



- (51) International Patent Classification:
H04B 13/02 (2006.01) *A61B 5/00* (2006.01)
- (21) International Application Number:
PCT/US2012/025061
- (22) International Filing Date:
14 February 2012 (14.02.2012)
- (25) Filing Language:
English
- (26) Publication Language:
English
- (30) Priority Data:
61/444,432 18 February 2011 (18.02.2011) US
- (71) Applicant (for all designated States except US): **PROTEUS BIOMEDICAL, INC.** [US/US]; 2600 Bridge Parkway, Ste. 101, Redwood City, California 94065 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **O' REILLY, David** [US/US]; 2508 Waverly Street, Palo Alto, California 94301 (US). **IONESCU, Arna Diana** [US/US]; 1258 York Street, San Francisco, California 94110 (US). **ROBERTSON, Timothy** [US/US]; 2719 Sequoia Way,

Belmont, CA 94002 (US). **THOMSON, Andrew** [GB/US]; 840 Westridge Drive, Portola Valley, California 94028 (US). **THOMPSON, Todd** [US/US]; 1289 Camino Pablo, San Jose, California 95125 (US). **ARNE, Lawrence** [US/US]; 250 Iris Way, Palo Alto, California 94303 (US).

(74) Agent: **FIELD, Bret E.**; Bozicevic, Field & Francis LLP, 1900 University Ave., Suite 200, East Palo Alto, California 94303 (US).

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

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: WEARABLE PERSONAL COMMUNICATOR APPARATUS, SYSTEM, AND METHOD

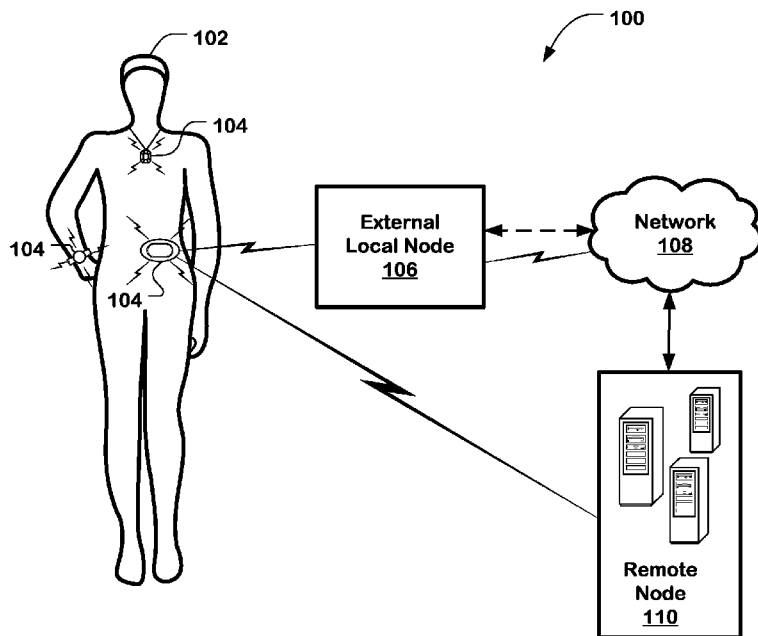


FIG. 1

(57) Abstract: A personal communicator to be worn by a living subject is disclosed. The personal communicator includes a feedback module to communicate information between the personal communicator and the living subject in a discreet manner that is substantially undetectable by other living subjects. A system further includes an external local node to at least one of transmit communications to and receive communications from the personal communicator. A method includes generating by a feedback module a discreet communication detectable by a living subject where the communication is substantially undetectable by other living subject.

WO 2012/112561 A1

GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD,
RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ,
DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT,
LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS,

SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

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

WEARABLE PERSONAL COMMUNICATOR APPARATUS, SYSTEM, AND METHOD

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application No. 61/444,432 filed on February 18, 2011, which is herein entirely incorporated by reference.

INTRODUCTION

[0001] The present disclosure is related generally to a wearable personal communication device that is operable in a personal monitor communication network. In particular, the present disclosure is related to a wearable personal communication device that is in communication with a living subject and communicates within the wearable personal communication environment in a discreet private manner that is substantially undetectable by others.

[0002] A broad industry with diverse product offerings is developing around personal monitors that sense physiologic parameters of a living subject and communicate such information to body-area network devices in communication with the personal monitor. Personal monitors are able to monitor and record individual physiology, e.g., physical activity, heart rate, respiration, temperature, sleep, etc., of the living subject and communicate these parameters beyond the body of the living subject to other devices, e.g., mobile phones, computers, internet servers, etc. A challenge for such personal monitors for an individual is to wear or use such a device on a continuous basis—for example, to apply an adhesive bandage-based personal monitor to their skin for weeks, months and potentially years and accept the possibility of its inconveniences and limitations, such as (i) potential skin irritation, (ii) the burden of frequent application and removal, and (iii) a feeling of intrusiveness into the wearer's daily life. Accordingly, there is a need for a personal monitor that creates a compelling rationale for an individual to wear or use such a device on a continuous basis for weeks, months and potentially years.

SUMMARY

[0003] In one aspect, a personal communicator is configured to be worn by a living subject. The personal communicator comprises a feedback module to communicate information

between the personal communicator and the living subject in a discreet manner that is substantially undetectable by other living subjects.

FIGURES

[0004] FIG. 1 illustrates one aspect of a personal communication system.

[0005] FIG. 2 is a block diagram of one aspect of a personal communicator.

[0006] FIG. 3 is a block functional diagram of one aspect of an integrated circuit component of a personal communicator.

[0007] FIG. 4 illustrates one aspect of a personal communicator configured to be placed on an external topical location of a subject such as a chest area and illustrates one aspect of a personal communication system.

DESCRIPTION

[0008] In one aspect, the present specification provides multiple a personal wearable communication devices ("personal communicator"). In one aspect, a personal communicator is in communication with a living subject. In one aspect, the personal communicator is in communication with a local node external to the body of the living subject. In one aspect, the local node is in communication with a remote node via a network and, accordingly, the living subject is able to communicate with the remote node. Information also may be communicated from the remote node and/or the local node to the living subject via the personal communicator. In various aspects, the two-way communication between the living subject and the personal communicator occurs discreetly such that the communications are non-detectable by humans. Such discreet mode of communication minimizes the intrusiveness into the living subject's sense of privacy and enhances the likelihood that the living subject will accept the personal communicator and use it in a prescribed manner.

[0009] In another aspect, the present specification provides a personal communicator that senses personal physiologic parameters of the living subject and communicates such parameters to the local node and in some aspects to the remote node. Information associated with the personal physiologic parameters also may be communicated from the remote node and/or the local node to the living subject via the personal communicator. As described above,

communications between the individual and the personal communicator occurs discreetly to enhance the likelihood of acceptance of the personal communicator by the living subject.

[0010] FIG. 1 illustrates one aspect of a personal communication system 100. As illustrated in FIG. 1, a personal communicator 104 is positioned on a living subject 102. The living subject 102 may be a human or a non-human being. In various aspects, the personal communicator 104 may be realized in many forms and configurations including sensor-enabled patches, watches, and jewelry, as shown in FIG. 1, for example, as well as a bandage with an adhesive portion, wristbands, earrings, bracelets, rings, pendants, clothing, undergarments, hats, caps, scarves, pins, accessories, belts, shoes, eyeglasses, contact lenses, hearing-aides, subcutaneous implants, and other devices that are wearable, implantable, or semi-implantable on or in the living subject 102 without limitation. The personal communicator 104 is configured to communicate with the living subject 102 and an external local node 106. The external local node 106 is configured to communicate with a remote node 110 via a network 108. In one aspect, the personal communicator 104 is configured to communicate with the remote node 110 directly. It will be appreciated that in the context of the present disclosure, communication is intended to encompass communications to and from the personal communicator 104 and the external local node 106. Likewise, communication is intended to encompass communications to and from the personal communicator 104 and the remote node 110 as well as communications to and from the external local node 106 and the remote node 110.

[0011] The personal communicator 104 may comprise any number of distinct physiological parameter or biomarker collecting and/or sensing capabilities. The number of distinct parameters or biomarker collecting and/or sensing capabilities may vary e.g., one or more, two or more, three or more, four or more, five or more, ten or more, and so on. In certain configurations, the personal communicator 104 comprises one or more active components that are able to dynamically monitor and record individual physiological parameters and/or biomarkers associated with the living subject 102. Such components include, without limitation, sensors, electronic recording devices, processors, memory, communication components. In one aspect, the personal communicator 104 may include an on-board battery to supply electrical power to the active components. The physiological parameter or biomarker sensing abilities may include sensing cardio-data, including heart rate, electrocardiogram (ECG), and the like, respiration rate, temperature, pressure, chemical composition of fluid, e.g., analyte in blood, fluid state, blood flow rate, physical activity, sleep, accelerometer motion data, without limitation, for example.

[0012] In one aspect, the personal communicator 104 provides specific information about the state of health of the subject 102. In another aspect, some of this information may be derived from sensors embedded in the personal communicator 104. The subject 102 may obtain the personal communicator 104 with a prescription, for example, and then wear the personal communicator 104 for a prescribed period, e.g., hours, days, weeks, months, years.

[0013] In one aspect, the personal communicator 104 includes, is configured to (a) monitor and record individual physiology, e.g., physical activity, heart rate, respiration, temperature, sleep, etc., of the living subject 102 and (b) communicate these parameters beyond the body of the living subject 102 to other devices, e.g., mobile phones, computers, internet servers, etc., in order to (c) enable support and collaboration for fitness, wellbeing, disease management, sport, entertainment, gaming, and other applications. A challenge for such personal communicators 104 is creating a compelling rationale for the individual 102 to wear or use the personal communicator 104 on a continuous basis—for example, to apply an adhesive bandage-based personal communicator 104 to their skin for weeks, months and potentially years and accept the possibility of its inconveniences and limitations, such as (i) potential skin irritation, (ii) the burden of frequent application and removal, and (iii) a feeling of intrusiveness into the wearer's daily life. An opportunity for the personal communicator 104 is to exploit fundamental "intimacy" advantages they have over other sensor-enabled and communication devices that are not worn on or in the body—a personal communicator 104 interface with the individual 102 is by definition highly personal and tangible, with the ability to have private, communication between the individual and the personal communicator (leveraging physical, tactile "body language" or other signals), where the communication is substantially undetectable by others. In this manner, the personal communicator 104 may enable product and service possibilities not feasible with other approaches. The body language opportunity seeks to overcome at least some of the challenges and burdens of the personal communicator 104 to create a compelling rationale to make personal communicator 104 as indispensable to a consumer as the mobile phone as an extension of their mind and body. In one aspect, discreet communications between the personal communicator 104 and the living subject 102 can be auditory via a small earpiece placed inside the ear canal, or visual via images projected on specialized eye glasses worn by living subject 102. In other aspects, discreet modes of communication between the living subject 102 and the personal communicator 104 include, without limitation, visual, auditory, vibratory, tactile, olfactory, and taste as described in the form of illustrative examples hereinbelow.

