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(54) **Title**: AN IMPROVED HEADSET

Fig. 1A -1

Fig. 1A -2

(57) **Abstract**: A method or apparatus to provide an improved headset. The headset includes at least one sensor. The headset further includes a configuration logic to configure the headset based on the position of the headset on the user's head.

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AN IMPROVED HEADSET

FIELD OF THE INVENTION

[0001] The present invention relates to headsets, and more particularly to using one or more sensors within the headset for improved operation.

BACKGROUND

[0002] As portable devices are becoming more common, headsets are proliferating. Headsets include the Bluetooth headsets or plug-in headsets often used with mobile phones, headphones used with music players or other listening devices. Headsets may also be used with stationary devices such as landline telephones, computers, stereos, etc.

[0003] While many older headsets are unpowered devices, simply using wires to lead the sound to the user's ears, newer headsets are powered, and often include some processing power. In particular, headsets that have wireless connectivity are battery powered. Some wired headsets also are powered to provide noise cancellation or other features.

SUMMARY

[0004] A headset including at least one sensor is described. The sensor is used in the headset to improve function.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

[0006] Figures 1A-D are exemplary forms of headsets.

[0007] Figure 2 is a block diagram of one embodiment of a headset.

[0008] Figure 3 is a flowchart of one embodiment of utilizing sensor data with a headset.

[0009] Figure 4 is a flowchart of one embodiment of using command data for a headset.

[0010] Figure 5 is a flowchart of one embodiment of using other sensor data with a headset.

[0011] Figure 6 is a flowchart of one embodiment of using a single button user interface.

[0012] Figure 7 is a table of one example of using a sports/lifestyle application with a single button user interface.

[0013] Figure 8 is a flowchart of one embodiment of using accelerometer based commands.

[0014] Figure 9 is a block diagram of one embodiment of a computer system which may be used with the present invention.

DETAILED DESCRIPTION

[0015] The method and apparatus described is a headset including at least one sensor. The headset, in one embodiment, includes a motion sensor to detect the motion and orientation of the headset. If the headset is in the orientation indicating that it is being worn by a user and exhibiting a motion signature indicative that it is being worn by a user, then certain configurations may be enabled, and the headset may be utilized in certain ways. In one embodiment, an accelerometer may be used to detect position. In one embodiment, an accelerometer may be used to detect minor motions characteristic of being positioned on a user's ear or head, indicating that the headset is being worn. In one embodiment, a temperature, heart rate, or other sensor may be integrated into the headset.

[0016] The following detailed description of embodiments of the invention makes reference to the accompanying drawings in which like references indicate similar elements, showing by way of illustration specific embodiments of practicing the invention. Description of these embodiments is in sufficient detail to enable those skilled in the art to practice the invention. One skilled in the art understands that other embodiments may be utilized and that logical, mechanical, electrical, functional and other changes may be made without departing from the scope of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense,

and the scope of the present invention is defined only by the appended claims.

[0017] Figures 1A-1D are exemplary drawings of various headsets. Such headsets may be designed to be used with a handheld device such as a mobile phone, MP3 player, or other music player or device. In one embodiment, the headset is designed such that the positions that the headset may rest on a level surface, such as a table, is different from the orientation of the headset when worn by a user. As can be seen on Figure 1A, the headset would have to rest on a sharp edge in order to be in the same position as on a user's head. Similarly, Figure 1B illustrates one embodiment a headset configuration which is an in-ear device that may be used to ensure that the orientation when worn is not duplicated when the headset is stored or carried. Figure 1C illustrates one embodiment of a headset which is a headphone having a similar quality. Figure 1D illustrates one embodiment of a headset which is a pair of glasses incorporating an audio output.

[0018] Note that the term headset for the purposes of this patent encompasses all devices designed to be worn on the user's head, and designed to transmit sound to the user whether through an in-ear speaker, bone conduction, or any other means of audio output.

[0019] In one embodiment, a simple gravity sensor may be used to detect orientation (e.g. a suspended weight, which has the weight touching a contact, when the headset is in a particular orientation). In one embodiment, an accelerometer may be used to determine orientation. The orientation may be determined based upon the rolling averages of accelerations. In one embodiment, once the orientation is determined, a dominant axis is assigned based upon the orientation. Determining an orientation of the electronic device may include identifying a gravitational influence. The axis with the largest absolute rolling average may be the axis most influenced by gravity, which may change over time (e.g. as the electronic device is rotated). Therefore, a new dominant axis may be assigned when the orientation of the electronic device and/or the inertial sensor(s) attached to or embedded in the electronic device changes.

[0020] In one embodiment, the actual axis with the largest absolute rolling average over the sample period is assigned as the dominant axis. In alternative embodiments, the dominant axis does not correspond to one of the actual axes of the inertial sensor(s) in a current orientation, but rather to an axis that is defined as approximately aligned to gravity. In one embodiment, the dominant axis corresponds to a virtual axis that is a component of a virtual coordinate system. In one embodiment, a true gravity assessment, such as by doing trigonometric calculations on the actual axes based on the gravitational influence is performed to determine orientation.

[0021] By ensuring that the "worn" orientation is not likely when the device is elsewhere, a simple identification of the worn orientation is sufficient to identify that the headset is being worn.

[0022] Figure 2 is a block diagram of one embodiment a headset control system. Note that the other aspects of the headset, e.g. transmission, voice control, any other features are not shown in this figure for simplicity.

[0023] The system 200 includes sensor logic 210. In one embodiment, the sensor logic 210 includes an orientation sensor 215. The orientation sensor 215 determines the orientation of the headset in space. In one embodiment, this is used for headsets configured to ensure that the "worn" orientation is not reproduced in other locations.

[0024] In one embodiment, the sensor logic 210 includes an accelerometer 220. The accelerometer 220 in one embodiment, determines orientation by detecting gravity, as noted above. In one embodiment, the accelerometer 220 determines whether a headset is being worn based on a motion signature. Generally speaking, people do not hold their heads perfectly steady. Even while standing still, minute motions are made naturally. The accelerometer 220 in the headset can detect these motions, and utilize that data to determine that the headset is being worn. In one embodiment, there are motion signatures 225 stored, to which the motions detected by the accelerometer are compared. In one embodiment, the motion signature of placing the headset on the ear and removing the headset from the ear is utilized to detect when the headset is being worn. If it has

been placed on the ear, but not removed, the headset is almost certainly being worn.

[0025] In one embodiment, the accelerometer 220 is also used to detect commands indicated by motions such as taps and shakes. In one embodiment, command mapper 230 may be used to identify commands based on accelerometer data. In one embodiment, accelerometer 220 includes a buffer (not shown), to buffer the accelerometer data temporarily.

[0026] In one embodiment, a temperature sensor 235 may be used to detect that the headset is being worn. The temperature sensor 235 would detect the user's body temperature, which is unlikely to be achieved in other environments, e.g. on a desk, in a purse, etc. In one embodiment, the output temperature sensor 235 may also be used for detecting health issues. In one embodiment, the temperature sensor 235 may also be used to provide a temperature-based adjustment to a step counter 240. In one embodiment, the temperature sensor 235 may include two sensors, an ambient sensor (e.g. external to the user) and a body sensor (e.g. the user's body temperature). With two sensors, the system can distinguish between being in a hot car and being worn, based on a difference in ambient and body temperatures. In one embodiment, the temperature difference may also be used to adjust other measurements, as will be described below.

[0027] In one embodiment, a heart rate sensor 245 may be included in the system as well. In one embodiment the heart rate sensor 245 may be incorporated into an ear clip which is part of the headset. The signal from an infrared light transmitted through earlobe would then be used to detect the heart rate in one embodiment. In another embodiment, reflected infrared light somewhere else on the head where there is a high density of capillaries may be used. The heart rate detection may be used to determine whether the headset is being worn. In one embodiment, the heart rate data may also be used to provide an exertion based adjustment to the sports solution 240.

[0028] In one embodiment, one or more of the sensors 210 may be present in a headset, and the sensors can be used to determine with some certainty whether a headset is being worn by a user.

[0029] In one embodiment, as noted above, the system includes a sports solution 240. The sports solution 240 is used to calculate activity information which may include speed, distance, cadence, steps and data via the headset. In one embodiment, temperature or heart rate data may also be provided to the sports solution 240. The sports solution 240 can adjust the calories burned, or the cadences, based on such data, as appropriate. One embodiment of a step counting algorithm that may be used by the system is described in U.S. Patent Application Serial No. 11/891,112, entitled "HUMAN ACTIVITY MONITORING DEVICE WITH DISTANCE CALCULATION." In one embodiment, the output of sports solution 240 may be provided to the user directly via audio feedback using training logic 290. In one embodiment, the sports solution's data may be made available to the user via alternative connections, e.g. a web page or a home computer. In one embodiment, the Sports solution tracks the user's steps taken throughout the day. This activity data and other sensor data may be sent to a remote server. It may be sent via SMS message through a wirelessly tethered mobile phone, or by alternative means. In one embodiment, the collected data received from the headset may be stored in a central location, and made available to the user. One example of such a system is described in co-pending application Serial No. 11/192,549, entitled "MONITOR, CONTROL, AND SHARE (MACS) SYSTEM".

