

that is adapted to communicate with one or more general-purpose communication networks. The communication interface module 2090 may, for example and without limitation, share various characteristics with previously discussed communication interface modules (e.g., the communication interface module 1790 of the exemplary mobile communication device 1700 illustrated in FIG. 17). The exemplary mobile communication device 2000 may also comprise a general communication processing module 2035 and a user interface module 2030, which may, for example, share various characteristics with analogous modules discussed previously.

[0110] The exemplary mobile communication device 2000 may also, for example and without limitation, comprise a cardiac information acquisition module 2010, various cardiac sensors (e.g., electrodes) 2020, 2022, 2024 and various cardiac information communication ports 2025, 2026. As discussed previously with regard to other exemplary communication devices, such modules or components may, for example, be utilized to acquire cardiac information (e.g., from a user of the mobile communication device 2000). Such modules and/or components are merely one illustration of a manner in which cardiac information may be acquired for analysis by the exemplary mobile communication device 2000.

[0111] The exemplary mobile communication device 2000 may additionally, for example, comprise a cardiac information-processing module 2050 (or analysis module). The processing module 2050 may process (e.g., analyze) cardiac information in any of a variety of manners. The following discussion will present various non-limiting examples of such processing. Note that in various exemplary scenarios, the cardiac information processed by the processing module 2050 might be stored in the memory 2040.

[0112] The following discussion will generally provide non-limiting illustrations of processing cardiac information in light of various cardiac pathologies. Such pathologies may, for example and without limitation, comprise various ischemic diseases, acute coronary syndrome (ischemic chest pain), acute myocardial infarction (heart attacks), arrhythmias tachyarrhythmias (fast rate disturbances), bradyarrhythmias (slow rate disturbances), etc. Although the following discussion generally provides illustrations of processing cardiac information in light of such pathologies, the scope of various aspects of the present invention should not be limited by characteristics of particular pathologies or pathologies in general. For example, various aspects of the present invention may apply equally to non-pathology cardiac areas. For example and without limitation, various aspects of the present invention may also apply to cardiac information related to general health monitoring, fetus monitoring, medication effectiveness monitoring, etc.

[0113] Cardiac signals may, for example, comprise a primary component (e.g., frequency component) and a variety of residual components (or harmonic components). The processing module 2050 may, for example, be adapted to analyze cardiac information by, at least in part, analyzing a primary component of a cardiac signal. For example, the processing module 2050 may be adapted to analyze the cardiac information by, at least in part, comparing a primary component characteristic of the cardiac signal to one or more primary component characteristics associated with a

known cardiac pathology. Such a primary component characteristic may, without limitation, comprise frequency, signal level, signal shape or statistical characteristics (e.g., medium value, mean value, variance, standard deviation, etc.).

[0114] The processing module 2050 may, for example, be adapted to process current cardiac information and previous cardiac information (e.g., generally corresponding to a first cardiac signal and at least a second cardiac signal). For example and without limitation, the processing module 2050 may be adapted to analyze cardiac information by determining a difference between a current cardiac signal (e.g., a primary component thereof) and at least one previous cardiac signal (e.g., a primary component thereof) and determining the existence of a cardiac pathology based, at least in part, on the determined difference. For example, the processing module 2050 may be adapted to determine the existence of a cardiac pathology by comparing the determined difference to at least one difference characteristic associated with a known cardiac pathology.

[0115] In a non-limiting exemplary scenario, the processing module 2050 may be adapted to compare changes in a cardiac signal to known pathologic patterns (e.g., ST-segment depression or ST-segment elevation). As mentioned previously, analysis of cardiac signal (or information) changes over time may comprise analyzing changes in heart rate or other heart characteristics (e.g., to monitor effectiveness of anti-arrhythmic medication, blood pressure medication or other medication).

[0116] The processing module 2050 may, for example, be adapted to process current and previous cardiac information corresponding to any of a variety of time intervals. For example and without limitation, the processing module 2050 may be adapted to determine short-term or long-term differences in a cardiac signal and to analyze such short-term or long-term differences.

[0117] The processing module 2050 may also, for example, be adapted to process more than two cardiac signals. For example and without limitation, the processing module 2050 may be adapted to analyze cardiac information by determining a trend between a current cardiac signal (e.g., a primary component thereof) and at least two previous cardiac signals (e.g., respective primary components thereof) and determining the existence of a cardiac pathology based, at least in part, on the determined trend. For example, the processing module 2050 may be adapted to determine the existence of a cardiac pathology by comparing the determined trend to at least one trend characteristic associated with a known cardiac pathology.

[0118] The processing module 2050 may also, for example, be adapted to analyze cardiac information by, at least part, analyzing one or more residual (or harmonic) components of a cardiac signal. For example, the processing module 2050 may be adapted to compare one or more residual component characteristics of the cardiac signal to one or more residual component characteristics associated with a known cardiac pathology. Such residual characteristics may, without limitation, comprise frequency, signal level, signal shape or statistical characteristics (e.g., median value, mean value, variance, standard deviation).

[0119] As mentioned previously, the processing module 2050 may, for example, be adapted to analyze cardiac information by, at least part, analyzing one or more residual (or harmonic) components of a cardiac signal. For example, the processing module 2050 may be adapted to compare one or more residual component characteristics of the cardiac signal to one or more residual component characteristics associated with a known cardiac pathology. Such residual characteristics may, without limitation, comprise frequency, signal level, signal shape or statistical characteristics (e.g., median value, mean value, variance, standard deviation).