[0014] In one aspect, the personal communicator 104, for example a sensor patch that adheres to the skin of an individual such as the living subject 102, communicates with its wearer by sending and receiving tactile or other signals. The default settings may be modified such that the personal communicator 104 discreetly vibrates or pulses in a specific manner or pattern, e.g., time or space based, to remind the subject 102 of events/ important events and/or to communicate important personalized messages to the wearer. The default settings also may be modified such that the subject 102 can transmit and record meaningful inputs and messages to the personal communicator 104 by communicating a simple language of finger taps, jiggles, scratches or other physical inputs initiated by the subject 102. Through the personal communicator 104 communications architecture, e.g., a Bluetooth or other communication links to other devices beyond the body, the composite set of sensed physiology, tactile inputs, and outputs can be transmitted to other individuals, groups, caregivers, and related products, e.g., online games, of the subject's 102 choosing via the external local node 106, network 108, and/or the remote node 110. The features of the personal communicator 104 are based on a sustained behavior change mechanism and it increases the value and potential of personal communicators 104 and the likelihood that consumers will seek out, use, and benefit from such personal communicators 104.

[0015] In-body communications include any communication of data or information via the body of the living subject 102, i.e., communication via or associated with inter-body aspects, intra-body aspects, and a combination of the same. For example, inter-body aspects include communications associated with devices designed to attach to a body surface. Intra-body aspects include communications associated with data generated from within the body, e.g., by the body itself or by a device implanted, ingested, or otherwise locatable in, or partially in, the body. For example, intra-body communications are disclosed in the U.S. Provisional Patent Application No. 61/251088, the entire content of which is hereby incorporated by reference.

[0016] Communications include and/or may be associated with software, hardware, circuitry, various devices, and combinations thereof.

[0017] The devices include devices associated with physiologic data generation, transmission, reception, communication. The devices further include various implantable, ingestible, insertable, and/or attachable devices associated with the human body or other living organisms. The devices still further include multimedia devices such as telephones, stereos, audio players, PDAs, handheld devices, and multimedia players.

[0018] The system for incorporating physiologic data enables exchange, transmission, receipt, manipulation, management, storage, and other activities and events related to physiologic data. Such activities and events may be contained within the system for incorporating physiologic data, partially integrated with the system for incorporating physiologic data, or associated with externalities, e.g., activities, systems, components, and the like which are external to the system for incorporating physiologic data.

[0019] The physiologic data environment includes any source of information or data, including remote computer systems, local computer devices. The information or data may comprise physiologic data in whole or in part, e.g., aggregated or generated with other types of data. The physiologic data may be pure or refined, e.g., physiologic data from which inferences are drawn.

[0020] As shown in FIG. 1, the personal communicator 104, regardless of form factor or implementation is in communication with an external local node 106. In one aspect, the personal communicator 104 includes the capability of communicating, e.g., receiving, transmitting, generating, and recording data directly or indirectly from the living subject 102. Although the data may include physiologic data, it is not limited as such. Any data of a physiologic nature may be associated with the living subject 102. The physiologic data may include, for example, heart rate, heart rate variability, respiration rate, body temperature, temperature of local environment, three-axis measurement of activity and torso angle, as well as other physiologic data, metrics, and indicators associated with one or more individuals. The physiologic data may be communicated at various times or time intervals to the external local node 106. For example, the communication may be real-time, i.e., in close temporal proximity to a time in which the physiologic data were generated, measured, ascertained, or on an historical basis, i.e., in far temporal proximity to a time in which the physiologic data was generated, measured, ascertained. In various aspects, the physiologic data may be associated with a variety of devices, e.g., cardiac device.

[0021] In one aspect, the external local node 106 may be configured as a communication hub and may include any hardware device, software, and/or communications component(s), as well as systems, subsystems, and combinations of the same which generally function to communicate physiologic and non-physiologic data between the personal communicator 104 and the external local node 106. Communication of the data includes receiving, storing, manipulating, displaying, processing, and/or transmitting the data to the remote node 110 via the network 108.

[0022] In various aspects, the external local node 106 also functions to communicate, e.g., receive and transmit, non-physiologic data. Example of non-physiologic data include gaming rules and data generated by a separate cardiac-related device such as an implanted pacemaker and communicated to the hub directly or indirectly, e.g., via the personal communicator 104.

[0023] Broad categories of external local nodes 106 include, for example, base stations, personal communication devices, handheld devices, and mobile telephones. In various aspects, the external local node 106 may be implemented as a handheld portable device, computer, mobile telephone, sometimes referred to as a smartphone, tablet personal computer (PC), kiosk, desktop computer, or laptop computer, or any combination thereof. Examples of smartphones include, for example, Palm® products such as Palm® Treo® smartphones, Blackberry® smart phones, Apple® iPhone®, and the like. Although some aspects of the external local node 106 may be described with a mobile or fixed computing device implemented as a smart phone, personal digital assistant, laptop, desktop computer by way of example, it may be appreciated that the various aspects are not limited in this context. For example, a mobile computing device may comprise, or be implemented as, any type of wireless device, mobile station, or portable computing device with a self-contained power source, e.g., battery, such as the laptop computer, ultra-laptop computer, personal digital assistant (PDA), cellular telephone, combination cellular telephone/PDA, mobile unit, subscriber station, user terminal, portable computer, handheld computer, palmtop computer, wearable computer, media player, pager, messaging device, data communication device, and so forth. A fixed computing device, for example, may be implemented as a desk top computer, workstation, client/server computer, and so forth.

[0024] The external local node 106 comprises personal communication devices including, for example, devices having communication and computer functionality and typically intended for individual use, e.g., mobile computers, sometimes referred to as “handheld devices.” Base stations comprise any device or appliance capable of receiving data such as physiologic data. Examples include computers, such as desktop computers and laptop computers, and intelligent devices/appliances. Intelligent devices/appliances include consumer and home devices and appliances that are capable of receipt of data such as physiologic data. Intelligent devices/appliances may also perform other data-related functions, e.g., transmit, display, store, and/or process data. Examples of intelligent devices/appliances include refrigerators, weight scales, toilets, televisions, door frame activity monitors, bedside monitors, bed scales. Such devices and appliances may include additional functionality such as sensing or monitoring

various physiologic data, e.g., weight, heart rate. Mobile telephones include telephonic communication devices associated with various mobile technologies, e.g., cellular networks.

[0025] In various aspects, the external local node 106 may provide voice and/or data communications functionality in accordance with different types of cellular radiotelephone systems. Examples of cellular radiotelephone systems may include Code Division Multiple Access (CDMA) systems, Global System for Mobile Communications (GSM) systems, North American Digital Cellular (NADC) systems, Time Division Multiple Access (TDMA) systems, Extended-TDMA (E-TDMA) systems, Narrowband Advanced Mobile Phone Service (NAMPS) systems, 3G systems such as Wide-band CDMA (WCDMA), CDMA-2000, Universal Mobile Telephone System (UMTS) systems, WiMAX (Worldwide Interoperability for Microwave Access, LTE (Long Term Evolution) and so forth.

[0026] In various embodiments, the external local node 106 may be configured to provide voice and/or data communications functionality in accordance with different types of wireless network systems or protocols. Examples of suitable wireless network systems offering data communication services may include the Institute of Electrical and Electronics Engineers (IEEE) 802.xx series of protocols, such as the IEEE 802.1a/b/g/n series of standard protocols and variants (also referred to as "WiFi"), the IEEE 802.16 series of standard protocols and variants (also referred to as "WiMAX"), the IEEE 802.20 series of standard protocols and variants, and so forth. A mobile computing device may also utilize different types of shorter range wireless systems, such as a Bluetooth system operating in accordance with the Bluetooth Special Interest Group (SIG) series of protocols, including Bluetooth Specification versions v1.0, v1.1, v1.2, v1.0, v2.0 with Enhanced Data Rate (EDR), as well as one or more Bluetooth Profiles, and so forth. Other examples may include systems using infrared techniques or near-field communication techniques and protocols, such as electromagnetic induction (EMI) techniques.

[0027] In one aspect, the external local node 106, for example, the hub, includes a software application associated with a mobile telephone of a patient. The application and mobile telephone function to receive physiologic data from a receiver, which, in turn, receives the physiologic data directly from an individual or indirectly, e.g., via a device. Examples of devices include cardiac devices and ingestible devices. The hub stores, manipulates, and/or forwards the data, alone or in combination with other data, via the network 108 to a remote node 110.

[0028] In various aspects, the external local node 106 (hub) receives, generates, communicates, and/or transmits, physiologic data, alone or in combination with other data, i.e., non-physiologic data from various sources. Communication from the external local node 106

includes any transmission means or carriers, and combinations thereof, including wireless, wired, RF, conductive, etc. as is known in the art or as may become available in the future.

[0029] In various aspects, the handheld device includes software, e.g., a software agent/application, associated with the physiologic data. In various aspects of the handheld device, the software is preconfigured, i.e., configurable by the manufacturer/retailer; configurable by the consumer, i.e., downloadable from a website; or a combination of the same.

[0030] The base station includes systems, subsystems, devices, and / or components that receive, transmit, and/or relay the physiologic data. In various aspects, the base station communicably interoperates with a receiver such as the personal communicator 104 and a communications network 108 such as the Internet. Examples of base stations are computers, e.g., servers, personal computers, desktop computers, laptop computers, intelligent devices / appliances, etc., as heretofore discussed.

[0031] In various aspects, the base station may be embodied as an integrated unit or as distributed components, e.g., a desktop computer and a mobile telephone in communication with one another and in communication with a patch receiver and the Internet.

[0032] In various aspects, the base station includes the functionality to wirelessly receive and/or wirelessly transmit data, e.g., physiologic data received from and transmitted to the personal communicator 104 and the Internet.

[0033] Further, in various aspects, the base station may incorporate and/or be associated with, e.g., communicate with, various devices. Such devices may generate, receive, and/or communicate data, e.g., physiologic data. The devices include, for example, "intelligent" devices such as gaming devices, e.g., electronic slot machines, handheld electronic games, electronic components associated with games and recreational activities.

[0034] The mobile telephone includes, for example, devices such as a short-range, portable electronic device used for mobile voice or data communication over a network of specialized cell site base stations. The mobile telephone is sometimes known as or referred to as "mobile," "wireless," "cellular phone," "cell phone," or "hand phone (HP)."

[0035] In addition to the standard voice function of a telephone, various aspects of mobile telephones may support many additional services and accessories such as short message service (SMS) for text messaging, email, packet switching for access to the Internet, java gaming, wireless, e.g., short range data / voice communications, infrared, camera with video recorder, and multimedia messaging system (MMS) for sending and receiving photos and video.

Some aspects of mobile telephones connect to a cellular network of base stations (cell sites), which is, in turn, interconnected to the public switched telephone network (PSTN) or satellite communications in the case of satellite phones. Various aspects of mobile telephones can connect to the Internet, at least a portion of which can be navigated using the mobile telephones.

