RANGEFINDING DEVICES AND METHODS FOR GOLFING

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ABSTRACT

A device comprises a rangefinder, memory, display, and processor. The rangefinder can measure a distance between a user and a target on a course. The memory stores data concerning a plurality of clubs including a hitting distance for each of the golf clubs. The processor, which is connected to the rangefinder, memory, and display, is configured to select, based on the measured distance, a recommended golf club and to determine a recommended swing speed for a golfer to hit a golf ball with the recommended golf club. The processor is further configured to cause the display to indicate the recommended golf club and swing speed. The device may alternatively or additionally comprise an inclinometer and calculate an adjusted distance based on tilt and the distance, and select the recommended golf club based on the adjusted distance.
500

DETERMINE LOS DISTANCE TO TARGET 510

DETERMINE INCLINATION TO TARGET 520

COMPUTE AN ADJUSTED DISTANCE 530

ACCESS PLAYER'S CLUB-DISTANCE DATA 540

SELECT CLUB 550

DETERMINE SWING SPEED 560

DISPLAY CLUB AND SWING SPEED 570

FIG. 5
RANGEFINDING DEVICES AND METHODS FOR GOLFING

RELATED APPLICATIONS

[0001] This application claims priority from U.S. Provisional Application No. 60/772,016, filed Feb. 9, 2006, which is hereby incorporated by reference in its entirety.

BACKGROUND INFORMATION

[0002] This disclosure relates generally to the sport of golf and more particularly, but not exclusively, to rangefinding in the context of golfing.

[0003] It is known to utilize rangefinding instruments while golfing to inform a golfer of the distance to a target, such as a hole or pin, on a golf course. Several laser-based rangefinders targeted to the golf market are commercially available. Such rangefinders with a club selection or club suggestion feature are also known. For example, such a rangefinder is disclosed in U.S. Patent Application Publication No. 2005/02211905 of Dunne et al. The rangefinder described in Dunne et al. collects data about a golfer’s hitting distances for various clubs and recommends a club based on that data and a distance to target as measured on the course. Dunne et al. discloses that various other sensors, such as a tilt sensor, can be incorporated into the rangefinder and purports to take tilt into account when recommending a club to the user. However, the only tilt-based adjustments mentioned in Dunne et al. are using a higher or lower numbered club in the case of a downward or upward tilt, respectively. Furthermore, the rangefinder described in Dunne et al. does not make any suggestion to the user other than the club to use.

[0004] Another rangefinder is disclosed in U.S. Patent Application Publication No. 2006/0077375 of Vermillion et al. The rangefinder described in Vermillion et al. determines a second range to a target based on a first range to the target and an angle to the target such that the parabolic trajectory of a golf ball is accounted for in determining the second range. The rangefinder described in Vermillion et al. includes range sensor for determining a first range to a target, a tilt sensor for determining an angle to the target, and a computing element for determining a second range to the target based on the first range and the determined angle. While Vermillion et al. may recommend a desired change in golf club selection, it does not does not make any other suggestion, such as a recommended swing speed. In addition, Vermillion et al. does not select one or more recommended clubs based on a hitter ability.

SUMMARY OF THE DISCLOSURE

[0005] According to one embodiment, a device for use while golfing comprises a rangefinder, a memory, a display, an input device, and a processor. The rangefinder determines a distance between a user and a target on a golf course. The memory stores data concerning a plurality of golf clubs, the data including a hitting distance for each of the golf clubs. The display can be viewed by the golfer. The input device receives from the user an indication of a selected hitter ability from at least two different hitter abilities. The processor is in communication with the rangefinder, the memory, the display, and the input device. The processor is configured to select, based on the distance, the hitter ability, and the data, a recommended golf club from of the plurality of golf clubs. The processor is further configured to cause the display to indicate the recommended golf club.

[0006] According to another embodiment, a method uses an electronic device in aid of golfing. The method determines a distance between a user and a target on a golf course and accesses data concerning a plurality of golf clubs, the data including a hitting distance for each of the golf clubs. The electronic device identifies, based on the distance, the data, and a hitter ability selected by a user from at least two different hitter abilities, a recommended golf club from the plurality of golf clubs. The electronic device displays the recommended golf club for viewing by the user.

[0007] According to yet another embodiment, a device for use while golfing comprises a rangefinder, a memory, a display, and a processor. The rangefinder can determine a distance between a user and a target on a golf course. The memory stores data concerning a plurality of golf clubs, the data including a hitting distance for each of the golf clubs. The display can be viewed by the user. The processor is connected to the rangefinder, the memory, and the display. The processor is configured to identify, based on the distance and the data, a recommended golf club from the plurality of golf clubs and to determine a recommended swing speed for a golfer to hit a golf ball with the recommended golf club. The processor is further configured to cause the display to indicate the recommended golf club and the recommended swing speed.

