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Dugan

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- (54) **BANDS FOR MEASURING BIOMETRIC INFORMATION**
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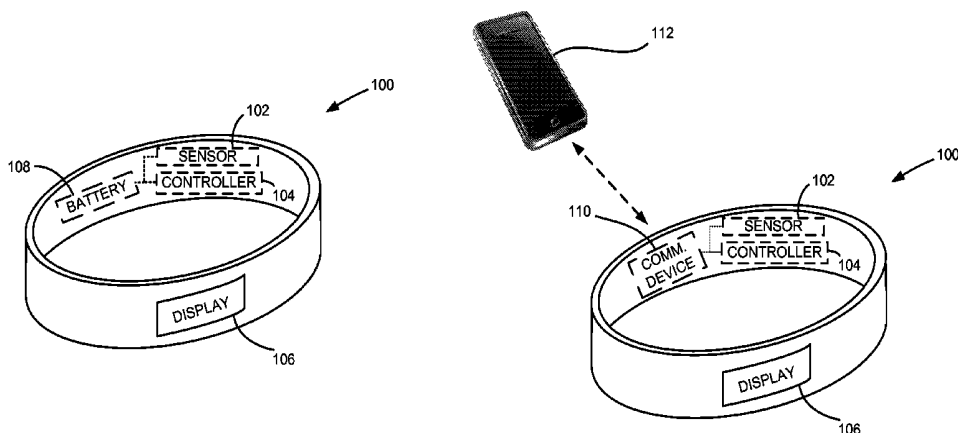
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(57) **ABSTRACT**

In some aspects, a system is provided that includes (1) a wrist band having one or more sensors that measure biometric data of a user wearing the band; and (2) a display on the band that displays a message based on biometric data measured by the band. The message indicates a heart rate zone of the user. Numerous other aspects are provided.

20 Claims, 5 Drawing Sheets



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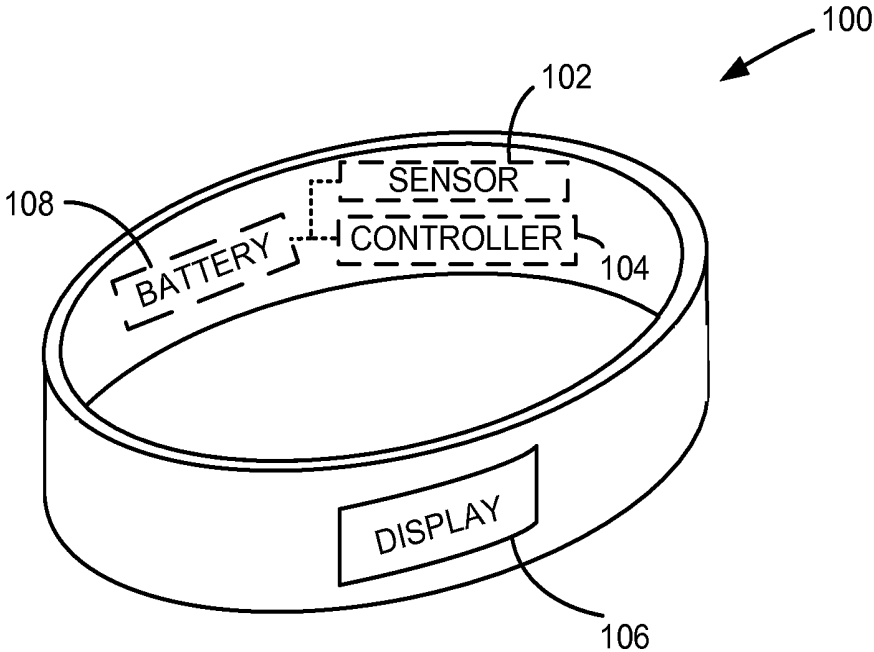


