(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 September 2017 (28.09.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/165238 A1

(51) International Patent Classification:
G06F 1/24 (2006.01)

(21) International Application Number:
PCT/US2017/023076

(22) International Filing Date:
17 March 2017 (17.03.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
15/076,528 21 March 2016 (21.03.2016) US

(71) Applicant: **MEDHAB, LLC** [US/US]; 3216 Essex Dr., Mansfield, Texas 76063 (US).

(72) Inventor: **ROSS, Johnny**; 3216 Essex Drive, Mansfield, Texas 76063 (US).

(74) Agent: **KARICH, Eric**; 20 Crestview, Aliso Viejo, California 92656 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: WEARABLE COMPUTER SYSTEM AND METHOD OF REBOOTING THE SYSTEM VIA USER MOVEMENTS

(57) Abstract: A wearable computer system (10) has an article of clothing (14) adapted to be worn by the user, and an electronic device (20). The electronic device (20) has a computer processor (42) operably connected with a computer memory (46), a battery (50), and at least one accelerometer (49). The computer memory (46) stores a stored data template of movement data that corresponds to a predefined series of movements, and also further stores executable code that includes the steps of: receiving movement data from the at least one accelerometer (49); comparing, periodically, the movement data to the stored data template; and rebooting the electronic device (20) upon a determination that the received movement data matches the stored data template.

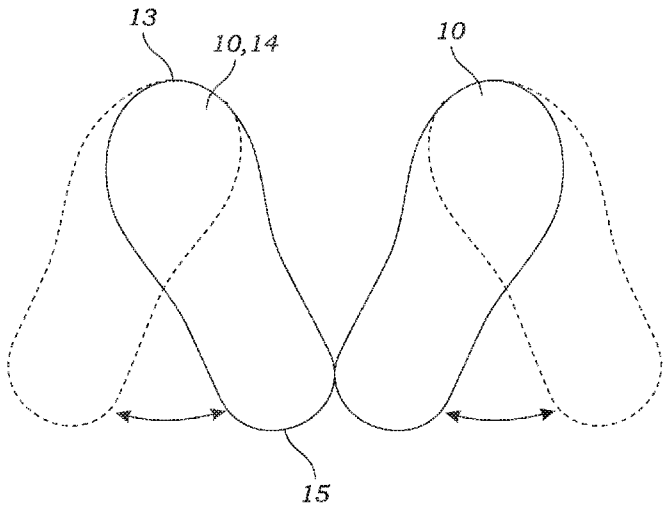


Fig. 11

WO 2017/165238 A1

TITLE: WEARABLE COMPUTER SYSTEM AND METHOD OF REBOOTING THE SYSTEM VIA USER MOVEMENTS

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION:

This invention relates generally to wearable computer systems, and more particularly to systems and methods for measuring power generated during running.

DESCRIPTION OF RELATED ART:

A growing number of computer devices are not integrated into clothing and similar wearable articles that are worn by users, for a variety of purposes, such as monitoring users as they exercise, engage in rehabilitation exercises, walk, sleep, work, and otherwise live their lives. These devices can gather data, provide information and feedback, and otherwise assist the users in their lives.

While typical computer devices include an on/off switch, or other forms of switches or other mechanisms for periodically rebooting the computer device, it may be difficult to provide such a switch in a wearable computer device. Furthermore, such a switch may physically interfere with the use of the computer device, and may also increase the expense of the device.

There is a long felt need in the industry for a wearable computer device that may be rebooted as needed via a mechanism that does not include a switch or similar physical mechanism.

SUMMARY OF THE INVENTION

The present invention teaches certain benefits in construction and use which give rise to the objectives described below.

One embodiment of the present disclosure includes a wearable computer system that may be rebooted by the movements of a user wearing the system. The system includes an article of clothing adapted to be worn by the user; and an electronic device for monitoring the movements of the user. The electronic device comprises a computer processor operably connected with a computer memory, a battery, and at least one accelerometer. The computer memory stores a stored data template of movement data that corresponds to a predefined series of movements. The computer memory further stores executable code that, when executed, enables the computer processor to perform a process that comprises the steps of: receiving movement data from the at least one accelerometer; comparing, periodically, the movement data to the stored data template; and rebooting the electronic device upon a determination that the received movement data matches the stored data template.

A primary objective of the present invention is to provide a wearable computer system having advantages not taught by the prior art.

Another objective is to provide a wearable computer system that may be rebooted in response to the movements of a user wearing the system.

Another objective is to provide a wearable computer system that does not require a switch or similar mechanism for rebooting the wearable computer system.

Another objective is to provide a sensor system that is less expensive to manufacture.

Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The advantages and features of the present invention will become better understood with reference to the following more detailed description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a top plan view of a wearable computer system, which represents one embodiment of the present invention;

FIGURE 2 is a perspective view of a felt layer on which is mounted two sensor assemblies, in a first step of manufacturing the wearable computer system of Fig. 1;

FIGURE 3 is a sectional view of a mold in which the felt layer and the sensor assemblies of Fig. 2 are placed;

FIGURE 4 is an exploded perspective view of a sensor sheet removed from the mold once urethane has been injected to form a urethane layer, and illustrating the wearable computer system being cut from the sensor sheet;

FIGURE 5 is a perspective view of a portable electronic device having a monitoring app installed thereupon for monitoring the movement of a user, and for illustrating the movements of the user on a display of the portable electronic device;

FIGURE 6 is a block diagram of the operable components of the portable electronic device of Fig. 5;

FIGURE 7 is a perspective view of the portable electronic device having the monitoring app installed thereupon for monitoring the forces measured by force sensors in the sensor insoles and illustrating the data in the form of a pie graph;

FIGURE 8 is a perspective view of the portable electronic device having the monitoring app installed thereupon for monitoring the forces measured by the force sensors in the sensor insoles and illustrating the data in the form of a contour plot;

FIGURE 9 is a block diagram of one embodiment of a sensor system that includes the portable electronic device, a monitoring computer, and a remote computer for monitoring the sensor system and storing data;

FIGURE 10 is an exploded perspective view of one embodiment of the wearable computer system of Fig. 1 being inserted into footwear to be worn adjacent a user's foot;

FIGURE 11 is a top plan view of a pair of the insoles of Fig. 10, illustrating movement of the wearable computer systems that is designed to cause a reboot of the wearable computer systems; and

FIGURE 12 is a flow diagram illustrating an exemplary method implemented by the wearable computer system of Fig. 10 for rebooting the wearable computer system in response to movements by the user wearing the system.

DETAILED DESCRIPTION OF THE INVENTION

FIGURE 1 is a top plan view of a wearable computer system 10 as used in one embodiment of the present invention. A felt layer, discussed below, is removed from the view of Fig. 1 to more clearly show a sensor assembly 20 that is located within the wearable computer system 10. Electronic components of the wearable computer system 10 are shown in a block diagram to more clearly illustrate the invention.

The wearable computer system 10 includes an article of clothing 14 adapted to be worn by a user, and an electronic device 20 for monitoring the movements of the user. In this embodiment, the article of clothing 14 is in the form of a sensor insole, as described in more detail below. In alternative embodiments, the article of clothing 14 may be in the form of alternative articles of clothing, including but not limited to as shirts, vests, sleeves, pants, shoes, bracelets, headbands, and other items known in the art, having different forms of sensors for monitoring the user wearing the article of clothing. In some embodiments, for example, the article of clothing 14 may be in the form of a shirt or other clothing covering the user's torso, for monitoring the user's heartbeat, temperature, and/or other vital signs. In another embodiment, the article of clothing 14 may be a sleeve (e.g., a compression sleeve) for monitoring movements of the user's arms or legs. In another embodiment, the article of

clothing 14 may be a bracelet for monitoring the user's movements (e.g., during exercises, rehabilitation exercises, safety monitoring, etc.). While a few alternatives are discussed herein, the scope of the invention should not be limited to these particular examples, but should further include any alternatives that may be devised by one skilled in the art given the teachings of the present invention.

As shown in Fig. 1, the electronic device comprises a computer processor 42 operably connected with a computer memory 46, a battery 50, and at least one accelerometer 49. In different embodiments of the invention, the electronic device 20 may further include a wide range of electronics and sensors for various purposes, as discussed in more detail below, and the invention should be construed to include this range of constructions, such as would be known to those skilled in the art.

Critical to the present invention, the wearable computer system 10 is adapted so that it may be rebooted by the movements of a user wearing the system 10. The wearable computer system 10 does not have a switch for disconnecting the battery 50 from the electronic device 20. For purposes of this application, the term "switch" is hereby defined to include any switch, button, lever, or similar or equivalent physical mechanism known in the art for removing power to the electronic device 20, or mechanically initiating a reboot of the electronic device 20, by physical manipulation of the switch rather than the movement of the wearable computer system 10.

In this embodiment, the computer memory 46 stores a stored data template of movement data that corresponds to a predefined series of movements. The computer memory 46 further stores executable code that, when executed, enables the computer processor to perform a process that enables the reboot of the electronic device 20 in response to the movements of the user (rather than the operation of a switch or other standard form of triggering a reboot).

In this embodiment, the process includes continually receiving movement data from a means for detecting movement, in this case the at least one accelerometer 49, and periodically comparing the movement data to the stored data template. In the event that the received movement data matches the stored data template, the programmed code initiates a reboot of the electronic device. While the current embodiment receives the movement data from the

accelerometer 49, in another embodiment the means for receiving movement data may include one or more of the force sensors 30, a combination of the force sensor(s) 30 and the accelerometer 49, or any other sensors known in the art that may function as described for determining the movement of the device.

In the embodiment of Fig. 1, the sensor insole 14 is shaped and adapted to fit within a shoe (not shown) of a user, or otherwise positioned against the underside of the foot of the user. A sensor assembly 20 is included in the sensor insole 14 for monitoring various forces and conditions of the sensor insole 14. In this embodiment, the sensor assembly 20 includes force sensors 30. In the embodiment of Fig. 1, the sensor insole 14 may include an electronic device 40 (in this case, in the form of a printed circuit board ("PCB")) having (or being operably attached to a computer processor 42, a computer memory 46, a battery 50, at least one accelerometer 49, and the force sensors 30.

