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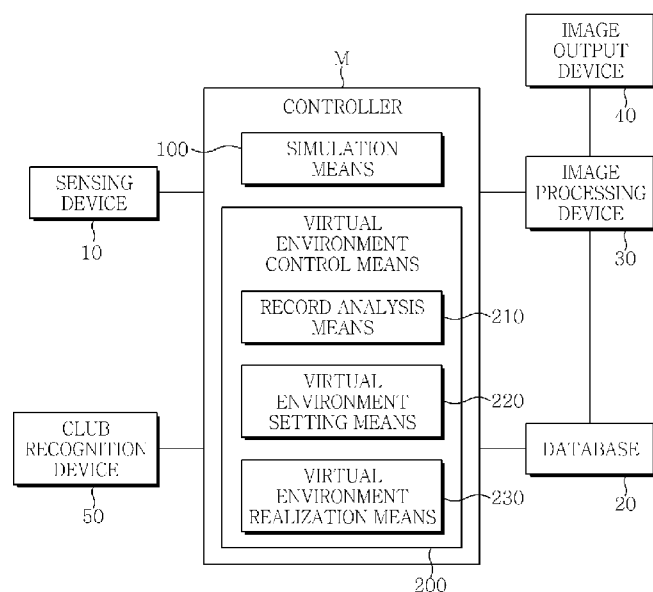
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(54) **Title:** APPARATUS AND METHOD FOR VIRTUAL GOLF DRIVING RANGE SIMULATION

[Fig. 1]



(57) **Abstract:** Disclosed herein are a virtual golf driving range simulation apparatus and method that are capable of providing various practice modes for each kind of golf shot so that a user can intensively practice a specific golf shot through golf simulation based on virtual reality, realizing a virtual environment which cannot be experienced on a real golf driving range so that the user can intensively practice a golf shot that can be utilized in a real game with interest, and changing the virtual environment whenever the user achieves a goal record so that the user can practice a golf shot step by step in a more skilled manner, thereby dramatically improving the user's golf skill.

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Description

Title of Invention: APPARATUS AND METHOD FOR VIRTUAL GOLF DRIVING RANGE SIMULATION

Technical Field

- [1] The present invention relates to a virtual golf driving range simulation apparatus and method, and, more particularly, to a virtual golf driving range simulation apparatus and method which sense a golf ball hit by a user and simulate the trajectory of the ball so that the user can practice a golf shot in a technical manner in a virtual environment for golf practice.

Background Art

- [2] With the recent upsurge of the golfing population, a so-called screen golf system, which offers the same sense of reality that a golfer would feel playing a round of golf on a real golf course using a virtual golf simulation apparatus based on virtual reality, has gained popularity.
- [3] The screen golf system senses the velocity and direction of a golf ball that a golfer hits onto a screen installed indoors for displaying a virtual golf range and displays the progress of the golf ball on the screen so that the golfer feels as if they were playing a round of golf on a real golf course.
- [4] The virtual golf simulation apparatus enables a user to play a round of virtual golf so that the user can improve his/her skill when playing a round of golf on a real golf course.
- [5] However, golf is a hard sport in which it is necessary to take various golf shots using various golf clubs depending upon the distance to a hole cup. For this reason, the user must skillfully take almost all kinds of golf shots during a round of golf so as to get a good score. As long as the user is not a professional, however, some kinds of golf shots taken by the user may be poor, and the conventional virtual golf simulation apparatus is limited for the user to intensively practice his/her poor golf shots.
- [6] This is because the conventional virtual golf simulation apparatus realizes an image regarding a virtual golf course on which a round of golf is played, and therefore, it is not possible to intensively practice only one or two golf shots.
- [7] The user must practice a specific golf shot on a real golf driving range so as to intensively practice the golf shot. However, practice of the golf shot on the real golf driving range is too tiresome to stimulate the user's interest with the result that improvement in golf skill of the user is very slow.
- [8] Therefore, there is a high necessity for a new golf practice apparatus concept that is capable of enabling a specific golf shot, which is possible only on a real golf driving

range, to be intensively practiced through golf simulation based on virtual reality and providing various functions, which cannot be provided on the real golf driving range, to improve golf skill of a user based on golf simulation using various high-technology apparatuses and systems.

Disclosure of Invention

Technical Problem

- [9] Therefore, it is an object of the present invention to provide a virtual golf driving range simulation apparatus and method that are capable of providing various practice modes for each kind of golf shot so that a user can intensively practice a specific golf shot through golf simulation based on virtual reality, realizing a virtual environment which cannot be experienced on a real golf driving range so that the user can intensively practice a golf shot that can be utilized in a real game with more interest, and changing the virtual environment whenever the user achieves a goal record so that the user can practice a golf shot step by step in a more skilled manner, thereby dramatically improving the user's golf skill.

Solution to Problem

- [10] In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a virtual golf driving range simulation apparatus including a sensing device for sensing at least one of a golf club and a ball according to a golf swing performed by a user, an image processing device for implementing a virtual environment in which the user practices a specific golf shot as an image, a simulation means for simulating a trajectory of the ball based on the result sensed by the sensing device in the realized virtual environment, and a virtual environment control means for analyzing a golf shot record of the user based on the simulation result and changing the virtual environment so that a goal range of a golf shot is changed based on the analysis result of the golf shot record.
- [11] In accordance with another aspect of the present invention, there is provided a virtual golf driving range simulation method including realizing a virtual environment in which a user practices a specific golf shot, sensing at least one of a ball and a golf club according to a golf shot taken by the user, simulating a trajectory of the ball based on the sensed result in the realized virtual environment, analyzing a golf shot record of the user based on the simulation result, and changing the virtual environment so that a goal range of a golf shot is changed based on the analysis result of the golf shot record.

Advantageous Effects of Invention

- [12] The virtual golf driving range simulation apparatus and method according to the present invention have the effect of providing various practice modes for each kind of golf shot so that a user can intensively practice a specific golf shot through golf

simulation based on virtual reality, realizing a virtual environment which cannot be experienced on a real golf driving range so that the user can intensively practice a golf shot that can be utilized in a real game with more interest, and changing the virtual environment whenever the user achieves a goal record so that the user can practice a golf shot step by step in a more skilled manner, thereby dramatically improving the user's golf skill.

Brief Description of Drawings

- [13] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:
- [14] FIG. 1 is a view showing the construction of a virtual golf driving range simulation apparatus according to an embodiment of the present invention;
- [15] FIGS. 2 to 7 are views showing an example of a virtual environment realized by the virtual golf driving range simulation apparatus according to the present invention; and
- [16] FIG. 8 is a flow chart showing a virtual golf driving range simulation method according to an embodiment of the present invention.

