A mobile device with local and remote services and applications for collecting, storing, analyzing and delivering health data to medical professionals and others. The mobile device communicatively connects to sensors attached to a body to collect health data and remote servers to send raw and massaged data for medical analysis. The mobile device also provides alerts and alarm messages based on the health sensor data.
Remote Applications & Services

701 Communication Service
702 Data Logging Service
703 Emergency Location Service
704 Scheduler Service
711 Medical Research Application
712 Emergency Response Application
713 Disease Tracker Application
714 Weather Reporter Application
715 Lifestyle Application

Fig. 7
Body condition data is received relating to a bodily condition of a user from body sensor(s) communicatively coupled to the mobile device.

Environmental data is received relating to an environmental condition from environmental sensor(s) communicatively coupled to the mobile device.

One or more processes are automatically initiated based on the body condition data and/or the environmental data.

Fig. 8
Base Station Subsystem (BSS) 900
Base Transceiver Station (BTS) 904
Base Station Controller (BSC) 902
Internal Frame Relay Network 910
Service Gateway Support Node (SGSN) 914
Internal Packet GGSN Network 920
GPRS Gateway Support Node (GGSN) 926
Fixed-End System (FES) or Internet 930
Boarder Gateway Router 934
Firewall 932
Corporate Network 940
Remote Authentication Dial-In User Service (RADIUS) Server 942
Public Land Mobile Network (PLMN) 945

Fig. 9
MOBILE DEVICES AS CENTERS FOR HEALTH INFORMATION, MONITORING AND SERVICES

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application Ser. No. 60/910,109 filed on Apr. 4, 2007 and entitled ADVANCEMENTS FOR WIRELESS DEVICES AND WIRELESS COMMUNICATIONS.

TECHNICAL FIELD

[0002] The subject invention relates generally to medical monitoring systems, and more particularly to personal devices for sampling, storing and transmitting health information for diagnostics and preventative health care.

BACKGROUND

[0003] Conventional health measuring and monitoring devices, such as heart rate monitors, are dedicated devices that are specific to a particular health issue, cumbersome to use and very expensive. Another drawback with such devices is the patient must come to the machine and remain for the time necessary for the machine to collect the health data. In most cases, a technician or nurse administers the test with the machine and provides the results to the doctor for analysis. Typically, the results are paper output by the machine. The interoffice delivery service must then deliver paper output to the doctor for analysis, a mechanism taking a considerable amount of time with the inherent risk of loss of data, all factors tending to raise the stress level and anxiety of the patient. This method of diagnosing problems relies on the patient exhibiting diagnosable symptoms during the testing period.

[0004] In some cases, such as cardiac monitoring, the patient can visit the doctor’s office and have a data logging device harnessed to their midsection. This provides for a longer data sample but the data logger is uncomfortable and the patient must return to doctor’s office to deliver the data logger after typically a twenty-four hour period. Although this method provides a larger data sample, it requires the same mechanism of data analysis and may miss the period where the patient exhibits diagnosable symptoms.

[0005] Although many illnesses and diseases are detectable by established tests, the medical profession regularly recommends annual visits as people age because the sooner a problem is detected the better the chance of a successful outcome. The mechanism behind this recommendation involves creating a baseline healthy individual database and a trend of the indicator parameters associated with a human organism. These parameters include such measurements as blood pressure, blood sugar level, red and white blood cell count, body weight, percent body fat composition, activity level, heart beat interval and regularity, brain activity and the like. Many of these properties change slowly over a period measured in years or decades and therefore are not easily observable on a daily basis.

[0006] The health care industry has realized the savings in both monetary value and quality of life in preventative health care and the information required to prevent initial symptoms from becoming a life threatening illness or disease. Today, the health care industry balances the preventative abilities against the cooperation of the individual and the sometime extreme cost of tests and medical visits to make a preventative diagnosis. However, there has been no historical sharing of individual health information. Neither has a service infrastructure developed leveraging health data information automatically to support a daily preventative healthcare system.

SUMMARY

[0007] The following presents a simplified summary in order to provide a basic understanding of some of the aspects described herein. This summary neither is an extensive overview nor intended to identify key or critical elements or to delineate the scope of the various aspects described herein. The sole purpose of the summary is to present some concepts in a simplified form as a prelude to the more detailed description presented later.

[0008] In one aspect, the invention includes a mobile device similar to today’s cellular telephone acting as a center for collecting health and lifestyle data and providing this data to other authorized individuals, such as health care professionals, for maintaining both good health and a healthy lifestyle. The invention includes a collection of applications and services allowing for the automated collection and analysis of an individual’s health data. The health data can be temporarily stored on the mobile device until a time appropriate for uploading to a remote system. After analysis, the remote system can download recommendations for changes or requests to schedule future office visits to the device and presented to the user.

[0009] In another aspect, the invention includes sensors for use by the mobile device in collecting the user’s health data. The user can have the sensors embedded in their body as a permanent installation or included in clothing, shoes, hats and jewelry as a wearable sensor net. The sensors can operate on both a wireless and wired technologies. Other sensors unrelated to parameters measured in the body but related to the health of the user, such as air quality can also be included in either the mobile device or the sensor net.

[0010] The invention has another aspect including the ability to communicate to other mobile devices in addition to communications with remote systems. The user can allow other users with compatible mobile devices to share the health information. For example, an elderly user can share their information with a relative as part of an ongoing caregiver arrangement. The communications between the mobile devices and between a mobile device and a remote system can be by a cellular network, a wireless network such as an 802.11 a/b/g/n specification, a “bluetooth” network or any other available network communications technology. The mobile device system and services provide security to prevent access to the user’s health information by any other than authorized individuals.

[0011] In another aspect of the invention, the mobile device may alert medical personnel of an imminent threat to the health of a user because of an analysis of data collected from the user. The user can also use the mobile device to subscribe to a medical study appropriate to the user and provide the user’s health information related to the study.

[0012] Another aspect of the invention provides the user guidance with respect to lifestyle choices. For example, the mobile device can monitor the user’s weight and daily level of activity and inform the user if either of these parameters varies outside of the user’s predefined requirements. The user receives the feedback necessary to correct a problem difficult to notice on a day-to-day basis.
To the accomplishment of the foregoing and related ends, certain illustrative aspects are described herein in connection with the following description and the annexed drawings. These aspects are indicative of various ways which can be practiced, all of which are intended to be covered herein. Other advantages and novel features may become apparent from the following detailed description when considered in conjunction with the drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 illustrates an exemplary non-limiting block diagram of embodiments of the invention in the context of mobile devices as centers for health information, monitoring and services.

FIG. 2 illustrates an embodiment of the sensors embedded in the user's body for collecting health data.

FIG. 3 illustrates an embodiment of the sensors attached to the user's clothing and jewelry for collecting health data.

FIG. 4 illustrates an embodiment of the health data information store component and the collections of health data stored therein.

FIG. 5 illustrates an embodiment of the local applications and services component and representative services and applications locally available to the user.

FIG. 6 illustrates an embodiment of the interfaces component and the hardware and software interfaces available to the mobile device for use by the user.

FIG. 7 illustrates an embodiment of the remote applications and services component and representative applications and services remotely available to the user.

FIG. 8 illustrates an embodiment of a method of automatically collecting and analyzing a user's health information.

FIG. 9 illustrates an overview of an exemplary, non-limiting network environment suitable for service by various embodiments.

