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Nanikashvili

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(54) **PERSONAL HEALTH MONITOR AND A METHOD FOR HEALTH MONITORING**

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- (63) Continuation of application No. 10/876,139, filed on Jun. 23, 2004, now abandoned, which is a continuation-in-part of application No. 10/086,633, filed on Mar. 4, 2002, now Pat. No. 7,222,054, which is a continuation-in-part of application No. 09/261,136, filed on Mar. 3, 1999, now Pat. No. 6,366,871.
(60) Provisional application No. 60/076,660, filed on Mar. 3, 1999.

(51) **Int. Cl.**
G06F 19/00 (2006.01)

(52) **U.S. Cl.** **702/188; 600/301**

(58) **Field of Classification Search** **702/188, 702/182-185, 118; 600/300, 301**

See application file for complete search history.

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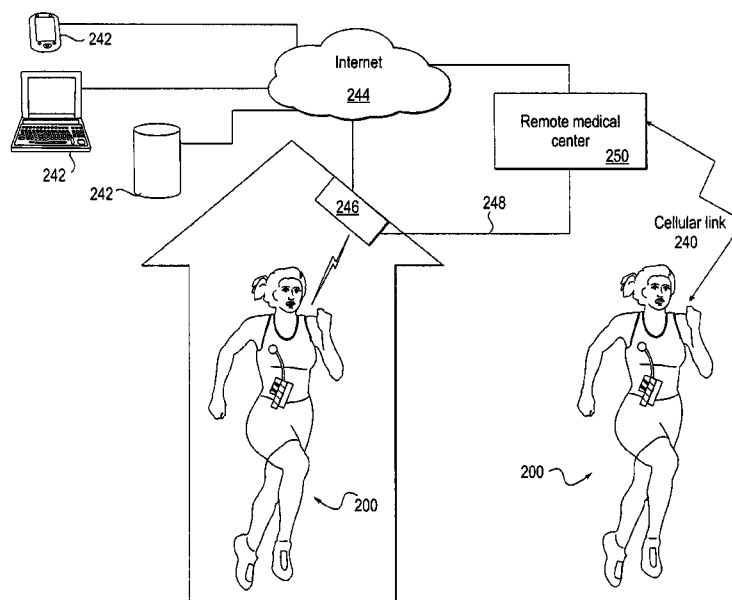
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(57) **ABSTRACT**

The invention provides a personal health monitor that includes a physiological data input device operative to gather physiological data; and a personal data accessory, whereas the personal data accessory is adapted to execute health monitoring software such as to enable the personal data accessory to receive the physiological data, process the physiological data to provide the physiological data and control a long range transmission of the processed physiological data to a remote entity. The invention provides a method for health monitoring, the method includes: gathering physiological data, providing the physiological data to a personal data accessory; executing health monitoring software to process the physiological data to provide processed physiological data; and transmitting the processed physiological data.

