



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
20.04.2016 Bulletin 2016/16

(51) Int Cl.:
A63D 15/00 ^(2006.01) **A63D 15/20** ^(2006.01)
G06F 19/00 ^(2011.01)

(21) Application number: **14885419.3**

(86) International application number:
PCT/CN2014/094510

(22) Date of filing: **22.12.2014**

(87) International publication number:
WO 2015/135357 (17.09.2015 Gazette 2015/37)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **10.03.2014 CN 201410085750**

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(54) **ASSISTED-TRAINING SYSTEM AND METHOD FOR BILLIARDS**

(57) The present disclosure relates to a billiard training aiding system and method. The system comprises a camera, a client end and a server, wherein a user can select a training subject according to requirements, and then the motion trajectory of each billiard ball is compared with an evaluation standard correlated to the billiard training subject and analyzed to obtain a training result. The

system accurately determines whether a current billiard shooting of a player has been successful based on billiard shooting data, thereby aiding in performing a scientific classification of the level of a player and an accurate analysis of the billiard shooting of the player, so as to provide detailed suggestions on rectification and improve the training effects.

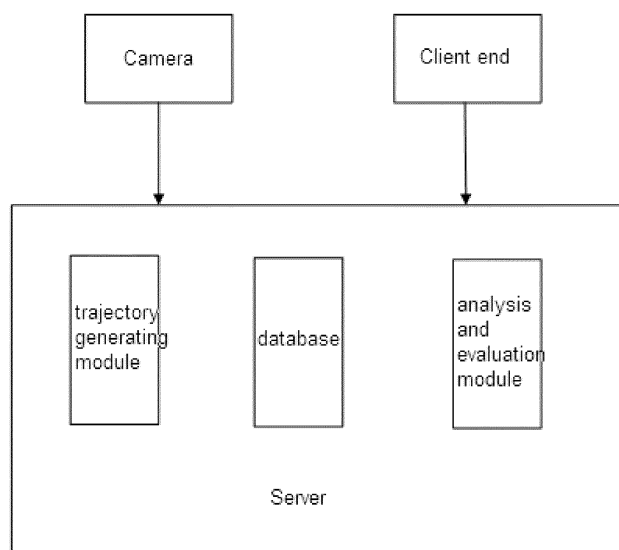


FIG. 1

Description**Technical Field**

5 **[0001]** The present invention relates to a billiard training aiding system, which pertains to the field of sport training.

Background of the Invention

10 **[0002]** Currently in daily training of billiard players, a training scheme is made by relying on experience of coaches, and the status of completion of the training plan is recorded by a traditional paper-and-pencil means. In the aforementioned traditional training pattern, guiding advice for a player is presented solely by relying on personal experience of coaches, and therefore there exist disadvantages such as that the basis for the guiding advice is insufficient, the record of the training plan is not comprehensive, the record of training and matches is not directly perceivable, and the analysis thereof is not objective. Meanwhile, if a coach is changed, due to the fact that the new coach cannot read the original training data within a short time, the time for training might be delayed. Furthermore, due to the fact that the recognition capability of human eyes is limited, manual determination cannot accurately determine the billiard shooting direction and trajectory of a player, and therefore a billiard training system is proposed in order to train a player to practice billiard shooting accurately.

20 **[0003]** Chinese patent literature CN102327697A discloses a projection-type billiard training system and its implementing method. The system includes a billiard table, an image collecting device, a billiard lamp, and a projector. A head end of the image collecting device mounted inside the billiard lamp is aligned with a lower end of the lamp, and is hung at a predetermined height above the billiard table while directly facing the center of the billiard table. The projector is hung beside the billiard lamp and is controlled by a computer. The implementing method of this system is as follows: establishing a standard database of training courses and related image files; when the system program is running, by selecting junior to senior training courses, the above-mentioned data and files are retrieved, the required demonstrating videos and images of auxiliary lines, billiard ball positions, aiming points, simulated motion trajectories of a cue ball and an object ball, etc. are displayed on the billiard table by the projector; when training according to images, videos of billiard shooting are captured by the image collecting device and transmitted to a computer for analysis, so as to present advice for the next shooting.

30 **[0004]** Although this patent achieved guidance of the billiard shooting direction and trajectory for a player by means of projection and improved billiard shooting accuracy and cue ball control ability, however, because the use of the projector has a certain light requirement, if the light is too bright, the projection effect will be very poor, but if the light is too dark, the training of the player will be adversely affected, furthermore, projection by the projector also forms certain shadows on the table which adversely affect viewing effects during a billiard shooting seen by a player, therefore, this scheme can hardly revivify a real environment of billiard matches.

Summary of the Invention

40 **[0005]** Thus, a technical problem to be solved by the present application is to provide a billiard training aiding system which overcomes the defects that the billiard training system of prior art cannot revivify a real environment of billiard training or matches and thus adversely affects the viewing effects seen by a player.

