METHODS AND SYSTEMS FOR DATA COLLECTION, ANALYSIS, FORMULATION AND REPORTING OF USER-SPECIFIC FEEDBACK

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ABSTRACT

Methods and systems provide user-specific feedback and recommendations to a user based on a user profile, contextual and/or biometric data, which may be collected using a sensing system, such as a wearable sensor device(s). A host system formulates and provides reports to the user relating to the user's sensed activities or conditions, and may also provide recommendations relating to performance and goal achievement, injury prevention, what-if analysis, gait analysis, shoe purchase suggestions, and the like. Data analysis algorithms may be used to identify similar patterns across large collections of user profiles and biometric data and apply data generated across a larger population to formulate recommendations for specific users.
FIG. 1
FIG. 2

Best time of the day to workout → Auto Session Profile Generation → Auto Training Programs

FIG. 3

Exiting → Geofencing → Location awareness
Smart Tasks
Entering
Within
FIG. 6

Notifications
- Real Time Notifications
  - Advice for a better technique (any sport)
  - Compliance to a plan/protocol
  - Positive reinforcement
- Offline notifications
- Notifications Type
  - Audio messages
  - Phone calls
  - Audio cues
  - Summary of what wasn't spoken for brevity or intensity
  - Push notifications

FIG. 7

Notifications Delivery Logic
- Timing
- Frequency
- Priority
- Delivery mechanism
Virtual Coach

These are the default Virtual Coach settings:

Click to upload

File Type: PNG
Transparency: Yes
Size: 640px x 430px

Desired Landing Value: Ball

Cadence Instruction:
Cadence:
150/min
60/min
200/min

Motorsome Always On:

Motorsome When Off Cadence:

Voice Feedback:

Foot Contact Time:

Performance:

Steps:

Speed:

Heart Rate:

Distance:

Distance Value:

200 yards
400 yards
10 miles

Time:

All Virtual Coach Text-to-Speech strings:

Text-to-Speech

Disabled/Enabled:

Text-to-Speech strings

Please select from the drop down the string and edit it appropriately following the instructions.

FIG. 12D
METHODS AND SYSTEMS FOR DATA COLLECTION, ANALYSIS, FORMULATION AND REPORTING OF USER-SPECIFIC FEEDBACK

REFERENCE TO EARLIER FILED PROVISIONAL PATENT APPLICATION


FIELD

[0002] This disclosure relates to data collected from one or more sensors, including wearable sensors, methods and systems for using sensor-collected data in combination with data from other sources, analysis of the data, and formulation of user-specific feedback, such as recommendations based on the user’s profile, goals, needs, contextual and/or biometric data. In some aspects, the present disclosure relates to methods and systems for comparing the user’s data set to data collected across large collections of users, and/or to contextual and/or biometric data categorized as similar, and providing user-specific feedback relating to the user’s relationship to collections of similar users and/or to similar sets of contextual and/or biometric data. In some embodiments, the system and methods allow a user to select feedback and reporting parameters and to select performance and achievement metrics forming the basis for providing user-specific recommendations related to health, wellness, fitness, or other purposes.

BACKGROUND

[0003] Various types of sensing systems for monitoring various physiological parameters have been incorporated in bands, wrist-worn devices, portable electronic devices, medical devices, shoes, insoles, socks and other types of garments for various applications, including recreational, fitness, sporting, military, diagnostic and medical and health and wellness applications. The use of sensing systems for fitness applications to monitor and analyze activities such as running, walking, energy expenditure, and the like, is now common. Medical applications for sensing pressure, posture, gait, temperature and the like for purposes of monitoring neuropathic and other degenerative conditions with the goal of alerting an individual and/or medical service providers to sensed parameters that may indicate the worsening of a condition, lack of healing, and the like, have been proposed. Footwear-related sensing systems directed to providing sensory data for patients suffering from neuropathy, for gait analysis, rehabilitation assessment, shoe research, design and fitting, orthotic design and fitting, and the like, have been proposed.

[0004] Sensing devices and footwear having sensors incorporated for monitoring pressure and other body parameters are well known. Health and fitness data collection devices are currently available for collecting a variety of biometric (e.g., physiological) data. Heart rate monitors, pedometers, fitness tracking devices, location tracking devices, blood glucose monitors, heart rhythm (e.g., ECG) monitors, etc., are in common usage. Consumers of these types of health and fitness data collection devices typically collect and store multiple disconnected data sets, such as data sets relating to activity type, activity time, distance travelled, average or instantaneous speed, steps climbed, temperature, heart rate, calories burned, perspiration, blood glucose levels, etc. In the usual scenario, some or all of the data may be represented graphically in a dashboard format on the device or on an associated remote display device that reports the data to the user but provides little or no user-specific analysis or feedback. Such devices generally do not provide user-specific guidance or make recommendations as to how to achieve a user’s goals, how to exercise or train more effectively, or the like. Methods and systems described herein are directed to integrating data contributed by a user with data collected by one or more sensor systems and providing useful, user-specific feedback.

SUMMARY

[0005] The present disclosure relates to methods and systems for collecting data from one or more sources or sensing systems and interfacing with a host system having analytical capabilities and tools to provide useful data analysis and, optionally, feedback to a user or to a coach or care provider or other desired (or permitted) person or group. In some embodiments, the methods and systems may provide integrated sensing, data collection, data analysis and data reporting functions. In some embodiments, a user registers with a host system and provides user profile information and data to the host system through a user interface, typically provided on a user’s electronic device. A user may also provide authorization through a user interface for data collected by one or more device, such as a wearable or portable sensor(s)—e.g., a fitness band, wrist-worn sensing system, heart rate sensor, wearable sensor such as a wearable pressure sensor, or the like—to be communicated to the host system. The host system may collect (and synchronize, if necessary) data from additional sensors or data sources, analyze the collected data sets, produce results and conclusions, and report to the user or a third party designated by the user (e.g., a coach or care provider) through a user interface or a third party interface.

[0006] In some embodiments, the sensing system itself may have data processing, recording and/or data transfer capabilities. Thus, in some embodiments, a sensing system such as a wrist-worn band or watch-like device, an anklet, or another wearable or mobile device, may have data processing, recording and/or transfer capabilities. Such sensing systems may additionally have display capabilities, as well as audio, visual and/or tactile messaging capabilities. In some embodiments, an auxiliary device, such as a dedicated electronic device (DED), may be provided in communication with a sensing system, and the DED may provide data processing, recording and/or transfer capabilities and may additionally have display capabilities, as well as audio, visual and/or tactile messaging capabilities. In some embodiments, a sensing system and/or DED may communicate with and transfer data to one or more external computing and/or display system(s), such as a smartphone, computer, tablet computer, dedicated computing device, medical records system or the like, using wired and/or wireless data communication means and protocols. A sensing system, DED and/or an external computing and/or display system may, in turn, communicate with a centralized host computing system (located, e.g., in the Cloud), where further data processing, analysis and formulation of user-specific feedback takes place. Both substantially real-time feedback and delayed feedback, including data displays, notifications, alerts, reports, comparisons, recommen-
dations, and the like, may be provided to the user, caretaker and/or clinician according to user, caretaker and/or clinician preferences.