Best Mode for Carrying out the Invention

- [17] Now, exemplary embodiments of a virtual golf driving range simulation apparatus and method according to the present invention will be described in detail with reference to the accompanying drawings.
- [18] First, a virtual golf driving range simulation apparatus according to an embodiment of the present invention will be described in detail with reference to FIG. 1. FIG. 1 is a block diagram showing the construction of a virtual golf driving range simulation apparatus according to an embodiment of the present invention.
- [19] As shown in FIG. 1, the virtual golf driving range simulation apparatus according to the embodiment of the present invention may include a sensing device 10, a database 20, an image realization means 30 and 40, a club recognition device 50, and a controller M.
- [20] Basically, the virtual golf driving range simulation apparatus according to the present invention realizes a virtual environment for allowing a user to perform golf practice on a golf driving range and simulates a golf shot taken by the user so that the user can evaluate his/her own golf shot.
- [21] A golf driving range embodied by the present invention is a 'virtual golf driving range' on which a virtual environment that can be experienced on a real golf driving range is realized so that a user can practice a golf shot which is more exciting, more intensive, and more practically useful in a real game.
- [22] The virtual environment regarding the virtual golf driving range is realized by the

virtual environment control means 200 through the image realization means using data obtained from the database 20. In the virtual environment realized as described above, a golf club which a user uses to take a golf shot is recognized by the club recognition device 50. When the user takes a golf shot, the sensing device 10 senses the golf shot taken by the user, and the simulation means 100 calculates a trajectory of the ball based on the result sensed by the sensing device 10 and the recognized club information so that the ball is simulated in the realized virtual environment.

- [23] The virtual golf driving range simulation apparatus according to the present invention and a conventional virtual golf simulation apparatus are similar to each other in terms of hardware but are different from each other in terms of software.
- [24] That is, the virtual golf driving range simulation apparatus according to the present invention realizes a virtual environment which provides contents for golf practice. On the other hand, the conventional virtual golf simulation apparatus realizes a real golf course (or a golf course which is not really present but is imaginarily designed) as an image based on virtual reality (hereinafter, referred to as a 'virtual golf course') so that a user can play a round of virtual golf in the same manner as playing a round of golf on a real golf course in the virtual reality in which the virtual golf course is implemented as an image.
- [25] Consequently, the virtual golf driving range simulation apparatus according to the present invention may be implemented in a manner similar to a so-called screen golf system, in which the conventional virtual golf simulation apparatus is implemented, in terms of hardware, and therefore, the virtual golf driving range simulation apparatus according to the present invention may be implemented so that a hitting plate, on which a user performs a golf swing to hit a ball, and a screen disposed in front of the hitting plate for displaying an image regarding a virtual golf driving range are provided in a space for golf practice having a predetermined size.
- [26] Hereinafter, the respective components of the virtual golf driving range simulation apparatus according to the present invention to realize the above-mentioned characteristics will be described in more detail.
- [27] The sensing device 10 senses the motion of a golf club and/or a ball according to a golf swing performed by a user.
- [28] The sensing device 10 may be embodied in various forms. For example, the sensing device 10 may be embodied by an infrared sensor which emits infrared light, receives an infrared light component reflected by a golf club head moved when a user hits a ball and the ball hit by the user, and analyzes the received infrared light component, a laser sensor which irradiates a laser, senses a laser component blocked by a golf club head moved when a user hits a ball and the ball hit by the user, and analyzes the sensed laser component, or an image sensor which collects images regarding a ball hit by a user as

the result of a golf swing and analyzes the collected images.

- [29] Meanwhile, the database 20 stores all data necessary for virtual golf driving range simulation. Specifically, the database 20 stores data regarding a virtual golf course realized by imaging a real golf course. Consequently, it is possible to realize a virtual environment in which a user can practice a golf shot based on a practice mode selected by the user on a virtual golf course selected by the user. Also, the database 20 stores a goal record of a practice mode based on ranking of a user and data regarding a goal range of a golf shot to realize a virtual environment in which a golf shot can be practiced based on skill ranking of a user.
- [30] Also, the database 20 may store personal information of users registered in the system, previously recorded information of the respective users, or information regarding skill rankings of the users registered in the system.
- [31] Meanwhile, the image realization means processes and realizes an image regarding a virtual environment in which a user can practice a specific golf shot. As shown in FIG. 1, the image realization means may include an image processing device 30 for extracting relevant data from the database 20 based on information received from the controller M and processing the data as an image so that the data can be output as the image and an image output device 40 for outputting the data processed by the image processing device 30.
- [32] The virtual environment control means 200 sets a virtual environment in which a user can practice a specific golf shot based on a practice mode selected by the user, image-processes the set virtual environment through the image processing device 30, and outputs the image-processed virtual environment through the image output device 40.
- [33] The image processing device 30 may be implemented as a modulated part for performing an image processing function in an independent apparatus or may be implemented as an independent apparatus.
- [34] The image output device 40 outputs the image information processed by the image processing device 30 to a screen. The image output device 40 may be implemented as a display device or a projector for projecting an image onto a screen to display the image.
- [35] The club recognition device 50 is provided to recognize a golf club held by a user when the user stands on the hitting plate while holding the golf club to take a golf shot.
- [36] The club recognition device 50 may be implemented in various forms. For example, the club recognition device 50 may be implemented as a radio frequency identification (RFID) reader, which is configured so that, when a user stands on the hitting plate in a state in which an RFID tag containing information regarding a golf club is attached to the golf club, the RFID reader (club recognition device) installed near the hitting plate

reads the RFID tag attached to the golf club held by the user for receiving information regarding the golf club to recognize the golf club.

[37] Also, the club recognition device 50 may be implemented as a barcode reader for reading a barcode or a quick response (QR) reader for reading a QR code. A barcode or a QR code containing information regarding a golf club is attached to the golf club, and the barcode reader or the QR reader installed near the hitting plate reads the barcode or the QR code to recognize the golf club.

[38] Also, the club recognition device 50 may be implemented as a camera device. A mark is formed at the golf club, and the camera acquires an image regarding the golf club and recognizes the mark regarding the golf club to recognize the golf club.

[39] Information regarding the golf club recognized by the club recognition device 50 and the result sensed by the sensing device 10 are processed by the simulation means 100. The processed result may be used to more accurately calculate the trajectory of the ball, to determine whether the golf club is suitable for the practice mode selected by the user, or to recognize what kind of golf club is used by the user so that a virtual environment is realized based on a position at which a golf shot can be taken using the golf club.