[0006] In order to solve the above-mentioned technical problem, the present invention provides a billiard training aiding system comprising:

45 a camera mounted above a billiard table and adapted for collecting and transmitting billiard images;
 a client end comprising a training mode selection unit and a screen display unit,
 the training mode selection unit being adapted for selecting a billiard training subject from a database on the server,
 and the screen display unit being adapted for displaying the selected billiard training subject and a training result;
 a server respectively connected to the camera and the client end, comprising a trajectory generating module, a database, and an analysis and evaluation module,
 wherein:

55 the trajectory generating module is adapted for receiving the billiard images transmitted by the camera, generating a motion trajectory for each billiard ball according to every frame of the billiard images, and sending the motion trajectory of each billiard ball to the analysis and evaluation module;
 the database is adapted for storing billiard training subjects and evaluation standards, each billiard training subject is correlated to one evaluation standard, and the database receives an ID of a billiard training subject

sent by the training mode selection unit and then send the corresponding billiard training subject as well as the correlated evaluation standard to the analysis and evaluation module;

the analysis and evaluation module is adapted for receiving the billiard training subject and the correlated evaluation standard sent by the database and also receiving the motion trajectory of each billiard ball sent by the trajectory generating module, analyzing by comparing the motion trajectory of each billiard ball with the evaluation standard correlated to the billiard training subject so as to obtain a training result, and then sending the training result to the screen display unit for displaying.

[0007] Preferably, in the aforementioned billiard training aiding system, the billiard training subject includes a first position for placement of a cue ball and a second position for placement of an object ball, the evaluation standard includes a motion trajectory of the cue ball, a motion trajectory of the object ball, status information of the object ball, stop positions of the billiard balls, and bouncing spots. Wherein, the status information of the object ball refers to whether the object ball is being pocketed.

[0008] Preferably, in the aforementioned billiard training aiding system, analysis and evaluation data includes billiard shooting scores, a comparing image between an actual billiard shooting trajectory and the standard trajectory, as well as a detailed analysis of a billiard shot.

[0009] Preferably, in the aforementioned billiard training aiding system, the server further comprises a reality enhancing module which provides an analysis assisting function for a user by measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming the images.

[0010] Preferably, in the aforementioned billiard training aiding system, the client end further comprises a training selection module which selects from a free training mode and a class training mode, wherein, the free training mode is adapted for freely selecting a billiard training subject from the database; the class training mode is adapted for retrieving a billiard training subject from the database according to a class schedule.

[0011] Preferably, in the aforementioned billiard training aiding system, the client end further comprises a user management module adapted for storing analysis and evaluation data, class schedule, user privilege, as well as shooting times for each billiard training subject, of each user.

[0012] Preferably, in the aforementioned billiard training aiding system, the client end further comprises a match module adapted for selecting two users from all the users, collecting match data of the two users in real time, analyzing the collected match data, and obtaining user match scores after the match is over.

[0013] Preferably, in the aforementioned billiard training aiding system, the client end further comprises a remote match module adapted for arranging a remote match between two users.

[0014] There is also provided a billiard training aiding method comprising the following steps:

selecting a billiard training subject from a database by a training mode selection unit of a client end and displaying the selected billiard training subject by a screen display unit, meanwhile sending the selected billiard training subject as well as the correlated evaluation standard to an analysis and evaluation module;

performing a billiard shooting training according to the billiard training subject; collecting billiard images by a camera and transmitting the billiard images to a server, receiving the billiard images sent by the camera and generating a motion trajectory for each billiard ball according to every frame of the billiard images by a trajectory generating module of the server, sending the motion trajectory of each billiard ball to the analysis and evaluation module, analyzing and comparing the motion trajectory of each billiard ball with the evaluation standard correlated to the billiard training subject so as to obtain a training result by the analysis and evaluation module, and sending the training result to the screen display unit for displaying.

[0015] Preferably, in the aforementioned billiard training aiding method, a reality enhancing process is further performed by the server, by means of measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming the images, so as to provide an analysis assisting function for a user.

[0016] Compared to prior art, the aforementioned technical solution of the present invention has the following advantages:

1. The billiard training aiding system of the present invention comprises a camera, a client end, and a server, wherein a user can select a training subject according to requirements, and then the motion trajectory of each billiard ball is compared with an evaluation standard correlated to the billiard training subject and analyzed to obtain a training result. This system overcomes the disadvantage that a billiard training system of prior art only provides a shooting advice while obtaining a level of a trainee. The present technical solution accurately determines whether a current billiard shooting of a player has been successful based on billiard shooting data, thereby aiding in performing a

scientific classification of the level of a player and an accurate analysis of the billiard shooting of the player, so as to provide specific pertinent guidance towards the shooting practice of the player as well as to provide detailed suggestions on rectification, thereby improving the training effects.

2. In the billiard training aiding system of the present invention, analysis and evaluation data includes billiard shooting scores, a comparing image between an actual billiard shooting trajectory and the standard trajectory, as well as a detailed analysis of a billiard shot. Therefore, a better guidance can be given after a user's training.

3. In the billiard training aiding system of the present invention, the server further comprises a reality enhancing module which provides an analysis assisting function for a user by measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming the images. By the assistance analysis, the user can be aware of his/her defects, so as to facilitate timely rectification to increase his/her playing level.

4. In the billiard training aiding system of the present invention, the client end further comprises a training selection module. By using the training selection module, a user can select from various training modes according to requirements, so that the application scope of this system is broadened to facilitate popularization.