FIG. 10 illustrates a block diagram of an exemplary, non-limiting operating environment in which various aspects described herein can function.

**DETAILED DESCRIPTION**

As mentioned in the background, there has been no historical sharing of health information, or services infrastructure that leverages such health data information automatically, among mobile devices and so health monitoring equipment remains ad hoc in the health industry.

In accordance with the invention, integration of health sensors into a mobile device ecosystem enables a host of services, algorithms and actions predicated on the sensor data for better personal information management and access to services that are of particular help to the owner of the mobile device, e.g., filtered or individually tailored for the mobile device user. For instance, with sensors attached to the human body that can communicate with the mobile device via wired or wireless protocols (e.g., Bluetooth), and/or with sensors embedded into the mobile device itself, the mobile device itself becomes a personal center of health information and services for the user of the mobile device.

FIG. 1 is an architectural overview of the intelligent personal health agent for a mobile device in accordance with the invention. Various health sensor data HSD 1 to HSD n (e.g., heart rate, stress levels, glucose levels) selected by a user is input to the user's mobile device 100. Other sensor data OSD 1 to OSD n may also be input to the device to provide a centralized health data information store 105 on mobile device 100. Mobile device 100 includes local applications and services 110 based on various subsets of the health and environmental data stored in information store 105. One such application can be a personal health advisor and intelligent agent 114 that manages the user's data and advises or takes action on behalf of the user in a way tailored for the user of the mobile device. Applications and services 110 may employ predictive algorithms that are based on the data of the health data information store 105, and operate to help the user prevent (e.g., the onset of a disease) or further encourage a future health result (e.g., weight loss).

A variety of communications, such as commands, requests, queries, data transmission, authentication, etc. may also take place, via interfaces 120 and one or more communications networks 130. A set of distributed or remote health applications and services that may have additional data 150, such as historical user data or aggregate user data trends across many users, for processing in connection with applications or services 140 carried out on behalf of the mobile device 100. This allows for hybrid processing for services too, taking advantage of a combination of local and remote computing capabilities with respect to processing, power, storage, etc. Applications or services 140 may also, in turn, communicate acknowledgements, results, commands, requests, etc. back to mobile device 140 as part of an ongoing dialog with the user about the user's health, as filtered via intelligent personal health agent 114.

For instance, if mobile device 100 determines, based on a collective state of health information in store 105 that the user is sick, action can be automatically taken to set up an appointment with an available doctor according to the needs of the user, financial or insurance resources can automatically be lined up for the user, or other automatic action can be taken. Representative, non-limiting sensor measurements by sensors HSD 1 to HSD n include heartbeat readings, blood pressure, emotion, stress, glucose levels, vitamin or medicine deficiency, birth control scheduling, and other illness specific symptoms identifiable by sensor measurements.

FIG. 2 depicts a user 201 with four embedded health sensors. The embedded health sensors collect readings of body variables and transmit them to the mobile health device 100. Embedded health sensor 202 represents a sensor for measuring blood toxins associated with kidney function. A user of this type of sensor requires dialysis to remove the toxins from their bloodstream because of insufficient kidney function. Typically, an individual in need of dialysis would have regularly scheduled visits to a treatment facility for a constant scheduled duration. An example of a dialysis schedule might be every Monday, Wednesday and Friday for four hours on each visit. The dialysis center does not vary the amount of treatment needed at each visit because there is no data available to determine the concentration of toxins in the patient's bloodstream as a function of time. The toxin concentration in a patient's bloodstream is dependent on food intake, fluid intake, fluid loss and the level of function of the patient's diseased kidneys. Based on these criteria there is an optimal time to conduct a dialysis when the maximum amount of toxins are accumulated in the patient's bloodstream before the toxins become harmful to the patient's other organs. Accordingly, there is also an optimal dialysis period.
to reduce the toxin concentration to a level sufficient to maintain a reasonable quality of life for the patient with respect to trips to the dialysis center.  

The combination of the embedded health sensor 202 and mobile device 100 permits the user to receive notice of the appropriate time for a dialysis. In another aspect, the mobile device 100 can notify the dialysis center of the user’s need for a dialysis treatment and inform the user of a confirmed appointment time. The mobile unit and the embedded health sensor provide the user maximum safety by monitoring the toxin concentration in the user’s bloodstream and minimizes the financial costs of the treatment by performing the dialysis treatment only when necessary.  

In another aspect of the invention, embedded health sensor 203 represents a sensor for measuring blood pressure. The mobile device 100 takes measurements continuously through all aspects of the user’s life. For example, the mobile device 100 takes a resting blood pressure while the user is sleeping and takes a stress level blood pressure while the user is at work. The mobile device 100 records the blood pressure samples and averages them to produce a more reliable representation of the user’s blood pressure. The mobile device 100 can regularly transmit the blood pressure information to a physician for adjusting the level of medication required for proper control of high blood pressure.  

Embedded health sensor 204 represents a health sensor for measuring blood sugar level. The mobile device 100 can collect sugar concentration data from the embedded health sensor and determine an optimal amount of insulin to deliver to the user. In another aspect, the mobile device 100 can communicate with an embedded insulin delivery system and provide the insulin delivery system the volume of insulin to inject into the user. The mobile device 100 can deliver the collected data to the user’s physician for analysis and consultation scheduling. The physician, through a remote application may communicate to the mobile device 100 that it is time for an appointment and alert the user. In another aspect of the invention, the user may sign up for clinical trials of a new insulin compound and authorize the mobile device 100 to provide the researchers the user’s health data related to blood sugar levels and insulin consumption.  

In another aspect of the invention, embedded health sensor 205 represents a health sensor for measuring electrical signal strength of the nervous system to the heart. The mobile device 100 can collect data concerning electrical discharge frequency and duration associated with the user’s heartbeat. The mobile device 100 can analyze this data and send alerts to the user and the user’s physician if the mobile device 100 detects any irregular electrical signals. Upon receiving this information, the physician can schedule an appointment and send notice of the appointment to the user through the mobile device 100. In another aspect of the invention where a pacemaker is already in place, the mobile device 100 can monitor the electrical discharge from the pacemaker device and detect the indication of a low battery voltage. The mobile device can send an alert to the user’s physician requesting an appointment for battery replacement. In response, the physician can notify the user through mobile device 100 of the date and time for the procedure.  

Embedded health sensor 206 presents another aspect of the invention representing one or more health sensors measuring chemical concentrations in the brain. The mobile device 100 collects data from embedded health sensor 206 and performs an analysis to verify that a user is properly taking their medication to control psychological disorders. The mobile device 100 can alert the user at the appropriate time to take the next dosage of the medication. The mobile device can provide the user’s brain chemistry data to the user’s physician for later analysis and medication adjustment. The user can also subscribe to a clinical study related to the user’s illness and provide health data for inclusion in research aimed at understanding and curing the user’s condition. The remote clinical study application can send the results of the clinical study and any recommendations to the user’s mobile device to alert the user to new treatments or theories related to the illness.  

FIG. 3 depicts a user 301 with five apparel health sensors and one other data sensor. The apparel health sensors, like the embedded health sensors above, collect readings of body variables and transmit them to the mobile device 100. The apparel health sensors are sewn into clothing, hats or shoes or are molded into jewelry for ease of application and removal. The mobile device 100 provides in one aspect the measurement of the weight of the user. When the user stands up, the user exerts their full body weight on the footpads. Over time, the predictive algorithms 112 of the mobile device 100 are capable of determining an accurate value of the user’s weight. The mobile device 100 transmits this health data to the user’s physician on a scheduled basis to maintain an accurate profile of the user’s weight.  

