US 20040030581A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2004/0030581 A1

Leven (43) Pub. Date: Feb. 12, 2004

(54) HEART MONITORING DEVICE

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(21) Appl. No.: **10/459,880**

(22) Filed: **Jun. 12, 2003**

Related U.S. Application Data

(60) Provisional application No. 60/388,598, filed on Jun. 12, 2002.

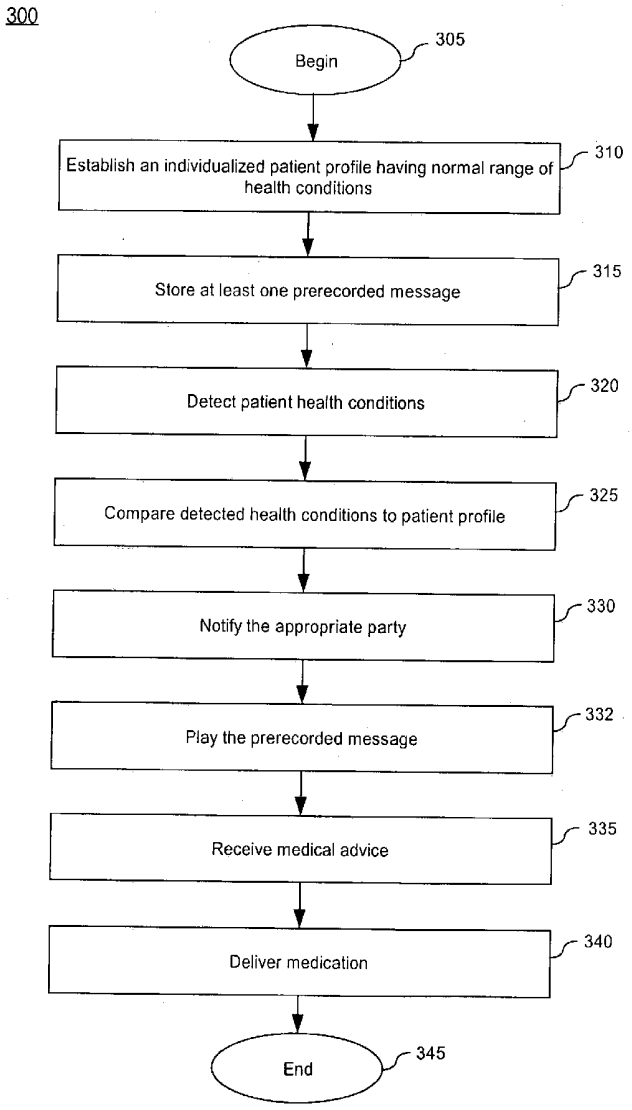
Publication Classification

(51) **Int. Cl.**[7] **G06F 17/60**

(52) **U.S. Cl.** **705/2**

(57) **ABSTRACT**

A wearable patient health monitoring device includes a plurality of sensors configured to monitor health conditions, a data storage communicably coupled to the sensors for recording monitored health conditions as data, a transceiver communicably coupled to the sensors for wireless communications configured for transmitting and receiving data, and an element for securing said monitoring device to the body. A patient health monitoring system is provided that includes a monitoring device, at least one health professional computing device communicably and at least one third-party computing device, both coupled to the monitoring device via a communications network. A method for monitoring health conditions of a patient includes establishing an individualize patient profile having a normal range of health conditions, sensing patient health conditions, comparing detected health conditions to patient profile, and notifying a health professional when the detected health conditions are outside of the established normal range.