[40] Meanwhile, the controller M is a component for controlling the virtual golf driving range simulation apparatus. The controller M includes a simulation means 100 and a virtual environment control means 200.

[41] The simulation means 100 simulates the trajectory of the ball based on the result sensed by the sensing device 10 in the realized virtual environment. That is, the simulation means 100 receives specific physical information of the ball based on the motion of the golf club and/or the ball sensed by the sensing device 10, calculates the trajectory of the ball based on the received information of the ball, and simulates the calculated trajectory of the ball in the realized virtual environment.

[42] The virtual environment control means 200 presets a plurality of practice modes to intensively practice according to golf shot types and realizes a virtual environment corresponding to the selected practice mode through the image processing device 30 and the image output device 40.

[43] The virtual environment control means 200 presets a plurality of practice modes for each kind of golf shot. For example, the virtual environment control means 200 presets a long game practice mode to intensively practice at least one golf shot selected from among a driver shot, a wood shot and an iron shot and a short game practice mode to intensively practice an approach shot and/or putting. The virtual environment control means 200 realizes a virtual environment in which a golf shot can be taken based on each practice mode.

[44] The driver shot (also referred to as a tee shot) is a shot taken using a driver, which is

one of the golf clubs, the wood shot is a shot taken using a wood driver, such as number 3 wood or number 4 wood, and the iron shot is a shot taken using number 1 iron to number 9 iron.

[45] The approach shot includes a pitch shot and a chip shot. The pitch shot is a shot taken using a pitch wedge or a sand wedge in the vicinity of a green so that a ball is located on the green, and the chip shot is a shot taken in the vicinity of the green so that the ball approaches a hole cup.

[46] The putting is a shot taken using a putter on the green so that the ball enters the hole cup.

[47] Although the virtual environment control means 200 defines and sets the practice modes, such as the long game practice mode and the short game practice mode, based on kinds of golf shots as described above, the virtual environment control means 200 may also define and set a driver practice mode to practice a driver shot, a wood practice mode to practice a wood shot, an iron practice mode to practice an iron shot, a pitch practice mode to practice a pitch shot, a chip practice mode to practice a chip shot, and putting practice mode to practice putting.

[48] Also, the virtual environment control means 200 may set a real game practice mode in which a golf shot practiced in a different practice mode is practiced on a virtual hole as in a real game or a mission execution mode in which a goal is achieved step by step with respect to some kinds of golf shots and may realize a virtual environment based on the set modes.

[49] Meanwhile, the virtual environment control means 200 is characterized by analyzing a golf shot record of a user based on the result simulated by the simulation means 100 and changing a virtual environment so that a goal range of a golf shot can be changed based on the analysis result.

[50] The virtual environment control means 200 includes a record analysis means 210, a virtual environment setting means 220, and a virtual environment realization means 230.

[51] The record analysis means 210 is configured to analyze a golf shot record of a user based on the result simulated by the simulation means 100.

[52] The virtual environment setting means 220 is configured to preset a plurality of practice modes to intensively practice according to golf shot types, to set a goal range and goal record of a golf shot in each of the practice modes, and to change the goal range and the goal record upon determining from the analysis result of the golf shot record that the goal record has been achieved.

[53] The virtual environment realization means 230 controls the image processing device 30 to realize a virtual environment for golf shot practice in each of the practice modes and to change the virtual environment in response to the change of the goal range and

the goal record.

- [54] The goal record may be defined as a record as to the number of times which balls are located within the goal range when the user takes golf shots in the practice mode selected by the user or as a goal value regarding flight distance and accuracy of the golf shot taken by the user.
- [55] Also, the goal record may not be defined as an absolute goal value but as a relative goal value. For example, previous records of the user may be analyzed to calculate the average of the records or select the best record, and the average of the records or the best record may be defined as the goal record. Alternatively, the record of a different user may be defined as the goal record.
- [56] Any one selected from among various skill rankings may be assigned to each user, and a goal record preset with respect to each skill ranking may be defined as the goal record. It is preferable to independently set the goal record for each of the practice modes.
- [57] For example, it is assumed that a user acquires a specific skill ranking in a driver shot practice mode, and a goal record of the user at the current ranking is 5 times (which means that, for 5 driver shots among a total of 10 driver shots, balls must be located within a goal range). If the goal record of the user is 6 times, which exceeds the goal record, i.e. 5 times, in the driver shot practice mode, the skill ranking of the user is upgraded by one ranking and reset. As a result, a new goal record based on the upgraded ranking is set. As the goal record is reset, the virtual environment is changed so that the goal range of a golf shot is further limited. Consequently, it is possible for the user to practice a golf shot in a more skilled manner as the user acquires an upgraded ranking.
- [58] The goal range may be defined to include a target region of a predetermined size in which a ball is located as the result of a golf shot on a virtual field, which is a place at which a user takes the golf shot. Alternatively, the goal range may be defined to include a virtual target formed in the target region.
- [59] Consequently, the goal range may be changed as the result of changing the virtual environment so that the size of the target region of the virtual field, at which the golf shot is taken, can be reduced or extended or as the result of changing the virtual environment so that the size of the virtual target formed in the target region can be reduced or extended, a detailed description of which will be described below.
- [60] Meanwhile, the virtual environment control means 200 may realize a virtual environment in which a golf shot based on each practice mode is taken at a specific position at which the shot can be taken on a virtual golf course (a golf course based on virtual reality including regular 18 holes and configured so that a round of virtual golf can be played at the conventional virtual golf simulation apparatus).