[0030] In one embodiment, the headset further includes a button interface 295. Button interface along with speaker system enables a single button to provide control over the sports solution, and provide audio feedback to the user. Figure 6 is a flowchart of one embodiment of using the single button navigation structure. Figure 7 is an exemplary table that describes one embodiment of the command loops which can be used.

[0031] In one embodiment, the button interface provides the ability to utilize a looping menu system, enabling the user to perform complex selections with the single button.

[0032] In one embodiment, the system further includes configuration logic 250. Configuration logic 250 enables the system to change the settings/profiles based on detected information. In one embodiment,

configuration logic 250 enables the headset to change the headset configuration. In one embodiment, configuration logic 250 enables the headset to send commands to a mobile device which is coupled to the headset, and change the configuration of the mobile device as well.

[0033] In one embodiment, configuration logic 250 includes a power logic 260. Power logic 260 enables the headset to be powered down, when the headset is not being worn, and automatically turned on when the headset is worn. Generally speaking headsets such as Bluetooth headsets are powered by batteries. The user is supposed to manually turn them off when he or she takes them off. This often does not happen, draining the batteries. Therefore, the power logic 260 powers down the transmission and other high powered elements of the headset when the headset is not being worn. Simply by monitoring the sensors 210, which require little power compared to maintaining a Bluetooth or similar network, the headset can be powered down and up, based on actual use. In one embodiment, the power logic 260 gradually scales down sampling of the sensors, as time lapses. For example, while in use accelerometer data may be sampled every 10 milliseconds. When lack of activity is initially detected, the sampling rate may be increased to every 40 milliseconds, and as time lapses the sampling rate may be decreased – gradually, stepwise, or in one step – to the lowest sampling rate. In one embodiment, the lowest sampling rate is one sample per second.

[0034] In one embodiment, configuration logic 250 further includes profile adjustor 270. Profile adjustor 270 adjusts the headset and/or the related mobile device to a different profile. Device profiles include the format how notifications are displayed (e.g. ringing on the headset, ringing a mobile device, ringing both, vibration, etc.) When the system detects that the headset is worn, the profile adjustor 270 can adjust the notification profile to ring only in the headset (and not the phone), and vice versa if the phone is not being worn. Other profile adjustments may be implemented by the profile adjustor 270 in response to sensor input.

[0035] In one embodiment, the system further includes command logic 280. Command logic 280 utilizes data from the sensors 210 to execute commands. In one embodiment, command logic 280 utilizes data from the

accelerometer 220. In one embodiment, command logic 280 interfaces with command store 285, which stores motion signatures for various commands. Such commands may include, for example "answer phone in response to detecting a tap-tap command if headset is on-ear," "answer phone in response to detecting a shake-shake command if the headset is not on-ear" or activate headset when detecting that headset is picked up and placed on ear," etc.

[0036] In one embodiment, the system further includes a user interface 290, which enables a user to adjust the settings. In one embodiment, the user may adjust the profile options, commands, and mappings through user interface 290.

[0037]

[0038] Figure 3 is a flowchart of one embodiment of the system. The process, in one embodiment, is active whenever the handset is powered.

[0039] At block 310, the process determines whether the headset has been placed into the "worn" position. The worn position corresponds to whatever position the headset inhabits when it is in use. If the process determines that the headset has been placed in the worn position, the process continues to block 315.

[0040] At block 315, the process determines whether the headset is currently off/on standby. If so, at block 320, the headset is turned on. In one embodiment, turning on the headset includes enabling any wireless communications, speakers, microphones and other aspects of a headset which would be utilized when the headset is in use. The process then continues to block 325. If the headset was not off, the process continues directly to block 325.

[0041] At block 325, the headset is paired to a mobile device, if this is appropriate. This is applicable only to wirelessly coupled headsets, as wired headsets need not be paired. If the headset is wireless, at block 325, whatever configurations need to be adjusted to couple the headset to the mobile device is performed. In one embodiment, the pairing may be done by utilizing a motion command. One embodiment of pairing in this manner is

described in co-pending application Serial No. 11/855,133 entitled "A METHOD AND APPARATUS TO ENABLE PAIRING OF DEVICES".

[0042] At block 335, the process determines whether there is a call in progress on the mobile device. If so, at block 340, the call is routed to the headset, and answered. This enables a user to pick up a call on a headset simply by placing the headset on the ear. In one embodiment, this feature may be enabled and disabled by the user. The process then continues to block 345. If there is no call in progress, the process continues directly to block 345.

[0043] At block 345, the process performs any other configuration steps. For example, in a mobile device such as a mobile phone, the configuration may include setting the ringer to ring via the headset only, etc.

[0044] The process then returns to block 310, to continue monitoring the status of the headset.

[0045] If at block 310 the process determined that the headset had not been put on, the process continues to block 350.

[0046] At block 350, the process determines whether the headset has been taken off. If so, the process continues to block 355. Otherwise, the process returns to block 310 to continue monitoring the status of the headset.

[0047] At block 355, the process determines whether there is a call in progress, if the mobile device is a telephone. If there is a call in progress, at block 360, the call is placed on hold, as a result of the headset being taken off. In another embodiment, the call may be routed to a speaker phone. In another embodiment, the call may be routed to a speaker phone, and the microphone may be muted. In one embodiment, the user may configure which of these options occurs. In one embodiment, the user may, while removing the headset, perform a motion command to select an option. In one embodiment, nothing further happens until the call is terminated. The device remains in this state, in one embodiment until the user performs another action. Therefore, the process returns to block 310, to monitor the headset. If there was no call in progress, as determined at block 360, the process continues to block 365.

[0048] At block 365, the process re-configures the device as if the headset were not connected. For example, it ensures that any notifications happen through the mobile device, not the headset.

[0049] At block 370, the headset is placed in suspend or low-power mode. In this mode, there is sufficient power maintained to monitor at least one sensor. However, other elements such as Bluetooth or other wireless connections are turned off. This extends the battery life of the device. The process then returns to block 310, to monitor for motion.

[0050] Figure 4 is a flowchart of one embodiment of using command data for a headset. In one embodiment, accelerometer data is continuously received in a buffer, and evaluated.

[0051] The process starts at block 410. At block 410, the process determines whether the data in the buffer corresponds to relevant accelerometer data, e.g. sufficient data for evaluation. Relevant accelerometer data is accelerometer data which may correspond to a command, step, or other monitored unit. If no accelerometer data was received, the process continues to block 415. At block 415, the process determines whether a sufficient period of no motion has occurred. Humans are always moving, at least minor muscle tremors occur even while holding "perfectly still." Therefore, a complete lack of motion indicates that the device is not being worn by a user. If a sufficient period of motionlessness has occurred – in one embodiment 5 seconds – the headset is turned off/put on standby. The process then ends at block 420. Note that the headset, in one embodiment, continues to monitor for accelerations, even while in standby mode.

[0052] If, at block 415, the process determines that the period of non-motion is below the threshold, the process returns to block 410, to continue monitoring the acceleration data.

[0053] If, at block 410, the process determined that relevant accelerometer data had been received, the process continues to block 425.

[0054] At block 425, the process determines whether the accelerometer data corresponds to a step. A step is a unit of movement which is used to monitor a user's activity level. If so, at block 430, the step is

added to the step buffer. The data corresponding to the step is then removed from the accelerometer buffer. The process then returns to block 410, to continue monitoring the accelerometer data.

[0055] If, at block 425, it was determined that the data did not correspond to a step, the process continues to block 435.

[0056] At block 435, the process determines whether the acceleration was a phone command. In one embodiment, one phone command is a shake shake (e.g. a particular identified motion). Note that shake shake in this case corresponds to sharp changes in direction (e.g. rapidly moving the device up-down-up-down). In one embodiment, a shake is defined by an acceleration, a sharp change in direction, and another acceleration, for example rapidly moving the device up and then down. Note that while shake shake is the motion command described, alternative commands may be defined as well. In one embodiment, the shake shake command may be available when the headset is not worn. In one embodiment, when the headset is worn, a phone command may be a tap-tap (e.g. two taps on the headset itself). However, any other defined set of motions may be substituted for the purposes of this discussion.

[0057] If the acceleration was identified as a phone command, at block 440, the process determines whether there is an incoming call, a call in progress, or neither. If there is an incoming call, at block 445, the phone command picks up the call. In one embodiment, the phone command further routes the call to the headset. Since the user is utilizing the headset accelerometer command to pick up the call, it is assumed that the user will wish to utilize the headset for the call. In one embodiment, the user may choose to route the call to voicemail, instead of answering the call, by utilizing a different command. For example, tapping the device three times may be the "send to voicemail command." For another example, taking the headset off may be a command to send the incoming call to voicemail.

[0058] If there was a call in progress, at block 450, in one embodiment the phone command is used to terminate the call. If neither was true, in one embodiment the headset instructs the mobile device to display an interface at block 453. In one embodiment, the interface may be a dialing interface. In

one embodiment, the interface may be a speech recognition menu. The process then returns to block 410, to continue monitoring the accelerometer data. If the data was not a phone command, the process continues to block 455.