5. In the billiard training aiding system of the present invention, the client end further comprises a user management module. The user management module manages user information so as to facilitate subsequent recording and inquiring, thereby increasing the utilization rate of information.

6. The present invention also provides a billiard training aiding method, wherein a user selects a billiard training subject from a database with a training mode selection unit of a client end, and then the user performs a billiard shooting training according to the billiard training subject, while a camera collects motion information of billiard balls during the training and the collected motion information is analyzed by an analysis and evaluation module, so as to obtain a training result. By providing specific pertinent training for the user and also providing evaluation standards for the user's reference, the training is made more pertinent, thereby facilitating improvement of the user's playing level.

Brief Description of the Drawings

[0017] In order to make the present invention easy and clear to understand, hereinafter, the present invention will be further described in detail according to specific embodiments of the present invention and with reference to the drawings, wherein:

FIG. 1 is a configuration diagram of an embodiment of a billiard training aiding system of the present invention;
FIG. 2 is a flow chart of an embodiment of a billiard training aiding method of the present invention.

Detailed Description of Embodiments

[0018] The specific embodiments of the present invention are described in detail hereinafter, in conjunction with the appended drawings. It should be understood that, the specific embodiments described hereinafter are only intended for illustrating and explaining the present invention, rather than restricting the present invention.

Embodiment 1

[0019] The present embodiment provides a billiard training aiding system, as shown in FIG. 1, comprising:

a camera mounted above a billiard table and adapted for collecting and transmitting billiard images, wherein, by collecting motion information of billiard balls on the billiard table with the camera, proper determinations can be made;
a client end comprising a training mode selection unit and a screen display unit, the training mode selection unit being adapted for selecting a billiard training subject from a database on the server, and the screen display unit being adapted for displaying a training result;
a server respectively connected to the camera and the client end, comprising a trajectory generating module, a database, and an analysis and evaluation module,

wherein:

the trajectory generating module is adapted for receiving the billiard images transmitted by the camera, generating a motion trajectory for each billiard ball according to every frame of the billiard images, and sending the motion trajectory of each billiard ball to the analysis and evaluation module;

the database is adapted for storing billiard training subjects and evaluation standards, each billiard training subject is correlated to one evaluation standard, and the database receives an ID of a billiard training subject sent by the training mode selection unit and then send the corresponding billiard training subject as well as the correlated evaluation standard to the analysis and evaluation module;

the analysis and evaluation module is adapted for receiving the billiard training subject and the correlated evaluation standard sent by the database and also receiving the motion trajectory of each billiard ball sent by the trajectory generating module, analyzing by comparing the motion trajectory of each billiard ball with the evaluation standard correlated to the billiard training subject, so as to obtain a training result, and then sending the training result to the screen display unit for displaying.

[0020] The billiard training aiding system of the present embodiment comprises a camera, a client end, and a server, wherein a user can select a training subject according to requirements, and then the motion trajectory of each billiard ball is compared with an evaluation standard correlated to the billiard training subject and analyzed to obtain a training result. This system overcomes the disadvantage that a billiard training system of prior art only provides a shooting advice while obtaining a level of a trainee. The technical solution of the present embodiment accurately determines whether a current billiard shooting of a player has been successful based on billiard shooting data, thereby aiding in performing a scientific classification of the level of a player and an accurate analysis of the billiard shooting of the player, so as to provide specific pertinent guidance towards the shooting practice of the player as well as detailed suggestions on rectification, thereby improving the training effects.

Embodiment 2

[0021] The present embodiment provides another billiard training aiding system on the basis of Embodiment 1. In the billiard training aiding system of the present embodiment, the billiard training subject includes a first position for placement of a cue ball and a second position for placement of an object ball, the evaluation standard includes a motion trajectory of the cue ball, a motion trajectory of the object ball, status information of the object ball, stop positions of the billiard balls, and bouncing spots. Wherein, the status information of the object ball refers to whether the object ball is being pocketed.

[0022] In the present embodiment, there is also configured a video showing a standard shooting done by a real person, with the stop positions of the billiard balls shown by means of shadows, so as to provide reference for the trainee.

[0023] In the present embodiment, analysis and evaluation data includes billiard shooting scores, a comparing image between an actual billiard shooting trajectory and the standard trajectory, as well as a detailed analysis of a billiard shot.

[0024] The server further comprises a reality enhancing module which provides an analysis assisting function for a user by measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming the images.

[0025] The client end further comprises a training selection module which selects from a free training mode and a class training mode, wherein,

the free training mode is adapted for freely selecting a billiard training subject form the database;

the class training mode is adapted for retrieving a billiard training subject form the database according to a class schedule.

[0026] The client end further comprises a user management module adapted for storing analysis and evaluation data, class schedule, user privilege, as well as shooting times for each billiard training subject, of each user. For instance, a higher user privilege may be able to edit the billiard training subjects, adding or deleting users, etc.

[0027] The client end further comprises a match module adapted for selecting two users from all the users, collecting match data of the two users in real time, analyzing the collected match data, and obtaining user match scores after the match is over.

