Title: A METHOD OF CAPTURING, DISPLAYING AND ANALYSING GOLF RELATED DATA AND APPARATUS THEREOF

Abstract: A method of capturing data to be used in a computer analysis system that analyses shots, played at different times on a golf course hole, relative to the position of features of the golf course hole in order to provide an indication of how to improve playing a hole, the method including the steps of capturing positional data based on a position of a golf ball by initiating an electronic positional data capture device to measure the current position of the positional data capture device, and storing the positional data
A METHOD OF CAPTURING, DISPLAYING AND ANALYSING GOLF RELATED DATA AND APPARATUS THEREOF

FIELD OF THE INVENTION

The present invention relates to a method of capturing, displaying and analysing golf related data and apparatus thereof.

BACKGROUND

When a golfer plays a golf course, in order to play the hole to the maximum of their ability they are required not only to be technically sound in the way they hold their club, stand and strike the ball, but must also be able to identify how best to play the hole. That is, for a golfer to improve their performance when playing a golf hole, they should determine where each of the shots they are playing should be directed in order to minimise the number of shots being taken to reach the pin.

A number of devices are available to golfers for use as an aide while playing the game. These devices generally provide a measuring system in order to provide a distance value to the pin or another object. Based on the distance measured, the golfer is able to select a suitable club based on his knowledge of how far he can hit a ball with the club. There are also devices that can also be used as an automatic score card to record the number of shots the golfer has taken to complete each hole.

US patent application, no. US 2004/0147329 by Meadows et al., describes a navigation system that enables a golfer to view Geographic Information Services (GIS) data for golf courses. The device may be a Personal Digital Assistant (PDA) with a Global Positioning System (GPS) incorporated therein that displays a view of the hole and the golfer's current position. Information is displayed showing the distance from the golfer to the pin. However, this device makes no use of data associated with how a golfer has previously played the hole, and merely provides current positional data to enable a user to direct the ball towards a desired object.
US patent application, No. US 2003/0149496 by Johnson, describes a device that records directional characteristics, such as whether a golf ball has landed in the centre of a fairway, or to the left or right of the fairway. This data collected is analysed for all rounds the golfer has played and so is not specific to any particular holes. Therefore, the data does not enable a golfer to improve playing performance of a specific hole.

US patent application, No. US 2004/0204782 by Kim, describes a device that enables a golfer to manually enter data as they play a golf course hole. The data entered does not include the analysis of shot positions in order to provide a golfer with an indication of how to improve playing the hole. The golfer merely enters their best guess at the remaining distance to the hole, as well as information such as whether the ball has landed on the fairway, in the rough or is out of bounds.

US patent application, US 5,810,680, by Lobb et al., describes a complex device that records the position of a golfer using GPS, and provides a calculated distance from the golfer to the pin. No information is provided that enables the analysis of shots relative to golf course hole features in order to provide an indication of how to improve how the hole is played.

US patent application, No. US 2005/0125242 by Butler, describes a booklet that enables a golfer to manually record various elements of how they play a golf course hole, such as the club used, and approximate distance and location of each shot. The system described relies on the user entering accurate information as well as the ability to analyse and deduce from the entered information any valuable guidance.

Various US patents, US 3,820,786, US 3,937,466 and US 3,949,987 by Candor, describe a book or kit for laying out a game plan of how to play a golf hole. The book or kit provides a golfer with a layout of a golf hole prior to playing it in order to allow them to determine their game plan. During play, the golfer may then indicate manually their approximate position in order to compare their game plan with the actual play. However, the user is not able to accurately enter detailed
positioning of the ball, nor are they provided with a device that provides an
indication of how to improve playing the hole.

None of the documents discussed describe a device that provides a golfer with
an indication of how to improve playing a hole. Many of the devices merely
provide data related to the golfer's current game being played. For example, the
information provided is merely a distance value to the next target, or an
accumulated number of shots. This information may be useful to allow a golfer to
determine what to do as a next shot in terms of getting the ball near to the pin, or
avoiding an object, but does not provide any indication to the golfer on how they
can improve playing the hole next time it is played.

Further, many of the described devices are not discrete devices that would be
permitted on a golf course. They include large display screens of information that
may not be allowed on the course, as well as having output and warning signals
that may prove a distraction to fellow players and users of the golf course.
Further, the use of such devices may contravene the rules of particular golf
course clubs, which can result in the user being banned from a club or regarded
as a cheat by his fellow golfers. For example, the devices may contravene the
rules of the R&A (Royal and Ancient) and the US golf association. As GPS
devices are not allowed on tournaments unless the device provides no advantage
to the golfer at the time.

At least some of the devices discussed above are large and/or cumbersome
devices that involve a lot of interaction between the golfer and the device while
the golf hole is being played, thus distracting the golfer from the many other
factors of the game, such as concentrating on the correct grip of the club or
ensuring they have the correct stance for taking the shot:

The present invention aims to overcome, or at least alleviate, some or all of the
afore-mentioned problems, or to at least provide the public with a useful choice.
SUMMARY OF THE INVENTION

In one aspect, the present invention provides a method of capturing data to be used in a computer analysis system that analyses shots, played at different times on a golf course hole, relative to the position of features of the golf course hole in order to provide an indication of how to improve playing a hole, the method including the steps of: capturing positional data based on a position of a golf ball by initiating an electronic positional data capture device to measure the current position of the positional data capture device, and storing the positional data.

In a further aspect, the present invention provides a positional data capture device for capturing data to be used in a computer analysis system that analyses shots, played at different times on a golf course hole, relative to the position of features of the golf course hole in order to provide an indication of how best to play the hole, the positional data capture device arranged to detect the current position of the positional data capture device, the positional data capture device including a position sensing device, a processor, a memory device and at least one button, whereupon pressing a single button, the position sensing device is arranged to detect the current position of the positional data capture device and the processor is arranged to store the current position in the memory device as ball positional data.

In yet a further aspect, the present invention provides a computer analysis system arranged to analyse ball positional data, based on multiple golf ball positions captured during multiple plays of a golf course hole, relative to feature positional data, based on the position of features of the golf course hole, the system further arranged to provide an indication of how best to play the hole.