[0059] At block 455, the process determines whether the acceleration data corresponds to volume control. Controlling volume, in one embodiment, is based on a motion signature. In one embodiment, the user may define an appropriate motion signature. For example, volume control in one embodiment may comprise a tap-tap (e.g. two short taps on the headset while it is worn.) If the acceleration data was a volume control, the process continues to block 460. At block 460, the process determines whether the headset is being properly worn. In one embodiment, "properly worn" indicates that the headset is worn in a way that the user can utilize the speaker in the headset if one is present. If the headset is properly worn, then the volume control is adjusted in response to the volume control command, at block 465. In one embodiment, the volume control is a cycle (e.g. each tap-tap command increases the volume until a maximum volume is reached, and subsequent tap-taps decrease the volume). Alternative methods of volume control may be used. For example, a tap-tap on one side of the device may indicate that the volume should be increased, while a tap on the other side of the device may indicate that the volume should be decreased. If the headset is not worn, an alternative volume command is executed, at block 470.

[0060] At block 480, the process determines whether the accelerometer data corresponds to any other command that is recognized. If so, that command is executed, at block 485. The command execution may vary by the position of the headset. In one embodiment, a different command may be associated with the same accelerometer data when the headset is worn v. when the headset is in a rest position. The process then returns to block 410, to continue monitoring the accelerometer data.

[0061] Figure 5 is a flowchart of one embodiment of using other sensor data with a headset. In one embodiment, the headset can be used as a step counter. Step counting is useful for determining a user's activity level. In one embodiment, the step counting mechanism is independent of the headset's

location, e.g. it works whether the headset is worn, or carried in a pocket, bag, backpack, purse, or elsewhere on the user.

[0062] At block 510, the process accumulates accelerometer data. At block 520, the process determines whether a potential step has been detected. In one embodiment, if a potential step is detected, the process continues to block 525. Otherwise, the process returns to block 510, to continue accumulating accelerometer data.

[0063] At block 525, the process determines whether there is an established cadence for the steps. Generally speaking, people walk at a particular cadence, and their cadence does not change unless circumstances change, e.g. the terrain, environment, or goals change.

[0064] If there is an established cadence, at block 530, the process determines whether the potential steps fit within the cadence. If so, at block 535, they are added to the step buffer. The process then continues to block 540.

[0065] At block 540, the audio output is adapted – if it is not already so -- to the user's cadence/steps. That is, based on the cadence, the system estimates a noise level, and adjusts audio output. Generally, when a user is running the ambient noise level is quite a lot higher than during a stroll. Therefore, in one embodiment, the audio output – whether of a mobile telephone, a mobile music player, or another device – is adjusted based on the user's cadence.

[0066] In one embodiment, the system may further include a training aspect. The training aspect provides audio feedback to the user. The cadence-adjustment for the audio feedback ensures that the feedback is appropriate to the cadence. A user running at a steady high cadence, as exercise, is likely interested in different data than a user who is taking a leisurely stroll. In one embodiment, if the headset measures that the user is walking, it provides walking related feedback focused on number of steps, aerobic steps, distance and calories. In one embodiment, if the headset detects a run, then feedback is on running parameters such as distance covered, pace, and speed. In one embodiment, the feedback itself, and the

particular types of feedback at various cadences, are configurable by the user.

[0067] At block 545, the process determines whether there are other sensors whose data should be integrated with the accelerometer data. If so, the process continues to block 550. Otherwise, the process returns to block 510, to continue monitoring the accelerometer data.

[0068] At block 550, the process compares sensor data with expected data. The expected data is based on immediate past data – e.g. the last set of readings for this user. In one embodiment, expected data may also utilize statistical data regarding this user, or equivalent users.

[0069] If there is a difference between the expected data and the actual sensor data, at block 560, the process determines whether the difference is an actual difference or a glitch or spike that should be ignored, or a potential problem.

[0070] For example, when measuring heart rate through an earclip, the ambient lighting and user's sweat may affect the readings from the sensor. Using the accelerometer data can adjust for such. For example, if a user is running along at a constant cadence and relatively constant heart rate, if there is a sudden spike in the heart rate, there should be a corresponding change in cadence to reflect this change in heart rate. If cadence has not changed in either direction, then this anomaly in the heart rate can be removed.

[0071] In another example, if one of the sensors is a pressure sensor, it can be used to measure changes in elevation. Knowing elevation changes can be again used to correct the sensor data. For example, if heart rate increases, and the pressure sensor shows that the user is climbing in elevation, and cadence changes slightly, then the system can determine that the user is running up a hill. If cadence is unchanged, elevation is unchanged, but heart rate spikes up or down, again this can be corrected, if it is the result of interfering factors such as user's sweat or changes in ambient lighting effecting the reading of an ear clip heart rate monitor.

[0072] If, at block 560, the process determines that the change is a glitch and is not a real change in the parameter being measured, the data is

corrected at block 565. At block 570, the data is stored. In one embodiment, the full data is stored, but the glitch is labeled. In one embodiment, by making this correction, the user is reassured that the sensor error is not an indicator of a health problem. In another embodiment, the glitch is not displayed. In one embodiment, the glitch data may be displayed upon specific request. In one embodiment, the glitch data may be collected for the purposes of evaluating sensor quality, accuracy, or usefulness. In another embodiment, the glitch data is not stored at all. The process then returns to block 510, to continue collecting data.

[0073] If at block 530, the process determined that the current steps were not within the cadence, the process continues to block 575.

[0074] At block 575, the process utilizes the sensor data to determine whether there are any abnormalities in the accelerometer readings. This parallels the discussion about correcting sensor glitches based on accelerometer data. If no corrections are needed, at block 580, the process starts a new step buffer. This new step buffer will be maintained until a new cadence is established. If there are abnormalities, at block 575, the process adjusts the cadence data based on the sensor information at block 585. The process then returns to block 530, and the step data is then either added to the existing step count, or to the new step buffer, depending on whether the adjusted cadence is still different from a current cadence.

[0075] If at block 525, no cadence was detected, the process continues to block 527. At block 527, a new cadence is established based on the new potential step data, and a new step buffer is initialized. The process then continues to block 535, where the potential step is added to the new step buffer.

[0076] Figure 6 is a flowchart of one embodiment of using a single button interface. The process starts at block 610. In one embodiment, the process starts when the device is active, but no buttons have been pressed.

[0077] At block 615, the process determines whether any buttons presses have been detected. In one embodiment, multiple button presses in rapid sequence may comprise a single command. Therefore, prior to evaluating the button press data the device ensures that the button presses

are finished. If so, the process continues to block 620. Otherwise, the process continues to block 660.

[0078] At block 620, the process determines the current state of the device, and the current location in the menu tree. At block 630, the appropriate response is identified. The appropriate action may be a change in state (e.g. turning on or off some feature), a change in feature (e.g. turn up or down the volume), or presenting another menu option. At block 640, the process determines whether the menu choice is an action, or the presentation of additional menu choices. If the response was to perform an action, at block 650 the action is performed. The process then returns to block 615 to monitor for further button presses.

[0079] If the response is the presentation of further menu choices, the process continues to block 660. At block 660, in one embodiment, menu choices are presented by verbally listing the options to the user.

[0080] If so, the process continues to block 670, to detect a subsequent button presses. At block 670, a subsequent button press is detected. The process then continues to block 620, to act on the subsequent button press.

[0081] If there is no subsequent selection at block 670, the process times out after a while, at block 680. After the process times out, it returns to block 615, to determine whether any button presses have been detected.

[0082] If, at block 615, no button presses are detected, the process continues to block 690. At block 690, the process determines whether there has been any state change detected that may trigger an action in the menu. For example, in one embodiment, a user beginning or ending a workout may trigger an action. In one embodiment, the sensor data is used to detect the state changes.

[0083] If no state change is detected, the process returns to block 615, to continue monitoring for button selections. If a state change is detected, the process continues to block 620, to detect the new state of the device, and the current location in the menu tree. In this way, the user can control the device utilizing only a single button.

[0084] In one embodiment, the headset may include a sports/lifestyle button. Figure 7 is a table of one embodiment of using this feature.

[0085] The sports/lifestyle button provides a single button user interface. In one embodiment, this works for a single ear solution as well as a stereo headset. The button enables a user to navigate through various options, without having to take off the headset, and without requiring a visual feedback mechanism (e.g. a screen). Furthermore, by only using a single button as the interface, the user need not grope for the correct button, and the interface can be easily implemented on a device with extremely limited real-estate such as a headset.

[0086] Figure 7 illustrates an exemplary navigation using a single button, for a lifestyle/sports application. As can be seen, depending on the starting condition, the result of each button press differs. In one embodiment, audio feedback may be used, to indicate what command was received. In another embodiment, the feedback may be via vibration, or audio data provided via bone conduction rather than a speaker.

[0087] In the table shown in Figure 7, the user can start, pause, and stop a workout program. In one embodiment, while the workout program is active, a musical accompaniment may play.

[0088] Figure 7 shows an exemplary table of actions in response to various types of activations of a single button. One of skill in the art would understand that this would apply to other types of applications, for example to navigation with a music player, a mobile phone application, etc.

[0089] In one embodiment, the user may utilize motions to communicate commands, instead of or in addition to using a button interface. Figure 8 is a flowchart of one embodiment of accelerometer based commands, and appropriate feedback.

[0090] The process starts at block 810. In one embodiment, the system continuously monitors for motion commands.

[0091] At block 820, the process determines whether a motion command has been received. A motion command, in one embodiment may be a shake shake command. A shake shake command is a rapid up-down-up-down movement of a device. Of course, this command can only be

received when the device is not being born. In one embodiment, the motion command may be a tap tap command. A tap tap command is two taps in rapid sequence on the device itself. This command can be most easily received when the device is worn.