[0036] In various aspects, the mobile telephone includes software, e.g., a software agent/application, associated with the physiologic data. One example is an auto refill application related to or integrated with an auto refill system to facilitate automated prescription refill functions. In various aspects of the mobile telephone, the software is preconfigured, i.e., configurable by the manufacturer/retailer; configurable by the consumer, i.e., downloadable from a website; or a combination of the same.

[0037] Further, various aspects of the hub include combinations of devices. One such combination is the personal communicator 104 in communication with the handheld device or the mobile telephone. Thus, for example, the personal communicator 104 wirelessly transmits physiologic data to the mobile telephone having a receiver and a software agent available thereon. The receiver of the mobile telephone receives the physiologic data. A software agent, e.g., an application, processes the physiologic data and displays various information related to the physiologic data via, for example, a customized graphical user interface (GUI). In various aspects, the software agent generates displays with a predetermined "look and feel," i.e., recognizable to a user as belonging to a predetermined group of software programs, GUIs, source devices, communities, gaming software, etc.

[0038] More particularly, the personal communication system 100 includes any environment having therein, or associated with, data or communication of physiologic data for a gaming or recreational purpose. Communication includes any method, act, or vehicle of communication, and/or combinations thereof. For example, communication methods include manual, wired, and wireless. Wireless technologies include radio signals, such as x-rays, ultraviolet light, the visible spectrum, infrared, microwaves, and radio waves, etc. Wireless services include voice and messaging, handheld and other Internet-enabled devices, data networking.

[0039] Vehicles of communication include the network 108. In various aspects, the network 108 comprises local area networks (LAN) as well as wide area networks (WAN) including without limitation Internet, wired channels, wireless channels, communication devices including telephones, computers, wire, radio, optical or other electromagnetic channels, and combinations thereof, including other devices and/or components capable of / associated with communicating

data. For example, the communication environments include in-body communications, various devices, various modes of communications such as wireless communications, wired communications, and combinations of the same.

[0040] Wireless communication modes include any mode of communication between points that utilizes, at least in part, wireless technology including various protocols and combinations of protocols associated with wireless transmission, data, and devices. The points include, for example, wireless devices such as wireless headsets, audio and multimedia devices and equipment, such as audio players and multimedia players, telephones, including mobile telephones and cordless telephones, and computers and computer-related devices and components, such as printers.

[0041] Wired communication modes include any mode of communication between points that utilizes wired technology including various protocols and combinations of protocols associated with wired transmission, data, and devices. The points include, for example, devices such as audio and multimedia devices and equipment, such as audio players and multimedia players, telephones, including mobile telephones and cordless telephones, and computers and computer-related devices and components, such as printers.

[0042] In one aspect, the remote node 110 comprises social network systems, commercial systems, healthcare systems, pharmacy systems, university systems, financial transaction systems, web communities, physician systems, family caregiver systems, regulatory agency systems, wholesaler/retailer systems as described in U.S. Patent Application No. 12/522,249 titled "INGESTIBLE EVENT MARKER DATA SYSTEM," the disclosure of which is herein incorporated by reference in its entirety. In other aspects, the remote node 110 comprises state games, behavioral reflective games, psychological response games, synchronization games, actual progress games, and recreational games as described in PCT Patent Application No. PCT/US09/60713 dated October 14, 2009 titled "METHOD AND SYSTEM FOR INCORPORATING PHYSIOLOGIC DATA IN A GAMING ENVIRONMENT" and published as WO 2010/045385, the disclosure of which is herein incorporated by reference in its entirety.

[0043] In various aspects, the personal communication system 100 provides health monitoring, assessment, and sensing in a closed loop. Furthermore, the personal communication system 100 provides a framework for caregivers to communicate with patients and implement wellness and disease management programs. Using the personal communicator 104 enables such communication to be conducted in a discreet manner. Servers at the remote node 110 may be configured as desired, e.g., to provide for subject directed

permissions. For example, the servers may be configured to allow a family caregiver to participate in the subject's therapeutic regimen, e.g., via an interface (such as a web interface) that allows the family caregiver to monitor alerts and trends generated by the server, and provide support back to the subject 102. The servers also may be configured to provide responses directly to the subject, e.g., in the form of subject alerts, subject incentives, which are relayed to the subject via the communication device. The servers also may interact with a health care professional, e.g., RN, physician, which can use data processing algorithms to obtain measures of health and compliance of the subject, e.g., wellness index summaries, alerts, cross-patient benchmarks, and provide informed clinical communication and support back to the subject 102.

[0044] FIG. 2 is a block diagram of one aspect of a personal communicator 104. The personal communicator 104 may comprise features, in any suitable configuration and combination. In one aspect, the personal communicator 104 comprises a power unit 202, an operation unit 204 that includes an electrode 204A, an operation or processing unit 206, and a memory unit 208. The personal communicator 104 may include a power management module 210 that controls the power consumption. The personal communicator 104 is configured to communicate with other near-by devices using one or more transmitters/receivers ("transceiver") module 212. As used herein, the term "transceiver" may be used in a very general sense to include a transmitter, a receiver, or a combination of both, without limitation. For example, the transceiver module 212 may be used for one-way or two-way communications with the external local node 106 and/or the remote node 110 (FIG. 1). Furthermore, the personal communicator 104 may include various features such as an accelerometer 214 to detect the orientation of the personal communicator 104. In instances where the subject 102 is laying down or in a horizontal position, the personal communicator 104 is capable of detecting that position and the duration of time that the subject 102 remains in that position. In addition to detecting the orientation of the personal communicator 104, in various aspects, the accelerometer 214 may be employed to detect other physical aspects of the personal communicator 104 such as static or dynamic acceleration forces, proper acceleration, position, vibrations, and the like.

[0045] Additionally, the personal communicator 104 may further include a personal monitoring portion comprising one or more sensors 216 to detect one or more distinct physiological parameters. By physiological parameter sensing ability is meant a capability of sensing a physiological parameter or biomarker, such as, but not limited to heart rate, respiration rate,

temperature, pressure, chemical composition of fluid, e.g., analyte detection in blood, fluid state, blood flow rate, accelerometer motion data, IEGM (intra cardiac electrogram) data.

[0046] Accordingly, the personal communicator 104 may include physiological parameter measuring tools that allows it to determine if the subject is simply laying down or if the subject has suffered some medical condition that has caused them to end-up in that position. For example, the subject may have had a heart attack and the personal communicator 104 can detect that condition and in conjunction with information from the accelerometer 214, the personal communicator 104 is able to determine that the subject has a potentially serious medical condition. Another example includes the instance where the subject suffers from an epileptic seizure. The accelerometer 214 provides information to the personal communicator 104 and the information from the accelerometer 214 combined with the measured physiological parameters allows the personal communicator 104 to determine that a medical condition is taking place that will require immediate attention.

[0047] In accordance with the teaching of the present disclosure, the signal receiver aspects of the personal communicator 104 may be configured to receive a conductive communication. The conductive communication may be associated with any physiologic part of the body or from a device that conductively transmits through a body using ionic emission through controlled release of mass from solid into a conducting solution or fluid. The communication may be produced by an ionic emission module or an IEM or a smart-parenteral delivery system. Ingestible event markers of interest include those described in PCT Application Serial No. PCT/US2006/016370 published as WO/2006/116718; PCT Application Serial No. PCT/US2007/082563 published as WO/2008/052136; PCT Application Serial No. PCT/US2007/024225 published as WO/2008/063626; PCT Application Serial No. PCT/US2007/022257 published as WO/2008/066617; PCT Application Serial No. PCT/US2008/052845 published as WO/2008/095183; PCT Application Serial No. PCT/US2008/053999 published as WO/2008/101107; PCT Application Serial No. PCT/US2008/056296 published as WO/2008/112577; PCT Application Serial No. PCT/US2008/056299 published as WO/2008/112578; and PCT Application Serial No. PCT/US2008/077753 published as WO 2009/042812; the disclosures of which applications are herein incorporated by reference. Smart parenteral delivery systems are described in PCT Application Serial No. PCT/US2007/015547 published as WO 2008/008281; each of the foregoing disclosures is herein incorporated by reference in its entirety.

[0048] As the personal communicator 104 of these aspects is configured to receive data encoded in current flow through a conductive fluid, the receiver and the device that emits the communication, e.g., a current signature, (such as an ingestible event marker (IEM)) use the living body with which they are associated as a communication medium. To employ the body as a communication medium for the signal, the body fluids act as the conducting fluid and the body of the subject is used as a conduction medium for communication. As such, the communication that is transferred between devices, e.g., transferred from an ionic emission device, an RFID device, and/or other signal-emitting devices, to a receiver, e.g., the personal communicator 104, travels through the body of the subject 102 (FIG. 1). The conductive communication of interest may be provided through and received from the skin and other body tissues of the body of the subject 102 in the form of electrical alternating current (a.c.) signals that are conducted through the body tissues. As a result, such signal receivers do not require any additional cable or hard wire connection between the device generating the communication and the device receiving the communication.

[0049] The personal communicator 104 may include a transbody conductive communication module configured to receive a conductive communication. The transbody conductive communication module is a functional module that is configured to receive a conductive communication, such as a communication emitted by an IEM. Where desired, the transbody conductive communication module may be implemented by a high power functional block, such as described above. In some instances, the transbody conductive communication module is configured to receive an encoded communication, by which is meant that the communication has been modulated in some manner, e.g., using a protocol such as binary phase shift keying (BPSK), frequency shift keying (FSK), amplitude shift keying (ASK), etc. In such instances, the personal communicator 104 transbody conductive communication module is configured to decode a received encoded communication emitted by an IEM. The personal communicator 104 may be configured to decode the encoded communication in a low signal to noise ratio (SNR) environment, e.g., where there may be substantial noise in addition to the information of interest, e.g., an environment having an SNR of 7.7 dB or less. The personal communicator 104 may be further configured to decode the encoded signal with substantially no error. In certain aspects, the personal communicator 104 has a high coding gain, e.g., a coding gain ranging from 6 dB to 12 dB, such as a coding gain ranging from 8dB to 10 dB, including a coding gain of 9 dB. The personal communicator 104 in accordance with various aspects can decode encoded communications with substantially no error, e.g., with 10% error or less.

[0050] In one aspect, the personal communicator 104 comprises a feedback module 218. The feedback module 218 may be implemented with software, hardware, circuitry, various devices, and combinations thereof. The function of the feedback module 218 is to provide communication with the living subject 102 (FIG. 1) in a discreet, tactful, circumspect manner. Accordingly, in various aspects the feedback module 218 may be implemented to communicate with the subject 102 using techniques that employ visual, audio, vibratory/tactile, olfactory, and taste. Such techniques are non-detectable by other living subjects such as humans, for example. In one aspect, the feedback module 218 enables close, intimate, and non-verbal communication between the subject 102 and the personal communicator 104. With the feedback module 218, the subject 102 can develop a unique language/vocabulary for communicating with the personal communicator 104.