In another aspect of the invention, apparel health sensor 301 can provide data to local lifestyle application on the level of activity performed by the user. For example, if the user’s weight drops to near zero, then the user is probably in a reclined position and the mobile device 100 can assign an appropriate caloric burn rate for this level of activity. If the user’s body weight drops to a low but non-zero value then the user is probably sitting and the mobile device 100 can assign an appropriate caloric burn rate for this activity. If the user’s body weight remains at the defined value then the user is probably standing and the mobile device 100 can assign an appropriate caloric burn rate for this activity. Mobile device 100 can combine the data above with position data from other data sensor 306 to calculate a rate of movement value and an associated caloric burn rate based on the user walking or running. In summary, over a few days time, the mobile device 100 can evaluate the user’s lifestyle and weight and consult with lifestyle services on remote systems to create a plan to improve the user’s health. The remote system lifestyle application 715 can transmit the proposed plan to mobile device 100 and uploaded to the user’s physician for approval before implementation.  

Apparel health sensor 302 is a bracelet, wristwatch or similar wrist worn sensing device representing another aspect of the invention. In one aspect of the invention, mobile device 100 can measure the conductivity between apparel health sensor 302 and apparel health sensor 301 and calculate a percent body fat composition of the user. Mobile device 100 can use this calculated health indicator to adjust the prescribed exercise regimen proposed to the user. In another aspect of the invention, the user’s mobile device 100 can share the lifestyle health data with another user’s mobile device 100. For example, two mobile device 100 users can agree to a
fitness contest and to verify the winner, they agree to share their percent body fat composition health data with each other.

[0038] In another aspect of the invention, apparel health sensor 303 is cap, similar but not limited to a baseball cap, outfitted with sensors for detecting brainwaves. The mobile device 100 collects health data from the apparel health sensor 303 for producing an electroencephalograph. The mobile device 100 can transmit the electroencephalograph to the user’s physician for analysis and/or to a remote medical researcher downloading the new data. Electroencephalograph produce a more accurate representation of the user’s brain wave activity because the data is sampled over a longer period of time and the user is participating in many different activities during the test i.e. periods of low thought process such as relaxing at home through periods of extreme thought process such as intense work situations.

[0039] Apparel health sensor 304 is jewelry in the form of a ring. In one aspect of the invention, mobile device 100 collects health data from apparel health sensor 304 representing the ambient air temperature. In another aspect, mobile device 100 collects health data from apparel health sensor 304 representing the user’s body surface temperature and conductivity level. For example, mobile device 100 can analyze the health data and determine that the ambient temperature is one hundred and one degrees Fahrenheit and the user’s surface temperature is rising combined with the corresponding decrease in conductivity indicating the onset of a heat stroke. Mobile device 100, upon reaching defined health alarm limits can alert the user to take shelter from the heat and increase fluid intake while communicating through alarm service 506 to notify emergency response application 712 and medical personnel of imminent severe threat to the user.

[0040] In another aspect of the invention, apparel health sensor 305 is a shirt, blouse, bathing suit top or similar article of clothing containing sensors for detecting exposure to ultraviolet radiation. Mobile device 100 collects health data from apparel health sensor 305 for determining the amount of ultraviolet radiation and time the user is exposed and based on prescribed limits, alerts the user when the mobile device 100 detects overexposure. The mobile device 100 also sends the collected health data to the user’s dermatologist for tracking the user’s exposure and updating exposure limits. The dermatologist downloads the new limit information to mobile device 100 to advise the user they have reached daily, weekly, monthly or seasonal exposure limits.

[0041] Other sensor data 306 can be, but is not limited to, a belt or “fanny pack” article containing but not limited to data sensors related to position, direction, air quality, etc. In one aspect of the invention, the sensor contains a global positioning sensor allowing a mobile device to collect data by identifying the user’s three-dimensional position on the planet. For example, if the user becomes disoriented while hiking in the mountains, the mobile device 100 can advise the user of his location. In another aspect, mobile device 100, using the directional data, can advise the user which direction to travel to reach the user’s desired objective.

[0042] In another aspect of the invention, mobile device 100 collects air quality data from other sensor data 306 to alert the user of possible acute respiratory problems. For example, on a particularly hot summer afternoon the air quality declines for the user because their age makes them particularly susceptible to particulate matter in the air. Mobile device 100 can alert the user to the declining air quality recommending they seek an air-conditioned environment. Mobile device 100 can also alert the user’s physician to the exposure. The user can choose to share this data with the mobile device 100 of friends or neighbors to prevent them from experiencing the same exposure.

[0043] In another aspect of the invention, the air quality decline can be due to natural pollutants such as pollen or other allergens. Mobile device 100 can detect the increase in allergens identified as harmful to the user and alert the user to take appropriate anti-histamine type medication to prevent the development of allergic symptoms. The user can confirm to mobile system 100 that the recommended medication was taken and mobile system 100 can inform the user’s pharmacy of the decrease in on-hand supply of the medication. If the user’s on-hand supply is low enough, the pharmacy can notify the user, and if requested by the user, prepare and send another prescription of the medication, assuring the user’s on-hand supply.

[0044] FIG. 4 depicts the health data information store 105 of mobile device 100. The explosion in memory technology has provided enormous amounts of storage space in a small footprint with no moving parts. The resultant use of this technology by mobile device 100 allows for the retention of large amounts of health data for on-site analysis and transmission to remote applications and services 140 as communication availability permits. For example, the user may be out of communication range for several days and the health data collected by mobile device 100 is queued in the health data information store 105 until communications are established and the health data can be delivered to the appropriate destination. Mobile device 100 permits the user to segregate health and outside data, alarm data, trend data and configuration data and provide security levels of varying degree with respect to access to the data by remote services and applications 140 and other mobile devices 100. It should be noted that the aforementioned segregations are exemplary and not limiting.

[0045] In one aspect of the invention, public health data 401 is maintained in the health data information store 105. Public health data 401 is accessible by any remote services and applications 140 interested in the data or by any other mobile device in proximity. The public health data 401 database does not require any security credentials before accessing the health data. For example, the user’s data concerning air quality can be of interest to other local mobile device 100 users who are also susceptible to low air quality and wish to avoid low air quality areas. Local weather forecasting services can access the air quality data to develop a much more detailed map of locations suitable to warn the audience of low air quality.

[0046] Health data information store 105 maintains Private health data 402 as another aspect of the invention. The user considers private health data 402 more sensitive and therefore protected by requiring security credentials before access. Each identified type of private health data 402 can have its own set of security credentials thus allowing particular access to particular sections based on the provided security credentials. For example, the section of private health data related to blood pressure and cholesterol level can have security credentials known only by the user’s cardiologist. Another section of private health data related to the user’s weight and percent body fat composition can have security credentials known by the user’s general practitioner, a remote server
application 140 for a medical research project related to weight loss and a friend’s mobile device 100 for a weight loss competition.

[0047] In another aspect of the invention, mobile device 100 maintains secure control data 403 for controlling devices typically implanted in the user’s body and critical to the user’s health. The data represents control values used by the devices in maintaining the user’s organic functions. For example, the user can have an insulin delivery device implanted to replace the need for daily injections. The mobile device 100 can communicate with the insulin delivery device and download new control values for the volumetric rate to deliver insulin and the number of times and times of day for deliveries. In another example, the user can have a pacemaker implanted to regulate the user’s heartbeat. Mobile device 100 can communicate with the pacemaker and download new control values for the level of charge to deliver and the frequency of delivery to ensure the pacemaker properly regulates the user’s heartbeat.