The force sensors 30 are adapted to send signals to the processor 42, transferring the values of the properties sensed by the force sensors 30 individually. Each of the plurality of force sensors 30 may be operably connected to the processor 42 by electrical connectors 60, in this case wires, or any other operative connection known in the art. The force sensors 30 may be any form of sensors useful for sensing force that are known in the art. While four of the force sensors 30 are illustrated, in different embodiments other numbers of the force sensors 30 may be used, depending upon the requirements of the user.

In this embodiment, the wires 60 may be attached to the PCB 40 via soldering; however, the wires 60 may be attached using any techniques or attachment mechanisms known in the art. The solder joints may also be covered with a protective layer, to strengthen the connection to withstand the stresses and strains placed upon the wires 60. This is further discussed in the descriptions of Figs. 11-13.

The wires 60 may be positioned in an S-curve configuration 62 between the force sensor 30 and the PCB 40. The S-curve configuration 62 provides strain relief during use, so that the electrical connection is not broken during use. For purposes of this application, the term "S-curve configuration" is defined to include any configuration in which the wires 60 are bent in places, so that the wires 60 are long enough to accommodate forces against the various components while in use without breaking any solder joints.

The computer processor 42 and the computer memory 46 may be any form of processor or processors, memory chip(s) or devices, microcontroller(s), and/or any other similar processing devices known in the art.

The battery 50 supplies power to the processor 42 and the plurality of force sensors 30 (and any other components). The battery 50 may be rechargeable which can be charged by an external power source, or in alternative embodiments it may be replaceable. The sensor assembly 20 may further include an inductive charging coil 70 which may be operably mounted adjacent the battery 50 and/or the PCB 40. The inductive charging coil 70 is used to charge the battery 50 by using an external inductive charger (not shown). Other devices or systems known in the art for supplying power may also be utilized, including various ports for charging the battery 50, and/or generating power directly using piezoelectric, solar, or other devices known in the art.

In the present embodiment, the force sensors 30 are piezoresistance based, meaning that the resistance of the circuit in which they have been integrated changes in response to the applied force. Other methods known to those skilled in the art may also be used to provide a force sensing mechanism. The applied force may then be determined by incorporating the force sensors 30 in a voltage divider, whereby the voltage across the force sensor 30 would change in response to the applied force, an RC circuit whereby the time constant would change in response to the applied force, or integrating an Ohmmeter to measure the resistance directly, or other methods of reading the applied force known to those skilled in the art. If a force measurement is desired instead, the known area of measurement allows that to be determined directly. The force sensors 30 have an upper limit to the force they may measure and still be accurate or without breaking. Using the plurality of force sensors 30 as shown in the present embodiment allows total force to be shared amongst the force sensors 30 and to measure the force distribution in the user's foot. The use of small sensors allows the force to be sampled over a smaller fraction of the surface area of the foot, giving a proportionally smaller force.

The force sensors 30, in the present embodiment, have a high sampling rate, up to 200 kHz, which is far beyond what would normally be needed for an activity like walking, but may be desirable when one wishes to analyze more impulsive forces, such as those due to running or

kicking. In some embodiments, the sampling rate and duration may be adjusted by the user based on the intended application. In some other embodiments, temperature sensors (not shown) may be incorporated into the sensor assembly 20 for providing temperature data. This may be important as the force sensor 30 may also be weakly temperature dependent and therefore changes in temperature may need to be corrected for.

The processor 42 may also include the memory 46 to store data collected by the plurality of sensors 30, and a transceiver 48 to transmit and receive signals for communication between the processor 42 and external computing devices enabled to send and receive the signals. The processor 42, the memory 46 and the transceiver 48 may all be mounted on the PCB 40, or in other suitable locations as determined by one skilled in the art.

The sensor insole 14 may be used in conjunction with a shoe (not shown), including any form of sneaker, slipper, or any other footwear known in the art for holding the insole 14 in mechanical communication with the underside of the person's foot. As a person wearing the shoe runs, force is exerted on the sensor insole 14, and data from the force sensors 30 can be collected. The data collected by the processor 42 from different force sensors 30 may be used in a variety of ways. The sensor assembly 20 may use the transceiver 48 to connect and transfer data from the sensor assembly 20 to a local and/or remote computer (not shown). The data may be transmitted by the transceiver 48 by any number of methods known to those skilled in the art, however, in particular, the data may be transferred in packets or bundles, containing multiple bytes or bits of information. The bundling of the data may be performed according to those skilled in the art for optimizing the data transfer rate between the sensor insole 14 and any remote receiver. Alternatively in another embodiment, the data may be reported via a reporting device worn by the user, attached to the shoe, located nearby, or located remotely. In another embodiment, the data may also be used to compare with a threshold value and take a predefined action based on the comparison. The data may be received, collected, reviewed, and utilized using different forms of computer devices.

The wearable computer system 10 may further include a clock 47 for tracking time, or it may be operably connected to another device for this purpose. The function of the clock 47 is discussed in greater detail below.

FIGURES 2-4 illustrate one embodiment of how the wearable computer system 10 may be manufactured. FIGURE 2 is a perspective view of a felt layer 90 on which is mounted two of the sensor assemblies 20 of Fig. 1. Fig. 2 illustrated one method of manufacturing the wearable computer system 10 of Fig. 1. Further steps in the manufacturing process are shown in Figs. 3 and 4, as discussed in greater detail below.

As illustrated in Fig. 2, the felt layer 90 has a top surface 92 and a bottom surface 94. The felt layer 90 may be large enough for one sensor assembly 20; or alternatively, it may be large enough for a pair of the sensor assemblies 20, as illustrated, or it may be large enough for a larger number of the sensor assemblies 20, depending upon the manufacturing requirements of the user. The felt layer 90 should neither be very thick, such that the force sensors 30 are not able to sense the wearer's foot properties correctly, nor be very thin so that the sensor assembly 20 causes pain or discomfort to the user's foot.

The term "felt layer" is hereby defined to include one or more layers of woven and/or nonwoven material (which may be produced by, e.g., matting, condensing and pressing woolen fibers bonded together by chemical, mechanical, heat or solvent treatment), and to also include one or more layers any form of cloth, flexible synthetic material, and any other layer of material that is suitable for insertion into a shoe consistent with the description of the present invention. The scope of this term should be broadly construed to include any material or materials that may be devised by one skilled in the art for this purpose. The felt layer 90 should be flexible enough to bend as a person wearing the shoe runs, to limit any discomfort felt by the wearer while running.

The sensor assemblies 20 may be mounted on the felt layer 90 and fastened in place, or they may just be placed thereupon. In one embodiment, the sensor assembly 20 may be attached to the felt layer 90 using an adhesive (not shown) or a suitable tacky substance. The purpose of attaching the sensor assembly 20 with the felt layer 90 is to retain the location of the force sensors 30 and other components of the sensor assembly 20, such as the PCB 40, the battery 50, and the inductive charging coil 70, during the molding process. Any alternative method which serves the purpose of properly positioning the sensor assembly 20 may also be used and may not require any bonding or direct attachment of the sensor assembly 20 to the felt layer 50, in an alternative embodiment.

FIGURE 3 is a sectional view of a mold 110 in which the felt layer 90 and the sensor assemblies 20 may be placed. As illustrated in Fig. 3, the mold 110 may include a top portion 112 and a bottom portion 114 that close together to form a planar internal cavity 116; however, any suitable construction functional as described may be used, according to the knowledge of one skilled in the art. The mold 110 further includes components (not shown) to supply a suitable resilient material (e.g., urethane foam, rubber, or any suitable resilient material known in the art) to form a resilient sheet on top of the felt layer 90 inside the internal cavity 116. The mold 110 may include conduits 117 for injecting the urethane foam and to allow air and gases to escape from the closed mold 110. While one embodiment of a mold, jig, or similar tool is shown, the wearable computer system 10 (of Fig. 1) may be manufactured using any similar or equivalent tool or method known in the art, and such alternatives should be considered within the scope of the present invention.

FIGURE 4 is an exploded perspective view of a sensor sheet 80 removed from the mold 110 of Fig. 3 once urethane foam has been injected to form a urethane layer 120 over the felt layer 90. As illustrated in Fig. 4, the sensor sheet 80 includes the felt layer 90 and the urethane layer 120 over the felt layer 90, with the sensor assembly 20 sandwiched between the felt layer 90 and the urethane layer 120.

Fig. 4 also illustrates the wearable computer system 10 being cut from the sensor sheet 80 via a cutting element 12. The cutting element 12 may be any form of cutting device, blade, die, or similar device. The cutting element 12 may be used to cut the sensor sheet 80 around the sensor assembly 20 to form a generally foot-shaped perimeter 100 and thereby forming the sensor insole 14 with the urethane layer 120 surrounding the sensor assembly 20 and over the cut out felt layer 90. The foot-shaped perimeter 100 is not necessarily a particular shape, as long as it may be placed into a shoe or other device to be worn by the user. There may be different sizes of the sensor insoles 14 depending on the size of shoes where the sensor insoles 14 would be used. In one embodiment of the present invention, only five sizes of the sensor insoles 14 are made and all other sizes will be cut or otherwise adapted from these original five sizes.

While Figs. 2-4 illustrate one embodiment of how the wearable computer system 10 (of Fig. 1) may be manufactured, alternative, similar, and equivalent methods may also be used, and such alternative methods of production should be considered within the scope of the present

invention.

FIGURE 5 is a perspective view of one embodiment of a portable electronic device 140 that may be utilized with the wearable computer system 10 (of Fig. 1). As illustrated in Figs. 5-6, the portable electronic device 140 of this embodiment is a smart phone that includes a monitoring app 150 (discussed in Fig. 6, below) installed thereupon. The application, or "app," is a computer program that may be downloaded and installed using methods known in the art. The app enables the user to monitor their movement as detected and analyzed by the wearable computer system 10, as illustrated in Fig. 5, and to communicate with the wearable computer system 10 as described in greater detail below to aid in executing proper physical motions. In the discussion of Figs. 5-6, we will begin with a description of the components of the portable electronic device 140, as they relate to the present invention. Then we will discuss in greater detail the functionality of the monitoring app 150, in one example, an embodiment used for physical therapy, and in another example, an embodiment for being used by a person during running.