[0092] If a motion command was received, at block 830, the associated action is identified if possible. If the associated action cannot be identified, at block 840, the process informs the user of this failure, at block 850. If the action is successfully identified, at block 860 the action is taken. In one embodiment, the associated action depends on a state of the device. For example, if the device is a music player that also has a mobile phone aspect, a tap tap command may mean "answer the phone" if there is a call in progress, or "advance to the next song" if there is no call, and the music is playing. In one embodiment, the user may program the commands available for each type of motion command. In one embodiment, a set of default commands may be pre-programmed.

[0093] At block 870, the process determines whether feedback should be provided for the command. If feedback should be provided, the process provides the appropriate feedback at block 880. Feedback for the command may include spoken audio feedback (e.g. "exercise program initiated"), tone audio feedback (e.g. a beep), or feedback provided through bone conduction for a headset that is being worn. Bone conduction is the conduction of sound to the inner ear through the bones of the skull. The process then returns to block 810 to continue monitoring for commands.

[0094] Figure 9 illustrates a block diagram of one embodiment of a computer system which may be used with the present invention. It will be apparent to those of ordinary skill in the art, however that other alternative systems of various system architectures may also be used. The computer system may include a bus or other internal communication means 915 for communicating information, and a processor 910 coupled to the bus 915 for processing information. The system further comprises a random access memory (RAM) or other volatile storage device 950 (referred to as memory), coupled to bus 915 for storing information and instructions to be executed by processor 910. Main memory 950 also may be used for storing temporary

variables or other intermediate information during execution of instructions by processor 910. In one embodiment, the system also comprises a read only memory (ROM) and/or static storage device 920 coupled to bus 915 for storing static information and instructions for processor 910, and a data storage device 925 such as a flash memory, magnetic disk, optical disk and its corresponding disk drive. Data storage device 925 is coupled to bus 915 for storing information and instructions.

[0095] The system may include various input/output devices, such as a screen, audio output, keyboard, button, mouse, etc. These I/O devices may also be coupled to bus 915 through bus 965 for communicating information and command selections to processor 910. Another device, which may optionally be coupled to computer system 900, is a communication device 990 for accessing other nodes of a distributed system via a network. The communication device 990 may include any of a number of commercially available networking peripheral devices such as those used for coupling to an Ethernet, token ring, Internet, or wide area network. The communication device 990 may further be a null-modem connection, a wireless connection mechanism, or any other mechanism that provides connectivity between the computer system 900 and the outside world. Note that any or all of the components of this system and associated hardware may be used in various embodiments of the present invention. It will be appreciated by those of ordinary skill in the art that any configuration of the system may be used for various purposes according to the particular implementation. The control logic or software implementing the present invention can be stored in main memory 950, mass storage device 925, or other storage medium locally or remotely accessible to processor 910.

[0096] It will be apparent to those of ordinary skill in the art that the system, method, and process described herein can be implemented as software stored in main memory 950 or read only memory 920 and executed by processor 910. This control logic or software may also be resident on an article of manufacture comprising a computer readable medium having computer readable program code embodied therein and being readable by

the mass storage device 925 and for causing the processor 910 to operate in accordance with the methods and teachings herein.

[0097] The present invention may also be embodied in a handheld or portable device containing a subset of the computer hardware components described above. For example, the handheld device may be configured to contain only the bus 915, the processor 910, and memory 950 and/or 925. The present invention may also be embodied in a special purpose appliance including a subset of the computer hardware components described above. For example, the appliance may include a processor 910, a data storage device 925, a bus 915, and memory 950, and only rudimentary communications mechanisms, such as a small touch-screen that permits the user to communicate in a basic manner with the device. In general, the more special-purpose the device is, the fewer of the elements need be present for the device to function. In some devices, communications with the user may be through a touch-based screen, or similar mechanism.

[0098] It will be appreciated by those of ordinary skill in the art that any configuration of the system may be used for various purposes according to the particular implementation. The control logic or software implementing the present invention can be stored on any machine-readable medium locally or remotely accessible to processor 910. A machine-readable medium includes any mechanism for storing or transmitting information in a form readable by a machine (e.g. a computer). For example, a machine readable medium includes read-only memory (ROM), random access memory (RAM), magnetic disk storage media, optical storage media, flash memory devices, electrical, optical, acoustical or other forms of propagated signals (e.g. carrier waves, infrared signals, digital signals, etc.).

[0099] In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention as set forth in the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

CLAIMS

What is claimed is:

1. A headset comprising:

a sensor to obtain sensor data, the sensor data indicating whether the headset is being worn by a user; and

a configuration logic to configure the headset based on the sensor data.

2. The headset of claim 1, wherein the sensor data comprises a motion signature and orientation data to determine whether the headset is being worn.

3. The headset of claim 1, further comprising a headset shape configured to define a particular orientation associated with the headset being worn, the case configured to ensure that the particular orientation is not duplicated when the headset is placed somewhere else.

4. The headset of claim 1, wherein the headset comprises one of the following: an earbud, a headphone, a headset including a microphone and a speaker, and glasses incorporating a speaker.

5. The headset of claim 1, wherein the sensor comprises an accelerometer to determine a location of the headset, the location indicating whether the headset is being worn.

6. The headset of claim 1, wherein the configuration logic comprises a power logic to switch the headset from and to stand-by.

7. The headset of claim 1 wherein the sensor comprises:

an accelerometer to detect a gesture, the gesture comprising placing the headset on a user's head and removing the headset from the user's head.

8. The headset of claim 1, wherein the sensor comprises:

an accelerometer to detect a motion command, a motion command comprising a defined set of motions associated with a particular action; and

a command mapper to identify a command associated with the motion command.

9. The headset of claim 8, wherein the motion command comprises one or more of the following: a shake shake command when the headset is not being worn, a tap tap command when the headset is being worn.

10. The headset of claim 8, wherein the configuration logic is further to execute the command identified.

11. The headset of claim 8, further comprising:

a feedback logic to provide feedback to the user regarding the identified command.

12. The headset of claim 7, further comprising:

the power logic to automatically place the headset into stand-by mode when the headset is not moving, indicating that the headset is not being worn by a user.

13. The headset of claim 1, further comprising:

a profile adjustor to adjust settings of the headset based on the sensor data.

14. The headset of claim 13, further comprising the profile adjustor adjusting a setting of a mobile device linked to the headset.

15. The headset of claim 1, further comprising:

a button logic to enable control of a function of the headset utilizing a single button and audio feedback.

16. A method comprising:

determining a motion signature of a headset based on sensor data;

determining whether the headset is being worn by a user based on the motion signature; and

configuring the headset based on whether the headset is being worn by a user.

17. The method of claim 16, further comprising:

identifying a motion command based on data from an accelerometer; and

identifying a command associated with the motion command; and

executing the command.

18. The method of claim 17, wherein the command comprises one or more of the following: altering a configuration of the headset, altering a configuration of a device coupled to the headset, altering an output characteristic of the headset, altering an output characteristic of the device coupled to the headset.

19. The method of claim 16, further comprising:

providing a single button interface to enable a user to navigate through a set of menus utilizing a single button and audio feedback.

20. A headset comprising:

an accelerometer to detect motions, the motions providing a motion signature indicating whether the headset is being worn;

a configuration logic to configure the headset based on the motion signature.

21. The headset of claim 21, further comprising:

a command mapping logic to identify a command associated with a motion signature.

22. The headset of claim 21, further comprising:

a power logic to adjust a power state of the headset based on the determination whether the headset is being worn.

23. The headset of claim 20, further comprising:

the accelerometer to detect a motion command;

a command mapping logic to identify a command based on whether the headset is being worn.