[0028] The client end further comprises a remote match module adapted for arranging a remote match between two users.

[0029] In the technical solution provided by the present embodiment, analysis and evaluation data includes billiard shooting scores, a comparing image between an actual billiard shooting trajectory and the standard trajectory, as well as a detailed analysis of a billiard shot. Therefore, a better guidance can be given after a user's training. The server further comprises a reality enhancing module which provides an analysis assisting function for a user by measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming

the images. By the assistance analysis, the user can be aware of his/her defects, so as to facilitate timely rectification to increase his/her playing level. The client end further comprises a training selection module. By using the training selection module, a user can select from various training modes according to requirements, so that the application scope of this system is widened to facilitate popularization. The client end further comprises a user management module. The user management module manages user information so as to facilitate subsequent recording and inquiring, thereby increasing the utilization rate of information.

Embodiment 3

[0030] The present embodiment provides a billiard training aiding system comprising client ends, node servers, and a main server. There may be a plurality of client ends connected to a centric node server through communication network in a manner of star connection, and the node server is provided with a branch database. There may be a plurality of node servers connected to a centric main server through communication network in a manner of star connection, and the main server is provided with a main server database.

[0031] The main server database stores games to be used in the game module, test subjects to be used in various evaluation and training, as well as determination standards for determining whether a billiard shooting of a player has been successful, so that the node servers can download these test subjects and key information of a billiard shooting into the branch database of the node servers.

[0032] The key information of a billiard shooting includes: whether an object ball has been pocketed, stop positions of the billiard balls, common areas that the billiard balls must pass through, and bouncing spots (spots where a billiard ball bounce on an edge of the billiard table).

[0033] The functional modules of the billiard training aiding and billiard shooting evaluation system includes an evaluation module, a game module, a training module, a match module, a management module, a reality enhancing module, and a billiard trajectory determination module.

[0034] The operating principle and implementing method of the billiard trajectory determination module has been disclosed in prior art, such as the disclosure of the invention patent with the publication No. CN101947385B issued on September 12, 2012.

[0035] The evaluation module is used for evaluating the level of a player. During evaluation, a user first selects a serial number of a test subject, and then the evaluation module plays corresponding demonstration video and introduction information of the test subject according to the serial number selected by the user. After the cue ball is shot by the user, the system determines the trajectory of the cue ball during the current billiard shooting as well as key information of the billiard shooting by means of the billiard trajectory determination module, and compares the collected trajectory of the cue ball and key information of the billiard shooting with the trajectory and related key information preset in the test subject, so as to comprehensively determine whether the current billiard shooting of the player has been successful. And then the determination result is outputted to the reality enhancing module, meanwhile the total number of times that the user has played this type of test subject as well as the remaining number of times to play the current test subject are displayed, and the total success ratio of billiard shooting of the user in the present system is recorded and displayed.

[0036] The game module is used for increasing interestingness of billiard training. During game playing, the user first selects a game that he/she wants to play, and then the game module loads the game progress according to the game name selected by the user, and plays an animation demonstration of the game stage according to the game name and the user's game progress. The user shoots the billiard ball according to the animation demonstration. And the system determines the trajectory of the cue ball during the current billiard shooting as well as key information of the billiard shooting by means of the billiard trajectory determination module, calculates the preparation time of the user before the billiard shooting, and compares the collected trajectory of the cue ball and key information of the billiard shooting with the trajectory and related key information preset in the game, so as to comprehensively determine whether the current billiard shooting of the player has been successful, and subsequently, according to whether the billiard shooting has been successful as well as the length of the preparation time of the user before the billiard shooting, adds to or subtracts from the life value and the score of the user based on predetermined rules. When the user exits the game, the game progress is saved, the score of the user id uploaded onto the node server to be stored in a game score list of the node server, and then the node server updates the score of the user into the main server database of the main server.

[0037] The training module is used for daily training of a player, including two training modes of free training and class training. In the free training mode, a user can freely select a subject suitable for him/her to do training, and can select multiple subjects to do training. In the class training mode, a user can select from a class schedule preset in the system to do training. During free training, the user first selects a serial number of a subject that he/she wants to practice, and then the training module plays corresponding demonstration video and introduction information of the subject according to the serial number selected by the user, and after the cue ball is shot by the user, the system determines the trajectory of the cue ball during the current billiard shooting as well as key information of the billiard shooting by means of the billiard trajectory determination module, compares the collected trajectory of the cue ball and key information of the

billiard shooting with the trajectory and related key information preset in the subject, so as to comprehensively determine whether the current billiard shooting of the player has been successful, and then, the determination result is outputted to the reality enhancing module, meanwhile the total number of times that the user has practiced this type of subject as well as the remaining number of times to practice the current subject are displayed, and the total success ratio of billiard shooting of the user in the present system is recorded and displayed, and at the same time, a detailed training record of the player is generated. During class training, the training module first reads a training record of the user and retrieves a serial number of a subject according to the training record, and then the training module plays corresponding demonstration video and introduction information of the subject, and after the cue ball is shot by the user, the system determines the trajectory of the cue ball during the current billiard shooting as well as key information of the billiard shooting by means of the billiard trajectory determination module, and compares the collected trajectory of the cue ball and key information of the billiard shooting with the trajectory and related key information preset in the subject, so as to comprehensively determine whether the current billiard shooting of the player has been successful, and then, the determination result is outputted to the reality enhancing module, meanwhile the total number of times that the user has practiced this type of subject as well as the remaining number of times to practice the current subject are displayed, and the total success ratio of billiard shooting of the user in the present system is recorded and displayed, and at the same time, a detailed training record of the player is generated.