[0051] In one aspect, the feedback module 218 may employ visual communication techniques using light sources to enable communication between the subject 102 (FIG. 1) and the personal communicator 104. In various aspects, light from light emitting diode (LED) sources, for example, may be optically channeled to the eye of the subject 102 through optical waveguides, fiber optics, reflection, refraction, total internal reflection, or other optical techniques for manipulating a beam of light or pulses of light to maintain discreet communication between the subject 102 and the personal communicator 104. In other aspects, such discreet optical communication may be implemented by way of implanted LEDs into the structure of eyeglasses, contact lenses, or other wearable devices, in such a manner as to be detectable only by the subject 102. In other aspects, mirrors or lens arrangements may be configured to transmit discreet light pulses such that they are visible only by the subject 102. In other aspects, liquid crystal displays (LCD) may be integrated into contact lenses or eyeglasses to provide a discreet form of visual communication between the subject 102 and the personal communicator 104. In other aspects, infrared (IR) techniques may be employed for discreet communication purposes.

[0052] In another aspect, the feedback module 218 may employ audio communication techniques to enable communication between the subject 102 (FIG. 1) and the personal communicator 104. In one aspect, the subject 102 may wear a small speaker in the form of an ear piece, for example, such that the communication remains private between the subject 102 and the personal communicator 104. In other aspects, the subject 102 may wear a form or hearing aid tuned to a particular frequency such that only the subject 102 is able to discern such audio communications. In either of the above described aspects, the audio communication may be transmitted by wire or wireless communication techniques. The audio communication may

be implemented in the form of text-to-speech or in the form of audible "beeps" of varying pitch to represent a perceived fundamental frequency of a sound to enable the subject 102 to develop a customized dictionary. Other auditory attributes of musical tones along with duration, loudness, timbre, and sound source location may be employed to develop the dictionary. It will be appreciated that pitch may be compared in terms of "higher" and "lower" in the sense that allows the construction of melodies. Pitch may be quantified as a frequency in cycles per second (Hz). Furthermore, other psychoacoustical attributes of sound may be employed to carry out communications discreetly between the subject 102 and the personal communicator 104. In other aspects, small microphones may be employed to detect speech and convert it into an electrical signal.

[0053] In another aspect, the feedback module 218 may employ vibratory/tactile communication techniques to enable communication between the subject 102 (FIG. 1) and the personal communicator 104. In one aspect, the personal communicator 104 may employ a piezoelectric element or eccentric wheel (or weights) to generate vibrations that are detectable only by the subject 102. Thus, in one aspect, the subject 102 may tap the personal communicator 104 to communicate information therewith. Piezoelectric sensors may be used to receive taps from the subject 102 and convert the taps into electrical impulse that can be used to communicate between the subject 102 and the personal communicator 104. Piezoelectric films such as piezoelectric fluoropolymer (PVDF) film or KYNAR® / PVDF piezoelectric film. Such piezoelectric films may be employed as pyroelectric sensors, accelerometers, touch-sensitive sensors, contact microphones, pickups, or drum triggers among other devices.

[0054] In other aspects, microelectromechanical systems (MEMS) (also written as micro-electro-mechanical, MicroElectroMechanical or microelectronic and microelectromechanical systems), which employ technology of very small mechanical devices driven by electricity may be employed to generate tactile impulses that are perceptible only by the subject 102 (FIG. 1). MEMS devices may be formed on very small scales and thus components between 1 to 100 micrometres in size (i.e., 0.001 to 0.1 mm) may be realized. MEMS devices generally range in size from 20 micrometers (20 millionths of a meter) to a millimeter and consist of a central unit that processes data, the microprocessor and several components that interact with the outside such as microsensors. MEMS may be fabricated using modified semiconductor device fabrication technologies, normally used to make electronics. These include molding and plating, wet etching (KOH, TMAH) and dry etching (RIE and DRIE), electro discharge machining (EDM),

and other technologies capable of manufacturing small devices. An early example of a MEMS device is the resonator – an electromechanical monolithic resonator.

[0055] Other aspects of tactile communication techniques include nerve or muscle stimulation techniques employing electrical impulses. For example, electrical current may be employed to stimulate muscle tissue. Electro-stimulation uses voltage in the range of about 0 to about 40 V and current in the range of about 0 to about 80 mA. Such low electrical energy levels are not harmful to the subject 102 and may be calibrated to optimize comfort versus sensitivity. For example, such voltages and currents are typical in transcutaneous electrical nerve stimulation (TENS), which currently is one of the most commonly used forms of electroanalgesia. In one aspect, trains of stimuli can be delivered with variable current strengths, pulse rates, and pulse widths as adjusted by the living subject 102. A preferred waveform is biphasic, to avoid the electrolytic and iontophoretic effects of a unidirectional current where typical stimulus parameters are amplitude, pulse width (duration), and pulse rate (frequency). In one aspect, the amplitude current may be set by the living subject 102 at a comfortable, low intensity level, just above threshold, pulse width may be set to anywhere in the range of about 10 to about 1000 microseconds, and the pulse rate may be set to anywhere in the range of about 80 to about 100 impulses per second (Hz); about 0.5 to about 10 Hz when the stimulus intensity is set high, for example. In one aspect, electrodes are placed in contact with the surface of the skin of the subject 102 to provide detectable stimulation. In other aspects, the electrodes may be embedded or partially embedded subcutaneously. In other aspects, galvanic skin response, electrical, electrostatic, or electromagnetic techniques may be employed to stimulate nerves or muscles to enable communication between the subject 102 and the personal communicator 104.

[0056] Other aspects of tactile communication techniques include thermal stimulation techniques. For example, thermoelectric circuits may be employed on the personal communicator 104 to generate sensations of hot and cold in varying degrees such that the subject 102 can develop a unique vocabulary based on thermally generated communications. A simple technique for generating thermal sensations includes driving a current through a resistor. More complex techniques exploit the thermoelectric effect where temperature differences are converted directly to electric voltage and vice versa. A thermoelectric device creates a voltage when there is a different temperature on each side. Conversely when a voltage is applied to it, it creates a temperature difference (known as the Peltier effect). At atomic scale (specifically, charge carriers), an applied temperature gradient causes charged carriers in the material,

whether they are electrons or electron holes, to diffuse from the hot side to the cold side, similar to a classical gas that expands when heated; hence, the thermally induced current. The thermoelectric effect can be used to generate electricity, to measure temperature, to cool objects, or to heat them. Because the direction of heating and cooling is determined by the polarity of the applied voltage, thermoelectric devices make very convenient temperature controllers and thus can be used for communications between the subject 102 and the personal communicator 104. Traditionally, the term thermoelectric effect or thermoelectricity encompasses three separately identified effects, the Seebeck effect, the Peltier effect, and the Thomson effect, any one of which may be employed to implement various aspects of tactile communication techniques.

[0057] In other aspects, tactile communication techniques include haptic sensors such as Electroactive Polymer Artificial Muscles (EPAMTM) based on dielectric elastomers. Such sensors have the bandwidth and the energy density required to make haptic sensors that are responsive and compact. Such EPAMTM based dielectric elastomers may be configured into thin, high-fidelity haptic sensor modules to provide a brief tactile “click” that corresponds to a key press or tap.

[0058] In one aspect, the feedback module 218 may employ olfactory and taste communication techniques to enable communication between the subject 102 (FIG. 1) and the personal communicator 104. A fluidic reservoir filled with an aromatic fluid may be used as a source for generating smells and tastes. In one aspect, an electrical current generated by the feedback module 218 may be driven through the fluidic reservoir to release the aromatic fluid. The sense of smell or taste may increase proportionately with the electrical current through the fluidic reservoir. Other techniques include solid state devices that outgas when an electrical current is passed therethrough and substrates with aromatic material embedded in wax that release aromas when an electrical current is passed therethrough. Such techniques may be configured for single use or multiuse. Although these techniques are suitable for communicating information from the personal communicator 104 to the subject 102, the subject 102 may use any other techniques described herein to communicate information to the personal communicator 104 such as tapping an external housing of the personal communicator 104.

[0059] The personal communicator 104 may incorporate various form factors and materials. In one example, the personal communicator 104 may be in the form of a patch similar in design, shape, size, and material to an adhesive bandage, i.e., may be removably-attachable to the subject 102 (FIG. 1). Specific dynamics of design, shape, design, and material may vary

according to use, environment, placement. For example, the design may incorporate various constructs and patterns. The constructs, for example, may include one or more layers, e.g., a substrate having an adhesive layer. The patterns may include various aesthetic features, e.g., various patterns, various colors, decals, imprints, etc., and non-aesthetic features, e.g., breathable materials, non-allergenic materials. The shape may vary, e.g., oval, circular, triangular, kidney-shaped, rectangular, square. The size may vary, e.g., approximately 75 mm by 120 mm, approximately 50 mm by 80 mm, approximately 25 mm by 40 mm, or other sizes, as desired. The material may incorporate any material or combinations of materials capable of carrying out the functionality of the personal communicator 104 as herein described. Further, in various aspects, considerations may be given to position, energy conservation schemes, carrier identification, decoding and error correcting.

[0060] The processing unit 206 communicate with the sensors 216 and/or other devices. In various aspects, for example, the processing unit 206 generates electronic communication with the sensors 216. In one example, the processing unit 206 includes electronic integrated circuits (not shown). In various aspects, a housing may include various features, e.g., watertight, hermetically sealed. The circuit board having electronic circuits may electronically communicate with the sensors 216. The power unit 202 may, for example, be a rechargeable power source such as a rechargeable battery.

[0061] In various aspects, different energy conservation schemes may be considered. Such schemes include a periodic wake-up, e.g., sensors and/or other components wake-up periodically such that energy, e.g., power source unit 202, is conserved during non-awake periods. Such energy conservation schemes may be controlled by the power management module 210.

[0062] In various aspects, the personal communicator 104 may accomplish one or more of sensing functions using a communication receiving element, e.g., using electrodes of the personal communicator 104 for receiving communications and sensing applications, or the personal communicator 104 may include one or more distinct sensing elements that are different from the signal receiving element. The number of distinct sensing elements that may be present on (or at least coupled to) the signal receiver may vary, and may be one or more, two or more, three or more, four or more, five or more, ten or more.

[0063] In various aspects, the personal communicator 104 may include a pair of electrodes that provide for dual functions of receiving and sensing information or communications. For example, the electrodes also may serve additional sensing functions. In certain aspects, the

electrodes may be used to generate an IEGM (intra cardiac electrogram) at whatever site they are located. From that data, there are many kinds of processing that can be done, e.g., to detect various cardiac events, such as tachycardia, fibrillations, heart rate. Another sensing capability that may be accomplished with two electrodes of the signal receiver employs measuring the impedance between the electrodes. The measured impedance will have some component which is determined by the trans-thoracic impedance, which relates to respiration. In this manner, the impedance data can be employed to obtain the respiratory rate of the subject. The electrodes may also be employed as sensors of fluid state of subject.