[0008] According to yet another embodiment, a method uses an electronic device in aid of golfing. The method receives an input from a user including a first hitting distance of a first golf club in a set of golf clubs. The method calculates a hitting distance for one or more of the other golf clubs in the set based on the first hitting distance and stores the first hitting distance and the one or more calculated hitting distances in memory. The method determines a target distance between the user and a target on a golf course. The method identifies, based on the target distance and the stored hitting distances, a recommended golf club from the set of golf clubs and displays the recommended golf club for viewing by the user.

[0009] Details concerning the construction and operation of particular embodiments are set forth in the following sections with reference to the below-listed drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a pictorial view of a device according to one embodiment.

[0011] FIG. 2 is an enlarged view of an electronic display as may be viewed through the eyepiece of the device of FIG. 1.

[0012] FIGS. 3A, 3B, 3C, 3D, and 3E are illustrations of various reticles for use on the display of FIG. 2.

[0013] FIG. 4 is a functional block diagram of one illustrative architecture of the device of FIG. 1.

[0014] FIG. 5 is a flowchart of a method according to one embodiment.

[0015] FIG. 6 is a diagram showing a trajectory of a golf ball.
DETAILED DESCRIPTION OF EMBODIMENTS

[0016] With reference to the above-listed drawings, this section describes particular embodiments and their detailed construction and operation. As one skilled in the art will appreciate, certain embodiments may be capable of achieving certain advantages over the known prior art, including some or all of the following: (1) aiding golfers to a greater extent; (2) providing golfers with swing speed guidance in addition to club selection guidance; and (3) providing more accurate ranging by more accurately taking account of the effects of inclination. These and other advantages of various embodiments will be apparent upon reading the following.

[0017] FIG. 1 is a pictorial view of a device 50 according to one embodiment. The device 50 is a portable handheld rangefinder with special features and capabilities for use when golfing. In this version, the device 50 comprises a rangefinder 54, which is a machine that measures the distance to a target. The rangefinder 54 may operate according to any principle, such as, for example, sonar, radar, or laser reflectometry. Presently, use of a laser-based rangefinder is preferred for the rangefinder 54. A laser-based rangefinder typically emits laser pulses to the target and detects reflections of those pulses through a lens 56. By measuring the time between emission and detection of the reflection, a range can be calculated. The shape of the laser beam may be elongated in the vertical direction by use of beam-shaping optics, a scanning beam, etc., to enable better ranging to a pin or flag in a golf hole, although a spot laser beam or other beam shapes may be used. The rangefinder 54 may be targeted using an integrated optical targeting sight 60 including an objective lens 62 and an eyepiece 64, through which a user views the distant target. Objective lens 62 focuses an image of the target at a first (front) focal plane (not shown) located medially of objective lens 62 and eyepiece 64. An erecting lens assembly (not shown) may be interposed between objective lens 62 and eyepiece 64 to invert the image and refocus it at a second (rear) focal plane (not shown) between the erecting lens assembly and eyepiece 64. A part of the erecting lens assembly may be movable in response to an optical power selector mechanism to adjust the optical power within a predetermined range of magnification.

[0018] A power button 66, when depressed, turns on certain electronics of the device 50 and causes the rangefinder 54 to emit laser pulses and acquire range readings. The device 50 also has a pair of menu interface buttons 68 for operating menus for inputting setup information and enabling functions of the rangefinder 54, as described in more detail in U.S. patent application Ser. No. 11/265,546, entitled “Rotary Menu Display and Targeting Reticles for Laser Rangefinders and the Like,” filed Nov. 1, 2005, which is incorporated herein by reference.

[0019] FIG. 2 is an enlarged view of an electronic display 100 as may be viewed through the eyepiece 64 of the device 50. The display 100 is preferably placed in the field of view of the targeting sight 60 of the device 50. The display 100 is preferably formed by a transmissive LCD display panel placed between the objective lens 62 and the eyepiece 64 so as to not obscure the field of view. For example, the LCD panel may include transmissive electrodes formed of indium tin oxide (ITO). The visual elements on the display 100 (e.g., reticle 110, line-of-sight distance readout 120) may be reflective or opaque, or both, when active. A source of illumination (not shown) may optionally be provided for illuminating the active display elements to enhance their visibility in low ambient light conditions. The illumination source may be integrated in device 50 in such a manner so as to prevent illumination from being projected out of objective lens 62 toward the target. In other embodiments (not shown), display 100 may comprise any of a variety of visual display devices other than or in addition to an LCD display. For example, display 100 may comprise fiber optic displays, light emitting diodes (LEDs), organic light emitting diodes (OLEDs), active matrix liquid crystal displays (AMLCD) and others. Moreover, the display need not be located in the optical path. For example, a display such as an LCD, DLP, or another display outside of the optical path may project an image of the visual elements onto a prism or reversed beam splitter located in the optical path.