FIG. 1A

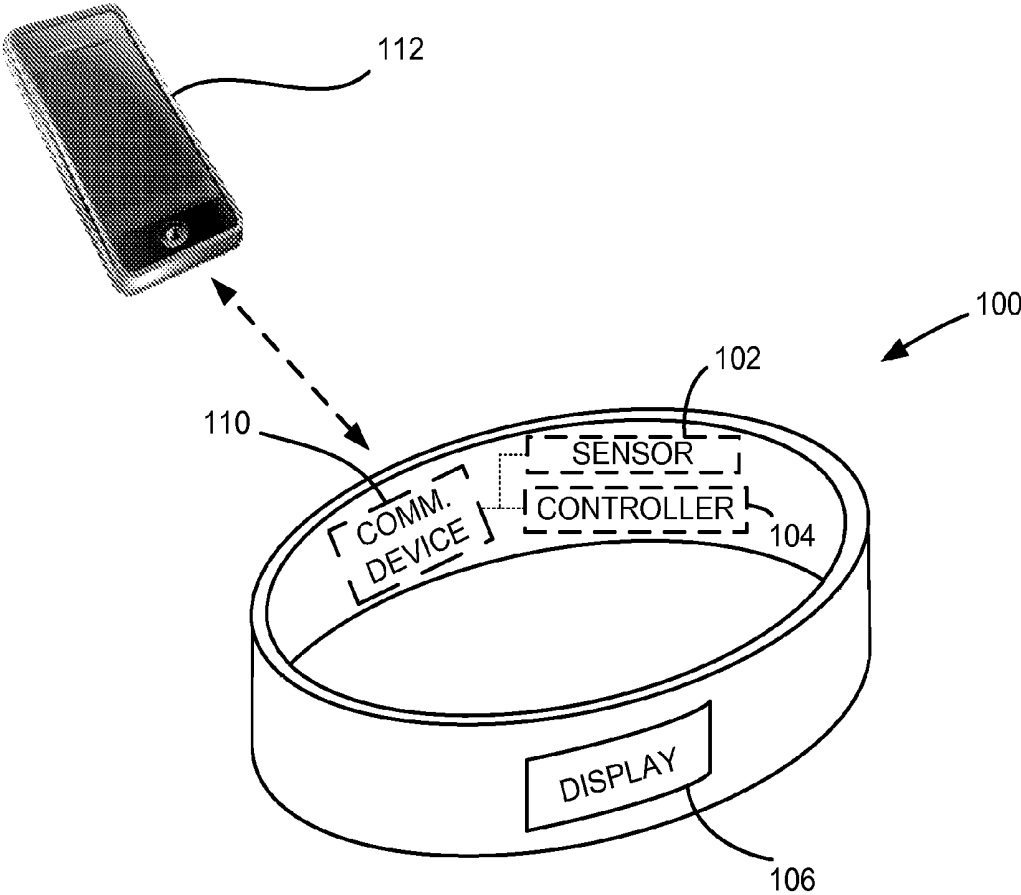


FIG. 1B

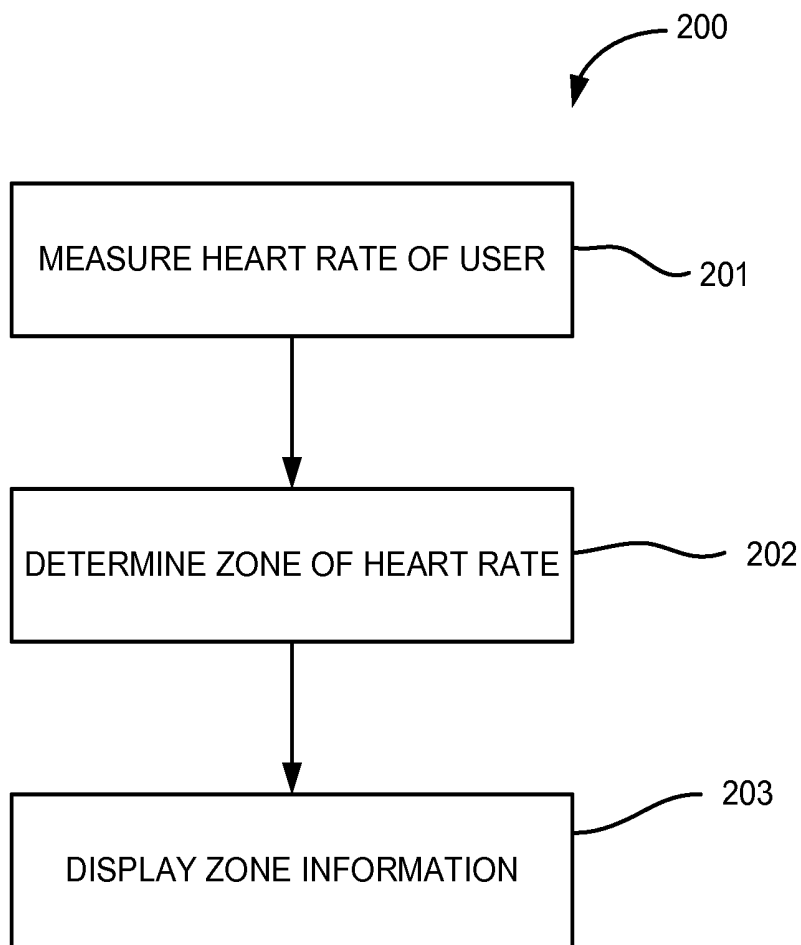


FIG. 2

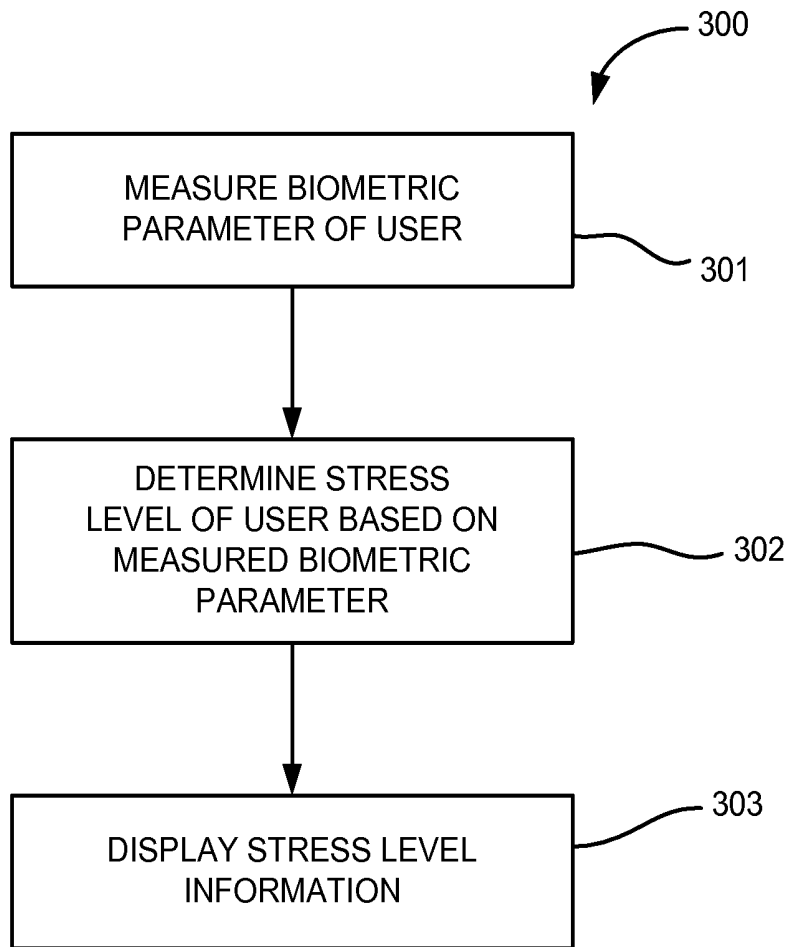


FIG. 3

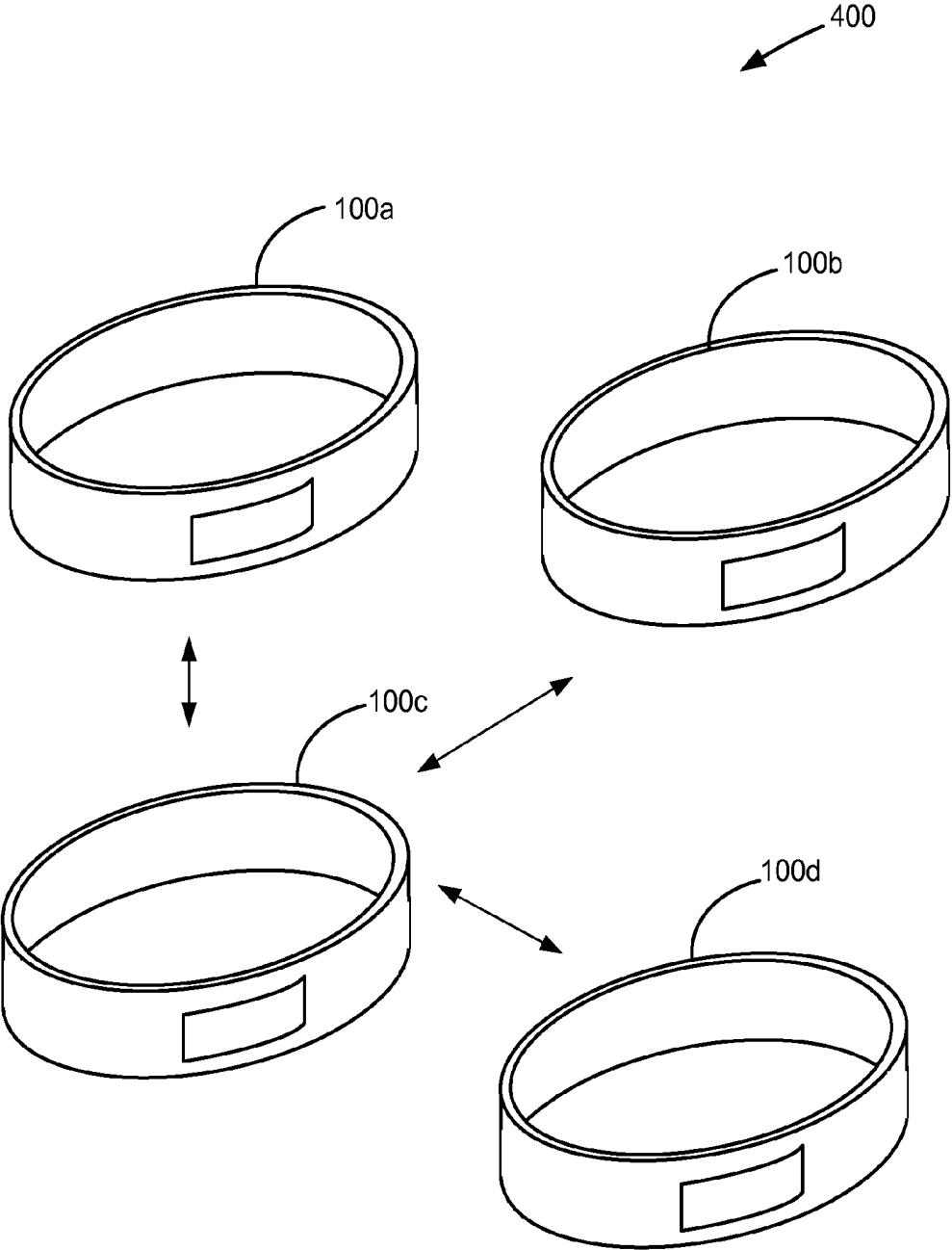


FIG. 4

BANDS FOR MEASURING BIOMETRIC INFORMATION

This application is a continuation of and claims priority to U.S. patent application Ser. No. 13/488,436 filed Jun. 4, 2012, and titled "BANDS FOR MEASURING BIOMETRIC INFORMATION", which claims priority to U.S. Provisional Patent Application No. 61/493,313, filed Jun. 3, 2011 and titled "BANDS FOR MEASURING BIOMETRICS". Each of these applications is hereby incorporated by reference herein in its entirety for all purposes.

FIELD OF THE INVENTION

The present invention relates to biometric measurements, and more particularly to wearable bands that may be employed to measure biometric information.