[0048] Mobile device 100 maintains health trend data 404 for analyzing long-term changes in the user’s health. For example, changes in body weight and composition, blood pressure, cholesterol level, blood sugar level all become more obvious when viewed as trend data. In another aspect, the point in time where medical intervention is required becomes predictable and therefore future medical problems are addressed at the most opportune time. In another aspect, the user can share their health trend data with medical research applications 711 interested in accumulating historical data for a particular disease or analysis.

[0049] Health data information store 105 maintains health alarm data 405 as another aspect of the invention. Health alarm data 405 is a collection of data values associated with each data source identifying values at which the user wishes alarm notifications sent to appropriate parties. The parties are provided appropriate security credentials allowing access to the remote health data of interest as well as the data logged by the mobile device. For example, the user may configure an alarm limit for body weight exceeding one hundred eighty pounds. The user can configure the mobile device 100 to detect the alarm condition and send a corresponding alarm message to the user. In another example, the user can configure an alarm limit of cholesterol level greater than one hundred fifty. The user can configure mobile device 100 to send an alarm message to the user and to the user’s cardiologist. The cardiologist can collect the health trend data 404 from the user’s mobile device 100 and analyze the recent trend to determine if the trend data warrants an adjustment in the user’s cholesterol medication. If necessary, the user’s cardiologist can notify the user of a required office visit or an adjustment in the user’s cholesterol medication dosage.

[0050] In another aspect of the invention, the health data information store 105 maintains a health data access list 406 provided by the user. The health data access list provides the login names, security credentials and associated private health data 402 accessible for this login account. The user defines the areas available on a per-account basis and configures what operations the account can execute. For example, the user can allow a friend’s account from another mobile device 100 to view body weight and body composition health data but not allow downloading or deletion of any of the health data. In another example, a remote medical research application 711 can upload and automatically delete the blood pressure data but cannot inspect the blood pressure data in the user’s mobile device.

[0051] The health data information store 105 maintains health data scheduler 407 configuration information related to actions the user requires based on the passage of time or a particular calendar date and time. For example, the user can configure mobile device 100 to send the previous month’s blood pressure health data on the first day of each month to the user’s cardiologist. In another example, the user can configure mobile device 100 to send the body weight, body composition and blood sugar level to the user’s general practitioner on the user’s birthday each year. The general practitioner reviews the health data and sends the user a notice of changes to the user’s general health regimen and any requirements for additional medical appointments.

[0052] In another aspect of the invention, the health data information store maintains health data events 408 configurations related to actions the user requires based on predefined events. For example, the user may configure the mobile device 100 to send blood pressure health data to a medical research application 711 related to clinical trials of a new blood pressure medication if the user’s blood pressure exceeds a predefined value. The mobile device 100 sends the health data even though the predefined value is not considered an alarm condition and the information would normally be sent at the end of the month.

[0053] Referring to FIG. 5, the mobile device 100 contains and executes many services and applications. The services and applications are updateable from the remote applications and services 140 servers and if the user requests, the mobile device 100 can change service configurations and add or delete applications. In one aspect of the invention, mobile device 100 provides a communication service 501 for communicatively coupling with embedded health sensors, apparel health sensors, other sensor data sensors, peer mobile devices 100, wireless networks and wired networks. The communication service 501 includes but is not limited to protocol support for “Bluetooth,” Ethernet, 802.11 a/b/g/n, universal serial bus (USB) IEEE 1394 (FireWire) and the like.

[0054] In another aspect of the invention, mobile device 100 provides a data logging service 502 archiving at least not limited to health data collected from the array of sensing devices. The data logging service provides for retaining the value from the sensing device along with the date and time the mobile device 100 collected the data. The mobile device 100 can associate metadata with the data providing information relating to the status and configuration of the mobile device 100 at the time the mobile device 100 collected the health data.

[0055] In another aspect of the invention, mobile device 100 provides a trend service 503 generating trend data for health data selected by the user for trending. The user defines the sample period for trending and the time window of the trend. For example, the user can configure a trend of body weight sampled on the every two weeks and maintained over the previous fifty-two weeks. The user can review the trend with the mobile device 100 or upload the health trend data 404 for review and archiving on another computing device.

[0056] Local applications and services 110 provide scheduler service 504 for scheduling user-defined actions. The user can configure the scheduler service for time-based or event-based actions. The user can schedule a time-based action relative to a clock time of day. For example, the user can
configure the scheduler service 504 to transmit all health data from the previous month to the user’s general practitioner every Sunday at midnight. The user can configure an event based action on events determined from health sensor data or predefined criteria. For example, the user may define an event to upload all health data to the user’s general practitioner immediately upon establishing network communications to the remote system if the user’s mobile device has not communicated with the remote system for more than seven days. [0057] In another aspect of the invention, mobile device 100 provides an encryption service 505 for conducting secure communications between the mobile device 100 and the remote applications and services 140 or peer mobile devices 100. The user can select the type of encryption on an application basis or the mobile device and the remote application or service 140 can negotiate a compatible encryption method. The encryption service provides security during transmission of health data and for any data stored on mobile device 100 in the event mobile device 100 is lost or stolen.

[0058] Local applications and services 110 provide an alarm service 506 for notifying a user-configured list of individuals of user health conditions requiring medical attention. For example, mobile device 100 can detect that user’s blood sugar level is below a lower threshold limit indicating a probable insulin overdose. Mobile device 100 can provide user an alarm indicating the immediate requirement for sugar intake to counter the insulin overdose. Additionally, mobile device 100 can transmit the alarm to remote emergency response application 712 requesting the dispatch of emergency medical personnel. Emergency medical personnel can more efficiently handle the medical emergency upon arrival because they already have reliable knowledge of the nature of the medical emergency.

[0059] In another aspect of the invention, mobile device 100 provides a lifestyle application 511 for managing the user’s body weight, body composition, activity level, etc. For example, the lifestyle application 511 can maintain a trend of the user’s body weight and body composition as collected by the mobile device 100 from apparel health sensor 301 and apparel health sensor 302. Mobile device 100 can notify the user of meeting the goals set by the user as a parameter of lifestyle application 511. Lifestyle application 511 can also track and trend the user’s activity level by monitoring and analyzing the user’s load data from apparel health sensor 301 as previously described.

[0060] Lifestyle application 511 can present the user with meal recommendations for appropriate caloric intake based on the user’s calculated activity level. If the user is away from home then lifestyle application 511 can recommend calorically appropriate restaurants based on the user’s activity level. Mobile device 100 provides the user input capabilities allowing the user to notify lifestyle application 511 of the caloric values of each meal for tracking caloric intake. For meals consumed at restaurants, mobile device 100 can automatically receive caloric data based on the user’s choices, transmitted over the mobile device 100 wireless network.

[0061] In another aspect of the invention, mobile device 100 provides a general health application 512 for tracking basic health parameters such as blood pressure, body temperature, blood sugar level, cholesterol level, etc. Mobile device 100 trends these general parameters and provides alerts if the trends begin to vary outside of medically suggested ranges of normal values based on age and personal medical history. Mobile device 100 through communication with remote applications and services 140 obtains information related to community health concerns such as the prevalence of influenza and locations where inoculations are available and presents alert information recommending vaccination. General health application 512 can also negotiate appointment times and dates then provide alerts advising of upcoming medical appointments.