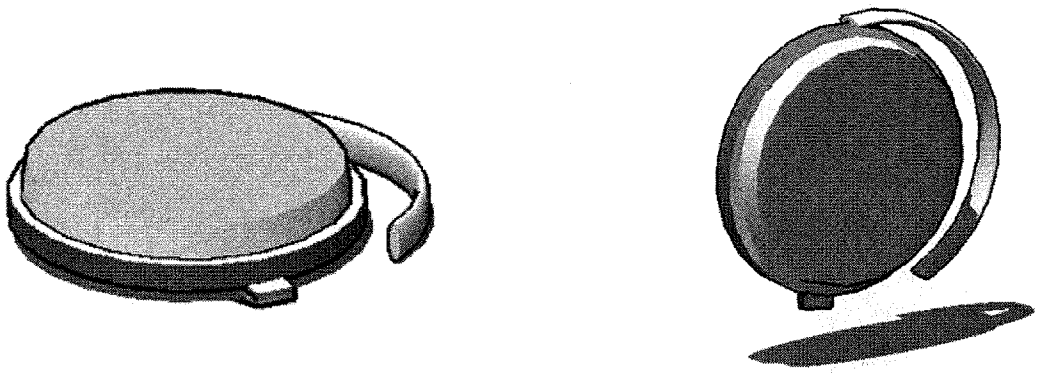

Fig. 1A -1

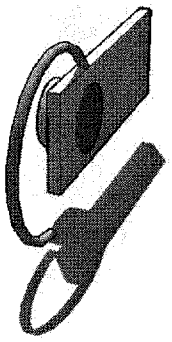

Fig. 1A -2

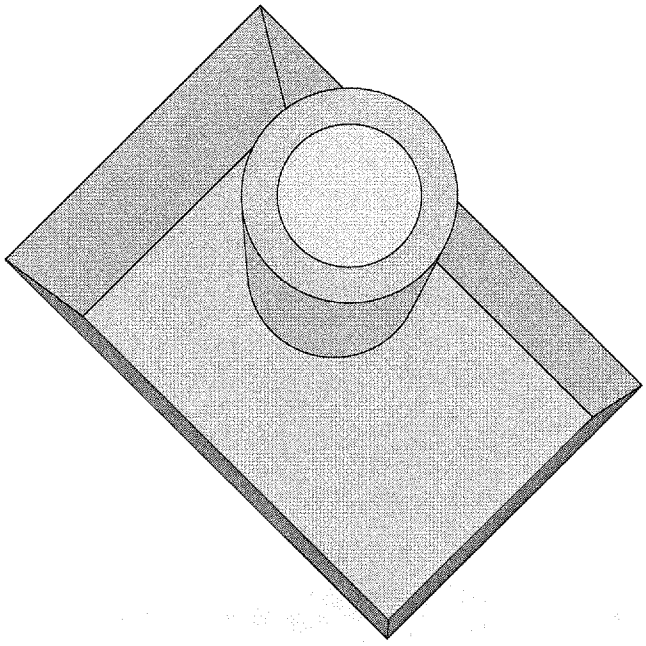

Fig. 1B

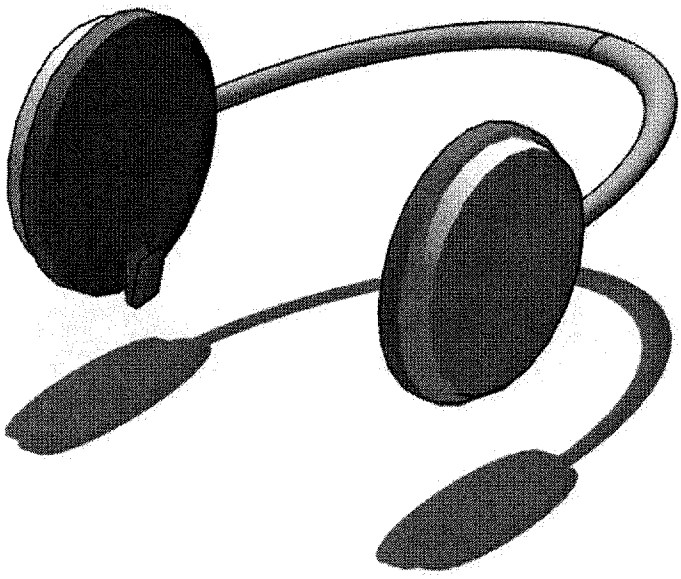

Fig. 1C

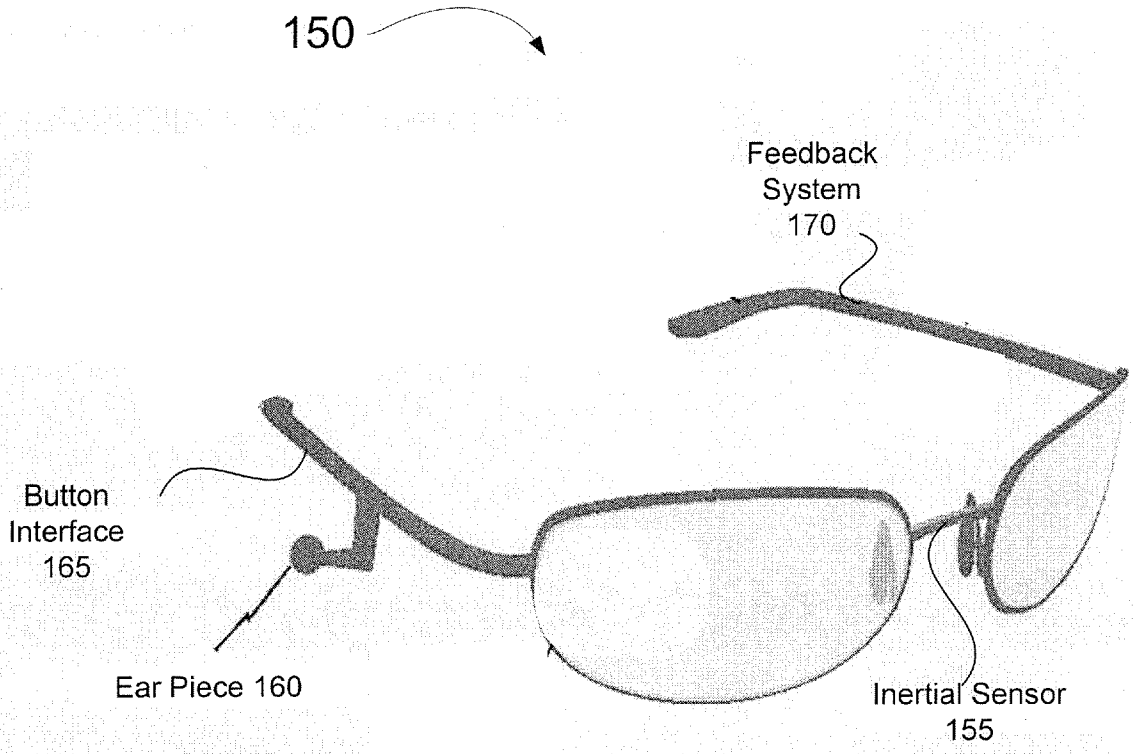
150
Feedback System 170
Button Interface 165
Ear Piece 160
Inertial Sensor 155

Figure 1D

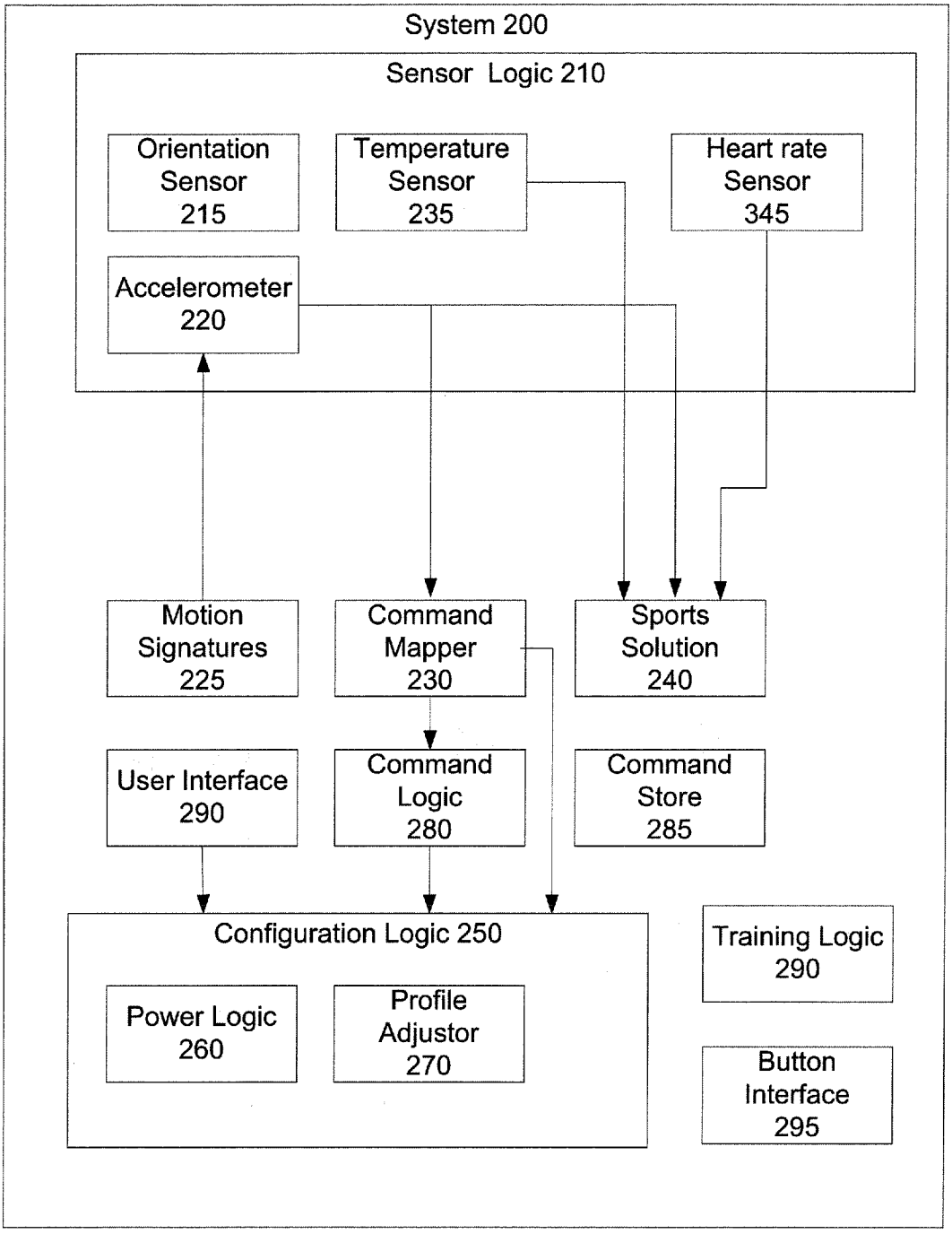
System 200
Sensor Logic 210
Orientation Sensor 215
Temperature Sensor 235
Heart rate Sensor 345
Accelerometer 220
Motion Signatures 225
Command Mapper 230
Sports Solution 240
User Interface 290
Command Logic 280
Command Store 285
Configuration Logic 250
Power Logic 260
Profile Adjustor 270
Training Logic 290
Button Interface 295