[0038] The match module is used for organizing training matches or entertainment matches. During a match, the match module randomly selects two users from those who choose to take part in the match and pairs them with each other, performs interaction between the paired two user terminals by means of a VEN system, collects data of every billiard shooting of the users in real time so as to realize a whole-process monitoring of the two-player billiard match status, and then, according to the match result, a total score of each user in the system is calculated.

[0039] The management module is used for managing user privileges, as well as managing game resources, test subject resources, class schedule data, etc. in the database. By operating on the user database, the adding, deleting, editing and managing operations of user privileges can be performed on users, and the game resources, test subject resources, class schedule data, etc. can be uploaded onto the branch servers or the main server.

[0040] The reality enhancing module is used for providing an analysis assisting function for a player. The reality enhancing module is able to achieve functions such as measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming the images. The function of measuring a distance between billiard balls is performed by means of the aforementioned billiard trajectory determination module to obtain actual coordinates of two billiard balls, and to calculate the actual distance between the two billiard balls according to the formula of

$$|AB| = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

wherein, (x_1, y_1) and (x_2, y_2) are the actual coordinates of the two billiard balls, $|AB|$ is the distance between the two billiard balls. The function of displaying a blocked area is performed by means of the aforementioned billiard trajectory determination module to obtain actual coordinates of the cue ball and the object ball, and to obtain two tangent lines that extend through the sphere center of the cue ball and being tangent to the object ball by solving the equation set of

$$\begin{cases} \frac{|x \cdot k - y + b|}{\sqrt{k^2 + 1}} = r \\ y = kx + b \end{cases}$$

wherein, (x, y) represents a physical coordinate of the cue ball and the object ball, r is the diameter of the billiard ball which is 26mm, k and b are unknown parameters. After the two tangent lines are obtained, the area of the quadrilateral formed by these tangent lines with the edges of the billiard table represents the blocked area. The operation of determining an existence of snookering is performed, with the help of the aforementioned function of displaying a blocked area, to

calculate a blocked area formed by the blocking object ball in front of the cue ball, and to determine whether the object ball that needs to be shot is completely positioned within the blocked area. If the object ball that needs to be shot is completely within the blocked area, then it is determined that a creation of snookering is successful. Otherwise, it is determined that a creation of snookering is failed. As for the function of displaying a shooting passage, if the three points of the cue ball, the object ball and the pocket entry form a straight line, then a shooting passage is formed. This reality enhancing module, by means of the aforementioned billiard trajectory determination module, obtains actual coordinates of the cue ball and the object ball, and verifies whether the actual coordinate of the pocket entry is on the straight line formed by the cue ball and the object ball by utilizing the formula of $y=kx+b$, wherein, (x, y) represents the coordinate of the pocket entry, k and b are the slope and intercept of the straight line formed by passing through the coordinates of the cue ball and the object ball.

Embodiment 4

[0041] The present embodiment provides a billiard training aiding method, the flow chart of which is as shown in FIG. 2, comprising the following steps:

- (1) selecting a billiard training subject from a database by a training mode selection unit of a client end, and meanwhile sending the selected billiard training subject as well as the correlated evaluation standard to an analysis and evaluation module;
- (2) performing a billiard shooting training according to the billiard training subject;
- (3) collecting billiard images by a camera and transmitting the billiard images to a server, receiving the billiard images sent by the camera and generating a motion trajectory for each billiard ball according to every frame of the billiard images by a trajectory generating module of the server, sending the motion trajectory of each billiard ball to the analysis and evaluation module, analyzing and comparing the motion trajectory of each billiard ball with the evaluation standard correlated to the billiard training subject so as to obtain a training result by the analysis and evaluation module, and sending the training result to a displayer for displaying.

[0042] With the billiard training aiding method of the present embodiment, a user selects a billiard training subject from a database with a training mode selection unit of a client end, and then the user performs a billiard shooting training according to the billiard training subject, and a camera is used to collect motion information of billiard balls during the training and the collected motion information is analyzed by an analysis and evaluation module, so as to obtain a training result. By providing specific pertinent training for the user and also providing evaluation standards for the user's reference, the training is made more pertinent, thereby facilitating improvement of the user's playing level.

[0043] As a further implementing way, in other preferred embodiments, the aforementioned billiard training aiding method also may further include the following aspects:

[0044] Analysis and evaluation data includes billiard shooting scores, a comparing image between an actual billiard shooting trajectory and the standard trajectory, as well as a detailed analysis of a current billiard shot.

[0045] With a reality enhancing module, an analysis assisting function is provided for a user by measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming the images.