Apple Corp Exhibit 1005

Apple Inc. v. Apple Inc.

IPR2023-00950, U.S. Patent No. 10,076,257

cardiac information and previous cardiac information (e.g., generally corresponding to a first cardiac signal and at least a second cardiac signal). For example and without limitation, the processing module 2050 may be adapted to analyze cardiac information by determining a difference between a current cardiac signal (e.g., at least one residual component thereof) and at least one previous cardiac signal (e.g., at least one residual component thereof) and determining the existence of a cardiac pathology based, at least in part, on the determined difference. For example, the processing module 2050 may be adapted to determine the existence of a cardiac pathology by comparing the determined difference to at least one difference characteristic associated with a known cardiac pathology.

[0120] Also as mentioned previously, the processing module 2050 may, for example, be adapted to process more than two cardiac signals. For example and without limitation, the processing module 2050 may be adapted to analyze cardiac information by determining a trend between a current cardiac signal (e.g., at least one residual component thereof) and at least two previous cardiac signals (e.g., respective residual components thereof) and determining the existence of a cardiac pathology based, at least in part, on the determined trend. For example, the processing module 2050 may be adapted to determine the existence of a cardiac pathology by comparing the determined trend to at least one trend characteristic associated with a known cardiac pathology.

[0121] The processing module 2050 may, for example, be adapted to perform spectral analysis of various cardiac signals (or signals derived therefrom). For example and without limitation, the processing module 2050 may be adapted to perform spectral analysis on a cardiac signal by, at least in part, comparing the frequency spectrum of the cardiac signal (e.g., a primary component or residual components thereof) with a frequency spectrum associated with a known cardiac pathology. Further for example, the processing module 2050 may be adapted to determine a difference (or trend) between a current cardiac signal at least one previous cardiac signal, and determine the existence of a cardiac pathology based, at least in part, on spectral analysis of the determined difference (or trend).

[0122] As mentioned previously, various types of cardiac information may be obtained using audio monitoring or acoustical sensing (or detecting) devices. The processing module 2050 may, for example and without limitation, process such information to determine various cardiovascular characteristics. For example and without limitation, such characteristics may comprise characteristics relating to blood pressure, contractility, blood flow and turbulence, etc. As discussed previously, cardiac information may be acquired from any of a variety of sources. Such information (e.g., digital and/or analog signals) may be analyzed (e.g., by the processing module 2050) to determine any of a large variety of cardiac conditions. Accordingly, the scope of various analysis aspects of the present invention should not be limited by characteristics of cardiac information obtained from any particular source (e.g., an electrode source, audio monitoring source, etc.).

[0123] The previous analysis examples are merely exemplary, and accordingly, the scope of various aspects of the present invention should not be limited by characteristics of particular types of cardiac information processing.

[0124] In various non-limiting exemplary scenarios, the mobile communication device 2000 (e.g., the processing module 2050) may be adapted to generate (or initiate generation of) an alert message based, at least in part, on the cardiac information analysis. For example and without limitation, the alert message may comprise characteristics of an alert message directed to the user of the mobile communication device 2000. The processing module 2050 may, for example, utilize the user interface module 2030 to generate an output notification to the user. Also for example, the alert message may comprise characteristics of a notification communicated to a second communication system. The processing module 2050 may, for example, utilize the communication interface module 2090 and/or the general communication-processing module 2035 to communicate such a notification. The alert message may, for example, be communicated to any of a variety of destinations (e.g., a health care facility, a physician, an emergency care facility, an ambulance service, 911 service, police and fire departments, etc.).

[0125] The previous exemplary mobile communication device 2000 was presented to provide specific illustrations of various generally broader aspects of the present invention. Various aspects of the present invention may also be applied to other electronic devices. For example and without limitation, a general-purpose computer may be adapted to process cardiac information.

[0126] FIG. 21 is a block diagram illustrating various portions of an exemplary computer system 2100, in accordance with various aspects of the present invention. The exemplary computer system 2100 may, for example and without limitation, share various characteristics with the exemplary computer system 1800 illustrated in FIG. 18 and discussed previously. The exemplary computer system 2100 may, for example, comprise various interfaces to a general-purpose computer user interface device (various examples of which were presented previously). Such interfaces may, for example and without limitation, comprise a source of cardiac information, which may be analyzed by the cardiac information-processing module 2150.

[0127] The following discussion will generally be directed to the cardiac information-processing module 2150 of the exemplary computer system 2100. The cardiac information processing module 2150 of the exemplary computer system 2100 may, for example and without limitation, share various characteristics with the cardiac information processing module 2050 of the mobile communication system 2000 illustrated in FIG. 20 and discussed previously. The processing module 2150 may, for example, be adapted to analyze cardiac information obtained from a user of the computer system 2100 (e.g., acquired by the cardiac information acquisition module 2110).

[0128] As discussed previously with regard to the mobile communication device 2000 illustrated in FIG. 20, the processing module 2150 may, for example, be adapted to analyze cardiac information by, at least in part, analyzing a primary component of a cardiac signal. For example, the processing module 2150 may be adapted to analyze the cardiac information by comparing at least one primary component characteristic of a cardiac signal to one or more primary component characteristics associated with known cardiac pathology.