30 Claims, 12 Drawing Sheets



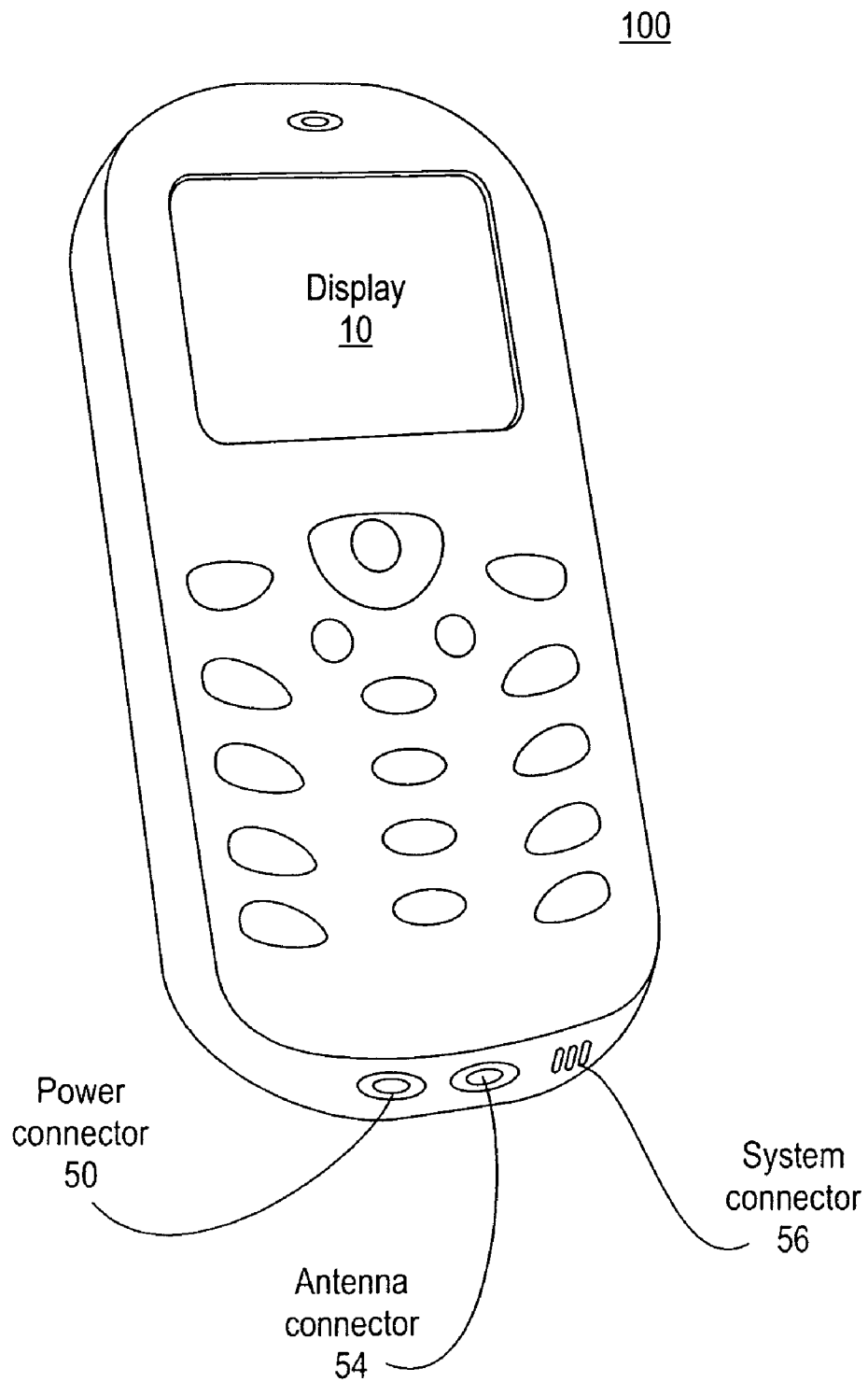


FIG. 1

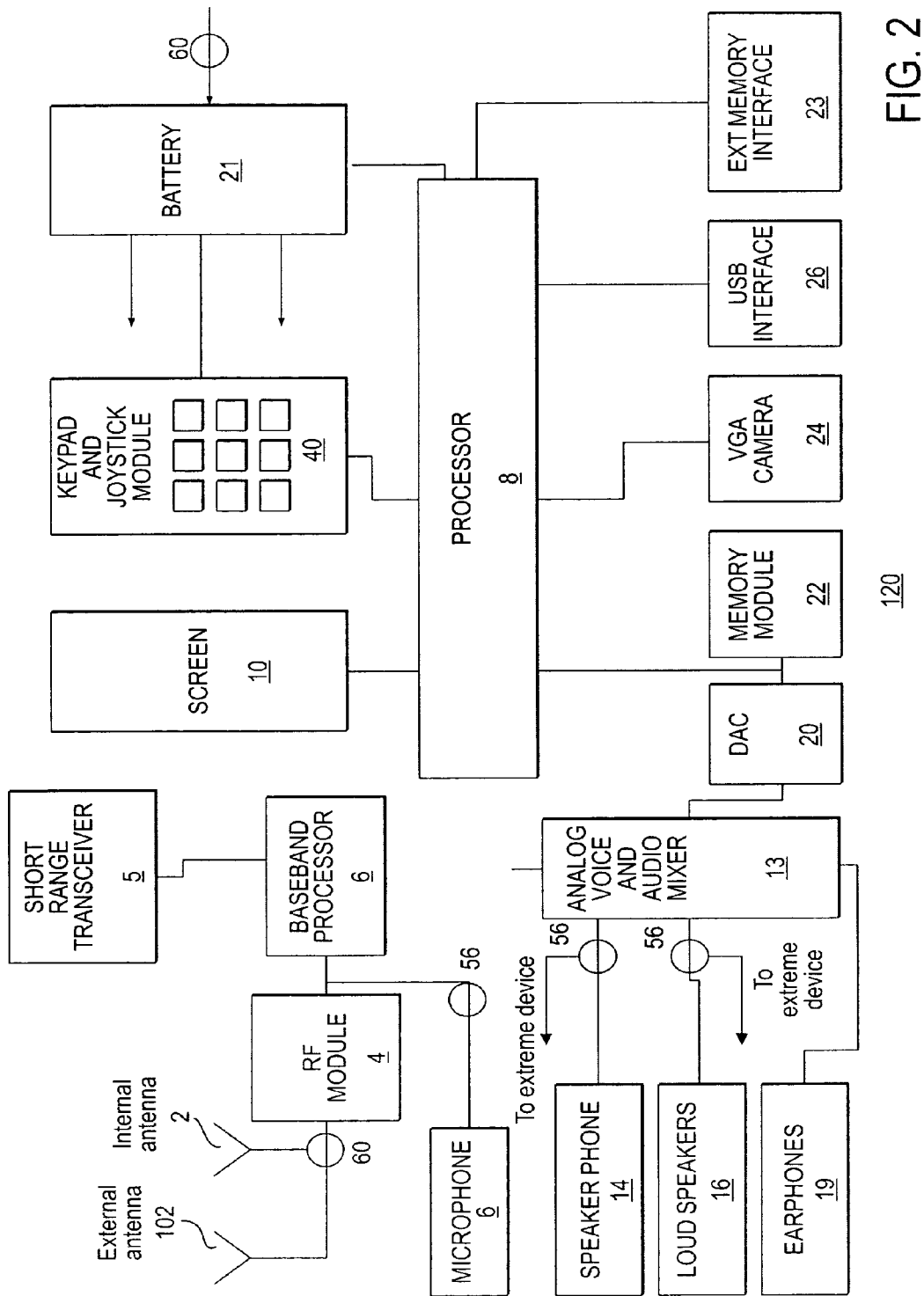


FIG. 2

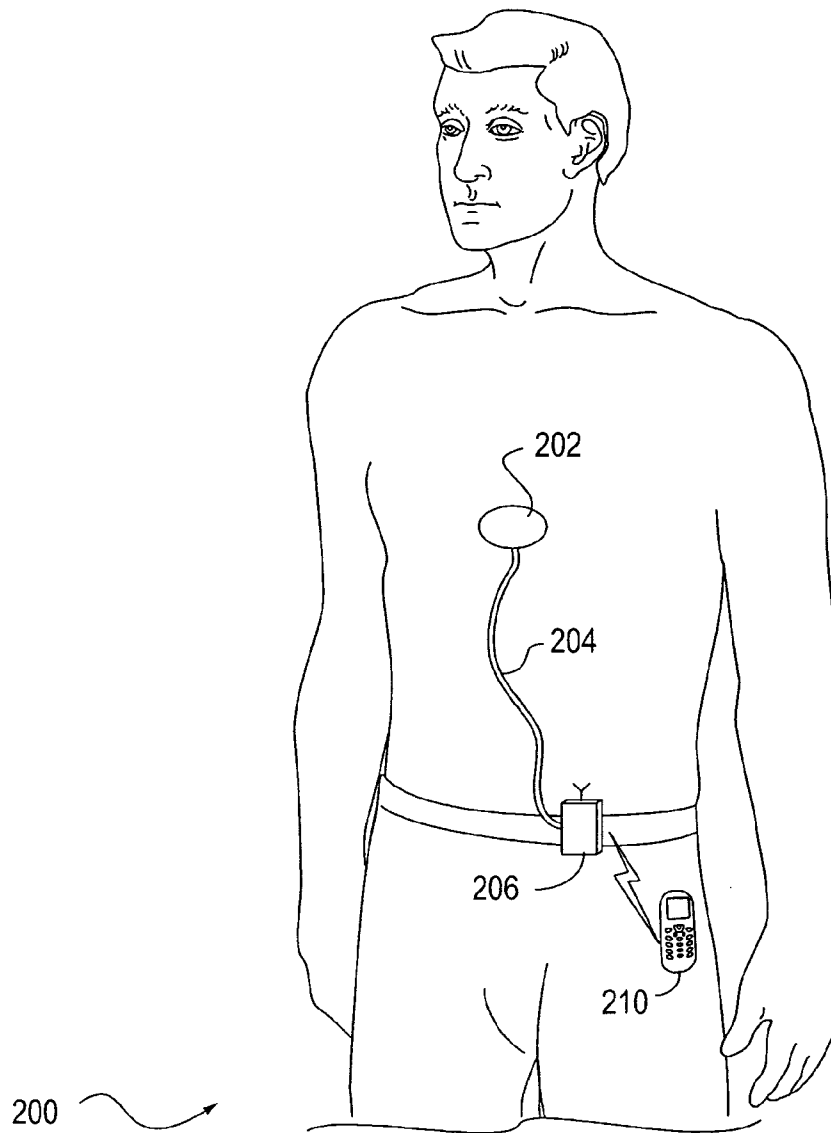


FIG. 3