[0064] As mentioned above, one or more additional physiologic sensors distinct from the electrodes may be included in the personal communicator 104. For example, a temperature sensor, e.g., a thermistor, may be included therein. If really precise temperature measurement are desired, there are other techniques like resistive temperature devices (RTDs), made out of platinum generally, which can give very precise measurements of temperature. An additional physiological sensor may include an LED and a photodiode combined into a pulse-oximeter, which may be employed to measure blood oxygenation, which also may provide information about pulse pressure.

[0065] In addition, the personal communicator 104 may include a pressure sensor, e.g., where the personal communicator 104 is implanted next to an artery to get measurements of arterial blood pressure. For example, one can get the pressure inside the body by putting a pressure sensitive membrane on the surface of the personal communicator 104. To get a more useful type of pressure, one usually wants to measure the venous or arterial blood pressure. In such a case, the membrane may be located in proximity to either an artery or a vein, so that as the artery pulsed it may exert a pressure on the pressure sensor. That could be calibrated to give an absolute pressure reading. Another possibility includes some sort of outrigger cuff, e.g., which cuffed around the artery. It could have strain gauges in it to measure pressure deflections, which are then be attached to the receiver, e.g., the personal communicator 104.

[0066] Generally, the personal communicator 104 may also include analyte detection sensors. For example, specific chemical sensors may be incorporated into the signal receivers to detect the presence of various agents, e.g., glucose, BNP (B-type Natriuretic, which is associated with cardiac disease). There are other ways that one could build an oxygen sensor, including selectively porous impedance cells, where the oxygen changes the pH of a cell, and then the conductivity of that is measured. Where the signal receiver includes an analyte detecting sensing element, this sensing element can be configured in the signal receiver in a number of

different ways. For example, a sensor that includes a selectively permeable membrane which is permeable to the agent to be detected may be provided, where there is an isolated cell behind it, and the agent passes through the membrane, and changes the properties, usually electrical properties, of the cell, which are then measured. For example, there may be a small reservoir on the side of the signal receiver with a membrane across it, and the measuring electrical circuitry behind it. Another way of detecting agents employs sensors known in the art as ChemFET sensors, which are based on the binding of analyte to the sensor causing a change in the conductivity. There may be included a material with electrical properties (or other properties) that are changed when the material binds to it. Various proteins may be detected that way.

[0067] In one aspect, the personal communicator 104 gathers physiologic data. The physiologic data includes data associated physiologic events, parameters, measurements. Such data include, for example, Galvanic skin response, heart rate, heart rate variability, respiration rate, body temperature, temperature of local environment, three-axis measurement of activity and torso angle, optical, pressure, sound, biochemical/biological, weight, position, derived electromyography (EMG), and electroencephalography (EEG). The physiologic data further include those data set out in the U.S. Patent Application Nos. 10/734,490; 10/764,429; 10/764,127; 10/764,125; 11/025,657; 11/324,196; 11/664,340; 11/731,786; 11/718,201; 11/897,942; 11/912,475; 12/063,097; 12/063,095; as well as PCT Application Serial Nos: PCT/US2007/015547; and PCT/US2008/ 52845, each of which is incorporated herein in its entirety by reference.

[0068] FIG. 3 is a block functional diagram of one aspect of an integrated circuit component of a personal communicator 104. In FIG. 3, the personal communicator 104 includes an electrode input 310. Electrically coupled to the electrode input 310 are a transbody conductive communication module 320 and a physiological sensing module 330. In one aspect, the transbody conductive communication module 320 is implemented as a first, e.g., high, frequency (HF) signal chain and the physiological sensing module 330 is implemented as a second, e.g., low, frequency (LF) signal chain. Also shown are CMOS temperature sensing module 340 (for detecting ambient temperature) and a 3-axis accelerometer 350. The personal communicator 104 also includes a processing engine 360 (for example, a microcontroller and digital signal processor), a non-volatile memory 370 (for data storage), and a wireless communication module 380 to receive data from and/or transmit data to another device, for example in a data download/upload action, respectively). In various aspects, the

communication modules 320, 380 may comprise one or more transmitters/receivers (“transceiver”) modules. As used herein, the term “transceiver” may be used in a very general sense to include a transmitter, a receiver, or a combination of both, without limitation.

[0069] The sensors 216 typically contact the subject’s 102 (FIG. 1) person, e.g., are removably attached to the torso. In various aspects, the sensors 216 may be removably or permanently attached to the personal communicator 104. For example, the sensors 216 may be removably connected to the personal communicator 104 by snapping metal studs. The sensors 216 may comprise, for example, various devices capable of sensing or receiving the physiologic data. The types of sensors 216 include, for example, electrodes such as biocompatible electrodes. The sensors 216 may be configured, for example, as a pressure sensor, a motion sensor, an accelerometer, an electromyography (EMG) sensor, an ingestible event marker, a biopotential sensor, an electrocardiogram sensor, a temperature sensor, a tactile event marker sensor, and an impedance sensor.

[0070] The feedback module 218 may be implemented with software, hardware, circuitry, various devices, and combinations thereof. The function of the feedback module 218 is to provide communication with the living subject 102 (FIG. 1) in a discreet, tactful, circumspect manner as described above. In various aspects the feedback module 218 may be implemented to communicate with the subject 102 using techniques that employ visual, audio, vibratory/tactile, olfactory, and taste.

[0071] FIG. 4 illustrates one aspect of a personal communicator 104 configured to be placed on an external topical location of a subject 102 (FIG. 1), such as a chest area. The personal communicator 104 includes an upper housing plate 410 (such as may be fabricated from a suitable polymeric material), and includes a manually depressible operation button 402 and a status identifier LED 403, which may be used to relay to an observer that the signal receiver is operating. Manually depressible operation button 402 can be manually manipulated to transition the signal receiver from a storage mode to a non-storage mode. When the signal receiver is in the storage mode, a micro-controller of the signal receiver may remain in a low duty cycle active state at all times to process input from the on/off button, and the digital signal processor (DSP) of the signal receiver powered off. When the on/off button is depressed to turn on the signal receiver, the micro-controller de-bounces the input and powers the DSP into its idle state. While in storage mode, the device may draw less than 10 μA , including 5 μA of current or less, such as 1 μA or less and including 0.1 μA or less. This configuration enables the device to remain at greater than 90% useful battery life if stored for one month (assuming the

presence of a 250 mAH battery). Such a button may also be employed for other functions. For example, such a button may be employed to instruct the signal receiver to obtain certain types of data. In addition or alternatively, such a button may be employed to manually instruct the signal receiver to transfer data to another device. The various functional aspects of the feedback module 218 (FIGS. 2, 3) are incorporated into the personal communicator 104 shown in FIG. 4 as may be dictated by a particular application.

[0072] Having described generally various aspects of a personal communication system 100 and a personal communicator 104, the disclosure now turns specific aspects of a personal communicator and its use. With reference now to FIGS. 1-4, in one aspect, the personal communicator 104 and the living subject 102 can communicate by way of a physical, tactile body language for diverse applications and uses of the personal communicator 104. Other symbolic languages have developed in fields that do not involve personal communicators 104 and serve as examples. For example, highly personalized visual, auditory, and physical communications of mobile phones suggest the potential of the personal communicator 104 mechanism. Just as a mobile phone user can set a flashing red light to indicate visually that a new email has been received, can set a specific ringtone or song to indicate by sound that a particular friend is calling, and can set a specific type of device vibration to indicate by feel that a given event on the calendar is occurring. The pervasive use of such symbolic communication mechanisms in devices like mobile phones demonstrate their importance and intuitive nature as communication technology comes closer and closer to individuals in their daily lives. In one aspect of the personal communicator 104 body language will be both specific and personal to the individual subject 102, e.g., based on predetermined settings, the user can assign a specific meaning to a particular vibration, and generalized and accepted by communities, e.g., a Body Language “dictionary” is published and becomes accepted as a means of personal communicator 104 communication, just as lists of popular emoticons like “;)” have created a standardized language of email and texting communication. In one aspect, an open application programming interface (API) will allow for diverse software and product developers to use and extend the body language to increase the depth and potential of its use in the personal communicator 104.

[0073] In one aspect, the personal communicator 104 enables alerts to individuals 102 who want to be notified or made aware of a specific appointment, message or need and desire the information to be delivered in a manner that (a) only the wearer can perceive and (b) where an alarm or alert-based feature may be valuable. For example, a living subject 102 who is a

diabetic woman living in San Francisco, CA, USA is concerned about becoming hypoglycemic during the night typically checks her blood glucose levels at 2:00am. The subject 102 now wears a personal communicator 104 on her skin and an alarm-based vibration feature can be pre-set by the subject 102 to activate at 2:00am. Using this mechanism, the subject 102 can be awakened to check her blood sugar without disturbing her husband, minimizing both her fears and the effect diabetes has on her family. In another example, users tell the personal communicator 104 system in advance where they will be traveling, and the personal communicator 104 vibrating alarm function sends them to bed and wakes them up to optimally prepare and get over jet-lag (before departure and after arrival). These alerts could also be sent via non-detectable auditory or even visual signals using a discreet ear piece in the ear canal or eye glasses that project visual displays as previously discussed. In one aspect, the alerts may be sent to a designated person who is a pre-designated recipient of the IEM communication when the subject ingests a medication. In one aspect, an alert may be sent by a pre-designated person to the subject 102 when the subject 102 fails to adhere to a medication regimen and/or when there is a need to send such alerts.

[0074] In one aspect, the personal communicator 104 further allows for a physiologic or molecular parameter that is sensed by the personal monitor 200 or an associated device to be communicated privately to the individual subject 102 in a manner that can support and encourage their behavior and decisions. For example, the subject 102 runs to make a meeting on time. Just before arriving, she feels a vibration from the personal communicator 104 that has been designed to mimic her heartbeat rhythm and lets her know she has reached her target heart rate. This real-time communication makes the subject 102 feel good about exercising, gives her confidence in her physical abilities, and subtly trains her to recognize and find unexpected moments for more exercise during the day.

[0075] In another related example, after sitting at her desk for two hours, the subject's 102 personal communicator 104 vibrates in an escalating rhythm of growing intensity, letting her know that the personal communicator 104 has sensed via the personal monitor 200 that she has been inactive during waking hours. Accordingly, personal communicator 104 prompts her to get up and walk around the block a few times. Such gentle "nudges" of the personal communicator 104, based on sensed physiologic or molecular parameters, lead to significant long-term benefits by providing the user feedback and communications that can support and encourage behavior change.

[0076] In various aspects, the personal communicator 104 further allows for the subject 102 to send and record personal messages to the personal communicator 104 via tactile inputs that facilitate a level of intimate and private communication not possible with any other form of input device. For example, enabling a “mood logging” function on her personal communicator 104 allows the subject 102 to discreetly log mood shifts throughout the day. At 10:05am she double taps her personal communicator 104 through her clothing to record that she’s feeling a little depressed and at 2:30pm she taps once to indicate that she is feeling more upbeat. Later in the evening she receives an email that displays her logged events, adding context from her calendar and other sources so the subject 102 can more easily remember what she was doing at various time, and prompts her to add more detailed information she didn’t have time to input earlier in the day.