[0046] Various training modes are selected with a training selection module. The training selection module is able to select from a free training mode and a class training mode, wherein, the free training mode is adapted for freely selecting a billiard training subject from the database, and the class training mode is adapted for retrieving a billiard training subject from the database according to a class schedule.

[0047] A user management module stores analysis and evaluation data, class schedule, user privilege, as well as shooting times for each billiard training subject, of each user

[0048] Two users are selected from all the users through a match module, and the match data of the two users are collected in real time and then analyzed, so as to obtain user match scores after the match is over.

[0049] The above-mentioned aspects further broadens the functionality of the billiard training aiding system, provides a trainee with more pertinent training, and at the same time makes the training more diversified and more interesting, so that the billiard training aiding method is able to achieve excellent training results. Apparently, the aforementioned embodiments are merely examples illustrated for clearly describing the present invention, rather than limiting the implementation ways thereof. For those skilled in the art, various changes and modifications in other different forms can be made on the basis of the aforementioned description. It is unnecessary and impossible to exhaustively list all the implementation ways herein. However, any obvious changes or modifications derived from the aforementioned description are intended to be embraced within the protection scope of the present invention.

[0050] Those skilled in the art should understand that, these embodiments of the present invention can be provided

as a method, a system, or a computer program product. Therefore, the present invention can adopt the forms of a complete hardware embodiment, a complete software embodiment, or an embodiment with both software and hardware combined. Furthermore, the present invention can adopt the form of a computer program product implemented on one or more computer readable storage media (including but not limited to magnetic disk, CD-ROM, optical storage device, etc.) containing computer usable program codes therein.

[0051] The present invention is described according to a flow chart and/or a block diagram of methods, devices (systems), and computer program products of embodiments of the present invention. It should be understood that, computer program instructions can implement each step and/or block of the flow charts and/or block diagrams, as well as combinations of steps and/or blocks of the flow charts and/or block diagrams. These computer program instructions can be encoded on a general-purpose computer, a special-purpose computer, an embedded processor, or a processor of other programmable data processing devices so as to produce a machine, thereby a device is formed which is able to realize the functionality defined in one or more steps of the flow chart and/or one or more blocks of the block diagram by means of instructions executed by a computer or a processor of other programmable data processing devices.

[0052] These computer program instructions can also be stored in a computer readable storage medium which is able to guide a computer or other programmable data processing devices to operate in a certain manner, so that a manufacture product comprising a command device is produced by means of the instructions stored in the computer readable storage medium, wherein the command device is able to realize the functionality defined in one or more steps of the flow chart and/or one or more blocks of the block diagram.

[0053] These computer program instructions can also be loaded on a computer or other programmable data processing devices, thereby a computer executable process is generated by means of a series of operating steps executed on the computer or other programmable devices, so that the instructions executed on the computer or other programmable devices provide steps used for realizing the functionality defined in one or more steps of the flow chart and/or one or more blocks of the block diagram.

[0054] Although preferred embodiments of the present invention have been described, other changes and modifications can be made to these embodiments, once those skilled in the art become aware of the basic inventive concept of the present invention. Therefore, the appended Claims should be construed to cover the preferred embodiments as well as all of the changes and modifications that come within the scope of the present invention.

Claims

1. A billiard training aiding system, **characterized in that**, comprising:

a camera mounted above a billiard table and adapted for collecting and transmitting billiard images;
 a client end comprising a training mode selection unit and a screen display unit, the training mode selection unit being adapted for selecting a billiard training subject from a database on the server, and the screen display unit being adapted for displaying the selected billiard training subject and a training result;
 a server respectively connected to the camera and the client end, comprising a trajectory generating module, a database, and an analysis and evaluation module,
 wherein,
 the trajectory generating module is adapted for receiving the billiard images transmitted by the camera, generating a motion trajectory for each billiard ball according to every frame of the billiard images, and sending the motion trajectory of each billiard ball to the analysis and evaluation module;
 the database is adapted for storing billiard training subjects and evaluation standards, each billiard training subject is correlated to one evaluation standard, and the database receives an ID of a billiard training subject sent by the training mode selection unit and then send the corresponding billiard training subject as well as the correlated evaluation standard to the analysis and evaluation module;
 the analysis and evaluation module is adapted for receiving the billiard training subject and the correlated evaluation standard sent by the database and also receiving the motion trajectory of each billiard ball sent by the trajectory generating module, analyzing by comparing the motion trajectory of each billiard ball with the evaluation standard correlated to the billiard training subject so as to obtain a training result, and then sending the training result to the screen display unit for displaying.

2. The billiard training aiding system in accordance with Claim 1, **characterized in that**, the billiard training subject includes a first position for placement of a cue ball and a second position for placement of an object ball, the evaluation standard includes a motion trajectory of the cue ball, a motion trajectory of the object ball, status information of the object ball, stop positions of the billiard balls, and bouncing spots.

3. The billiard training aiding system in accordance with Claim 1 or 2, **characterized in that**, analysis and evaluation data includes billiard shooting scores, a comparing image between an actual billiard shooting trajectory and the standard trajectory, as well as a detailed analysis of a billiard shot.

4. The billiard training aiding system in accordance with any one of Claims 1-3, **characterized in that**, the server further comprises a reality enhancing module which provides an analysis assisting function for a user by measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming the images.