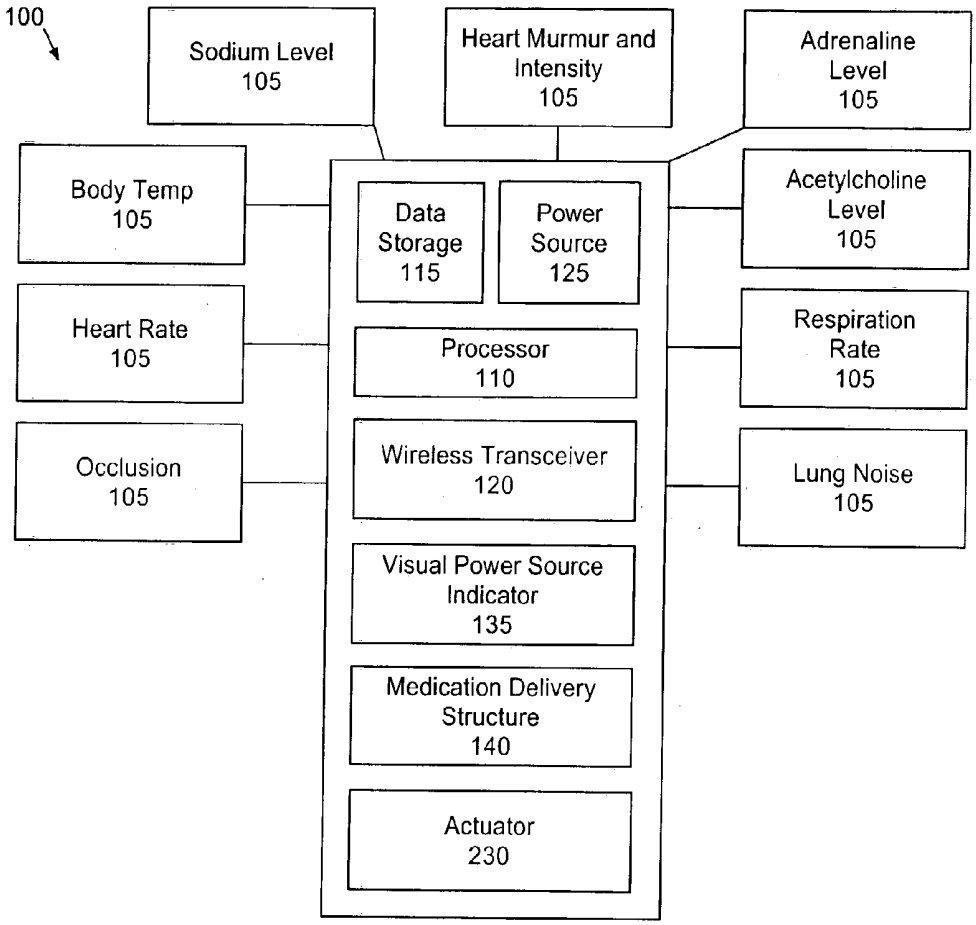


FIGURE 1

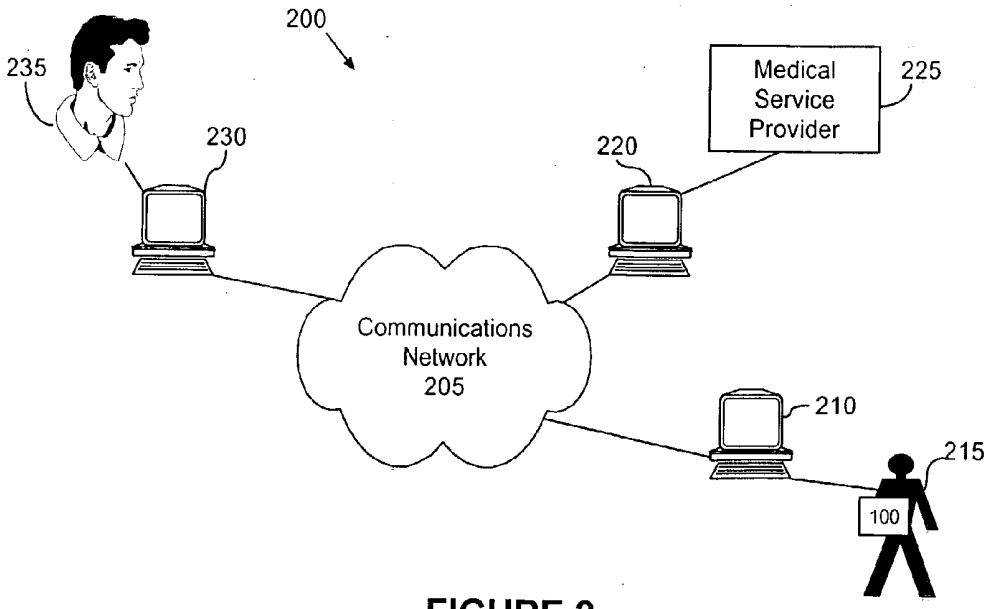


FIGURE 2

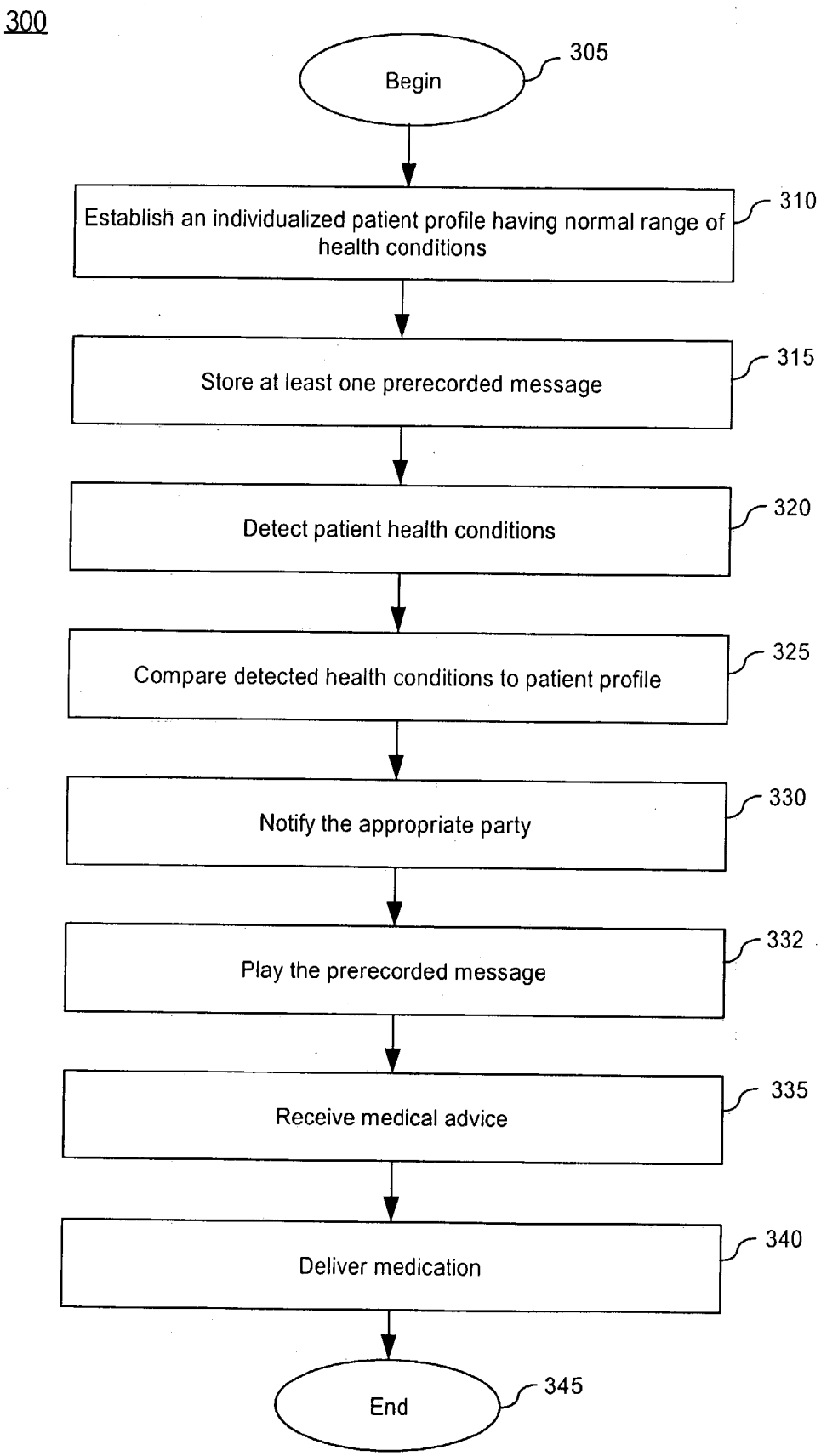

300
Begin
305
Establish an individualized patient profile having normal range of health conditions
310
Store at least one prerecorded message
315
Detect patient health conditions
320
Compare detected health conditions to patient profile
325
Notify the appropriate party
330
Play the prerecorded message
332
Receive medical advice
335
Deliver medication
340
End
345

FIGURE 3

HEART MONITORING DEVICE

CROSS REFERENCE TO RELATED APPLICATION

[0001] Under 35 USC §119(e), this application claims the benefit of U.S. Provisional Application No. 60/388,598 entitled Health Monitoring Device, filed on Jun. 12, 2002, the entirety of which is now incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Technical Field

[0003] This invention relates in general to a medical device, and in particular to a wearable health monitoring device.

[0004] 2. Description of the Related Art

[0005] Several attempts have been made to develop an apparatus that provides efficient and reliable health monitoring capabilities. For instance, a number of inventions in the prior art have incorporated the use of devices to monitor medical conditions of bodily organs, such as the heart. Specifically, in U.S. Pat. Pub. No. 2002/0016719 to Nemeth et al. ("Nemeth"), a medical device is disclosed which includes a wireless communication device to receive medical data from a monitor borne by an ambulatory patient and wirelessly transmits at least some of the medical data to a computer network. Nevertheless, the device disclosed in Nemeth fails to provide immediate and individualized health monitoring to a user.

[0006] Other health monitoring devices of the prior art fail to combine real-time monitoring, real-time evaluation of the conditions being monitored, administering of real-time health advice, and real-time medication delivery. Thus, while other health monitoring devices can provide portions of a patient's health care needs, a comprehensive health program needs to react immediately the changes in patient health. Moreover, a comprehensive health program can also recognize changes in a patient that may indicate the likelihood of future health problems. Such recognition can allow the patient to advert serious health conditions due to preemptive medical steps.

[0007] Additionally, many health monitoring devices are not suitable for monitoring the ambulatory patient in a real world environment. Some monitoring devices require bulky and cumbersome wires while others fail to appropriately and comprehensively monitor the ambulatory patient.

[0008] While some health care monitoring devices can contact others in the event of a medical emergency, other individuals may also need to be contacted. For instance, a person having a pace maker or any sort of serious heart ailment requiring medical supervision may need to have constant monitoring of his vital signs to provide instant notice to healthcare officials of any impending threat of heart failure. In addition to notifying the health care officials, other individuals, such as family members or coworkers, may currently remain un-contacted.

[0009] Upon receipt of a notification that one's vital signs are abnormal, many users of health monitoring devices must orally ingest medication. If medication is not taken at the appropriate time, a patient can suffer from sudden cardiac arrest, heart failure or other form of organ breakdown. The use of health monitoring devices in combination with the task of taking considerable amounts of medication can be inconvenient and expensive.

SUMMARY OF INVENTION

[0010] The present invention concerns a wearable patient health monitoring device including a plurality of sensors configured to monitor health conditions, a data storage communicably coupled to the sensors for recording monitored health conditions as data, and a transceiver communicably coupled to the sensors for wireless communications configured for transmitting and receiving data. The sensors can include a sensor to monitor heart rate, a sensor to monitor heart murmurs, a sensor to monitor heart intensity, a sensor to monitor lung noise, a sensor to monitor respiration rate, a sensor to monitor for occlusion, a sensor to monitor adrenal level, a sensor to monitor acetycholine level, a sensor to monitor temperature, and a sensor to monitor sodium levels. The monitoring device can also include a user actuator for signaling the transceiver to contact at least one of an emergency services, a health care professional, and a processing device.

[0011] In one arrangement, the monitoring device can also include a visual power source indicator. The transceiver can be configured to detect available communication links. The monitoring device can also include a viewing screen for displaying at least one of data from the sensors, data received by the transmitter, and monitor device diagnostic information. The monitoring device also can include a processor operatively connected to the sensors. The processor can be programmed with an individualized patient profile having ranges of normal health conditions, wherein the processor compares detected health conditions to the range of normal health conditions.

[0012] In another arrangement, the monitoring device can include a medication delivery structure operatively connected to the processor, where the processor signals the medication delivery structure to deliver medication when health conditions outside of the range of normal health conditions are detected by the sensors. The medication delivery structure is at least one of a dermal patch, a medication port, and a medication pump. The processor can be operatively connected to the transceiver, and the processor can signal the medication delivery structure to deliver medication upon receiving a medication delivery signal from a health professional.

[0013] The present invention also provides a patient health monitoring system including a wearable patient health monitoring device having a plurality of sensors configured to monitor health conditions, a data storage for recording monitored health conditions as data, and a transceiver for wireless communications. The system also includes at least one health professional computing device communicably coupled to the monitoring device via a communications network and at least one third party computing device communicably coupled to the monitoring device via a communications network. The system can also include a patient computing device communicably coupled to the monitoring device and communicably coupled to the health professional computing device and the third party computing device via at least one of a wired communications

network and a wireless communications network. The patient computing device can be configured to play audible messages.

[0014] In one arrangement, the system can include a monitoring device having a processor operatively connected to the sensors where the processor can be programmed with an individualized patient profile. The profile can have ranges of normal health conditions and the processor can compare detected health conditions to the range of normal health conditions. The monitoring device can signal at least one of the patient computing device, the health professional computing device, and the third party computing device when health conditions detected by sensors fall outside of the established normal health conditions. The monitoring device can contact at least one of the health professional computing device and the third party computing device based on data from the monitoring device.

[0015] Further the present invention provides a method for monitoring the health conditions of a patient. The method includes establishing an individualized patient profile having normal ranges of health conditions, detecting patient health conditions, comparing detected health conditions to a patient profile, and notifying a health professional when the detected health conditions are outside of the established normal range. The method can also include signaling at least one of a personal computing device, a third party computing device, and a health professional computing device when the detected health conditions are outside of the established normal range.

[0016] In one arrangement, the method can include storing at least one prerecorded message and playing at least one prerecorded message. The method can also include receiving medical advice from at least one of the health professional and a third party and delivering medication when the detected health conditions are outside of the established normal range.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] There are presently shown in the drawings embodiments which are presently preferred, it being understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown.

[0018] **FIG. 1** is a schematic diagram illustrating a health monitoring device in accordance with the inventive arrangements disclosed herein.

[0019] **FIG. 2** is a schematic diagram illustrating the collection and transfer of data via a health monitoring system in accordance with the inventive arrangements disclosed herein.

[0020] **FIG. 3** is method for monitoring the health conditions of patient in accordance with inventive arrangements disclosed herein.

DETAILED DESCRIPTION OF THE INVENTION

[0021] The invention disclosed herein provides a wearable health monitoring device, system, and method of using the same. Importantly, the device can be used by an ambulatory patient in a real world environment. Specifically, the device can monitor and detect a myriad of health conditions. In accordance with the present invention, health conditions can relate to any bodily condition and substance level that is indicative of the health of an individual. Additionally, a patient health monitoring system allows a user to monitor an individual's health conditions by detecting, storing, analyzing and reporting the health conditions. Furthermore, the device and system can contact the appropriate party at the occurrence of a particular health related event and can provide a real-time medical history to a health professional. Notably, a heath care provider, such as a doctor, can also be provided with access to stored data to facilitate continuous monitoring of a user's health.

[0022] **FIG. 1** is a schematic diagram illustrating an exemplary health monitoring device **100** in accordance with the inventive arrangements disclosed herein. As shown in **FIG. 1, a** health monitoring device **100** can include a wearable health monitor having a plurality of sensors **105**. The plurality of sensors **105** can be utilized to monitor various health conditions. The health monitor **100** can include particular sensors **105** for monitoring specific health conditions. For instance, a non-exhaustive list of the particularized sensors **105** that can be provided include a sensor **105** to monitor heart rate, a sensor **105** to monitor heart murmurs, a sensor **105** to monitor heart intensity, a sensor **105** to monitor lung noise, a sensor **105** to monitor respiration rate, a sensor **105** to monitor for occlusion, a sensor **105** to monitor adrenal level, a sensor **105** to monitor acetycholine level, a sensor **105** to monitor temperature, and a sensor **105** to monitor sodium levels. Nevertheless, other sensors **105** can also be added to measure additional health conditions. Importantly, the sensors **105** provided by the health monitoring device **100** can be selected to correspond to the particular needs of a patient to provide the patient with comprehensive and customized health care.

[0023] The health monitoring device **100** can also include a data storage **115** for recording monitored health conditions, and a wireless transmitter **120**. The data storage **115** can include RAM, ROM, flash based memory, a hard drive, and the like. Advantageously, the data storage **115** can include non-volatile memory that will preserve health records in the unlikely event of a power outage. Furthermore, the data storage **115** can also be removable to allow access to the data in the event of a power outage. The health monitor **100** can also include a transceiver **120** for permitting wireless communication over suitable wireless communication links in a manner that is well known in the industry.

[0024] A health monitoring device **100** can also include a power source **125**. The power source **125** enables the health monitoring device to operate for extended periods of time without the need for any maintenance. A power source can include a lithium battery or other rechargeable power supply.

[0025] Further, the health monitoring device **100** also can include a visual power source indicator **135** to operate as a signaling device to indicate power levels. For instance, the visual indicator **135** can include a red light on the surface of the device **100** to indicate low power levels. Regardless, the monitoring device **100** can be charged using a conventional electrical adapter and/or cradle unit. Notably, the cradle unit can provide a wired link for transmitting and receiving data.

[0026] Referring to **FIG. 2**, the health monitoring device **100** can be used in conjunction with a health monitoring system **200**. The health monitoring system **200** includes a

health monitoring device **100**, a wired or wireless communications network **205**, one or more health professional computing devices **220**, and one or more third party computing devices **230**. Additionally, the system **200** can include a patient computing device **210**. The health professional computing devices **220**, the one or more third party computing devices **230**, and the patient computing device **210** can all be in communication with the health monitor **100** and the each other via the communications network **205**. The communications network **205**, can include, for example, the Internet, the Public Switched Telephone Network (PSTN), Local Area Networks (LAN), Wide Area Networks (WAN), and the like. Additionally, the wireless communication network **205** can include an suitable wireless communication standard, such as Wi-Fi, 802.11a, 802.11b, 802.11g, and the like.

[**0027**] In one embodiment, data stored in the data storage **115** can be transferred to the patient's computing device **210**. Once the data has been transferred to the patient computing device **210**, the patient can use software to manipulate, analyze, and view the data. Additionally, the one or more health professional computing devices **220** and the one or more third party computing devices **230** can access the data on the patient computing device via the communications network **205** for further manipulation, analyzing, and viewing. Nevertheless, the inventive arrangements are not so limited.

[**0028**] The monitoring device **100** can communicate with the health professional computing devices **220** and third party computing devices **230** in a variety of configurations. While the monitoring device **100** can directly communicate with the health professional computing devices **220**, third party computing devices **230**, and the patient computing device **210** over a wireless communications link, i.e. using a cellular communication link or the like, the monitoring device **100** also can communicate indirectly. For instance, the monitoring device **100** can wirelessly communicate to the patient computing device **210** using a short range communication standard, such as Bluetooth or one of the 802.11 family of wireless communication protocols. The patient computing device **210** can then initiate a communication in the form of an electronic mail, text message, and the like. The computing devices further can communicate voice and/or sound messages using a real time voice over Internet Protocol to a remotely located computer. Relaying communications to distant computing devices over the communications network, such as the Internet, can allow for remotely located people to still receive comprehensive medical treatment. In any case, the patient computing device **210** can send a fax or initiate a standard telephone call.

[**0029**] The health professional computing devices **220** and the third party computing devices **230** can also directly communicate with the monitoring device over a wireless communications network **205**. Thus, data in the data storage **115** that has not been transferred to the patient computing device **210** can be access directly from the monitoring device **100**. Such accessibility may be life saving if vital data has not yet been transferred to the patient computing device **210**. Additionally, communication network **205** can allow data to be accessed via a Web site through a visual and/or audio (voice) browser. Data received from third parties also can be downloaded and/or accessed from the user's computer system **210** and/or the health monitoring device **100**. Additionally, collected data can be transferred freely from a third party computer system **230** and a doctor's computer system **220** for further detailed analysis as illustrated in **FIG. 2**.

[**0030**] In operation, a health monitoring device **100** can be strapped to a user's chest, worn around the neck, or generally secured to the body of the user in any suitable fashion. Preferably, the health monitoring device can be unobtrusive and will not interfere with the daily activities of the user. Additionally, the health monitor device **100** can be constructed of a durable material able to withstand daily environmental stress.

[**0031**] As illustrated in **FIG. 2**, the health professional computing devices **220**, the third party computing devices **230**, and the patient computing device **210** can include a conventional personal computer equipped with the suitable software. The patient computing device **210** can be utilized to store data continuously until the monitoring device **100** fails, or until the remaining battery power is depleted to a predetermined level, in which case the data can be retrieved manually. Also, depending upon user preference and/or a health care professional's instructions, data can be transmitted continuously in real time, at predetermined intervals, or responsive to a user **215** request. For example, the monitoring device **100** can transmit data to the patient computing device **210**, the health professional computing devices **220**, the third party computing devices **230** in real time with the detection of a condition.

[**0032**] In another embodiment, the monitoring device **100** can include an actuator **130** for signaling the transceiver **120** to contact emergency services (i.e. 911) and a health care professional. For example, the user **215** experiencing any noticeable changes in pulse rate or other symptoms of possible health problems, can instantly transmit data to a doctor **235** by engaging the actuator **130** located on the monitoring device **100**. The actuator can also be used to transfer the data on the monitoring device **100** to the appropriate computing device. Thus the actuator **130** can be used as a panic button, which can provide the latest monitoring data available as well as initiate 911 calls or other calls to preprogrammed numbers when engaged. For example, the monitoring device **100** can include cellular communications and audio capability to call or cause the patient computing device **210** to call, and play prerecorded messages in the event the user is incapacitated. Similarly, a user **215** can transmit data to the doctor **225** in intervals providing the doctor **225** the ability to monitor the user's **215** corresponding health conditions without the user **215** being located in the doctor's **225** office.

[**0033**] One aspect of the present invention can automatically detect an operative wireless communications link. In the event such a link is detected and a connection is made, the invention can transmit the data to a remotely located computer system, which is accessible through the wireless communications link. The data can be transmitted with a unique identifier corresponding to the user's **215** identity. Once the data is transmitted, the data can be processed, whether in the home of the user **215** on the patient computing device **210** or on a remotely located computer, such as computing devices **220** and **230**, by software configured to detect particular health conditions through analysis of the collected data. If necessary, the software can send electronic

alerts to the user's doctor **225**. The data also can be processed in a server communicatively linked to the computer communications network and made available through a Web site for user, doctor, and/or third party review. Advantageously, the invention allows data to be collected over a period of weeks thereby facilitating the early detection of deteriorating health conditions through the analysis of health conditions collected over an extended period of time.

[**0034**] In one aspect of the invention, the doctor **225** can be prompted or notified of any changes in health conditions. For example, the data collected can be provided to a user's doctor **225** to alert the doctor **225**. Subsequently, the doctor **225** can prepare to proceed with the necessary steps to prevent and treat any health conditions. For instance, if a user **215** has an increase in heartbeat, the health monitoring device **100** can detect these changes and provide important data to the doctor **225**. Upon receipt of such information, the doctor **225** can attempt to administer preventative medication and develop alternative medical treatment as may be determined and recommended by a physician or health service. For example, physicians and/or third party medical services can make medical treatment recommendations which can be transmitted to the patient computing device **210** or to the health monitor device **100**.

[**0035**] Additionally, although not shown, the health monitor **100** can include a display screen for viewing data collected by the monitor's sensors, received information from the computer communications network **205**, instructions from the doctor **225**, and/or other unit diagnostic information. The data relating to the user's **215** health conditions also can be utilized to prepare an early diagnosis in the instance of an emergency situation before a doctor **225** has actually physical examined the user.

[**0036**] Similarly, the invention disclosed herein can be used to transfer data concerning the user's **215** vital signs to a third party **235**. As illustrated in **FIG. 2**, the data can be transferred to a third party, such as a family member or the like, to provide the designated third party **235** with important information regarding the user's **225** heart condition. For instance, a third party **235**, such as a spouse, can utilize the computer system **230** to upload data and maintain a constant source of information regarding a particular user's **215** heart condition during specific intervals or other selected time periods.

[**0037**] In an alternative embodiment of the present invention, data from the user's computer system **210** and computer communications network **205** can be equipped with a password to provide security measures. For example, the user's doctor **225** or other third party **235** can be equipped with a password to ensure that the personal information of the user **215** can only be accessed by these designated individuals. Accordingly, any individual attempting to access the computer communication network **205** without an authorization password to verify that the user **225** granted access to available storage data will be denied.

[**0038**] The monitoring device **100** can also include processor **110**. The processor **110** can be communicably coupled to the sensors **105** for the transfer of data from the sensors to the processor. The processor **110** can be programmed with an individualized patient profile having a range of normal health conditions. The patient profile can include ranges for the user's normal range of heart beat, murmurs, adrenaline levels, and other health conditions. With an established patient profile, the processor **110** can compare detected health conditions to the normal ranges for the individual. If a particular detection falls outside of the normal range, the monitoring device **100** can contact the appropriate computing device via email, instant message, text message, fax, and the like.

[**0039**] In another embodiment, the monitoring device **100** can include a medication delivery structure **140**, such as a dermal patch, medication port, and a medication pump. The medication delivery structure **140** can be communicably coupled to the processor **110** and the transceiver **120**. Since, the medication delivery structure **140** is communicably connected to the processor **110**, the monitoring device **100** can provide automated health care. When the processor determines that a detected health condition is outside of the normal range of values established in the patient profile, the processor can signal the medication delivery structure **140** to deliver the appropriate medicine. Such an embodiment provides the advantages of regulating health conditions. For example, the monitoring device can be used to regulate a women's hormone levels based upon ovulation cycles.

[**0040**] In another embodiment, the medication delivery structure **140** can be communicably coupled to the transceiver **140**. Thus, a doctor **225** can view data sent by the monitoring device **100**, analyze the data, and send medication instructions to the monitoring device **100**. In response, the processor can interpret the instructions and signal the medication delivery structure **140** to deliver the appropriate medicine. Such an embodiment can provide medicine in the crucial emergency stages of the first minutes of a heart attack.

[**0041**] The wireless connectivity of the present invention can support additional emergency functions. For example, healthcare facilities such as emergency rooms and the like, can be equipped with wireless communication equipment for communicating with the health monitor device. Thus, if a user is brought into such a facility, the health monitor device **100** can detect a wireless network connection and upload any collected data to the healthcare facility computer system so that the user may be readily diagnosed. Similarly, when traveling, various establishments can be equipped with wireless communication equipment allowing the health monitor device **100** to automatically detect a network connection and upload data that can be sent to any one of a variety of network addresses including, but not limited to, the user's computer system **210** and third party computer systems **220** and **230**. Thus, data can be archived and/or analyzed without the user having to be in close proximity to the user's home computer **210**.

[**0042**] The system **200** can be realized in hardware, software, or a combination of hardware and software. The present invention can be realized in a centralized fashion in one computer system, or in a distributed fashion where different elements are spread across several interconnected computer systems. Any kind of computer system or other apparatus adapted for carrying out the methods described herein is suited. A typical combination of hardware and software can be a general purpose computer system with a computer program that, when being loaded and executed, controls the computer system such that it carries out the methods described herein.

[0043] Additionally, a method **300** for monitoring a patient is provided. The method **300** can use the monitoring device **100** and health monitoring system **200** discussed above, however, the invention is not so limited. The method **300** can be practiced without a device or with any suitable device.

[0044] Method **300** can begin at step **305**. At step **310**, a patient profile can be established. The patient profile can include a normal range of health conditions for the particular patient. For instance, the patient profile can include the range of normal resting heart rates for the particular patient. Other relevant information, such as weight, height, and medical history can also be included in the patient profile as such information can be beneficial to medical diagnosis.

[0045] At step **315**, one or more prerecorded messages can be stored. The prerecorded messages can include messages related to the health conditions of the individuals. An example of one such a message can include a message indicating recent surgery, allergies, or other pertinent medical information. Such a message may provide crucial information to a medical provider that is not readily available. Additionally, the message can also be a general message to a family or friend. The message could simply be a reminder to walk the patient's dogs if the patient is unconscious in the hospital.

[0046] At step **320**, patient health conditions can be detected. Step **320** can involve routine measurements, such as detecting body temperature, and can also include complex measurements, such as detecting acetycholine levels. As discussed above, a health monitoring device can be used to detect the patient conditions; nevertheless, multiple instruments, devices, and sensors, can be employed to detect a patient's health conditions.

[0047] Turning to step **325**, the health conditions that were detected in step **320** can be compared to the patient profile. The comparison can include a simple numerical evaluation of whether a detected condition falls within the normal range of values for that particular patient. Nevertheless, the invention is not so limited. The comparison can also compare a detected condition to a multitude of information within the patient profile. For instance, it may be beneficial to compare a rise in heart rate to multiple hormone levels. In some circumstances, a rise in heart rate can be considered normal, and therefore, should not always be a cause for concern when detected conditions fall outside of normal ranges.

[0048] In step **330**, the appropriate party can be notified when the detected conditions are outside the normal range. The appropriate party can include a health care professional, or a computing device, such as a personal computing device or a computing device of a health care provider or third party. Additionally, the notification can be an indirect notification where multiple devices relay the notification over a communications network, such as the Internet. Notifying the appropriate party when a detected condition is outside of a predetermined range can allow for immediate medical attention. Furthermore, a medical emergency may be averted in method **300** because detected conditions that may indicate an even worse health condition can be used to trigger the notification of the appropriate party. With early detection, appropriate measures can be taken to avoid an emergency situation.

[0049] Other parties besides a health care professional can also be notified. For instance, a detected condition may trigger signaling a family member in a situation where there is no immediate medical emergency. For instance, if vitamin C levels are detected to be too low, a relative may want to be notified. In such an event, a relative, instead of a costly doctor, can respond to the notification and remind the patient to take a multi-vitamin.

[0050] In step **332**, one or more recorded messages can be played. The message can be played with a conventional speaker, but the message can also include audio and video to be played on a viewing screen. The message can be played to the same party that was signaled in step **330**; however, the invention is not limited in this regard. The message can be played to any appropriate party. The contents of the message can include instructions to a relative, notification for the health care professional of any relevant health conditions, and any other appropriate message including recently and stored measured health conditions.

[0051] In step **335**, medical advice can be received. Typically, the medical advice can relate to the detected conditions. For instance, if detected conditions are compared to normal ranges, and the detected conditions indicate an imminent heart attack, advice can be received regarding which medicine to take. Also typically, the medical advice can be sent from a health care professional; however, other parties, such as a nutritionist, can also send the medical advice that is received. The medical advice can be received in the form of a phone call, a text message, a digital signal, or any other suitable means of communication whether received by the device, the patient computing device, the telephone, fax, and the like.

[0052] In step **340**, medication can be delivered to the patient. Typically, medication can be delivered when detected conditions are outside of the patient's normal range. Thus, the delivery of medication to the patient can be in direct response to the detected conditions. The instructions to medicate can be included in the medical advice that is received in step **335** which can include not only textual, audio, video instructions and comments, but also instructions to increase dosage, decrease dosage, and delivery a one-time dosage. Medication can be delivered in the appropriate manner, such as orally, intravenously, subcutaneously and via any appropriate medication delivery structure. The method can end at step **345** or can return to the beginning step **305**.

[0053] Aspects of the present invention can also can be embedded in a computer program product, which comprises all the features enabling the implementation of the system described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present context means any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

[0054] This invention can be embodied in other forms without departing from the spirit or essential attributes thereof. Accordingly, reference should be made to the following claims, rather than to the foregoing specification, as indicating the scope of the invention.

What is claimed is:

1. A wearable patient health monitoring device comprising:

a plurality of sensors configured to monitor health conditions;

a data storage communicably coupled to said sensors for recording monitored health conditions as data; and

a transceiver communicably coupled to said sensors for wireless communications configured for transmitting and receiving data.

2. The monitoring device according to claim 1, wherein said sensors include a sensor to monitor heart rate, a sensor to monitor heart murmurs, a sensor to monitor heart intensity, a sensor to monitor lung noise, a sensor to monitor respiration rate, a sensor to monitor for occlusion, a sensor to monitor adrenal level, a sensor to monitor acetycholine level, a sensor to monitor temperature, and a sensor to monitor sodium levels.

3. The monitoring device according to claim 1, further comprising a user actuator for signaling the transceiver to contact at least one of an emergency services, a health care professional, and a processing device.

4. The monitoring device according to claim 1, further comprising a visual power source indicator.

5. The monitoring device according to claim 1, wherein the transceiver is configured to detect available communication links.

6. The monitoring device according to claim 1, further comprising a viewing screen for displaying at least one of data from said sensors, data received by said transmitter, and monitor device diagnostic information.

7. The monitoring device according to claim 1, further comprising a processor operatively connected to said sensors, said processor programmed with an individualized patient profile having ranges of normal health conditions, wherein said processor compares detected health conditions to said range of normal health conditions.

8. The monitoring device according to claim 7, further comprising a medication delivery structure operatively connected to said processor, wherein said processor signals said medication delivery structure to deliver medication when health conditions outside of said range of normal health conditions are detected by said sensors.

9. The monitoring device according to claim 8, wherein the medication delivery structure is at least one of a dermal patch, a medication port, and a medication pump.

10. The monitoring device according to claim 7, wherein said processor is operatively connected to said transceiver, said processor signals said medication delivery structure to deliver medication upon receiving a medication delivery signal from a health professional.

11. The monitoring device according to claim 10, wherein the medication delivery structure is at least one of a dermal patch, a medication port, and a medication pump.

12. A patient health monitoring system comprising:

a wearable patient health monitoring device having a plurality of sensors configured to monitor health conditions, a data storage for recording monitored health conditions as data, and a transceiver for wireless communications;

at least one health professional computing device communicably coupled to said monitoring device via a communications network;

at least one third party computing device communicably coupled to said monitoring device via a communications network.

13. The monitoring system according to claim 12, further comprising a patient computing device communicably coupled to said monitoring device and communicably coupled to said health professional computing device and said third party computing device via at least one of a wired communications network and a wireless communications network.

14. The monitoring system according to claim 12, wherein said patient computing device is configured to play audible messages.

15. The monitoring system according to claim 14, wherein said monitoring device further includes a processor operatively connected to said sensors, said processor programmed with an individualized patient profile having ranges of normal health conditions, wherein said processor compares detected health conditions to said range of normal health conditions.

16. The monitoring system according to claim 15, wherein said monitoring device signals at least one of said patient computing device, said health professional computing device, and said third party computing device when detected health conditions are health conditions outside of said normal health conditions are detected by said sensors.

17. The monitoring system according to claim 12, wherein said monitoring device contacts at least one of said health professional computing device and said third party computing device based on data from said monitoring device.

18. A method for monitoring the health conditions of a patient, comprising the steps of:

establishing an individualized patient profile having normal ranges of health conditions;

detecting patient health conditions;

comparing detected health conditions to a patient profile; and

notifying a health professional when the detected health conditions are outside of the established normal range.

19. The method according to claim 18, further comprising the step of signaling at least one of a personal computing device, a third party computing device, and health professional computing device when the detected health conditions are outside of the established normal range.

20. The method according to claim 18, further comprising the step of:

storing at least one prerecorded message; and

playing at least one prerecorded message.

21. The method according to claim 18, further comprising the step of receiving medical advice from at least one of the health professional and a third party.

22. The method according to claim 18, further comprising the step of delivering medication when the detected health conditions are outside of the established normal range.

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专利名称(译)	心脏监测设备		
公开(公告)号	US20040030581A1	公开(公告)日	2004-02-12
申请号	US10/459880	申请日	2003-06-12
[标]申请(专利权)人(译)	LEVEN SAMUEL		
申请(专利权)人(译)	LEVEN SAMUEL		
当前申请(专利权)人(译)	LEVEN SAMUEL		
[标]发明人	LEVEN SAMUEL		
发明人	LEVEN, SAMUEL		
IPC分类号	A61B5/00 A61B5/0205 A61B5/024 A61B5/08 A61B7/00 G06F19/00 G06F17/60		
CPC分类号	A61B5/0002 A61B5/02055 A61B5/024 A61B5/0816 A61B5/145 A61B5/14546 G06Q50/22 A61B5/4839 A61B7/00 G06F19/322 G06F19/3418 G06F19/3456 A61B5/411 G16H10/60 G16H20/10 G16H40/67		
优先权	60/388598 2002-06-12 US		
外部链接	Espacenet USPTO		

摘要(译)

可佩戴的患者健康监测设备包括：多个传感器，被配置为监测健康状况;数据存储器，可通信地耦合到传感器，用于将监测的健康状况记录为数据;收发器，可通信地耦合到用于无线通信的传感器，被配置用于发送和接收数据，以及用于将所述监测装置固定到身体上的元件。提供了一种患者健康监测系统，其包括监测设备，至少一个可通信的健康专业计算设备和至少一个第三方计算设备，两者都经由通信网络耦合到监控设备。一种用于监测患者的健康状况的方法包括建立具有正常范围的健康状况的个体化患者概况，感测患者健康状况，将检测到的健康状况与患者概况进行比较，以及当检测到的健康状况在所述健康状况之外时通知健康专业人员。建立正常范围。