In yet a further aspect, the present invention provides a computer analysis method including the steps of analysing ball positional data, based on multiple golf ball positions captured during multiple plays of a golf course hole, relative to feature positional data, based on the position of features of the golf course hole, and providing an indication of how best to play the hole.
In yet a further aspect, the present invention provides a golf improvement system including a data capture device arranged to catch positional data, an analysis system arranged to analyse the positional data and further arranged to determine how a user may improve their golf game, and a display system arranged to display information that instructs the user on how to improve their golf game.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

- **Figure 1** shows a block diagram of a positional data capture device according to an embodiment of the present invention;
- **Figure 2** shows a flow diagram when using the data capture device according to an embodiment of the present invention;
- **Figure 3** shows a system block diagram according to an embodiment of the present invention;
- **Figure 4** shows an example of an image of a golf course hole with various features associated with that hole displayed according to an embodiment of the present invention;
- **Figure 5** shows an image of the golf course hole with a number of smart zones indicated according to an embodiment of the present invention;
- **Figure 6** shows a system diagram of a data analysis system according to an embodiment of the present invention;
- **Figure 7** shows an example of a graphical display showing the various features of a golf course hole with icons depicting the various locations of a golf ball as the hole is played by a golfer according to an embodiment of the present invention;
- **Figure 8** shows a graphical representation of a display provided to a PC from a web server based on information determined by a data analysis system according to an embodiment of the present invention;
- **Figure 9** shows an example of a display indicating various shot distances made for certain types of golf club according to an embodiment of the present invention;
Figure 10 shows an example of a display indicating the spread of shots taken when using specific types of club for all courses according to an embodiment of the present invention;

Figure 11 shows a further example of a display indicating the spread of shots taken when using specific types of golf club for all courses according to an embodiment of the present invention;

Figure 12 shows a system block diagram for an instructional information system according to an embodiment of the present invention;

DETAILED DESCRIPTION OF THE INVENTION

First Embodiment

Figure 1 shows a block diagram of a positional data capture device 101 that is used to capture positional data for use in a computer analysis system. The data capture device includes a microprocessor 103, a memory device 105, a Global Positioning System (GPS) device 107, a push button device 109 and a data transfer device 111. The microprocessor is in communication with the memory, GPS device and push button device. The device 101 also includes a power source, such as a battery.

The memory device 105 of the data capture device 101 in this embodiment is a memory card such as a CompactFlash (CF) card, Secure Digital (SD) card and the like. Alternatively a flash drive may be used as the memory device with a USB connection to enable simple transfer of the data. Alternatively, the memory may be an internal memory device.

The data capture device 101 is a discrete device that is portable. The device may be held manually, in the pocket of the user, attached to the belt of the user, or located in any other place such that it does not interfere with the golfer as they play their game.

When the push button device 109 is pressed by the user, the microprocessor sends a signal to the GPS device 107. The GPS device 107 then obtains
geographical positioning information in the form of latitude and longitude readings under control of the microprocessor 103. The microprocessor 103 stores the readings in the memory device 105. The microprocessor 103 controls the data transfer device 111 to allow the data stored in the memory 105 to be transferred externally.

As the data capture device 101 is discrete, it is easily carried by a golfer when playing a round of golf. The data capture device 101 is used by the golfer to capture the ball positions of the golf ball before each shot.

Figure 2 shows a flow diagram when using the data capture device of this embodiment in use. At step 201, the golfer approaches the tee in order to take their first shot off the tee towards the pin. Prior to taking the shot, as the golfer is located near, in proximity, or over the ball, the golfer presses the button 109 to capture the ball position, as shown at step 203. At step 205, the GPS device 107 captures the current latitude and longitude readings of the device's location, and the microprocessor 103 stores those readings in the memory device 105. The golfer then takes their shot at step 207. The golfer then determines if the round of golf has ended at step 209, and if so, at step 213 the process ends. If the game has not finished the golfer approaches the next ball position at step 211. The steps from 203 to 209 are then repeated until the round of golf has been completed.

The tee and pin positions are stored as predefined waypoints. If the button is pressed near a predefined waypoint, the system determines that the round has ended, either because the player has reached the 18th hole, or because the player has reached a tee on a 1st hole.

The operation of the data capture device 101 is very simple and only requires the golfer to press a single button on the device at each ball position. With consecutive or sequential presses of the button, the position of the golf ball is recorded as it is played around the course.
The captured positional data in the data capture device 101 is stored in memory until after the golfer has completed their round of golf. The data is uploaded from the data capture device 101 to a computer analysis system for analysis at a later time, as will be explained below.

As the data capture device 101 is discrete it does not interfere with the golfer's game. Further, as the data capture device 101 is simple to operate due to the single one press operation of a single button, the golfer does not need to use any great amount of concentration to operate the device and so enables them to concentrate on playing the individual shots correctly.

Figure 3 shows a system block diagram according to this embodiment. The system includes the data capture device 101 connected to a computer device 301, such as a personal computer (PC), via a communication channel 303. The PC 301 has a connection to the Internet 305 via any suitable connection means, such as a hard-wired or wireless connection. A web server 307 is accessible via the Internet 305. The web server 307 is in connection with a database 309 and a data analysis system 311.

A golfer can use the PC 301 to upload the positional data from the data capture device 101 via the data transfer device and the communication channel 303. In this embodiment, the communication channel represents the transfer of the data from the memory card to the PC.

Alternatively, the communication channel 303 may be any suitable channel such as a Bluetooth communications interface, an Infra red interface or a hard wired interface, for example. Other types of connections are also envisaged that allow data to be transferred from the data capture device 101 to the PC 301. The uploaded positional data is stored by the PC in its local memory after it is transferred from the data capture device 101.

The golfer uses the PC 301 to connect to a suitable website that enables the stored positional data to be transferred via the web server 307 to the database.
The positional data stored in the database 309 may then be analysed by the data analysis system 311.

The website is accessed by the golfer through the use of a suitable user name and password. The golfer can obtain a user name and password by registering with the website after purchasing the data capture device. The website enables the user to store in the database 309 all the positional data of all rounds of golf for all golf courses that the website has Geographic Information Services (GIS) data stored for. That is, the website has access to GIS data associated with any number of different golf courses and their associated holes. The GIS data provides latitude and longitude positional data for all the features of the golf course. By analysing the position of the golf ball after each shot during each round of golf for a particular hole, relative to the features of the golf course hole, it becomes possible to provide an indication to the golfer of how to improve playing the hole. The indication provided may be based on the comparison of the player’s performance profile with an indication of how best to play the hole.

Further, data can be transmitted back to the PC 301 from the web server 307 to display an image of the golf course hole depicting the features of the hole. This enables a graphical image to be displayed on the PC 301 based on the physical layout of the golf course hole where the physical layout includes an indication of the position of the golf course hole’s features. The web server 307 also transmits back to the PC 301 the positional data of the golf shots made that are associated with that golf course hole, and indicates on the displayed golf course hole image where the different ball positions were located by displaying an icon for each ball position.

Further details of how the computer data analysis system 311 provides an indication of how to improve playing a hole of a golf course is now provided.

Various data is stored in the database 309 to enable the data analysis system 311 to analyse and provide to the golfer information that enables them to improve the way they play a particular golf course hole, or to enable them to improve certain aspects of their golf.
As mentioned above, the database stores positional data of the features of each golf course hole that the website provides analysis on. The features include, but are not limited to, the tee, the pin, the green, the fairway, rough areas, bunkers, trees or bushes, slopes, water features, and out of bounds areas. Positional data is in the form of latitude and longitude data points that define the position or geographical area covered by the feature. The information may be obtained from various sources that have the information readily available, such as, for example, local authorities, the golf course itself or a map data collection services, or may be obtained by manually collecting the data when at the golf course.