5. The billiard training aiding system in accordance with any one of Claims 1-4, **characterized in that**, the client end further comprises a training selection module which selects from a free training mode and a class training mode, wherein,
the free training mode is adapted for freely selecting a billiard training subject form the database;
the class training mode is adapted for retrieving a billiard training subject form the database according to a class schedule.

6. The billiard training aiding system in accordance with any one of Claims 1-5, **characterized in that**, the client end further comprises a user management module adapted for storing analysis and evaluation data, class schedule, user privilege, as well as shooting times for each billiard training subject, of each user.

7. The billiard training aiding system in accordance with any one of Claims 1-6, **characterized in that**, the client end further comprises a match module adapted for selecting two users from all the users, collecting match data of the two users in real time, analyzing the collected match data, and obtaining user match scores after the match is over.

8. The billiard training aiding system in accordance with any one of Claims 1-6, **characterized in that**, the client end further comprises a remote match module adapted for arranging a remote match between two users.

9. A billiard training aiding method, **characterized in that**, comprising the following steps:

selecting a billiard training subject from a database by a training mode selection unit of a client end and displaying the selected billiard training subject by a screen display unit, meanwhile sending the selected billiard training subject as well as the correlated evaluation standard to an analysis and evaluation module;

performing a billiard shooting training according to the billiard training subject;

collecting billiard images by a camera and transmitting the billiard images to a server, receiving the billiard images sent by the camera and generating a motion trajectory for each billiard ball according to every frame of the billiard images by a trajectory generating module of the server, sending the motion trajectory of each billiard ball to the analysis and evaluation module, analyzing and comparing the motion trajectory of each billiard ball with the evaluation standard correlated to the billiard training subject so as to obtain a training result by the analysis and evaluation module, and sending the training result to the screen display unit for displaying.

10. The billiard training aiding method in accordance with Claim 1, **characterized in that**, a reality enhancing process is further performed by the server, by means of measuring a distance between billiard balls, displaying an area blocked by an object ball in front of a cue ball, determining an existence of snookering, displaying a shooting passage, drawing a folded line trajectory, replaying the shooting, and locally zooming the images, so as to provide an analysis assisting function for a user.