BACKGROUND

Biofeedback devices such as portable heart rate monitoring (HRM) devices are commonly used in fitness related activities for weight loss, goal heart rate (HR) training, and general HR monitoring. Such devices may sometimes be employed by healthcare professionals for chronic and/or acute heart condition monitoring and/or diagnosis.

Portable HRMs and other monitoring devices typically are expensive, and in some cases are cost prohibitive for many consumers. A need exists for inexpensive and/or simplified monitoring systems.

SUMMARY

In some aspects, a system is provided that includes (1) a wrist band having one or more sensors that measure biometric data of a user wearing the band; and (2) a display on the band that displays a message based on biometric data measured by the band. The message indicates a heart rate zone of the user.

In some aspects, a system is provided that includes (1) a wrist band having one or more sensors that measure biometric data of a user wearing the band; and (2) a display on the band that displays a message based on biometric data measured by the band. The message indicates a stress level of the user.

In some aspects, a system is provided that includes a wrist band having one or more sensors that measure biometric data of a user wearing the band. The wrist band adapted to (1) detect at least one of a handshake, a fist bump and a high five of the user; and (2) share information with another user in response to the detection.

Numerous other aspects are provided, as are various methods, apparatus and computer program products for carrying out these and other aspects of the invention. Each computer program product may be carried by a medium readable by a computer (e.g., a carrier wave signal, a floppy disc, a hard drive, a random access memory, etc.).

Other features and aspects of the present invention will become more fully apparent from the following detailed description, the appended claims, and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a schematic diagram of a band provided in accordance with the present invention.

FIG. 1B illustrates an embodiment of the band of FIG. 1A that includes a communications device in accordance with the present invention.

FIG. 2 is a flowchart of an example method of employing the band of FIGS. 1A and/or 1B for zone training in accordance with the present invention.

FIG. 3 is a flowchart of an example method of employing the band of FIGS. 1A and/or 1B for monitoring stress level in accordance with the present invention.

FIG. 4 illustrates a group that may be formed by a plurality of users employing bands in accordance with the present invention.

DETAILED DESCRIPTION

In one or more embodiments of the invention, a wearable wrist band or "bracelet" (collectively referred to as a band herein) is provided that includes a sensor for measuring heart rate, pulse, temperature, or the like and displaying an indication of the measured data such as (1) a color; and/or (2) a message, which may depend on the value of the measured data. Examples include, for example:

- (1) a stress level band having a color and/or message based on a measured stress level of a person wearing the band (e.g., as determined by measuring and/or monitoring heart rate, pulse rate, body temperature, perspiration, or the like); and/or
- (2) a zone band having a color and/or message based on a determined heart rate zone of a person wearing the band (e.g., recovery, fat burning, target heart rate, anaerobic zone, maximum, etc.).

In some embodiments, the bands may be flexible and/or waterproof. Such bands are simple to use and inexpensive. Example embodiments are these and other bands are described below.

FIG. 1A is a schematic diagram of a band **100** provided in accordance with the present invention. The band **100** may include a biometric sensor **102** coupled to a controller **104**, and display **106** coupled to the controller **104**. The band **100** may be fabricated from any suitable material. In some embodiments, the band **100** may be formed from a flexible and/or waterproof material such as silicone; and the sensor **102** and/or controller **104** may be embedded therein.

The sensor **102** may include any suitable biometric sensor configured to measure one or more of but is not limited to, heart rate, pulse rate, temperature, respiration, acceleration, skin resistivity, etc. More than one sensor **102** may be provided.

The controller **104** may include a programmable logic controller, microprocessor, application specific integrated circuit, or the like having suitable programming code for performing the methods described herein. More than one controller **104** may be used.

The display **106** may be any suitable display such as a liquid crystal display, electronic paper display, organic light-emitting diode display, or the like.

A battery **108** may be provided for powering sensor **102**, controller **104** and/or display **106**. In some embodiments, battery **108** may be rechargeable and/or replaceable. In one particular embodiment, the battery may be recharged via a USB connection (not shown) that allows information to be transferred from band **100** to another device such as a computer (not shown).