[0129] Also as discussed previously with regard to the mobile communication device 2000 illustrated in FIG. 20, the processing module 2150 may, for example, be adapted to analyze cardiac information by, at least in part, analyzing a residual component of a cardiac signal or plurality of such signals. For example, the processing module 2150 may be adapted to analyze the cardiac information by comparing at least one residual component characteristic of a cardiac signal (or plurality of such signals) to one or more residual component characteristics associated with a known cardiac pathology.

[0130] Additionally as discussed previously with regard to the mobile communication device 2000 illustrated in FIG. 20, the processing module 2150 may, for example, be adapted to analyze cardiac information by, at least in part, performing spectral analysis on a cardiac signal. Also for example, the processing module 2150 may be adapted to perform such spectral analysis with a plurality of signals. For example and without limitation, the processing module 2150 may be adapted to analyze the cardiac information by determining a difference between a current cardiac signal at least one previous cardiac signal, and determining the existence of a cardiac pathology based, at least in part, on spectral analysis of the determined difference.

[0131] Still further as discussed previously, the computer system 2100 (e.g., the processing module 2150 and various other modules of the computer system) may be adapted to generate an alert message based, at least in part, on cardiac information analysis performed by the processing module 2150.

[0132] FIG. 22 is a block diagram illustrating an exemplary method 2200, in a mobile communication device (or computing system), for analyzing cardiac information of a user, in accordance with various aspects of the present invention. The exemplary method 2200 may, for example and without limitation, share various functional characteristics with the exemplary mobile communication device 2000 and computer system 2100 illustrated in FIGS. 20-21 and discussed previously.

[0133] The exemplary method 2200 may begin executing for any of variety of reasons, some of which were discussed previously with regard to various mobile communication devices and computer systems. The exemplary method 2200 may, at step 2220, comprise acquiring user cardiac information (e.g., from a user of a mobile communication device or general-purpose computer user interface device). Such acquisition was generally discussed previously with regard to various mobile communication devices and computer systems (e.g., various cardiac information acquisition modules and various related modules).

[0134] The exemplary method 2200 may, at step 2230, comprise performing various additional functions related to the cardiac information acquired at step 2220. For example and without limitation, step 2232 may comprise analyzing at least a portion of acquired cardiac information. Various characteristics of such analysis were discussed previously and will also be discussed later. Step 2232 may, for example and without limitation, share various functional characteristics with the processing modules 2050, 2150 of the exemplary mobile communication device 2000 and computer system 2100 illustrated in FIGS. 20-21 and discussed previously.

[0135] Also for example, step 2234 may comprise storing at least a portion of acquired cardiac information in a memory. Non-limiting examples of such storage were discussed previously with regard to the cardiac information acquisition module 1710 and memory 1740 of the exemplary MCD 1700 of FIG. 17. Further for example, step 2236 may comprise interfacing with a user regarding the acquired cardiac information. Non-limiting examples of such user interaction were discussed previously with regard to the cardiac information acquisition module 1710 and the U/I module 1730 of the exemplary MCD 1700 of FIG. 17. Still further for example, step 2238 may comprise communicating acquired user cardiac information with other communication systems. Various characteristics of such communication will be discussed later.

[0136] The exemplary method 2200 may, at step 2240, comprise performing any of a variety of types of continued processing. Such continued processing may, for example, comprise acquiring, communicating and/or analyzing additional cardiac or user information. Various non-limiting examples of such continued processing were presented previously and will also be presented later.

[0137] FIG. 23 is a block diagram illustrating various portions of an exemplary mobile communication device 2300, in accordance with various aspects of the present invention. The exemplary mobile communication device 2300 may, for example and without limitation, share various characteristics with the exemplary mobile communication devices (and portions thereof) illustrated in any of FIGS. 1-22 and discussed previously. For example, the mobile communication device 2300 may comprise characteristics of any of a variety of types of mobile communication devices.

[0138] The exemplary mobile communication device 2300 may comprise a communication interface module 2390 that is adapted to communicate with one or more general-purpose mobile communication networks. The communication interface module 2390 may, for example and without limitation, share various characteristics with previously discussed communication interface modules. The exemplary mobile communication device 2300 may also comprise a general communication processing module 2335 and a user interface module 2330, which may, for example, share various characteristics with analogous modules discussed previously.

[0139] The exemplary mobile communication device 2300 may also, for example and without limitation, comprise a cardiac information acquisition module 2310 and/or cardiac information processing module 2350, various cardiac sensors (e.g., electrodes or acoustical sensors) 2320, 2322, 2324 and various cardiac communication ports 2325, 2326. As discussed previously with regard to other exemplary communication devices, such modules or components may, for example, be utilized to acquire and/or process (e.g., analyze) cardiac information (e.g., from a user of the mobile communication device 2300). Such modules and/or components are merely one illustration of a manner in which cardiac information may be acquired for analysis by the exemplary mobile communication device 2300.

[0140] The exemplary mobile communication device 2300 may additionally, for example, comprise a cardiac information communication module 2360 (e.g., a CCM). The CCM 2360 may comprise a communication module for communicating cardiac information with a remote device, such as a computer system 2100, a mobile communication device 2000, or a server 2120. The CCM 2360 may also be adapted to receive cardiac information from a remote device, such as a computer system 2100, a mobile communication device 2000, or a server 2120.