As illustrated in Fig. 5, the monitoring app 150 also monitors a person performing a physical activity such as running, and displays the physical activity in real time (defined to include near-real time, with a slight delay for computer processing, transmission, etc.). The sensor system 300, shown in Fig. 9, includes the wearable computer system 10 and the portable electronic device 140, as discussed above and below in more detail.

In the embodiment of Fig. 5, the monitoring app 150 (of Fig. 6) operably installed on the portable electronic device 140 performs multiple steps. First, a digital model 161 of the person is generated, and the digital model 161 is displayed on the computer display 160 of the portable electronic device 140. Movement of the digital model 161 is displayed, in real time, based upon the data received from the wearable computer system 10 (of Fig. 1), so that the digital model 161 of the person approximates the movement of the person performing the physical activity.

This enables the user to watch himself/herself performing the exercises, to better determine whether they are being performed correctly. The display may also be transmitted to other computer devices, such as a doctor, trainer, caretaker, etc., so that they may monitor the activities and take corrective action if required.

The movement of the digital model 161 may also be compared with a preferred movement model of the monitoring app 150 (of Fig. 6), to determine if the actual movement of the person approximates the preferred movement model, or if correction is needed. Communication with the person, in real time, with corrective instructions 163 may be provided when correction is needed. Corrective instructions 163 may include audio, text, video (e.g., video of the exercise being correctly performed), haptic, and/or any other medium desired to assist the user in performing the exercises such as running (or other activities) correctly.

The system may also provide a script that outlines exactly how the user should run in a physically appropriate manner. For examples countdowns, instructions (e.g., raise leg, lower leg, etc.), which are synchronized with the movements in the video. In this manner, the user is able to perform the run correctly, and receive both instruction and correction, without the requirement of having a personal trainer, which can be expensive. The system is therefore able to deliver superior training, at relatively lower costs, than are available in the prior art.

FIGURE 6 is a block diagram of the operable components of the portable electronic device 140 of Fig. 5. The portable electronic device 140 may include various electronic components known in the art for this type of device. In this embodiment, the portable electronic device 140 may include a device display 160, a speaker 162, a camera 164, a device global positioning system ("GPS"), a user input device 168 (e.g., touch screen, keyboard, microphone, and/or other form of input device known in the art), a user output device 170 (such as earbuds, external speakers, and/or other form of output device known in the art), a device transceiver 172 for wireless communication, a computer processor 174, a computer memory 176, the monitoring app 150 operably installed in the computer memory 176, a local database 178 also installed in the computer memory 176, and a data bus 180 interconnecting the aforementioned components. For purposes of this application, the term "transceiver" is defined to include any form of transmitter and/or receiver known in the art, for cellular, WIFI, radio, and/or other form of wireless (or wired) communication known in the art. Obviously, these elements may vary, or may include alternatives known in the art, and such alternative embodiments should be considered within the scope of the claimed invention.

As shown in Fig. 6, the speaker 162, typically integrated into the portable electronic device 140, though the speaker 162 may also be an external speaker, and may give the user audio feedback and instructions during use. The speaker 162 may be any sort of speaker, known by those skilled in the art, capable of transforming electrical signals to auditory output.

Another synergistic use of the monitoring app 150 with common portable electronic devices 140 is that the monitoring app 150 may be continuously calibrated by using the camera 164 of the portable electronic device 140 and common motion capture software. In this instance, if the motion capture determined that both the user's feet were on the ground, but for some reason the monitoring app 150 reported that the user's feet were not at the same level, the position of the user's feet in the monitoring app 150 could be reset to the correct value. The same calibration technique used for position may also be used for the user's velocity and distance travelled based on the number of steps taken, discussed below in greater detail.

The integration of the device GPS 166 and the wearable computer system 10 provides several benefits. First, it may be another potential method of calibration. For example, if the horizontal motion of the sensors (specifically by use of the force sensors 30) have determined that user has travelled a certain distance, agreement can be checked with the device GPS 166 and changes can be made to the data or real-time acquisition programs. The onboard device GPS 166 also increases the safety of the user. If the user was undergoing a strenuous activity and suddenly, and/or for an extended period of time, stopped, the monitoring app 150 may determine that a problem has occurred. The monitoring app 150 could then alert the authorities or others and provide the user's location.

There are many types of user input devices 168 that may be combined for use with the present invention. One type may be the touch-screen capability present in modern smartphones. Here, the user could adjust settings, program routines, select exercises, etc. Various user input devices 168 which may be integrated with present invention, for interfacing with the monitoring app 150 or the wearable computer system 10, should be considered equivalent and within the scope thereof.

The user output devices 170 may be speakers, earbuds, external connections to computers, etc. The user output device 170 is a key component of providing feedback to the user and/or others who may be monitoring the user and is discussed in greater detail below. Various

user output devices 170 may be integrated with present invention and should be considered equivalent and within the scope thereof.

The device transceiver 172 may be an integrated wireless transmitter/receiver combination, though a wired connection may be possible or desired in some instances. The device transceiver 172 may be used to communicate with the transceiver 48 on the wearable computer system 10, and/or other computers or monitoring devices. Such transceivers are known to those skilled in the art and their equivalents should be considered within the scope of the present invention.

The local database 178 may be included for receiving and storing data temporarily, such as medical programs, therapy routines, logs from earlier use, a predefined distance value, a reference step count, a reference distance ratio, a predefined threshold time, power generated by the user during running, a distance travelled by the user during running, and information about the user; however, this is not required, and all data may be retained in another location if desired.

The above components may be interconnected via the data bus 180, which is a generic term for a conduit of information or electronic signals. There are many possible implementations of the data bus 180 by those skilled in the art, and such implementations should be considered equivalent and within the scope of the present invention.

As illustrated in Fig. 6, the computer memory 176 of the portable electronic device 140 may be used to extend the utility of the portable electronic device 140. In this case, the computer memory of the portable electronic device 140 receives the monitoring app 150 and/or an internet browser for browsing web pages that may include additional medical or training programs. Additional programs may also be included, such as medical diagnostic programs, exercise routines, therapy routines, training programs, and others, some of which are discussed in greater detail below.

We begin a discussion of alternate embodiments of the present invention, by introducing an embodiment where the monitoring app 150 verifies connectivity with the transceiver 48 of the wearable computer system 10 and the device transceiver 172. In this embodiment, the monitoring app 150 continually monitors the acquisition of data. Should data acquisition be

interrupted, the monitoring app 150 will make a predetermined number of attempts, three for example, to regain connectivity. Should this fail, an alarm or other visual, haptic, or audio cue will be produced, alerting the user to move the portable electronic device 140 closer to the wearable computer system 14 in order to regain the data connection.

In the embodiment of Figs. 5 and 7-8, the monitoring app 150 may be used to generate a graphical user interface on the device display 160 of the portable electronic device 140, as illustrated in Fig. 5, to enable the user to interact with the monitoring app 150. In this embodiment, the graphical user interface may be used to show the user the position of their body, in two or three dimensions, while they are performing the actions required by the instruction program. Also, such instruction may be in the form of audio commands from the speaker 162, visual cues on the monitor of the portable electronic device 140, beeping or other audio cues from the speaker 162 that would indicate pacing or other information, or vibration of the portable electronic device 140. The information given to the user by the monitoring app 150 need not be just instruction, but could also indicate when to start or stop an activity, audio or visual feedback of the results of a completed activity, information on suggested future activities or programs to utilize, or trends of a user's progress in performing various activities.

Using running as one example, the force sensors 30 sense forces applied against the bottom of the foot. With this information, the monitoring app 150 may guide the user as they perform the activity, and reconstruct their motion as it is saved in the computer memory 176. Because the force sensors 30 are located in several places on each foot, the alignment of the foot may be determined. The force sensors 30 may determine if the user is stepping too hard or soft, fast or slow, if their rhythm is correct, if there is a systematic drift during the course of the activity, and more. The monitoring app 150 may also provide feedback and encouragement to the user, telling them how to better perform the activity, giving them the time remaining, or coaxing them to continue even if the monitoring app 150 determines they are becoming fatigued.

In physical therapy it is just as important to not perform an activity incorrectly as it is to perform it correctly. Learning an incorrect way to move may slow the healing process, or even further injure the user. By monitoring the user's motions, the monitoring app 150 can instruct the user to stop if they are performing an activity too wrong, and if the problem

cannot be corrected by the feedback provided, to seek the assistance of a medical practitioner before resuming exercises.

In a related embodiment, a companion app 149 may be installed on another instance of the portable electronic device 140, for providing a convenient way of monitoring a patient or user who is using the monitoring app 150, for example a doctor or nurse with the companion app 149 installed on a mobile device, such as a cell phone, laptop computer, tablet computer, etc. The companion app 149 may include the following functionality: the ability to report notifications of the exercise status and sensor insole data, as with the monitoring app 150, the ability to receive text, SMS, or other types of instant messaging or alerts to inform the user of the companion app 150 that the user of the monitoring app 150 has missed an exercise or other scheduled activity such as running, the ability to video the patient performing exercises, with the videos able to be sent to health care providers or others, and the ability to receive notifications from providers or others requesting videos or other data from the patient, practitioner, trainer, or any user of the companion app 149 or monitoring app 150. Other functions of the companion app 149 and their modes of implementation may be added or modified by those skilled in the art, and should be considered equivalent and within the scope of the present invention.

A related feature of the present invention is that it enables, both in real-time and over longer timespans, the user to engage in activities that encourage bilateral equivalence. When an activity is performed, it is often important to not favor one side over another. If a user desires to treat both sides, it is often natural that one side is 'better' at an exercise than the other, either due to handedness or prior physical condition. For instance, if one side is stronger than the other, the force sensors 30 may detect greater force applied when the stronger side performs the prescribed action. The monitoring app 150 may detect this favoring, and either explicitly or internal to the routine, instruct the user to perform the actions to bring both sides into equivalent physical condition. Often this requires the analysis of the long-term performance of a user, and here the storage of data on the local database 178 or on the database of a remote computer (shown in Fig. 9) is useful and is described below. With the monitoring app 150 connected to a network (shown in Fig. 9), the data may be monitored in real-time or afterwards by medical practitioners or others. This has the potential for not just the sharing of information with numerous practitioners, but also the monitoring of the user's progress when not on-site, such as therapy performed in the

user's home or other location away from the treatment facility.