[0062] Local applications and services 110 provides a disease tracker application 513 for monitoring more specific and detailed parameters associated with indicated diseases. When the user indicates a selected disease is applicable, disease tracker application 513 creates entries with data logging services 502 and trend service 503 to monitor appropriate health data at a greater frequency. For example, if the user selects diabetes, disease tracker application 513 will monitor blood sugar levels at a greater frequency and narrow the window of acceptable ranges for a timer of reporting of health data outside of the acceptable range. Additionally, mobile device 100 will more frequently transmit diabetes related health data to the identified physician resulting in scrutiny of the disease.

[0063] Disease tracker 513 can also search through remote applications and services 140 for breaking research information or clinical trial studies of interest and present a notice through mobile device 100 advising of new treatments or medications of interest. Disease tracker 513 can also provide, if authorized, the accumulated health data to research organizations associated with the identified disease.

[0064] In another aspect of the invention, mobile device 100 provides a weather reporter application 514 for providing alerts of current weather conditions, predictions of upcoming weather and transmits localized weather related data to remote weather reporter application 714. For example, mobile device 100 uses other sensor data 306 to record air temperature, humidity and air quality data and presents the information with alerts indicative of unusual conditions such as a high pollen count. Weather reporter application 514 uploads this localized weather data to remote weather reporter application 714 where weather reporter application 714 combines the weather data with uploads from other mobile devices 100 producing a more accurate and detailed weather report for communication to appropriate local mobile devices 100 for presentation.

[0065] In another aspect of the invention, data sharing application 515 provides for sharing of health data with other mobile devices 100 and remote applications and services 140. The data sharing application can mirror real-time health data allowing others to see data values and changes as they occur. For example, a user experiencing chest pains can configure data sharing application 515 to mirror cardiac related health data to the user’s cardiologist for analysis and recommendations on courses of action based on the present situation. At the conclusion of the online analysis, the mirror is disabled and mobile device 100 discontinues real-time health data transmission.

[0066] Referring to FIG. 6, the mobile device 100 contains both hardware and software interfaces. The hardware interfaces include interfaces to the sensing devices either embedded in or attached the user and any sensing devices included in mobile device 100 including “Bluetooth.” Interfaces to cellular networks such as CDMA and GSM, interfaces wireless networks including 802.11 a/b/g/n, interfaces to wired networks including Ethernet and user interfaces in the form of a display screen on the mobile device 100. The software
interfaces include programmatic interfaces to public data, private data, control data, configuration data, alarm data and schedule data.

[0067] Sensor interface 601 provides communicative capabilities allowing mobile device 100 to collect health data from the embedded, apparel and other sensors. For example, the embedded sensors can support a “Bluetooth” implementation providing wireless communication of health data from the embedded health sensor to mobile device 100.

[0068] Cellular network interface 602 provides communicative capabilities allowing mobile device 100 to transfer information to remote application and services 140 servers or other mobile devices 100. For example, a mobile device 100 can use a cellular network to transmit lifestyle information from the lifestyle application 511 on mobile device 100 to the lifestyle application 715 on a remote server 140.

[0069] Wireless network interface 603 provides communicative capabilities allowing mobile device 100 to transfer information to remote application and services 140 servers or other mobile devices 100 located within range of the wireless network. For example, the remote server 140 can download the caloric information associated with purchases at a restaurant to mobile device 100 when the user pays the bill at the end of the meal.

[0070] Wired network interface 604 provides communications capabilities as described for the cellular network interface and the wireless network interface in a format compatible with locations where cellular or wireless network support is not practical or available. For example, in certain remote locations such as an Antarctic research facility, wired communications to a satellite uplink may be the only means of transmitting data to a remote server.

[0071] User interface 605 provides input and output capabilities for mobile device 100. A mobile device 100 includes a graphical display screen for presentation of data in formats such as textual, tabular or graphical. For example, the user can select a trend chart and trend service 503 will generate a graphical representation of the trend. The graphical display can also present alarm messages to the user in different formats such as colors, including flashing, bold and underlined and different sized fonts. The mobile device 100 can also present audible alarms configurable by the user such as beeps or tones intended to attract the user’s attention when mobile device 100 presents important messages for viewing.

[0072] Mobile device 100 provides an input system such as a keyboard, touch screen, stylus, etc. for input of selections and configuration information. For example, the user can select a block of private health data 402 and enter a name and password as security credentials for accessing the health data. The user can then select available actions for the new account’s operations on the private data such as “read-only.”

[0073] The public data interface 611 of mobile device 100 provides programmatic access to any data stored on mobile device 100 in the public health data 401 section of the health data information store 105. For example, another mobile device 101 can request local weather information form a mobile device 101 storing its weather information in public health data 401.

[0074] The private data interface 612 of mobile device 100 provides identical programmatic support for private health data 402 access as described for public data interface 611 access with the exception of the requirement of providing security credentials before mobile device 100 allows access to the private health data 402. Additionally, private data interface 612 enforces the permitted actions available through the interface for operations on the private health data 402. For example, a remote medical research application 711 attempting to access blood chemistry private health data 402 must first present security credentials defined to allow access to the health data of interest. Additionally, the mobile device 100 will deny the remote medical research application 711 permission to delete the private health data 402 because the configuration denies private data interface 612 deletions of this private health data 402.

[0075] The control data interface 613 of mobile device 100 provides identical programmatic support for secure control data 403 access as described for private health data 402 with the exception of providing additional layers of security by requiring additional security credentials and validating control data against internal data ranges. For example, a remote emergency response application 712 must provide security credentials to access the secure control data 403 and if the remote emergency response application 712 attempts to change the volumetric flow rate of the insulin pump associated with this secure control data 403, the remote emergency response application 712 must supply another set of security credentials. Once both sets of security credentials are accepted, the mobile device 100 control data interface 613 then validates that the new volumetric flow rate for the insulin pump is within the allowable range of values.

[0076] The configuration interface 614 of mobile device 100 provides programmatic access to configuration parameters used for operation of and access to mobile device 100. For example, configurable parameters include but are not limited to the frequency of collecting data from the health sensors, the time period between uploads from mobile device 100 to remote servers, the health data to upload and the location of the remote servers, the security credentials for accessing private health data and the like.

[0077] The alarm interface 615 of mobile device 100 provides programmatic access to alarm parameters for providing alerts for defined alarm conditions. The mobile device 100 can display alarms on the user interface 605 and/or transmit alarms to remote applications and services 140. For example, the user can configure an alarm for systolic blood pressure exceeding one hundred thirty millimeters of mercury. If the blood systolic blood pressure reading rises above this value then an alarm message is displayed by mobile device 100 user interface 605 and an alarm message is transmitted to a remote server notifying the user’s cardiologist.

[0078] The scheduler interface 616 of mobile device 100 provides programmatic access to user scheduled actions for transferring data. The user can schedule actions based on clock time or the occurrence of a defined event. For example, the user can select midnight every Sunday to transmit all collected health data to remote medical research application 711. In another example, the user can select an event of low blood sugar to transmit health data related to blood sugar level to the user’s physician.

[0079] Referring to FIG. 7, mobile device 100 can interact with remote services and applications 140. The remote services and applications 140 can have counterparts running locally on mobile device 100.