AliveCor, Inc. Exhibit 1005

Apple Inc.

IPR2023-00950, U.S. Patent No. 10,076,257

a variety of manners. The following discussion will present various non-limiting examples of such communication. Note that in various exemplary scenarios, the cardiac information communicated by the CICM 2360 may be stored in the memory 2340.

[0141] The CICM 2360 may be adapted to communicate cardiac information over (at least in part) a general-purpose communication network (e.g., a mobile communication network). For example, the CICM 2360 may be adapted to utilize the communication interface module(s) 2390 (and/or the general communication processing module 2335) to perform such communication.

[0142] The CICM 2360 may be adapted to determine when to communicate cardiac information. For example and without limitation, the CICM 2360 may be adapted to initiate communication of the cardiac information or may be adapted to respond to an initiating request/command from another source (e.g., from a user of the mobile communication device 2300 or from another communication device). For example, the CICM 2360 may be adapted to communicate the cardiac information in response to a user request (or command) received through the user interface module 2330. Further for example, the CICM 2360 may be adapted to communicate the cardiac information in response to a request (or command) received from another communication device through the communication interface module 2390.

[0143] The CICM 2360 may, for example, be adapted to communicate cardiac information in response to the acquisition of cardiac information (e.g., cardiac information obtained by the cardiac information acquisition module 2310). For example, the CICM 2360 may be adapted to immediately communicate acquired cardiac information to another system in real-time or in a time-delayed manner.

[0144] Further for example, the CICM 2360 may be adapted to communicate cardiac information in response to analysis of cardiac information (e.g., analysis performed by the cardiac information processing module 2350). In a non-limiting exemplary scenario, the CICM 2360 may be adapted to communicate cardiac information in response to particular analysis results (e.g., exceeding a particular level of health concern). For example, the CICM 2360 may be adapted to automatically and immediately communicate cardiac information when analysis results are indicative of a relatively dangerous health condition. Also for example, the CICM 2360 may be adapted to periodically (e.g., daily) communicate cardiac information when analysis results are indicative of a relatively moderate alert level. Further for example, the CICM 2360 may be adapted to not communicate cardiac information when analysis results are indicative of a relatively normal or safe cardiac condition.

[0145] The CICM 2360 may, for example, be adapted to communicate cardiac information based, at least in part, on a profile comprising information indicating when (and/or how) such communication should occur. For example and without limitation, such a profile may comprise information indicating various conditions under which cardiac information should be communicated (e.g., timing conditions, analysis result conditions, user interaction conditions, etc.).

[0146] In general, the CICM 2360 may be adapted to communicate cardiac information in response to any of a

variety of causes or conditions. Accordingly, the scope of various aspects of the present invention should not be limited by characteristics of any particular causes or conditions.

[0147] The CICM 2360 may be adapted to communicate any of a variety of types of cardiac information. For example, the CICM 2360 may be adapted to communicate cardiac information acquired from a user of the mobile communication device 2300 (e.g., in real-time or stored cardiac information). Also for example, the CICM 2360 may be adapted to communicate cardiac information acquired by the mobile communication device 2300 during a plurality of cardiac information acquisition events (or acquisition periods). The CICM 2360 may, for example, be adapted to communicate all or a portion of acquired cardiac information. The CICM 2360 may also, for example, be adapted to communicate a summary of acquired cardiac information and/or analysis results of acquired cardiac information. Such summary or analysis results may, for example, comprise a summary or analysis results corresponding to a single event of cardiac information acquisition or a plurality of such events spaced in time. Communicated cardiac information may comprise various other types of information (e.g., location information (e.g., obtained through GPS, cell triangulation, UWB, network location, etc.), user identification information, care provider information, medical history information, insurance information, contact information, etc.). The scope of various aspects of the present invention should not be limited by characteristics of particular types of cardiac or cardiac-related information that might be communicated.

[0148] The CICM 2360 may be adapted to communicate the cardiac information in any of a variety of manners (e.g., utilizing the communication interface module 2390 and/or general communication processing module 2335). For example and without limitation, the CICM 2360 may be adapted to communicate the cardiac information through a cellular telephone network. Also for example, the CICM 2360 may be adapted to communicate the cardiac information through a computer network (e.g., a PAN, LAN, WAN, MAN, the Internet, etc.). Further for example, the CICM 2360 may be adapted to communicate the cardiac information through a television network, telephone network, and/or a satellite communication network.

[0149] The CICM 2360 may be adapted to communicate the cardiac information utilizing any of a variety of communication protocols. For example and without limitation, the CICM 2360 may be adapted to communicate the cardiac information (e.g., through the communication interface module 2390) utilizing a cellular telephone protocol (e.g., GSM, EDGE, CDMA, WCDMA, etc.). Also for example, the CICM 2360 may be adapted to communicate the cardiac information (e.g., through the communication interface module 2390) utilizing a computer communication protocol (e.g., Bluetooth, IEEE 802.11, UltraWideBand, IEEE 802.15, Ethernet, Token Ring, USB, FireWire, etc.). Further for example, the CICM 2360 may be adapted to communicate the cardiac information utilizing a communication protocol (or a portion thereof) that is customized for the communication of cardiac or health-related information. The scope of various aspects of the present invention should not be limited by characteristics of any particular communication

communicating cardiac information (e.g., communication network characteristics or communication protocol characteristics).