In yet another embodiment, the monitoring app 150 may contain a mode wherein the monitoring app 150 instructs the force sensors 30 to turn on for only brief periods of time during a longer duration exercise such as running a marathon. This allows data on the user's performance to be sampled throughout the duration of their activity, without the risk of draining the battery 50 as may happen for activities of long duration. Typically the user has entered in the monitoring app 150 an estimate of the duration of their activity, usually measured in hours or fractions thereof. The monitoring app 150 may then pick several times to transition the sensor insoles 10 from a "sleep mode" to a "sprint mode".

During the "sleep mode" the force sensors 30 are not acquiring data and the battery 50 is putting out minimal power, only enough to maintain telemetry with the monitoring app 150. At the prescribed times, (the "sprint mode") the monitoring app 150 will instruct the battery 50 to begin a power up cycle, for warming the battery 50 and bringing it to full power. Then the force sensors 30 will be powered and take data for a short span of time, typically about 10 seconds, though the time may be set to be longer or shorter as needed. At the end of the "sprint mode", data collection ceases and the battery 50 is powered down into "sleep mode" as discussed above. "Sprint mode" may be initiated by voice command, touching the touch-sensitive device display 160 of the portable electronic device 140, or pre-programmed.

In yet another embodiment, the monitoring app 150 may contain a mode useful for acquiring data for a sprinter. In this embodiment, the monitoring app 150 signals the user to begin running. In the case of sprinting, there is a time lag between the start of running and the attainment of the rhythmic full speed run. This occurs when the user is accelerating, getting their stride, etc. To save on memory space, data for some predetermined interval, for example two seconds, is not taken. After the two second delay, data is taken normally and throughout the end of the run. Optionally, data may be taken the entire time in order to capture the start as well, as feedback during that phase may be important to the user's performance. Also, if the user is primarily concerned with monitoring starts, the monitoring app 150 may only run for the first few seconds to record just that portion of the run.

The applications of the present invention go far beyond physical therapy or running. For instance the sensor insoles 10 may be used in the training of an athlete such as a martial

artist, runner, or bicyclist. Here, the training is very similar to physical therapy, where technique can be monitored with feedback provided to the user and/or trainers. Also a history of the user's progress may be formed for use in charting progress and suggestions for further development.

FIGURE 7 is a perspective view of the portable electronic device 140 having the monitoring app 150 installed thereupon for monitoring the forces measured by the force sensors 30 in the sensor insoles 10 and illustrating the data in the form of a pie graph. In Fig. 8, the force data may be shown as a pie graph for each of the force sensors 30, containing the percentage of the user's total weight (or applied force) when standing. Alternatively, with a calibrated system, the absolute values may be displayed. The method of display of the data from the sensor insoles 10 may be displayed as shown or in any other method known to those skilled in the art, and a few of those alternate methods are discussed below as alternative embodiments.

FIGURE 8 is a perspective view of the portable electronic device 140 having the monitoring app installed thereupon for monitoring the forces measured by the force sensors 30 in the sensor insoles 10 and illustrating the data in the form of a contour plot. Fig. 8 shows an alternate embodiment of the output of the monitoring app 150 as shown on the device display 160 of the portable electronic device 140. Here, the device display 160 shows a contour map of the intensity of the applied force, at the position of the force sensors 30 on the user's foot. In another embodiment, the displayed image may be a heat or intensity map, with the colors corresponding to surfaces of constant force. Additionally the monitoring app 150 may contain an interpolation program, using methods known to those skilled in the art, to provide a more detailed mapping of the force on the bottom of the foot, which may be helpful for medical applications, in particular. Additional numbers of the force sensors 30 may be placed in the wearable computer system 14 to increase the accuracy of the interpolation.

The sensor system 300 (shown in Fig. 9) may be used for monitoring and reporting power generated by a person performing an exercise such as running. The sensor system 300 comprises the wearable computer system 14 (such as is shown in Fig. 1), and the portable electronic device 140 (shown in Fig. 6). In this embodiment, the monitoring app 150 (shown in Fig. 6) is in the form of a power measurement program operably installed in the computer

memory 176 of the portable electronic device 140.

As shown in Figs. 1, 6, and 9, the power measurement program 150 receives data from the force sensors 30 to determine a force generated by the person via the substrate layer of the sensor insole. The power can then be calculated based upon the data received including force generated by the running person, distance travelled by the person, and the taken time, and the power may then be outputted to and displayed on the computer display 160 of the portable electronic device 140, as discussed in greater detail below.

For purposes of this application, the terminology of computing "power" and displaying "power" is hereby defined to include any particular form of power or equivalent measure. This may include an instantaneous measurement, an average over time, peak power, and average peak power, to name a few.

FIGURE 9 is a block diagram of one embodiment of a sensor system 300 that includes the portable electronic device 140, a monitoring computer 260, and a remote computer 240 for monitoring the wearable computer system 14 and storing data. The sensor insoles 10, in the present embodiment, are operably connected (e.g., wirelessly) to the portable electronic device 140, such as via BLUETOOTH® or similar protocol.

In this embodiment, wherein the portable electronic device 140 is a cellular telephone, the portable electronic device 140 also streams data via a cellular network 200 (and/or another network 210, such as the Internet, or any form of local area network ("LAN") or a wireless network, to the other computers 260 and/or 240. Alternatively, in another embodiment, the portable electronic device 140 may communicate with the network 210 through a network device 220 such as a wireless transceiver or router. Here we consider two computers in the present embodiment of the invention, the remote computer 240 and the monitoring computer 260.

The remote computer 240 has a computer processor 242, a computer memory 244, a user interface 246 operably installed in the computer memory 244, a database 248 operably installed in the computer memory 244, and a remote display 250. The remote computer 240 functions primarily as a repository of data taken during the user's activity such as running. Data stored on the remote computer 240 may be accessed via the network 210 by other

computers, or viewed locally using the remote display 250.

The monitoring computer 260 has a computer processor 262, a computer memory 264, a browser 266 operably installed in the computer memory 264, and a monitoring program 267 operably installed in the computer memory 264. Also, the computer may be connected to a monitoring display 268 for viewing the data and/or the output of the monitoring program 267, and have a printer 269 for printing physical copies of the same. The browser 266 may be a typical internet browser or other graphical user interface ("GUI") that may allow communication over the internet to the patient, other health care practitioners, or trainers. The monitoring program 267 interprets the results of the data sent by the monitoring app 150 and provides analysis and reports to the user of the monitoring computer 260. The monitoring program 267 provides information not included in the monitoring app 150, for example diagnosis of conditions and suggestions for treatment, or comparison of results with other patients either in real-time or by accessing the database 248 of the remote computer 240.

One embodiment of the sensor system 300 includes providing the various components, particularly the force sensors 30, a unique address programmed therein for identification. The sensor system 300 includes a data collection system 230 for simultaneously monitoring both the first and second locations and, in addition to any other number of locations that may be desired, around the world.

In this embodiment, the data collection system 230 may include a cell phone (such as is shown in Fig. 5), and the remote computer 240 for simultaneously monitoring both the first location and a second location. In alternative embodiment, any one of these elements, or combinations thereof, may be used, in addition to any additional computer devices for tracking the data.

In this embodiment, a unique address is stored in each of the various components, and may include an IP address, or any form of unique indicator (e.g., alphanumeric). The address may be stored in the memory 264, or in any other hardware known in the art, and is transmitted with the data so that the data may be associated with the data in a database (e.g., the local database 178 of the portable electronic device 140, or the database 248 of the remote computer 240). This method is discussed in greater detail below.

Data from the various components may then be streamed to the remote computer 240 (or other component of the data collection system 230) for storage in the database 248. For purposes of this application, "streaming data" may be performed in real time, with data being constantly transmitted (e.g., in typical "packets"), or it may be aggregated and sent periodically, or it may be stored and periodically downloaded (e.g., via USB or other connection) and transmitted.

In one embodiment, the data may include force data from the at least one of the force sensors 30. Selected data, such as the force data, may be transmitted in real time, while more complex data, such as the movement data may be stored in the memory 46 until a suitable trigger, such as actuation of a pushbutton, passage of a predetermined period of time, or other trigger (e.g., at the end of an exercise), and then streamed as a single transmission. Transmitting the data in this manner has proven to greatly relieve demands on the sensor insoles 10, which might otherwise make management of the data extremely difficult, especially when large numbers of users are utilizing the system.

In one embodiment, the data may be periodically analyzed by the remote computer 240 (or other suitable computer system) for "alarm conditions" (e.g., information and/or deviations that may be of interest to the user and/or the doctor and/or any other form of administrator). If an alarm condition is detected, a pertinent alert may be sent to the monitoring computer 260, directly to the user (e.g., via text message, email, signal to the portable electronic device 140, etc.), or to any other suitable party. For example, if the user is putting too much force on an injured leg during rehabilitation, or performing the exercise incorrectly, an alert may be sent to the user for immediate action, and/or a message (e.g., training video, etc.) may be sent via email or other method to help the user perform the exercise correctly.

In another embodiment, in which the sensor system 300 is used in an industrial setting, reports may be sent to supervisors to correct incorrect behavior of workers. In the case of monitoring workers compensation recipients, a fraud monitor may be alerted if the recipient is detected acting in a manner inconsistent with their injury (e.g., playing a sport).

FIGURE 10 is an exploded perspective view of one embodiment of the wearable computer system 10 of Fig. 1 being inserted into footwear 18 to be worn adjacent a user's foot 16. In

this embodiment, the wearable computer system 10 is in the form of insole described above. In alternative embodiments, the wearable computer system 10 may be in the form of a sandal, sock, or other construction known in the art.

FIGURE 11 is a top plan view of the wearable computer system 10, in the form of the pair of the insoles of Fig. 10, illustrating movement of the wearable computer systems 10 that is designed to cause a reboot of the wearable computer systems. In the embodiment of Fig. 11, the movement includes placing the user's weight on a front portion 13 of the foot (e.g., the ball of the foot, toes, etc.), and then pivoting heels 15 towards each other, and away from each other. This movement is not likely to be encountered during regular walking or running, but is a unique movement that is intended to trigger a reboot. This movement may be in the form of a single movement, or a movement that is repeated a predetermined number of times. Those skilled in the art may determine any one of a number of movements for this function, and any alternative devised by one skilled in the art should be considered within the scope of the present invention.