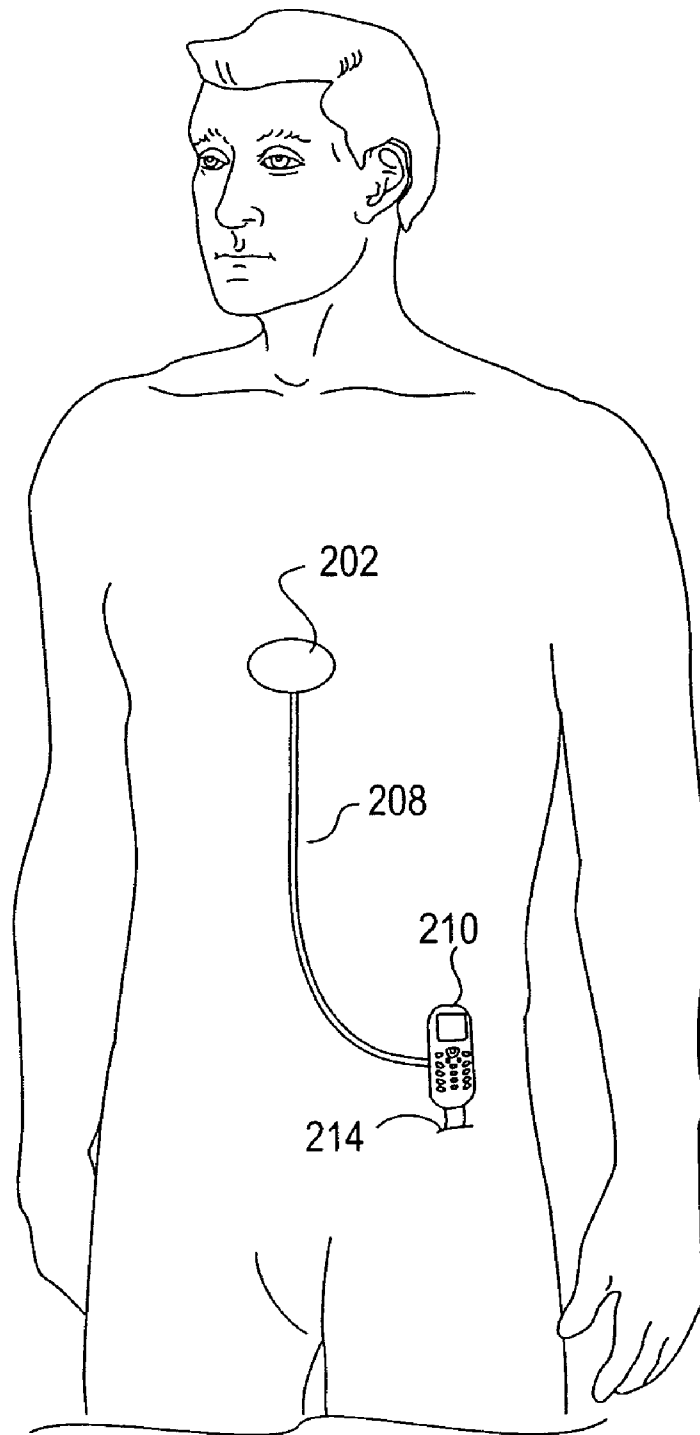


FIG. 4

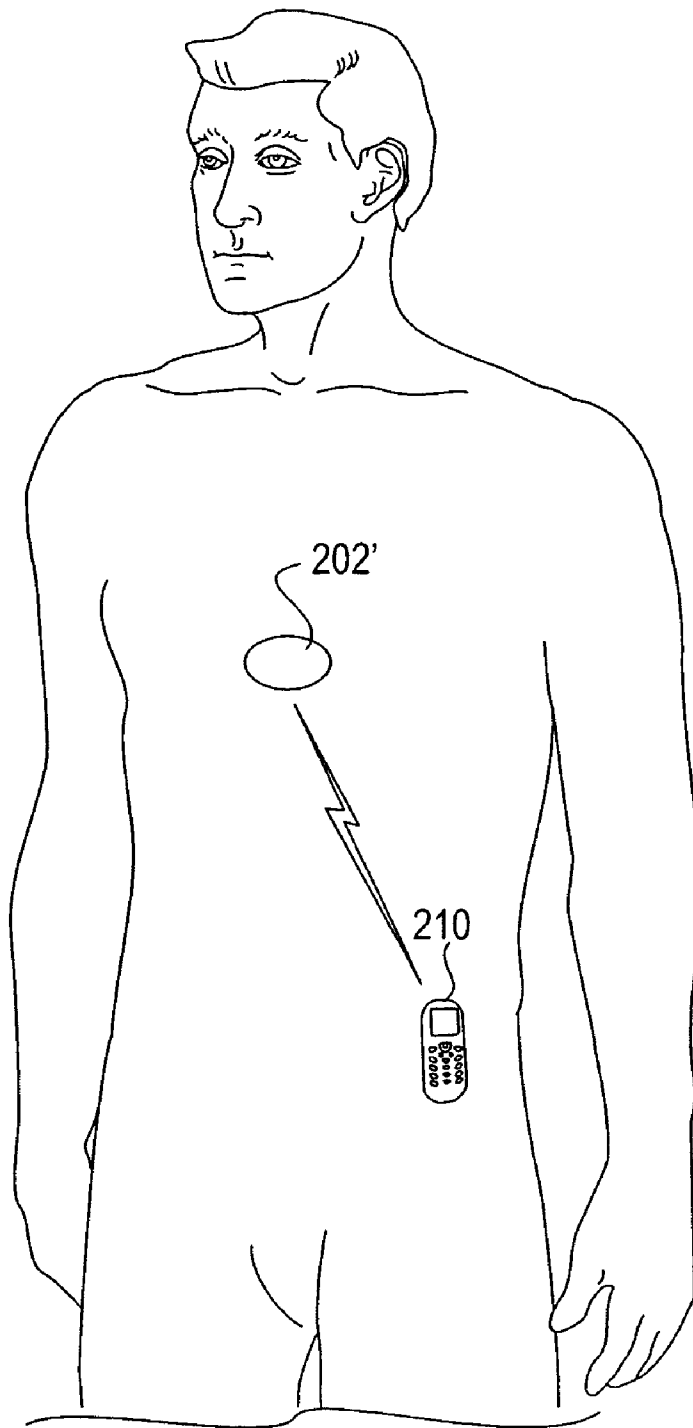


FIG. 5

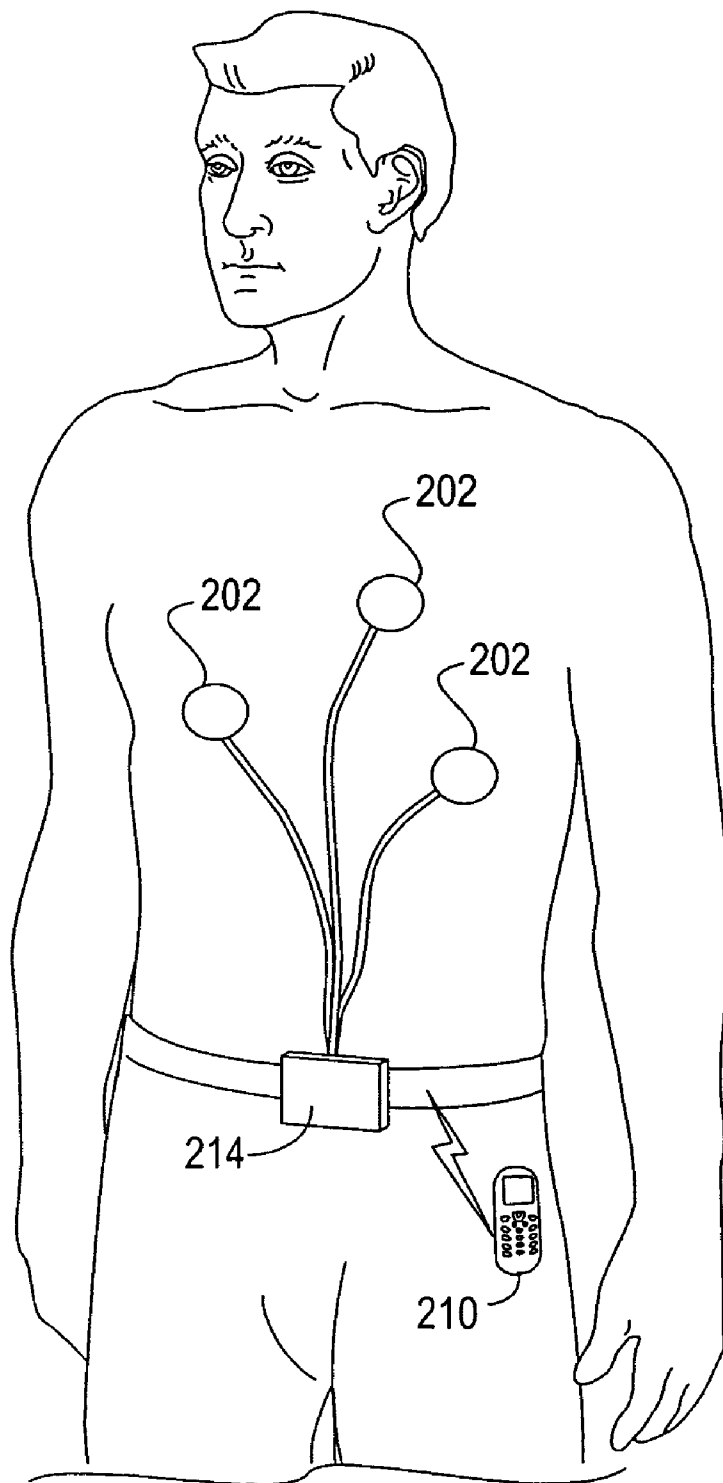
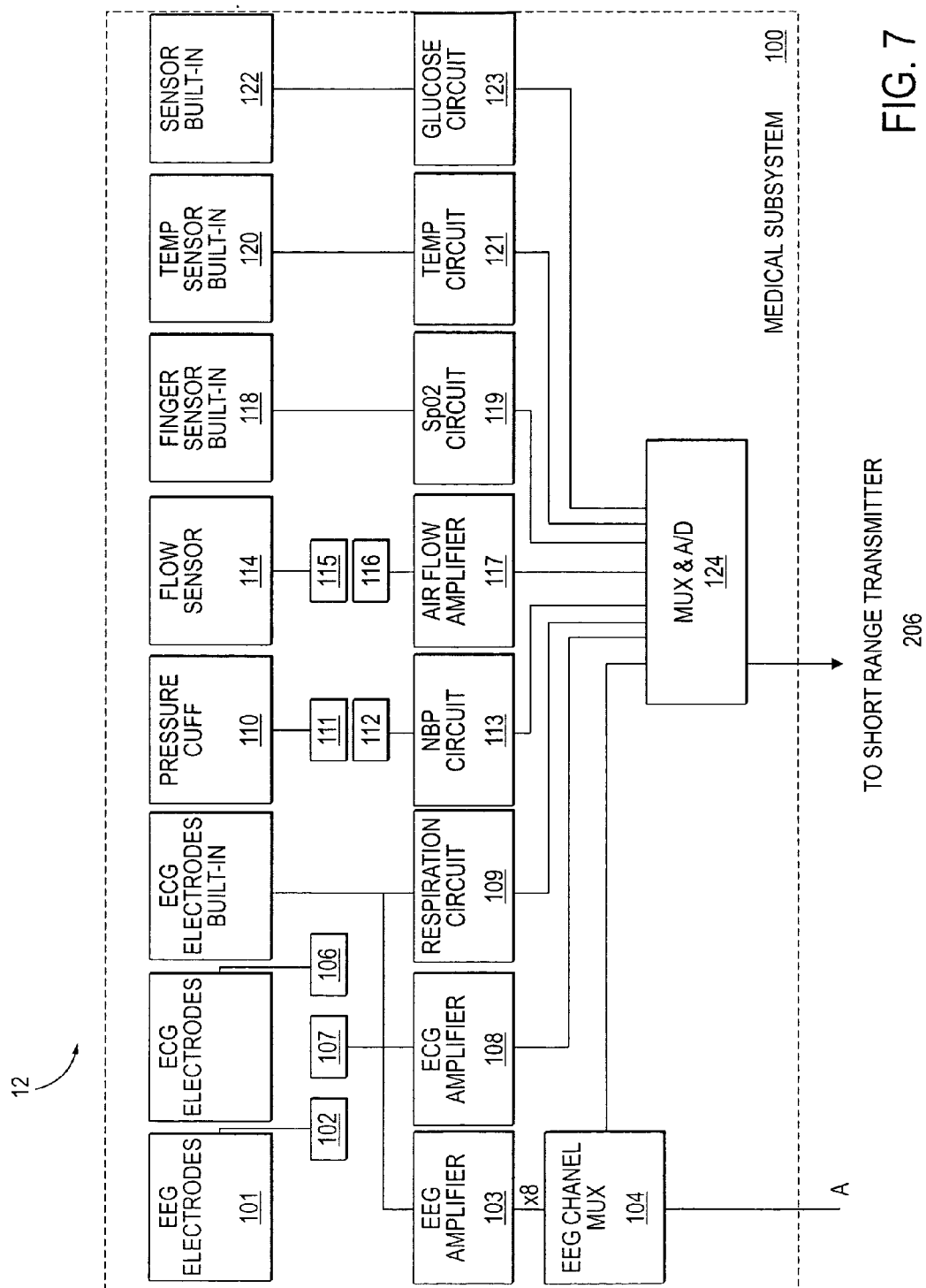