[0150] The CICM 2360 may, for example, be adapted to interact with a user of the mobile communication device 2300 regarding the communication of cardiac information in any of a variety of manners. For example, the CICM 2360 may be adapted to communicate the cardiac information without any interaction (e.g., real-time interaction) with the user. In such an exemplary scenario, a user might not be aware that such communication is occurring. Also for example, the CICM 2360 may be adapted to interact with a user regarding the communication of cardiac information (e.g., notifying the user of the communication and/or verifying with the user that the communication of such information should proceed). The scope of various aspects of the present invention should not be limited by characteristics of any particular type of user interaction or the existence of non-existence of such user interaction.

[0151] The CICM 2360 may be adapted to communicate the cardiac information to any of a variety of destinations. For example and without limitation, the CICM 2360 may be adapted to communicate the cardiac information to a destination associated with medical care (e.g., a care facility, hospital room, emergency room, physician, etc.). Also for example, the CICM 2360 may be adapted to communicate the cardiac information to a destination associated with emergency assistance (e.g., “911,” ambulance service, police department, fire department, paramedics, etc.). Further for example, the CICM 2360 may be adapted to communicate the cardiac information to a destination (e.g., a virtual cardiac service) comprising an organization dedicated to handling such cardiac information. Still further for example, the CICM 2360 may be adapted to communicate the cardiac information to other destinations that may have an interest in such information (e.g., insurers, employers, personal assistants, particular family members, etc.).

[0152] The destination(s) for communicated cardiac information may be specified by a user (e.g., in a communication profile established by the user). Note that in various exemplary scenarios, the communication of cardiac information may be governed by personal privacy considerations. For example, the communication of various types of cardiac information may be governed by the Health Information Protection Act (“HIPA”). In other exemplary scenarios, the CICM 2360 may be adapted to encrypt, or otherwise securely communicate, various types of cardiac or personal information. In still other exemplary scenarios, the CICM 2360 may be adapted to disassociate communicated cardiac information from a particular user’s identity. The scope of various aspects of the present invention should not be limited by characteristics of any particular destination for communicated cardiac or cardiac-related information.

[0153] The CICM 2360 may be adapted to perform any of a variety of additional functions (e.g., functions that may be logically associated with the communication of cardiac information). For example and without limitation, the CICM 2360 may be adapted to establish and maintain a communication link over which the user may communicate to various entities regarding communicated cardiac information. Also for example, the CICM 2360 may be adapted to obtain additional information from the user (e.g., from the

memory 2340 or through the user interface module 2330). Further for example, the CICM 2360 may be adapted to obtain instructions for the user (e.g., behavior instructions) and present such obtained instructions to the user (e.g., utilizing the user interface module 2330). The scope of various aspects of the present invention should not be limited by characteristics of any particular additional functions related to the communication of cardiac information that might be performed.

[0154] The previous exemplary mobile communication device 2300 was presented to provide specific illustrations of various generally broader aspects of the present invention. Various aspects of the present invention may be applied to other electronic devices. For example and without limitation, a general-purpose computer may be adapted to communicate cardiac information.

[0155] FIG. 24 is a block diagram illustrating various portions of an exemplary computer system 2400, in accordance with various aspects of the present invention. The exemplary computer system 2400 may, for example and without limitation, share various characteristics with exemplary computer systems and/or associated components discussed previously and illustrated in any of FIGS. 1-23. The exemplary computer system 2400 may, for example comprise various interfaces to a general-purpose computer user interface device (various examples of which were presented previously). Such interfaces may, for example and without limitation, comprise a source of cardiac information, which may be communicated by the cardiac information communication module 2460 (“CICM”). Such interfaces may also, for example, comprise a source of cardiac information, which may be processed by the exemplary computer system 2400 (e.g., by the cardiac information processing module 2450), resulting in related cardiac information, which may be communicated by the CICM 2460.

[0156] The exemplary computer system 2400 may comprise characteristics of any of a variety of types of computer systems. For example and without limitation, the exemplary computer system 2400 may comprise characteristics of a mobile computer and/or a desktop computer. Also for example, the computer system 2400 may comprise characteristics of a laptop computer, notebook computer and/or handheld computer.

[0157] The following discussion will generally be directed to the CICM 2460 of the exemplary computer system 2400. The CICM 2460 of the exemplary computer system 2400 may, for example and without limitation, share various characteristics with the CICM 2360 of the mobile communication device 2300 illustrated in FIG. 23 and discussed previously. The CICM 2460 may, for example, be adapted to communicate cardiac information obtained from a user of the computer system 2400. Also for example, the CICM 2460 may be adapted to communicate a summary of cardiac information obtained from the user and/or results of analysis of cardiac information obtained from the user (e.g., as performed by the cardiac information processing module 2450).

[0158] As discussed previously with regard to the CICM 2360 of the exemplary mobile communication device 2300 illustrated in FIG. 23, the CICM 2460 may, for example, be adapted to communicate cardiac information obtained from a user of the computer system 2400. Also for example, the CICM 2460 may be adapted to communicate a summary of cardiac information obtained from the user and/or results of analysis of cardiac information obtained from the user (e.g., as performed by the cardiac information processing module 2450).

Apple Cor. Inc. Exhibit 1005

US Patent No. 10,076,257
 IPR2023-002300

communication network. Such cardiac information may, for example, be obtained through the cardiac information acquisition module **2410** and communicated utilizing the communication interface module **2490**.