[0020] The display 100 may include a circular menu along its perimeter, which can be navigated using buttons the 66, 68 to select one or more of various functions of the device 50. The visual elements on the display 100 include a reticle 110, which indicates where the rangefinder 54 is pointed (i.e., where the laser beam of a laser-based rangefinder is directed) and thus where a measurement reading is taken. Below the reticle 110 is a line-of-sight distance readout 120, as measured by the rangefinder 54. This distance may be reported in meters, yards, or other units of length. Above the reticle 110 is a “true” distance readout 130. The true distance is calculated based on inclination measurements and possibly golf ball flight data to better account for the effects of elevation difference between the target and the golfer using the device 50. Details of those calculations are described below in this document. The display 100 also includes a suggested club indicator 140, which indicates a club that the device 50 recommends the golfer to use based on the line-of-sight distance, true distance, and possibly other factors. In addition, the display 100 furthermore indicates a suggested swing speed for the golfer to hit the ball using the suggested club in order to reach or move toward the target. The suggested swing speed is preferably indicated by means of a swing meter 150 or other graphical scale. Algorithms for selecting a club and determining a swing speed are described below in this document.

[0021] Along the perimeter of the display 100 are ball type selections 160, denoted “A,” “B,” and “C” in FIG. 2, corresponding to short, standard, and long-distance balls, respectively, for example. A greater or lesser number of ball types can be displayed. The user can make an appropriate selection to match the type of ball he or she is playing. The user can also choose between a default club selector 170 and a custom club selector 175. As described in greater detail below, the club selection and swing speed determination algorithms take into account range data for the various possible clubs. That data can be default values or can be customized data determined by training or programming the system for a specific user’s golfing characteristics—in particular, his or her historical or expected hit distances for various clubs.

[0022] The display 100 may also include one or more hitter abilities (not shown). For example, a pro, men’s, senior men’s, women’s, and senior women’s hitter ability may be denoted “1,” “2,” “3,” “4,” and “5” respectively. A greater or lesser number of hitter abilities can be used and/or
displayed. The user can make an appropriate selection to best reflect the one or more hitter abilities that best reflects their hitting ability. As described in greater detail below, the club selection and swing speed suggestion algorithms can take into account the hitter ability when recommending one or more clubs. According to one embodiment, each golf club has associated with it a hitting distance, or range of hitting distances, for each hitter ability. For example, a pro hitter ability may have a hitting distance of 310 yards (or a range of 290 to 330 yards) associated with a driver, a men’s hitter ability may have a hitting distance of 255 yards (or a range of 250 to 280 yards) associated with a driver, and a women’s hitter ability may have a hitting distance of 195 yards (or a range of 190 to 220 yards) associated with a driver. In another embodiment, data concerning club range is scaled by a factor based on the hitter ability. For example, a pro hitter ability may have a factor of 1.5, a men’s hitter ability may have a factor of 1.3 and a women’s hitter ability may have a factor of 1.0. Assuming a driver has a hitting distance of 200 yards (or a range of 195 to 205 yards) and the user indicates that they have a pro hitter ability, the range may be scaled by a factor of 50 percent (e.g., multiplied by 1.5) to approximately 300 yards (or a range of 293 to 308 yards).

[0023] According to yet another embodiment, a user may indicate that they belong to more than one hitting ability. For example, the hitting abilities may include short hitter, mid hitter, and long hitter, male hitter, and female hitter. The user could indicate that they are a male hitter and then indicate that they have a long hitter ability, mid hitter ability, or short hitter ability. By way of example, a male short hitter may have a range of 200 to 250 yards with a driver, a male mid hitter may have a range of 230 to 260 yards with a driver, and a male long hitter may have a range of 260 to 290 yards with a driver. Likewise, a female short hitter may have a range of 150 to 170 yards with a driver, a female mid hitter may have a range of 170 to 190 yards with a driver, and a female long hitter may have a range of 190 to 220 yards. Other hitter abilities may include a PGA pro, LPGA pro, and an amateur, for example. In addition, the user may input a profile for a set of clubs. For example, the user may indicate that they are long with irons but short with woods.

[0024] According to still another embodiment, the user may enter a hitting distance, or range of hitting distances, for all or a subset of the user’s golf clubs. If the user enters a hitting distance for a subset of the user’s golf clubs, a hitting distance for one or more of the other golf clubs may be calculated based on the hitting distance(s) of two or more golf clubs in the subset, such as by using known interpolation or extrapolation techniques. For example, if the user has a hitting distance of 150 yards with a 5-iron and 130 yards with a 7-iron, a hitting distance of 140 yards with a 6-iron and 160 yards with a 4-iron could be inferred for the user. In addition, if the user enters hitting distance data for one golf club, a hitting distance for one or more of the other golf clubs may be calculated using a hitting distance increment between golf clubs. For example, if the user has a hitting distance of 150-yards with a 7-iron, a hitting distance of 160-yards with a 6-iron, 170-yards with a 5-iron, and 180 yards with a 4-iron can be calculated assuming a 10 yard increment between golf clubs. As discussed in greater detail with respect to FIG. 4, the user can enter some or all of their golf club information directly into device 50. In addition, the user can enter the information in other ways, such as via software that downloads data to device 50 using a wired or wireless connection.