FIG. 6



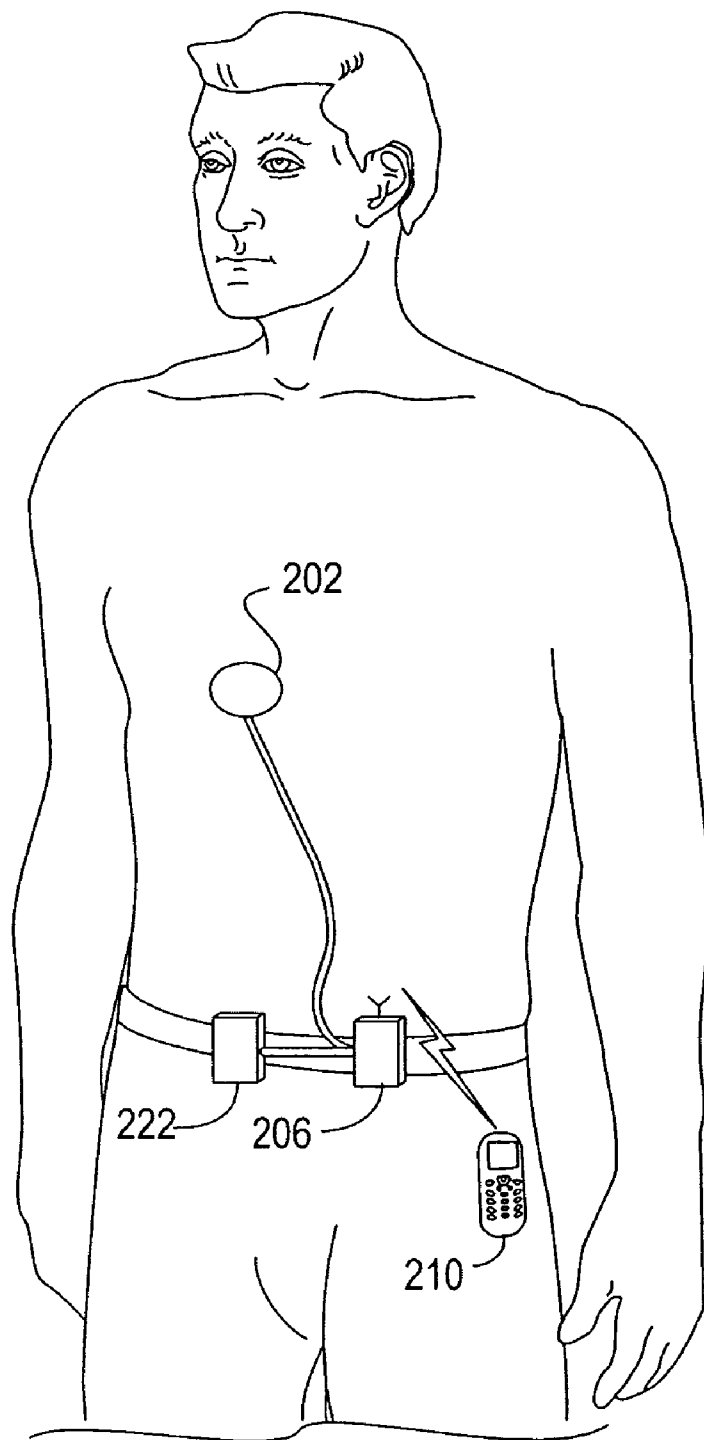
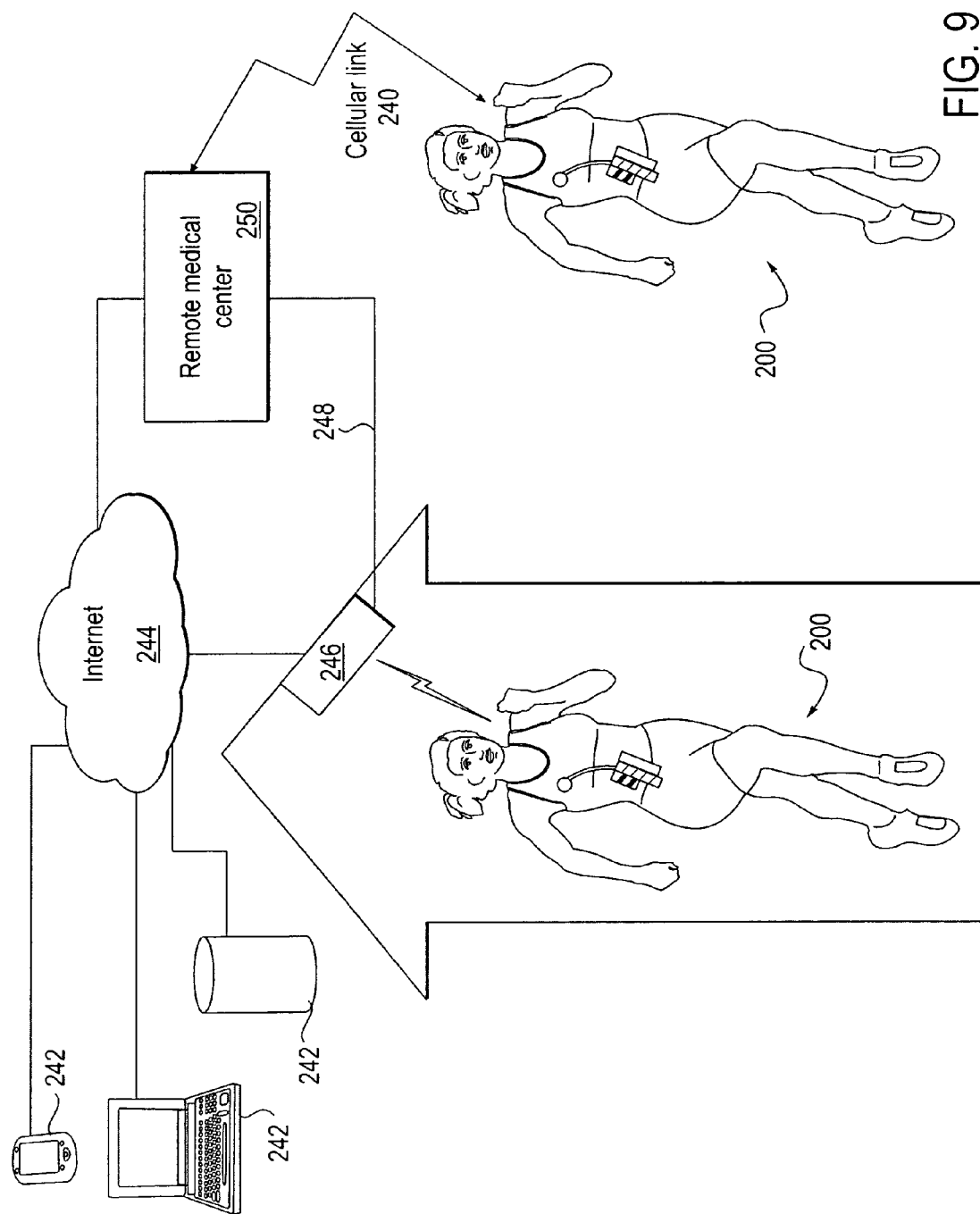
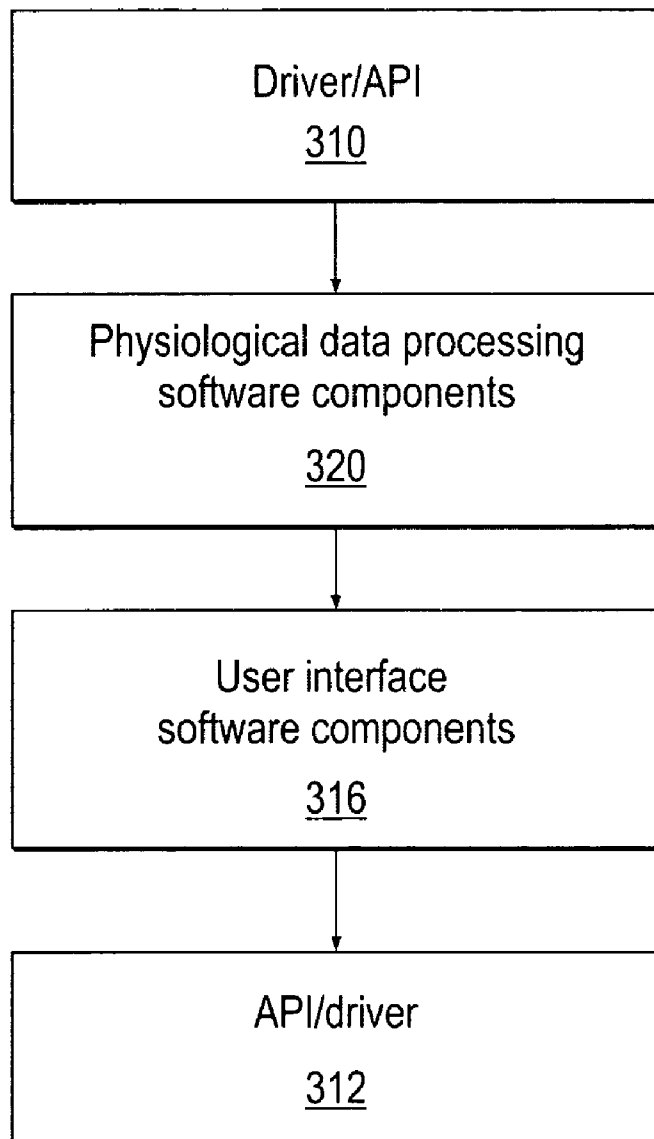