[0080] Communication service 701 of the remote server provides compatible communication protocols with mobile device 100 communication service 501 allowing reliable secure communications between the remote server and mobile device 100. For example, mobile device 100 and a
remote server can use TCP/IP on an 802.11 a/b/g/n wireless network to upload health data to a medical research application 711 running on the remote server.

[0081] Data logging service 702 of the remote server provides data archiving capabilities for mobile device 100. For example, at the end of each month, mobile device 100 uploads all health data to data logging service 702 for archival purposes for the lifetime of the user. Mobile device 100 can then delete the uploaded data from the mobile device 100 to provide storage space for additionally collected health data.

[0082] Emergency location service 703 of the remote server provides tracking capabilities to locate mobile device 100 at any location on the planet. Mobile device 100 contains a global positioning sensor and can report the current location to emergency location service 703 when supplied with valid security credentials. For example, emergency rescue personnel could locate a user incapacitated by an illness reported by mobile device 100 without requiring involvement by the incapacitated user.

[0083] Scheduler service 704 of the remote server provides time and event based actions initiated by the remote server for mobile device 100. For example, the release of an updated version of a software application installed on mobile device 100 can generate a download of the new application version to mobile device 100. In another example, at noon on the first day of each month, remote server executes a timed event and downloads a list of all remote applications available for use by mobile device 100 to all interested mobile devices 100.

[0084] Medical research application 711 of a remote server provides the user of mobile device 100 with information related to the health concerns of the user and the opportunity for the user to participate in medical research programs and drug trial programs. The user can post a medical profile with the medical research application 711 to researches looking for candidates like the user. Additionally, the user can browse a list of medical research programs looking for any research programs that might be of interest to the user. Once the user selects a medical research application 711 program and the medical research application 711 programs accepts the user, mobile device 100 establishes security credentials and identities allowing the remote medical research application 711 to collect health data from the user’s mobile device 100. The user can also choose to interact with respect to other users admitted to the remote medical research application 711 with direct communication from mobile device 100 to mobile device 100. The medical research application 711 also provides analysis related to the user to the user’s physician through the user’s mobile device 100.

[0085] Emergency response application 712 of a remote server provides capabilities to dispatch emergency medical personnel to mobile device 100 anywhere on the planet, even if the user is incapacitated and cannot assist in providing location information. For example, mobile device 100 can detect an erratic heartbeat and extremely low blood pressure and transmit a request for medical assistance to emergency response application 712. Included in the transmission are the GPS determined coordinates of mobile device 100. While mobile device 100 is summoning emergency medical help, the user is unconscious, because of an ongoing heart attack, and unable to assist in requesting emergency medical assistance.

[0086] Disease tracker application 713 of a remote server provides capabilities to assist the user in understanding and fighting a specific disease affecting the user. For example, a physician has diagnosed the user as diabetic and the user, through mobile device 100, selects to join this disease community on remote disease tracker 713. Mobile device 100 presents the user’s profile to the remote disease tracker application 713 community bulletin board and provides the user’s disease related health data to any medical research application 711 associated with this community. The remote disease tracker application also alerts the user through mobile device 100 of all drug trial programs associated with this community. Additionally, remote disease tracker application 713 presents support groups for this community to the user through mobile device 100 and the user can elect to join the support groups for guidance.

[0087] In another aspect of disease tracker application 713, the long-term archived public and private user health data can be analyzed to discover markers or trends indicating the presence of the initial stages of a disease unknown to the user. Disease tracker application 713 can accomplish the analysis by methods such as but not limited to trending or statistical analysis of the archived data with respect to other individuals of the user’s age, genetic disposition and lifestyle. When disease tracker application 713 detects specific markers or trends, disease tracker application 713 can send an alert to the user notifying the user of the possible detection of the early stages of a particular disease. Disease tracker application 713 also can, if authorized by the user, provide this same alert to the user’s physician and schedule an appointment for the user with the physician to review the findings of the analysis.

[0088] Weather reporter application 714 of a remote server provides capabilities to notify the user of weather conditions in the user’s locality and to collect localized weather information from the user through mobile device 100 to create a more accurate and detailed weather forecast. For example, if selected by the user, mobile device 100 uploads the user’s locale weather and air quality data to the remote weather reporter application for analysis. The combination of many users submitting weather data provides a more accurate localized forecast because of the greater number of data points. The remote weather reporter application analyzes the weather data and computes a weather prediction to download to all mobile devices 100 in the localized area.

[0089] Lifestyle application 715 of a remote server provides capabilities to assist the user in leading a healthy lifestyle with respect to body weight, body composition, eating habits, exercise habits, sleep habits, etc. For example, the user can upload their body weight and body composition information from mobile device 100 to remote lifestyle application 715 for inclusion in an analysis program that outputs a weight appropriate exercise regimen for the user and downloads the regimen to mobile device 100. The user can also select information available from remote lifestyle application 715 on healthy choice eating venues in the user’s locality. The user can subscribe to online journals through remote lifestyle application 715 presenting informative articles on proper sleep habits to promote better health. Remote lifestyle application 715 can also present a weight appropriate list of support groups based on the users profile information and body weight health data through mobile device 100. The user can read a summary of each support group’s makeup and goals and select a support group in line with the lifestyle goals of the user.

[0090] Referring to FIG. 8, illustrated is an exemplary non-limiting flow diagram showing a method for use in connection with a mobile device in accordance with the invention. At
body condition data is received relating to a bodily condition of a user from body sensor(s) communicatively coupled to the mobile device. At 220, environmental data is received relating to an environmental condition from environmental sensor(s) communicatively coupled to the mobile device. At 230, one or more processes are automatically initiated based on the body condition data and/or the environmental data.

Thus, based on a collective profile of various measurements sensed from the user, an intelligent agent on the mobile device (or implemented through a network service) can offer relevant services, or take automatic action. Predictive medicine is possible where the mobile device can aggregate and analyze various subsets of sensor data and appreciate a health characteristic or trend prior to the mobile device user receiving an associated illness or condition. In such case, the mobile device can automatically take, or help the user take, preventive action to stave off the onset of illness or condition. For instance, the mobile device can optionally instruct the user how to mitigate the trend, provide other relevant information about treatment, or otherwise take action to prevent a predicted health trend. For example, before a diabetic’s sugar levels become too low, the mobile device can sense the trend, alert the user and/or take action on behalf of the user. For another example, if the user is in critical condition, a doctor can be automatically notified via any of the communication methods available to the mobile device (email, SMS, phone call, beeper, facsimile, etc.). Micro-sensors can also be included in ordinary bodily wear products like jewelry (e.g., rings, necklaces), wristbands, hats, sunglasses, etc. Sensors may also be integrated into a user’s shoes, making the shoes an activator for virtual phone, sensors of emotion, triggering various functionality for the device.

In addition to personal health information, other environmental information can be taken into account, in order to provide a holistic account of a mobile device user’s environment, both inside the body and outside. For instance, GPS tags can be embedded in people or their things such that health information can be coupled to location. For example, a person’s onset of fever combined with a GPS position in Siberia and an ambient temperature of -15 degrees can trigger an alert to the user to find a warmer locale. When one considers barometric, air or water quality, temperature, humidity, or other environmental readings, the scenarios and services that can be predicated on such data on behalf of the mobile device user are virtually limitless.