In another embodiment, the user may physically touch, manipulate, or tap upon the wearable computer system 10 in a predetermined pattern that may be distinguished from ordinary use of the system, as a method of triggering the reboot. In one embodiment, this may be detected by the accelerometer 49; and in another embodiment, this may be detected by the force sensor(s) 30, or other suitable sensors.

FIGURE 12 is a flow diagram illustrating an exemplary method implemented by the wearable computer system of Fig. 10 for rebooting the wearable computer system in response to movements by the user wearing the system. As illustrated in Fig. 12, the movement data is constantly monitored for a match, and in the event of a match, the wearable computer system 10 is rebooted.

The following includes definitions of selected terms employed herein:

- The terms "computer," "computer device," and "server" as used herein, refers to a device and/or system of devices that include at least one computer processing element, e.g., a central processing unit (CPU), and some form of computer memory having a capability to store data. The computer may comprise hardware, software, and firmware for receiving, storing, and/or processing data as described

below. For example, a computer may comprise any of a wide range of digital electronic devices, including, but not limited to, a server, a desktop computer, a laptop, a smart phone, a tablet, or any form of electronic device capable of functioning as described herein.

- The term "database" as used herein, refers to any form of one or more (or combination of) relational databases, object-oriented databases, hierarchical databases, network databases, non-relational (e.g. NoSQL) databases, document store databases, in-memory databases, programs, tables, files, lists, or any form of programming structure or structures that function to store data as described herein.
- The term "computer memory" as used herein refers to any tangible, non-transitory storage that participates in providing instructions to a processor for execution. Such a medium may take many forms, including but not limited to, non-volatile media, volatile media, and any equivalent media known in the art. Non-volatile media includes, for example, ROM, magnetic media, and optical storage media. Volatile media includes, for example, DRAM, which typically serves as main memory. Common forms of computer memory include, for example, hard drives and other forms of magnetic media, optical media such as CD-ROM disks, as well as various forms of RAM, ROM, PROM, EPROM, FLASH-EPROM, solid state media such as memory cards, and any other form of memory chip or cartridge, or any other medium from which a computer can read. While several examples are provided above, these examples are not meant to be limiting, but illustrative of several common examples, and any similar or equivalent devices or systems may be used that are known to those skilled in the art.

Various embodiments are described above with reference to the accompanying drawings, which form a part hereof, and which show, by way of illustration, specific exemplary embodiments by which the innovations may be practiced. The embodiments may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the embodiments to those skilled in the art. Among other things, the various embodiments may be methods, systems, media, devices, or any similar or equivalent arrangements known to those skilled in the art. Accordingly, the various embodiments may take the form of an entirely hardware embodiment, an entirely software embodiment or an

embodiment combining software and hardware aspects. The detailed description is, therefore, not to be taken in a limiting sense.

The network described above may include any device or system for communicating information from one computer device to another. For example, a global computer network (e.g., the Internet) may be used, including any form of local area networks (LANs), wide area networks (WANs), direct connections, such as through a universal serial bus (USB) port, other forms of computer-readable media, or any combination thereof. On an interconnected set of LANs, including those based on differing architectures and protocols, a router may act as a link between LANs, enabling messages to be sent from one to another. In addition, communication links within LANs typically include twisted wire pair or coaxial cable, while communication links between networks may utilize analog telephone lines, full or fractional dedicated digital lines including T1, T2, T3, and T4, Integrated Services Digital Networks (ISDNs), Digital Subscriber Lines (DSLs), wireless links including satellite links, or other communications links known to those skilled in the art. The network may further include any form of wireless network, including cellular systems, WLAN, Wireless Router (WR) mesh, or the like. Access technologies such as 2G, 3G, 4G, and future access networks may enable wide area coverage for mobile devices. In essence, the wireless network may include any wireless communication mechanism known in the art by which information may travel between computers of the present system.

The system server may include one or more servers, desktop computers, multiprocessor systems, microprocessor-based or programmable electronics devices, network appliances, or any form of equivalent device(s) known in the art. The system computer may be in the form of a single device, or multiple devices. The system server may be distributed over a plurality of network devices and/or implemented using cloud architecture. The system server may operate using a master/slave approach over a plurality of network devices, within a cluster, a peer-to-peer architecture, and/or any of a variety of other architectures.

As used in this application, the words "a," "an," and "one" are defined to include one or more of the referenced item unless specifically stated otherwise. The terms "approximately" and "about" are defined to mean +/- 10%, unless otherwise stated. Also, the terms "have," "include," "contain," and similar terms are defined to mean

"comprising" unless specifically stated otherwise. Furthermore, the terminology used in the specification provided above is hereby defined to include similar and/or equivalent terms, and/or alternative embodiments that would be considered obvious to one skilled in the art given the teachings of the present patent application. While the invention has been described with reference to at least one particular embodiment, it is to be clearly understood that the invention is not limited to these embodiments, but rather the scope of the invention is defined by the following claims.

CLAIMS

What is claimed is:

1. A wearable computer system that may be rebooted by the movements of a user wearing the system, the system comprising:

an article of clothing adapted to be worn by the user;

an electronic device for monitoring the movements of the user, the electronic device comprising a computer processor operably connected with a computer memory, a battery, and at least one accelerometer;

the wearable computer system not having a switch for disconnecting the battery from the electronic device;

wherein the computer memory stores a stored data template of movement data that corresponds to a predefined series of movements;

wherein the computer memory of the electronic device stores executable code that, when executed, enables the computer processor to perform a process that comprises the steps of:

receiving movement data from the at least one accelerometer;

comparing, periodically, the movement data to the stored data template; and

rebooting the electronic device upon a determination that the received movement data matches the stored data template.

2. The system of claim 1, wherein the article of clothing comprises a pair of sensor insoles, each comprising a substrate layer to be worn adjacent the underside of a foot of the person, and wherein the electronic device further includes a plurality of force sensors and a transmitter for transmitting data from the plurality of force sensors.

3. The system of claim 1, wherein the electronic device does not have a physical switch that functions to reboot the electronic device or to power down the electronic device.

4. The system of claim 1, wherein the computer memory includes a library of stored data templates, and one of which may trigger the rebooting of the electronic device.

5. The system of claim 1, wherein the electronic device further includes an inductive

charging coil operatively connected for charging the battery.

6. A method for rebooting an electronic device, the method comprising the steps of:

providing a wearable computer system comprising: an article of clothing, and an electronic device comprising a computer processor, a computer memory, and at least one accelerometer, the electronic device further comprising a stored data template, and programming that causes the electronic device to reboot upon receipt of movement data that matches the stored data template;

wearing the article of clothing;

performing a predefined series of movements, such that the at least one accelerometer of the article of clothing generates movement data that corresponds to a stored data template, thereby causing the electronic device to reboot.

7. The method of claim 6, wherein the article of clothing comprises a pair of sensor insoles, and wherein the electronic device further includes a plurality of force sensors and a transmitter for transmitting data from the plurality of force sensors, and further comprising the steps of positioning each of the pair of sensor insoles in one of a pair of shoes, and wearing the shoes such that each of the sensor insoles is operably positioned adjacent the underside of one of the feet of the wearer.

8. The method of claim 6, wherein the electronic device does not have a physical switch that functions to reboot the electronic device or to power down the electronic device.

9. The method of claim 6, wherein the computer memory includes a library of stored data templates, and one of which may trigger the rebooting of the electronic device.

10. The method of claim 6, wherein the electronic device further includes an inductive charging coil operatively connected for charging the battery.

11. A wearable computer system that may be rebooted by the movements of a user wearing the system, the system comprising:

an article of clothing adapted to be worn by the user;

an electronic device comprising a computer processor operably connected with a computer memory, a battery, and a means for detecting movement;

wherein the computer memory stores a stored data template of movement data that corresponds to a predefined series of movements;

wherein the computer memory of the electronic device stores executable code that, when executed, enables the computer processor to perform a process that comprises the steps of:

receiving movement data from the means for detecting movement;

comparing, periodically, the movement data to the stored data template; and

rebooting the electronic device upon a determination that the received movement data matches the stored data template.

12. The system of claim 11, wherein the article of clothing comprises a pair of sensor insoles, each comprising a substrate layer to be worn adjacent the underside of a foot of the person, and wherein the electronic device further includes a plurality of force sensors and a transmitter for transmitting data from the plurality of force sensors.

13. The system of claim 11, wherein the electronic device does not have a physical switch that functions to reboot the electronic device or to disconnect power from the electronic device.