FIG. 8





300

FIG. 10

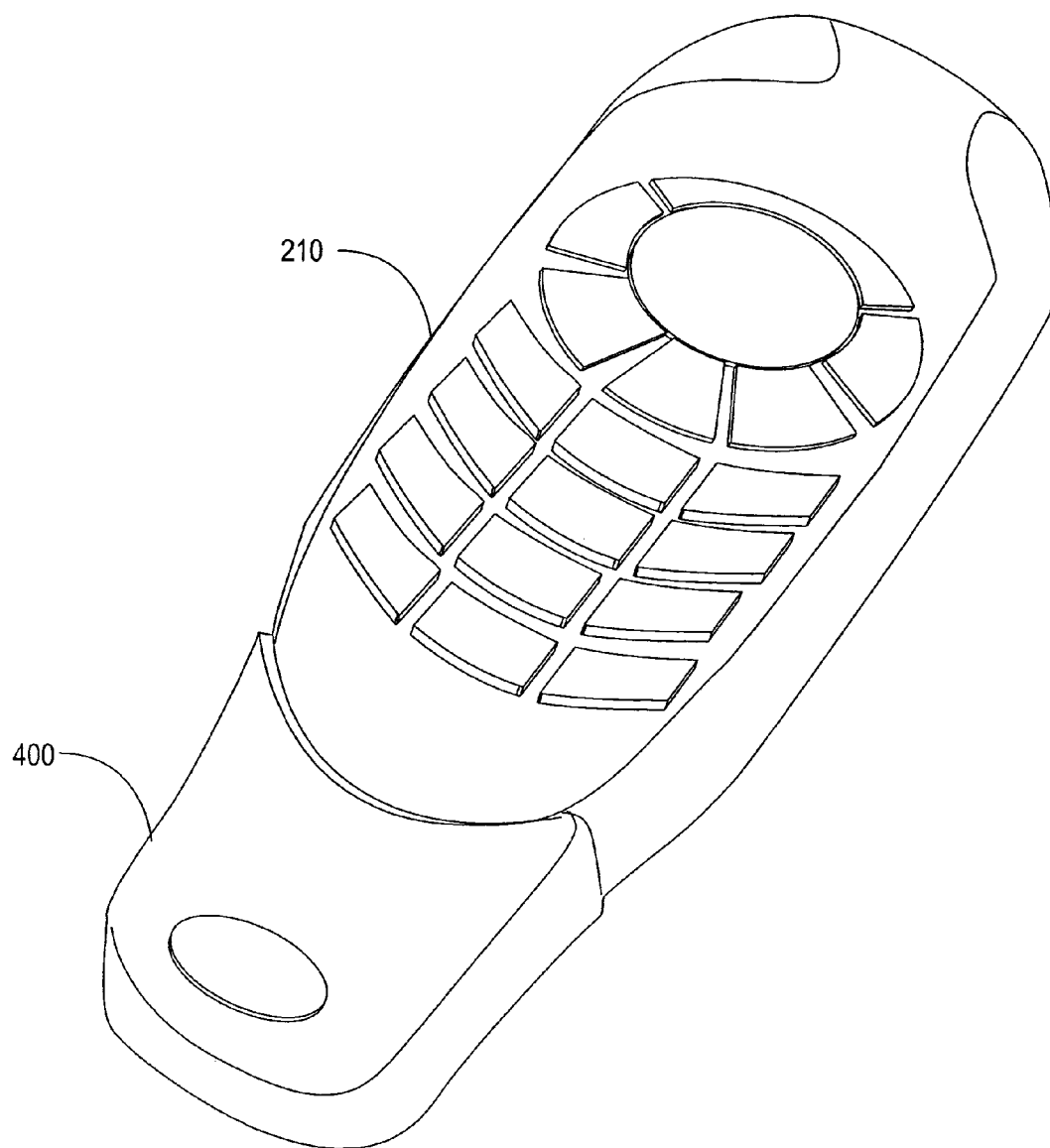
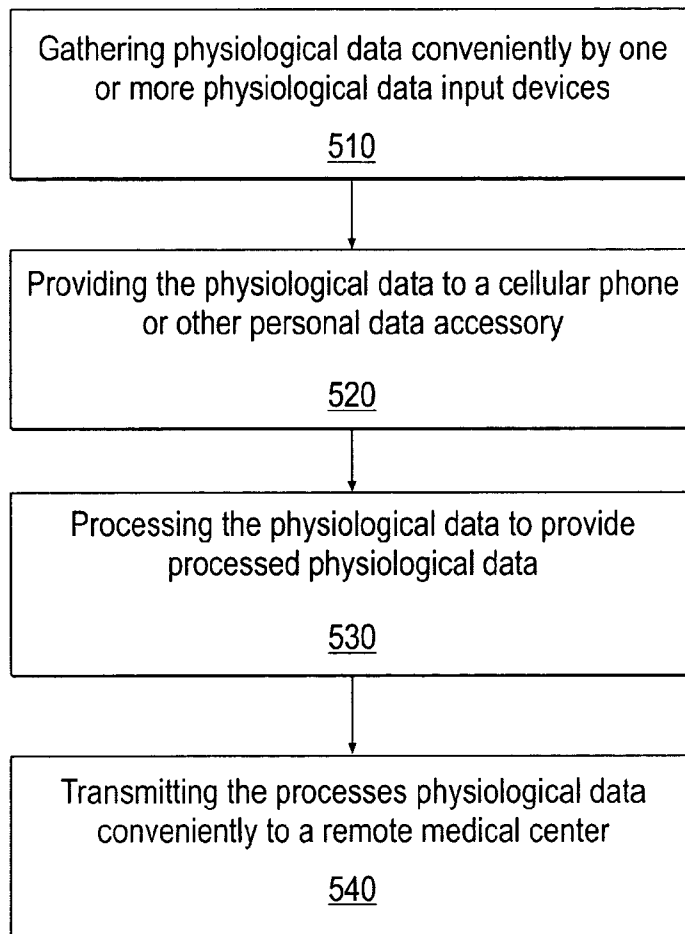


FIG. 11



500

FIG. 12

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PERSONAL HEALTH MONITOR AND A METHOD FOR HEALTH MONITORING

RELATED APPLICATIONS

This patent application is a continuation of U.S. patent application Ser. No. 10/876,139 filed on Jun. 23, 2004 now abandoned which is a continuation in part of U.S. patent application Ser. No. 10/086,633 filed on Mar. 4, 2002 now U.S. Pat. No. 7,222,054 which is continuation in part of U.S. patent application Ser. No. 09/261,136 filed on Mar. 3, 1999, now U.S. Pat. No. 6,366,871, which claimed priority from U.S. provisional patent application Ser. No. 60/076,660 filed on Mar. 3, 1999. This patent application is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

The invention relates to personal health monitors and methods for health monitoring and especially to a personal health monitor that includes a cellular phone, hand-held device or other personal data assistant.

BACKGROUND OF THE INVENTION

The amount of hand-Held devices and personal data accessories, such as cellular phones, PDA and etc. has dramatically increased during the last two decades. Multiple vendors across the globe invest increasing amounts of research and development efforts to provide highly sophisticated, highly complex cellular phones. The data processing power, Graphical User Interface (GUI) capabilities and computational power of cellular phones dramatically increased during the last decade, as well as the amount of various applications that are supported by modem cellular phones.

Modem cellular phones are adapted to support multimedia applications, data related applications, as well as various games. There are various manners to download software that is later executed by the cellular phone. There are various operating systems that are supported by cellular phones (Such as: Symbian, Linux, BREW, REX, RTX, PALM, PPC2003 and etc.). By utilizing cross-operating system software tools, such as the JAVA™ software suit, applications can be developed almost regardless of the operation systems.

Cellular phone vendors have also dramatically decreased the power consumption of their cellular phones, while increasing the efficiency of cellular phone batteries, thus allowing cellular phones to operate for prolonged periods, before recharging the cellular phone battery. Nevertheless, cellular phones are periodically recharged.

FIG. 1 illustrates a prior art cellular phone 100 that includes a power connector 50 (also referred to as battery connector) for enabling an external device to charge the battery of the cellular phone, an antenna connector 52 (for connecting the cellular phone to an external antenna, such as a car mounted antenna), as well as an additional connector 56 (also referred to as system connector) for connecting the cellular phone to external devices such as audio amplifiers, hands free kit, external memory devices, communication link (RS232, USB and etc.), special data communication link, and the like. The connectors 50, 52 and 56 could be combined in one or two connectors. Other prior art cellular phones, such as some Nokia™ cellular phones, include a system connector and a battery connector. U.S. Pat. No. 6,424,842 of Winstead titled "Dual function connector for cellular phones", which is incorporated herein by reference, provides a complex dual function connector that includes multiple contacts and slots.

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FIG. 2 illustrates a prior art cellular phone 100. Cellular phone 100 includes an internal or external antenna 2, RF module 4, base-band processor 6, processor 8, display 10, microphone 12, speakerphone 14, loud speakers 16, analog voice and audio mixer 18, earphones 19, digital to analog converter (DAC) 20, memory module 22, integrated camera 24, USB interface 26, external memory interface 28 and keypad and joystick module 40, Optional Wireless link interface (such as: Bluetooth, WLAN, UWB (Ultra Wide Band) or other wireless link).

The internal antenna 2 can be bypassed by an external antenna 102 that is connected to cellular phone 120 via an antenna connector 54. The power supply 108 is connected on one hand to power connector 50 for recharging battery 21 and is also connected to system connector 56 to provide power from the battery 21.

Cellular phone 100 is capable of: (i) receiving RF signals from antenna 2 or external antenna 102, and vice versa; (ii) receiving audio signals from microphone 12 or an external microphone that may be a part of a hands-free/car-kit assembly; (iii) providing audio signals to loud speakers 16 or to external loud speakers; (iv) receiving information signals such as data and/or video signals from an internal camera 24, or external devices such as an external camera a computer or other cellular phone. Serial Interface, Data link interface or USB interface 26 and external memory interface 28 may receive signals via system connector 56.

Antenna 2 or external antenna 102 receives and transmits Radio Frequency (RF) signals that are provided by or received from Radio Frequency (RF) module 4. RF module 4 is connected between antenna 2 and base-band processor 6 and is able to convert RF signals to base-band signals and vice versa. Base-band processor 6, display 10 and keypad and joystick module 40, as well as integrated camera 24, USB interface 26, external memory interface 28 and digital to analog converter (DAC) 20 are controlled by and connected to processor 8 that may execute various applications. Processor 8 is controlled by a software package that may include an operating system as well as many application software, including Java engines. The software package, as well as various information are stored at memory module 22 that may include RAM as well as ROM memory cells. Memory module 22 is connected to DAC 20 and processor 8. The software package includes at least one software that is related to the transmission of information between the cellular phone and a remote station. This software is also referred to as communication related software.

Cellular phone 100 is able to receive, process and generate audio signals, by DAC 20 and base-band processor 6 that are connected to analog voice and audio mixer 18 that in turn is connected to speakerphone 14, loud speakers 16 and earphones 19. Base-band processor 6 is further connected to microphone 12. Keypad and joystick module 40 includes a multi-way Joystick and multiple keys and soft keys, positioned below display 10.

Cellular phone 100 also includes a short-range module 5, illustrated as being connected to base-band processor 6, for short-range wireless transmission and reception of information. This short-range wireless transmission and reception can be according to various standards, including the Bluetooth, WLAN, ZigB, Wi-Fi, WLAN, UWB and other standards. It is noted that module 5 can be connected to other components of the cellular phone 100. U.S. patent application 2004/0027244 of Menard, titled "Personal medical device communication system and method", which is incorporated

herein by reference, provides a description of some prior art short-range and long-range transmission methods that are known in the art.

The following U.S. patent applications, that are incorporated herein by reference, describe cellular phones that are capable of applying short-range transmission: U.S. patent application 20030114106 of Miyatsu et al., titled "Mobile internet solution using java application combined with local wireless interface"; U.S. patent application 2003/0045235 of Mooney et al., titled "Smart bluetooth interface gateway to mate a non-bluetooth wireless device with a bluetooth headset"; and U.S. patent application 20030235186 of Park titled "Internet cordless phone".

