The present shuttle shot assessment system overcomes the drawbacks as follows:

- (I) subjective judgment of human coach in assessing the quality of a shot;
- (II) human errors in assessment resulting from but not limited to distraction, fatigue, obstruction, wrong viewing angle and distance etc;
- (III) the inconsistent quality of shuttle served to trainee will affect the trainee's ability to return;
- (IV) tedious entry of criteria scores and final grade for each shot; and
- (V) no cumulative data to analyze and gain insights into training outcomes.

The drawbacks are overcome by the present shuttle shot assessment system in

- a) objectively assessing each shot based on preset criteria;
- b) employing smart devices which consistently perform their respective functions;

- c) providing shuttles being served via a shuttle feeder to ensure consistent of serve quality across players;
- d) collecting raw data automatically in the online system; and
- e) performing easily analysis of the shuttle shot via the online system.

Numerous modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that, within the scope of the appended claims, the present invention may be practiced in a manner other than as specifically described herein.

CLAIMS

1. A badminton shuttle shot assessment system for badminton players/trainee comprising

(a) a vision system (10) including a plurality of smart devices (12, 14, 16) being placed strategically in a badminton court having a front court and a backcourt for capturing action of badminton shuttle shots of the players/trainee around the badminton court;

(b) a detection system (20) having vision processing power with customized machine learning capability for tracking motion of the badminton shuttle shots and being capable of producing relevant metrics regarding the badminton shots;

(c) a real time grading system (32) for assessing the metrics from the detection system (20) on the badminton shuttle shots by the player/trainee, assigning a score to each of grading criteria, and aggregating a final overall grade for the shuttle shots; wherein the grading criteria is configurable to suit individual player/trainee;

(d) Online and App user interface (23) of a tablet/laptop (40) digitally linked up with the vision system (10), and the real time grading system which provides a coach to access to the scores of the grading criteria and the aggregating of the final overall grade; and

(e) Quantitative data store (36) for storing the metrics, the grading criteria, the grades of the shots of the players/trainee as a source of analysis for common weaknesses.

2. A badminton shuttle shot assessment system for badminton players/trainee comprising

(a) a vision system (10) including a plurality of smart devices (12, 14, 16) being placed strategically in a badminton court having a front court and a backcourt for capturing action of badminton shuttle shots of the players/trainee around the badminton court;

(b) a detection system (20) having vision processing power with customized machine learning capability for tracking motion of the badminton shuttle shots and being capable of producing relevant metrics regarding the badminton shots;

(c) a real time grading system (32) for assessing the metrics from the detection system (20) on the badminton shuttle shots by the player/trainee, assigning a score to each of grading criteria, and aggregating a final overall grade for the shuttle shots; wherein the grading criteria is configurable to suit individual player/trainee;

(d) Online and App user interface (23) of a tablet/laptop (40) digitally linked up with the vision system (10), and the real time grading system which provides a coach to access to the scores of the grading criteria and the aggregating of the final overall grade;

(e) Quantitative data store (36) for storing the metrics, the grading criteria, the grades of the shots of the players/trainee as a source of analysis for common weaknesses; and

(f) a shuttle feeder (18) or the like being provided to the badminton shuttle shot assessment system, wherein the shuttle feeder (18) functions as shuttles serving of consistent quality for a particular player/trainee who is undergone assessment to return.

3. The badminton shot assessment system as set forth in Claim 1 or Claim 2, wherein the smart devices include a front court smart device (12) for detecting a shuttle shot net crossing and landing at the front court; a feeder smart device (16) to detect serving of shuttle shot; and a backcourt smart device (14) for detecting the shuttle shot which lands on the backcourt.

4. The badminton shot assessment system as set forth in Claim 1 or Claim 2, wherein the grading criteria include clearance of the shuttle shot when the shuttle passes over a badminton net at the badminton court; flight duration of the shuttle; trajectory of the shuttle; and landing zone of the shuttle.

5. The badminton shot assessment system as set forth in Claim 1 or Claim 2, wherein the real time grading system and the quantitative data store are online system.

6. The badminton shot assessment system as set forth in Claim 1 or Claim 2, further comprising a portable screen (50) to block out any backlight directed to the vision system (10) and the detection system (20), wherein a black screen creates a controlled consistent environment to the assessment system.

7. The badminton shot assessment system as set forth in Claim 1 or Claim 2, wherein the vision system (10) captures at a rate of 30 frame per second the movement of the shuttle shot at real time for assessment of the shuttle shot.

8. The badminton shot assessment system as set forth in Claim 1 or Claim 2, wherein the detection system (20) is provided with machine learning capability to track the shuttle shot in motion and produces relevant metrics regarding the shuttle shot at points of interest.

9. The badminton shot assessment system as set forth in Claim 7, wherein the assessment of the shuttle shot is updated into the real time grading system (30) for further processing.

10. The badminton shot assessment system as set forth in Claim 4, wherein the system uses metrics from the detection system after the system has assessed the grading criteria configured by the coach for a particular type of shot, and is then assigned a score to each grading criteria and aggregate a final overall grade for the shot, and a grade is displayed in real time.

11. The badminton shot assessment system as set forth in Claim 10 wherein the grade is displayed on the online user interface.

12. The badminton shot assessment system as set forth in Claim 1 or Claim 2, wherein the online and App user interface is provided with settings to fine-tune criteria of a shot assessment of a player/trainee.

13. The badminton shot assessment system as set forth in Claim 12, wherein on the online and App user, a coach is able to see in real time each criteria of the player/trainee and the grade for each shuttle shot assessment.

14. The badminton shot assessment system as set forth in Claim 13, wherein the coach digitally sets an ID of the player/trainee and the type of shots being assessed for the player/trainee.

15. The badminton shot assessment system as set forth in Claim 14, wherein the type of shots includes loop, net, drop, smash and/or the combination thereof.

16. The badminton shot assessment system as set forth in Claim 1, wherein the quantitative data store is used to store quantitative data of the player/trainee for reviewing in the grading criteria and for adjustment of the grading criteria thereof.

17. The badminton shot assessment system as set forth in Claim 16, wherein the quantitative data is a source of analysis for common weaknesses for the player/trainee.

18. The badminton shot assessment system as set forth in Claim 1, further comprising a portable screen (50) to block out any backlight which affects visual shuttle shot assessment.

19. The badminton shot assessment system as set forth in Claim 18, wherein the portable screen (50) is erected at a position on the badminton court to block out the backlight.

20. The badminton shot assessment system as set forth in Claim 1, wherein App interfaces are uploaded onto smart devices with settings to fine-tune the criteria of the assessment of shuttle shot of the player/trainee.