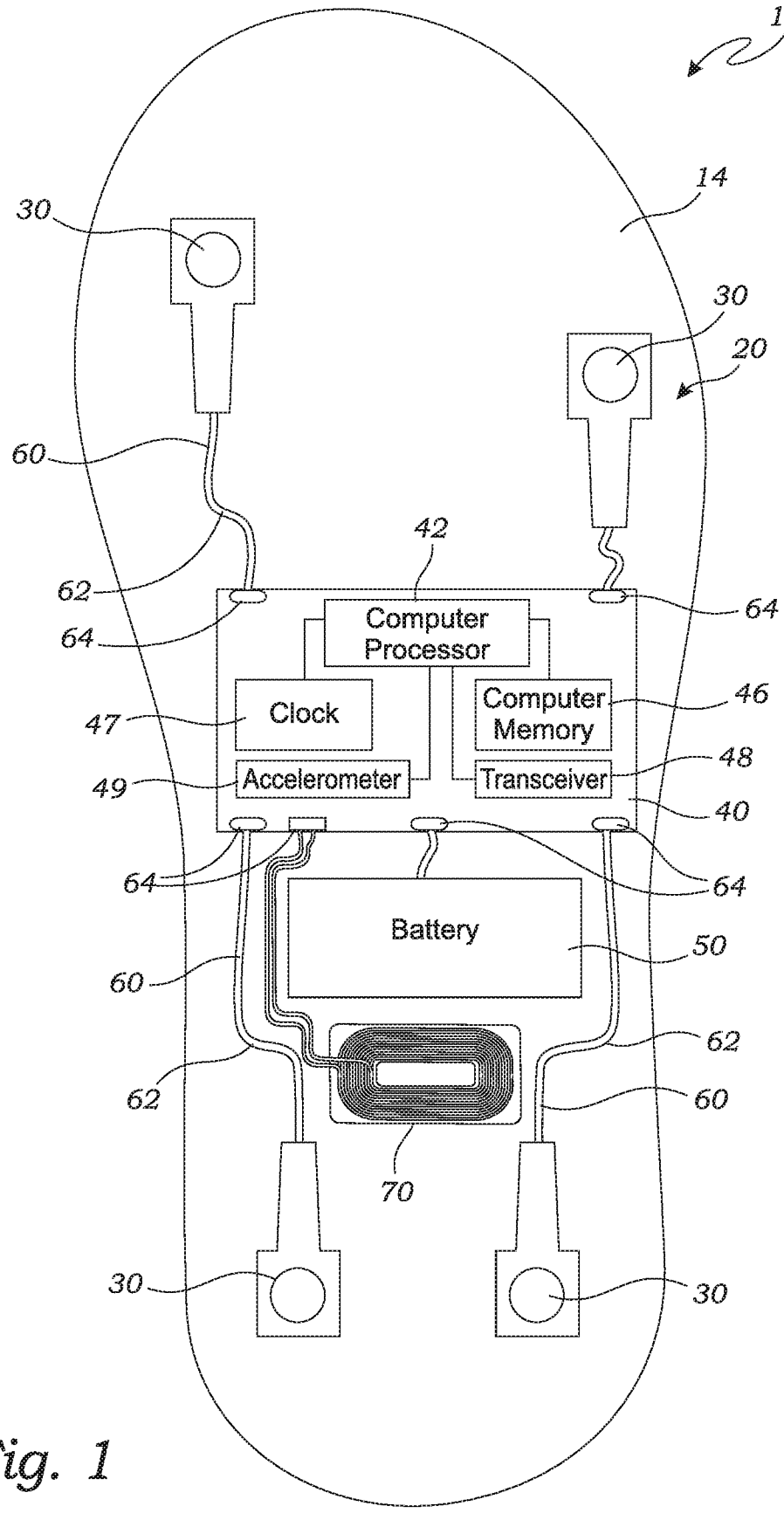

10
14
30
30
20
60
42
62
64
64
Computer Processor
Clock
Computer Memory
46
47
48
49
Accelerometer
Transceiver
40
64
64
Battery
50
60
62
62
60
70
30
30