U.S. patent application 20030114106 of Miyatsu et al. describes a telecommunications system and method for downloading application software to a local communications network via an external communications network. The local communications network comprises a plurality of devices including an interface device. The interface device includes an interface for interfacing with the external communications network for downloading an application software from an application software source to the interface device via the external communications network. The local communications network preferably comprises a local wireless network, such as a Bluetooth and wireless networks, and the external communications network preferably comprises a mobile communications network for downloading application software to a mobile phone of the local wireless network.

A cellular phone that does not include a short-range transceiver, such as a bluetooth transceiver can be connected to an adapter or other means that facilitates short-range communication with the phone. U.S. patent application 2003/0045235 of Mooney et al. describes a smart bluetooth interface gateway device that allows a bluetooth headset to establish an audio connection and communicate with a conventional wireless phone (e.g., a wireless phone that does not have bluetooth installed). The connection is controlled merely by monitoring the presence of sound and tones in the audio stream from an analog audio jack of a conventional wireless phone. The smart bluetooth interface gateway device is attached to the wireless phone just as a wired headset would. Use of the wireless phone is the same as if a wired headset were plugged in.

Various methods and devices for monitoring the health of a person are known in the art. They include special hardware for gathering and processing physiological data and a wireless device utilizes for transmitting the gathered information. The special hardware is much less sophisticated and less efficient as the hardware of cellular phones. The development of dedicated hardware is usually costly.

The following U.S. patents and patent applications, which are incorporated herein by reference, provide a brief review of state of the art systems and devices: U.S. patent application 2004/0027244 of Menard, titled "Personal medical device communication system and method"; U.S. Pat. No. 5,390,238 of Kirk, et al., titled "Health support system"; U.S. Pat. No. 5,566,676 of Rosenfeldt et al., titled "Pressure data acquisition device for a patient monitoring system"; U.S. Pat. No. 5,772,586 of Heinonen et al., titled "Method for monitoring the health of a patient"; U.S. Pat. No. 5,840,020 of Heinonen et al., titled "monitoring method and a monitoring equipment" and U.S. Pat. No. 5,983,193 of Heinonen et al., titled "patient's nursing apparatus and nursing system".

U.S. Pat. No. 6,366,871 titled "Personal ambulatory cellular health monitor for mobile patient" of Geva, which incorporated herein by reference describes an ambulatory patient monitoring apparatus including a portable housing including

at least one physiological data input device operative to gather physiological data of the patient, location determination circuitry operative to determine geographic location information of the patient, cellular telephone communications circuitry for communicating the physiological data and the geographic location information to a central health monitoring station, voice communications circuitry. The patient conducts voice communications with a clinician at the central health monitoring station, digital signal processing circuitry for processing signals associated with any of the physiological data input device, the location determination circuitry, the cellular telephone communications circuitry, and the voice communications circuitry, and control circuitry for controlling any of the digital signal processing circuitry, the physiological data input device, the location determination circuitry, the cellular telephone communications circuitry, and the voice communications circuitry.

There is a need to provide an efficient method for health monitoring as well as an efficient personal health monitor.

SUMMARY OF THE INVENTION

The invention provides a method for health monitoring, the method includes: (i) gathering physiological data; (ii) providing the physiological data to a Cellular Phone, Hand-Held device or PDA (personal data accessory); (iii) executing health monitoring software to process the physiological data to provide processed physiological data; and (iv) transmitting the processed physiological data.

The invention provides a personal health monitor that includes: (i) a physiological data input device operative to gather physiological data; and (ii) a Cellular Phone, Hand-Held device or personal data accessory, whereas the Cellular Phone, Hand-Held device or personal data accessory is adapted to execute health monitoring software such as to enable the personal data accessory to receive the physiological data, process the physiological data to provide the physiological data and control a long range transmission of the processed physiological data to a remote entity.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the invention will be apparent from the description below. The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

FIGS. 1-2 are schematic diagrams of a prior art cellular phone;

FIGS. 3-6 and 8 are schematic illustrations of a person that is wearing single or multiple physiological data input devices and also carries a cellular phone or PDA, according to an embodiment of the invention;

FIG. 7 is a schematic illustration of a medical sub-system;

FIG. 8 illustrates a plug-in unit, according to an embodiment of the invention;

FIG. 9 illustrates a medical center as well as devices for gathering, processing and transmitting physiological data, according to an embodiment of the invention;

FIG. 10 illustrates an example of the configuration of a health monitoring software that is implemented in the Cellular phone or PDA, according to an embodiment of the invention;

FIG. 11 illustrates a plug-in device that is detachably connected to cellular phone, according to an embodiment of the invention; and

FIG. 12 is a flow chart of method for health monitoring, according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

The following description mainly refers to monitoring a health of a person. It is noted that this method and monitors can be applied to track multiple persons simultaneously, such as tracking the performances of a team of players.

The following description also refers to a cellular phone that can be provided with health monitoring software that enables the cellular phone to process physiological data, and especially without any addition of complex hardware, such as additional processors. It is noted that the invention can be applied to other multi-task and/or multi-purpose accessories, especially personal data accessories (PDAs) other than cellular phones that in turn may include palm-computers and the like.

The following description describes various transmitters, such as short-range transmitters and long-range transmitters. Each transmitter is associated with a corresponding receiver, but for simplicity of explanation a larger emphasis was placed upon the transmitters.

It is noted that according to various embodiments of the invention the cellular phone (or other personal data accessory) can include a short-range transmitter for transmitting information (such as instructions) to various components (such as physiological data input devices, adapters and the like) that are equipped with corresponding short-range receivers.

The cellular phone that is referred to in the following figures can resemble the prior art cellular phone 100 of FIGS. 1 and 2 but in addition has health monitoring software for processing physiological data.

FIGS. 3-6 are schematic illustrations of a personal health monitor 1 that includes one or more physiological data input devices and a cellular phone (or another PDA), according to various embodiment of the invention. Each figure illustrates one or more physiological data input devices that may include at least one of the following devices: an electrocardiograph (ECG) input device, a device for monitoring blood oxygen saturation, a device for monitoring respiration, a device for monitoring blood glucose, a device for monitoring blood pressure, a device for monitoring lung function, a device for monitoring SpO2 saturation, a device for monitoring temperature, a device for fat analysis, a drug dispenser, drug taking reminder, a container device, a fetal heart rate monitor device for pregnancy women, EEG device and the like. Each physiological data input device includes at least one sensor and may also include an analog component such as an analog amplifier, an analog comparator and the like. Such a physiological data input device may also include an analog to digital converter (ADC), although such an ADC is typically located within another component that is connected to the physiological data input device.

FIG. 3 illustrates a person 200 that is wearing a physiological data input device 202 operative to gather physiological data. In this figure the physiological data input device 202 are connected to person 200 by a sticker, but this is not necessarily so. The physiological input device 202 can be connected to an elastic stripe or some type of belt that in turn is worn by person 200.

The physiological data input device 202 is connected by wire 204 to a short-range transmitter 206 or the device 202 is embedded in the 206. The short-range transmitter 206 is adapted to wirelessly transmit the gathered physiological data to cellular phone 210 or other personal data accessory. Either

the physiological data input device 202 or the short-range transmitter 206 include an analog to digital converter for providing a digital stream of signals representative of the physiological condition of the person 200.

According to various embodiments of the invention the short-range transmitter 206 transmits the physiological data to the cellular phone 210 in bursts. Burst transmitters are known in the art and do not require additional explanation. Typically, such a transmitter includes one or more buffers or other memory components (such as a stack, multiple memory cells and the like), for storing data before being transmitted in bursts. The bursts can be transmitted whenever a certain transmission condition is fulfilled (for example—the one or more buffers are full), or in a predefined manner. The burst rate is usually responsive to a ratio between the sampling-rate of the physiological data provided by the physiological data input device and between the transmission bit-rate. Typically the sampling-rate is at selected such as to fulfill the Nyquist condition.

The short-range transmitter 206 can apply error corrections algorithms, such as CRC, in order to compensate for possible errors in the short-range transmission. The short-range transmission can be implemented in a standard manner, for example according to the Bluetooth standard, but this is not necessarily so.

It is further noted that a short-range transmission circuitry can reside within the cellular phone 210 or be attached to the phone by means of a short-range transmission adapter 222, as illustrated in FIG. 5.

FIG. 4 illustrates another embodiment of the invention in which the physiological data input device 202 is connected via wire 208 to the cellular phone 210 via an additional component, such as protocol adapter 212. The additional component can include a signal converter, adapted to convert signals arriving from the physiological data input device 202 to a format that is recognized by the mobile phone 210. The converter may include an analog to digital converter, communication protocol adapted and the like.

FIG. 5 illustrates another embodiment of the invention in which the physiological data input devices 202 have wireless short-range transmission capabilities and are capable of short-range communication with the cellular phone 210. Electrodes that include wireless transmission capabilities are known in the art and are described, for example, at U.S. Pat. No. 6,577,893 of Besson et al., titled “wireless medical diagnosis and monitoring equipment” which is incorporated herein by reference.

FIG. 6 illustrates another embodiment of the invention in which multiple physiological input devices 202 are connected to an adapter 214 that in turn may generate a multiplexed signal stream that includes signals from one or more of the multiple physiological input devices 202. The adapter 214 conveniently includes one or more analog to digital converters, buffers and a short-range transmitter 206. According to another embodiment of the invention the adapter 214 includes an interface, instead of the short-range transmitter, that is connected to a wire that in turn is connected to cellular phone 210.