[0025] Finally, the display 100 includes various other indicia, such as the user’s handicap 180, current temperature 190 or other sensed condition such as angle of inclination with respect to the target, and a battery charge indicator 195. In other versions of the display 100, the visual elements may be re-arranged, some elements shown in FIG. 2 may be omitted, and/or additional elements (e.g., current score, number of strokes on current hole, date and time, etc.) can be displayed. The display 100 may also display other information relating to the device 50, such as control or setup information.

[0026] Various reticles 110 are possible, which are shown for the sake of illustration in FIGS. 3A-3E. Preferably the user can select the desired reticle 110 to be displayed on the display 100. The device 50 may utilize different reticles under different conditions. For example, reticle 110 illustrated in FIG. 3A includes crosshairs having a transparent portion surrounding the point of intersection. This may help the user aim device 50 at a golf ball, golf green, golf hole, or pin or flag in the golf hole when rangefinder 54 emits a spot laser beam. Reticle 110 illustrated in FIG. 3D includes one rectangle inside of another rectangle. This may help the user aim device 50 at the pin or flag in a golf hole when rangefinder 54 emits a vertically elongated laser beam. Reticle 110 illustrated in FIG. 3C includes one rectangle inside of another rectangle. Both of the rectangles have a transparent portion along the center of the long axis of the rectangles. A horizontal crosshair extends laterally from the transparent portion. This may help the user aim device 50 at the golf ball, golf green, golf hole, or pin or flag in the golf hole when rangefinder 54 emits a spot laser beam or a vertically elongated laser beam. Reticle 110 illustrated in FIG. 3D includes a circle having an aiming point at its center. This may help the user aim device 50 at the golf ball, golf hole, or golf green when rangefinder 54 emits a spot laser beam. Reticle 110 illustrated in FIG. 3E includes a square having an aiming point at its center. This may help the user aim device 50 at the golf ball, golf hole, or golf green when rangefinder 54 emits a spot laser beam.

[0027] FIG. 4 is a functional block diagram of one illustrative architecture of the device 50. In FIG. 4, a bus-based architecture is illustrated, based on a bus 405. Other types of architectures are also suitable. A number of other components interface to the bus 405, including the rangefinder 54, a processor 410, a memory 420, a display driver 430, a user input interface 440, an external peripheral interface 450, other sensor interfaces 460, and a GPS (global positioning system) receiver 470. Other versions of the device 50 may have less than all of these components and/or may contain other components.

[0028] The processor 410 may be any form of processor and is preferably a digital processor, such as a general-purpose microprocessor or a digital signal processor (DSP), for example. The processor 410 may be readily programmable, hard-wired, such as an application specific integrated circuit (ASIC); or programmable under special circumstances, such as a programmable logic array (PLA) or field programmable gate array (FPGA), for example. Program
memory for the processor 410 may be integrated within the processor 410, may be part of the memory 420, or may be an external memory.

[0029] The processor 410 executes one or more programs to control the operation of the other components, to transfer data between the other components, to associate data from the various components together (preferably in a suitable data structure), to perform calculations using the data, to otherwise manipulate the data, and to present results to the user. For example, the processor 410 preferably executes a club selection and swing speed determination algorithm.

[0030] The memory 420 may store default club distance data, custom club distance data, programs executed on the processor 410, and other data (e.g., map graphic files). The memory 420 may be permanent or removable.

[0031] The display driver 430 can interface with the processor 410 and the display 100 to present, for example, in textual and/or graphical form the club selection and swing speed suggestions calculated by the processor 410. Some versions of the system 100 may not include the display 100, in which case the display driver 430 may instead drive an external display wirelessly or via a wired connection. The external display may be a PDA (personal digital assistant), handheld computer, mobile phone, dedicated display unit for the device 50, printer, or the like.

[0032] The user input interface 440 may interface to one or more user input devices, such as the buttons 66 or other controls.

[0033] The external device interface 450 allows for connection to an external device, such as another computer, a display screen, a printer, etc. The external device interface 185 preferably provides an industry standard interface, such as a wireless or wired connection. In the case of a wired connection, a data bus may be provided using any protocol, such as Advanced Technology Attachment (ATA), Personal Computer Memory Card International Association (PCMCIA), and/or Universal Serial Bus (USB), for example. The wireless connection may use low powered electromagnetic waves to transmit data using any wireless protocol, such as Bluetooth™, WiFi, or IEEE 802.11, for example. Any of the components illustrated in FIG. 4 as being directly connected to the bus 405 may instead be external peripherals connected via the external device interface 450. For example, the rangefinder 54, rather than being directly connected to the internal bus 405, may be a separate external device connected via the external device interface 450.