In some embodiments, the band **100** may be configured to communicate wirelessly with other devices such as a mobile telephone, tablet computer, laptop computer, desktop computer or the like. For example, FIG. 1B illustrates an

embodiment of the band 100 in which the band 100 includes communications device 110 such as a transmitter/receiver chip that allows the controller 104 to communicate with a mobile device 112. In some embodiments, the controller 104 may send information to and/or receive information from mobile device 112 using a wireless protocol such as WiFi, Bluetooth, or the like.

FIG. 2 is a flowchart of an example method 200 of employing the band 100 for zone training. With reference to FIGS. 1A-2, an exerciser (not shown) may wear the band 100 on his/her wrist. In step 201, sensor 102 of band 100 detects and measures the heart rate, pulse or another biometric parameter of the exerciser and provides this information to controller 104.

Based on the measured heart (or other information), in step 202, the controller 104 may determine an exercise zone for the exerciser. Generally, recommended exercise zones may depend on such factors as age and/or weight. In some embodiments, band 100 may be pre-programmed with particular definitions of the target heart rates for multiple zones. Any number of zones may be used (e.g., 1, 2, 3, 4, 5, 6, 7, etc.). For instance, bands may be pre-programmed with suitable heart rate zones for exercisers based on age and/or weight. In other embodiments, an exerciser may specify his/her age and/or weight and controller 104 may determine appropriate heart rate zones for the exerciser. For example, a mobile device 112 may include an application that prompts an exerciser for his/her age and/or weight, and then communicates this information (or zone information calculated by the mobile device) to the controller 104 via communications device 110.

In step 203, the band 100 displays heart rate zone information. For example, the controller 104 may cause display 106 to display a different color for each heart rate zone. In some embodiments, text information may be provided such as heart rate, zone, encouraging messages and/or warnings, or the like. Table 1 below provides exemplary colors for heart rate zones. Other colors may be employed.

TABLE 1

HEART RATE RANGE (BEATS PER MINUTE)	COLOR
70-95	GREEN
95-105	BLUE
105-120	PURPLE
120-135	YELLOW
135-150	PINK
150+	RED

In at least one embodiment, the controller 104 may include exercise routines that specify which heart rate zones an exerciser should be in and/or move between during an exercise routine. Band 100 may display an up arrow or down arrow (or other indicators) to indicate that an exerciser should increase or decrease his/her heart rate so as to move to another zone. A zone band may have a color and/or message based on what zone a user's heart rate is in (e.g., recovery, fat burning, target heart rate, or anaerobic zone). A different color can correspond to each zone, and/or the band 100 may display the current zone as a message.

FIG. 3 is a flowchart of an example method 300 of employing the band 100 for monitoring stress level in accordance with the present invention. With reference to FIGS. 1A-1B and FIG. 3, a user (not shown) may wear the band 100 on his/her wrist. In step 301, sensor 102 of band

100 detects and measures the heart rate, pulse or other biometric parameter of the user and provides this information to controller 104.

Based on the measured heart rate (or other parameter such as temperature), in step 302, the controller 104 may determine a stress level of the user. In general, heart rate increases as stress level increases. As such, controller 104 may determine when the heart rate of the user rises above a pre-determined heart rate level (e.g., such as a steady state heart rate for the user, or a heart rate measured when the user is relaxed). Zones of stress may be determined for the user such as low stress, moderate stress, high stress and extreme stress based on various heart rate ranges of the user. Temperature of the user may be similarly employed (e.g., as temperature may decrease with stress). Such stress ranges may be pre-programmed, determined by the controller 104, determined by mobile device 112 and communicated to controller 104 or the like. For example, a mobile device 112 may include an application that prompts the user to meditate, breath deep or otherwise relax when determining a low stress level for the user. The mobile application may then communicate this information (or zone information calculated by the mobile device) to the controller 104 via communications device 110.

In step 303, the band 100 displays stress level information for the user. For example, the controller 104 may cause display 106 to display a different color for each stress level zone of the user. In some embodiments, text information may be included such as heart rate, stress level zone, encouraging messages and/or warnings, or the like. Table 2 below provides example colors for stress level zones. Other colors may be employed.