According to an embodiment of the invention the adaptor 214 can include a medical sub-system that facilitates the connection of multiple physiological input devices 202 of various types. Such a medical sub-system is described, for example, in U.S. Pat. No. 6,366,871 titled “Personal ambulatory cellular health monitor for mobile patient” of Geva, which incorporated herein by reference.

FIG. 7 illustrates a medical sub-system 100 that includes a multiplexing and analog to digital converter 124 that is con-

nected to multiple analog components such as EEG amplifier **103**, ECG amplifier, respiration circuit **109**, NBP circuit **113**, air flow amplifier **117**, SpO2 circuit **119**, temperature circuit **121** and glucose circuit **123** that in turn are connected to various sensors such as EEG electrodes **101**, ECG electrodes **105**, a pressure cuff **110** for measuring NIBP, and an air flow sensor **114** for measuring spirometry, finger sensor **118**, temperature sensor **120** and glucose sensor **122**. The sensors can be connected directly to the analog circuits or via various connectors or plugs, such as plugs **102**, **106**, **107**, **115**, as well as via EEG multiplexer **104**. Some of the plugs, such as plug **107**, can be used for connecting a first sensor or another sensor, and the connector includes circuitry for determining which sensor is actually connected to the plug.

According to various embodiments of the invention hardware components, such as adaptor **214**, physiological input device **202**, and alternatively or additionally, short-range transmitter **206** that are connected to the cellular phone by a wire, the cellular phone **210** can be utilized for supplying energy to the wired components. For example, the battery of the cellular phone can be connected, via a wire and/or a connector such as system connector **56** of FIG. 1.

FIG. 8 illustrates another embodiment of the invention in which the person **200** carries one or more physiological data input devices, such as device **202**, as well as a personal location subsystem **222** capable of determining a location of the person **200**. Thus, location information is also sent to the cellular phone **210** and then long-range transmitted to a remote station (not shown).

The personal location subsystem **222** determines the location of person **200**. It usually includes known location determination circuitry such as GPS components including a GPS receiver and a filter that is tuned to a known GPS frequency for GPS satellite communication via a built-in antenna. The personal location subsystem **222** conveniently receives a pseudo range (PR) and pseudo range dot (PRD) from GPS satellites in communication range. The GPS receiver preferably operates in aided mode enabling "snapshot" operation as is known in GPS systems. The position of person **200** and velocity data is conveniently transmitted via a short-range transmitter **206** and to cellular phone **210**.

The location of person **200** can be transmitted in predetermined events (Such as location, Distance, Velocity and such as system initialization) or automatically.

Reference is now made to FIG. 9 which is a simplified block diagram illustrating end-to-end communication between a physiological data input devices **202** worn by two persons **200** and **201** and between a remote medical center **230**, according to an embodiment of the invention.

The physiological data input device **202** worn by the first person **200** is connected by wire **204** to a short-range transmitter **206**. The short-range transmitter **206** transmits physiological data to cellular phone **210** where the data is processed. The cellular phone **210** is capable of determining whether to transmit the processed physiological data, to transmit a portion of the data or not to transmit it at all.

The cellular phone **210** is connected over a cellular network that is represented by wireless link **240** or via another network such as Internet **244** to a remote medical center **250**. The remote medical station **250** can be connected to various databases and accessories **242** via another network such as the Internet **244**.

The second person **201** also wears a physiological data input device **202** that is connected by wire **204** to a short-range transmitter **206** that in turn transmits physiological data towards short-range receivers **246** that are capable of transmitting the data to the remote medical center **250** via a

WLAN, Cable TV, Satellite TV, CCTV, Telephone line, GSM/GPRS, CDMA, TDMA, iTV, Internet and other network represented by link **248**. In this scenario the gathered physiological data can be analyzed by the short-range receiver **246** (or more specifically by a processor that is connected to the receiver). In case of the cable TV, CCTV, ITV, Satellite TV and etc the TV device might be the GUI interface device for user.

Various remote medical centers are also known as central medical monitoring stations and are known in the art. Such a center is described at U.S. Pat. No. 6,366,871 titled "Personal ambulatory cellular health monitor for mobile patient" of Geva, which incorporated herein by reference. It is noted that Geva describes a monitor that is capable of vocal communication with the person, and this feature can be implemented by using the cellular phone **210**.

The physiological data input devices **202** and the cellular phone **210** can operate in various modes that include: (i) Event recording activated by the person, either at the person initiative, a third party (such as a clinician) initiative, or pursuant to an alarm, where the person performs one or more tests and transmits processed physiological data to the remote medical center **230**. In this mode the remote medical center **230** may be contacted at the beginning of the event for transmission of processed physiological data during the event or at the conclusion of the testing. (ii) Continuous monitoring where physiological data are captured periodically and transmitted to the remote medical center **230**. Continuous monitoring may be provided in any of the following ways: Patient-activated event recorder where processed pre-event/event/post-event data is transmitted to the remote medical center **230**; Device-activated event recorder where physiological data is detected which fall outside preset parameters; Holter-mode where processed physiological data is transmitted automatically when a buffer of an adaptor or a memory space of the cellular phone allocated for storing the processed (or non-processed) physiological data becomes full; and Holter-mode where processed physiological data is transmitted by a person at any time.

FIG. 10 illustrates a configuration of the health monitoring software **300**, according to an embodiment of the invention. The health monitoring software **300** includes a driver/API **310** between the cellular phone and the wireless network for long-range transmission of processed physiological data, for example in accordance to GPRS, CDMA, GSM and the like. The health monitoring software also includes an API or driver **312** for the short-range or wired data link through which the cellular phone receives the physiological data. The health monitoring software also includes physiological data processing software components **314** as well as user interface software components **316**.

It is noted that other software configurations can be utilized. It is also noted that the drivers/API can be a part of the non-medical software components of the cellular phone. For example, a cellular phone that has an embedded short-range receiver includes a short-range communication software module, regardless the presence of the medical application.

The user interface component **316** can apply various known in the art techniques, such as but not limited to a menu based interface in which the person can make various selections between various options that are displayed over the display of the cellular phone. It is also noted that given the advanced multimedia capabilities of modem phones the user interface can also include receiving vocal input and outputting vocal output.

The physiological data processing software component 314 can apply various well-known algorithms for processing the physiological data.

For example, the software can enable the personal health monitor 1 to perform at least one of the following: (i) automatic arrhythmia analysis in different quantization levels (up to 8 bits) in different sampling rates (including 100 Hz), (ii) perform one lead arrhythmia detection in various noise conditions, (iii) perform continuous automatic adaptation to the patient normal heartbeat morphology, (iv) perform continuous real time processing and provide, on request, a summary of the patient heart condition, (v) perform environmental and adaptive noise/movement artifact elimination, (vi) enable the person to adjust the definitions of the pathology sequences detected by the system (for example the number of consecutive PVC heartbeats and the minimum heart rate to define VT) and others.

The health monitoring software 300 can detect various medical events and determine a medical state of a person. In some operational modes out of the mentioned above modes an occurrence of a medical event can initiate a transmission of processed physiological data and even cause the cellular phone 210 to generate an audio an/or visual alarm message. This health monitoring software 300 can process received physiological data to determine the occurrence of the following: isolated premature ventricular contraction (PVC), isolated premature atrial contraction (PAC), bigeminy, trigeminy, couplet, bradycardia, tachycardia, ventricular tachycardia, supra-ventricular tachycardia. The software can detect a morphology change, perform PR, ST, QRS, QT segmentation, Heart Rate Variability (HRV) analysis and QT Analysis, and the like. According to various embodiments of the invention the health monitoring software 300 can cause the cellular phone to display graphs or other visual representations of the monitored physiological data. According to an embodiment of the invention the cellular phone 210 is capable of retrieving medical information related to the person, and displaying the retrieved medical information. In order to prevent unauthorized use of such a feature the cellular phone can apply various measures such as password protection, biometric measures and the like. FIG. 11 illustrates a plug-in device 400 that is detachably connected to cellular phone 210, according to an embodiment of the invention. The plug-in device can gather one or more type of physiological data, and can include one or more of the previously mentioned sensors, analog circuitry and even can include a multiplexer and analog to digital converter and cable/direct connection and communication to the Cellular Phone that is based on the micro controller. The following scenarios provide example of the interaction between the person and the monitor. For simplicity of explanation we refer to the plug-in device of FIG. 11 but this also applies to the previously mentioned configurations. A sugar level test includes the following stages: the person initialized the test by pressing a certain button, the person inserts a strip in a strip chamber of the plug-in device, the person places a drop of blood on the strip, the plug in sends physiological data reflecting the content of that drop to the cellular phone 210 that in turn processes the gathered physiological data to determine the level of sugar. The person can also view pervious sugar level tests, for example during a time period defined by the person. The cellular phone can display a history trend graph of results with normal level highlighted in a different color. A ECG test can include the following stages: the person presses on a certain button, the person places his fingers on an electrode, the personal physiological monitor retrieves and processes physiological data to determine the stage of the person, a cardiogram is displayed on the

monitor of the cellular phone. The person can see the result of previous tests and/or determine whether to save the results of the current test, and the like.

FIG. 12 is a flow chart of method 500 for health monitoring, according to an embodiment of the invention.

Method 500 starts by stage 510 of gathering physiological data, conveniently by one or more physiological data input devices. Conveniently, one of the configurations illustrated at FIGS. 3-6, 8 can be used. Data is gathered by one or more physiological data input device.

Stage 510 is followed by stage 520 of providing the physiological data to a cellular phone or other personal data accessory. This stage can include short-range transmission of the physiological data, wire based transmission and the like.

Stage 520 is followed by stage 530 of processing the physiological data to provide processed physiological data. Stage 530 may include applying various well-known algorithms, such as those previously mentioned.

Stage 530 is followed by stage 540 of transmitting the processed physiological data, conveniently to a remote medical center. This stage usually includes long-range transmission of the information.