[0034] One particular example of an electronic device connectable to the device 50 via the external device interface 450 is a computer, to which the device 50 connects as a peripheral. Such a computer may be a personal computer, a handheld computer such as a PDA (personal digital assistant) or smart mobile phone, or the like. Taking advantage of the external computer's expanded user interface can simplify certain data-entry tasks for the user, such as entering characteristics of the user's clubs (e.g., available irons, available woods, and associated face or loft angles), ball data, the user's distance performance characteristics (i.e., how far he or she hits the ball) for each club in the user's set, the one or more hitter abilities that best reflects their hitting ability, and data regarding course layout for a selected golf course. Club data (e.g., loft angles and default distances for the average user of such clubs), ball data, and course layout are preferably made available by the club or ball manufacturers or seller or golf courses for downloading by the user. Preferably the user enters several custom distances for each club by swing speed (or suitable approximation, such as hard swing, medium swing, soft swing) so that a swing speed profile can be constructed for each club. This data can be obtained by the user hitting balls at a driving range and noting the club used, speed of swing, and length of hit. Alternatively, the computer may execute a software program to query the user about his or her golf experience in order to deduce or estimate the user's distance data for various clubs. For example, data about the user's gender, height, weight, golf experience, handicap, etc. can be used to adjust default club-distance values.

[0035] Other sensors may optionally be a part of the device 50 or connectable to the device 50. Such other sensors include an inclinometer (i.e., tilt sensor), temperature sensor, a humidity sensor, an altimeter, an anemometer, a compass, and a barometer, for example. With knowledge of the variable(s) measured by the one or more sensors, the processor 410 can calculate the density of air or other parameters affecting a golf ball's flight.

[0036] The device 50 may also optionally include or be able to communicate with a GPS receiver 470, which can determine the location of the device in terms of altitude, longitude, and altitude. In addition, device 50 and/or GPS receiver 470 may include an altimeter to provide altitude readings. Armed with that information and altitude-longitude-altitude data regarding possible targets on the golf course, the device 50 can compute line-of-sight distance and inclination without utilizing the rangefinder 54 or other sensors. The club selection and swing speed suggestion algorithms described herein can operate on such data, whether obtained from a GPS receiver, a rangefinder and inclinometer, or otherwise.

[0037] FIG. 5 is a flowchart of a method 500 that may be performed by or with the aid of the device 50, according to one embodiment. The method 500 determines (510) a line-of-sight (LOS) distance between the golfer (more particularly the device 50) and the target. This step is preferably performed using the rangefinder 54, but it may be performed in other ways. For example, using the GPS receiver 470 to determine the golfer's current location and accessing target position data, which may be supplied by the golf course, a processor can calculate a distance between those two points in space. As another example, a golfer with an electronic device can estimate the distance to the target or observe printed distance markers on the golf course and enter that distance in the electronic device, which can perform the method 500. The method 500 also determines (520) an inclination to the target with respect to the golfer or the device 50. This is preferably performed by an inclinometer that is part of the device 50 and is preferably performed at the time of distance LOS ranging.

[0038] Next the method 500 computes (530) an adjusted distance based on the LOS distance and the inclination. According to one embodiment, the adjusted distance may be an equivalent horizontal range. With reference to FIG. 6, diagram 600 illustrates the pin or hole 605 located on a hill 610. For purposes of illustration, the trajectory curve 620, angle, and hill 610 are greatly exaggerated and not to scale.
The pin 605 is elevated above the golfer (represented by the intersection of the x-axis and y-axis) at an angle of inclination of theta, $\theta$. As previously described, method 500 determines (510) the LOS distance 615 between the golfer and the pin 605 and determines (520) an inclination theta, $\theta$, to the pin 605 with respect to the golfer. A trajectory 620 of a golf ball depends on many factors, including the drag generated by the dimples on the ball, the spin rate of the ball, the terminal velocity of the ball, the wind force, the launch velocity, and ball bounce, and roll on inclined planes. An equivalent horizontal range 625 helps the golfer determine the range at which the golfer should aim in order to reach a pin 605. For example, although the pin 605 is located a horizontal distance 630 from the golfer, for example 120 yards, the ball would fall short of pin 605 if the golfer hit the ball expecting it to travel 120 yards. By taking the trajectory of the ball into consideration, the equivalent horizontal range 625, for example 130 yards, may be calculated. Armed with the equivalent horizontal range 625, the golfer can hit the ball as though the pin 605 was 130 yards away on level ground. In addition, a predicted roll and bounce of the ball may be factored in.