Moreover, if users are willing to have embedded sensors in their bodies, a host of remote applications and services can provide extra value add to the user in the form of automatic hospital services, administration of dynamic exercise and dieting programs, and other services. Accordingly, in one non-limiting aspect, the invention targets the synergy of bodily sensor data, heart rate, stress level, and other environmental data, e.g., measurements with respect to items of food one is going to eat, air quality (pollution), water quality, etc. Moreover, any product one purchases, such as clothes, can be sensed with one or more measurements that may initiate further actions and services, or rendering of information about the product (e.g., an object age sensor that authenticates antiques).

In one embodiment, the mobile device directly, or indirectly through a service, senses data relating to the emotional state of another mobile device user such that a friend can tell if another friend is experiencing a certain emotional state (whether angry, stressed, relaxed, happy, bored, etc.). The aggregation of health sensory data thus enables a variety of personal services based on the sharing of such data with other mobile phone users. Due to the implications on privacy, however, the invention enforces strict authorization rules that enable only designated users certain privileges for such data. One or more layers of security can be implemented to protect privacy of the user. For instance, one might authorize only their trusted family or friends to see normally encrypted data relating to one’s health as a backup in case of unconsciousness or other scenario where only the trusted family or friends should have access to the data. Thus, the invention includes the ability to grant privileges to certain data of the collective personal health store as authorized by the user of the mobile device.

In other embodiments, where a group of mobile devices collectively point to a common trend for many users in a given area, conditions affecting a great number of people may be inferred and widespread measures can be taken to mitigate the threat (e.g., a breakout of fever, or other set of common symptoms may be detected across a wide audience). This could be effective in detecting and preventing the further spread of malaria, or other communicable infectious diseases. The mobile device is thus a gateway to a host of health and environmental services that can build on top of health and environmental data sensed by and aggregated in the mobile device.

FIG. 9 depicts an overall block diagram of an exemplary packet-based mobile cellular network environment, such as a GPRS network, in which the invention may be practiced. In such an environment, there are a plurality of Base Station Subsystems (“BSS”) 900 (only one is shown), each of which comprises a Base Station Controller (“BSC”) 902 serving a plurality of Base Transceiver Stations (“BTS”) such as BTSs 904, 906, and 908, BTSs 904, 906, 908, etc. are the access points where users of packet-based mobile devices become connected to the wireless network. In exemplary fashion, the packet traffic originating from user devices is transported over the air interface to a BTS 908, and from the BTS 908 to the BSC 902. Base station subsystems, such as BSS 900, are a part of internal frame relay network 910 that may include Service GPRS Support Nodes (“SGSN”) such as SGSN 912 and 914.

Each SGSN is in turn connected to an internal packet network 920 through which a SGSN 912, 914, etc. can route data packets to and from a plurality of gateway GPRS support nodes (GGSN) 922, 924, 926, etc. As illustrated, SGSN 914 and GGSNs 922, 924, and 926 mainly provide an interface to external Internet Protocol (“IP”) networks such as Public Land Mobile Network (“PLMN”) 945, corporate intranets 940, or Fixed-End System (“FES”) or the public Internet 930. As illustrated, subscriber corporate network 940 may be connected to GGSN 924 via firewall 932; and PLMN 945 is connected to GGSN 924 via border gateway router 934. The Remote Authentication Dial-In User Service (“RADIUS”) server 942 may be used for caller authentication when a user of a mobile cellular device calls corporate network 940.

Generally, there can be four different cell sizes in a GSM network—macro, micro, pico and umbrella cells. The coverage area of each cell is different in different environments. Macro cells can be regarded as cells where the base station antenna is installed in a mast or a building above
average roof top level. Micro cells are cells whose antenna height is under average roof top level; they are typically used in urban areas. Pico cells are small cells having a diameter is a few dozen meters; they are mainly used indoors. On the other hand, umbrellas cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

Although not required, the claimed subject matter can partly be implemented via an operating system, for use by a developer of services for a device or object, and/or included within application software that operates in connection with one or more components of the claimed subject matter. Software may be described in the general context of computer-executable instructions, such as program modules, being executed by one or more computers, such as clients, servers, mobile devices, or other devices. Those skilled in the art will appreciate that the claimed subject matter can also be practiced with other computer system configurations and protocols, where non-limiting implementation details are given.

FIG. 10 thus illustrates an example of a suitable computing system environment 1000 in which the claimed subject matter may be implemented, although as made clear above, the computing system environment 1000 is only one example of a suitable computing environment for a mobile device and is not intended to suggest any limitation as to the scope of use or functionality of the claimed subject matter. Further, the computing environment 1000 is not intended to suggest any dependency or requirement relating to the claimed subject matter and any one or combination of components illustrated in the example operating environment 1000.

With reference to FIG. 10, an example of a remote device for implementing various aspects described herein includes a general purpose computing device in the form of a computer 1010. Components of computer 1010 can include, but are not limited to, a processing unit 1020, a system memory 1030, and a system bus 1021 that couples various system components including the system memory to the processing unit 1020. The system bus 1021 can be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures.

Computer 1010 can include a variety of computer readable media. Computer readable media can be any available media that can be accessed by computer 1010. By way of example, and not limitation, computer readable media can comprise computer storage media and communication media. Computer storage media includes volatile and non-volatile as well as removable and non-removable media implemented in any method or technology for storage of information such as computer readable instructions, data structures, program modules or other data. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CDROM, digital versatile disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by computer 1010. Communication media can embody computer readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and can include any suitable information delivery media.

The system memory 1030 can include computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) and/or random access memory (RAM). A basic input/output system (BIOS), containing the basic routines that help to transfer information between elements within computer 1010, such as during startup, can be stored in memory 1030. Memory 1030 can also contain data and/or program modules that are immediately accessible to and/or presently being operated on by processing unit 1020. By way of non-limiting example, memory 1030 can also include an operating system, application programs, other program modules, and program data.

The computer 1010 can also include other removable/non-removable, volatile/nonvolatile computer storage media. For example, computer 1010 can include a hard disk drive that reads from or writes to a removable, nonvolatile magnetic media, a magnetic disk drive that reads from or writes to a removable, nonvolatile magnetic disk, and/or an optical disk drive that reads from or writes to a removable, nonvolatile optical disk, such as a CD-ROM or other optical media. Other removable/non-removable, volatile/nonvolatile computer storage media that can be used in the exemplary operating environment include, but are not limited to, magnetic tape cassettes, flash memory cards, digital versatile disks, digital video tape, solid state RAM, solid state ROM and the like. A hard disk drive can be connected to the system bus 1021 through a non-removable memory interface such as an interface, and a magnetic disk drive or optical disk drive can be connected to the system bus 1021 by a removable memory interface, such as an interface.

A user can enter commands and information into the computer 1010 through input devices such as a keyboard or a pointing device such as a mouse, trackball, touch pad, and/or other pointing device. Other input devices can include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and/or other input devices can be connected to the processing unit 1020 through user input 1040 and associated interface(s) that are coupled to the system bus 1021, but can be connected by other interface and bus structures, such as a parallel port, game port or a universal serial bus (USB). A graphics subsystem can also be connected to the system bus 1021. In addition, a monitor or other type of display device can be connected to the system bus 1021 via an interface, such as output interface 1050, which can in turn communicate with video memory. In addition to a monitor, computers can also include other peripheral output devices, such as speakers and/or a printer, which can also be connected through output interface 1050.