[**0159**] As discussed previously with regard to the CICM **2360** of the exemplary mobile communication device **2300** illustrated in FIG. **23**, the CICM **2460** may, for example, be adapted to initiate communication of the cardiac information in response to an initiating request (or command) from another entity (e.g., a user or another communication system). The CICM **2460** may also, for example, be adapted to initiate communication of the cardiac information in response to analysis of the cardiac information.

[**0160**] Also for example, the cardiac information may comprise characteristics of any of a variety of cardiac or cardiac-related information. For example, the cardiac information may comprise raw or processed cardiac data, cardiac information analysis results, user identification information, location information, care provider information, physician information, medical history information, insurance information, etc.

[**0161**] As discussed previously with regard to the CICM **2360** of the mobile communication device **2300** illustrated in FIG. **23**, the CICM **2460** may be adapted to communicate the cardiac information in any of a variety of manners. For example and without limitation, the CICM **2460** may be adapted to communicate the cardiac information through any of a variety of communication networks and utilizing any of a variety of communication protocols (e.g., standard, proprietary, customized, etc.).

[**0162**] Also as discussed previously with regard to the CICM **2360** of the mobile communication device **2300** illustrated in FIG. **23**, the CICM **2460** may be adapted to interact with a user in any of a variety of manners. For example and without limitation, the CICM **2460** may be adapted to communicate with a user (e.g., utilizing the user interface module **2430**) regarding the communication of the cardiac information, the results of such communication, information received in response to such a communication (e.g., user behavior instructions), etc.

[**0163**] FIG. **25** is a block diagram illustrating an exemplary method **2500**, in a mobile communication device (or computing system), for analyzing cardiac information of a user, in accordance with various aspects of the present invention. The exemplary method **2500** may, for example and without limitation, share various functional characteristics with the exemplary mobile communication device **2300** and computer system **2400** illustrated in FIGS. **23-24** and discussed previously.

[**0164**] The exemplary method **2500** may start at **2510** for any of variety of reasons, some of which were discussed previously with regard to various mobile communication devices and computer systems. The exemplary method **2500** may, at step **2520**, comprise acquiring user cardiac information (e.g., from a user of a mobile communication device or general-purpose computer user interface device). Such acquisition was generally discussed previously with regard to various mobile communication devices and computer systems (e.g., various cardiac information acquisition modules and various related modules).

[**0165**] The exemplary method **2500** may, at step **2530**, comprise performing various additional functions related to

the cardiac information acquired at step **2520**. For example and without limitation, step **2538** may comprise communicating at least a portion of acquired cardiac information (or information resulting from analysis thereof). Various characteristics of such analysis will be discussed later. Step **2538** may, for example and without limitation, share various functional characteristics with the cardiac information communication modules **2360**, **2460** of the exemplary mobile communication device **2300** and computer system **2400** illustrated in FIGS. **23-24** and discussed previously.

[**0166**] Also for example, step **2534** may comprise storing at least a portion of acquired cardiac information in a memory. Non-limiting examples of such storage were discussed previously with regard to the cardiac information acquisition module **1710** and memory **1740** of the exemplary MCD of FIG. **17**. Further for example, step **2536** may comprise interfacing with a user regarding the acquired cardiac information. Non-limiting examples of such user interaction were discussed previously with regard to the cardiac information acquisition module **1710** and the U/I module **1730** of the exemplary MCD of FIG. **17**. Still further for example, step **2536** may comprise analyzing acquired user cardiac information. Non-limiting examples of such analysis were discussed previously with regard to the cardiac information processing modules **2050**, **2150** of the exemplary mobile communication device **2000** and computer system **2100** illustrated in FIGS. **20-21**.

[**0167**] The exemplary method **2500** may, at step **2540**, comprise performing any of a variety of continued processing. Such continued processing may, for example, comprise acquiring, communicating and/or analyzing additional cardiac information. Various non-limiting examples of such continued processing were presented previously.

[**0168**] FIG. **26** is a block diagram illustrating an exemplary method **2600**, in an electronic device, for communicating cardiac information, in accordance with various aspects of the present invention. The exemplary method **2600** may, for example and without limitation, share various characteristics with exemplary methods illustrated in any of FIGS. **1-25** and discussed previously.

[**0169**] The exemplary method **2600** may be implemented in any of a large variety of electronic devices (e.g., electronic devices that are not normally associated with user health activities). For example and without limitation, such an electronic device may comprise characteristics of various general-purpose communication devices, computing devices, entertainment devices, audio/visual devices, standard household devices, etc. Also for example, such electronic devices might not generally include electronic devices substantially dedicated to health-monitoring, such as might typically be found in health care facilities, health clubs, etc. During such use, the exemplary method **2600** may advantageously and without limitation provide for monitoring of user health when such health is not on the user's mind. In other words, the exemplary method **2600** may, among other things, provide for monitoring user health without interrupting a user's normal routine. As a non-limiting example, the exemplary method **2600** may provide for monitoring user health during work or commuting, rather than solely during exercise or focused medical activities.