The equivalent horizontal range 625 is a function of the LOS distance and the angle of inclination, or $f(LOS, \theta)$. The trajectory 620 may be defined by a polynomial equation or set of polynomial equations that can be solved to determine the equivalent horizontal range 625 based on the LOS distance, the angle of inclination, and other factors. By way of example, knowing the LOS distance 615 and angle of inclination, $\theta$, the elevation of the pin 605 above ground (e.g., the x-axis) may be calculated. Because the trajectory 620 of the ball may be thought of as a vertical and horizontal position over time, the curve and its polynomial equation may be solved to ensure that at the time the ball intersects with the pin 605, it has an elevation equal to the elevation calculated using the LOS distance 615 and angle of inclination, $\theta$. An imaginary trajectory 620 can then be extended through the hill 610 to a point horizontally located from the golfer (e.g., where the ball would intersect the x-axis but for the hill 610). The equivalent horizontal range 625 can then be calculated as the horizontal distance between the golfer and the imaginary point at which the ball intersected the x-axis. In addition, the equivalent horizontal range 625 may be a function of an initial velocity of a golf ball, an altitude of the golfer above sea level, a barometric pressure, an ambient temperature, a relative humidity, and possibly other factors.

Further, the adjusted distance may be a true distance analogous to TRUE BALLISTIC RANGE™, which is an equivalent horizontal range that takes into account inclination, as described in U.S. patent application Ser. No. 11/555,591, entitled “Ballistic Ranging Methods and Systems for Inclined Shooting,” filed Nov. 1, 2006, which is incorporated herein in its entirety. The principles disclosed in that application can be applied to golf ball flight trajectories, the primary differences being in the aerodynamics of a golf ball as compared to a bullet, the dependence of take-off direction on the club used (higher numbered clubs resulting in a steeper take-off direction, and lower numbered clubs resulting in a more level take-off direction), and the dependence of initial ball velocity on swinging speed. For a number of different club and swing speed combinations, the processor 410 or other suitable processor can determine a number of different calculated shot positions using the equations and principles set forth above and in the above-referenced application and then choose the most appropriate combination or a few of the most appropriate combinations at steps 550 and 690 and display them at step 570. Iterative techniques can be applied to fine tune the swing speed to a more precise value for a given club. When there are multiple appropriate combinations, the displaying step 570 may cycle sequentially through the combinations of recommended club selection and corresponding swing speed for each club or display some or all of them simultaneously to the extent the display 100 has the space and capability to do so.

Other methods of calculating an adjusted distance are taught in the prior art.

As part of the foregoing, the method 500 accesses (540) the player’s club-distance data, which may be default values, custom values, values based on the hitter ability, or some combination of these.

Optionally, the method 500 may also determine a type of golf ball to use for the shot. Different golf balls have different flight or ballistic characteristics. Some balls are designed for maximum carry, others for shorter distances with more predictable flight. Thus, the club-distance data accessed at step 540 may be club-ball-distance data. Ball type is another variable that can be chosen and suggested to the golfer. In this case, the method 500 performs an additional step (not shown) to select a club. This may be performed, for example, by calculating final ball positions based on trajectory calculations for a number of different ball-club-swing speed combinations and choosing the closest one or closest few.

The method 500 may calculate and/or recommend only a club, both a club and a swing speed, both a club and ball type, all three, or any other combination of the three. Thus, the swing speed determining step 560 is optional. In addition, the method 500 may select (550), based on the hitter ability, the determined LOS distance, the adjusted distance, and/or the club-distance data, one or more recommended clubs. This may involve the additional steps (not shown) of selecting the hitting ability from multiple different hitting ability groups, for example a pro, men’s, senior men’s, women’s, and senior women’s hitting ability, and scaling the data concerning the hitting distances associated with the golf clubs by a factor based on the hitter ability.

In addition, the displaying step 570 may display other information, such as the LOS distance, the true distance, and other measured variables. For example, the temperature display 190 can alternate display inclination angle for a period of time, say, for example, about five seconds, before reverting to a temperature readout.

The device 50 may have additional capabilities, and the method 500 may perform other functions, not necessarily illustrated in the drawings. For example, the device 50 can include a handicap tracker and can display the player’s handicap 190, as illustrated in FIG. 2. As another example, the device may have a capability to count strokes by hole or by round, such as by activation of a button after each stroke, and update a cumulative score for the round with respect to par.

As yet another example, the device 50 can be used to range to the golf ball after the shot is completed. This can provide immediate feedback to the player regarding hitting
distance. This measured range can also be used to supplement the player's club-distance database. Entries in this database can be time-stamped. When enough data is accumulated in the database, it better represents the user's abilities. If the data is time-stamped and sufficiently copious, then the accessing step S40 can filter the data, such as by a exponentially weighted window over time so as to give greater weight to more recent data. If compass bearing and inclination are also measured at the time of ranging to the hit ball, then the location of the hit ball can be calculated. This location can be displayed on a map to provide a graphical depiction of the user's play for a particular hole or an entire round. This calculated location can also be used to determine a range to the next target.