TABLE 2

STRESS LEVEL	COLOR
LOW	GREEN
MEDIUM	BLUE
HIGH	PURPLE
EXTREME	RED

In at least one embodiment, the controller 104 may cause messages to be displayed on the display 106 such as "relax", "breathe", "getting agitated", "step away from the situation", or the like based on the level of stress of the user. In some embodiments, a stress level band may have a color and/or message based on stress level (e.g., as determined by heart rate, pulse, temperature, etc.). A user may use mind control to adjust your heart rate and change the message (e.g., via breathing techniques). Any suitable message may be displayed such as be calm, back off, getting agitated, etc.

In some embodiments, the band 100 may be a "mood" band. For example, sensor 102 may measure temperature of a user and provide the temperature information to the controller 104. In response to this information, the controller 102 may cause display 106 to display a color representative of the user's mood. Example colors are provided below in Table 3. Other colors may be employed.

TABLE 3

MOOD	COLOR
HAPPY/PASSIONATE	DARK BLUE
CALM	BLUE
SLIGHTLY CALM	BLUE GREEN
NORMAL	GREEN

TABLE 3-continued

MOOD	COLOR
SLIGHTLY NERVOUS	AMBER
ANXIOUS	GRAY
STRESSED	BLACK

The temperature ranges used for each mood/color may be pre-selected based on statistical averages for men, women, boys, girls, etc., or in some embodiments, may be determined by the controller 104 by monitoring the steady state or normal temperature of a user and/or the temperature of the user during known times of stress. For example, mobile device 112 may include an application that asks a user his/her mood. Based on this information, the mobile device 112 may direct the controller 102 to store relevant temperature ranges which correlate to moods of the user. Of course, if desired, a mood band may be formed using thermotropic liquid crystals calibrated to a nominal temperature of about 82° F. as in a conventional mood ring in place of or in addition to the above described controller embodiment.

In some embodiments, the band 100 may be configured to detect the presence of like bands. For example, a band 100a may be assigned to a group 400 of bands 100a-d as shown in FIG. 4. Fewer or more bands may be in the group 400. Each band 100a in the group 400 may be configured to communicate with other bands in the group 400 (e.g., via communications device 110 and/or mobile device 112) so as to identify members of the group, such as to beep, vibrate, change colors and/or display a message when other people/members of group 400 are near (e.g., other people from your college, people with similar interest or status, people within a frequent flyer program or points level, etc.), or the like. For instance, each band 100a-d may periodically broadcast identifying information so that any band in the group 400 may detect and identify the band(s).

In some embodiments, bands 100 may “exchange” information with other bands in a group or any other band. For instance, the sensor 102 may include an accelerometer (not separately shown) that may recognize a handshake by a user of the band (e.g., by detecting the rapid up/down motion which occurs when two people shake hands). This may trigger the controller 104 in the band 100 of each person to share contact information for the user (e.g., email addresses, cellular telephone numbers, generate a Facebook friend request, or the like). Likewise, bands may be “bumped” together to share information. Any such information may be communicated to mobile devices 112 if desired. As an example, person A wearing band 100a may shake hands, high five, bump fists, etc., with person B wearing band 100b. Each band 100a, 100b may include a sensor 102 such as an accelerometer, strain gauge or the like which detects an acceleration and/or an acceleration pattern along one or more axis that is identifiable by controller 104 of each band 100a, 100b as a request to share information. In response thereto, controller 104 of each band 100a, 100b may cause information to be shared. For instance, bands 100a, 100b may directly broadcast information between one another; and/or bands 100a, 100b may direct mobile devices 112 of each user to share contact or other information.

In other embodiments, a wearable band may include a built-in flash drive in place of, or in addition to, one or more of the above. For example, monitored/collected data may be stored on the flash drive.

In one or more embodiments, a band may be used to motivate people to take the stairs. Most staircases in build-

ings are stark and depressing. A hotel chain may spruce up their staircases and even provide incentives for people to use them (to promote healthy living, save electricity by not using elevators, etc.). One or more of the above bands may be used as part of such a promotion.

Accordingly, while the present invention has been disclosed in connection with exemplary embodiments thereof, it should be understood that other embodiments may fall within the spirit and scope of the invention, as defined by the following claims.