In one aspect, sensing systems (including one or more auxiliary or DED devices, and/or an external computing and/or display device) collect and analyze biometric data from body sites and provide intermittent or continuous monitoring and reporting of conditions and/or activity parameters and, in addition, combine the collected biometric data with additional data for purposes of analyzing and reporting activity parameters and providing feedback to the user, or to a coach in fitness applications, or to a caretaker or medical professional in other applications for purposes of reducing the incidence and/or severity of injuries, improving a user's performance (e.g., gait), providing information to caretakers, improving compliance with a prescribed regimen, and accelerating the pace and quality of wound healing. In yet other aspects, sensors, interfaces, systems and materials described herein for collection and analysis of biometric and/or biomechanical data may be used for a variety of sports-related, military, fitness, medical, diagnostic and therapeutic purposes.

Exemplary sensing systems incorporating wearable force or pressure sensors and DEDs, as well as data handling and processing routines and user interfaces, are described in U.S. Patent Publication US2013/0192071 A1 (WO 2013/116242) and PCT International Patent Application No. PCT/US14/049265, the disclosures of which are incorporated herein in their entirety. Other types of sensing systems, including many types of fitness and activity trackers, heart rate devices, pedometers, various types of medical condition sensors, and the like, may contribute data for processing in methods and systems described herein. Many exemplary systems will be provided with reference to fitness applications; it will be appreciated that the disclosed methods and systems are suited for use in many different environments and in a variety of applications.

In some embodiments, sensing systems incorporating various types of sensors, leads, traces and terminals may be mounted to and/or incorporated in or associated with garments, such as socks, shirts, underwear, leggings, footies, gloves, caps, sleeves, body bands and brassieres, and other substrates, such as insoles, shoes, boots, belts, straps, bandages, wraps, wrapping bands, wound dressings, sheets, pads, cushions, sporting equipment, and the like. In some embodiments, a sensing system is implemented in a wearable garment, such as a sock, a shirt, a glove, or the like and the sensing system includes one or more force and/or pressure sensors. In some embodiments, a DED may incorporate an accelerometer, a gyroscope, an orientation sensing component, a location sensing component, a temperature sensor, display capability, visual, audio and/or tactile indicating capabilities, and the like. Methods and systems for data collection, analysis and formulation of user-specific feedback are particularly well suited for use with sensing systems incorporating force or pressure sensors in combination with a DED incorporating one or more of the following: an accelerometer, a gyroscope, an orientation sensing component, a location sensing component, or a temperature sensor.

In one embodiment, an authentication routine and/or user identification system matches a DED and one or more associated sensing system(s) (e.g., a collection of sensor(s) associated with an underlying substrate) with a user, caretaker and/or clinician, and may link user information or data from other sources to a software- and/or firmware-implemented system residing on the DED or on one or more external computing system(s). In some embodiments, user information and data is linked to a wearable device or to a mobile device such as a smart phone, and the wearable device or the mobile device, or both, communicate with a centralized host computing system or facility where data is stored, processed and analyzed, and where output, feedback, communications, instructions, information, and the like may be formulated for delivery back to the user, caretaker and/or clinician.

Calibration routines may be provided to ensure that the sensing system(s) and any intermediate devices are properly configured to work optimally for each specific user and with the data processing and feedback system selected. Configuration and setup routines may be provided to guide the user (or authorized third party) to input user information or data to facilitate data collection, and various protocols, routines, data analysis and/or display characteristics, and the like, may be selected by the user (or authorized third party) to provide data collection and analysis targeted to specific users. Notification and alarm systems may be provided, and selectively enabled, to provide messages, warnings, alarms, notifications and the like to the user, and/or to authorized third parties, substantially in real-time, based on sensed data. Notification and alarm limits and boundaries may be set by the user, or by an authorized third party, or may be determined and set by the host system.

Many specific examples described herein relate to fitness applications. In some aspects, methods and systems described herein relate to a platform and host system that allows end users to select or design a training program and provides end users with motivation, recommendations and valuable data (real-time and not) to improve their training experience. The platform comprises a host computing system that may communicate with multiple components and services that range from mobile devices (smartphones and tablets) to services on the cloud and web sites that leverage the user’s data in combination with biometric and/or contextual data, using multilevel data processing and, optionally, artificial intelligence processing methods, to create ad-hoc customized feedback to specific users with the overall goal of physical condition and/or performance improvement and user engagement. The platform may also provide pre-determined and/or programmable fitness/activity programs that guide users through a series of activities. For example, a user may configure the platform to allow users to set their own training regimen and the platform formulates feedback to coach the user in accordance with that regimen. Alternatively, the platform may additionally or alternatively provide a menu of training programs or regimen selectable by users, and the platform will then formulate feedback to coach the user in accordance with the selected program and may recommend the use of additional or different programs as the user progresses. In some embodiments, the platform may additionally or alternatively provide a menu of virtual trainers or caretakers selectable by the user and formulates feedback in accordance with the style or personality of the selected trainer or caretaker.

In some aspects, the host system leverages an electronic delivery system by using smartphones and mobile electronics like smart watches and accessories (e.g., the wearable internet of things (IOT)) to communicate in real time to users by delivering user-specific feedback and notifications much like a personal trainer or caretaker would do. For example, the
host system may provide feedback for communicating to users, in real time, when they are within or outside boundaries set with respect to various parameters in a user’s configurations or recommended by selected programs. In a running training program, for example, the host system may provide user-specific feedback based on the user’s profile, real-time biometric data collected, and a selected training program or reporting parameters and boundaries relating to the user’s gait when running (e.g., ball/heel strike of the foot), the pace and cadence, the heart rate training zone, etc., for the purpose of motivating and coaching the user during the workout and providing recommendations for correcting the user’s form when necessary. The system may use different modes to deliver feedback and notifications to end users, from audio cues and audio (e.g., spoken) recommendations, to text, email and automated phone calls. The delivery mode, timing and frequency of reporting and feedback formulated by the host system is preferably dynamic over the course of the user’s training program, rather than static.

[0014] In some aspects, the system provides user selection from different levels and styles of feedback (e.g., coaching), as well as user-specific feedback. Thus, the system may provide basic activity notifications (e.g., simple status information and biometric data reporting relating to a current activity) to real-time coaching tips and full training programs tailored for the end user, as well as reports relating to the user’s workout form, compliance with the training program(s), progression, and the like. User feedback may be provided in substantially real time, or delayed, and may be delivered to the user in accordance with user preferences and smart algorithms that predict the most effective notification timing, frequency and delivery mode. In other aspects, the system may be customized to provide real-time (and/or delayed) observation and participation in the user’s activities by authorized third parties such as coaches, caregivers, and the like, remotely via a mobile application or web site/service or the like. In other aspects, the host system may assist the user to initiate operations on his/her behalf, such as communications with others.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 shows a highly schematic diagram illustrating a host system interfacing with a plurality of data modules to provide user-specific feedback.

[0016] FIG. 2 shows a schematic diagram illustrating an exemplary automated training data module.

[0017] FIG. 3 shows a schematic diagram illustrating an exemplary location awareness data module.

[0018] FIG. 4 shows a schematic diagram illustrating an exemplary external integration data module.