Figure 4 shows an example of an image of a golf course hole with various features associated with that hole displayed. The hole includes a number of different tees 401, two fairways 403, a green 405, various groups of trees 407, a left rough 409, a right rough 411, a water hazard 413 and an out of bounds area 415.

The database also includes all the uploaded golf ball positional data for any holes that have been previously played by users subscribed to the system. The ball positional data is associated with a particular hole of a particular course. The data is also in the form of latitude and longitude data points collected by the GPS system and transferred for storage in the database via the website and its server.

Alternatively, it will be understood that the positional data may be any other suitable format other than or in combination with latitude and longitude data points, such as Cartesian points, for example.

Data in the form of statistics is also stored for each golfer registered with the system. The statistics may include but are not limited to, for example, the minimum, maximum and average distances hit by the golfer for different golf clubs, accuracy data for particular shots using certain clubs, consistency data indicating the number of shots that are on the fairway.
Further, the database holds instructional data for providing instructions and
guidance to the golfer based on the analysis carried out by the analysis system
on the data stored in the database. The instructions provided are intended to
help the golfer improve the way they play golf in general or to improve how the
golfer can play a particular hole of a golf course.

The database also stores smart zone positional data. Smart zones are specified
zones or defined areas on the golf course hole that surround a target point that
has been defined as being the ideal point which a golfer should aim for in order to
play the hole efficiently, or to best play the hole. The smart zones are identified
by working backwards from the pin and determining a minimum number of target
points or zones that will enable the minimum number of shots to be taken to the
pin. For example, by determining the furthest distance that can be accurately hit
to the pin from a safe point, or relatively easily accessible point, on the fairway, a
smart zone can be defined at that furthest distance. A smart play zone is
designated around that point for the golfer to aim for. From that point on the
fairway another zone may be determined based on the furthest distance that can
be accurately hit to reach the defined smart zone. In this manner, various smart
zones can be created to enable the minimum number of shots to be played
bearing in mind the hole features and distances that can be accurately hit. The
shape of the smart zone may be any suitable shape around the target. For
example, if the fairway is relatively thin, the smart zone is likely to be elliptical and
thin in shape to accommodate the shape of the fairway. Whereas, the smart
zone area may be substantially circular in shape if the fairway is fairly broad.
Other shapes are envisaged whereby obstacles of the golf course hole are taken
into account and so results in the shape of the smart zone being altered to take
into account positions where an ideal shot should not be positioned.

Figure 5 shows an image of the golf course hole with a number of smart zones
indicated thereon.

The database also holds various other types of data associated with the way the
hole was played. For example, the golfer may enter various additional pieces of
information such as course variables including the length of the grass on the
fairway and the dampness of the greens, for example. Other information provided by the golfer may include current weather factors that influenced how a game was played. It will be understood that, as an alternative, weather information may be retrieved automatically based on the time, date and location that a hole is played. The golfer may also enter which type of golf club was used for each shot, as well as any other equipment related types of information such as the manufacturer of the golf clubs or balls used, type of gloves used etc. Further information related to when the hole was being played may include, for example, the time of day the course is being played, how hot or humid it was, the player's golf partner, etc. This information is then transferred via the web server to the database for storage and later use by the data analysis system.

Alternatively, the type of golf club selection may be detected by reading a barcode or RFID tag on the golf club with a barcode scanner or RFID reader near to the golf club bag to detect the golf club being removed from the bag. Alternatively, a portable barcode or RFID scanner may be employed to detect the type of club being used. Also, a separate card may be carried with a list of barcodes indicating the different types of golf clubs so that the user can scan in the relevant barcode when they select a type of golf club.

The following list of data may be captured and analysed. It will be understood that the list is non-exhaustive at that various other types of data are envisaged.

USER DATA: GPS-Waypoint data: Longitude and Latitude. Accuracy of GPS information can be improved through the use of a differential device. Club selection data. Player profile data, name, addresses, and handicap. Handicap changes monitored over time which will include detailed data of specific areas of improvement.

MAP DATA: Golf Course Raw Data: Digital images, Topography including, all measurements, slopes and elevations. Ball classification zones e.g. Smart play zones fairways, greens, right and left rough, out of bounds, hazards etc. Tee and pin locations and any other reference points of interest.
GROUNDS DATA: General conditions Data - Soil and ground data which will
include moisture information, grass lengths type etc., speed of greens and
amount of run on fairways. Wind, strength and direction, Humidity, precipitation,
barometer readings. Tee and Pin locations.

ANALYSED DATA: Includes, information or statistics derived from the raw data
that is of interest or benefit to the golfer, manufacturer, professional, coach,
commentator, groundskeepers or architects.

Ball location analysis may be carried out by comparing a single GPS Waypoint
with Map, User and Grounds raw data we can calculate information relevant to
the USERS. Examples include:

Ball location, Fairway, Smart play zone, sand trap etc, the direction and angle of
the slope at the ball, Distance and direction to the Pin, Distance and direction
from the Tee, Whether the next shot is up or down hill.

By keeping a record of these ball locations over time statistics can be generated
that can be used for skill and game performance analysis. For example,
percentage of shots on fairway, greens in smart zones.

Shot analysis may be carried out by looking at more than one waypoint and
comparing with position with map, user and grounds raw data we can add
information and statistics to the knowledge gained from ball location analysis.

The data includes: distance hit, average distance hit per club, distance hit per
club up hill, etc, % of shots on target (within 'x' degrees of target), spread of shot
angles, accuracy of shots, and consistency of shots.

Game analysis may be carried out by looking at all the shots in a round and all
rounds on a particular golf course it is possible to determine, for example: scores
and averages, greens in hit in regulation number of hits, percentage of ups and
downs made (i.e. this is the percentage of times that a player, having missed the
green with his approach shot, gets the ball into the hole in two shots from where the ball lay), and 0, 1, 2, 3, 4+ putts and the associated percentage.

Trend analysis may be performed after the data is collected. Patterns and trends in a person's game can be determined, as follows, for example.

Strengths: a high percentage of ups and downs are made and a low average of putts means that the player has a good short game.

Weaknesses: a diamond shape of ball locations appearing "from the tee to the green indicates that a problem with alignment, grip, or width of stance, for example, is causing a wide variation in shot position. Other shapes detected may indicate different problems. The shapes may be detected automatically using image recognition software.

Weather dependant trends can be determined. For example, good scores may be recorded on windy days compared with the course average.

Topological dependant trends can be determined. For example, the player always hits long when hitting up hill.

Course trends can be determined. For example, Hole 4 is par 4 but the average score is 6. This may be due to the hole being comparatively hard.

Figure 6 shows a system diagram of the data analysis system 311.