- [61] For example, when a user plays a round of virtual golf on Pebble Beach Golf Course (a virtual golf course obtained by realizing Pebble Beach Golf Links located at Pebble Beach, California, USA as virtual reality) through the virtual golf simulation apparatus, a driver shot on hole number 1 may be out of bounds (OB). In order to intensively practice such a driver shot, therefore, the user may select a practice mode to intensively practice a driver shot through the virtual golf driving range simulation apparatus according to the present invention, and may select hole number 1 of Pebble Beach Golf Course as a virtual environment. In this case, the virtual environment setting means 220 of the virtual environment control means 200 may set a virtual environment corresponding to a tee shot position of hole number 1 of Pebble Beach Golf Course, and the virtual environment realization means 230 may realize a virtual environment based on the above mentioned information preset by the virtual environment setting means 220 through the image processing device so that a driver shot can be practiced at the tee shot position of hole number 1 of Pebble Beach Golf Course.
- [62] At this time, in the virtual golf driving range simulation apparatus according to the present invention, a goal record is set with respect to the driver shot taken by the user, a goal range (for example, a target region of hole number 1 of Pebble Beach Golf Course or a virtual target formed in the target region) of the virtual environment is set based on the goal record, the virtual environment is changed so that the goal record is reduced when the user achieves the goal record, the goal record is further upgraded and reset, and the virtual environment is changed so that the reduced goal record is further reduced when the user achieves the reset goal record. Consequently, it is possible for the user to intensively practice a tee shot in a skilled manner so that the user can perfectly take the tee shot on hole number 1 of Pebble Beach Golf Course.
- [63] In terms of hardware, the record analysis means 210, the virtual environment setting means 220, and the virtual environment realization means 230 may be implemented as a single controller configured to perform the functions of the respective means or as a plurality of controllers corresponding to the respective means. In terms of software, the record analysis means 210, the virtual environment setting means 220, and the virtual environment realization means 230 may be implemented as a single program configured to perform the functions of the respective means or as a plurality of programs corresponding to the respective means.
- [64] Hereinafter, an example of a virtual environment realized by the virtual golf driving range simulation apparatus according to the present invention will be described with reference to FIGS. 2 to 7.
- [65] First, when the virtual golf driving range simulation apparatus is operated as shown in FIG. 2, a plurality of predetermined practice modes is displayed so that a user can select one of the practice modes.

- [66] In an example shown in FIG. 2, a tee shot practice mode M1, a pitch shot practice mode M2, and a chip shot practice mode M3 are displayed. The tee shot practice mode M1 is a practice mode set to intensively practice a driver shot and to realize a virtual environment based thereon, the pitch shot practice mode M2 is a practice mode set to intensively practice a pitch shot and to realize a virtual environment based thereon, and the chip shot practice mode M3 is a practice mode set to intensively practice a chip shot and to realize a virtual environment based thereon.
- [67] After one of the practice modes is selected, a virtual field on which a golf shot based on the selected practice mode is taken, i.e. a virtual golf course, may be selected. FIG. 3 shows an example of a screen displaying various virtual golf courses, one of which is selected.
- [68] In an example shown in FIG. 3, a golf course and a specific hole of the golf course can be simultaneously selected. However, the present invention is not limited thereto. For example, a golf course may be selected first, and then a user may directly select a desired one from among 18 holes of the selected golf course.
- [69] On the other hand, FIG. 4 shows an example of a virtual environment realized based on the practice mode selected by the user. Specifically, FIG. 4 shows that a user selects drive shot practice in the tee shot practice mode M1 and a virtual environment is realized based on a position at which a user takes a driver shot with respect to a ball B on a virtual field based thereon.
- [70] The virtual field shown in FIG. 4 has water hazards W located at opposite sides of a fairway. A target region R for a tee shot is divided by boundary lines R3 and R4, and the water hazards W are located outside the respective boundary lines R3 and R4. The user takes a tee shot so that a ball B is located in the target region R. The number of times which the ball is located in the target region R may be preset and provided as a goal record.
- [71] In the virtual field shown in FIG. 4, however, an original target region R is divided by boundary lines R1 and R2. As the user achieves the goal record, the virtual environment is changed so that the water hazards W are located outside the respective boundary lines R3 and R4.
- [72] That is, FIG. 4 shows that the virtual environment is changed so that the goal range is limited as the user achieves the goal record (an image is implemented so that the water hazards W gradually encroach on the target region R whenever the goal record is achieved).
- [73] Consequently, the virtual environment is changed so that the target region R is gradually narrowed whenever the user achieves the goal record with the result that it is possible for the user to more accurately practice a tee shot in a state in which the space in which a ball is located as the result of the tee shot is gradually narrowed.

- [74] On the other hand, FIG. 5 shows an example of a virtual environment realized as a user selects a pitch shot practice mode M2. In the pitch shot practice mode M2, a ball B must be located around a pin P on a green G.
- [75] The virtual environment shown in FIG. 5 is a virtual field regarding an area in the vicinity of the green G. The green G is a target region, and a virtual target T is formed in a predetermined region around the pin P of the green G, which is the target region.
- [76] The user takes a pitch shot so that the ball B is located in the virtual target T. A given goal record may be defined as the number of times which the ball is located in the virtual target T.
- [77] As the user achieves the given goal record, the virtual environment may be changed so that the size of the green G, which is the target region, is gradually reduced or so that the size of the virtual target T is gradually reduced.
- [78] In this way, the virtual environment is changed so that the size of the green G is gradually reduced or so that the size of the virtual target T is gradually reduced whenever the user achieves the goal record with the result that it is possible for the user to more intensively practice a pitch shot in a skilled manner.
- [79] The virtual environment shown in FIG. 5 is changed so that the size of the green G, which is the target region, or the virtual target is gradually reduced as the user achieves the goal record. Alternatively, the virtual environment may be changed so that the pin P, i.e. a hole cup, is located at a more difficult position as the user achieves the goal record, although not shown in the drawing.
- [80] For example, when the user takes pitch shots in a state in which the hole cup is located at the center of the green G and achieves the goal record, the virtual environment may be changed so that the position of the hole cup is shifted to the edge of the green G. Consequently, it is possible for the user to practice a pitch shot in a more limited state.
- [81] In the above example, the position of the hole cup is changed based on a predetermined information as the user achieves the goal record. Alternatively, the user may directly select or designate the position of the hole cup.
- [82] FIG. 6 shows that the user directly select the position of the pin P on the green G in the virtual environment based on the practice mode for pitch shot practice. Also, FIG. 6 shows that the user directly select or designates a position at which a pitch shot is to be taken.
- [83] On the other hand, as shown in FIG. 7, it is possible for the user to directly select or designate the position of the pin P (a flag put in the hole cup), on the green G (i.e. position of the hole cup). Candidate positions, at which the pin P is to be located, on the green G are displayed, as shown in FIG. 7, so that the user can select one of the positions. Alternatively, it is possible for the user to directly designate an arbitrary

position on the green G.

[84] When the user selects or designates the position of the pin P, a new hole cup and a new pin P are created at the position, the goal record and goal range are corrected and reset based on the user's selections or designations, and a virtual environment is realized based on the reset information .

[85] As shown in FIG. 7, a 30 m section, a 60 m section, or a 90 m section may be set in the vicinity of the green G, and the position at which the user directly takes a pitch shot in the set section may be designated. Alternatively, one section may be selected from among a plurality of sections so that a predetermined position of the selected section is set as the position at which a pitch shot is to be taken.

[86] FIG. 7 shows that the user directly designates an arbitrary position in the vicinity of the 60 m section and practices a pitch shot at the position.

[87] A rough R and bunker BK as well as a fairway may be present in the vicinity of the green G, and the user may select or designate pitch shot practice in the rough R or the bunker BK.