[0019] FIG. 5 shows a schematic diagram illustrating an exemplary environmental awareness data module.

[0020] FIG. 6 shows a schematic diagram illustrating an exemplary notifications data module.

[0021] FIG. 7 shows a schematic diagram illustrating an exemplary notifications delivery data module.

[0022] FIG. 8 shows a schematic diagram illustrating an exemplary predictions data module.

[0023] FIG. 9 shows a schematic diagram illustrating an exemplary self-learning data module.

[0024] FIG. 10 shows a schematic diagram illustrating an exemplary emotional feedback data module.

[0025] FIG. 11 shows a schematic diagram illustrating an exemplary motivational feedback data module.

[0026] FIG. 12A shows an exemplary virtual coach enable user interface and an exemplary virtual coach selection.

[0027] FIG. 12B shows an exemplary user interface for a virtual coaching program illustrating exemplary user selection choices for running form feedback.

[0028] FIG. 12C shows a portion of another exemplary user interface illustrating exemplary user selection choices for performance feedback.

[0029] FIG. 12D shows yet another exemplary user interface illustrating exemplary user selection choices for selectable feedback options.

[0030] FIG. 13 shows a schematic diagram illustrating exemplary user subpopulation clusters.

[0031] It will be understood that the appended drawings are not necessarily to scale, and that they illustrate specific embodiments of some aspects of systems and components described herein. The present invention is not limited to the aspects illustrated in the drawings or disclosed specifically herein.

DETAILED DESCRIPTION

[0032] In many embodiments, systems and methods described herein leverage data collected from three main data sources. A first category of data is user profile data, which may be provided directly or indirectly by a user, and may include information about the user, for example: gender, age, weight and height, foot size, foot conformation, shoes owned and worn during monitored activities, activity preferences and goals, reporting and data presentation and delivery preferences, coaching preferences, etc. A second category of data is biometric data, which refers to data that may be collected by one or more sensing systems or data collection device(s) connected with one or more sensors or sensing systems that detects user biometric data in real-time including, for example: heartbeat, pressure points, pressure exerted at identified body locations, temperature, moisture, blood gas compositions, body motion, position and location, body part (arm, leg, foot, shoulder, torso, etc.) biomechanical motion and position, etc. A third category of data is contextual data, which refers to data that may be collected externally of the user and communicated to and stored by a hardware component such as a smartphone, a computer, a dedicated data collection device or host system and/or software services. Contextual data may relate to information such as GPS location, outside temperature, weather conditions, terrain, user preferences, external user accounts (e.g., calendar, social networks, etc.) Each category of data may be communicated to and stored by a host system via any suitable data collection and/or communication device, such as a smartphone, an electronic sensing device, a computer or the like using any suitable data communication system.

[0033] The schematic diagram shown in FIG. 1 illustrates a host system communicating with users (through various means, including communication with sensing devices, electronic devices, software-enabled systems, apps, or the like) to collect and store user input. The host system additionally communicates with sensor systems and collects and stores sensor input (through various means, including communication with various types of sensing systems and/or electronic devices, software-enabled systems, apps, or the like). User and sensor input is communicated to, received by and stored in the host system, and user feedback is formulated in and delivered to the user from the host system.
The host system additionally incorporates or has access to a plurality of logic modules which are described in greater detail below and which function to collect and organize data from multiple sources, perform data processing, apply intelligence, and provide content and instructions to the host system for user feedback. The logic modules, in some embodiments, function as machine expert components that apply artificial intelligence logic rules that leverage databases created through dedicated tools.

An interface providing user registration prompts and user profile prompts may be provided and displayed to users, and users may be prompted to enter personal data in a variety of fields. In one embodiment, the user downloads and opens an app and enters user information, and user information is stored in a data storage facility provided in or accessible by a host system. In athletic training (or other) applications involving running, walking or leg movement, user profile data may include information such as user name, gender, date of birth, weight, height, shoe size, stride length, foot information such as arch type, tendency to promote or supinate, foot rotation characteristics (i.e., inward rotation, slight or more pronounced outward rotation), static and dynamic leg axis (i.e., bow legs, straight legs, knock knees). Explanatory diagrams and menus may be provided to assist the user to accurately characterize his/her foot, leg and movement attributes.

In other types of athletic training applications involving other types of movement, e.g., golf, baseball, boxing, gaming, etc., involving movement of other body areas, user profile information may include information such as user name, gender, date of birth, weight, height, equipment specifications and types, arm, shoulder or torso information and characteristics, and the like. In medical care applications, user profile data may include information such as user name, gender, date of birth, weight, height, medical condition, monitored biometric parameters and boundaries, medical equipment, medications, medical care professionals, and the like. It will be appreciated that many different types of user profile information, user attributes and equipment types and attributes may be useful and may be collected in a user profile interface.

In fitness applications, additional information indicating specific running shoe models owned and worn by the user may be provided. In one embodiment, for example, the user profile interface is pre-populated with different running shoe brands and the user selects brands owned and sizes, frequency and type of usage, and the like. The user may have an option to rate attributes of the specific shoes, including comfort, price, etc. Additional, more detailed information relating to the user’s experience of specific footwear may be collected, such as the user’s subjective shoe fit opinions (size fit, width fit, arch style or fit, support and comfort). Collection of this data from users across various populations allows other aspects of the host system to characterize specific footwear in accordance with the feedback provided and make footwear recommendations tailored to specific users based on their foot type, shoe attributes and shoe experience across a population. Similar features and interface options may be provided for other types of fitness training, medical monitoring and health and wellness applications. Detailed information may be collected, for example, relating to a user’s wearable accessories (gloves, clothing, head gear, etc.), sports and fitness equipment (golf clubs, bats, boxing gloves, etc.), and subjective user experience data may also be collected. Collection of this data from users across various populations allows the host system to characterize specific user wearables and equipment and make recommendations for wearables and equipment tailored to specific users based on their user profile data.

Sensor input may include biometric and/or biomechanical data from a variety of sensors, including wearable sensors (pressure and force sensors, heart rate sensors, accelerometers, gyroscopes, medical monitoring sensors for monitoring blood glucose, temperature, heart rhythm, ECG, EEG, blood pressure, blood oxygen, sleep quantity and quality, body weight and body mass index, etc.) used by the user. Accelerometers, gyroscopes and other types of location, position and motion sensors may additionally provide data relating to user position, location, motion, and the like.

Sensor system(s), typically worn or carried by a user to monitor biometric properties during an activity, or to monitor biometric (e.g., physiological) properties in everyday life, are typically registered to and provide data (continuously or intermittently) to the host system. The sensor system itself, and/or the host system, may provide data monitoring and feedback to the user (or to a third party permitted by the user, such as a coach or caretaker) on a continuous or intermittent basis. In an exemplary embodiment, a sensor system comprising one or more sensors located to sense force or pressure on the bottom of a user’s foot may be used in combination with a DED or one or more external sources that collects locational data, positional data (e.g., using an accelerometer and/or gyroscope) heart rate data, etc.