[0048]  The algorithms for operating the methods and systems illustrated and described herein can exist in a variety of forms both active and inactive. For example, they can exist as one or more software or firmware programs comprised of program instructions in source code, object code, executable code or other formats. Any of the above can be embodied on a computer-readable medium, which include storage devices and signals, in compressed or uncompressed form. Exemplary computer-readable storage devices include conventional computer system RAM (random access memory), ROM (read only memory), EPROM (erasable, programmable ROM), EEPROM (electrically erasable, programmable ROM), flash memory and magnetic or optical disks or tapes. Exemplary computer-readable signals, whether modulated using a carrier or not, are signals that a computer system hosting or running a computer program can be configured to access, including signals downloaded through the Internet or other networks. Concrete examples of the foregoing include distribution of software on a CD ROM or via Internet download. In a sense, the Internet itself, as an abstract entity, is a computer-readable medium. The same is true of computer networks in general.

[0049]  The terms and descriptions used herein are set forth by way of illustration only and are not meant as limitations. Those skilled in the art will recognize that many variations can be made to the details of the above-described embodiments without departing from the underlying principles of the invention. For example, the “target” about which a note is made may be a geological, geographical, botanical, cartographical, human, or social feature or condition. In the following listing of claims, all terms are to be understood in their broadest reasonable sense unless otherwise indicated, and equivalents of the claims' terms and elements are expressly reserved within the scope of this invention.

1. A device for use while golfing, the device comprising:
   a rangefinder that determines a distance between a user and a target on a golf course;
   a memory storing data concerning a plurality of golf clubs, the data including a hitting distance for each of the golf clubs;
   a display that can be viewed by the user;
   an input device for receiving from the user an indication of a selected hitter ability from at least two different hitter abilities; and
   a processor in communication with the rangefinder, the memory, the display, and the input device, the processor being configured to select, based on the distance, the hitter ability, and the data, a recommended golf club from the plurality of golf clubs, the processor being further configured to cause the display to indicate the recommended golf club.

2. A device as set forth in claim 1, further comprising an inclinometer mounted in alignment with the rangefinder so as to measure an inclination of a line-of-sight between the user and the target and wherein the processor is in communication with the inclinometer and wherein the distance includes an adjusted distance based on the inclination and a line-of-sight distance from the user to the target.

3. A device as set forth in claim 2, wherein the display depicts at least one of the distance and the adjusted distance.

4. A device as set forth in claim 1, wherein the processor is configured to determine a swing speed for a golfer to hit a golf ball with the recommended golf club, the processor being further configured to cause the display to indicate the determined swing speed and the display depicts a meter to indicate the determined swing speed.

5. A device as set forth in claim 1, further comprising:
   one or more sensors selected from the group comprising a temperature sensor, a humidity sensor, an altimeter, an anemometer, a compass, and a barometer, wherein said one or more sensors are connected to the processor such that the processor can access one or more variables measured by the sensors, and wherein the processor selects the recommended golf club based on the one or more measured variables.

6. A device as set forth in claim 1, wherein the input device allows the user to indicate a type of golf ball such that the processor can access the indicated golf ball type, and wherein the processor selects the recommended golf club based on the indicated golf ball type.

7. A device as set forth in claim 1, further comprising:
   an interface port for connecting to a computer apart from the device, and
   wherein the data concerning the plurality of golf clubs is custom data for a golfer transferred to the device via the interface port.

8. A device as set forth in claim 1, wherein the data stored in the memory further concerns a plurality of different golf balls, and wherein the processor is further configured to select a golf ball to hit with the recommended golf club, the processor being further configured to cause the display to indicate the golf ball.

9. A device as set forth in claim 1, wherein the data includes for each golf club a hitting distance for a soft swing speed, a medium swing speed, and a hard swing speed.

10. A device as set forth in claim 1, wherein the data includes for each golf club a hitting distance for each of the different hitter abilities.

11. A device as set forth in claim 1, wherein the data concerning the plurality of golf clubs is scaled by a factor based on the hitter ability.