The data analysis system 311 includes a microprocessor 601, a memory device 603 and an input/output port 605. The input/output port 605 is in communication with the web server 307 and the database 309. The analysis system can retrieve data from the database and analyse the data based on instructions received from the web server under control of the microprocessor. The analysis stage of the data is now described in more detail below.
Various types of analysis can be carried out by the analysis system 311 using the data retrieved from the database 309. In particular, the golf ball positions captured during the golfer's play of the holes of a golf course are analysed with respect to the position of shots played previously on the same hole, the position of the features of the hole and the position of the smart zones created for the hole.

For example, images can be created by the analysis system that enable a display to be forwarded to the users PC to show the various shot positions captured while the user played the hole. Figure 7 shows an example of a graphical display showing the various features of the golf course hole with icons depicting the various locations of the golf ball as the hole is played by a golfer. The tee 701 is indicated to show where the golfer starts from. A first icon 703 represents the first position of the golf ball that was captured by the golfer on the fairway when they were playing the hole. A second icon 705 identifies the position of the golf ball on the fairway after the second shot. A third icon 707 identifies the position of the golf ball on the green after the third shot. A fourth icon 709 identifies the position of the golf ball on the green after the fourth shot. The pin is indicated by a flag icon 711. Lines 713 are displayed between each of the first to fourth icons to indicate the direction of play that the golfer took while playing the hole.

At this stage, if the golfer can see that a certain point indicated on the display is not accurately depicted, for example if the positional data received or stored is not accurate, they can modify the data by selecting the appropriate icon and dragging it to the correct point. Alternatively, the icon position may be modified by accessing an editing mode and re-entering the latitude and longitude information of that positional point. For example, the positional data captured may not be particularly accurate and may show that a shot was just of the fairway or green whereas in reality it was just on the fairway or green. This adjustment results in more accurate statistics being provided to the user.

By overlaying the shots taken by a golfer at different times that they play a hole, it becomes possible to detect or determine certain trends associated with how a golfer plays.
Figure 8 shows a graphical representation of a display provided to the PC from the web server based on information determined by the data analysis system. The image shows the position of 20 shots taken from the tee for a single golfer.

The tee 801 is identified. A smart zone 803 is also shown on the display to provide an indication of where the golfer should be aiming for when playing their tee shot. In the centre of the smart zone is a target. Various icons 805 are displayed depicting where the golfers tee shots have been positioned each time they have played the hole. Various rough assumptions can be made by viewing the displayed information and the positions of the icons. For example, it can be seen that the majority of tee shots towards the fairway land either on the fairway or are slightly to the left of the fairway, with the exception of two shots.

However, the data analysis system provides further detailed analysis of the number of shots in order to give the golfer a more detailed analysis of how the hole has previously been played. A text box 807 is displayed on the screen that provides various statistics about how the hole has been played at this point in the game. The text box lists how many shots out of the total shots played have landed on the fairway (13/20), landed in the right rough (2/10), landed in the left rough (4/20), landed out of bounds (1/20) and landed in the smart play zone (8/20). These values are also provide as a percentage of the total number of tee shots made, i.e. 65%, 10%, 20%, 5% and 40% respectively.

Further information 809 may also be displayed in the form of another text box when hovering or placing a cursor over each of the ball position icons. The further information provides details on where the ball is positioned, what distance the ball has travelled since the last shot, the distance the ball is off the target, and the angle the ball is off the target. All these values can be calculated using geometry by the data analysis system from the ball, feature and smart zone positional data.

Analysis data and images may be provided to the user for each individual shot taken as the hole is played. Data may also be provided to the user to indicate
their overall play on certain holes. For example, data may be provided on how accurate or consistent a player is on a particular golf course. The data may indicate that they have a high percentage of shots hitting the fairway for one particular golf course when playing with a certain golfing partner, but not on the same course when playing with a different partner. The data may also indicate that when the golfer plays a certain golf course a consistently high number of shots are being played off the fairway. The data provided may also indicate that the course is particularly hard, or that there is some other reason for the poor performance, such as there are significant distractions affecting the way the golfer plays on those courses. This may then show the golfer that they find certain courses or golf course clubs more preferable than others, or have become too used to a certain course.

Further, an icon may be displayed that shows an average spread of a shot. For example, the average position of a tee shot made may be calculated from the positions of all the balls. The average position is a combination of the average length and average deviation from the target. An icon may then be displayed at this point. The icon may further be enhanced by identifying a shape around it to show the deviation from the average point. The shape may be defined by the individual points of each of the shots made.

Figure 9 shows an example of a display indicating various shot distances made for certain types of golf club.

The type of golf club is indicated with either a golf club icon, such as for a wood, or a heading indicating the club, such as in the case of the '3-iron' and 7-iron'. It will be understood that an icon indicating an iron club can be used as an alternative to the headings shown. In this example, there is a driver (901), a 3-iron (903), and a 7-iron (905) positioned along an x-axis of a graph. The y-axis of graph depicts distance 907 from 0m to 350m in 50m increments. For each of the clubs multiple bar graphs are shown to indicate the minimum, average and maximum distances hit with that particular type of golf club.
This information provides the golfer with a quick review of the best type of golf club to be using over particular distances. Also, it provides the golfer with information to distinguish which type of golf club is used more consistently by comparing the deviations between the minimum and maximum distances, or the deviation between the minimum or maximum and the average distances. All these various calculations can be made by the data analysis system and displayed separately or alongside the distance graph.

Figure 10 shows an example of a display indicating the spread of shots taken when using specific types of club for all courses.

In this example, there is a driver (1001), a .3-iron (1003), and a 7-iron (1005). For each golf club, a shot spread icon is displayed to show what percentage of shots are hit within 5 degrees left and right of the target. That is, an angle spread is indicated to show the amount of shots hit within a 10 degree spread around the target. The size of the arc is varied depending on the percentage number of shots played within the indicated range. In the example shown in figure 10, it can be seen that 20% of shots for the driver were played within a centre range 1009, which is plus and minus 5 degrees either side of the target point, 30% of shots were played within a left hand range 1011, which is a range covering 10 degrees immediately to the left of the centre range, 15% of shots were played within a far left range 1013, which is a range covering a further 10 degrees to the left of the left hand range, 25% of shots were played in a right hand range 1015, which is a range covering 10 degrees to the right of the centre range, and 10% of shots were played in a far right range 1017, which is a range covering 10 degrees immediately to the right of the right hand range.

This information can be used to inform the user what percentage of their shots are being hooked or sliced for each of the types of golf club indicated. This can thus provide important information to the user when they decide how they approach playing a particular hole, or using a particular type of club, under certain playing circumstances or environments. For example, looking at the data for the 3-iron 1003, it can be seen that 70% of shots are either hit in the centre,
right hand or far right ranges which may indicate a slight problem the golfer has with that club.