In some embodiments, one or more of the following data fields may be sensed and/or determined and reported to the user through a user interface: heart rate, calories burned, distance, pace, speed, ascent, descent, altitude, foot landing, foot contact, number of steps, cadence, vertical speed, heart rate zone, calories (fit), power, ambient temperature, ambient pressure, body temperature, blood pressure, blood oxygen level and blood glucose level. In other types of sensor systems, additional or different data fields relating to biometric, activity, health and/or wellness information of other types, of interest to users for other purposes may be displayed to the user. In some embodiments, one or more of the data fields listed above (optionally including additional data fields) may be displayed to the user during (and following) an activity. In some embodiments, the user may set boundaries and request notifications when sensed values for selected parameters exceed the predetermined boundaries. Various metrics may be calculated and reported to the user, in real time or subsequently, using a variety of media and reporting formats.

In one aspect, methods and systems described herein may be used in association with one or more biometric (e.g., physiological) sensors and may function as a “Virtual Coach” or “Virtual Caregiver.” Relevant feedback, such as real time reporting of biometric and other parameters, alarms and notifications when predetermined thresholds or boundaries are violated, recommendations for performing actions or modifying behaviors in support of user goals and/or well-being is formulated by the host system and communicated to the user and, optionally, to another permitted party authorized by the user, such as a coach, a caretaker or another permitted party, through an electronic device interface. In another aspect, systems and associated methodologies are disclosed for collecting data from the user using one or a variety of sources; comparing user data to data collected from a larger population and, particularly, to data collected from members...
of a larger population that share attributes with the user or have similar attributes or goals; providing user specific recommendations based on the data collected from the user in combination with similar data collected from other users having some commonality to the current user; and performing user-defined smart tasks or providing user-specific feedback based on such data.

[0042] In some embodiments, the user selects an activity (e.g., running, walking, cycling, skiing, etc.) prior to initiating data collection. In some embodiments, the system interfaces with sensors and has the capability to determine the type of activity that the user initiates (i.e., running, jogging, standing, sitting, walking, biking, skiing, etc.) without requiring user input. In case of a runner, the system may combine “how fast”, “how far” data with “how well” they are running. Data analysis using systems and methods described herein may provide the user with activity performance metrics, coaching input, and/or injury prevention guidance in real-time as the user engages in activity, or at a subsequent time. Methods and systems of the present invention may also be used to monitor and guide injury rehabilitation, as well as to monitor and guide users who have activity limitations and/or deficits. In an elderly patient or injury rehabilitation scenario, for example, a host system providing a virtual caregiver option to a user integrates data from multiple sensors, generates a gait analysis on the fly (standing or walking) and compares it with similar data sets to evaluate the user’s gait and posture and predict the chance of that user falling, or to make recommendations that may improve the user’s gait or posture, or reduce the user’s chances of falling. Notifications and/or alarms may be programmed to alert either or both the user and a caregiver, for example, of the higher risk of the patient falling and recommend the use of a walker or wheel chair. The system may also be able to track and report user weight changes over periods of time.

[0043] In one aspect, methods and systems described herein provide a platform for collecting and storing user information and data; collecting and storing data from user-worn and/or user enabled sensor systems; collecting and storing data from sources external to users; analyzing and integrating the data collected from various sources; formulating feedback (in the form of information, data, notifications, recommendations, and the like) relevant to the user based on user input preferences or instructions and/or based on information gleaned from larger populations; and delivering the user specific feedback to the user, optionally with additional content. The platform is typically operated by a third party host operator and typically resides on a host system, such as on a host operated computing system located at a facility remote from the user (e.g., in the Cloud). The host platform may communicate (directly or indirectly through one or more intermediate devices) with user-worn and/or user enabled sensor systems for data collection, and with external sources for collection of external data using various types of communications protocols; similarly, the host platform may communicate (directly or indirectly) with the user through one or more intermediate devices (e.g., an electronic device having data storage, processing and/or display capabilities such as a smartphone, computer, tablet, smart watch, or other smart device).

[0044] The host system incorporates a plurality of discrete logic modules, each module comprising and/or accessing one or more database(s) and machine learning algorithms and applying logic rules, optionally artificial intelligence logic rules, to formulate user-specific feedback. The exemplary logic modules illustrated in FIG. 1 including “Self Learning,” “Predictions,” “Auto Training Programs,” “Motivation,” “Environmental Awareness,” “Emotions,” “Notifications,” “Location Awareness,” “Notification Delivery,” and “External Integrations.” Additional or fewer modules may be incorporated in any host system, depending on the user population, the type of sensor input(s), the desired user feedback, and the like. An exemplary structure for each of the individual logic modules shown in FIG. 1 is illustrated in FIGS. 2-11. It will be appreciated that these module configurations are exemplary, and that additional and different information, data, content and logic may be applied in these or additional modules.

[0045] FIG. 2 shows an exemplary Auto Training Programs module. This module may provide access to a library of automated and programmable or programmable user sessions, such as fitness training sessions, rehabilitation sessions, or the like. In some situations, multiple programmable or programmable modules may be presented as feedback to the user for user selection; in some situations, the host system may select a programmable or programmable session for presentation to a specific user based on user profile data or other data relating to the user. In another aspect, an auto training program module may provide additional information, such as recommended time of day for a specific user to perform an activity, recommended activities, recommended locations, and the like.

[0046] FIG. 3 shows an exemplary Location Awareness module. A host system environment awareness module may track a user’s location and environment using locational data (such as GPS data) collected from a user worn or carried sensing or electronic device that interfaces with the host system. A host system location awareness module may include geo-fencing capabilities (e.g., the capability to identify a geographical perimeter based on its latitude and longitude location) that allow a user or a device operating within the system to set boundaries and provide alerts or notifications to a user when he or she enters and/or exits a geofenced boundary. Geofenced boundaries may additionally trigger the application and presentation of Smart Tasks (described in more detail below).

[0047] FIG. 4 shows an exemplary integration module, which may interface with external sources of data as well as external user accounts, networks, or the like. In the exemplary integration module shown, data from other sensing devices, such as a JAWBONE device, a FITBIT device (or another activity monitoring device), a sleep monitoring device, or other sources of sensed information are communicated to the module. An integration module may also include integrations with one or more of the following: an electronic user calendar (e.g., for scheduling or proposing workout or activity schedules that are compatible with the user’s calendar and free time), an electronic user music account or media account (e.g., NETFLIX, AMAZON, Pandora, iTickets, etc.), for automatically retrieving music or entertainment compatible with the user’s workout or activity, or to recommend entertainment or products compatible with the user’s lifestyle and life patterns), a user’s social or professional networks (e.g., FACEBOOK, TWITTER, LINKED IN, etc.). This type of integration module may allow the host system to make recommendations based on a variety of information derived externally of the sensing system. Thus, reference to a user’s calendar through an integrations module may allow the host system to make recommendations to the user relating to...
scheduling activities (e.g., runs, walks, events, etc.), may allow the platform to select or make recommendations to the user relating to entertainment while engaging in activities (e.g., music, movie and other media programming, etc.), and to discern the user’s mood and make recommendations based on the content of external user accounts and connections.

FIG. 5 shows an exemplary environmental awareness module. Environmental awareness may additionally involve data relating to current and/or future predicted weather conditions, current terrain types or terrain types (e.g., paved or non-paved road or path, topography, etc.) experienced along a user’s projected activity path, other environmental factors such as traffic lights, traffic patterns, traffic conditions, and the like that a user may experience along a projected activity path. Providing awareness of and recommendations relating to terrain type may involve alerting a user to terrain along a specified route, recommending routes or alternative routes based on terrain type and user limitations, and the like.