12. A device as set forth in claim 1, wherein the hitting distance includes a range of hitting distances.
13. A method of using an electronic device in aid of golfing, the method comprising:
   determining a distance between a user and a target on a golf course;
   accessing data concerning a plurality of golf clubs, the data including a hitting distance for each of the golf clubs;
   the electronic device identifying, based on the distance, the data, and a hitter ability selected by a user from at least two different hitter abilities, a recommended golf club from the plurality of golf clubs; and
   the electronic device displaying the recommended golf club for viewing by the user.
14. A method according to claim 13, further comprising determining an inclination of a line-of-sight between the user and the target and computing an adjusted distance on the basis of the determined distance and the inclination and wherein the step of identifying the recommended golf club is based on the adjusted distance.
15. A method according to claim 13, wherein the data includes for each golf club a hitting distance for each of the different hitter abilities.
16. A method according to claim 13, further comprising scaling the data by a factor based on the selected hitter ability.
17. A method according to claim 13, where the step of determining the distance includes measuring a line-of-sight distance using a laser rangefinder.
18. A method according to claim 13, wherein the step of determining the distance between the user and the target comprises:
   determining a position of the user utilizing a GPS system;
   determining a position of the target utilizing a map; and
   computing, based on the position of the user and the position of the target, the distance.
19. A method as set forth in claim 13, further comprising:
   determining, based on the determined distance and the recommended golf club, a recommended swing speed for a golfer to hit a golf ball with the recommended golf club; and
   displaying for viewing by the user the recommended swing speed.
20. A method as set forth in claim 14, wherein the step of computing an adjusted distance is based on one or more of the following:
   (a) an initial velocity of a golf ball;
   (b) an altitude of the user above sea level;
   (c) a barometric pressure;
   (d) an ambient temperature; and
   (e) a relative humidity.
21. A method as set forth in claim 13, wherein the hitting distance includes a range of hitting distances.
22. A device for use while golfing, the device comprising:
   a rangefinder that can determine a distance between a user and a target on a golf course;
   a memory storing data concerning a plurality of golf clubs, the data including a hitting distance for each of the golf clubs;
   a display that can be viewed by the user; and
   a processor connected to the rangefinder, the memory, and the display, the processor being configured to identify, based on the distance and the data, a recommended golf club from the plurality of golf clubs and to determine a recommended swing speed for a golfer to hit a golf ball with the recommended golf club, the processor being further configured to cause the display to indicate the recommended golf club and the recommended swing speed.
23. A device as set forth in claim 22, further comprising:
   an inclinometer held in alignment with the rangefinder so as to measure an inclination of a line-of-sight between the user and the target, wherein the rangefinder is connected to the processor such that the processor can access the measured inclination, wherein the processor is further configured to compute an adjusted distance based on the distance determined by the rangefinder and the measured inclination, and wherein the processor identifies the recommended golf club and determines the recommended swing speed based on the adjusted distance.
24. A device as set forth in claim 22, wherein the display depicts the adjusted distance.
25. A device as set forth in claim 22, further comprising:
   one or more sensors selected from the group comprising
   a temperature sensor, a humidity sensor, an anemometer, an altimeter, an anemometer, a compass, and a barometer, wherein said one or more sensors are connected to the processor such that the processor can access one or more variables measured by the sensors, and wherein the processor selects the recommended golf club and determines the recommended swing speed based on the one or more measured variables.
26. A device as set forth in claim 22, wherein the display depicts a graphical scale to indicate the recommended swing speed.
27. A device as set forth in claim 22, wherein the data concerning the plurality of golf clubs comprises for each golf club a soft swing speed, a medium swing speed, and a hard swing speed.
28. A device as set forth in claim 22, further comprising an input device connected to the processor for receiving from the user an indication of a selected hitter ability from at least two different hitter abilities, and wherein the data includes for each golf club a hitting distance for each of the hitter abilities and the processor identifies the recommended golf club based on the selected hitter ability.
29. A device as set forth in claim 22, further comprising an input device connected to the processor for receiving from the user an indication of a selected hitter ability from at least two different hitter abilities, and wherein the data concerning the plurality of golf clubs is scaled by a factor based on the hitter ability and the processor identifies the recommended golf club based on the selected hitter ability.
30. A device as set forth in claim 22, wherein the hitting distance includes a range of hitting distances.
31. A method of using an electronic device in aid of golfing, the method comprising:
receiving an input from a user including a first hitting distance of a first golf club in a set of golf clubs;
calculating a hitting distance for one or more of the other golf clubs in the set based on the first hitting distance;
storing the first hitting distance and the one or more calculated hitting distances in memory;
determining a target distance between the user and a target on a golf course;
identifying, based on the target distance and the stored hitting distances, a recommended golf club from the set of golf clubs; and
displaying the recommended golf club for viewing by the user.

32. A method as set forth in claim 31, wherein the input includes a second hitting distance for a second golf club in the set and the hitting distance for one or more of the other golf clubs in the set is interpolated based on the first hitting distance and the second hitting distance.

33. A method as set forth in claim 31, wherein the input includes a second hitting distance for a second golf club in the set and the hitting distance for one or more of the other golf clubs in the set is extrapolated based on the first hitting distance and the second hitting distance.

34. A method as set forth in claim 31, wherein the hitting distance for one or more of the other golf clubs in the set is calculated based on a hitting distance increment between golf clubs.