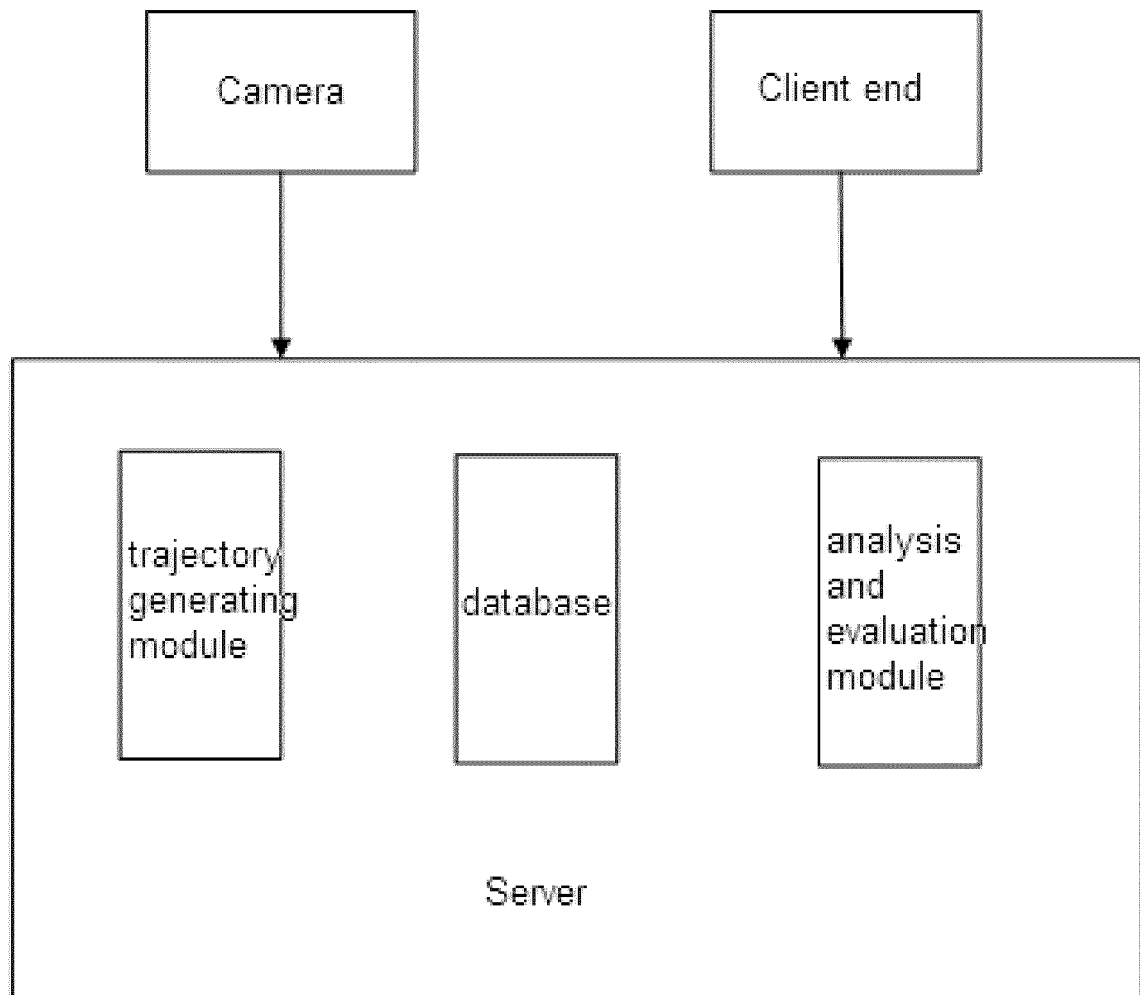


FIG. 1

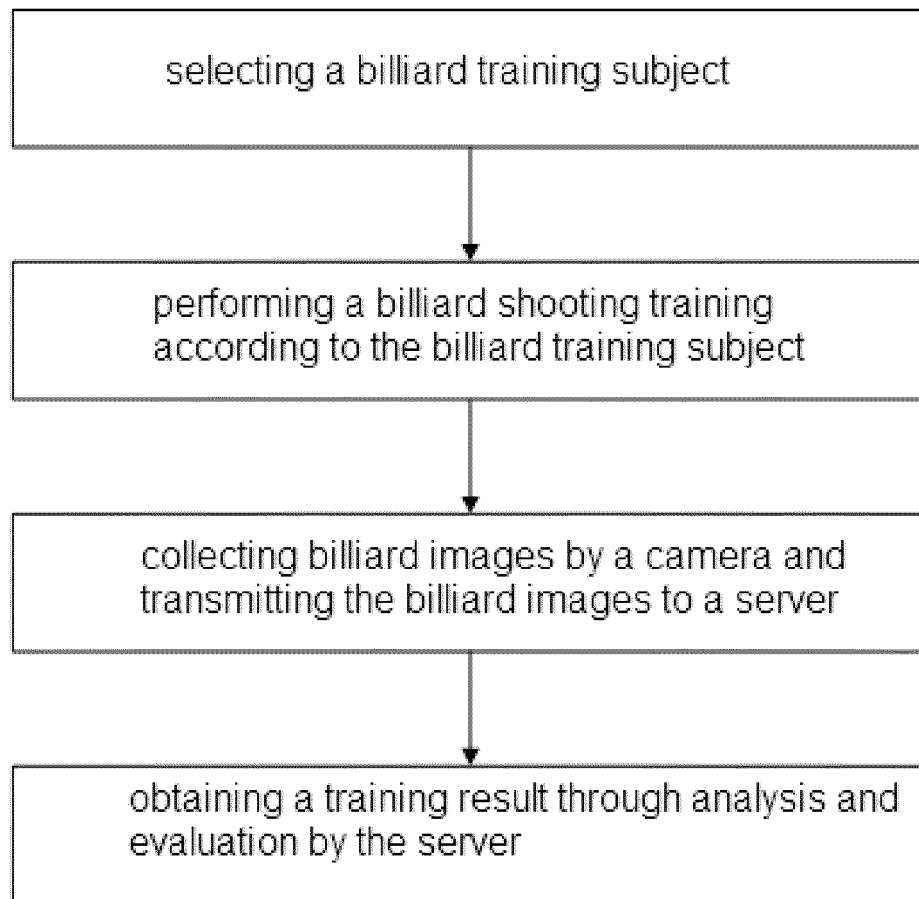


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/094510

A. CLASSIFICATION OF SUBJECT MATTER

A63D 15/00 (2006.01) i; A63D 15/20 (2006.01) i; G06F 19/00 (2011.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A63D, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, CNPAT, CNKI: camera shooting, track, billiard, snooker, video, camera, screen, display, data, train+, practic+, exercis+, analys+, contrail

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 103877721 A (RIGOUR INC.), 25 June 2014 (25.06.2014), claims 1-10	1-10
A	CN 102327697 A (LI, Jiaoang), 25 January 2012 (25.01.2012), description, paragraphs [0073]-[0161], and figures 1-23	1-10
A	CN 103143158 A (BEIJING UNIVERSITY OF TECHNOLOGY), 12 June 2013 (12.06.2013), the whole document	1-10
A	FR 2804879 A1 (LECOQ, T.), 17 August 2001 (17.08.2001), the whole document	1-10
A	JP 2009273542 A (TAITO KK), 26 November 2009 (26.11.2009), the whole document	1-10

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 12 March 2015 (12.03.2015)	Date of mailing of the international search report 27 March 2015 (27.03.2015)
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer LI, Kai Telephone No.: (86-10) 62085515

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2014/094510

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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 103877721 A	25 June 2014	None	
CN 102327697 A	25 January 2012	CN 102327697 B	10 April 2013
CN 103143158 A	12 June 2013	CN 103143158 B	05 November 2014
FR 2804879 A1	17 August 2001	None	
JP 2009273542 A	26 November 2009	JP 5356724 B2	04 December 2013

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 102327697 A [0003]
- CN 101947385 B [0034]