Environmental awareness may additionally involve data relating to current and/or future predicted proximity to friends, sights, business, or the like, along a current or projected activity path of a user. In some embodiments, an environmental awareness module may provide one or more of the following features: Crossroad/Traffic Light Detection—e.g., a way to warn users of crossroads, traffic lights and other environmental features that pose a danger to the user and perform a smart-task to stop or pause or lower the volume of music (if playing) to ensure user is aware of potential dangers; automatically create a music selection based on the local area; inform users of friend and workout partners that are in the current area; and inform users about entering and exiting a specific area (e.g., entering a playground area and warn the user to be careful of children at play). FIG. 6 illustrates an exemplary Notification module structure. Using this module, the notification type—e.g., audio cues (non-verbal), audio messages (verbal), push notifications, texts and automated phone calls may be selected (by the user or the host system) as the delivery mode for various notifications. Notifications of different types and having different content may be delivered at different times using different delivery modes. The timing, frequency and priority of notifications is important, and may be handled in a delivery module or in a Notification Delivery Logic module, as described below. Real-time and/or offline (non-real time) notifications may be provided, as selected by the user or as determined by the platform. Notifications of many types may be provided, including (without limitation) notifications regarding compliance to a selected plan or regimen, activity-related parameters and reports; technique-related recommendations for improved performance, injury prevention, etc., positive reinforcement for encouraging activity, etc. Off-line notifications may include activity reports provided to the user in a programmed or programmable format.

Different types of audio cues (non-vocal sounds, e.g., bing/bang sounds) may be used to notify users when they are doing something correctly or incorrectly. The audio cues may be different when the user is performing an activity correctly (bing) or when a sensed parameter is within a boundary than when a sensed parameter is outside a predetermined boundary (bang). This type of notification aids the user during a monitoring period. Audio messages, such as spoken cues (generated, e.g., from a text-to-speech engine), may be used to notify users of the status of their activity or to report real time sensed values (e.g., current speed, pace, distance, etc.), or to apply changes to the activity to comply with the parameters (e.g., to increase or decrease a Heart Rate Zone). Audio messages may be provided to motivate the user to improve sensed values and overall performance.

Device push notifications, which generally comprise messages that are pushed by the host system to the user’s device, may appear as text messages on a device. How such messages appear may be also dependent on the type of platform (Operating System) that the device is running. E-mail messages may also originate at the host system and be communicated to the user’s email inbox. These messages may include consolidated reports including varying detail relating to the user’s past activities, the system’s analysis of the user’s activities and performance, suggestions and recommendations for future activities, improvements, and the like. In another scenario, automated phone calls may originate with the host system and be automatically placed to users informing them of particular events, activity recommendations, warnings or alerts, such as change of weather or the like.

FIG. 7 illustrates an exemplary Notification Delivery Logic module structure, including notification timing, frequency and priority, as well as delivery mode or mechanism. These elements may be selected by the user and/or determined by the platform. The format, content and timing of notification deliveries may vary so that the notifications remain fresh and of interest to the user. This module may also provide priority routing of conflicting messages or resolve conflicting message timing issues.

FIG. 8 illustrates an exemplary Prediction module structure. Based on historical data collected and stored corresponding to each user, this module of the host system may make predictions and recommendations to users such as the best day and weather conditions for particular types of activities, best time of day for a workout, best shoes to wear for a particular workout, route or terrain type, best “pals” for workout sharing and data comparison, etc.

FIG. 9 illustrates an exemplary Self-learning module that includes both historical user data leveraging and social learning components. The social learning component may involve grouping, or clustering of participating users having similar attributes (described below). Based on grouping users by attributes, “Foot Pals” having similar activity profiles and other selected attributes may be identified for each user, and recommendations relating to activity tips, training tips, shoe recommendations, and the like. Historical user data may be analyzed by the host system module to provide user recommendations relating, for example, to workout patterns and regimen, activity types, locations, frequency, solo vs. group participation, and suggestions concerning footwear, terrain, equipment, speed, frequency, distance, and the like.

A host system “emotion” module, as schematically illustrated in FIG. 10, may direct additional feedback content to a user, such as jokes and facts, based on the user’s location, activity, mood detection, or the like. Additional content such as music, playlists, interesting facts or stories, or the like, may be selected for and/or recommended to a user based on mood detection, user activity and performance metrics, geographical location, and the like. A host system “motivation” module may additionally be provided, as schematically illustrated in FIG. 11, to formulate and track user performance-based awards, points, etc., and to prompt the user to participate in activities.
Methods and systems for formulating and providing user-specific feedback based on user profile information and sensed data may include one or more of the modules described above, and may include additional functionality. In some embodiments, host systems having at least two, or at least three, or at least four, or at least five, or at least six, or at least seven, or at least eight of the functional modules described above and shown in FIGS. 2-11 are provided. Formulation of user-specific feedback may be based on any combination of user profile input, user activities, user goals, real time sensed (biometric) data, real time contextual data, coordinated analysis of multiple real time sensed and contextual data sets, and coordinated analysis of databases containing historical sensed and contextual, as well as user data. Various settings for controlling and adjusting the type, content, frequency and delivery mode for feedback may be provided and may be accessible to a user directly on a sensing device and/or on an intermediate mobile electronic device. In many embodiments, various control settings may be provided in a user's mobile application. In some embodiments, various control settings may additionally or alternatively be communicated from the host system to the user's sensing device or mobile electronic device.

Methods and systems described herein may be used to provide user-specific feedback delivered through a “Virtual Coach” or “Virtual Caregiver” format, as mentioned above. Different levels of coaching and caretaking may be delivered to individual users, ranging from basic activity notification (e.g., simple status of the current activity and simple metrics relating to current activity) to real-time coaching or care-taking tips and full training or care programs tailored specifically for the end user. The Virtual Coach and/or Virtual Caretaker features may provide users with a series of real time communications relating to the user's current condition, workout parameters and form, compliance with a rehabilitation or training regimen, progress toward a goal, or the like. These features may be used to communicate to a user when he/she is within or outside a boundary set in these configurations for the purpose of engaging and motivating the user during activity and providing an opportunity for the user to modify his/her behavior. These settings may be defined in a configuration setting in a mobile device or a mobile application that monitors user's biometric data.

A Virtual Coach or Virtual Caretaker feature provided by the host system may allow the user to select from among a variety of pre-set fitness/activity/health and wellness programs that guide users through a series of activities. In some embodiments, the host system may present a user with a selection of specific individuals or avatars representing virtual coaches or caretakers, each having a unique name, voice and feedback style. Users may select a specific virtual coach or caretaker, and feedback is then delivered through the selected virtual coach or caretaker. FIG. 12A illustrates a sample user interface showing a virtual coach feature enabled and one exemplary virtual coach, “Mara.” In some embodiments, the host system may select or assign a specific virtual coach or virtual caretaker to a specific user based on user profile information and user data. In some embodiments, the user may select a specific virtual coach or caretaker for delivery of feedback, and the user may also select, or program, many aspects of the feedback content, delivery format, and delivery frequency. Sample activity feedback selections, content and user interfaces are illustrated in FIGS. 12B, 12C and 12D.