Figure 11 shows a further example of a display indicating the spread of shots taken when using specific types of golf club for all courses in a particular date range in combination with the distance data for each type of golf club. By combining the statistical data of accuracy and distance, the golfer is able to more easily determine which type of golf club is considered the most accurate for certain distances. Again, the type of golf club is indicated including a driver (1101), a 3-iron (1103), and a 7-iron (1105). The data shown above each club is a combination of the elements previously described in figures 9 and 10, i.e. the distance data 1107 and the shot spread data 1109.

It will be understood that the data available to the user is not limited to the few examples described above, and that various other graphs and images can be provided to indicate how a golfer can improve their game based on their past performance and current playing habits, as well as the recommended advice on how best to play the holes.

It will be understood that various filtering arrangements can be implemented when displaying data and graphs for courses and holes that have already been played. For example, the user may want to show all data for all holes for only one specific club, show data associated with one hole for all clubs, or show data for specific times and/or dates. Further, the user may want to limit the data supplied and displayed based on, for example, certain weather playing conditions, their golfing partners, or any other of the data that has been stored in the database.

The various information, graphs and plans provided by the analysis system enable patterns to be determined and so allow a user to improve their golf game.

The information from the data analysis system can be used in many different ways. The information can be sent to an output device such that it is displayed on single user's computer systems for personal use, or may be made more
widely available so that other golfers can view other player's data. Further, display systems can be arranged to display the information during tournaments for viewers to see how the golfers played the particular hole in earlier rounds, or in previous tournaments. Any of the information discussed above may be displayed.

The information can be sent as an output so that it is displayed via television broadcasts, whether live or time delayed, as well as broadcast or multicast to data receiving devices such as mobile communication devices, laptops etc via the Internet or other data transmission networks. Further, any of the information discussed above may be sent to output devices so that the information is printed, faxed, sent to a telephone messaging system or e-mailed.

Various golf courses can be selected by golfers using the web site via the web server to determine how best to play a particular course or hole.

The information displayed, broadcast or multicast may include any or all of the data or images discussed above, as well as any calculations or analysis that may be carried out by the data analysis system using any of the data stored in the database.

The data analysis system may provide information on common mistakes of the user based on the analysed data. For example, if a particular club is always used for a distance that they are unable to reach with that club, or a certain club is used on days when it is windy, and that club is shown to be the least accurate on windy days, then the data analysis system may detect using the data that this is occurring and highlight this information for the user to correct their tactics or course management technique.

Figure 12 shows a system block diagram for an instructional information system.

The instructional information system includes the data analysis system 311 connected to the web server 307 and the database 309. Further, an instructional
database is also in communication with the data analysis system 311 via the input output module 605.

By analysing the statistics and/or patterns created by the data analysis system, advice can be provided to the golfer in order to enable them to improve their game. The instructional information provides guidance or tips on how the user can improve their game based on the user's past performance and the all the data stored in the database 309. The advice may consist of simple tactical advice or technical information. For example, the advice may be which club to use for certain length shots or different holes or parts thereof, a suggested approach to the green, which manufacturer of golf clubs is more suitable for the user based on the information the user has provided and the data captured, a suggested manner of hitting the ball, a suggested stance or a suggested grip, alignment changes etc. The type of club that the system suggests to use may be determined by the type of club that must be used, e.g. if the ball has landed in a sand trap a sand wedge must be used to get the ball out, or the suggestion may be determined based on the required distance to reach the pin or next smart zone, for example. This information is calculated from the player's statistics for using various clubs. The instructional advice is stored in a separate database, however, it will be understood that the instructional advice may be stored in the same database as that used to store the statistical, positional and other data associated with the golfer and performance.

A particular problem type can be detected by the data analysis system based on the data and statistics stored and created. When a problem type has been detected, the data analysis system can retrieve the appropriate instructions from the instructional database 1201, which will direct the golfer on how to correct the problem.

The instructional information may be in many different forms, such as guidelines, practice tips or exercises, such as practice routines. This information may be provided to the user such that they can carry out the exercises at a convenient time to them, such as in the office, for example.
Alternatively, the data provided by the data analysis system in the form of graphs, maps, data and tables etc may be analysed by a golfing professional to provide the golfer with a detailed analysis of their game and where certain problems are occurring, as well as their strengths. The golfing professional may then provide the golfer with valuable advice in the form of guidelines, practice tips, and exercises.

The advice may be provided in many different forms, such as, for example, a list of recommendations, exercises or tips. Or the advice may be in the form of grip diagrams, suggested equipment use, multimedia files, such as audio files or videos, explaining exercises, stances, swing techniques etc.

Some examples of the type of advice that may be provided includes, for example:
- **Warm up for 30min prior to playing the round** by hitting the club that will be used to tee off on first hole.
- **Use a 3 iron** and aim down left side of fairway.
- **Use a strong grip.**
- **Aim to land the ball on the front right of the fairway with the approach shot.**

As explained above, the website allows registered users to logon and access their own data for particular holes and courses and monitor their shots played over different time periods. Further, all users may be provided with certain information for certain holes of different courses, such as the ball positional data for players based on their handicap, average drive length etc.

When logged in, the user can select a view of various holes from various golf courses they have played. They are able to view an individual round of golf played for that hole, or a combination of other rounds of golf played for that hole. The ball position for each time the hole has been played is displayed on the user's screen, in a similar manner to that shown in figure 7. If multiple plays of the hole are requested by the user, the image shown includes icons for all ball positions recorded for that hole over a selected date range.
The user can select to view their last round, last ten rounds, individual rounds selected by date or all rounds.

As the user selects each hole to view, the display closes in on that hole. The user can also zoom in onto different parts of a hole, such as shown in figure 8. Further, the user can zoom in to more detailed areas of play, such as the green.

Using these various options, the user can quickly view a course that they have played before and analyse different holes played at various different times or with ball positional data overlaid for any number of different times the hole has been played. This enables the user to get a quick understanding of how to improve playing that hole based on past performance.

The information made available to all users can be used to arrange competitions, such as the longest tee drive off hole 7 on a certain course. This may help promote the use of certain golf courses. The winner of the competition may then be offered prizes relevant to the data they have entered. For example, if it has been determined that a particular club or type of golf ball of a particular manufacturer has been providing problems, the golfer may be offered a replacement club or set of golf balls from a different manufacturer as a prize. Various competitions could be organised for players that have, for example, the longest drive, most accurate or consistent shots etc.

Further, the website provides a chat forum to allow golfers to discuss various quirks of certain courses and how they overcome particular problems.

The described system provides a seamless data capture method that allows analysis to be carried out on a golfer's play in comparison to previous holes played by the golfer. The analysis stage provides valuable feedback for use by different people. The system is ideal for golf club golfers as well as more professional orientated players. The system enables a golf professional to more effectively teach and train golfers by analysing their shots over time to determine a trend of performance and identify issues. The system then enables the golf pro to see if the tutored golfer has taken on board the advice by comparing play
before and after the training session. The system further allows golfers to prepare a game plan prior to playing a hole by analysing how they have played the hole previously.