Fig. 1

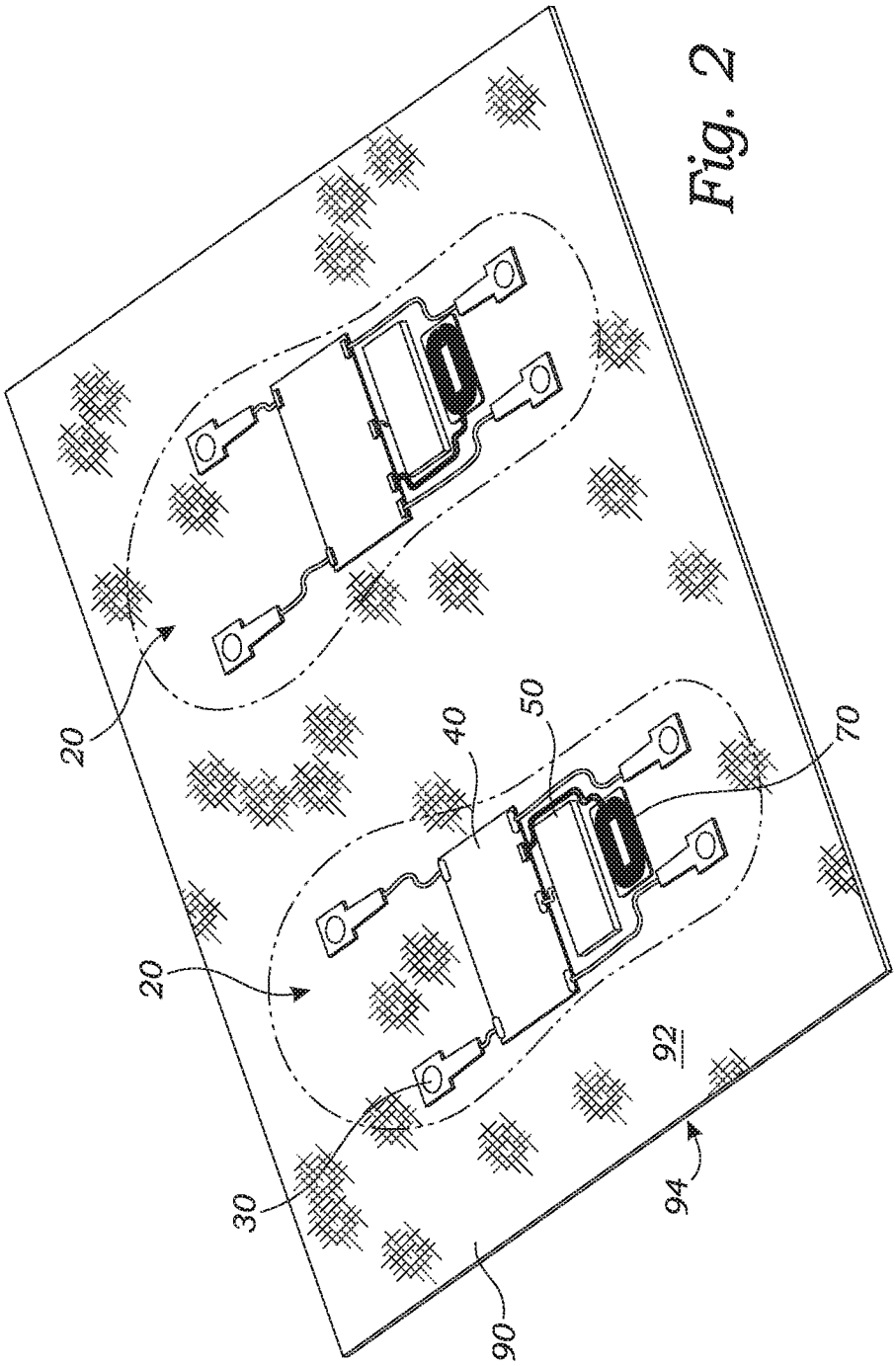


Fig. 2

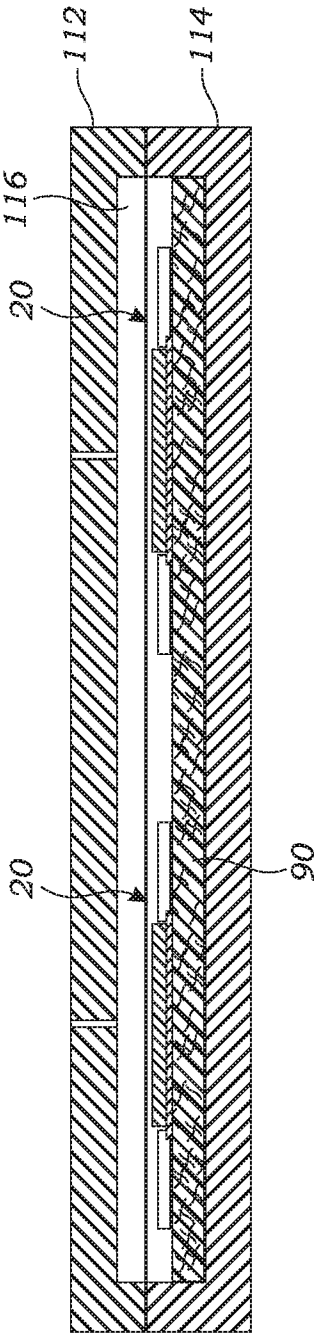


Fig. 3

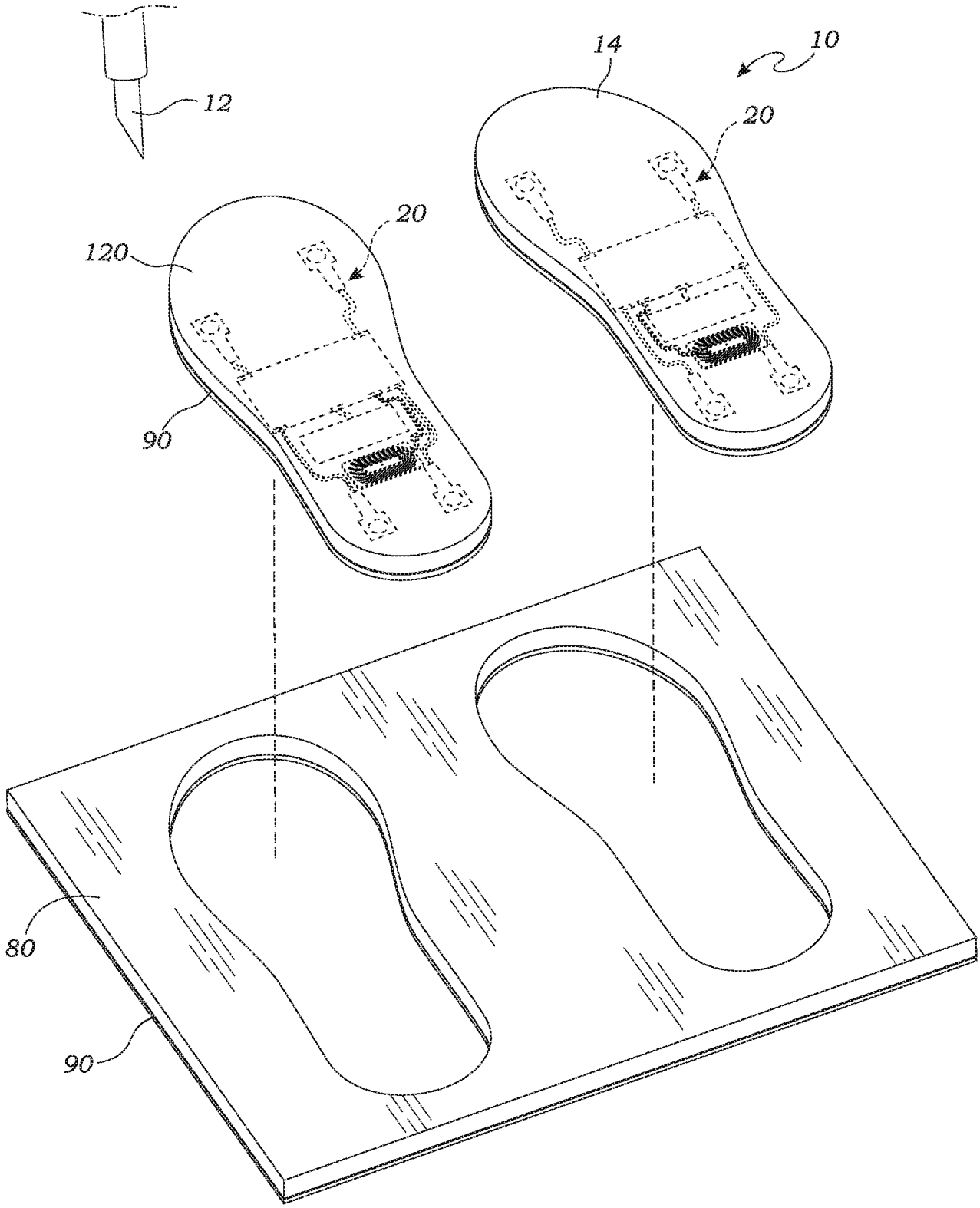


Fig. 4

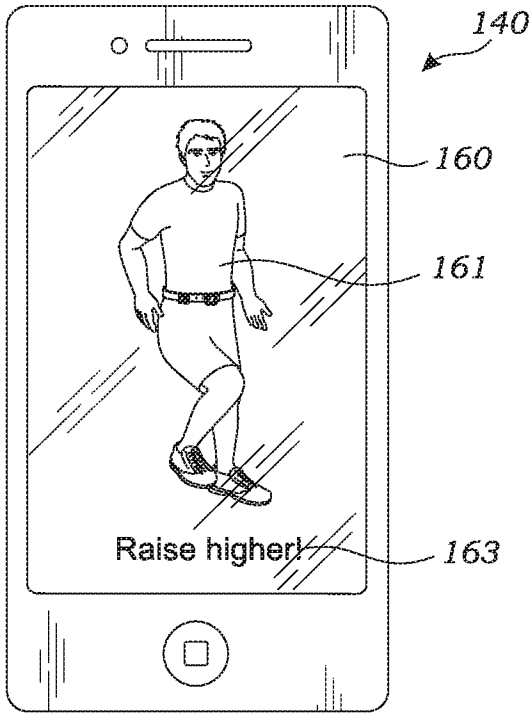

140
160
161
Raise higher!
163

Fig. 5

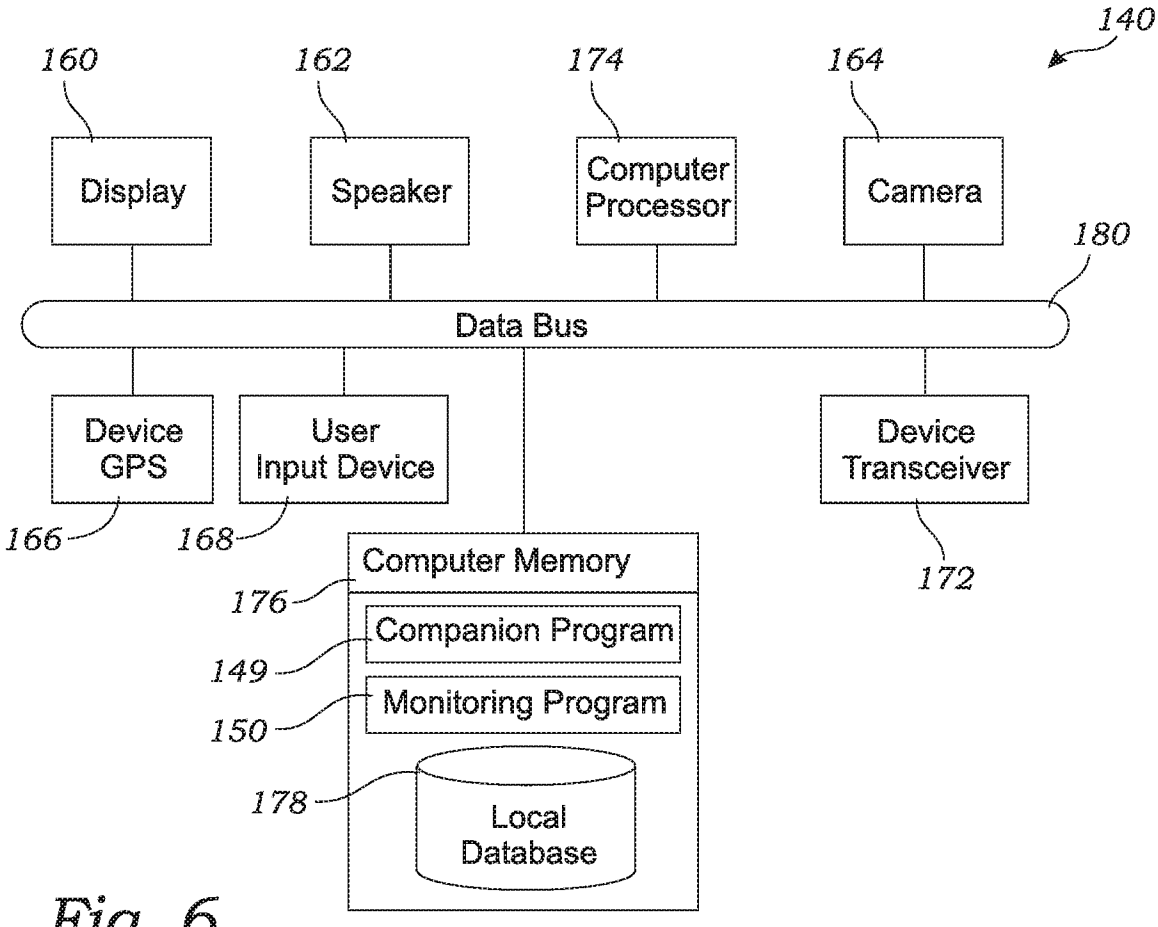

140
160
162
174
164
Display
Speaker
Computer Processor
Camera
180
Data Bus
Device GPS
User Input Device
Device Transceiver
166
168
172
Computer Memory
176
Companion Program
149
Monitoring Program
150
178
Local Database