Fig. 2

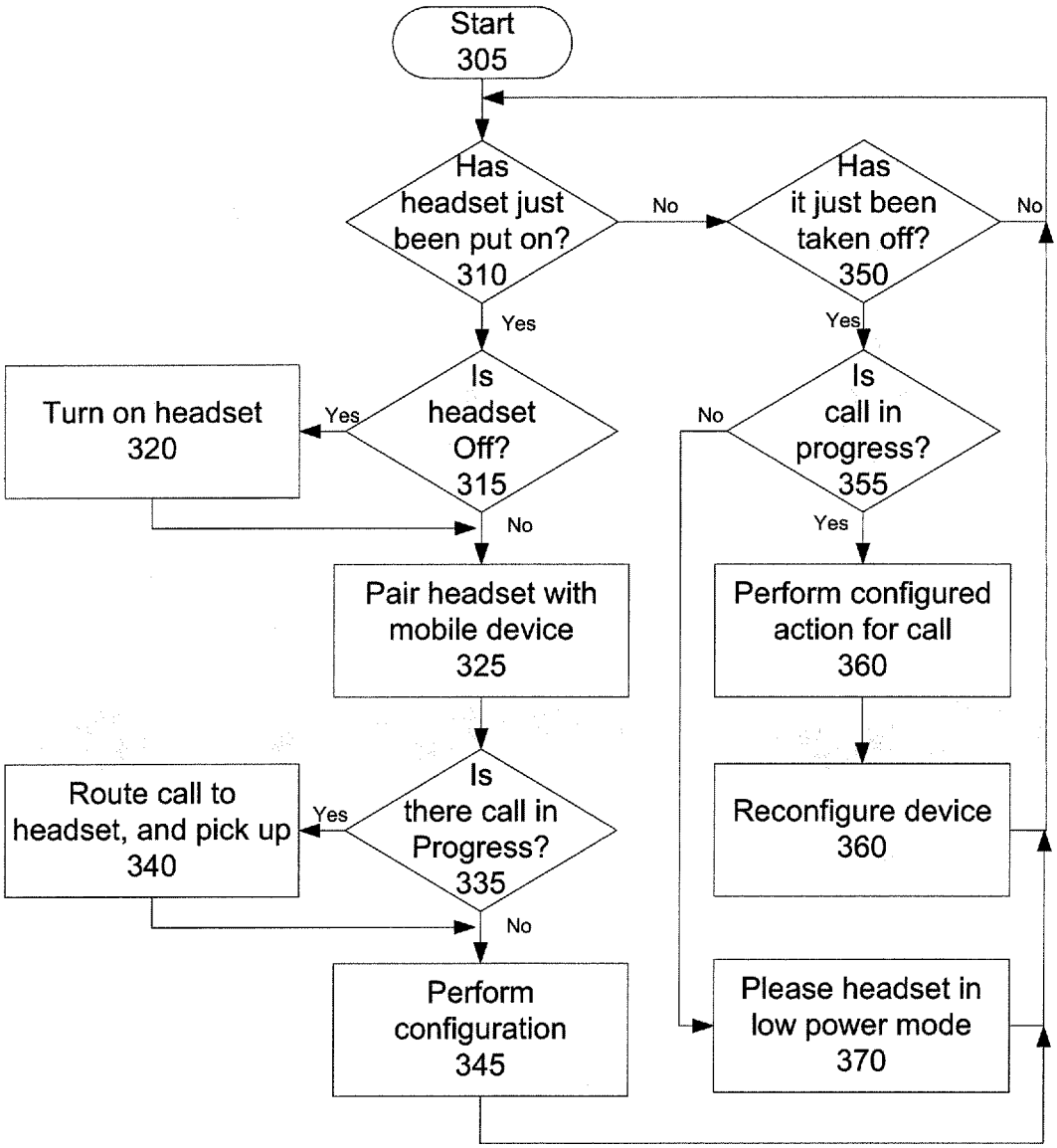
Start
305
Has headset just been put on?
310
No
Has it just been taken off?
350
No
Yes
Yes
Turn on headset
320
Yes
Is headset Off?
315
No
Is call in progress?
355
Yes
Pair headset with mobile device
325
Perform configured action for call
360
Route call to headset, and pick up
340
Yes
Is there call in Progress?
335
No
Reconfigure device
360
Perform configuration
345
Please headset in low power mode
370

Fig. 3

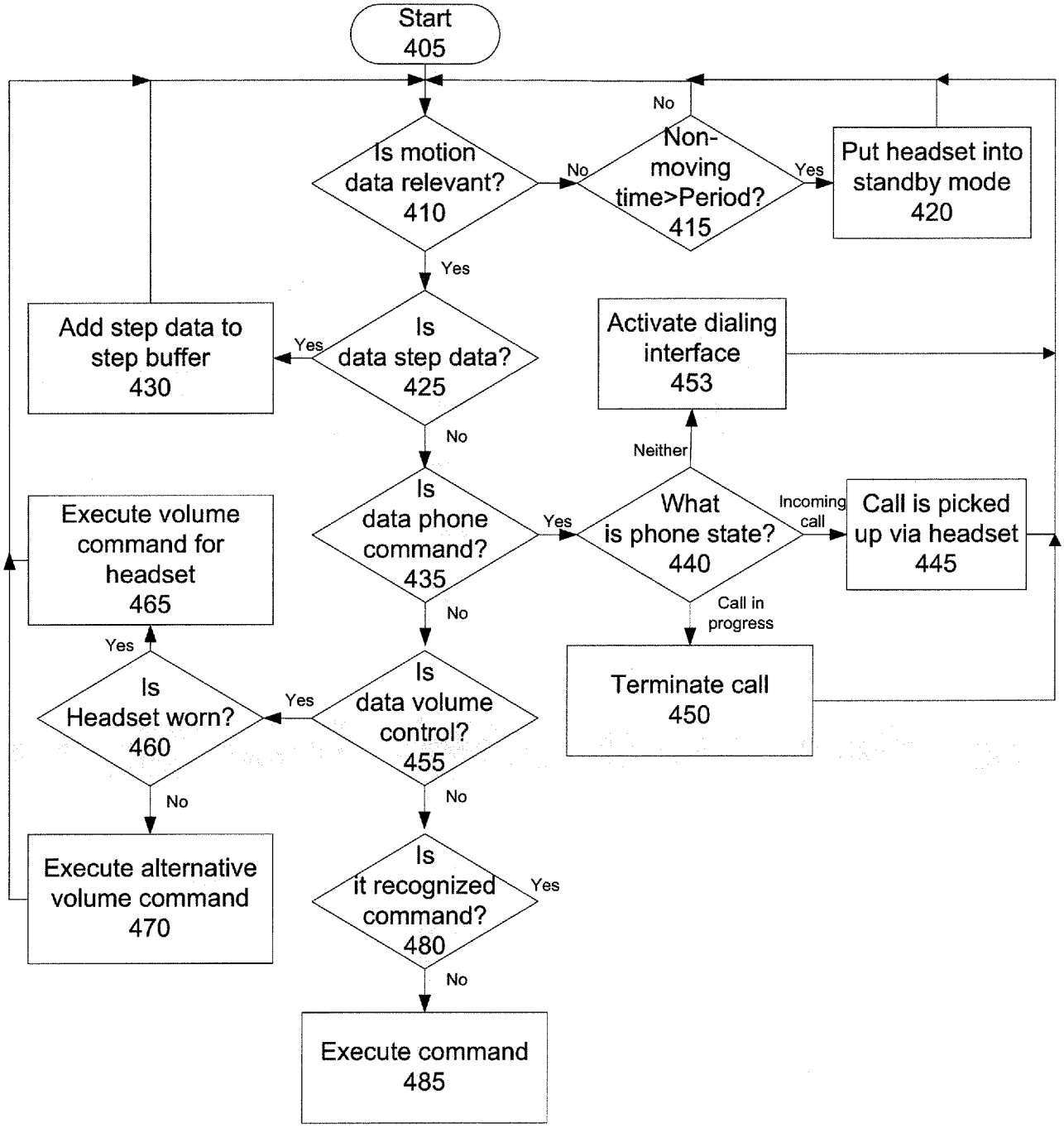
Start
405
Is motion data relevant?
410
No
Non-moving time>Period?
415
Yes
Put headset into standby mode
420
No
Yes
Is data step data?
425
Yes
Add step data to step buffer
430
Activate dialing interface
453
No
Neither
Is data phone command?
435
Yes
What is phone state?
440
Incoming call
Call is picked up via headset
445
Call in progress
Terminate call
450
No
Execute volume command for headset
465
Yes
Is Headset worn?
460
Yes
Is data volume control?
455
No
Execute alternative volume command
470
No
Is it recognized command?
480
Yes
No
Execute command
485