[0077] The personal communication system 100 and the personal communicator 104 allows the subject 102 to capture relevant health and emotional events in a convenient format that’s easy to bring to her next doctor’s visit, but which does not require the subject 102 to, for example, pull out her mobile phone or a log book to take the time to formally log such events or potentially draw the attention these more elaborate and public actions require.

[0078] In another example, enabling the “pain logging” function of her personal communicator 104 allows the subject 102 to record relative pain thresholds throughout the day that are associated with her chronic lower back pain, and which allows her and her physician to understand how her medication adherence and daily activities correlate to her pain. Periodically throughout the day, either prompted by the personal; communicator 104 or not, the subject 102 discreetly taps her personal communicator 104 through her clothing, with the number of taps associated with a defined pain scale, e.g., one tap is low pain, two taps is moderate pain, three taps is high pain. Combined with sensed parameters of the subject’s 102 pain medication ingestions and missed doses, her physical activity and exercise, and her sleep patterns and quality, the personal communicator 104 creates a comprehensive pharmacologic/behavior/pain map which can be used to optimize her care and improve her outcomes.

[0079] In yet another example, the subject 102 has enabled the “addiction logging” function of her personal monitor, which allows her to record cravings for such things as food, alcohol or cigarettes that she wants to avoid and use less of over time. Throughout the day, the subject 102 rubs or scratches her personal communicator 104 through her clothing to identify and mark times of craving. The subject 102 sets the personal communicator 104 to then communicate this information to her sister, who is then prompted to send her an email or call her as a form of

support and intervention. In this example, the personal communicator 104 helps people break their addiction by helping them understand their behavioral patterns and prompt the wearer to focus on something else or trigger pre-defined interventions.

[0080] In another aspect, the personal communicator 104 further allows other individuals of a wearer's choosing to send messages to the wearer via the tactile body language. Analogs in other modes of communication in history, where new languages and group understandings have developed rapidly with the availability of new technologies, include drum beats, smoke signals, Morse Code, signal flags, SMS texting shorthand, and Twitter hashtags. In the case of body language via the personal communicator, such auditory, visual and written shorthand communications are now extended to include physical and tactile communications. For example, the subject 102 wears an internet-connected personal communicator 104 and sets access permissions to allow her sister to send her body language messages. The sister could either use her mobile phone or computer to send an email or text to the subject 102 that is translated at the server level into body language and is forwarded to the personal communicator 104 of the subject 102. The subject's sister could be wearing a personal communicator 104 also and sending messages directly to the personal communicator 104 of the subject 102 through the sister's tactile inputs. In either case, the subject 102 and her sister communicate via a pre-defined and mutually understood set of tactile messages, e.g., a pre-set vibration of a particular length of time communicates, "I love you," while a triple tap and its associate buzz indicates "I am thinking of you right now."

[0081] In one aspect, a personal communicator 104 further allows for body language to be used as part of online and other electronic gaming and entertainment environments, in which (a) the wearer's body effectively becomes a controller in the electronic game whereby (b) the wearer's physiologic and molecular parameters, e.g., physical activity, blood glucose, and (c) tactile inputs into their personal communicator 104, e.g., tap to indicate a desire to run in the virtual world of the game, become associated game inputs, values, rewards and currencies. For example, the personal communicator 104 connects to an established online virtual world such as those created by PlayFish®, and established games such as Farmville®, Cityville® or Fantasy Football. Users of such personal communicator 104 earn exclusive virtual currency and privileges to enrich their virtual world by accomplishing specified things that are monitored and measured by the personal communicator, such as adhering to their medication, completing their exercise regimens or using body language to communicate with their gaming friends. Participants can, for example, boost their measured activity in the real world to progress in their

virtual world while they are away from the computer or mobile screen. By directly linking activity and other behavior in the real world as measured by the personal communicator 104 with life on the screen, their bodies become a new digital interface.

[0082] In one aspect, a new currency introduced only to personal communicator 104 users deepens engagement and accelerates progress within their virtual communities. One link between players' real-world actions and their virtual progress creates a loop in which virtual game play reinforces healthy habits. The community of other personal communicator-enabled players provides gentle reminders, competition, and reinforcement for behavior changes. For example, just as game players today can communicate with each other during game play via such things as Xbox® Live and associated communications headsets, players using the personal communicator 104 can interact with each other, online and offline, via body language messages. In one aspect, group dynamics, such as described in U.S. Provisional Application No. 61/431,416 entitled "System, Method and Article to Prompt Behavior Change," which is incorporated herein by reference in its entirety, may form part of an online and other electronic gaming and entertainment environment.

[0083] Situational examples include the diabetic subject 102 having difficulty finding the time and motivation to get the exercise she needs to keep her diabetes in check. She also loves playing Farmville® game and is excited when she learns that she can connect her personal communicator 104 to her Farmville® account in a way that actually nudges her to exercise more (via the types of vibrations etc described above) and still feels rewarding and fun because her activity is linked to her performance and currency in the Farmville® game. The subject 102 can now expand her Farmville farm even faster. After returning from her walk each evening, she can log in to Farmville to irrigate her crops with the specialized offline activity level-based currency, e.g., "RainDrops," she just earned and can watch her crops grow more quickly before her eyes and then harvest them immediately to earn extra Farm Coins. The subject 12 also can develop the habit of taking her Metformin® diabetes medication before logging in so she can use the 50 RainDrops she receives for each pill the personal communicator 104 senses. The subject's 102 monitored medication adherence and physical activity can increase her status within Farmville® game to the point where she can unlock the ability to give one personal communicator 104 to a friend. The subject 102 can decide to send the personal communicator 104 to a friend who plays Fantasy Football, for example. With the personal communicator 104, the subject's 102 friend can receive a point multiplier for her Fantasy Football team score each week based on how many of her health goals she achieved that week. She "plays" in the

physical world to increase her score just as her players do during professional games. They are now able to both further their online play during the day based on their offline behavior, and to communicate with each other via personal communicator 104 on their respective progress.

[0084] As previously discussed above in connection with FIG. 1, the personal communicator 104 can be implemented in the personal communication system 100. The personal communicator 104 and body language can detect user activity and body position, along with more sophisticated measurements of walking gait and body lean or imbalance. The data collected by the personal communicator 104 also provides additional metrics like sleep quality determined using algorithms capable of detecting specific patterns of activity. The 2-way communication approach of the personal communicator 104 has demonstrated the ability to record physiologic data including accelerometer data and transmit it to another device like the external local node 106, e.g., a phone. The data are then forwarded on to data storage and processing locations at the remote node 110 where it can be analyzed. Once the data has been analyzed it is returned to the subject 102 in a more meaningful form on their phone or computer in a web based interface. Through the use of communication from the phone to the personal communicator 104, the actions of the personal communicator 104 can be modified. The tactile communications at the core of personal communicator 104 are enabled by a 3-axis accelerometer 214, 350 (FIGS. 2, 3) and associated technologies within the personal communicator 104. In one aspect, the accelerometer 214, 350 is capable of detecting motion or acceleration that is associated with movement of the personal communicator 104 patch attached to the subject 102. Specific vibrations, pulses, ripples, taps, jiggles or scratches can be recognized through the use of algorithms designed to recognize predetermined personal communicator 104 body language words or phrases.

[0085] Accordingly, in one aspect the present disclosure is directed to (a) any form of personal communicator 104 or monitor (such as any sensor-enabled device worn on the body—whether by adhesive or other application to the skin or simply worn on the body as clothing—or any sensor-enabled device inserted or implanted under the skin or within the body, such as implantable loop recorders or therapy delivery devices; the personal communicator 104 may be made up of multiple pieces worn on different parts of the body; (b) any form of sensing performed by any such personal communicator 104, including medication adherence, physiologic, molecular or other forms of sensed measurements; (c) any similar device that may be used either alone or in an ancillary manner and may be implemented in the same manner with the personal communicator 104 and body language, including blood pressure cuffs, weight

scales, blood glucose meters; and (d) any form of communication that is substantially undetectable by others, be it tactile, physical, auditory or visual used by such personal communicator used as part of online and other electronic gaming and entertainment environments/monitors that are perceived only by the subject associated with the personal communicator, including those delivered by touch or feel by the wearer, such as vibrations, pulses, ripples or taps, jiggles or scratches.

[0086] Furthermore, in one aspect the present disclosure is directed to one or more implementation methods to optimize the introduction and use of personal communicator 104, including (i) introduce one personal communicator 104 function at a time; (ii) provide (just enough) real-time feedback through the personal communicator 104; (iii) enable the personal communicator 104 to learn the wearer's behavior in order to adjust to the wearer's preferences; (iv) provide full access to setup options; (v) allow easy opt-out from alerts; (vi) only use the personal communicator 104 to convey personal information; (vii) all other communication can be directed to a phone/web interface so that the value of the personal communicator 104 usage is focused on the most personal and intimate of communications.

[0087] In addition, in one aspect the present disclosure is directed to behavior change principles. The patient journey follows three primary stages of (1) getting started with a therapy regimen for treatment of chronic disease(s); (2) getting into a routine to establish good habits and choices to follow and adhere to the therapy regimen and other positive lifestyle choices, e.g., diet, sleep, exercise; and (3) getting through rough spots and difficult periods in therapy and disease progression or difficulties in order to continue to make progress in chronic disease management and continued wellbeing. The personal communicator 104 and body language may create a product mechanism for sustained behavior change and continuous reinforcement in each of these aspects of the patient journey as follows:

[0088] 1. Get Me Started: the personal communicator 104 coaches the wearer in real time and enhances the value of a personal monitor;

[0089] 2. Get Me Into a Routine: the personal communicator 104 becomes the wearers' constant companion to helps him/her remember and gives the wearer short-term success from alerts and other tactile messaging to reinforce his/her actions; and

[0090] 3. Get Me Through the Rough Spots: the personal communicator 104 constantly reinforces healthy choices and enables the wearer to track his/her behavior.

[0091] Notwithstanding the claims, the invention is also referred to in the following clauses:

1. A personal communicator to be worn by a living subject, the personal communicator comprising a feedback module to communicate information between the personal communicator and the living subject in a discreet manner that is substantially undetectable by other living subjects.
2. The personal communicator of clause 1, wherein the feedback module comprises a communication circuit that employs one or more of the following:
 - a visual communication technique,
 - an audio communication technique,
 - a vibratory/tactile communication technique,
 - an olfactory communication technique,
 - a taste technique.
3. The personal communicator of clause 1 or 2, further comprising a personal monitoring portion comprising at least one sensor to detect at least one distinct physiological parameter.
4. The personal communicator of any of the preceding clauses further comprising a communication module to for transmitting to and/or receiving from an external local node.
5. The personal communicator of any of the preceding clauses further comprising an accelerometer to detect at least one physical aspect of the personal communicator.
6. The personal communicator according to any of the preceding clauses 4 or 5, wherein the external local node is in communication via a network and/or the personal communicator with a remote node.
7. The personal communicator according to any of the preceding clauses 4-6 wherein the external local node is a handheld device, for example a smartphone for communicating, i.e. receiving and transmitting, physiological and/or non-physiological data.