Fig. 6

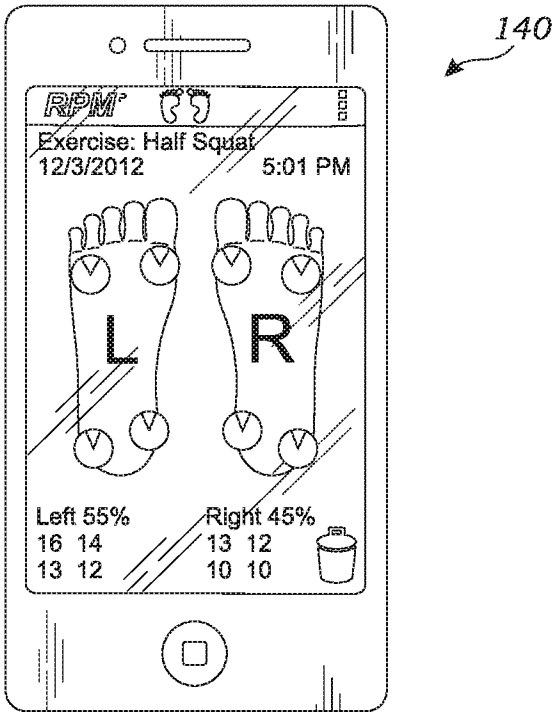

140
RPM
Exercise: Half Squat
12/3/2012
5:01 PM
L
R
Left 55%
16 14
13 12
Right 45%
13 12
10 10

Fig. 7

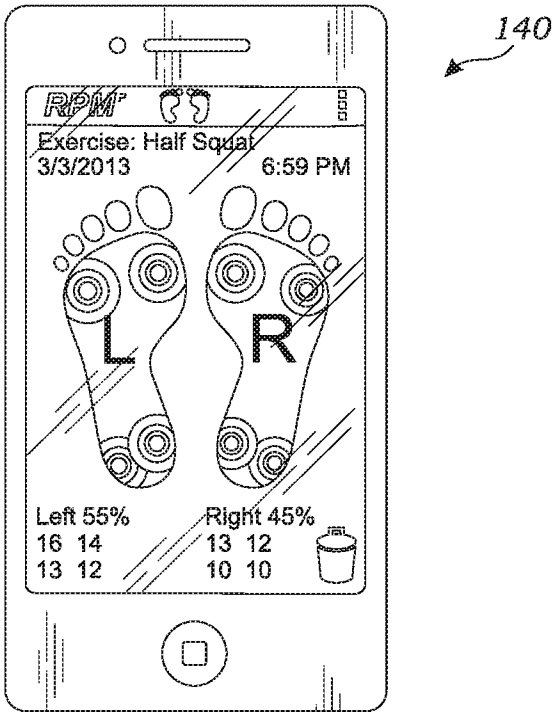

140
RPM
Exercise: Half Squat
3/3/2013
6:59 PM
L
R
Left 55%
16 14
13 12
Right 45%
13 12
10 10

Fig. 8

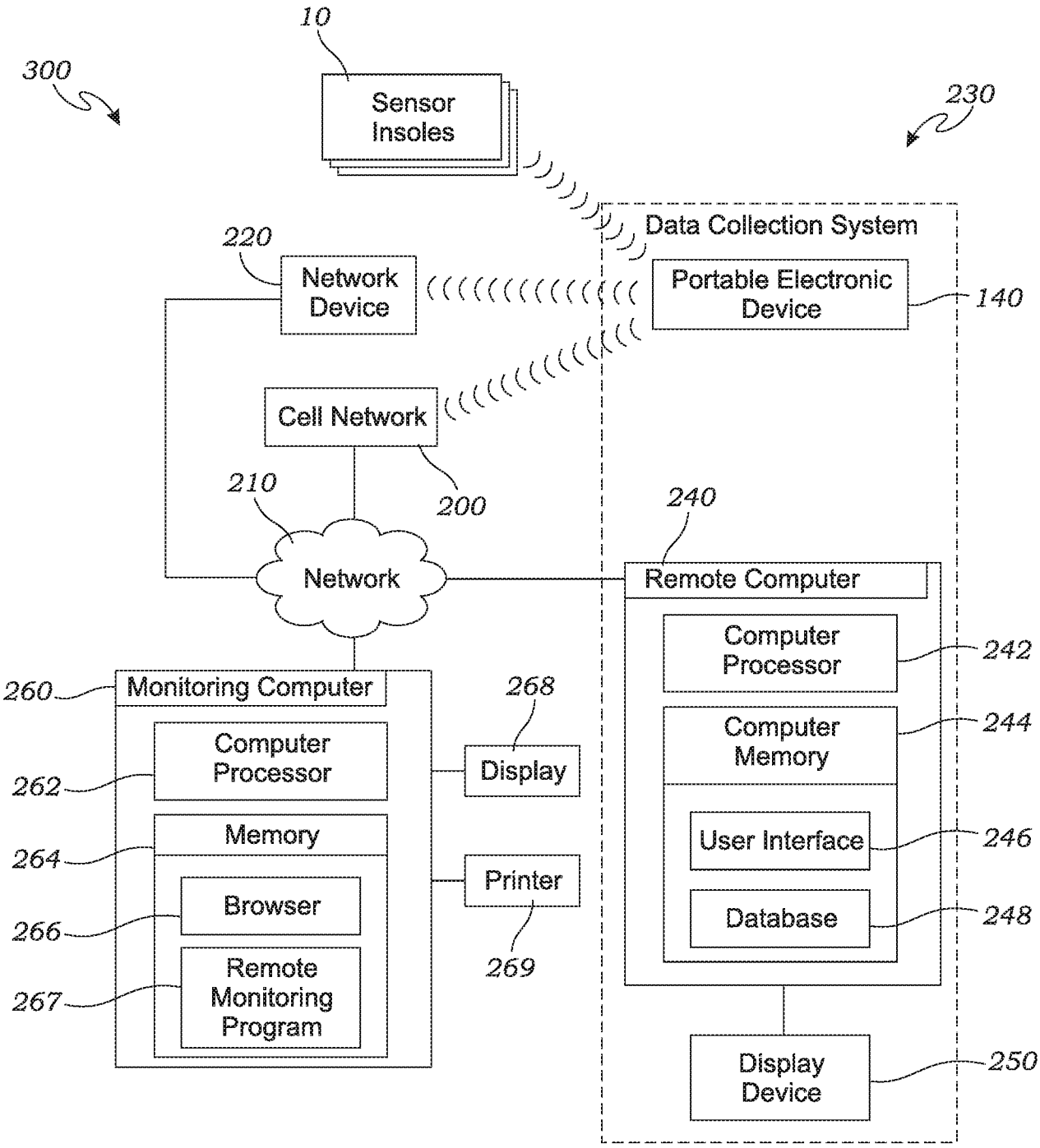

300
10
Sensor Insoles
230
Data Collection System
220
Network Device
Portable Electronic Device
140
Cell Network
200
210
Network
240
Remote Computer
Computer Processor
242
Computer Memory
244
User Interface
246
Database
248
Display Device
250
260
Monitoring Computer
Computer Processor
262
Memory
264
Browser
266
Remote Monitoring Program
267
268
Display
Printer
269

Fig. 9

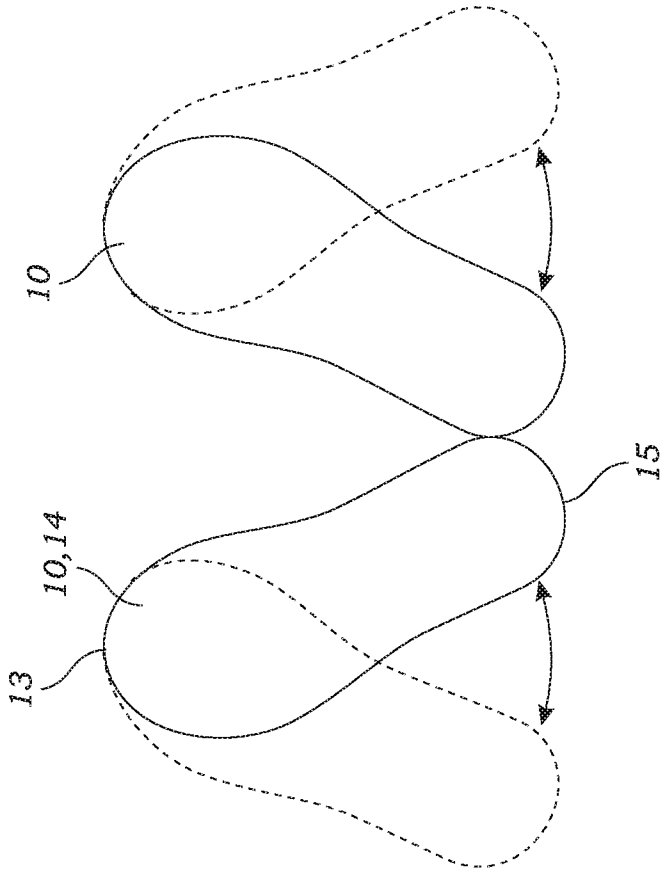


Fig. 11

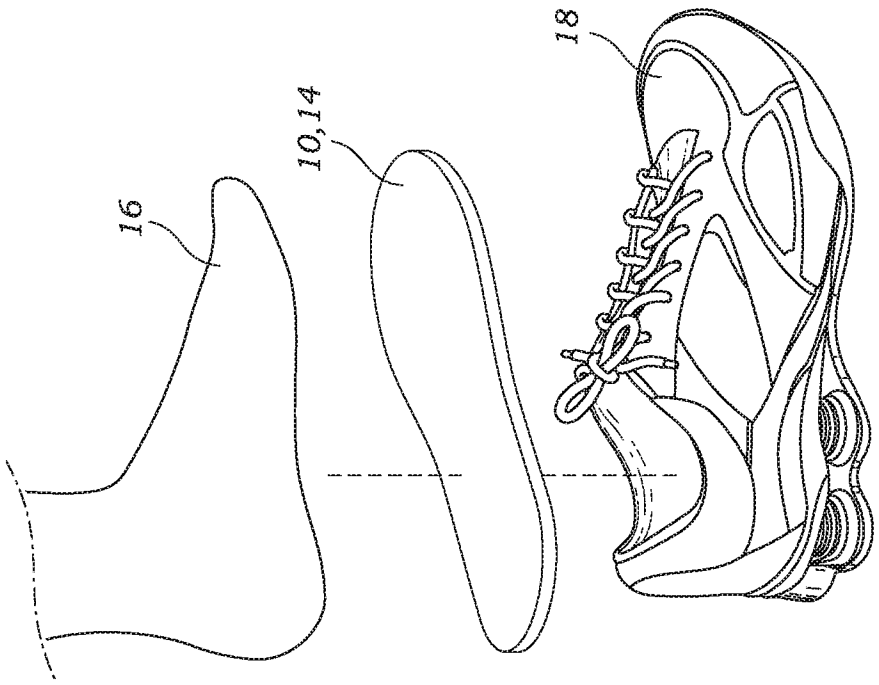


Fig. 10

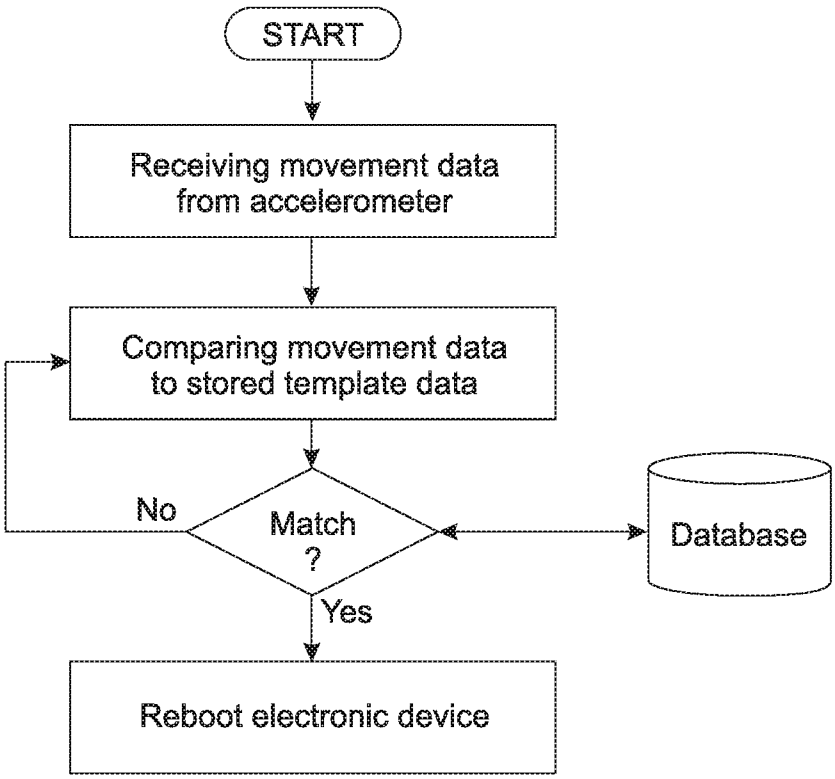

START
Receiving movement data from accelerometer
Comparing movement data to stored template data
Match ?
No
Yes
Database
Reboot electronic device

Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2017/023076

A. CLASSIFICATION OF SUBJECT MATTER

G06F 1/24 *(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)

G08B 6/00, 23/00, G06F 1/24

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)

PAJ, Esp@cenet, DWPI, Patentscope, USPTO DB, CIPO (Canada PO), SIPO DB, PatSearch (RUPTO internal), RUPAT, RUABRU, RUABEN, RUPAT_OLD, RUABU1

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2013/0154838 A1 (MOTOROLA MOBILITY, INC.) 20.06.2013, paragraphs [0020] - [0026], [0033] - [0038], claims 1, 15, fig. 2-3	1, 6, 11 2-5, 7-10, 12, 13
A	US 9223494 B1 (ROCKWELL COLLINS, INC.) 29.12.2015	1-13
A	US 2014/0266646 A1 (JULIAN MICHAEL URBACH) 18.09.2014	1-13

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

☐ See patent family annex.

* 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 document 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
07 June 2017 (07.06.2017)	29 June 2017 (29.06.2017)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37	Authorized officer K. Afanasiev Telephone No. (495)531-64-81