Fig. 4

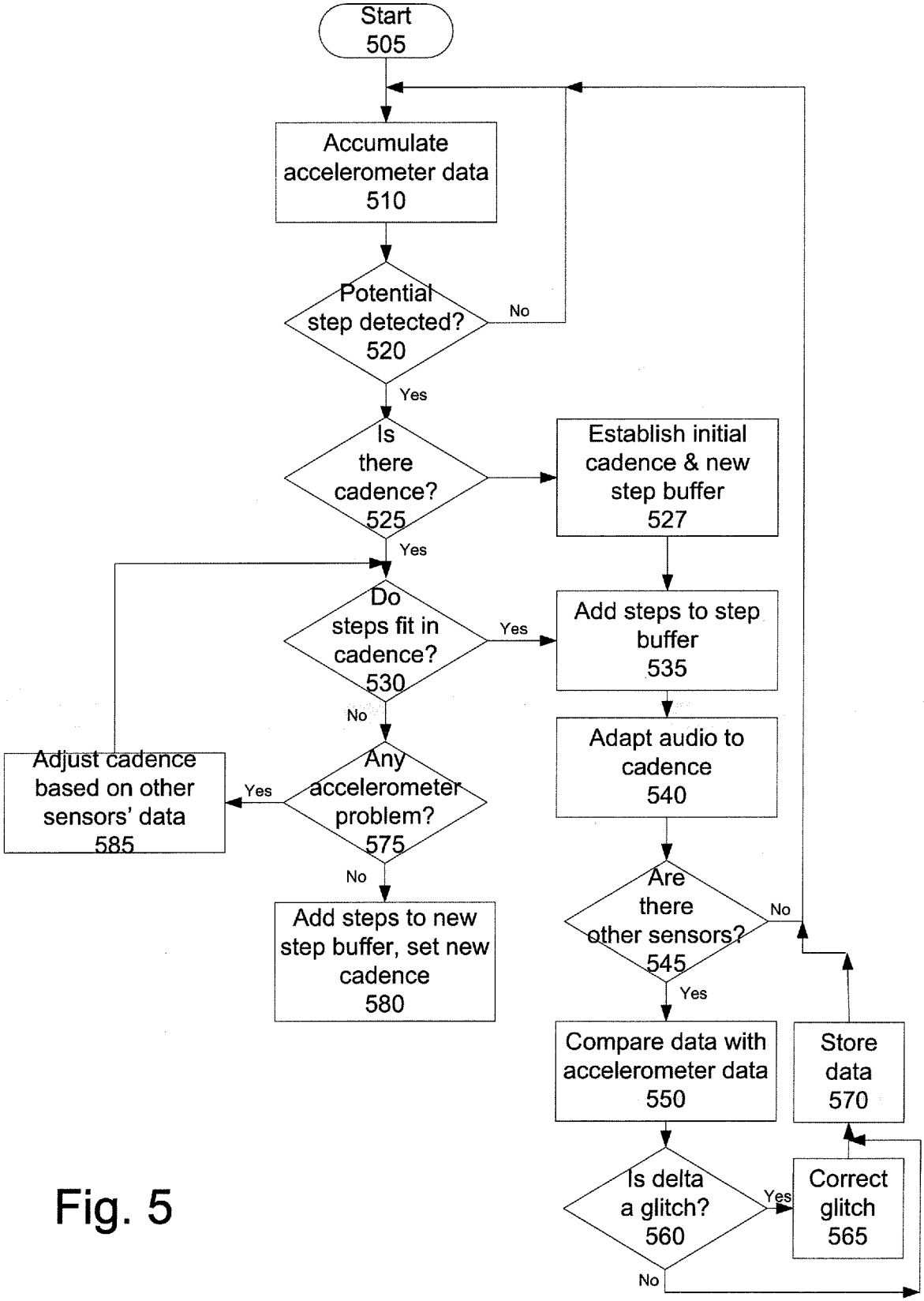
Start
505
Accumulate accelerometer data
510
Potential step detected?
520
No
Yes
Is there cadence?
525
Establish initial cadence & new step buffer
527
Yes
Do steps fit in cadence?
530
Yes
Add steps to step buffer
535
No
Adapt audio to cadence
540
Adjust cadence based on other sensors' data
585
Yes
Any accelerometer problem?
575
No
Add steps to new step buffer, set new cadence
580
Are there other sensors?
545
No
Yes
Compare data with accelerometer data
550
Store data
570
Is delta a glitch?
560
Yes
Correct glitch
565
No

Fig. 5

Current State	Command	Basic	Exemplary Communication
Off	Long Push	Turns on	Ascending Arpeggio . "Welcome to Motion-Sports. Your Step Counter is now on. To hear your step-count, press once at any time. To start a workout, press twice. To get a summary of your last 5 workouts, press three times.
Off	Inactivity	Reduce sensor test	Reduce sensor test frequency, until minimum is reached
On	Long Push	Turns off	Descending Arpeggio. "Headset turning off"
On	Inactivity	Turns off	Descending Arpeggio. "Headset turning off"
No workout in progress	One push	Summary report	"In 27 minutes, you have walked 3,400 steps and covered 1.3 miles."
No workout in progress	Two pushes	Initiate workout	Ascending Arpeggio. "Workout is about to start. Once the workout starts , for a progress update press once or to pause the workout press twice at any time. 5-4-3-2-1-GO!"
No workout in progress	Three pushes	Overall summary	In your last 5 workouts, you have covered 8.9 miles in 1 hour and 32 minutes at an average pace of 6 minutes and 45 seconds per mile. For best accuracy you can calibrate this instrument in 3 minutes, press twice to start the calibration process, press once to return to the main menu.
Workout in progress	One push	Summary report	"Total workout time is 4 minutes and 23 seconds. You have covered 0.75 miles at an average pace of 6 minutes and 45 seconds per mile"
Workout in progress	Two pushes	Pause workout	Descending Arpeggio. "Workout Paused. Total workout time is 4 minutes and 23 seconds. You have covered 0.75 miles at an average pace of 6 minutes and 45 seconds per mile. Press once to resume workout, twice to end workout."
Workout paused	One push	Restart workout	Ascending Arpeggio. "Workout Resuming. "5-4-3-2-1-GO!"
Workout paused	Two pushes	End workout	Descending Arpeggio. "Congratulations, Workout Completed. "Total workout time was 4 minutes and 23 seconds. You covered 0.75 miles at an average pace of 6 minutes and 45 seconds per mile."

Fig. 6

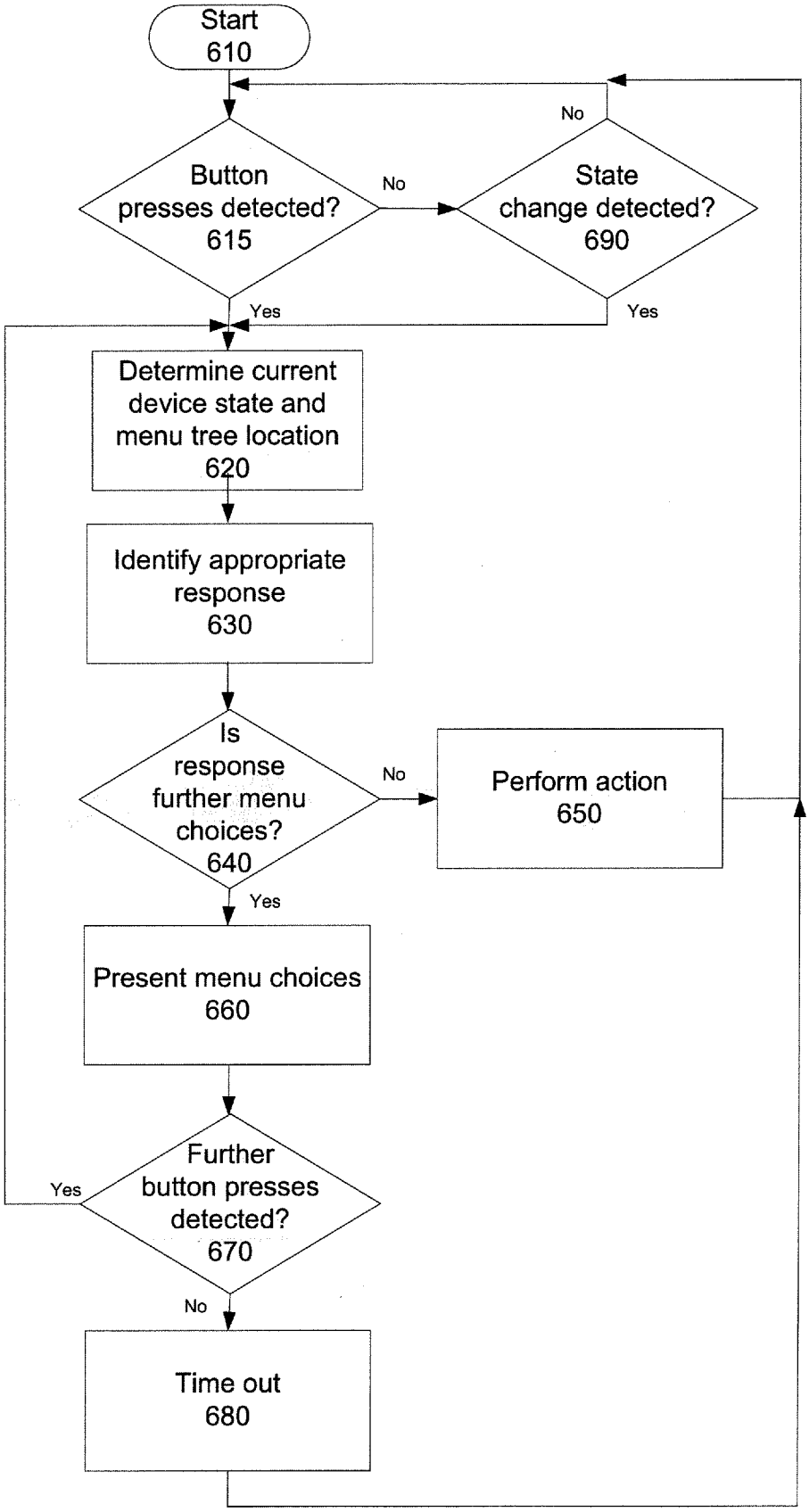
Start
610
Button presses detected?
615
No
State change detected?
690
No
Yes
Yes
Determine current device state and menu tree location
620
Identify appropriate response
630
Is response further menu choices?
640
No
Perform action
650
Yes
Present menu choices
660
Further button presses detected?
670
Yes
No
Time out
680