AliveCor Exhibit 1005

[**0170**] The exemplary method **2600** may begin, executing at step **2610** for any of a variety of reasons, some of which were discussed previously with regard to various mobile communication devices and computer systems. The exemplary method **2600** may, at step **2610**, comprise acquiring user cardiac information (e.g., from a user of a mobile communication device or general-purpose computer user interface device). Such acquisition was generally discussed previously with regard to various mobile communication devices and computer systems (e.g., various cardiac information acquisition modules and various related modules).

exemplary method 2600 may, at step 2620, comprise acquiring health-related information from a user of the electronic device implementing the exemplary method 2600. For example, the exemplary method 2600 may, at step 2622, comprise performing normal operation of the electronic device, where such normal use is not generally associated with user health.

[0171] The exemplary method 2600 may then, at step 2624, comprise, while performing normal operation at step 2622, acquiring health-related information of a user of the electronic device. Step 2624 may comprise acquiring such health-related information in any of a variety of manners. For example and without limitation, step 2624 may comprise monitoring cardiac activity of the user, monitoring electrical characteristics of the user, monitoring audio characteristics of the user, monitoring visual characteristics of the user, etc. For example and without limitation, step 2624 may comprise performing such acquisition substantially without the user's awareness that such acquisition is occurring. Though not necessary, such covert health information acquisition may advantageously provide for an accurate representation of a user's normal state of health (e.g., avoiding white jacket syndrome and other effects associated with utilizing dedicated health equipment or working directly with health care professionals). Many non-limiting exemplary characteristics of such information acquisition were presented previously.

[0172] The exemplary method 2600 may, at step 2630, comprise performing any of a variety of activities related to the information acquired at step 2620. For example, step 2632 may comprise analyzing the acquired health information, step 2634 may comprise storing acquired health information (e.g., for longer than a transient period), step 2636 may comprise interfacing with the user regarding acquired health information, and step 2628 may comprise communicating acquired health information to another electronic device or system. Many non-limiting exemplary characteristics of such analysis, storage, user interfacing and communicating were presented previously.

[0173] FIG. 27 is a block diagram illustrating various portions of an exemplary electronic device 2700, in accordance with various aspects of the present invention. The exemplary electronic device 2700 may, for example and without limitation, share various characteristics with the exemplary mobile communication devices (or portions thereof) or computer systems (or portions thereof) illustrated in any of FIGS. 1-25 and discussed previously. Additionally, the exemplary electronic device 2700 may share various functional characteristics with the exemplary method 2600 illustrated in FIG. 26 and discussed previously.

[0174] The exemplary electronic device 2700 may comprise characteristics of any of a large variety of electronic devices (e.g., electronic devices that are not normally associated with user health activities). For example and without limitation, the electronic device 2700 may comprise characteristics of communication devices, computing devices, entertainment devices, audio/visual devices, standard household devices, etc. Also for example, the electronic device might generally not include electronic devices substantially dedicated to health-monitoring, such as might typically be found in health care facilities, health clubs, etc.

[0175] The exemplary electronic device 2700 may comprise one or more general-purpose utilization modules 2735 that the electronic device 2700 utilizes for its normal non-

health-related operation. The exemplary electronic device 2700 may also comprise a health information acquisition module 2710. The acquisition module 2710 may, for example and without limitation, share various functional characteristics with step 2620 of the exemplary method 2600 illustrated in FIG. 26 and discussed previously.

[0176] The acquisition module 2710 may, for example, be adapted to (e.g., while the general-purpose utilization module(s) 2735 is operating normally) acquire health-related information of a user of the electronic device 2700. The acquisition module 2710 may be adapted to acquire such health-related information in any of a variety of manners. For example and without limitation, the acquisition module 2710 may be adapted to monitor cardiac activity of the user, monitor electrical characteristics of the user, monitor audio characteristics of the user, monitor visual characteristics of the user, monitor temperature characteristics of the user, etc. For example, the acquisition module 2710 may be adapted to utilize any of a variety of sensors 2720 (and/or communication ports) for such acquisition. For example and without limitation, the acquisition module 2710 may be adapted to perform such acquisition substantially without the user's awareness that such acquisition is occurring. Many non-limiting exemplary characteristics of such information acquisition were presented previously.

[0177] The exemplary electronic device 2700 may also comprise any of a variety of modules to perform additional activities corresponding to acquired health-related information. For example, the exemplary electronic device 2700 may comprise any of: a health-information processing module 2750 adapted to analyze acquired health information, a memory 2740 adapted to store acquired health information (e.g., for longer than a transient period), a user interface module 2730 adapted to interface with a user regarding acquired health information, and a health-information communication module 2760 adapted to communicate acquired and/or analyzed health information to another electronic device or system (e.g., utilizing dedicated communication circuitry or utilizing communication circuitry inherent in the electronic device 2700). Many non-limiting exemplary characteristics of such analysis, storage, user interfacing and communicating were presented previously.

[0178] Various aspects of the present invention may be implemented in various degrees of integration. For example, various modules may be integrated in an independent integrated circuit or may be integrated into other integrated circuits. For example and without limitation, various modules discussed herein may be integrated into a baseband processor chip or controller chip. Accordingly, the scope of various aspects of the present invention should not be limited by characteristics of any particular degree of integration.

[0179] Various aspects of the present invention were illustrated by referring to various functional modules. It should be noted that such modules may be implemented in hardware, software or a combination thereof. Additionally, various modules may share various submodules or subcomponents. For example, a first module and a second module may share a particular hardware component or software submodule. Accordingly, the scope of various aspects of the present invention should not be limited by characteristics of any particular type of module or by any arbitrary boundary between modules.