The host system as described herein may also be linked to and used by professional coaches and medical care providers, such as physicians, nurses, physical therapists and other care providers to facilitate remote monitoring of the activities and/or condition(s) of users and to communicate feedback and recommendations to users and/or to the third party provider(s). In one scenario, for example, a professional athletic coach or trainer, or a professional caregiver or medical professional, may be linked to the host system and a user's account on the host system. In some applications, one or more (authorized) third parties (e.g., coach or caretaker or training partner or colleague) may monitor a user's condition or performance in substantially real time as biometric data is acquired by a sensing system worn or carried by the user and communicated to the host system. In some applications, one or more (authorized) third parties may monitor a user's condition or performance over a period of time to detect trends and/or gauge current performance levels or conditions and provide feedback to the user.

In some applications, an additional interface with the host system may be provided for third party entry of configurations for specific users, such as data collection content and frequency, alert and notification boundaries, and the like. In some applications, the third party coach or caretaker may provide content such as user-specific feedback in the format of training protocols, activity and performance modifications and recommendations, motivational messages, and the like, to the user through the host system. Thus, in some embodiments, the host system serves as an interface and analytical reporting system, collecting and providing real time and/or historical data relating to a user's condition, activities and/or performance to one or more user-permitted third party participants, and relaying communications between a monitored end user utilizing a sensing system and a coach or caregiver monitoring the status and/or activities of the monitored end user.

In some embodiments, the host system and user interfaces may be customized for use by a particular user or company, and user interfaces, reporting and notification formats, and the like may be customized by or co-branded with a third party for presentation to a collection of users. In this setting, the host system typically allows the third party to provide content, protocols, activity and performance modifications and recommendations, reporting and notification formats and delivery modes, configurations, settings, and the like, while the host system may serve as an interface and reporting system providing feedback to users.

In some embodiments, the host system may additionally provide one or more purchase and payment modules. In these embodiments, user profile data may include payment authorization data, and the host system may provide interfaces between users and third party sales outlets. If the host system presents a particular sports or fitness equipment or accessories, the host system may present sales outlets offering recommended products to the user and facilitate a sales transaction. If the host system makes a recommendation for matching a user with a particular coach or trainer or caregiver, for example, the host system may present subscription or payment options for retaining a particular coach or trainer or caregiver and/or purchasing other types of goods or services.

In some embodiments, systems and methods disclosed herein integrate data collected over a population or
sub-population of users and groups in clusters according to similarity or affinity of one or more user data fields or characteristics. In one embodiment, for example, the host system is configured to use any number of individual data points, also referred to as attributes or features, to create groups (clusters) of users that have an affinity with respect to selected attributes. Users falling within common clusters may be classified as “pals”—e.g., “foot pals,” “ski pals,” (bike) “riding pals,” etc. Health and wellness-related clusters may also be formulated, with similar groupings of users having common characteristics, goals, and the like. Examination and comparison of other data fields corresponding to members of the cluster allows the system to formulate and provide recommendations to a user based on comparison of the user’s data with the attribute data of reference individuals sharing similar attributes, and/or a reference group determined by classification of user data available in the system.

For example, a first classification might cluster a user population or sub-population by gender. A next level, second classification might add age, then additional attributes, including height, weight, feet characteristics (e.g., size, pronation, etc.), and so on. The final result may be an N-dimensional space where each subject is classified in relation to other members of the group or sub-group. Groups of affine subjects may be determined by pivoting around fewer data attributes (M dimensions). The group membership may be determined by calculating the “distance” of subjects from the center of the cluster and may be visualized by positioning individuals at the relevant distance from the center of the cluster in relation to other individuals in the group. Example user subpopulation clusters are schematically illustrated in FIG. 13.

In one specific example, let C be a data point representing the center of a cluster where each dimension is the numerical expression of the individual features, for example, men of age 35, weight 180 lbs., height 6’, foot size 10.5, over-pronating. Let X be a data point corresponding to a specific subject—for example, John, age 36, weight 160 lbs., height 6’2”, foot size 10.5, over-pronating. If the distance D(Distance (X, C) is below a set threshold, the subject will be considered part of the specific cluster. Note that any suitable algorithm may be used to create clusters, as long as it’s computationally sustainable. This usually translates in finding an efficient, yet accurate, distance function.

In one embodiment, a variation of the “k-means clustering” algorithm provides a suitable way to build the desired clusters. The standard k-means algorithm assigns a set of k random additional vectors (or points) to define cluster “centroids.” For each iteration, the following computation is carried out: each data point is assigned to the cluster centroid closest to it; the centroid is moved to the average position of all the data points that belong to it; and, if any of the centroids moved in the last step, perform another iteration, otherwise exit. This algorithm allows identification of suitable clusters for various populations and sub-populations.

In another embodiment, if we want to create clusters “on the spot,” based on a subset of features, or pivoting around specific centers, k specific centers can be provided, and clusters may be computed in a single iteration. Clustering of individuals in groups and sub-groups may also be performed using different classification algorithms and techniques, including hierarchical clustering, agglomerative nesting, and k-NN (nearest neighbor) algorithms. Each new user can be classified and grouped in any of the existing clusters. The classification can be used immediately to provide recommendations that pertain to the relative distance of subjects in the group.

The type of cluster classification and the recommendations available using the type of cluster classification previously described is somewhat static, as the recommendation will always be the same provided that the user stays in the same cluster. A more dynamic set of recommendations can be provided to the user when data based on their physical activity, or sensed data collected during physical activity, is included in the analysis. In one embodiment, for example, using data acquired from the foot pressure from multiple users that share commonalities (i.e. foot pals), the system can build recommendations that can be pushed to the runner during the physical activity. The runner may be prompted, for example, to modify their behavior throughout an activity (for example, they may be prompted to start running slower or more quickly, or to change their stride, cadence or the striking point). In this case, the host system may observe changes in biometric user data patterns and recommend changes in user behavior to improve the user’s performance, to prevent an injury, and/or keep the runner on target to attain his/her goal (s).

As the user complies with a recommendation, the virtual coach can run multiple simulations of type “what if” and “expected outcome is”. The best one that applies to the running subject can be used by the system as the next recommendation that is going to be delivered to them. When the user ignores a recommendation, a motivational message can be used to win the confidence and build up the compliance with the recommendation system.

To illustrate, let’s consider the following scenario: Subject A has the following user attributes: Weight: 190 lbs., Height: 5’7″, Build: Medium, Arch Type: Medium, Foot Width: Normal, Current goal: run for 5 miles at 7.5 mph, no stops, Status: active and running regularly. Goal status: Achieved and sustaining Subject B has the following attributes: Weight: 195 lbs., Height: 5’6″, Build: slender, Arch Type: Medium, Foot Width: Normal, Current goal: run for 4 miles at 4.5 mph, with 2 stops, Status: working on it, very little success so far, Goal status: not achieving. The classification compares Subject B’s profile with hundreds of others that are similar, but have already achieved the goal or are currently seeing better results. When a matching population (cluster) has been assembled, the system compares other relationships between the best candidates and subject B’s features, using other attributes like body build, dedication, time in achieving results and so on, as well as run patterns, based on the biometric data. Subject A is a good candidate to use as a prototype for the recommendation because Subject A has an affine profile compared to subject B (same cluster), and Subject A has a better achievement result.