Fig. 7

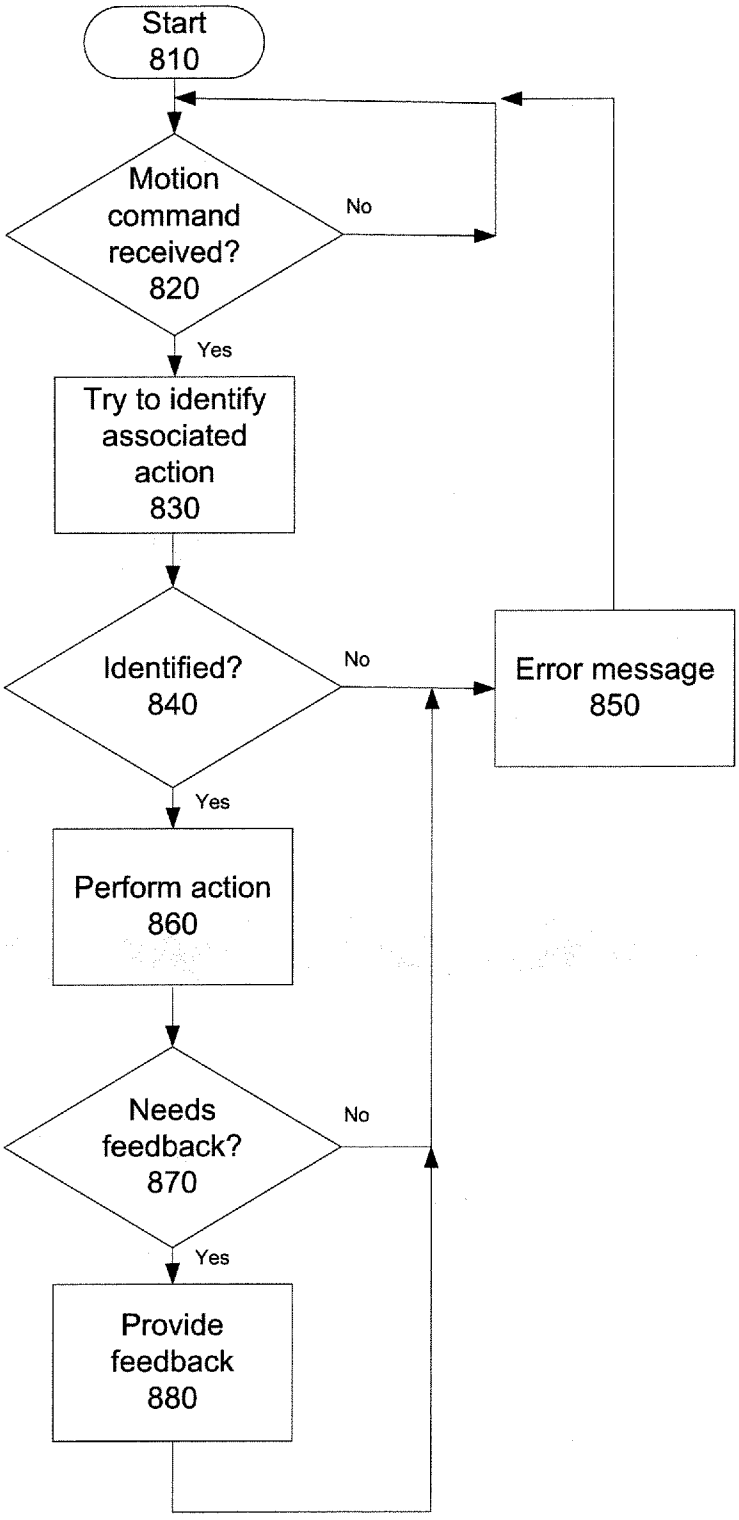
Start
810
Motion command received?
820
No
Yes
Try to identify associated action
830
Identified?
840
No
Error message
850
Yes
Perform action
860
Needs feedback?
870
No
Yes
Provide feedback
880

Figure 8

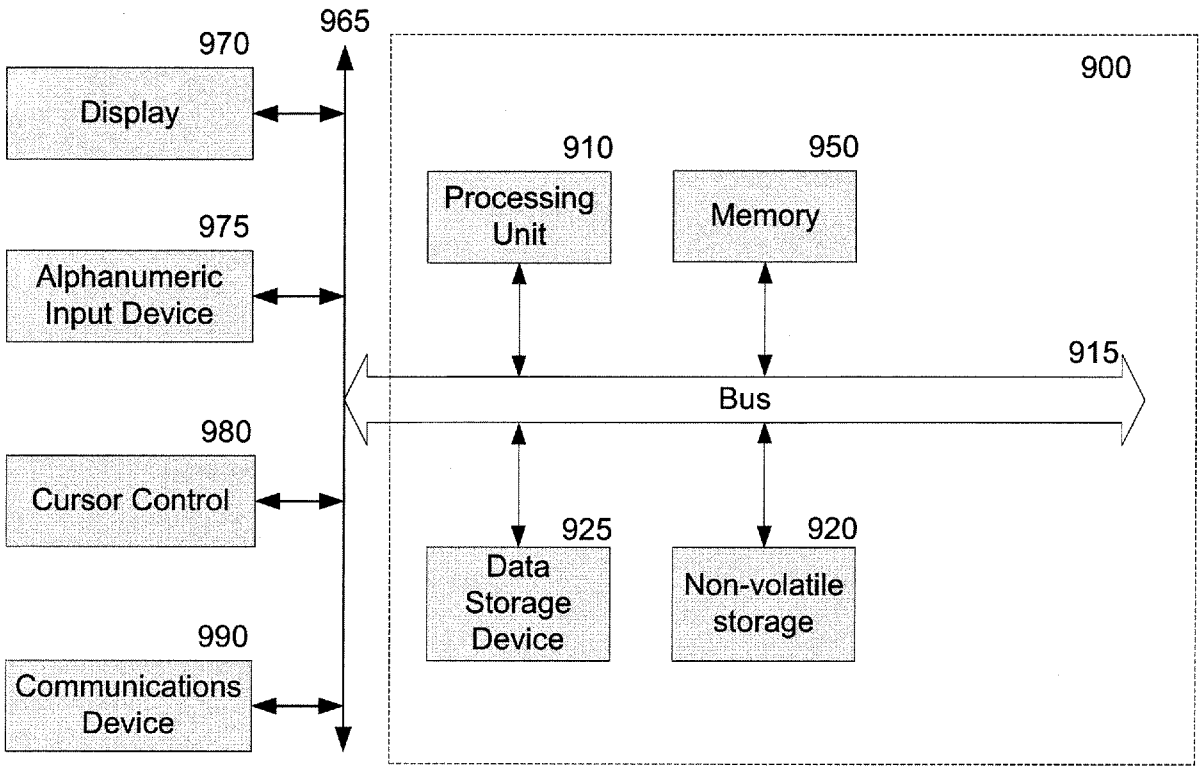
965
970
Display
900
910
Processing Unit
950
Memory
975
Alphanumeric Input Device
915
Bus
980
Cursor Control
925
Data Storage Device
920
Non-volatile storage
990
Communications Device

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/042183

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04M 3/42 (2009.01)
USPC - 379/201.06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - H04M 3/42, G06F 17/00 (2009.01)
USPC - 379/201.06, 235/375

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)
PatBase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2005/0232404 A1 (GASKILL) 20 October 2005 (20.10.2005) entire document	1, 3-4, 6-7, 13-15 --- 2, 5, 8-12, 16-23
Y	US 7,010,332 B1 (IRVIN et al) 07 March 2006 (07.03.2006) entire document	2, 5, 8-12, 16-23
Y	US 2007/0125852 A1 (ROSENBERG) 07 June 2007 (07.06.2007) entire document	9
Y	US 6,013,007 A (ROOT et al) 11 January 2000 (11.01.2000) entire document	19

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"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
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 June 2009	24 JUN 2009
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774