AliveCor Exhibit 1005

[0180] Further, various functional modules have been described herein utilizing the same reference numerals as those used in the drawings. U.S. Patent No. 10,076,257

when referring to functionality that the various functional modules might perform when operational. Thus, the phrase “adapted to”, as used herein, is generally synonymous with “capable of”, “operational to” and “configured to”.

[0181] While the invention has been described with reference to certain aspects and embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from its scope. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A general-purpose mobile communication device (“MCD”) comprising:

a communication interface module adapted to communicate with a general-purpose communication network; and

at least one module operational to acquire cardiac information from a user of the general-purpose mobile communication device, while the user is utilizing the mobile communication device for general communication.

2. The general-purpose mobile communication device of claim 1, wherein the MCD comprises a general-purpose cellular telephone.

3. The general-purpose mobile communication device of claim 1, wherein the MCD comprises a general-purpose mobile e-mail device.

4. The general-purpose mobile communication device of claim 1, wherein the MCD comprises:

a first electrode coupled to the at least one module; and

a second electrode coupled to the at least one module; and

wherein the at least one module is further operational to detect cardiac activity of a user of the MCD that is conductively coupled to the first and second electrodes.

5. The general-purpose mobile communication device of claim 1, wherein the at least one module is operational to interface with a cardiac sensor disposed on the MCD.

6. The general-purpose mobile communication device of claim 1, wherein the at least one module is operational to interface with a cardiac sensor separate from the MCD.

7. The general-purpose mobile communication device of claim 1, wherein the at least one module is operational to:

detect use of the MCD; and

acquire cardiac information from a user of the MCD in response to detecting use of the MCD.

8. The general-purpose mobile communication device of claim 1, wherein the at least one module is operational to periodically acquire cardiac information from a user of the MCD.

9. The general-purpose mobile communication device of claim 1, wherein the at least one module is operational to acquire cardiac information from a user of the MCD in response to a command from the user for the MCD to acquire the cardiac information.

10. The general-purpose mobile communication device of claim 1, wherein the at least one module is operational to present information related to acquired cardiac information to a user of the MCD.

11. The general-purpose mobile communication device of claim 1, wherein the at least one module is further operational to analyze at least a portion of cardiac information acquired from a user of the MCD.

12. The general-purpose mobile communication device of claim 11, wherein the at least one module is operational to analyze the acquired cardiac information by, at least in part, comparing a primary component of a cardiac signal to a primary component characteristic associated with a known cardiac pathology.

13. The general-purpose mobile communication device of claim 11, wherein the at least one module is operational to analyze the acquired cardiac information by, at least in part:

determining a difference between a current cardiac signal and at least one previous cardiac signal; and

determining the existence of a cardiac pathology based, at least in part, on the determined difference.

14. The general-purpose mobile communication device of claim 11, wherein the at least one module is further operational to generate an alert message based, at least in part, on cardiac information acquired and analyzed by the at least one module.

15. The general-purpose mobile communication device of claim 1, wherein the at least one module is operational to communicate first information related to acquired cardiac information over the general-purpose communication network.

16. The general-purpose mobile communication device of claim 15, wherein the at least one module is operational to determine to communicate the first information in response to a request to communicate the first information.

17. The general-purpose mobile communication device of claim 15, wherein the first information comprises at least a portion of cardiac information acquired by the at least one module.

18. The general-purpose mobile communication device of claim 15, wherein the first information comprises information related to cardiac information acquired and analyzed by the at least one module.

19. The general-purpose mobile communication device of claim 15, wherein the at least one module is operational to communicate the first information with a destination associated with medical care.

20. A general-purpose mobile communication device (“MCD”) comprising:

a cardiac sensor disposed on the MCD; and

at least one module operational to:

communicate with a general-purpose communication network; and

utilize the cardiac sensor to acquire cardiac information from a user of the general-purpose mobile communication device.

21. The general-purpose mobile communication device of claim 20, wherein the cardiac sensor comprises a first electrode and a second electrode.

AliveCor Exhibit 1005

Apple Inc.

U.S. Patent No. 10,076,257

22. The general-purpose mobile communication device of claim 21, wherein the first electrode is disposed on a main body portion of the MCD.

23. The general-purpose mobile communication device of claim 21, wherein the first electrode is disposed on a user interface portion of the MCD.

24. The general-purpose mobile communication device of claim 21, wherein the first electrode comprises a conductive metal surface.

25. The general-purpose mobile communication device of claim 21, wherein the first electrode comprises a conductive plastic surface.

26. The general-purpose mobile communication device of claim 21, wherein the MCD further comprises an indicium identifying the location of the first electrode.

27. The general-purpose mobile communication device of claim 21, wherein the MCD comprises no indicium identifying the location of the first electrode.

28. In an electronic device, a method for monitoring health, the method comprising:

performing normal operation generally associated with the electronic device, where the normal operation is generally disassociated with user health-related activities;

while performing the normal operation, acquiring health-related information of a user of the electronic device.

29. The method of claim 28, wherein the electronic device comprises a cellular telephone.

30. The method of claim 28, wherein the electronic device comprises a mobile email device.

31. The method of claim 28, wherein the electronic device comprises a user interface device for a general-purpose computer.

* * * * *