A set of multiple hypotheses can be built and ranked; the best applicable recommendation is provided to subject B (for example, to follow similar patterns observed in subject A, such as number of steps per minute, stride length, distance covered, etc.). As the subject complies with the recommendations, the system can compare the likelihood of positive impact against the goal, then compares against the past of other subjects (e.g. subject A) in the same pool, and create a baseline for subject B, to continue evaluate the expected outcome vs. the actual outcome. A positive observed outcome following a specific recommendation(s) is noted and positively affects the system to make the same
recommendation for other subjects with similar characteristics. A negative observed outcome following a specific recommendation is also noted and negatively affects the system and reduces the likelihood of giving that specific recommendation in future.

[0073] User-specific feedback and recommendations can be provided in real-time (i.e., when the user is performing an activity) so that the user can benefit immediately from the recommendations. Appropriate means of real-time communication for the recommendations may include: audible cues and/or messages delivered, for example, via specific user interface(s) on smart-phone/computer applications; audible messages via automated phone call, text message or e-mail accounts, text messages, e-mails, twitter accounts, etc. Recommendations may also be provided to the user in a non-real time scheduling format (e.g., after the fact or as a result of a more complex, off-line processing). Appropriate means of delivering offline communications to users may include: end-of-day daily reports via email; digital dashboards (web or smart-phone/computer apps); Social Media services (e.g. Twitter, Facebook, etc.).

[0074] In addition to recommendations formulated using classification of data and pattern matching algorithms, the host system may also be capable of performing "smart tasks" based on specific user directives, as a direct consequence of the occurrence of a specific combination of real-time data (individual data points or aggregated). In one embodiment, a smart task is characterized by: a condition that is evaluated and an action that is executed when the condition is verified. A smart task may be activated by the user through a dedicated subsystem (e.g., digital dashboard) in which the user can view, create, update and delete smart tasks.

[0075] Conditions can be very coarse (i.e., based on a large amount of aggregated data), for example: total number of steps during a workout, total number of miles during a run, total number of steps taken in a week, total number of miles travelled in a week, distance recorded during a run, speed recorded during a run, average minute per mile, etc. These conditions will generally be evaluated at regular intervals periodically, and will typically fire at most once during the reference period (workout, run, week, etc.). Conditions can also be very granular (i.e., based on specific data patterns), for example: x % variation in stride; x % variation in pronation; x % variation in eversion; progressive change in speed; x lbs. delta weight detected (dehydration). These conditions are generally evaluated at a higher frequency, and can fire several times during the reference period (workout, run, week, etc.).

[0076] The host system may provide a preset menu of "smart tasks" that the user can enable/disable and/or tune with actual parameters (e.g., change the variation percentage in stride). The user may also create new smart tasks by duplicating and modifying existing ones, or by activating new smart tasks by selecting specific patterns in their data. The user interface allows the user to be flexible with their choices. In some embodiments, smart tasks can auto-update to new parameters. For example, smart tasks tracking all-time records (e.g., reaching a total of 10000 steps) may automatically update to the next level of achievement once the user has achieved that level. Or, smart tasks tracking performance records (e.g., run a time below a 6 minute mile) may automatically track against the best performance. Smart tasks can be seen as powerful mechanisms that may provide immediate feedback to the user for motivational and self-improvement purposes and, alternatively, that may provide a means to detect unusual patterns and provide corrective feedback, as well as a means to communicate with others (e.g., acquaintances, personal trainer(s), etc.) the results of specific activities or the occurrence of specific conditions.

[0077] Actions can be any action that the host system supports. Depending on the type of the task and the goal, they may include: direct feedback to the user (motivational stimuli, corrective feedback); indirect feedback to the user (e.g., power booster songs from their collection); feedback to friends (bragging, competitive and motivational stimuli; social networking); end-of-day reporting, digital dashboard; and alerting.

[0078] In some embodiments, methods and systems described herein provide smart feedback relating to footwear wear patterns or recommendations for replacement. In one specific example, when the user identifies particular footwear worn during certain activities and the host system is capable of calculating the distance travelled by the user while wearing particular footwear and participating in certain activities, the host system can determine and monitor a user's mileage accumulated on specific footwear. The host system may provide user-specific feedback relating to the user's mileage accumulated on specific footwear to the user on a continuous or intermittent basis through a user feedback interface. The host system may alternatively or additionally alert the user when the mileage accumulated using particular footwear has reached a predetermined number of miles, and the host system may additionally recommend replacement of the footwear based on accumulated mileage. Shoe purchase recommendations may be provided to the user based on user profile information, user activities, user preferences, and external footwear database information. Shoe purchase recommendations may also be provided based on data collected from a larger population that share attributes with the user or have similar user profile information.

[0079] In one specific example of recommendations made based on clustering, consider the following scenario: "Provide the best fitting shoe recommendation for a specific customer based on the entire population data." The assumption is that people with similar anatomical features will experience similar comfort or pain levels in wearing a shoe. Therefore, individuals having similar individual foot and body structural features provide the best basis for footwear fit predictions.

[0080] Let's consider a user (or foot) profile with the following features: Gender, Age, Weight, Height, Foot Size, Arch Type, Pronation Type, Prevalent Activity type and intensity. Let's also consider the following information provided by (some or all) users: Brand (make, model) of shoes worn; subjective fitting information, including Size Fit, Width Fit, Arch Support, Comfort, and Frequency of Usage. The system will cluster the user population based on the user (foot) profile data. The resulting clusters identify groups having affinity (similar characteristics) across selected data categories. Depending on the number of features we select in a specific query, different groups can result (e.g. subjects [male, age 40, over-pronating] vs. [male, age 40, over-pronating, size 10.5]). An additional classification may cluster the shoes, in relation to users, based on the subjective fitting information provided by each user. A ranked list of shoes may be assembled based on the fitting information for each specific cluster of users and used to provide user-specific feedback.

[0081] For example, let A, B, C be three clusters of users in our population. Let S1, S2, . . . SN be a set of shoes that the population has come to try/wear. For each cluster, the collect-
tion of shoes SJ . . . SN may be ranked based on relative relevance of such shoes for the sub-population of users in the cluster. For example, S1 is recommended favorably by 5 users in cluster A, 2 users in cluster B, 0 users in cluster C. S2 is recommended favorably by 3 users in cluster A, 2 users in cluster B, 10 users in cluster C. S3 is recommended favorably by 1 user in cluster A, 5 users in cluster B, 2 users in cluster C. Also, S1 is negatively recommended by 1 user in cluster A, 1 user in cluster B, 3 users in cluster C. Assuming, for the sake of simplicity, that a favorable recommendation counts as +1, while a negative recommendation counts as –1. The resulting ranked list for cluster A is (S1, S2, S3) (total rank: –4, 3, 1); the resulting ranked list for cluster B is (S3, S2, S1) (total rank: 5, 2, 1). The resulting ranked list for cluster C is (S2, S1) (total rank: 10, 2, –3). The calculation of relevance for the ranking algorithm is generally more sophisticated, because the evaluation of the shoe is more granular (using, for example, a rank of 1 to 5 for each of the subjective fitting attributes assigned by each user on a shoe).