The described capture device provides an advantage in that it is a small discrete device that merely captures data during the playing of a round. No feedback is provided to the golfer on the course during play, and as such the R&A rules are not broken.

Further Embodiments

It will be understood that the embodiments of the present invention described herein are by way of example only, and that various changes and modifications may be made without departing from the scope of invention.

Further, it will be understood that the GPS device may be used in conjunction with a relative or differential GPS system that is located in the vicinity of the golf course, for example in the club house. The use of the differential or relative technology enables more accurate positional data to be captured.

Further, it will be understood that the ball positional data may be captured by a GPS device that is located within each of the golf clubs. The GPS devices may record the positional data when a button on the top of the golf club is pressed. Alternatively, the positional data may be captured by the GPS device in the club upon the detection of a push button being pressed on another device using wireless communication technology. Alternatively, the positional data may be captured automatically by detecting when the golf ball has been hit through the use of an impact detector in the golf club.

Further, it will be understood that the positional data may be captured automatically by detecting that the golfer has selected a golf club or by detecting that the golfer is holding the golf club, through the use of sensors on the golf bag or on the golf club itself. For example, motion sensors may be placed on the golf
bag to detect a club is being selected. Heat or pressure sensors may also be used in the grip of the golf club to detect when the club is being held.

Further, it will be understood that the GPS device may be located in the golf bag or cart and that the positional data is captured upon pressing a button attached to the golf bag or cart. Further, the positional data capture device may be located remotely from the GPS device and be in wired or wireless communication with the GPS device.

Further, it will be understood that the data capture device components may be located within a mobile communication device, such as a mobile or cell telephone. The collection of positional data capture may be carried out by implementing an application on the mobile communication device and capturing the data by pressing a pre-determined button on the device.

Further, it will be understood that a more complex hand held device may be used to capture the data, store the data and analyse the data. The complex device may be a PDA type device or portable computing device, for example. The device may be able to store all data locally or be in wireless communication with another system that stores the data. Further, the other system may also carry out some of the analysis itself and communicate back to the hand held device information to aid the golfer’s game. The complex device may display a list of barcodes to be scanned to enable the user to select a certain type of golf club or to enter any other type of data. Alternatively, the complex device may include an RFID or barcode scanner to detect a barcode or RFID tag on the golf club.

Further, meteorological data may be captured automatically by the complex device while the hole is being played.

Further, it will be understood that the GPS positional data may be captured automatically without the need to press a button. For example, the GPS device may be activated using RFID (Radio Frequency Identification) techniques. An RFID tag may be located within a golf ball, golf club or elsewhere such that when the golfer approaches the ball the tag is detected by an RFID reader located on
the golfer. The detection of the RFID tag triggers the GPS to capture the current positional data.

Further, it will be understood that the GPS device may be triggered to capture the positional data using barcodes and a barcode scanner or detector in a similar way to the RFID tag embodiment described above.

Further, it will be understood that the use of a detection system on a golf club, such as an RFID tag or barcode for example, enables the detection of the type of club being used. This data may then be stored and transmitted to the database for use by the data analysis system. Subsequently, various information and statistics associated with the type of club used and the shots made can be used by the analysis system and/or the instructional system to provide guidance, tips or recommendations to the golfer based on which club is being used, or the manufacturer of the club.

Further, it will be understood that the data retrieved from the database can be related to more than one golfer of a golf course. Data associated with multiple golfers may be used by golfers who have not yet played a particular course in order to determine how others have played the hole before. In this manner, it becomes possible to deduce the common errors made, based on the data and images provided, and so provide the golfer with an indication of how to best play the hole based on previous golfer's experiences.

Further, it will be understood that golf course clubs may use the data and images associated with their courses to determine how their course is being played, and whether they should modify their current golf course designs. Further, the data can be used by golf course developers to determine how best to develop new more difficult courses based on current courses that are providing particular difficulties to seasoned golfers.

It will be understood that various other features may be included in the data capture device, such as a housing with a belt clip attached, two or more buttons to indicate the capture of data, the selection of a golf club, the start or end of a
round of golf, etc. Further, the device may have a display, such as an LCD display that indicates the number of shots that have been taken and the golf clubs being used. A timer may optionally be employed to avoid the storage of multiple values for a single ball position within a set time period. For example, if the data capture button is pressed more than once in quick succession. Further, the battery device in the data capture device may be a chargeable device that can be charged in connection with the PC. A display can indicate when the battery is fully charged. Each device may have its own serial number to allow the information to be automatically uploaded based on the registered user for that device. Further, the device may automatically erase the data captured after uploading the information.

Further, it will be understood that software may be made available on the computing device that the data capture device uploads the data to. This software may be used to retrieve the data from the data capture device, carry out any analysis on the data, or to display or output information or feedback based on the analysis.

The images shown in the drawings of this specification are only graphical images that may be displayed of the golf course. It will be understood that the images may also be digital photographic images taken of the golf course where those images are manipulated to align the latitude and longitude points associated with the features of the golf course. The ball positional data captured during play may then be overlaid onto the digital image to show the position of the shots that were taken.

Further, it will be understood that areas of the image depicting the golf course holes may be shaded to indicate the distribution of shots over time, where different shading indicates the number of shots or percentage of shots that have landed in that area.
CLAIMS

1. A method of capturing data to be used in a computer analysis system that analyses shots, played at different times on a golf course hole, relative to the position of features of the golf course hole in order to provide an indication of how to improve playing a hole, the method including the steps of:
   capturing positional data based on a position of a golf ball by initiating an electronic positional data capture device to measure the current position of the positional data capture device, and
   storing the positional data.

2. The method of claim 1, wherein an indication of how to improve playing a hole is provided by comparing a performance profile with an indication of how best to play the hole.

3. The method of claim 1, wherein the positional data capture device measures its current position when in proximity to the golf ball.

4. The method of claim 3 further including the step of triggering the measurement of the positional data capture device's position by detecting an RFID tag in the golf ball.

5. The method of claim 1 further including the steps of transmitting the stored data to the analysis system and analysing the stored data.

6. The method of claim 1 further including the steps of:
   detecting the selection of a golf club, and
   initiating the positional data capture device to measure the positional data capture device's current position upon said detection.

7. The method of claim 6 further including the step of storing the detected golf club selection.
8. The method of claim 6, wherein the golf club selection detection is carried out by detecting a bar code scan of a barcode associated with the golf club.

9. The method of claim 8, wherein the bar code is attached to the golf club.

10. The method of claim 8, wherein the bar code is provided on a display device, and the bar code associated with the selected golf club is scanned from the display device.

11. The method of claim 6, wherein the golf club selection detection is carried out by detecting an RFID scan of an RFID tag associated with the golf club.

12. The method of claim 11, wherein the RFID tag is attached to the golf club.

13. The method of claim 1 further including the step of capturing the positional data by pressing a single button on the positional data capture device.

14. The method of claim 13, wherein the single button is pressed only once to capture the positional data.

15. The method of claim 13, wherein the single button is sequentially pressed to cause the position sensing device to detect a sequence of positions of the positional data capture device.