The computer 1010 can operate in a networked or distributed environment using logical connections to one or more other remote computers, such as remote server 1070, which can in turn have media capabilities different from device 1010. The remote server 1070 can be a personal computer, a server, a router, a network PC, a peer device or other common network node, and/or any other remote media consumption or transmission device, and can include any or all of the elements described above relative to the computer 1010. The logical connections depicted in FIG. 10 include a network 1071, such as local area network (LAN) or a wide area network (WAN), but can also include other networks/buses. Such networking environments are commonplace in homes, offices, enterprise-wide computer networks, intranets and the Internet.
When used in a LAN networking environment, the computer 1010 is connected to the LAN 1071 through a network interface or adapter. When used in a WAN networking environment, the computer 1010 can include a communications component, such as a modem, or other means for establishing communications over the WAN, such as the Internet. A communications component, such as a modem, which can be internal or external, can be connected to the system bus 1021 via the user input interface at input 1040 and/or other appropriate mechanism. In a networked environment, program modules depicted relative to the computer 1010, or portions thereof, can be stored in a remote memory storage device. It should be appreciated that the network connections shown and described are exemplary and other means of establishing a communications link between the computers can be used.

The word “exemplary” is used herein to mean serving as an example, instance, or illustration. For the avoidance of doubt, the subject matter disclosed herein is not limited by such examples. In addition, any aspect or design described herein as “exemplary” is not necessarily to be construed as preferred or advantageous over other aspects or designs, nor is it meant to preclude equivalent exemplary structures and techniques known to those of ordinary skill in the art. Furthermore, to the extent that the terms “includes,” “has,” “contains,” and other similar words are used in either the detailed description or the claims, for the avoidance of doubt, such terms are intended to be inclusive in a manner similar to the term “comprising” as an open transition word without excluding any additional or other elements.

The aforementioned systems have been described with respect to interaction between several components. It can be appreciated that such systems and components can include those components or specified sub-components, some of the specified components or sub-components, and/or additional components, and according to various permutations and combinations of the foregoing. Sub-components can also be implemented as components communicatively coupled to other components rather than included within parent components (hierarchical). Additionally, it should be noted that one or more components may be combined into a single component providing aggregate functionality or divided into several separate sub-components, and that any one or more middle layers, such as a management layer, may be provided to communicatively couple to such sub-components in order to provide integrated functionality. Any components described herein may also interact with one or more other components not specifically described herein but generally known by those of skill in the art.

In view of the exemplary systems described supra, methodologies that may be implemented in accordance with the described subject matter will be better appreciated with reference to the flowcharts of the various figures. While for purposes of simplicity of explanation, the methodologies are shown and described as a series of blocks, it is to be understood and appreciated that the claimed subject matter is not limited by the order of the blocks, as some blocks may occur in different orders and/or concurrently with other blocks from what is depicted and described herein. Where non-sequential, or branched, flow is illustrated via flowchart, it can be appreciated that various other branches, flow paths, and orders of the blocks, may be implemented which achieve the same or a similar result. Moreover, not all illustrated blocks may be required to implement the methodologies described herein.

What is claimed is:

1. A mobile device comprising:
   a. at least one body condition sensory input for receiving body condition data relating to a bodily condition of a user from at least one body sensor communicatively coupled to the mobile device;
   b. at least one environmental sensory input for receiving environmental data relating to an environmental condition from at least one environmental sensor communicatively coupled to the mobile device; and
   c. an application or service accessible by the mobile device that automatically performs at least one process based on the body condition data and/or the environmental data.

2. The mobile device of claim 1, wherein the body sensor is embedded in the body below skin level.

3. The mobile device of claim 1, wherein the body sensor is attached to clothing worn adjacent to the body.

4. The mobile device of claim 3, wherein the clothing comprises hats, shirts, pants, shoes and jewelry.

5. The mobile device of claim 2, wherein the body sensor detects at least one of blood pressure, blood sugar level, cholesterol level and core body temperature.

6. The mobile device of claim 1, wherein the environmental sensor detects air quality adjacent to the body.

7. The mobile device of claim 1, wherein the application or service automatically sends an alarm to a remote service alerting emergency medical personnel of a critical body condition.

8. The mobile device of claim 1, further comprising a health data information store for archiving health data.

9. The mobile device of claim 8, wherein the application or service automatically logs body condition data to the health data information store.

10. The mobile device of claim 9, wherein the application or service automatically archives the body condition data to a remote server.

11. The mobile device of claim 9, wherein the application or service automatically uploads the body condition data to a remote server for analysis by a physician.

12. The mobile device of claim 1, further comprising a user interface for presenting formatted body condition data.

13. A method for use in connection with a mobile device, the method comprising:
   a. receiving body condition data relating to a bodily condition of a user from at least one body sensor communicatively coupled to the mobile device;
   b. receiving environmental data relating to an environmental condition from at least one environmental sensor communicatively coupled to the mobile device; and
automatically performing at least one process based on the body condition data and/or the environmental data.

14. The method of claim 13, wherein the automatic process comprises notifying emergency medical response personnel of a location of an incapacitated person requiring immediate medical attention and requesting dispatch of emergency medical personnel to the location of the incapacitated person without interaction of the incapacitated person.

15. The method of claim 14, wherein the automatic process further comprises notifying emergency medical response personnel of the nature of the medical emergency.

16. A method for use in connection with a mobile device, the method comprising:
   automatically receiving blood sugar level data relating to a diabetic user from at least one blood sugar level sensor embedded in the user's body and communicatively coupled to the mobile device;
   automatically determining if the blood sugar level is within a range prescribed by the user's physician;
   automatically transmitting a command to an emergency delivery device system embedded below the user's skin and communicatively coupled to the mobile device to release either a sugar solution or insulin if the user's blood sugar is out of range low or high respectively, and notifying an emergency medical response team of an immediate need for assistance;
   automatically logging the blood sugar level data to an archival location on the mobile device; and
   automatically transmitting the archived blood sugar level data from the mobile device to a remote server for analysis;

17. The method of claim 16, wherein the transmitted blood sugar data is encrypted.

18. The method of claim 16, wherein the analysis is part of a medical research project or drug trial project.

19. The method of claim 18, further comprising transmitting instructions for changed medical behavior from the remote server to the mobile device.

20. The method of claim 19 wherein the changed medical behavior comprises a change in medication type or dosage.

21. A method for use in connection with a mobile device, the method comprising:
   automatically receiving pacemaker electrical data relating to a user from a pacemaker embedded in the user's body and communicatively coupled to the mobile device;
   automatically receiving blood pressure data relating to the user from a blood pressure sensor embedded in the user's body and communicatively coupled to the mobile device;
   automatically determining if the electrical data is within a range prescribed by the user's physician;
   automatically determining if the blood pressure data is within a range prescribed by the user's physician;
   automatically transmitting a command to the pacemaker to increase or decrease the electrical discharge amount or frequency if the user's blood pressure is out of range low or high respectively;
   notifying an emergency medical response team of an immediate need for assistance;
   automatically logging the electrical and blood pressure data to an archival location on the mobile device; and
   automatically transmitting the archived electrical and blood pressure data from the mobile device to a remote server for analysis;

22. The method of claim 21, wherein the transmitted electrical and blood pressure data is encrypted.

23. The method of claim 21, wherein the analysis is part of a medical research project or drug trial project.

24. The method of claim 23, further comprising transmitting instructions for changed medical behavior from the remote server to the mobile device.

25. The method of claim 24 wherein the changed medical behavior comprises a change in pacemaker electrical discharge amount or frequency parameters.

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