8. A personal communication system, comprising a personal communicator according to any of the preceding clauses and an external local node to transmit communications to and/or receive communications from the personal communicator.
9. The personal communication system of clause 8, further comprising a remote node for transmitting communications to and/or receiving communications from the external local node.
10. Use of a smartphone, mobile phone, or computer as an external local node, and/or a remote node, with a personal communicator according to any of the preceding clauses, 1-7 and/or the system according to any of the preceding clauses 8 or 9.
11. A method of communicating with a personal communicator as described in any of the clauses 1-7, and/or a system according to any of the clauses 8 or 9, the method comprising generating by a feedback module a discreet communication detectable by a living subject, wherein the discreet communication is substantially undetectable by other living subjects.
12. The method of clause 11, wherein the feedback is generated by one or more of the following:
- a visual communication,
 - an audio communication.
 - a vibratory/tactile communication,
 - an olfactory communication,
 - a taste communication.
13. The method of clause 12, comprising monitoring by at least one sensor at least one physiological or non-physiological parameter.
14. The method of any of the clauses 11-13 comprising communicating information to an external local node.
15. The method of any of the preceding clauses 11-14 comprising detecting by an accelerometer at least one physical aspect of the personal communicator.

16. Use of a personal communicator according to any of the preceding clauses 1-7, and/or a system according to any of the clauses 8 or 9 for communicating personal information between a subject wearing the personal communicator and an environment of the personal communicator.

[0092] It is to be understood that this disclosure is not limited to particular embodiments or aspects described, as such may vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to be limiting, since the scope of the present invention will be limited only by the appended claims.

[0093] Where a range of values is provided, it is understood that each intervening value, to the tenth of the unit of the lower limit unless the context clearly dictates otherwise, between the upper and lower limit of that range and any other stated or intervening value in that stated range, is encompassed within the invention. The upper and lower limits of these smaller ranges may independently be included in the smaller ranges and are also encompassed within the invention, subject to any specifically excluded limit in the stated range. Where the stated range includes one or both of the limits, ranges excluding either or both of those included limits are also included in the invention.

[0094] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although any methods and materials similar or equivalent to those described herein can also be used in the practice or testing of the present invention, representative illustrative methods and materials are now described.

[0095] All publications and patents cited in this specification are herein incorporated by reference as if each individual publication or patent were specifically and individually indicated to be incorporated by reference and are incorporated herein by reference to disclose and describe the methods and/or materials in connection with which the publications are cited. The citation of any publication is for its disclosure prior to the filing date and should not be construed as an admission that the present invention is not entitled to antedate such publication by virtue of prior invention. Further, the dates of publication provided may be different from the actual publication dates which may need to be independently confirmed.

[0096] It is noted that, as used herein and in the appended claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. It is further noted

that the claims may be drafted to exclude any optional element. As such, this statement is intended to serve as antecedent basis for use of such exclusive terminology as solely, only and the like in connection with the recitation of claim elements, or use of a negative limitation.

[0097] As will be apparent to those of skill in the art upon reading this disclosure, each of the individual embodiments described and illustrated herein has discreet components and features which may be readily separated from or combined with the features of any of the other several embodiments without departing from the scope or spirit of the present invention. Any recited method can be carried out in the order of events recited or in any other order which is logically possible.

[0098] Although the foregoing disclosure has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is readily apparent to those of ordinary skill in the art in light of the teachings of this disclosure that certain changes and modifications may be made thereto without departing from the scope of the appended claims.

[0099] Accordingly, it will be appreciated that those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the invention and are included within its scope. Furthermore, all examples and conditional language recited herein are principally intended to aid the reader in understanding the principles of the invention and the concepts contributed by the inventors to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents and equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure. The scope of the present disclosure, therefore, is not intended to be limited to the exemplary aspects and embodiments shown and described herein. Rather, the scope of present disclosure is embodied by the appended claims.

[00100] It is worthy to note that any reference to “one aspect” or “an aspect” means that a particular feature, structure, or characteristic described in connection with the aspect is included in at least one aspect. Thus, appearances of the phrases “in one aspect” or “in an aspect” in various places throughout the specification are not necessarily all referring to the same aspect. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner in one or more aspects.

[0101] Some aspects may be described using the expression “coupled” and “connected” along with their derivatives. It should be understood that these terms are not intended as synonyms for each other. For example, some aspects may be described using the term “connected” to indicate that two or more elements are in direct physical or electrical contact with each other. In another example, some aspects may be described using the term “coupled” to indicate that two or more elements are in direct physical or electrical contact. The term “coupled,” however, also may mean that two or more elements are not in direct contact with each other, but yet still co-operate or interact with each other.

[0102] While certain features of the aspects have been illustrated as described herein, many modifications, substitutions, changes and equivalents will now occur to those skilled in the art. It is therefore to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the aspects.

CLAIMS

1. A personal communicator to be worn by a living subject, the personal communicator comprising:
 - a feedback module to communicate information between the personal communicator and the living subject in a discreet manner that is substantially undetectable by other living subjects.
2. The personal communicator of claim 1, wherein the feedback module comprises a communication circuit that employs a visual communication technique.
3. The personal communicator of claim 1, wherein the feedback module comprises a communication circuit that employs an audio communication technique.
4. The personal communicator of claim 1, wherein the feedback module comprises a communication circuit that employs vibratory/tactile communication technique.
5. The personal communicator of claim 1, wherein the feedback module comprises a communication circuit that employs an olfactory communication technique.
6. The personal communicator of claim 1, wherein the feedback module comprises a communication circuit that employs a taste technique.
7. The personal communicator of claim 1, comprising:
 - a personal monitoring portion comprising at least one sensor to detect at least one distinct physiological parameter.
8. The personal communicator of claim 1, comprising:
 - a communication module to at least one of transmit to and receive from an external local node.
9. The personal communicator of claim 1, comprising:
 - an accelerometer to detect at least one physical aspect of the personal communicator.

10. A personal communication system, comprising:
 - a personal communicator to be worn by a living subject, the personal communicator comprising a feedback module to communicate information between the personal communicator and the living subject in a discreet manner that is substantially undetectable by other living subjects; and
 - an external local node to at least one of transmit communications to and receive communications from the personal communicator.
11. The personal communication system of claim 10, wherein the personal communicator comprises:
 - a physiological sensing module operative to sense physiological information from the subject.
12. The personal communication system of claim 10, wherein the personal communicator comprises:
 - a wireless communication module operative to at least one of communicate information from the personal communicator to the external local node and receive information from the external local node.
13. The personal communication system of claim 10, comprising:
 - a remote node to at least one of transmit communications to and receive communications from the external local node.
14. A method of communicating with a personal communicator, the method comprising:
 - generating by a feedback module a discreet communication detectable by a living subject, wherein the discreet communication is substantially undetectable by other living subjects.
15. The method of claim 14, comprising:
 - generating by the feedback module a visual communication.
16. The method of claim 14, comprising:
 - generating by the feedback module an audio communication.

17. The method of claim 14, comprising:
generating by the feedback module a vibratory/tactile communication.
18. The method of claim 14, comprising:
generating by the feedback module an olfactory communication.
19. The method of claim 14, comprising:
generating by the feedback module a taste communication.
20. The method of claim 14, comprising:
monitoring by at least one sensor at least one physiological parameter.
21. The method of claim 14, comprising:
communicating information to an external local node.
22. The method of claim 14, comprising:
detecting by an accelerometer at least one physical aspect of the personal communicator.