According to another embodiment of the invention the analyzed physiological data as well as optional information from the personal location can be sent to a center, such as medical center 250 and may be utilized for providing and controlling a diet and/or exercise regime. For example, a person starts to run and begins to transmit location information. This location information along with the timing of its transmission can be used to determine if the person runs, the distance that he runs and even an estimated calorie consumed during this running session. This data can be added to physiological data such as heart rate and fat measurement to provide an indication about the progress of the person in a diet physical fitness regime. The cellular phone 210 can be used to process above mentioned data and display the person indications about scheduled meals, physical exercises, and the like or the above data can be processed in medical center 250 and The cellular phone 210 can be used to send the person indications about scheduled meals, physical exercises, and the like.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove.

Those skilled in the art will readily appreciate that various modifications and changes may be applied to the preferred embodiments of the invention as hereinbefore exemplified without departing from its scope as defined in and by the appended claims.

I claim:

1. A personal health monitor comprising:

a physiological data input device operative to gather physiological data; and

a multi-purpose personal data accessory, whereas the multi-purpose personal data accessory is adapted to execute health monitoring software such as to enable the multi-purpose personal data accessory to receive the physiological data, process the physiological data to provide processed physiological data and control a long range transmission of the processed physiological data to a remote entity.

2. The personal health monitor of claim 1 wherein the multi-purpose personal data accessory is a cellular phone or Hand-Held device.

3. The personal health monitor of claim 1 wherein the multi-purpose personal data accessory comprises a battery

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and wherein the physiological data input device is adapted to receive power from the battery.

4. The personal health monitor of claim 1 wherein the physiological data input device is adapted to short-range transmit the physiological data to the personal data accessory.

5. The personal health monitor of claim 4 wherein the physiological data input device comprises a burst transmitter for transmitting the physiological data in a bursts.

6. The personal health monitor of claim 4 wherein the physiological data input device comprises a IRDA transmitter.

7. The personal health monitor of claim 1 further comprising a location determination circuitry for providing location information to the wireless device.

8. The personal health monitor device of claim 1 wherein the physiological data input device is shaped such as to be detachably attached to the multi-purpose personal data accessory.

9. The personal health monitor of claim 1 wherein the multi-purpose personal data accessory is adapted to long range transmit the physiological data input if it determines that a medical event has occurred.

10. The personal health monitor of claim 1 further comprising a protocol adapter coupled to the multi-purpose personal data accessory adapted to convert signals from the physiological data input device to a format recognizable by the multi-purpose personal data accessory.

11. The personal health monitor of claim 1 further comprising an adaptor for sending data gathered from multiple physiological data input devices to the multi-purpose personal data accessory.

12. The personal health monitor of claim 1 further comprising an adaptor for performing analog processing and analog to data conversion of signals provided from multiple physiological data input devices.

13. The personal health monitor device of claim 1 wherein the physiological data input device is embedded in the wireless device.

14. The personal health monitor device of claim 1 wherein the physiological data input device is embedded in the multi-purpose personal data accessory.

15. The personal health monitor of claim 1 wherein the personal data accessory is an interactive television.

16. The personal health monitor of claim 1 wherein the physiological data comprises a weight indication.

17. The personal health monitor of claim 1 wherein said long-range transmission is performed over a network that is

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configured according to one of the following standards: WLAN, GSM, GPRS, CDMA, TDMA, Satellite TV, iTV, Cable TV and CCTV.

18. Apparatus according to claim 1 wherein said short range or long range transmission involves allocating at least one SDIO/SD/MMC/CF slot.

19. A method for health monitoring, comprising:

gathering physiological data, by a physiological data input device; providing the physiological data to a multi-purpose personal data accessory; executing health monitoring software, by the multi-purpose personal data accessory to process the physiological data to provide processed physiological data; and transmitting the processed physiological data.

20. The method of claim 19 wherein the multi-purpose personal data accessory is a cellular phone or Hand-Held device.

21. The method of claim 19 further comprising receiving power from the multi-purpose personal data accessory.

22. The method of claim 19 wherein the stage of providing the physiological data involves short range transmission of the physiological data.

23. The method of claim 22 wherein the short range transmission involves transmitting bursts that comprise physiological data.

24. The method of claim 19 further comprising providing location information to the personal data accessory.

25. The method of claim 19 further comprising a preliminary stage of attaching the physiological data input device to the personal data accessory.

26. The method of claim 19 further comprising long range transmitting the processed physiological data if a medical event occurs.

27. The method of claim 19 wherein the stage of providing comprises converting further comprising a protocol adapter coupled to the multi-purpose personal data accessory adapted to convert signals from the physiological data input device to a format recognizable by the multi-purpose personal data accessory.

28. The method according to claim 19 further comprising estimating calories consumed during a physical activity.

29. The method according to claim 19 further comprising providing an indication about a progress of a person in a diet physical fitness regime.

30. The method according to claim 19 further comprising providing indications about scheduled activities.

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(12) **INTER PARTES REEXAMINATION CERTIFICATE (853rd)****United States Patent****Nanikashvili**(10) **Number:** **US 7,542,878 C1**(45) **Certificate Issued:** **Apr. 8, 2014**(54) **PERSONAL HEALTH MONITOR AND A METHOD FOR HEALTH MONITORING**(75) Inventor: **Reuven Nanikashvili, Ashdod (IL)**(73) Assignee: **Card Guard Scientific Survival Ltd.,
Rabin Science Park, Rehovot (IL)****Reexamination Request:**

No. 95/001,312, Mar. 16, 2010

Reexamination Certificate for:Patent No.: **7,542,878**Issued: **Jun. 2, 2009**Appl. No.: **11/059,791**Filed: **Feb. 16, 2005****Related U.S. Application Data**

(63) Continuation of application No. 10/876,139, filed on Jun. 23, 2004, now abandoned, which is a continuation-in-part of application No. 10/086,633, filed on Mar. 4, 2002, now Pat. No. 7,222,054, which is a continuation-in-part of application No. 09/261,136, filed on Mar. 3, 1999, now Pat. No. 6,366,871.

(60) Provisional application No. 60/076,660, filed on Mar. 3, 1998.

(51) **Int. Cl.**
G06F 19/00 (2011.01)(52) **U.S. Cl.**USPC **702/188; 600/301**(58) **Field of Classification Search**

None

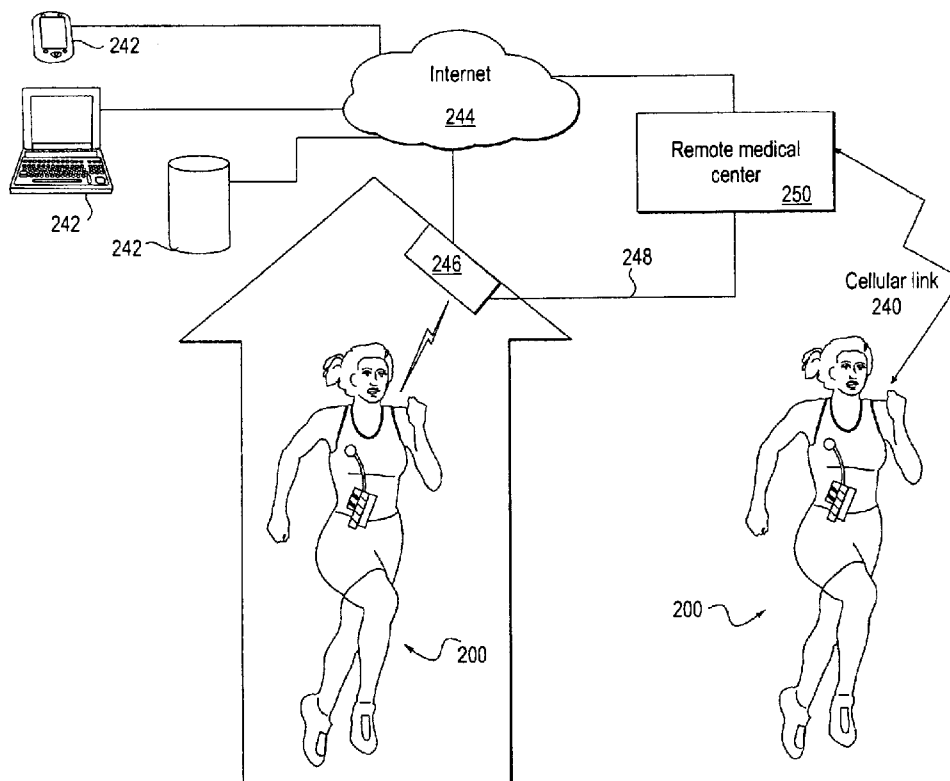
See application file for complete search history.

(56) **References Cited**

To view the complete listing of prior art documents cited during the proceeding for Reexamination Control Number 95/001,312, please refer to the USPTO's public Patent Application Information Retrieval (PAIR) system under the Display References tab.

Primary Examiner — Linh M. Nguyen(57) **ABSTRACT**

The invention provides a personal health monitor that includes a physiological data input device operative to gather physiological data; and a personal data accessory, whereas the personal data accessory is adapted to execute health monitoring software such as to enable the personal data accessory to receive the physiological data, process the physiological data to provide the physiological data and control a long range transmission of the processed physiological data to a remote entity. The invention provides a method for health monitoring, the method includes: gathering physiological data, providing the physiological data to a personal data accessory; executing health monitoring software to process the physiological data to provide processed physiological data; and transmitting the processed physiological data.



**INTER PARTES
REEXAMINATION CERTIFICATE
ISSUED UNDER 35 U.S.C. 316**

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THE PATENT IS HEREBY AMENDED AS
INDICATED BELOW.

AS A RESULT OF REEXAMINATION, IT HAS BEEN
DETERMINED THAT:

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Claims **2-30** are cancelled.

Claim **1** was not reexamined.

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