[0082] After the classification is performed, a user can receive shoe recommendations simply by providing their foot profile. The recommendation will be accurate as long as enough data points (i.e., a sufficient data population) are available in the knowledge base. Users may also be able to provide their own “feedback” data, augmenting the overall knowledge base and altering the clusters and classification for the ranking algorithms.

[0083] While the present invention has been described above with reference to specific embodiments and the accompanying drawings in which specific embodiments are shown and explained, it is to be understood that persons skilled in the art may modify the embodiments described herein without departing from the spirit and broad scope of the invention. Accordingly, the descriptions provided above are considered as being illustrative and exemplary of specific structures, aspects and features within the broad scope of the present invention and not as limiting the scope of the invention. The various embodiments described herein may be combined to provide further embodiments. The described devices, systems and methods may omit some elements or acts, may add other elements or acts, or may combine the elements or execute the acts in a different order than that illustrated, to achieve various advantages of the disclosure. These and other changes may be made to the disclosure in light of the above detailed description. It will also be understood that while the above description and the appended claims refer to methods for accomplishing certain tasks and providing certain feedback, the invention and the disclosure also provides means and systems for implementing the described methods using a host system, as described, interfacing with one or more electronic devices.

[0084] In the present description, where used, the terms “about” and “consisting essentially of” mean ±20% of the indicated range, value, or structure, unless otherwise indicated. It should be understood that the terms “a” and “an” as used herein refer to “one or more” of the enumerated components. The use of the alternative (e.g., “or”) should be understood to mean either one, both, or any combination thereof of the alternatives, unless otherwise expressly indicated. As used herein, the terms “include” and “comprise” are used synonymously, and those terms, and variants thereof, are intended to be construed as non-limiting. In general, in the following claims, the terms used should not be construed to limit the disclosure to the specific embodiments disclosed in the specification.

We claim:

1. A method for formulating user-specific feedback, comprising:
   a. providing an electronic user interface for populating user information;
   b. providing an electronic user interface for selecting a user-desired objective selected from the group of physical training objectives, physical rehabilitation objectives, and medical condition objectives;
   c. providing a host system capable of: receiving the user information, the user-desired physical training objective, and user biometric information sensed by a user-worn or user-carried sensing system; analyzing the user information, user-desired physical training or medical condition improvement objective and user biometric information; and formulating user-specific feedback for guiding a user to achieve the user-desired objective; and
   d. providing a user interface for communicating the user-specific feedback to the user.

2. The method of claim 1, wherein the user-worn or user-carried sensing system is selected from the group consisting of: fitness and activity trackers, heart rate devices, pedometers, medical devices, and garment-worn sensing systems.

3. The method of claim 1, wherein the user-worn or user-carried sensing system comprises at least one force or pressure sensor.

4. The method of claim 3, wherein the user-worn or user-carried sensing system additionally comprises at least one of the following sensing components: an accelerometer, a gyroscope, an orientation sensing component, a location sensing component, and a temperature sensor.

5. The method of claim 1, wherein the host system is additionally capable of receiving additional information derived from a source other than the user, and the additional information is analyzed, with the user information, user-desired physical training or medical condition improvement objective and user biometric information to formulate user-specific feedback for guiding the user to achieve the user-desired objective.

6. The method of claim 1, wherein the host system provides pre-determined and/or programmable fitness/activity programs for selection by a user that guide a user through a series of activities.

7. The method of claim 1, wherein the host system provides a menu of training programs selectable by the user and formulates the user-specific feedback taking into account a selected training program.

8. The method of claim 8, wherein the host system provides a menu of virtual trainers or virtual caretakers selectable by the user and formulates the user-specific feedback through a selected virtual trainer or virtual caretaker.

9. The method of claim 1, additionally comprising providing a user interface for selection of at least one aspect of user feedback content, delivery format and delivery frequency.

10. The method of claim 1, wherein the host system additionally programs at least one of the user feedback content, delivery format, and delivery frequency on a dynamic basis.

11. A method for formulating user-specific feedback, comprising:
   a. providing a user interface for populating user information;
b. providing a user interface for selecting at least one user-desired objective selected from the group of physical training objectives, physical rehabilitation objectives; and medical condition objectives;
c. providing a user interface for selecting a virtual coach or virtual caretaker for delivery of feedback to the user;
d. providing a host system capable of: receiving the user information, the at least one user-desired objective, and user biometric information sensed by a user-worn or user-carried sensing system; analyzing the user information, the at least one user-desired objective and user biometric information; and formulating user-specific feedback for guiding a user to achieve the user-desired objective; and
e. providing a user interface for communicating the user-specific feedback to the user through the virtual coach or virtual caretaker.

12. The method of claim 11, wherein the virtual coach or virtual caretaker has name, voice and feedback style.

13. A method for formulating user-specific feedback, comprising:
a. providing an electronic user interface for creating a user account and populating user information in the user account;
b. providing an electronic user interface for selecting user-desired condition(s) or activity reporting parameters and user condition or activity notification boundaries in the user account;
c. providing a host system capable of: receiving the user information, receiving the user-desired condition or activity reporting parameters and the user condition or activity notification boundaries; receiving user data sensed by a user-worn or user-carried sensing system; analyzing the user information, the user-desired condition or activity reporting parameters and user condition or activity notification boundaries; and formulating user-specific feedback comprising reports for delivery to the user relating to sensed conditions and activities and notifications when sensed conditions or activities are outside notification boundaries; and
d. providing a user feedback interface for communicating the user-specific feedback to the user.

14. The method of claim 13, wherein the user information includes user authorization for providing access to the user information and information sensed by a user-worn or user-carried sensing system by an authorized third party.

15. The method of claim 13, wherein the third party is a user-selected coach or caretaker.

16. The method of claim 13, additionally comprising providing a third party electronic interface with the user account in the host system and providing access to user information, information sensed by a user-worn or user-carried sensing system, and user-desired condition(s) or activity reporting parameters and boundaries to the authorized third party.

17. The method of claim 16, wherein a third party electronic interface additionally allows the authorized third party to contribute to and communicate user-specific feedback to the user through the user feedback interface.

18. The method of claim 13, additionally comprising formulating user-specific feedback for providing user-specific recommendations for changing a condition or activity when sensed conditions or activities are outside notification boundaries.

19. A method for monitoring footwear usage, comprising: providing a user interface for entry of user information relating to footwear worn at specific times and/or during specific activities; collecting data from a user-worn or user-carried sensing device and calculating a cumulative distance travelled while specific footwear is worn; and reporting the cumulative distance travelled while specific footwear is worn to the user.

20. The method of claim 19, additionally comprising making a recommendation to the user for replacing footwear when the cumulative distance travelled while specific footwear is worn exceeds a predetermined distance.

21. The method of claim 20, additionally comprising making a recommendation to the user for replacing footwear with a purchase of specific footwear based on comparison of user information, user activity information and data collected from a larger population that share attributes with the user.

22. The method of claim 21, additionally comprising providing a user interface for purchasing new footwear.