16. A method of displaying data captured by the method of any one of the preceding claims, the method of displaying including the steps of:
   - displaying an image based on a physical layout of the golf course hole, wherein the physical layout includes an indication of the position of the features of the golf course hole, and
   - displaying the captured positional data within the image.

17. The display method of claim 16 further including the step of displaying an icon in the image indicating the position of the golf ball based on the positional data of the golf ball and the position of the features of the golf course hole.
18. The display method of claim 17 further including the step of displaying multiple icons in the image indicating the position of a number of golf balls as played on the golf course hole at various times.

19. The display method of claim 17 further including the step of displaying a specified zone, wherein the specified zone is a defined area on the golf course hole in which it has been determined the golf ball should be positioned in order to best play the hole.

20. The display method of claim 17 further including the step of displaying an area centred on the average ball position for each shot, wherein the size and shape of the area is determined from the spread of the shots from the average ball position.

21. The display method of claim 17 further including the step of displaying a range of different clubs that are used for making the shot, and displaying distances hit for each club.

22. The display method of claim 17 further including the step of displaying slice and hook angles for different clubs.

23. The display method of claim 17 further including the step of retrieving and displaying information received from an instructional system to provide instructions on how to improve playing a hole.

24. The method of claim 23, wherein the instructions include at least one of exercises, drills, tips and suggested courses of action.

25. The method of claim 23, wherein the instructions provide strategy suggestions, including at least one of: a suggested club selection for different parts of the hole, a suggested approach to the green, a suggested manner of hitting the ball, a suggested stance, a suggested grip.
26. A system arranged to perform the method of claims 16 to 25.

27. A positional data capture device for capturing data to be used in a computer analysis system that analyses shots, played at different times on a golf course hole, relative to the position of features of the golf course hole in order to provide an indication of how best to play the hole, the positional data capture device arranged to detect the current position of the positional data capture device, the positional data capture device including a position sensing device, a processor, a memory device and at least one button, whereupon pressing a single button, the position sensing device is arranged to detect the current position of the positional data capture device and the processor is arranged to store the current position in the memory device as ball positional data.

28. The positional data capture device of claim 27 whereupon sequential depression of the single button causes the position sensing device to detect a sequence of positions of the positional data capture device.

29. The positional data capture device of claim 27 further including a data transfer device arranged to transfer the stored ball positional data to an external device.

30. The positional data capture device of claim 27 further including a golf club detection device arranged to detect the selection of a golf club.

31. The positional data capture device of claim 30, wherein the golf club detection device is further arranged to detect which golf club is selected.

32. The positional data capture device of claim 30, wherein the detection device is an RFID detector.

33. The positional data capture device of claim 30, wherein the detection device is a barcode scanner.
34. The positional data capture device of claim 30, wherein the processor is further arranged to store data based on the selected golf club in the memory device.

35. A computer analysis system arranged to analyse ball positional data, based on multiple golf ball positions captured during multiple plays of a golf course hole, relative to feature positional data, based on the position of features of the golf course hole, the system further arranged to provide an indication of how best to play the hole.

36. The computer analysis system of claim 35 including a data retrieval device arranged to retrieve the ball positional data and feature positional data, and a processor arranged to process the retrieved ball positional data relative to the positional feature data.

37. The computer analysis system of claim 36 wherein the data retrieval device is further arranged to retrieve meteorological data associated with the golf course hole at the time the golf course hole was played.

38. The computer analysis system of claim 36 wherein the data retrieval device is further arranged to retrieve golf club data based on the golf club used to make individual shots while playing the hole.

39. The computer analysis system of claim 36, wherein the processor is further arranged to analyse the ball positional data to determine at least one of: a range of angles over which a golf ball is hit from one or more locations; the accuracy of shots made to a defined target; the distance of golf ball shots; how consistently shots reach a defined target.

40. The computer analysis system of claim 36 further including a database arranged to store instructional data, the processor arranged to determine a problem type based on a determined problem determined from the retrieved ball positional data, and further arranged to retrieve instructional data associated with
the determined problem type from the database, wherein the instructional data provides information based on how to solve the determined problem.

41. The computer analysis system of claim 36, wherein the processor is further arranged to analyse the ball positional data relative to a specified zone, wherein the specified zone is a defined area on the golf course hole in which it has been determined the golf ball should be positioned in order to best play the hole.

42. The computer analysis system of claim 41, wherein the processor is further arranged to analyse the ball positional data relative to the specified zone to determine an output value based on shots where the golf ball was positioned in the specified zone.

43. The computer analysis system of claim 42, wherein the output value determined is the percentage of shots where the golf ball was positioned in the specified zone.

44. The computer analysis system of claim 41, wherein the processor is arranged to determine the position of the first specified zone by calculating distance data based on how far a player can hit the golf ball to a further specified zone using an appropriate golf club, wherein the further specified zone is a defined area on the golf course hole in which it has been determined the golf ball should next be positioned in order to best play the hole.

45. The computer analysis system of claim 36, wherein the processor is further arranged to analyse the ball positional data relative to the feature positional data and detect a performance trend.

46. The computer analysis system of claim 45, wherein the processor is further arranged to detect a trend by detecting a pattern in the ball positional data.
47. The computer analysis system of claim 46, wherein a pattern is detected by detecting a shape from the ball positional data.

48. The computer analysis system of claim 36, wherein the processor is arranged to determine an appropriate golf club, the appropriate golf club being one of a golf club that must be used to hit the golf ball, and a selected golf club.

49. The computer analysis system of claim 48 further including a memory device arranged to store statistics associated with a golfer, wherein the selected golf club is determined by: calculating a distance required to reach a specified zone from the ball positional data, wherein the specified zone is a defined area on the golf course hole in which it has been determined the golf ball should be positioned in order to best play the hole, and determining which golf club is suitable for the calculated distance based on at least one of the stored statistics and the feature positional data.

50. The computer analysis system of claim 49, wherein the stored statistics include at least one of: the average distance a golf ball is hit for each golf club; a level of skill associated with the golfer; the maximum, minimum and average distances hit using each golf club; the accuracy obtained using each golf club; course variables.

51. The computer analysis system of claim 36 further including an output device arranged to output information based on multiple golf ball positions, retrieved from the processed ball positional data, relative to at least one of: the position of the golf course hole features and at least one specified zone, wherein a specified zone is a defined area on the golf course hole in which it has been determined the golf ball should be positioned in order to best play the hole.

52. The computer analysis system of claim 51, wherein the output device is a display device arranged to display an image showing the multiple golf ball positions on the golf course hole.
53. The computer analysis system of claim 51, wherein the output device is an electronic messaging system arranged to transmit information based on the multiple golf ball positions on the golf course hole.

54. The computer analysis system of claim 53, wherein the electronic messaging system is one of an e-mail system, telephone messaging system or facsimile system.