[88] A virtual ball B is formed at the position at which the pitch shot is to be taken, and a virtual environment is realized based on the position.

[89] Hereinafter, a virtual golf driving range simulation method according to an embodiment of the present invention will be described with reference to FIG. 8.

[90] When a user logs in (S10), information regarding the user is loaded, and the controller recognizes the logged in user. Also, the controller outputs a plurality of predetermined practice modes so that the user can practice each kind of golf shot.

[91] When the user selects a practice mode from among the plurality of predetermined practice modes (S20), the controller checks ranking of the logged in user in the selected practice mode (S30). The user may select a virtual golf course from among a plurality of virtual golf course as a virtual field at which the user practices a golf shot. Alternatively, the user may practice a golf shot on a virtual field preset by the controller without selection of the virtual field.

[92] Subsequently, the controller sets a goal record and a goal range of a golf shot based on the ranking of the user (S40).

[93] Subsequently, the controller realizes a virtual environment based on the selected practice mode. Specifically, the controller realizes a virtual environment to which the goal record and goal range set at Step S40 have been applied (S50).

[94] As the user takes a golf shot based on the selected practice mode in the realized virtual environment, the sensing device senses the motion of a golf club or a ball, and the controller calculates the trajectory of the ball based on the sensed result so that simulation can be performed in the realized virtual environment (S60).

[95] The club recognition device recognizes the golf club held by the user when the user

stands on the hitting plate while holding the golf club to take a golf shot. In a case in which the recognized golf club is not suitable for golf shot practice based on the practice mode selected by the user, the controller may output video or audio information informing the user that it is necessary to change the golf club.

[96] For example, if the user selects a practice mode for driver shot practice and stands on the hitting plate while holding number 7 iron, the club recognition device recognizes the golf club held by the user, informs the user that the golf club held by the user is not suitable, and guides the user so that the user can practice a golf shot using a driver.

[97] After the simulation is performed, the controller analyzes a golf shot record of the user based on the simulation result (S70) and determines whether the user has achieved the goal record in the corresponding practice mode (S80).

[98] Upon determining that the user has not achieved the goal record, the controller may retry the corresponding practice mode according to user selection (S110). Alternatively, the controller may finish the corresponding practice mode without retrial (S120).

[99] Upon determining that the user has achieved the goal record, the controller resets the ranking of the user, upgrades and resets the goal record, and sets the goal range of the golf shot so that the goal range of the golf shot is further limited (S90).

[100] Subsequently, the controller changes the virtual environment so that the goal range of the golf shot is limited (S100). Consequently, it is possible for the user to intensively practice a golf shot in a more skilled manner in the changed virtual environment.

Mode for the Invention

[101] Various embodiments of a virtual golf driving range simulation apparatus and method have been described in the best mode for carrying out the invention.

Industrial Applicability

[102] In the virtual golf driving range simulation apparatus and method according to the present invention as described above, it is possible to provide various practice modes for each kind of golf shot so that a user can intensively practice a specific golf shot through golf simulation based on virtual reality, to realize a virtual environment which cannot be experienced on a real golf driving range so that the user can intensively practice a golf shot that can be utilized in a real game with interest, and to change the virtual environment whenever the user achieves a goal record so that the user can practice a golf shot step by step in a more skilled manner, thereby dramatically improving the user's golf skill. Consequently, the present invention can be widely used in industries related to the virtual golf driving range simulation apparatus and method.

Claims

- [Claim 1] A virtual golf driving range simulation apparatus comprising:
a sensing device for sensing at least one of a golf club and a ball according to a golf swing performed by a user;
an image processing device for implementing a virtual environment in which the user practices a specific golf shot as an image;
a simulation means for simulating a trajectory of the ball based on the result sensed by the sensing device in the realized virtual environment;
and
a virtual environment control means for analyzing a golf shot record of the user based on the simulation result and changing the virtual environment so that a goal range of a golf shot is changed based on the analysis result of the golf shot record.
- [Claim 2] The virtual golf driving range simulation apparatus according to claim 1, wherein the virtual environment control means presets a plurality of practice modes to intensively practice according to golf shot types and realizes a virtual environment for golf shot practice based on a predetermined information through the image processing device.
- [Claim 3] The virtual golf driving range simulation apparatus according to claim 1, wherein the virtual environment control means comprises:
a record analysis means for analyzing the golf shot record of the user based on the simulation result;
a virtual environment setting means for setting a goal range of a golf shot to be practiced by the user and changing the goal range of the golf shot based on the analysis result of the golf shot record; and
a virtual environment realization means for realizing a virtual environment based on the information set by the virtual environment setting means and changing the virtual environment in response to the change of the goal range.
- [Claim 4] The virtual golf driving range simulation apparatus according to claim 1, wherein the virtual environment control means comprises:
a record analysis means for analyzing the golf shot record of the user based on the simulation result;
a virtual environment setting means for setting a goal range and goal record of a golf shot corresponding to skill ranking of the user in each practice mode to intensively practice according to golf shot types and changing the goal range and the goal record upon determining from the

analysis result of the golf shot record that the goal record has been achieved; and

a virtual environment realization means for realizing a virtual environment for golf shot practice in each practice mode and changing the virtual environment in response to the change of the goal range and the goal record.

[Claim 5] The virtual golf driving range simulation apparatus according to claim 2, further comprising:

a database for storing data regarding a plurality of virtual golf courses on which a round of virtual golf is played, wherein

the virtual environment control means is configured to realize a virtual environment in which a golf shot based on each of the practice modes can be taken at a position at which the golf shot is possible on a virtual golf course stored in the database.

[Claim 6] The virtual golf driving range simulation apparatus according to claim 1, wherein the virtual environment control means is configured to change the virtual environment so that the goal range of the golf shot is limited upon determining from the analysis result of the golf shot record of the user that the goal record has been achieved.

[Claim 7] A virtual golf driving range simulation method comprising:
realizing a virtual environment in which a user practices a specific golf shot;

sensing at least one of a ball and a golf club according to a golf shot taken by the user;

simulating a trajectory of the ball based on the sensed result in the realized virtual environment;

analyzing a golf shot record of the user based on the simulation result; and

changing the virtual environment so that a goal range of a golf shot is changed based on the analysis result of the golf shot record.

[Claim 8] The virtual golf driving range simulation method according to claim 7, wherein the step of realizing a virtual environment comprises:
being selected to any one from among a plurality of preset practice modes so that golf shot practice can be intensively performed according to golf shot types; and
realizing a virtual environment corresponding to the selected practice mode as an image so that golf shot practice can be performed based on the selected practice mode.

- [Claim 9] The virtual golf driving range simulation method according to claim 7, wherein
the step of analyzing the golf shot record of the user comprises determining whether the golf shot record of the user has reached a predetermined goal record, and
the step of changing the virtual environment comprises setting the goal range of the golf shot so that the goal range of the golf shot is limited upon determining that the golf shot record of the user has reached the goal record and changing the virtual environment based on the set information.
- [Claim 10] The virtual golf driving range simulation method according to claim 7, wherein
the goal range comprises a target region of a predetermined size in which a ball is located as the result of a golf shot on a virtual field at which the user takes the golf shot, and
the step of changing the virtual environment comprises changing the virtual environment so that the size of the target region is reduced stepwise whenever the goal range is limited.
- [Claim 11] The virtual golf driving range simulation method according to claim 7, wherein
the goal range comprises a virtual target formed at a target region of a predetermined size in which a ball is located as the result of a golf shot on a virtual field at which the user takes the golf shot, and
the step of changing the virtual environment comprises changing the virtual environment so that the size of the virtual target formed at the target region is reduced stepwise whenever the goal range is limited.
- [Claim 12] The virtual golf driving range simulation method according to claim 8, wherein
the step of being selected to any one from among the plurality of preset practice modes comprises being selected to a practice mode to practice any one selected from among a driver shot, a wood shot, and an iron shot,
the step of realizing a virtual environment comprises implementing a virtual environment regarding a virtual field on which the selected golf shot is taken as an image, and
the step of changing the virtual environment comprises changing the virtual environment so that the virtual field is limited stepwise whenever the user achieves a goal record of the selected golf shot.

- [Claim 13] The virtual golf driving range simulation method according to claim 8, wherein
the step of being selected to any one from among the plurality of preset practice modes comprises being selected to a practice mode to practice any one selected from among a pitch shot, a chip shot, and putting,
the step of realizing a virtual environment comprises implementing a virtual environment regarding a virtual field comprising a green on which the selected golf shot is taken as an image, and
the step of changing the virtual environment comprises changing the virtual environment so that the green is limited stepwise whenever the user achieves a goal record of the selected golf shot.
- [Claim 14] The virtual golf driving range simulation method according to claim 8, wherein
the step of being selected to any one from among the plurality of predetermined practice modes comprises being selected to a practice mode to practice any one selected from among a pitch shot, a chip shot, and putting,
the step of realizing a virtual environment comprises implementing a virtual environment regarding a virtual field comprising a green on which the selected golf shot is taken and a virtual target formed on the green as an image, and
the step of changing the virtual environment comprises changing the virtual environment so that the virtual target on the green is reduced stepwise whenever the user achieves a goal record of the selected golf shot.
- [Claim 15] The virtual golf driving range simulation method according to claim 8, wherein
the step of being selected to any one from among the plurality of predetermined practice modes comprises being selected to a practice mode to practice any one selected from among a pitch shot, a chip shot, and putting,
the step of realizing a virtual environment comprises implementing a virtual environment regarding a virtual field comprising a green on which the selected golf shot is taken as an image, and
the step of changing the virtual environment comprises changing the virtual environment so that the position of a hole cup on the green is changed according to a predetermined information or by user selection or designation when the user achieves a goal record of the selected golf

shot.

[Claim 16]

The virtual golf driving range simulation method according to claim 8, further comprising:

being selected to any one from among a plurality of virtual golf courses on which a round of virtual golf is played, wherein the step of realizing a virtual environment comprises implementing a virtual environment in which a golf shot based on the selected practice mode can be taken at a position at which the golf shot is possible on the selected virtual golf course.

[Claim 17]

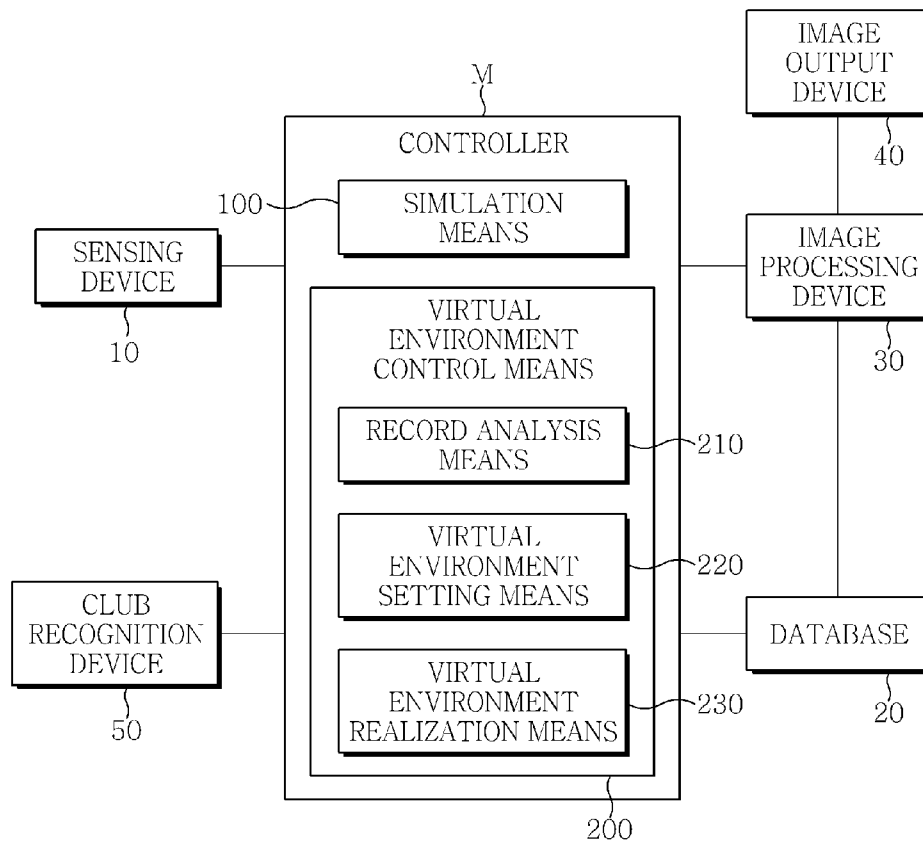
The virtual golf driving range simulation method according to claim 16, wherein the step of changing the virtual environment comprises changing the virtual environment so that the goal range of the shot on the selected virtual golf course is limited whenever the user achieves a goal record of the selected golf shot.

[Claim 18]

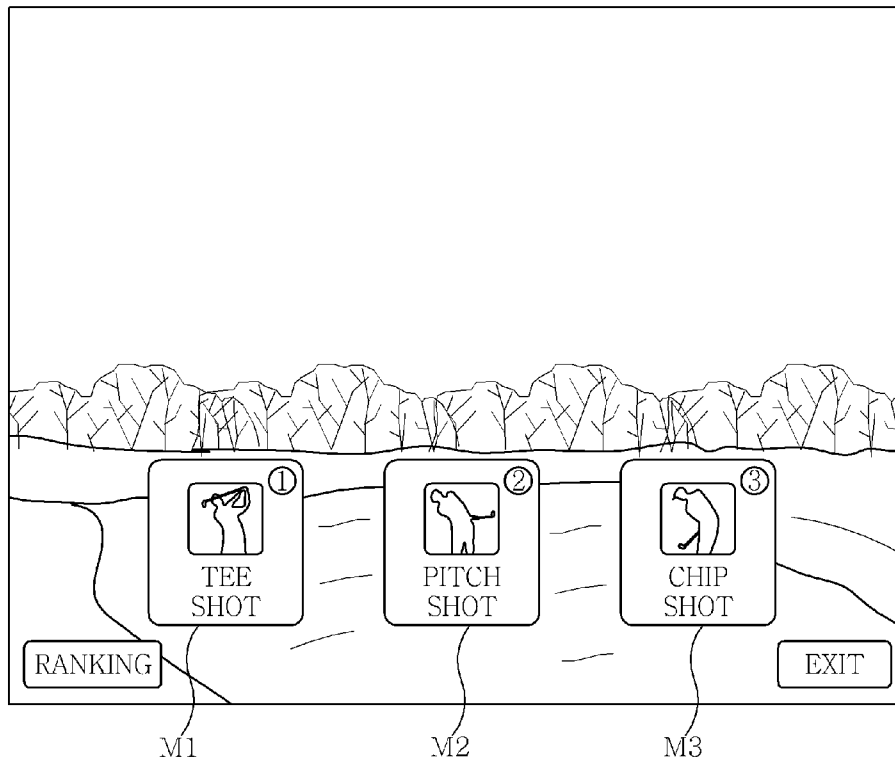
The virtual golf driving range simulation method according to claim 8, further comprising:

when a practice mode to practice any one selected from among a pitch shot, a chip shot, and putting is selected at the step of being selected to any one from among the plurality of predetermined practice modes, being selected or designated to the position of a pin on a green; and being selected or designated to a position at which a golf shot based on the selected practice mode can be taken.

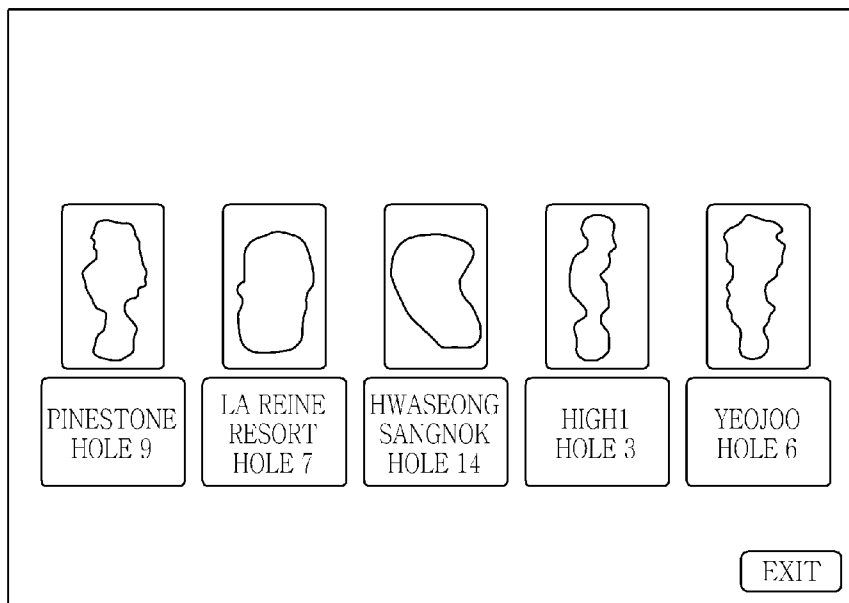
[Fig. 1]



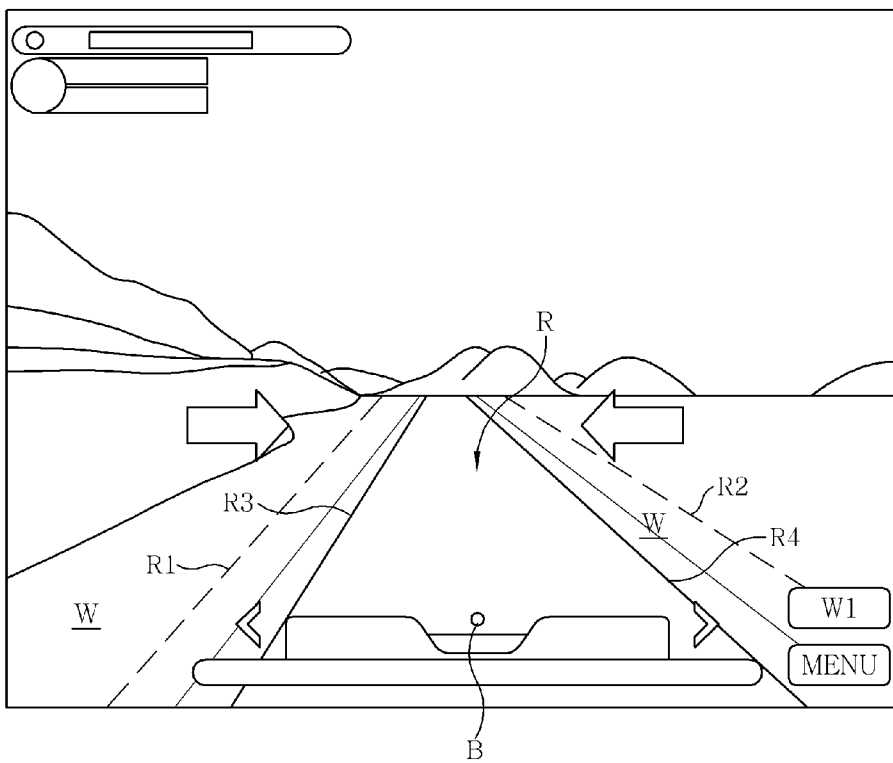
[Fig. 2]