The invention claimed is:

1. A system comprising:

a mobile device of a user; and

a wrist band having one or more sensors configured to measure biometric data of the user, the wrist band operative to communicate measured biometric data to the mobile device of the user, the wrist band and the mobile device of the user operative to:

determine an age, temperature, and weight of the user; prompt the user to relax;

determine calibration measurements taken while the user relaxes in response to the prompt;

determine a baseline temperature of the user adjusted for an activity level of the user;

determine a plurality of heart rate zones specific to the user based on the age, weight and calibration measurements;

after determining the plurality of heart rate zones specific to the user, measure heart rate and temperature of the user while the user is wearing the wrist band; and

display on the wrist band a message based on the heart rate and temperature measured by the wrist band, wherein the message indicates a heart rate zone of the user selected from the plurality of heart rate zones and a determined mood of the user based on the measured temperature relative to the activity level adjusted baseline temperature.

2. The system of claim 1, wherein the wrist band and mobile device of the user are operative to prompt the user to relax by prompting the user to breath deep.

3. The system of claim 1, wherein the wrist band and mobile device of the user are operative to prompt the user to relax by prompting the user to meditate.

4. The system of claim 1, wherein the wrist band is configured to display a color corresponding to the heart rate zone of the user.

5. The system of claim 1, wherein the wrist band and the mobile device of the user are configured to determine the heart rate zone selected from at least four heart rate zones.

6. The system of claim 1, wherein the wrist band and the mobile device of the user are configured to determine the heart rate zone selected from a first heart rate zone, a second heart rate zone, a third heart rate zone, a fourth heart rate zone, a fifth heart rate zone, and a sixth heart rate zone.

7. The system of claim 6, wherein the wrist band is configured to display:

a green color responsive to the user's heart rate being in the first heart rate zone;

a blue color responsive to the user's heart rate being in the second heart rate zone;

a purple color responsive to the user's heart rate being in the third heart rate zone;

a yellow color responsive to the user's heart rate being in the fourth heart rate zone;

a pink color responsive to the user's heart rate being in the fifth heart rate zone; and

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a red color responsive to the user's heart rate being in the sixth heart rate zone.

8. The system of claim 6, wherein:

the first heart rate zone corresponds to approximately 95 or less heart beats per minute;

the second heart rate zone corresponds to approximately 95-105 heart beats per minute;

the third heart rate zone corresponds to approximately 105-120 heart beats per minute;

the fourth heart rate zone corresponds to approximately 120-135 heart beats per minute;

the fifth heart rate zone corresponds to approximately 135-150 heart beats per minute; and

the sixth heart rate zone corresponds to approximately greater than 150 heart beats per minute.

9. The system of claim 1, wherein the wrist band is further configured to detect at least one of a handshake of the user, a fist bump of the user, and a high five of the user.

10. The system of claim 1, wherein the wrist band comprises a waterproof material.

11. The system of claim 1, further comprising a controller embedded in the wrist band, the controller coupled to at least one of the one or more sensors.

12. The system of claim 1, wherein the wrist band is configured to display a color representative of the determined mood.

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13. The system of claim 12, wherein the color representative of the determined mood is selected from the group consisting of dark blue, blue, blue green, green, amber, gray, and black.

14. The system of claim 1, wherein the wrist band further comprises a liquid crystal display.

15. The system of claim 14, wherein the liquid crystal display is a thermotropic liquid crystal display calibrated to a nominal temperature of about 82° F.

16. The system of claim 1, wherein the message comprises text.

17. The system of claim 1, wherein the message comprises text information representative of the heart rate.

18. The system of claim 1, wherein the mobile device is configured to communicate an age of the user to the wrist band.

19. The system of claim 1, wherein the mobile device is configured to communicate the user's weight to the wrist band.

20. The system of claim 1, wherein the wrist band is configured to display information representative of a stress level.

* * * * *

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摘要(译)

在一些方面，提供了一种系统，其包括（1）具有一个或多个传感器的腕带，所述传感器测量佩带所述带的用户的生物测量数据；和（2）在频带上的显示，其显示基于由频带测量的生物测量数据的信息。该消息指示用户的心率区域。许多其他方面提供。