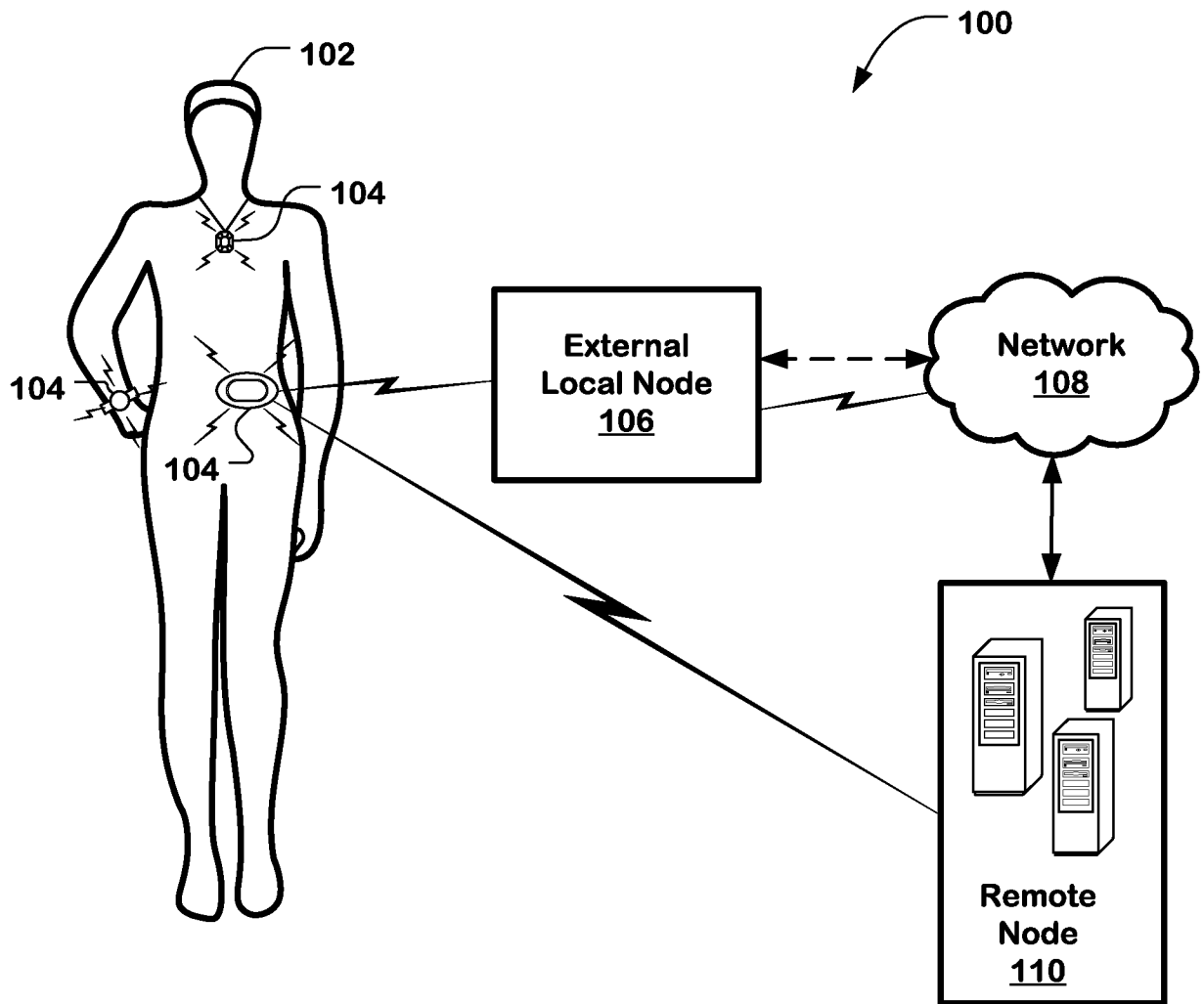


FIG. 1

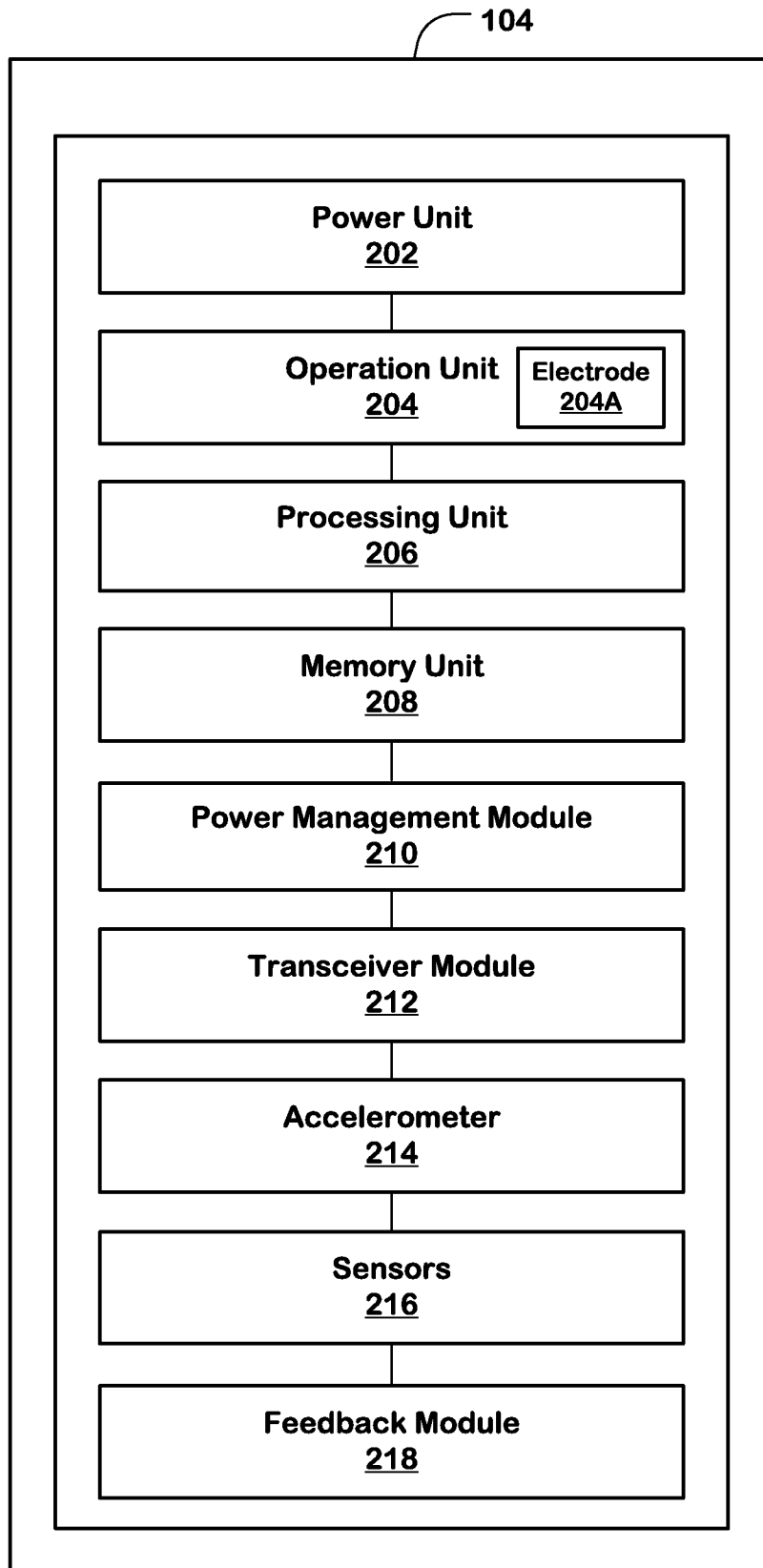


FIG. 2

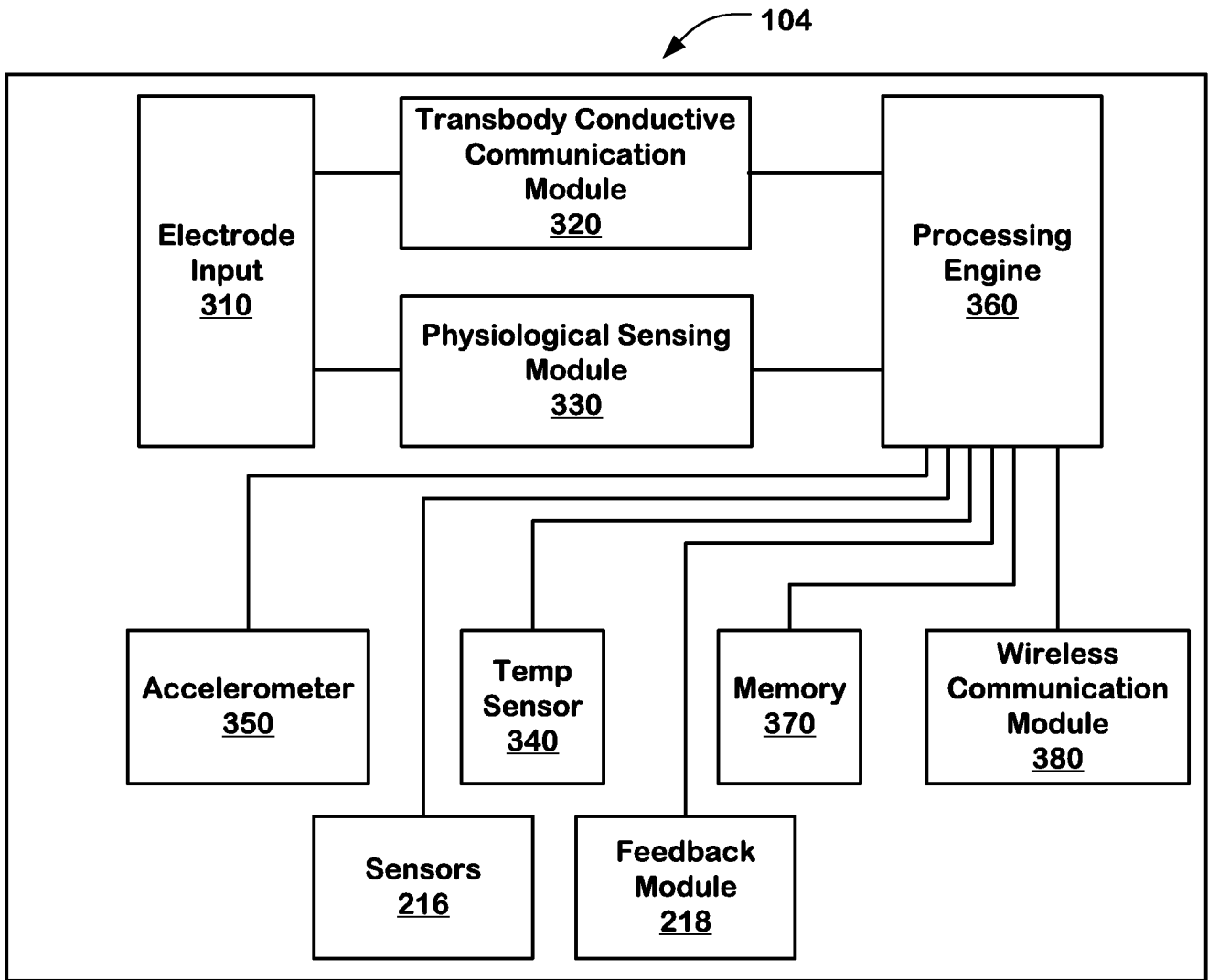


FIG. 3

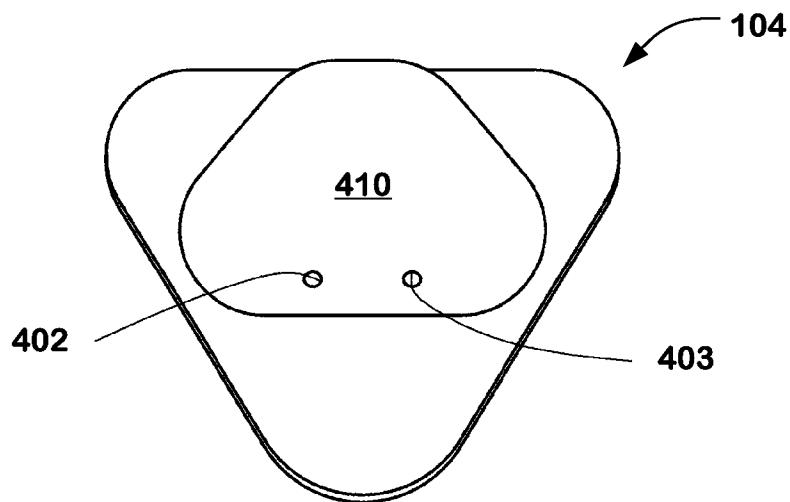


FIG. 4

A. CLASSIFICATION OF SUBJECT MATTER***H04B 13/02(2006.01)i, A61B 5/00(2006.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04B 13/02; H04B 13/00; G06Q 50/00; A61B 5/0402; A61B 5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: physiological, feedback, sensor, wearable

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2009-189570 A (NATIONAL INSTITUTE OF INFORMATION & COMMUNICATION TECHNOLOGY et al.) 27 August 2009 See the abstract, paragraphs [0012]-[0015], [0041]-[0043], and figures 1, 2, 8.	1-22
X	KR 10-2008-0040860 A (LG ELECTRONICS INC.) 09 May 2008 See the abstract, claims 1-5, and figure 1.	1-22
X	US 2008-0189134 A1 (BJORLIN et al.) 07 August 2008 See the abstract, claims 1, 5, and figure 1.	1-22
A	US 2008-0200774 A1 (LUO) 21 August 2008 See the abstract and claims 32-33.	1-22

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

25 MAY 2012 (25.05.2012)

Date of mailing of the international search report

29 MAY 2012 (29.05.2012)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsu-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

SOHN, Hyun-Woong

Telephone No. 82-42-481-5973



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/025061

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2009-189570 A	27.08.2009	None	
KR 10-2008-0040860 A	09.05.2008	None	
US 2008-0189134 A1	07.08.2008	CA 2599299 A1	23.08.2007
		EP 1993435 A2	26.11.2008
		KR 10-2008-0097331 A	05.11.2008
		US 7933781 B2	26.04.2011
		WO 2007-095128 A2	23.08.2007
		WO 2007-095128 A3	23.08.2007
		WO 2007-095128 B1	20.03.2008
US 2008-0200774 A1	21.08.2008	CN 101742981 A	16.06.2010
		WO 2008-098346 A1	21.08.2008