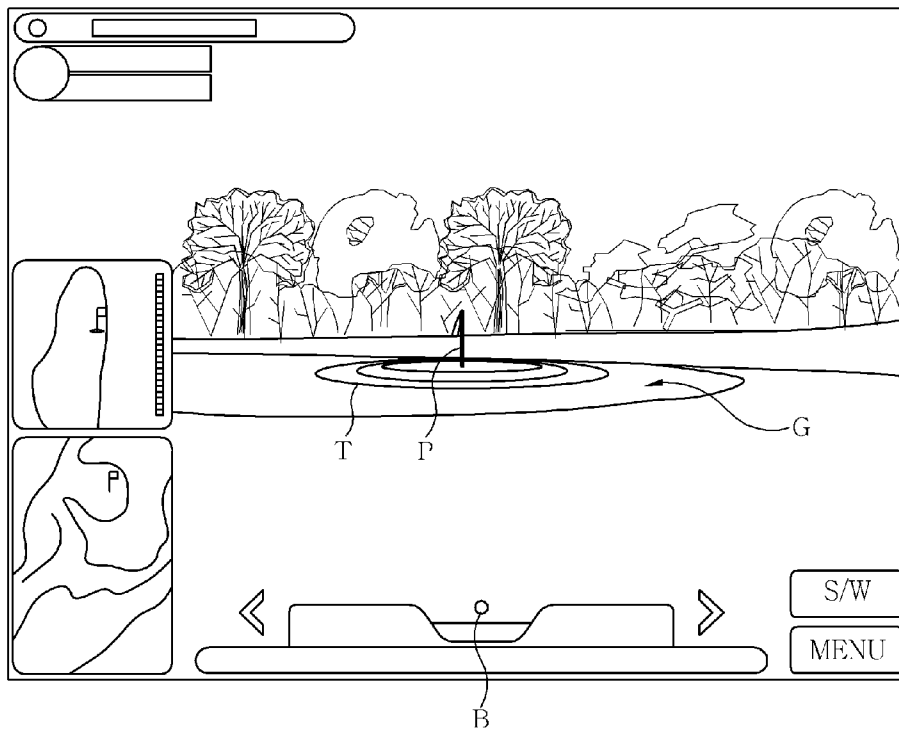
[Fig. 3]



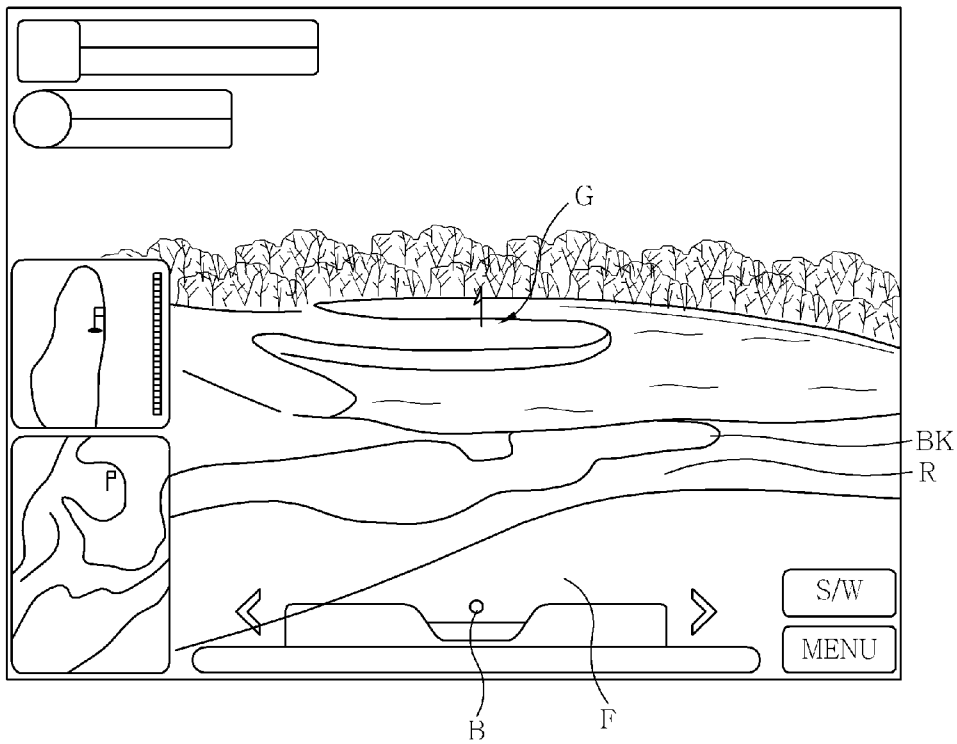
[Fig. 4]



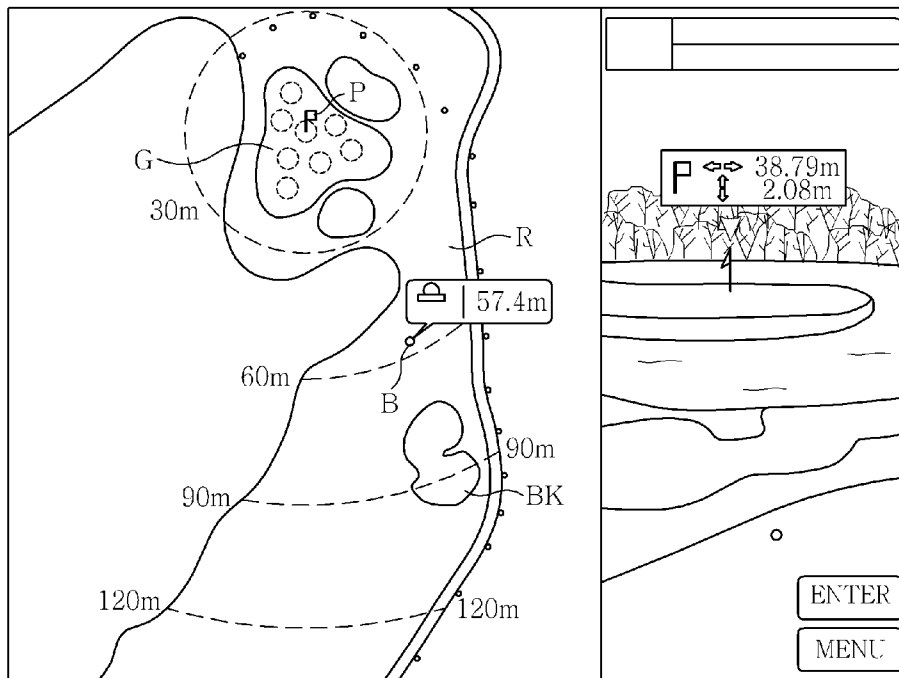
[Fig. 5]



[Fig. 6]



[Fig. 7]



[Fig. 8]