55. The computer analysis system of claim 53, wherein the transmitted information is in the form of an image.

56. The computer analysis system of claim 51, wherein the output device is a printing device arranged to produce an image showing multiple golf ball positions on the golf course hole.

57. The computer analysis system of claim 51, wherein the output device is a broadcasting device arranged to broadcast an image showing multiple golf ball positions on the golf course hole.

58. A computer analysis method including the steps of analysing ball positional data, based on multiple golf ball positions captured during multiple plays of a golf course hole, relative to feature positional data, based on the position of features of the golf course hole, and providing an indication of how best to play the hole.

59. The computer analysis method of claim 58 further including the steps of:

   a data retrieval device retrieving the ball positional data and feature positional data, and

   a processor processing the retrieved ball positional data relative to the positional feature data.

60. The computer analysis method of claim 59 further including the step of the data retrieval device retrieving meteorological data associated with the golf course hole at the time the golf course hole was played.
61. The computer analysis method of claim 59 further including the step of the data retrieval device retrieving golf club data based on the golf club used to make individual shots while playing the hole.

62. The computer analysis method of claim 59 further including the step of the processor analysing the ball positional data to determine at least one of: a range of angles over which a golf ball is hit from one or more locations; the accuracy of shots made to a defined target; the distance of golf ball shots; how consistently shots reach a defined target.

63. The computer analysis method of claim 59 further including the steps of a database storing instructional data, the processor determining a problem type based on a determined problem determined from the retrieved ball positional data, and retrieving instructional data associated with the determined problem type from the database, wherein the instructional data provides information based on how to solve the determined problem.

64. The computer analysis method of claim 59 further including the steps of the processor analysing the ball positional data relative to a specified zone, wherein the specified zone is a defined area on the golf course hole in which it has been determined the golf ball should be positioned in order to best play the hole.

65. The computer analysis method of claim 64 further including the step of the processor analysing the ball positional data relative to the specified zone to determine an output value based on shots where the golf ball was positioned in the specified zone.

66. The computer analysis method of claim 65, wherein the output value determined is the percentage of shots where the golf ball was positioned in the specified zone.
67. The computer analysis method of claim 64 further including the step of the processor determining the position of the first specified zone by calculating distance data based on how far a player can hit the golf ball to a further specified zone using an appropriate golf club, wherein the further specified zone is a defined area on the golf course hole in which it has been determined the golf ball should next be positioned in order to best play the hole.

68. The computer analysis method of claim 59 further including the step of the processor analysing the ball positional data relative to the feature positional data and detect a performance trend.

69. The computer analysis method of claim 68 further including the step of the processor detecting a trend by detecting a pattern in the ball positional data.

70. The computer analysis method of claim 69 further including the step of detecting a pattern by detecting a shape from the ball positional data.

71. The computer analysis method of claim 59 further including the step of the processor determining an appropriate golf club, the appropriate golf club being one of a golf club that must be used to hit the golf ball, and a selected golf club.

72. The computer analysis method of claim 71 further including the steps of a memory device storing statistics associated with a golfer, and determining the selected golf club by: calculating a distance required to reach a specified zone from the ball positional data, wherein the specified zone is a defined area on the golf course hole in which it has been determined the golf ball should be positioned in order to best play the hole, and
determining which golf club is suitable for the calculated distance based on at least one of the stored statistics and the feature positional data.

73. The computer analysis method of claim 72, wherein the stored statistics include at least one of: the average distance a golf ball is hit for each golf club; a level of skill associated with the golfer; the maximum, minimum and average
distances hit using each golf club; the accuracy obtained using each golf club; course variables.

74. The computer analysis method of claim 59 further including the step of an output device outputting information based on multiple golf ball positions, retrieved from the processed ball positional data, relative to at least one of: the position of the golf course hole features and at least one specified zone, wherein a specified zone is a defined area on the golf course hole in which it has been determined the golf ball should be positioned in order to best play the hole.

75. The computer analysis method of claim 74, wherein the output device is a display device and the display device displays an image showing the multiple golf ball positions on the golf course hole.

76. The computer analysis method of claim 74, wherein the output device is an electronic messaging system and the electronic messaging system transmits information based on the multiple golf ball positions on the golf course hole.

77. The computer analysis method of claim 76, wherein the electronic messaging system is one of an e-mail system, telephone messaging system or facsimile system.

78. The computer analysis method of claim 76, wherein the information is transmitted in the form of an image.

79. The computer analysis method of claim 74, wherein the output device is a printing device and the printing device produces an image showing multiple golf ball positions on the golf course hole.

80. The computer analysis system of claim 74, wherein the output device is a broadcasting device and the broadcasting device broadcasts an image showing multiple golf ball positions on the golf course hole.
A golf improvement system including a data capture device arranged to catch positional data, an analysis system arranged to analyse the positional data and further arranged to determine how a user may improve their golf game, and a display system arranged to display information that instructs the user on how to improve their golf game.
Figure 2
Figure 9
Figure 11
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. 

A63B 69/36 (2006.01)

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

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

DWPI and IPC mark A63B and keywords: golf and rfid and analyse and position and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
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<tbody>
<tr>
<td>Y</td>
<td>US 7115498 B2 (MEADOWS et al.) 10 October 2006 Column 10 lines 10 to 12</td>
<td>1-3,5,13-17, 21-25,27-29</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>18,20,30-34</td>
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[X] Further documents are listed in the continuation of Box C  [X] See patent family annex

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

Date of the actual completion of the international search 28 April 2008

Date of mailing of the international search report 2 MAY 2008

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AUSTRALIAN PATENT OFFICE
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Telephone No: (02) 6283 2426

Form PCT/ISA/210 (second sheet) (April 2007)
### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>JP 2005102902 A (NIPPON ELECTRIC CO, et al.) 21 April 2005 Abstract</td>
<td>6-12,30-34</td>
</tr>
</tbody>
</table>
## Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  □ Claims Nos.:
   
   because they relate to subject matter not required to be searched by this Authority, namely:

2.  □ Claims Nos. 26, 81
   
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

   See additional sheet.

3.  □ Claims Nos.:
   
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

## Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1.  □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2.  □ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3.  □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4.  □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

## Remark on Protest

□ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

□ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

□ No protest accompanied the payment of additional search fees.
<table>
<thead>
<tr>
<th>Supplemental Box</th>
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<tbody>
<tr>
<td>(To be used when the space in any of Boxes I to IV is not sufficient)</td>
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<tr>
<td><strong>Continuation of Box No: II</strong></td>
</tr>
</tbody>
</table>

Claim 26 cannot be searched because it does not define any features in the system. It is therefore not known what features to search for.

Claim 81 is too unclear to enable a search to be carried out. The system includes a device to capture "positional data", but it is not defined what feature is having its position measured.
This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

<table>
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<tbody>
<tr>
<td>US 2003191547</td>
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<td>US 7118498</td>
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<td>us 2002177490</td>
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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX