US 20130090565A1

(19) **United States**

(12) **Patent Application Publication**

Quy

(10) **Pub. No.: US 2013/0090565 A1**

(43) **Pub. Date: Apr. 11, 2013**

(54) **METHOD AND APPARATUS FOR MONITORING EXERCISE WITH WIRELESS INTERNET CONNECTIVITY**

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(21) Appl. No.: **13/632,771**

(22) Filed: **Oct. 1, 2012**

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/211,033, filed on Sep. 15, 2008, now Pat. No. 8,277,377, which is a continuation of application No. 11/649,703, filed on Jan. 3, 2007, now abandoned, which is a continuation of application No. 11/184,274, filed on Jul. 18, 2005, now Pat. No. 7,156,808, which is a continuation of application No. 10/418,845, filed on Apr. 18, 2003, now Pat. No. 6,936,007.

Publication Classification

(51) **Int. Cl.**

A61B 5/00	(2006.01)
A63B 24/00	(2006.01)
H04W 8/24	(2006.01)
A61B 5/0205	(2006.01)

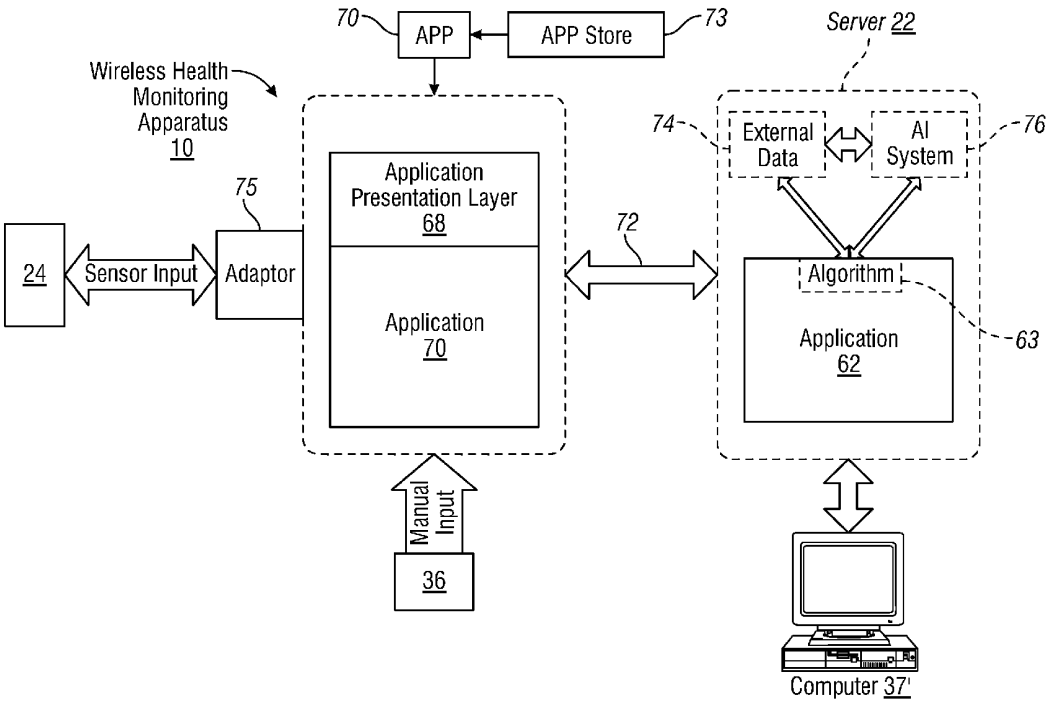
(52) **U.S. Cl.**

CPC ***A61B 5/0022*** (2013.01); ***A61B 5/02055*** (2013.01); ***A63B 24/0062*** (2013.01); ***H04W 8/24*** (2013.01)

USPC **600/484**; 482/8; 709/219

(57) **ABSTRACT**

Methods and apparatuses are provided for a wireless health monitoring system for interactively monitoring fitness or health condition of a user by connecting an internet-enabled wireless web device ("WWD"), such as a mobile phone or tablet, to a health monitoring device which may be a medical device or other device such as an exercise machine. The WWD may be wirelessly connected to the device, such as via an RF connection, including using protocols such as 802.15 or 802.11. The wireless connection may employ an adaptor, to convert proprietary RF schemes to input to a WWD. Alternatively, an adaptor may convert the output of a health monitoring device to a Bluetooth® signal for transmission to a WWD. The data is transmitted from the WWD to an Internet server using standard Internet protocols. The user may interact with the server and with other users equipped with similar apparatus.



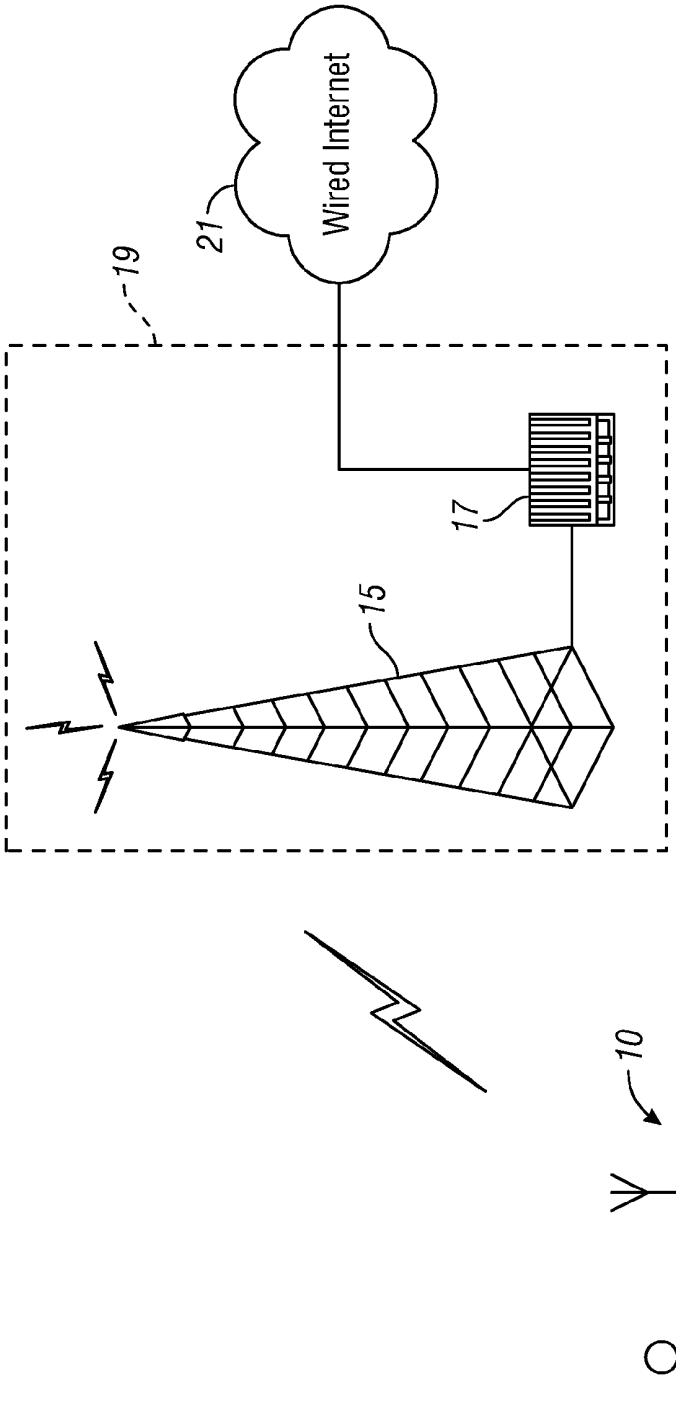


FIG. 1

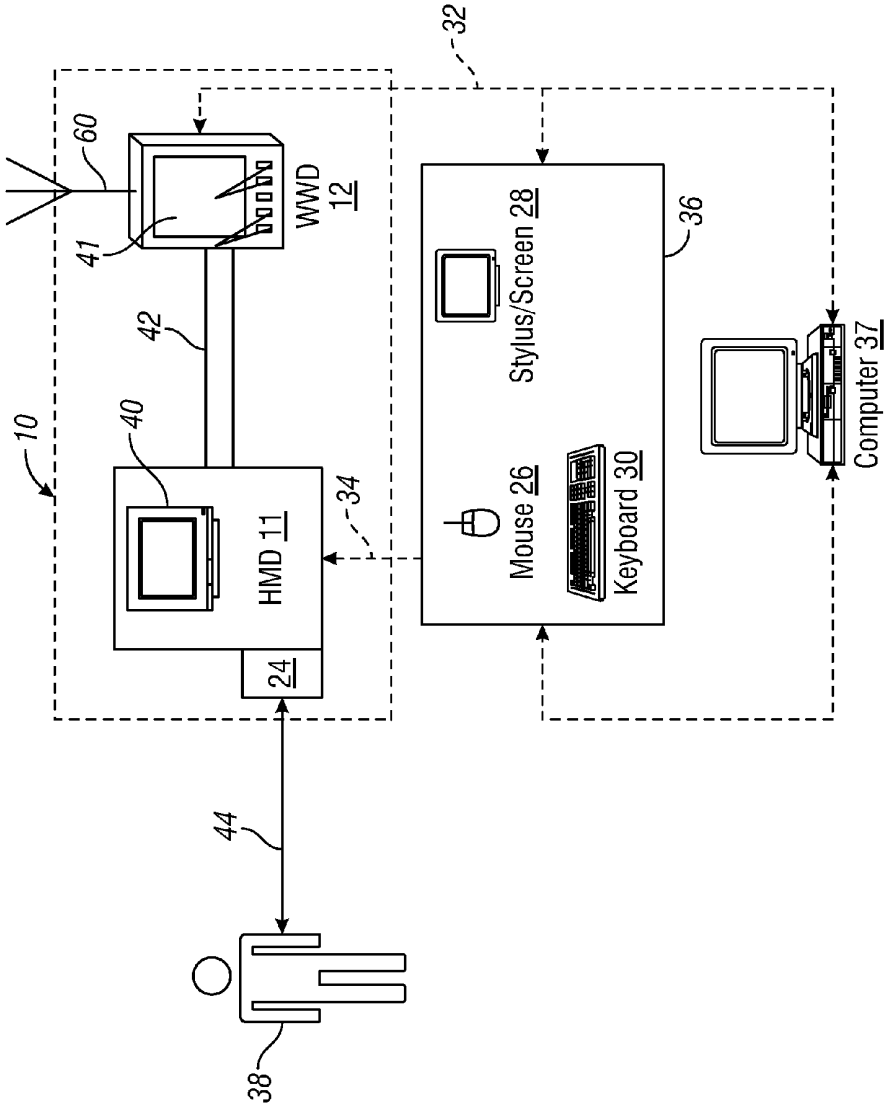

32
60
WWD 12
41
42
10
40
HMD 11
34
24
Stylus/Screen 28
36
Mouse 26
Keyboard 30
Computer 37
44
38

FIG. 2

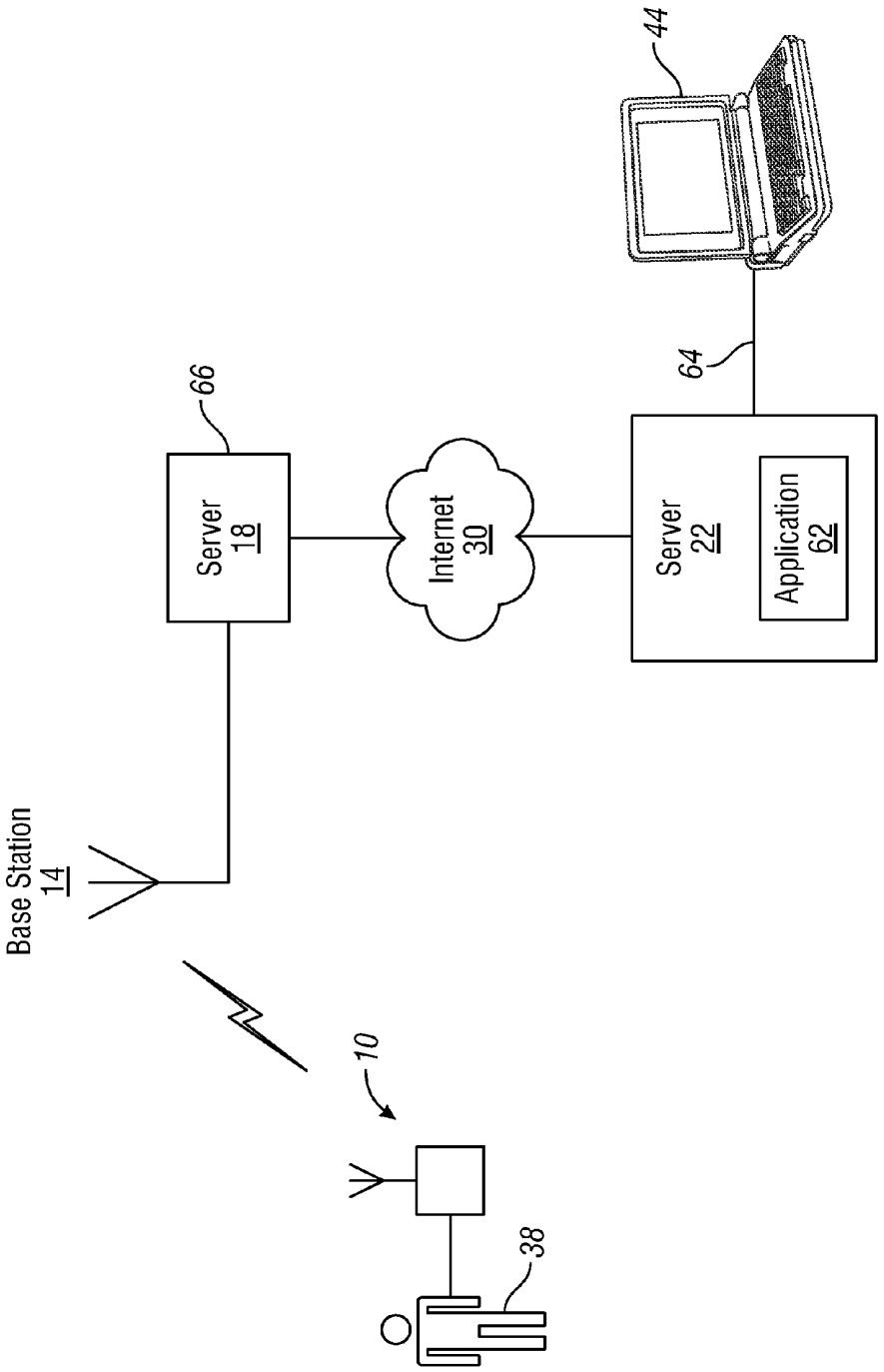

44
64
66
Server
18
Internet
30
Server
22
Application
62
Base Station
14
10
38

FIG. 3

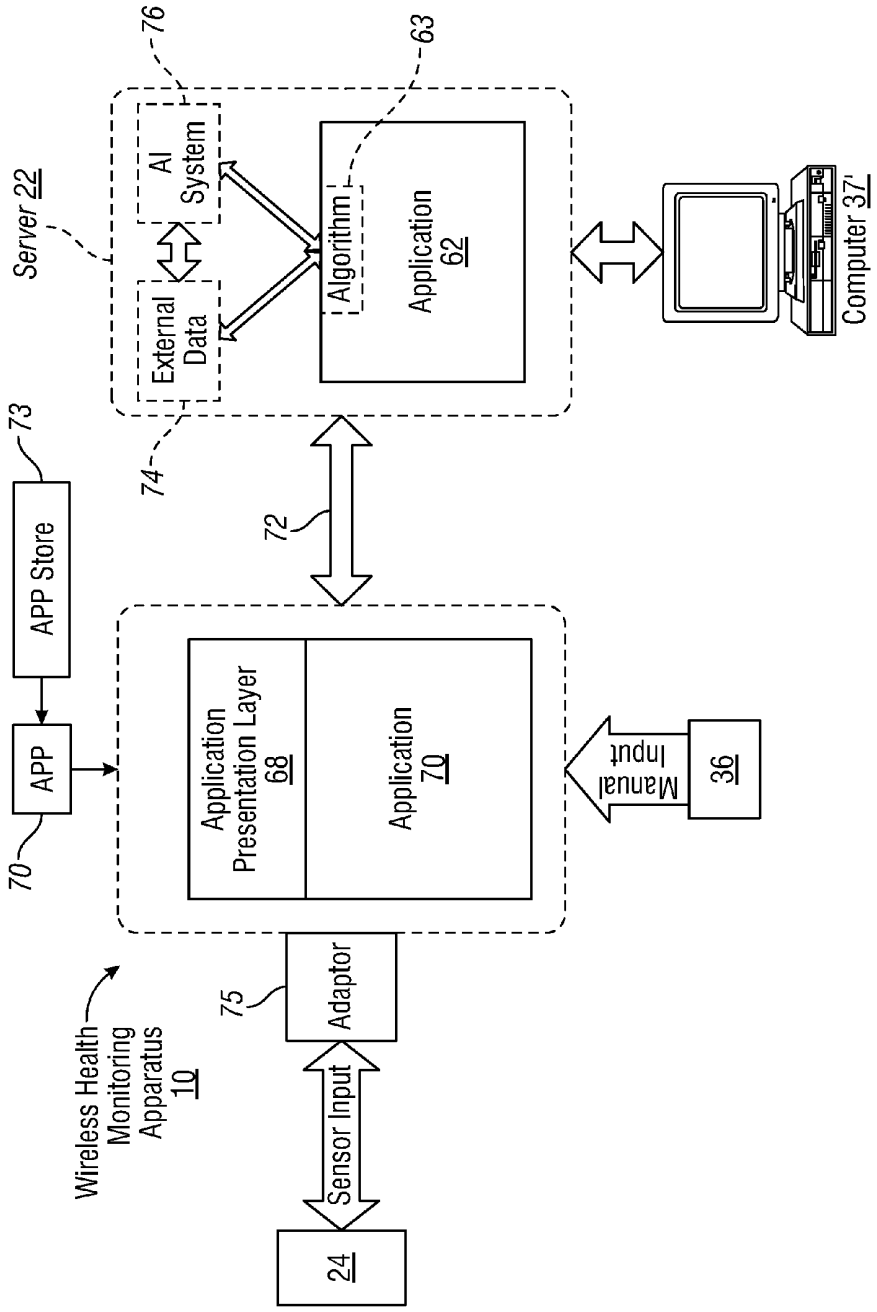

Server 22
76
AI System
External Data
63
Algorithm
Application 62
Computer 37'
74
72
73
APP Store
APP
70
Application Presentation Layer 68
Application 70
Manual Input
36
Wireless Health Monitoring Apparatus 10
75
Adaptor
Sensor Input
24

FIG. 4

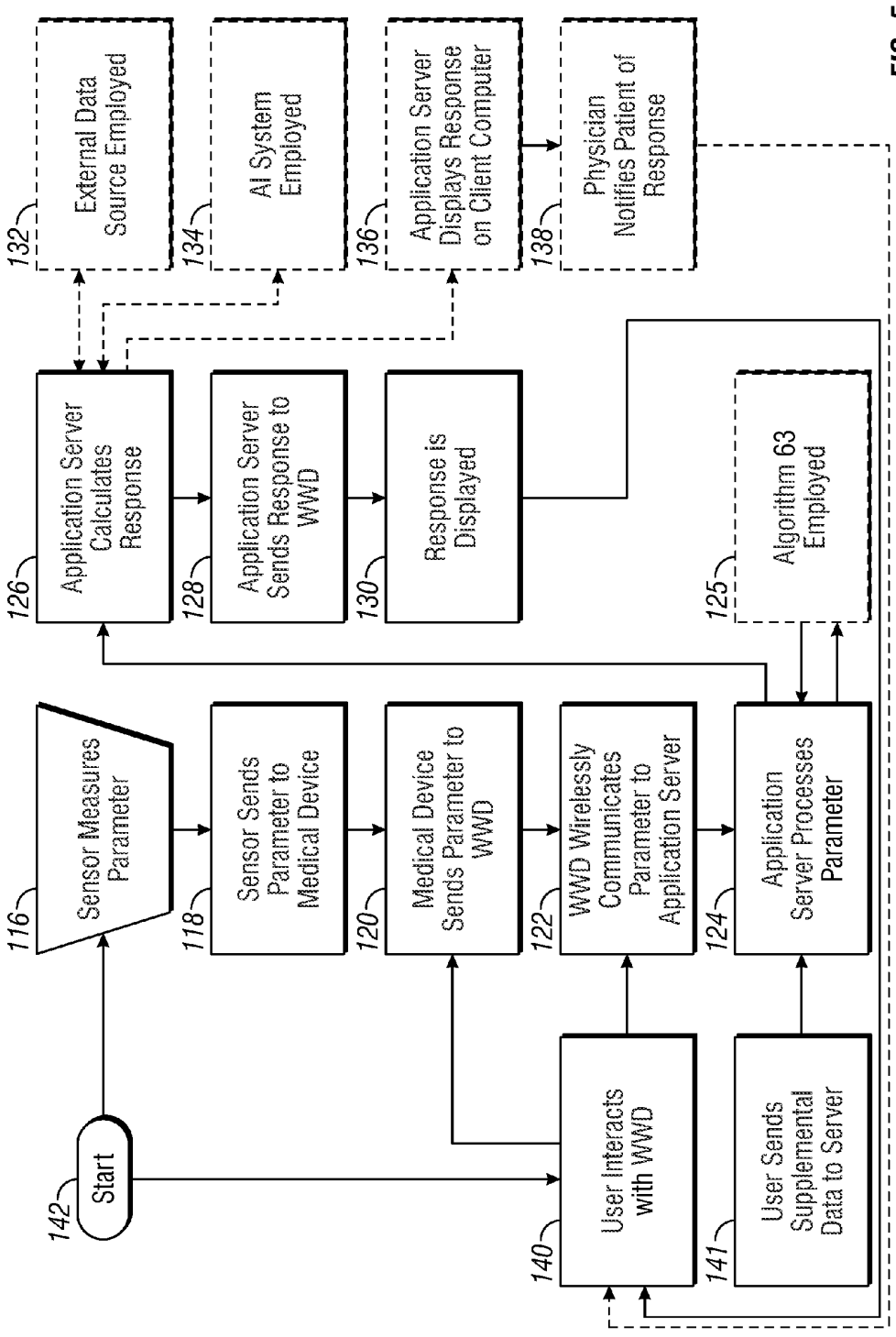

Start
142
Sensor Measures Parameter
116
Sensor Sends Parameter to Medical Device
118
Medical Device Sends Parameter to WWD
120
WWD Wirelessly Communicates Parameter to Application Server
122
Application Server Processes Parameter
124
Algorithm 63 Employed
125
Application Server Calculates Response
126
Application Server Sends Response to WWD
128
Response is Displayed
130
External Data Source Employed
132
AI System Employed
134
Application Server Displays Response on Client Computer
136
Physician Notifies Patient of Response
138
User Interacts with WWD
140
User Sends Supplemental Data to Server
141

FIG. 5

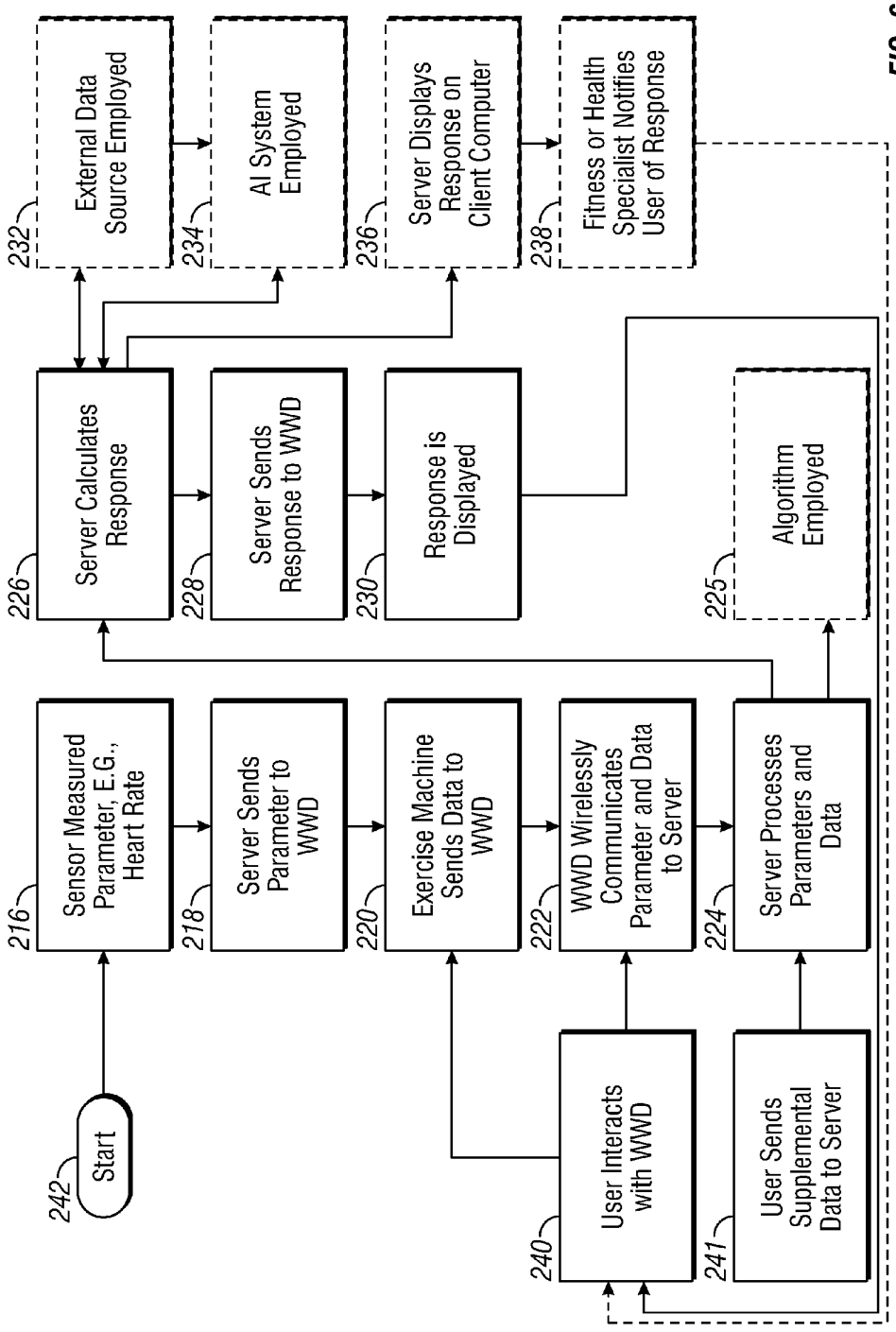

Start
242
Sensor Measured Parameter, E.G., Heart Rate
216
Server Sends Parameter to WWD
218
Exercise Machine Sends Data to WWD
220
WWD Wirelessly Communicates Parameter and Data to Server
222
Server Processes Parameters and Data
224
User Interacts with WWD
240
User Sends Supplemental Data to Server
241
Server Calculates Response
226
Server Sends Response to WWD
228
Response is Displayed
230
Algorithm Employed
225
External Data Source Employed
232
AI System Employed
234
Server Displays Response on Client Computer
236
Fitness or Health Specialist Notifies User of Response
238

FIG. 6

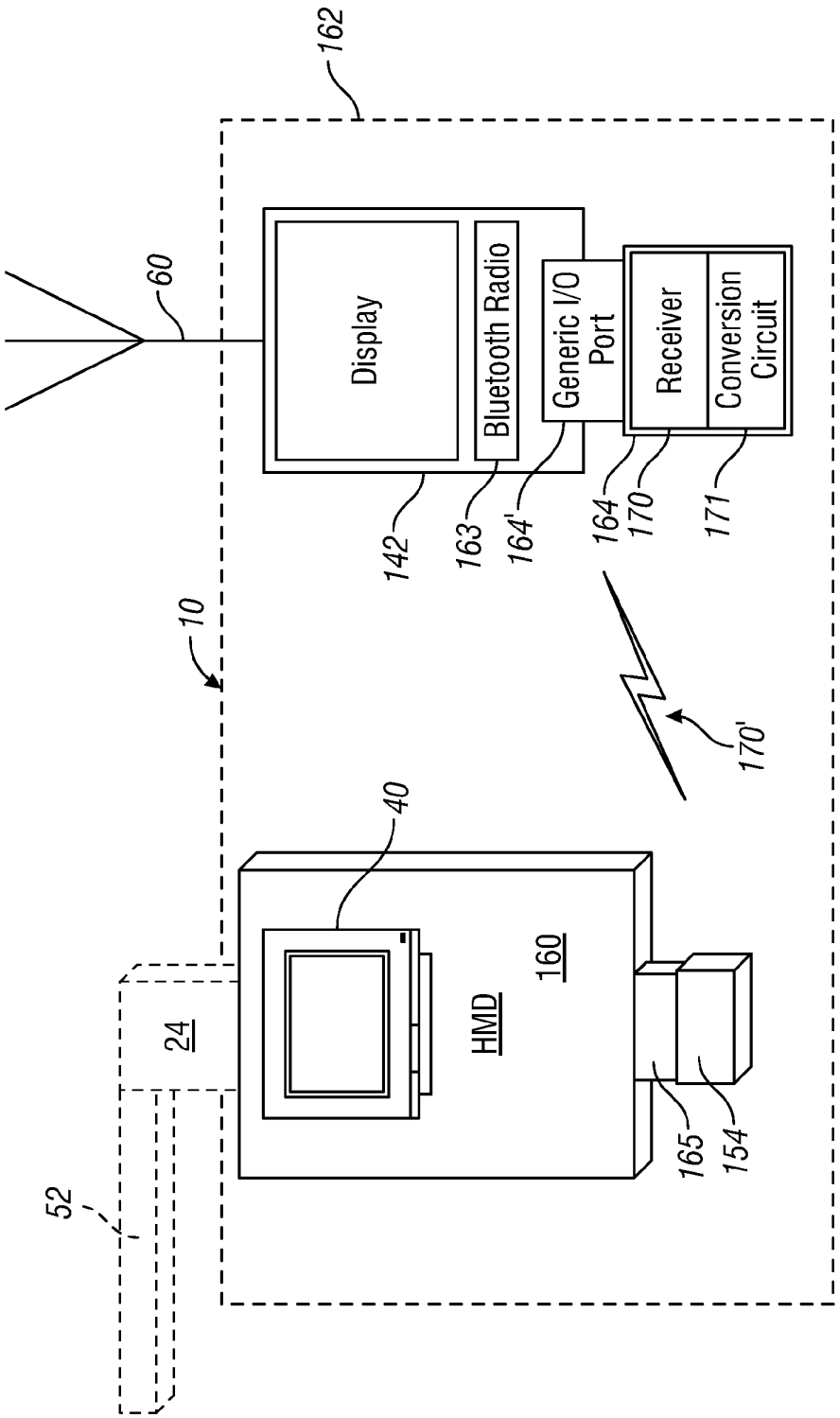

162
60
Display
Bluetooth Radio
Generic I/O Port
Receiver
Conversion Circuit
142
163
164'
164
170
171
10
170'
40
160
HMD
24
52
165
154

FIG. 7

METHOD AND APPARATUS FOR MONITORING EXERCISE WITH WIRELESS INTERNET CONNECTIVITY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This is a continuation-in-part of U.S. patent application Ser. No. 12/211,033, filed Sep. 15, 2008, entitled "Method And Apparatus For Monitoring Exercise With Wireless Internet Connectivity", now U.S. Pat. No. 8,277,377, which is a continuation of U.S. patent application Ser. No. 11/649,703, filed Jan. 3, 2007, entitled "Method and Apparatus for Health and Disease Management Combining Patient Data Monitoring with Wireless Internet Connectivity," which is a continuation of U.S. patent application Ser. No. 11/184,274, filed Jul. 18, 2005, entitled "Method and Apparatus for Health and Disease Management Combining Patient Data Monitoring with Wireless Internet Connectivity," now U.S. Pat. No. 7,156,808, which is a continuation of U.S. patent application Ser. No. 10/418,845, filed Apr. 18, 2003, now U.S. Pat. No. 6,936,007. The disclosure of each of the prior applications is incorporated herein by reference in its entirety.

REFERENCE TO GOVERNMENTAL SUPPORT

[0002] (none)

REFERENCE TO MICROFICHE APPENDIX

[0003] (none)

FIELD OF THE INVENTION

[0004] The present invention relates to monitoring of living subjects, and more particularly to health-monitoring of persons where measured or input health data is communicated by a wireless device to and from a software application running on an internet-connected server and where the same may be studied and processed by the software application, a health professional, or the subject.

BACKGROUND OF THE INVENTION

[0005] Several attempts have been made in the past to achieve efficient interactive communication of medical or health information between a subject or patient and a reviewer or provider of that information. In particular, communication of consumer physiological information has been a subject of such attempts. It is noted that in this regard the "reviewer or provider of medical or health information" is understood to include not only a physician but also a software application or algorithm that may analyze the information.

[0006] Medical or health information has been made available on a CD-ROM accessible by a home computer system. This passive approach had certain disadvantages. First, although the personal computer is prevalent is the United States, it is generally too expensive for a consumer physiological monitoring system and there are many people who find it too complicated to set up and use for that purpose. High-risk, chronically ill patients, responsible for more than half of health care costs in the United States and forming the fastest growing segment of those requiring health care, are indeed the most likely not to be able to afford or use a system built around a personal computer. In addition, such systems are limited in their interactivity to the information stored on the CD.

[0007] Previous patents by the Inventor addressed both of these disadvantages, as well as the need to reduce health care costs through providing educational health care information and interactive physiological monitoring in the home environment by means of a user-friendly, interactive system (see, e.g., U.S. Pat. Nos. 5,601,435, 6,144,837, and continuations thereof).

[0008] These previous patents were based on a video game console, or a multimedia player using a conventional television screen as the display device to achieve a system which is simpler to use than systems based on a personal computer. An initial embodiment of the previous patents utilized a compact disc to provide interactive information for disease management.

[0009] Even with the advantages provided, these systems limited the user to location in which the device was located. Even where devices are portable, as in the case of a laptop computer with a modem, an ordinary POTS phone line must be found and used. Where the user's computer employs a broadband connection, such as DSL or satellite, the choices of location are even more limited.

[0010] Attempts have been made to remedy this deficiency. For example, many telemetry systems allow a "wireless" distance to be placed between a health measuring unit and a remote monitoring system. However, such systems are limited in their range.

[0011] Other systems have used cellular telephone technology to increase the wireless health monitoring range. However, these systems have several deficiencies, such as requiring significant modification of the mobile phone. For example, U.S. Pat. No. 5,772,586, issued Jun. 30, 1998 to Heinonon et al., discloses a method for monitoring the health of a patient. This system uses a specialized connection between the patient health measuring unit and the cellular phone, however. The patient health measuring unit is located in the battery space of the mobile phone and is connected to a communication bus of the mobile phone. Other systems have been proposed, but these suffer from similar deficiencies in that they are not designed to be used with "off-the-shelf" wireless devices or health measuring equipment.

[0012] The deployment of the above systems also currently lacks employment of full back-end server functionality with which to provide a wide range of interactive communication with the patient. Instead, such systems, if internet-enabled, are often limited to mere one-way non-interactive data transfer via a modem. While some systems are more enhanced, including that disclosed in U.S. Pat. No. 5,357,427, issued Oct. 18, 1994 to Langen et al., and entitled "Remote Monitoring of High-Risk Patients using Artificial Intelligence", these systems are limited by the wired telecommunications infrastructure.

SUMMARY OF THE INVENTION

[0013] Embodiments of the present invention overcome one or more of the disadvantages of the prior art by providing a full-feature health-monitoring system that may wirelessly connect to a back-end server application via the internet. The invention allows wireless access to and from a wide variety of present medical or health-related instruments and devices, while maintaining the capability of connecting to future such devices.

[0014] In particular, the invention may be embodied in several systems. Two complementary such systems are described herein, although extensions to other such systems

can be envisioned. First, an embodiment of the invention may be employed to manage the disease state or condition of a patient. In this embodiment, the patient may employ a health monitoring device ("HMD"), in particular a medical device, and a wireless connection provides data from the medical device for processing via the internet including a review by a physician, or other health care professional if required.

[0015] The second embodiment, a health or lifestyle management plan may be implemented. Various health parameters, such as those relating to nutrition or exercise, may be entered into a health monitoring device, in this instance termed an "exercise machine", and the same may be wireless communicated to a server. An application may process and store the health parameters, and a health specialist, or other users, may optionally review the same.

[0016] Wireless internet connectivity has many advantages. For example, in the first embodiment, a diabetic could connect a blood glucose meter to an internet-enabled wireless web device ("WWD") away from home and download data to a Diabetes Management Company's server and, in response, receive guidance displayed on the screen (or by voice) about choices for the next meal.

[0017] Alternatively, in the second embodiment, a person interested in tracking an exercise program may take the WWD to the local health club and attach the same to an exercise machine, send data output from various exercise machines over the Internet, and receive a personalized response from the server of a company specializing in Health & Lifestyle Management. The individual may input caloric content of foods eaten, and may further input caloric content of exercise performed. In this way, e.g., a person in a weight-loss program may see in great detail whether they are expending more calories in the form of exercise than the same individual is consuming in the form of food.

[0018] In general, in the health management embodiment, the system may be employed to monitor the physiologic status of a healthy subject while eating, exercising, or performing other activities. For clarity, such devices are termed herein "exercise machines". These may include an electronic body weight scale, a body fat gauge, biofeedback devices, physiotherapy or chiropractic equipment, blood pressure recorders, or the like, or any type of exercise machine or monitor, including a heart rate monitor, treadmill, rowing machine, stepper, or the like.

[0019] In more detail, the present invention provides a method and system for assisting patients or other users to manage a disease or maintain healthy lifestyle by collecting health-related data and providing information in response to those data by means of a WWD designed to display interactive information through a connection to the Internet. The present invention may be connected to various HMDs, both medical and exercise-related in nature, and may communicate information via a wireless connection such as a wireless Internet connection.

[0020] A major advantage of embodiments of the invention is that the same frees the user from the constraints of wired systems. The same allows users with consumer "off-the-shelf" wireless devices to significantly extend the range of connectivity over that of wired computer, television, or even wireless telemetry systems.

[0021] In a first embodiment of the present invention, the WWD is a web-enabled cellular phone. Here it is noted that the term "web" or "internet" are used interchangeably to refer to the internet in general. In a second embodiment, the WWD is a palm, handheld, or laptop computer, or a PDA, equipped with a wireless modem. In a third embodiment, the WWD may be a hybrid device that combines the functions of a computer, PDA and telephone. Prior mobile phones have evolved to smart phones that incorporate the features of a PDA, and provide a browser program designed to facilitate navigate of the internet and interaction with websites. (e.g. iPhone®, available from Apple Corp. of Cupertino, Calif.). A variety of application programs (or "Apps") specifically designed for various brands of mobile phones can be downloaded from the internet.

[0022] In the second embodiment, the handheld computer may take the form of a tablet computer, which is a type of flat computer and graphics touch screen that uses a multi-touch fingertip or stylus user interface and virtual keyboard instead of a conventional keyboard and mouse. The compact form of a tablet, combined with wireless internet connectivity, is suitable for mobile usage, and enables it to be employed during exercise where it would be awkward to use a conventional laptop computer (e.g., riding an exercise bicycle). In addition, the touch screen user interface makes website navigation easier during exercise than operating a conventional keyboard and mouse. A tablet (or a smart phone), typically incorporates an accelerometer to detect physical movement and orientation so that it is not restricted to a fixed direction of use. A significant trait of tablets, in contrast to traditional desktop or laptop computers, is the distribution of third-party applications via downloaded distribution from sources known as App Stores (e.g. iTunes®), as with smart phones. Thus in this embodiment, an App for monitoring exercise may be downloaded to the tablet from an internet server. Additionally, the "instant-on" warm bootup feature of tablet computers enhances use of the App during exercise. Some tablet computers combine mobile telephone capabilities ("phablets"), as in the third embodiment described above.

[0023] An adaptor is used if necessary to convert the output signal of the medical monitoring device to a suitable input signal for the WWD. The adaptor allows connection of the WWD to a medical device, exercise monitor, exercise machine or other variety of health care equipment, and the connection may be made via several techniques. For example, an adaptor may be plugged into a mobile phone. The adaptor receives data via an RF wireless connection that is not present in the phone itself, and sends the data to an application program (App) running on the phone that has been downloaded from the internet. The data may be transmitted from a pulse monitor, a treadmill, a weight scale, a pedometer, exercise bicycle, or other monitoring device. Several of these devices may be networked together. Alternatively, the adaptor may be plugged or wired to the monitoring or exercise device in order to transmit the data in suitable wireless form (e.g., with Bluetooth® protocols) to be received by a mobile phone as instructed by a downloaded App. As for wired techniques, a standard parallel bus or serial cable may be used if the input/output ports between the HMD and the WWD are appropriate. Otherwise, a suitable separate adaptor may be employed.

[0024] The connection may also be an input such as a disk drive or other media input for input of data, a USB port or phone jack or other such wired input, again employing an adaptor if required.

[0025] As for wireless techniques, infrared (IR), microwaves, radio frequency (RF), e.g., a variety of 802.11 or 802.15 protocols, optical techniques including lasers, and other such techniques may be used. With some monitoring

devices, such as a pulse monitor worn on the body, battery consumption is a consideration. In this case, wireless techniques with low power consumption would be beneficial. For example, Bluetooth Low Energy (a wireless protocol operating at 2402-2480 MHz with 40 2 MHz wide channels designed to be implemented with low power consumption, and branded as Bluetooth Smart) or a variety of other 802.15 protocols implemented with low power consumption semiconductor chips. The user or subject may also input data manually, such as by a stylus, keypad, virtual keyboard, synchronization from a PC, or by various other techniques discussed below.

[0026] A major advantage of the invention is that by use of an optional adaptor, the system is compatible with current and prior HMDs as well as maintaining a capability of adapting to future such systems.

[0027] Other advantages of the invention may include one or more of the following. An embodiment of the invention may be used when a user is traveling or otherwise away from their "wired" means of communication. The invention allows wireless health-monitoring to the level of accuracy previously achieved only by desktop so-called "wired" computer systems. The invention is protocol-independent.

[0028] The interaction between a WWD and a back-end server may provide a major additional advantage in certain embodiments of the invention. In particular, the relatively small amount of memory currently provided on a WWD as compared to a back-end server severely limits the functionality of applications running on the WWD, especially in terms of computing capacity, processing power, and user interface. By providing significant application functionality on the back-end, less memory and processing capabilities become necessary on the WWD (i.e., on the "front-end"). Thus, memory may be used in the WWD for an enhanced user interface or for other purposes, according to the user requirements.

[0029] In a method according to an embodiment of the invention, the user connects to a specific Internet site and a software program, resident on a remote server located on the Internet, downloads an interactive user interface for that user and an application for the measurement of an exercise parameter such as physiological data and/or exercise data. The software may also be downloaded to the WWD from a personal computer via a synchronization operation in known fashion. The software provides a personalized display for the user and configures the WWD to control and monitor devices connected via a generic input/output port to the WWD. The software may be designed to suit the constraints of the small display screens of WWDs. The software, as well as inputs from the user or other inputs, can control the manner, content, and display of information presented to the user, and measured or input data can be stored for review by a health care provider, fitness coach, or by a software algorithm or application. The algorithm may be of varying complexity, from a simple program that merely acknowledges receipt of information to an artificial intelligence algorithm, such as an expert system, collaborative filtering system, rules based system, case-based reasoning system, or other such artificial intelligence application.

[0030] Further information may be provided to or from the user, including information entered manually. The user may input this information via a personal computer, which then may download the input information to the WWD via a synchronization operation using standard protocols.

[0031] The user may also input supplemental information via a PC connected independently to the server via the internet. Such supplemental information may include data that is difficult or inconvenient to input on the WWD. In this way, the user may be afforded a more convenient environment in which to manipulate data to supplement the data input to the WWD. The deployment of voice processing technology may be used to enable an even more convenient user interface: i.e., one to which users can talk (e.g. the Siri voice interface available for iPhone®).

[0032] In all of these respects, the portable aspect of the WWD is important: to wit, the user may conveniently carry the WWD on their person wherever they may go, allowing data entry at the time needed.

[0033] Other aspects, features, and advantages will be apparent from the summary above, as well as from the description that follows, including the figures and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] FIG. **1** illustrates a general embodiment of a wireless health-monitoring system according to the present invention.

[0035] FIG. **2** illustrates an embodiment of a wireless health-monitoring apparatus according to the present invention, showing the system of FIG. **1** up to a point of a wireless antenna.

[0036] FIG. **3** illustrates an embodiment of a back end of a health-monitoring system according to the present invention.

[0037] FIG. **4** illustrates a data flow diagram according to an embodiment of the present invention, including downloading an application to a mobile phone, and inserting an adaptor.

[0038] FIG. **5** illustrates an embodiment of a method of use for a wireless application and a server application according to the present invention, in which the same is implemented for disease and patient management.

[0039] FIG. **6** illustrates an embodiment of a method of use for a wireless application and a server application according to the present invention, in which the same is implemented for health management, including monitoring pulse rate and amount of exercise performed.

[0040] FIG. **7** illustrates an embodiment of a wireless connection between a HMD and a WWD, with an adaptor to convert the wireless signal.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0041] Various acronyms are used for clarity herein. Definitions are given below.

[0042] The term "HMD" may encompass not only devices with physiologic sensors but also devices with a keypad, keyboard, a virtual keyboard, mouse, pointer, pressure sensor, or other such inputs that the patient or user may employ to perform data entry of the desired parameters. In general, HMDs include some means for determining a health parameter.

[0043] In a disease management embodiment, an HMD may be a blood glucose monitor, a blood pressure monitor, an ambulatory ECG recorder, EEG recorder, a respiratory monitor, a temperature or heart rate monitor, and so on.

[0044] In a healthy lifestyle management embodiment, an HMD may be an exercise machine, including treadmills, rowers, steppers, exercise cycles, or other aerobic or anaerobic exercisers, or a health monitor, including monitors for tem-

perature, brain activity, heart rate, blood pressure, amount of work or rate of work performed, etc. The accelerometer in a smart phone or tablet may be employed to monitor the amount of exercise performed (e.g., as a pedometer).

[0045] The term "subject" as used herein primarily indicates a human subject. The same may be a medical patient under physician care, a person interested in maintaining health via accurate recording of nutrition and exercise, and so on. The term "user" is generally used to refer to the user of the device, which may be synonymous with the subject or may alternatively be a caregiver of the subject, etc. The term "patient" is used, in addition to a person under the care of a physician, to also refer to a "normal" or healthy individual who is interested in maintaining a healthy physiologic balance.

[0046] The term "signal communication" is used to mean any type of connection between components where the connection is, e.g., electromagnetic, and where the connection allows information to be passed from one component to another. This term may be used in a similar fashion as "coupled", "connected", "information communication", "data communication", etc. The following are examples of signal communication schemes. As for wired techniques, a standard bus, serial or parallel cable may be used if the input/output ports are compatible and an optional adaptor may be employed if they are not.

[0047] As for wireless techniques, radio frequency (RF) or microwaves, and optical techniques, including lasers or infrared (IR), and other such techniques may be used. A variety of methods and protocols may be employed for short-range, wireless communication including those ratified by IEEE 802 family protocols. A number of proprietary technology standards for exchanging data over short distances have become established. One of the most popular is Bluetooth® (an evolving technology using short-wavelength radio transmissions in the ISM band from 2400-2480 MHz). The standard protocol is specified by the Bluetooth Special Interest Group (SIG) and may be ratified as an IEEE 802.15 standard. Bluetooth technology and Near Field Communication (NFC 13.56 MHz) technology are increasingly being integrated into mobile phones and tablets.

[0048] Another proprietary standard, which is designed for monitoring data in sports and wellness, is ANT (a wireless communications protocol in the 2.4 GHz ISM band). ANT Plus (+) adds an interoperability function to allow for the networking of devices. Another proprietary standard (e.g., available from Polar Inc.) uses a coded 5 KHz radio frequency transmission to communicate with exercise monitoring devices. Several wireless techniques (e.g. Wireless USB, Z-Wave, ZigBee, and Body Area Network) are designed to create personal area networks (PANs), with advantages such as long battery life, and secure networking for monitoring a variety of devices.

[0049] For wide-area wireless telecommunication, a variety of cellular, radio, satellite, optical, or microwave methods may be employed, and a variety of protocols, including IEEE 802 family protocols (e.g. 802.11, 802.16, or 802.20), Wi-Fi, WiMax, UWB, Voice over IP (VOIP), Long-Term Evolution (LTE), IMT-Advanced, and other wide-area network or broadband transmission methods and communication standards have been developed. The systems and methods disclosed here will encompass such communication schemes, as well as future such schemes.

[0050] The term "generic input/output port" is used to mean any type of convention, standard, universal, stock, consumer, or "off-the-shelf" type of port for data input and output. These may include both wired and wireless ports. A further description is given below.

[0051] Various embodiments of the invention are now described in more detail.

[0052] Referring to FIG. **1**, a system of the present invention is shown for monitoring health data from a user or subject **38**. The system includes a wireless health-monitoring apparatus ("WHMA") **10** described in further detail below. WHMA **10** is linked in a wireless fashion to a wireless connection point of presence ("POP") **19**, the same including at least a base station antenna **15** coupled to a server **17**. Server **17** is in turn connected to the wired, or even a wireless (not shown) Internet **21**, which may include the World Wide Web.

[0053] Referring to FIG. **2**, a first embodiment of WHMA **10** is shown. WHMA **10** includes an HMD **11**, which may include an optional monitor screen **40**, coupled via an optional adaptor **42**, which may include a wireless link, to a WWD **12**. WWD **12** connects wirelessly via an antenna **60** to base station **15** (see FIG. **1**). One function of WWD **12** is to provide the user interface; other functions are described below.

[0054] As noted above, HMD **11** may include a physiologic sensor **24** or may include a manual system **36** for input of physiologic data via a connection **34**. Manual system **36** may also be used to input data directly into WWD **12** via a connection **32**. Manual system **36** may include, e.g., a keyboard **30**, a mouse **26**, a stylus device **28**, and may also employ a separate monitor (not shown). Of course, the user may also view information on monitor **40** or on a screen **41** of WWD **12**. In many embodiments, e.g., using a smart phone or tablet, the keyboard may be a virtual keyboard on the smartphone or tablet. Data may also be input via a computer **37** or **37'** (see FIG. **4**).

[0055] It will be clear to one of skill in the art given this teaching that cable **32**, as well as cables **34** and **44**, may be replaced with wireless circuitry to communicate signals wirelessly.

[0056] For medical devices and applications, physiologic sensor **24** may include, e.g., a sensor appropriate for measuring blood glucose levels, blood pressure, heart rate, brain activity, or any other desired parameter as required by the physician. Sensor **24** may connect via an optional cable **44** to subject **38**. Alternatively, sensor **24** may be distal of HMD **11**, i.e., at or within subject **38**. In other words, if cable **44** is employed, sensor **24** may be proximal or distal of cable **44**. If a wireless communications capability is added, sensor **24** need not physically connect with HMD **11** or WWD **12** at all. That is, the same may measure a health parameter and may communicate the same to HMD **11** or wireless health-monitoring apparatus **10** wirelessly. The short range wireless communications schemes which may be employed include infrared, radio frequency including a variety of 802.15 or 802.11 protocols, or other such schemes, including those described herein.

[0057] As examples of sensor types, to measure blood glucose levels, sensor **24** may be a sensor that accepts a drop of blood, e.g., via a finger-prick. To measure heart rate, sensor **24** may be placed via an elasticized band disposed on the chest. Other health monitors may also be employed so long as the measured data may either be transferred to WWD **12**, e.g., via optional adaptor **42**, described in further detail below, or by

being read by a user, e.g., from a display, and manually input to WWD **12**. Alternatively, the measured data may be transferred to WWD **12** via wireless communication schemes, such as RF which includes Bluetooth® 802.15, 802.11 protocols, infrared, optical, microwaves, etc., directly from sensor **24** or from HMD **11** as described in greater detail below.

[0058] The user, who may or may not be the same person as subject **38**, may input data to WWD **12** from history or experience. For example, in a health or exercise device, if subject **38** consumes a known number of calories, this information may be entered via manual system **36** directly into WWD **12** or into HMD **11**. Further, the user, the subject, and the sensor are not necessarily the sole sources of information. Data stored on the server, or on a separate server operated for health management may also be employed to result in a health benefit to subject **38**.

[0059] Referring to FIG. **3**, WHMA **10** is shown communicating wirelessly with the Internet. In doing so, WHMA **10** generally sends a wireless signal to a base station **14** (in known fashion) that is connected to a server **18** that is in signal communication (in known fashion) with the internet. Server **18** communicates via a protocol (in known fashion) to Internet **20**, which also communicates via a protocol (in known fashion) to a server **22** running an application **62**. Server **22** may be accessed (in known fashion) by a client computer **44** through a connection **64**.

[0060] As noted, the protocols for data communication are known. However, they currently vary amongst known techniques. The present invention is not limited to any particular protocols, and may be implemented in any languages supported by the WWD and server. Of course, as computing capabilities continue to increase, it is expected that the capabilities of WHMA **10**, servers **18** and **22**, as well as application **62** and client **44**, and other components, will correspondingly increase.

[0061] Application **62** running on server **22** may interact with WHMA **10** in a number of ways. Referring to FIG. **4**, WHMA **10** is shown in signal communication with server **22** via a connection **72**. Connection **72** schematically represents the wireless Internet connection and intervening pathways. WHMA **10** includes an application that may be viewed as having two components: a base wireless or device application **70** and an application presentation layer or user interface **68**. User interface **68** is employed to, e.g., present a menu of options to the user, to allow the user to choose inputs, and to generally operate the device. User interface **68** may vary widely in sophistication, e.g., from a simple data entry field to a full graphical user interface. These applications may accept as inputs data from a sensor **24** via an adaptor **75** as well as from a manual input **36**. One or both the base wireless or device application **70** and user interface **68** may be downloaded to the device **10** from a server, e.g., using an App store **73**, as will be described below

[0062] The WHMA **10** may employ an adaptor **75** to accept input from a sensor **24**, and thus to allow wireless communications with an exercise monitor or exercise device. Alternatively, an adaptor (not shown) may connect to the exercise monitor or exercise device to allow communications with a WHMA **10**, which in this case may or may not have its own adaptor).

[0063] Server **22** has a base server application **62** with which the same calculates or provides a response based at least in part on data from WHMA **10**. Application **62** may include an algorithm **63** for analyzing data from the HMD, and either application **62** or algorithm **63** may optionally access data from an external data source **74** and may further consult an artificial intelligence system **76**.

[0064] External data source **74** may be a memory or disk or other such storage that stores health data, such as healthy and unhealthy weight/height ranges, healthy and unhealthy cholesterol counts, the patient's or subject's prior medical or health history, healthy and unhealthy blood pressure values, information corresponding to the caloric and other nutritional content of foods, information corresponding to the caloric expenditure values of various exercises, algorithms for calculating various health parameters, etc. In general, any data that may benefit the health of a subject or patient may be stored in external data source **74**. External data source **74** may also include online access of health information from external web sites, ftp servers, or other sources.

[0065] Due to the current relatively small amount of memory and storage available on current WWDs, such external application processing as by application **62** and external data storage as by external data **74** may be particularly important.

[0066] As noted, application **62** or algorithm **63** may also consult AI system **76** for suggestions as to health benefits. AI system **76** may even interact with external data source **74** to extract useful information from the same. AI system **76** may employ, e.g., case-based reasoning, rules-based systems, collaborative filtering, neural networks, expert systems, or other such systems as are known.

[0067] It should also be noted that each of application **62**, algorithm **63**, external data source **74**, or AI system **76**, may physically reside on more than one server, e.g., on an array of servers for, e.g., storage or multiple processing purposes. Each of application **62**, algorithm **63**, external data source **74**, or AI system **76**, or combinations of each, may also respectively reside on different servers.

[0068] The extent to which server application **62** interacts with wireless application **70** depends on the use to which the system is put. For example, in a less interactive embodiment, device application **70** may act to measure a diabetic patient's blood glucose level and report the same to server application **62**. In this case, a physician may simply review the measured value and send the patient an email reporting that the value is acceptable or not. In a highly interactive embodiment, a patient may have numerous HMDs **11** connected via optional adaptors to a WWD **12**, and wireless application **70** may correspondingly send a large amount of health data to server application **62**. The physician, accessing server application **62**, may in turn send detailed care plans to a caregiver via connection **72**. The received data may be analyzed using algorithm **63**, external data source **74**, and AI system **76**. In this sense, the two applications may be highly interactive.

[0069] It is noted that an Application Service Provider (ASP) may operate application **62**. That is, application **62** may be leased by an ASP to the health care provider, and the ASP may perform all necessary upgrades and maintenance to application **62** and its associated components. In addition, the application may be stored in the cloud, that is by servers networked for online storage, where data is stored in virtualized pools of storage which are generally hosted by third parties.

[0070] To initialize the system, a wireless application is loaded into the WWD, e.g., an exercise monitoring app is downloaded from a server over the internet into a smart phone. The loading of the wireless application may alterna-

tively occur via synchronization from a desktop. The server application may first be loaded into an appropriate internet-connected server. Subject data may be loaded into the WWD or into the server. In the latter case, the subject information may later be transferred to the WWD or transferred to the server from the WWD, as called for by the application.

[0071] The wireless application may access the server and server application, or vice-versa, as determined by the respective program instructions. Examples are now given for (1) a system of disease and patient management and (2) a system for health management employing an exercise machine.

Example Employing System for Disease Management

[0072] Referring to FIG. **5**, an example is given for a system of disease and patient management. In this figure, as well as in FIG. **6**, boxes in dotted lines may generally be considered optional.

[0073] In FIG. **5**, a medical device may determine health parameters and an optional physician review is provided. Health parameters may also be determined by user manual input.

[0074] The program is started (step **142**) and a sensor measures a health parameter (step **116**). The sensor may send the parameter to a medical device (step **118**). The medical device then sends the parameter to the WWD (step **120**). The WWD then wirelessly communicates the parameter to the application server (step **122**), e.g., via the wireless web. The application server processes the parameter (step **124**), and calculates or provides a response (step **126**) based at least in part on the parameter. The application server may optionally employ algorithm **63** (step **125**), external data (step **132**) or an AI system (step **134**) in the calculation. The application server then sends the response to the WWD (step **128**), where the response is displayed (step **130**).

[0075] It should be noted that the term "response" here is used generally may simply be an acknowledgement that the parameter was received by the application server, but to provide more utility, a more sophisticated response may be desirable. The term "calculate" is also used generally, and may entail a simple calculation as well as a complex one. A result may, e.g., be the result of a calculation.

[0076] As noted above, the sensor may connect to any type of medical device or other such device in which information pertaining to a patient's disease or condition may be ascertained. The parameter may be any value corresponding to such information.

[0077] The method may also use a manual input as shown. In this case, after the start (step **142**) of the application, the user may interact with the WWD (step **140**). The interact may be a data input, a command to read data from a medical device, a response to a physician question or statement, an acknowledgement of physician notification, etc. Calculations by the application server may further take into account supplemental data sent by the user to the server, e.g., in a wired fashion directly over the internet (step **141**).

[0078] FIG. **5** also shows a physician review and notification. In this option, the responses are displayed on a client computer (step **136**) in signal communication with the application server. A physician may then review the response on the client computer, and notify the patient of the responses (step **138**). For example, the physician may notify the patient of positive or negative responses. Of course, it should be noted that the "client computer" may simply be a pager, PDA, WWD, or other such device, as well as a more typical desktop or laptop computer.

[0079] In one implementation, a diabetic may keep a database on a server of a dietary history and a blood glucose history. With this data at-hand wirelessly, the diabetic may choose whether to eat a particular food by entering nutritional information about the food into a WWD, transmitting the same wirelessly to the server, and receiving a recommendation from the server. The recommendation may be based on the food and also on data or information that had previously been transmitted wirelessly, including data from a blood glucose monitor, data input manually, if any, as well as data from algorithm **63**, external data source **74**, and AI system **76**.

Example Employing System for Health Management Using a General Exercise Machine

[0080] Referring to FIG. **6**, an example is given for a system of health, nutrition, and/or exercise management. In this example, the HMD is an exercise machine as that termed has been defined above.

[0081] The program is started (step **242**) and a sensor measures a health parameter (step **216**), where the health parameter corresponds to health, fitness, nutrition, exercise, etc., e.g., pulse or heart rate. The sensor may send the parameter to the WWD (step **218**) or in some cases to the exercise machine to be relayed to the WWD. It is understood here that the "sensor" may be, e.g., a blood pressure monitor, but may also be a simple device connected to an aerobic exerciser that tracks miles ran, work performed, etc.

[0082] The exercise machine may then send exercise information or data to the WWD (step **220**), along with the parameter if it has been so relayed. The WWD wirelessly communicates the parameter and data to the application server (step **222**), e.g., via the wireless web.

[0083] An alternative and complementary way of entering the parameter is by user input (step **248**). For example, the user may enter the parameter into the exercise machine or into the WWD. This parameter may correspond to an amount of exercise performed, an amount of food consumed, etc.

[0084] Calculations by the application server may also take into account supplemental data sent by the user to the server, e.g., in a wired fashion directly over the internet (step **241**).

[0085] The application server processes the parameter (step **224** and optionally step **225**), and calculates a response (step **226**) based at least in part on the parameter. The application server may optionally employ external data (step **232**) or an AI system (step **234**)

in the calculation. The application server then sends the response to the WWD (step **228**), where the response is displayed.

[0086] The same definitional statements regarding the terms "response", "calculate", "sensor", etc., as given before, apply in this embodiment as well.

[0087] As an optional step, a health specialist or fitness coach may notify the patient or subject of the response (step **238**) after having the same displayed on their client computer (step **236**). The health specialist may be replaced in this example by an application that may also include an algorithm.

Adaptor Hardware

[0088] A description is given below of a particular type of adaptor hardware. As noted above, the adaptor may optionally be used to connect a HMD to a WWD.

[0089] In general, a connection is necessary between a HMD **11** and a WWD. The nature of this connection may vary. For example, the connection may be wired or wireless. For wired systems, the connection may be direct or an adaptor may be employed, either on one or both ends of the direct wired connection, to adapt the signal appropriately. In the same way, for wireless systems, the connection may be direct, if both HMD and WWD employ the same wireless protocol, or an adaptor may be involved to modify the signal of one or both devices. These connections, all of which are encompassed by the present invention, are discussed in more detail below. Details of a wired connection are illustrated in FIG. **7** of the '191 patent incorporated by reference above.

[0090] Referring to FIG. **7**, an embodiment of a wireless implementation of the WHMA **10** is shown. In FIG. **7**, a wireless connection is shown between HMD **160** and WWD **162**, wherein an adaptor **164** is plugged into generic input/output port **164'** of WWD **162**. The adaptor incorporates a wireless receiver **170** to accept a radio frequency (RF) **170'** signal transmitted from the HMD **160**, and circuitry **171** to convert the signal into a scheme corresponding to the generic input/output port **164'** on WWD **162**. Alternatively, the adaptor may plug into a connector **165** on HMD **160**, shown by adaptor **154**.

[0091] Of course, the use and structure of adaptor **154** or **164**, between HMD **160** and WWD **162**, depends on factors such as the prevalence of an industry standard for such communications. In other words, if the output of HMD **160** is a wireless signal that is readily acceptable to WWD **162**, then the same may be directly connected without the need for the adaptors. Thus the increasing adoption of Bluetooth® wireless protocols, such as Bluetooth Smart®, for HMD **160** enable such to be connected to the Bluetooth® wireless radio **163** incorporated into a WWD **162** in the form of a smart phone or tablet. Nevertheless the continuance of proprietary RF wireless schemes for HMD that are not typically incorporated in a consumer WWD may in many cases necessitate the use of an adaptor.

[0092] While the device shown in FIG. **7** is described in the context of general wireless communications, various protocols may be employed. For radio frequency communications, protocols such as Bluetooth®, 802.15 or 802.11 may be advantageously employed. Other techniques employing a similar configuration include those employing IR, microwaves, optical techniques including lasers, and so on.

[0093] It should be understood that the above is merely exemplary, and that the form of the adaptor may vary widely between HMDs and WWDs.

[0094] It will be understood that the above description of a "Method and Apparatus for Exercise Monitoring Combining Exercise Monitoring and Visual Data with Wireless Internet Connectivity" has been with respect to particular embodiments of the invention. While this description is fully capable of attaining the objects of the invention, it is understood that the same is merely representative of the broad scope of the invention envisioned, and that numerous variations of the above embodiments may be known or may become known or are obvious or may become obvious to one of ordinary skill in the art, and these variations are fully within the broad scope of the invention. For example, while certain wireless technologies have been described herein, other such wireless technologies may also be employed. Furthermore, while various types of medical devices have been mentioned, numerous other types may also be used in the embodiments of the invention, including pulse oximeters, syringe drivers, infusion pumps, spirometers, ventilators, EEG recorders, anesthesia monitors, and so on. Accordingly, the scope of the invention is to be limited only by the claims appended hereto, and equivalents thereof In these claims, a reference to an element in the singular is not intended to mean "one and only one" unless explicitly stated. Rather, the same is intended to mean "one or more". All structural and functional equivalents to the elements of the above-described preferred embodiment that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the present claims. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed by the present claims. Furthermore, no element, component, or method step in the present invention is intended to be dedicated to the public regardless of whether the element, component, or method step is explicitly recited in the claims. No claim element herein is to be construed under the provisions of 35 U.S.C. §§112, 6, unless the element is expressly recited using the phrase "means for".

1. An application on a non-transitory computer readable medium, the application configured to be downloaded to a WWD from an Internet server and configured for interoperability with an operating system on the WWD, the application comprising instructions for causing the WWD to:

a. monitor an exercise parameter, wherein the exercise parameter includes both exercise data and physiological data, the monitor an exercise parameter including:
   i. configure a first WWD to interact with an adaptor, the adaptor configured to receive an exercise parameter using a wireless communications scheme; and
   ii. receive an exercise parameter using the configured adaptor;
b. render a user interface, including an indication of the exercise parameter;
c. transmit the exercise parameter to an Internet server; and
d. receive a response from the Internet server, the response a result of a calculation involving the exercise parameter.

2. The application of claim **1**, wherein the first WWD is a mobile phone or a tablet computer.

3. The application of claim **1**, wherein the adaptor is configured to plug into a generic input/output port of the first WWD and configured to convert RF signals to a form suitable for data manipulation by the operating system of the first WWD.

4. The application of claim **3**, wherein the RF signal employs a transmission scheme selected from the group consisting of 802.11 and 802. 15 wireless protocols, or a transmission scheme employing a frequency range in the 2.4 GHz band or the 5 GHz band.

5. The application of claim **1**, wherein the transmit to the Internet server employs a protocol selected from the group consisting of: a variety of cellular protocols, a variety of 802.11 protocols, 802.15 protocols, 802.16 protocols, 802.20 protocols, ultrawideband protocols, wireless universal serial bus protocols, VOIP protocols, broadband wireless protocols, or satellite communication protocols.

6. The application of claim 1, wherein the exercise parameter is received from a sensor coupled to an exercise monitor, and wherein the exercise monitor is selected from the group consisting of: a heart rate monitor, a respiration rate monitor, a blood pressure monitor, a temperature monitor, an accelerometer, a pedometer, an ECG monitor, an EEG monitor, a GPS device, a body weight scale, a body fat gauge, a biofeedback device, a treadmill, a rowing machine, an exercise bicycle, a stepper, other exercise equipment, and combinations thereof.

7. The application of claim 1, wherein the application is further configured to receive another exercise parameter from a sensor within the wireless internet device, wherein the sensor within the wireless internet device is a GPS device, an accelerometer, a blood pressure monitor, a temperature monitor, a heart rate monitor, an EEG monitor, or an ECG monitor.

8. The application of claim 1, wherein the application is further configured to receive another exercise parameter which is a nutrition parameter, and wherein the nutrition parameter is received from a user interface associated with the first WWD.

9. The application of claim 1, wherein the Internet server is configured to transmit data corresponding to the health parameter to a second WWD, whereby a user of the second wireless unit device may monitor exercise performed by the user of the first WWD.

10. A kit for monitoring health and/or exercise, comprising:

a. an adaptor for coupling to a WWD, the adaptor configured to receive an exercise parameter using a wireless communications scheme;

b. an application on a non-transitory computer readable medium, the application configured to be loaded onto a WWD or or downloaded to a WWD from an Internet server and configured for interoperability with an operating system on the WWD, the application comprising instructions for causing the WWD to:

i. monitor an exercise parameter, the monitor an exercise parameter including:

1. configure a WWD to interact with the adaptor; and

2. receive an exercise parameter using the configured adaptor, wherein the exercise parameter includes both exercise data and physiological data;

ii. render a user interface, including an indication of the exercise parameter;

iii. transmit the exercise parameter to an Internet server; and

iv. receive a response from the Internet server, the response a result of a calculation involving the exercise parameter.

11. A kit for monitoring health and/or exercise, comprising:

a. an adaptor for coupling to a port on a health or exercise monitor, the adaptor configured to transmit an exercise parameter to a WWD using a wireless communications scheme;

b. an application on a non-transitory computer readable medium, the application configured to be loaded onto a WWD or downloaded to a WWD from an Internet server and configured for interoperability with an operating system on the WWD, the application comprising instructions for causing the WWD to:

i. monitor an exercise parameter, the monitor an exercise parameter including:

1. configure a WWD to interact with the adaptor; and

2. receive an exercise parameter using the configured adaptor, wherein the exercise parameter includes both exercise data and physiological data;

ii. render a user interface, including an indication of the exercise parameter;

iii. transmit the exercise parameter to an Internet server; and

iv. receive a response from the Internet server, the response a result of a calculation involving the exercise parameter.

12. The kit of claim 11, wherein the WWD is a mobile phone or a tablet computer.

13. The kit of claim 11, wherein the adaptor is configured to plug into an input/output port of an exercise device and configured to convert signals to RF signals suitable for transmission to the WWD.

14. The kit of claim 13, wherein the RF signal employs a transmission scheme selected from the group consisting of 802.11 and 802. 15 wireless protocols, or a frequency range in the 2.4 GHz band or the 5 GHz band.

15. The kit of claim 11, wherein the transmit to the Internet server employs a protocol selected from the group consisting of: a variety of cellular protocols, a variety of 802.11 protocols, 802.15 protocols, 802.16 protocols, 802.20 protocols, ultrawideband protocols, wireless universal serial bus protocols, VOIP protocols, broadband wireless protocols, or satellite communication protocols.

16. The kit of claim 11, wherein the exercise parameter is received from a sensor coupled to an exercise monitor, and wherein the exercise monitor is selected from the group consisting of: a heart rate monitor, a respiration rate monitor, a blood pressure monitor, a temperature monitor, an accelerometer, an ECG monitor, an EEG monitor, a pedometer, a GPS device, a body weight scale, a body fat gauge, a biofeedback device, a treadmill, a rowing machine, an exercise bicycle, a stepper, other exercise equipment, and combinations thereof.

17. The kit of claim 11, wherein the application is further configured to receive another exercise parameter from a sensor within the wireless internet device, wherein the sensor within the wireless internet device is a GPS device, an accelerometer, a blood pressure monitor, a temperature monitor, a heart rate monitor, or an ECG monitor.

18. The kit of claim 11, wherein the Internet server is configured to transmit data corresponding to the exercise parameter to another WWD, whereby a user of the another wireless unit device may monitor exercise performed by the user of the WWD.

19. A system for monitoring exercise, comprising:

a. the application of claim 1, and

b. a server application, the server application disposed on an Internet server and configured to receive a parameter from the application of claim 1, to perform a calculation using the parameter, and to return a result of the calculation to the application of claim 1.

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专利名称(译)	用无线因特网连接监视运动的方法和装置		
公开(公告)号	US20130090565A1	公开(公告)日	2013-04-11
申请号	US13/632771	申请日	2012-10-01
[标]申请(专利权)人(译)	Q TEC SYST		
当前申请(专利权)人(译)	Q-TEC系统有限责任公司		
[标]发明人	QUY ROGER J		
发明人	QUY, ROGER J.		
IPC分类号	A61B5/00 A63B24/00 H04W8/24 A61B5/0205		
CPC分类号	A61B5/0022 H04W4/22 A63B24/0062 H04W8/24 A61B5/0008 A61B5/021 A61B5/02438 A61B5/04325 A61B5/08 A61B5/14532 G06F19/3418 G06F19/3481 G06Q50/24 H04W24/00 H04W84/12 H04W84/18 H04L67/125 H04L67/04 H04L67/12 H04L69/18 A61B5/02055 G16H20/30 G16H40/67 H04W4/90		
外部链接	Espacenet USPTO		

摘要(译)

提供了用于无线健康监测系统的方法和装置，用于通过将诸如移动电话或平板电脑的启用因特网的无线网络设备（“WWD”）连接到健康监测设备来交互地监测用户的健康或健康状况。可以是医疗设备或其他设备，例如健身器械。 WWD可以无线连接到设备，例如通过RF连接，包括使用诸如802.15或802.11之类的协议。无线连接可以使用适配器，以将专有RF方案转换为输入到WWD。或者，适配器可以将健康监测设备的输出转换为蓝牙信号以传输到WWD。使用标准Internet协议将数据从WWD传输到Internet服务器。用户可以与服务器以及配备有类似装置的其他用户交互。