US 20160022209A1

(19) United States
(12) Patent Application Publication
(10) Pub. No.: US 2016/0022209 A1
(43) Pub. Date: Jan. 28, 2016
Fraisl

(54) SYSTEMS AND METHODS FOR TRACKING HYDRATION

(71) Applicant: **HYDR8 Inc.**, Saratoga, CA (US)

(72) Inventor: **Daniel J. Fraisl**, Saratoga, CA (US)

(21) Appl. No.: **14/754,599**

(22) Filed: **Jun. 29, 2015**

Related U.S. Application Data

(60) Provisional application No. 62/018,079, filed on Jun. 27, 2014, provisional application No. 62/162,510, filed on May 15, 2015.

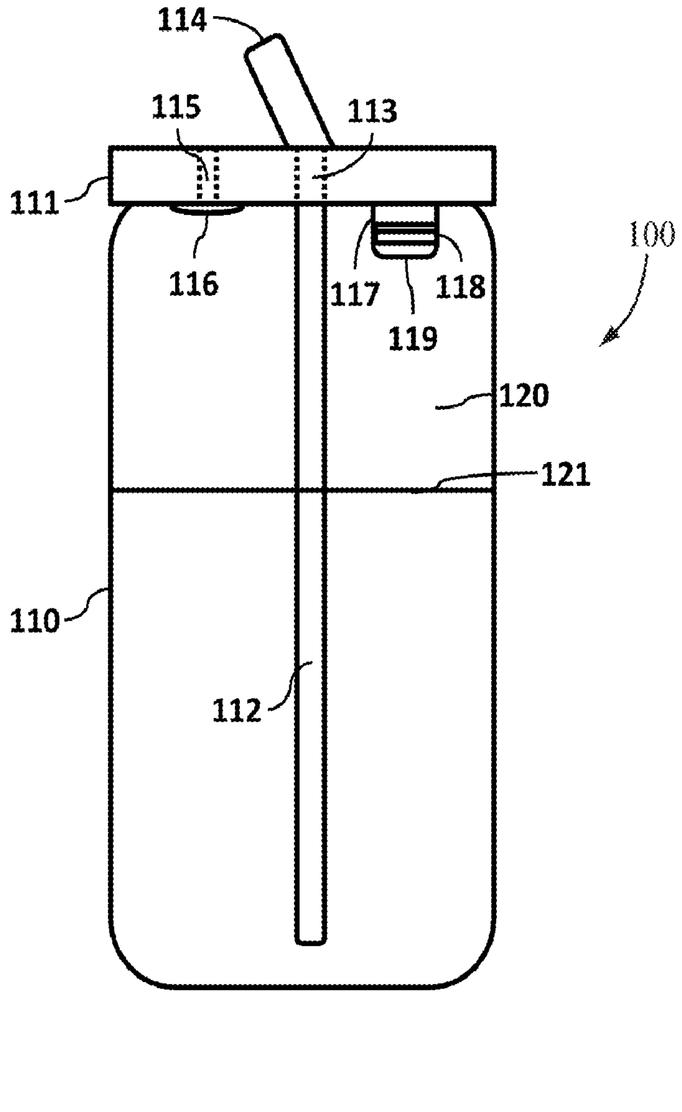
Publication Classification

(51) **Int. Cl.**
A61B 5/00 (2006.01)
A61B 5/11 (2006.01)
A63B 24/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 5/4875*** (2013.01); ***A63B 24/0062*** (2013.01); ***A61B 5/4205*** (2013.01); ***A61B 5/6887*** (2013.01); ***A61B 5/7278*** (2013.01); ***A61B 5/0024*** (2013.01); ***A61B 5/7282*** (2013.01); ***A61B 5/486*** (2013.01); ***A61B 5/1118*** (2013.01); *A63B 2024/0065* (2013.01); *A61B 2560/0462* (2013.01); *A61B 2562/0247* (2013.01); *A61B 2560/0475* (2013.01); *A61B 2562/0271* (2013.01); *A61B 2562/029* (2013.01); *A61B 2562/0219* (2013.01); *A61B 2560/0209* (2013.01)

(57) **ABSTRACT**

Devices, systems, and methods are provided for monitoring hydration of a user that include a fluid container including one or more sensors, e.g., pressure sensors, accelerometers, and the like, for identifying when the user consumes fluid from the container and/or determining the volume of fluid consumed. The fluid container may communicate with a mobile electronic device to monitor at least one of volume and frequency of fluid consumption and provide an output to the user related to compliance with hydration recommendations. Optionally, the system may also include a fitness tracker for monitoring one or more aspects of the user's physical activity; and the mobile device may monitor hydration of the user based at least in part on the user's physical activity.



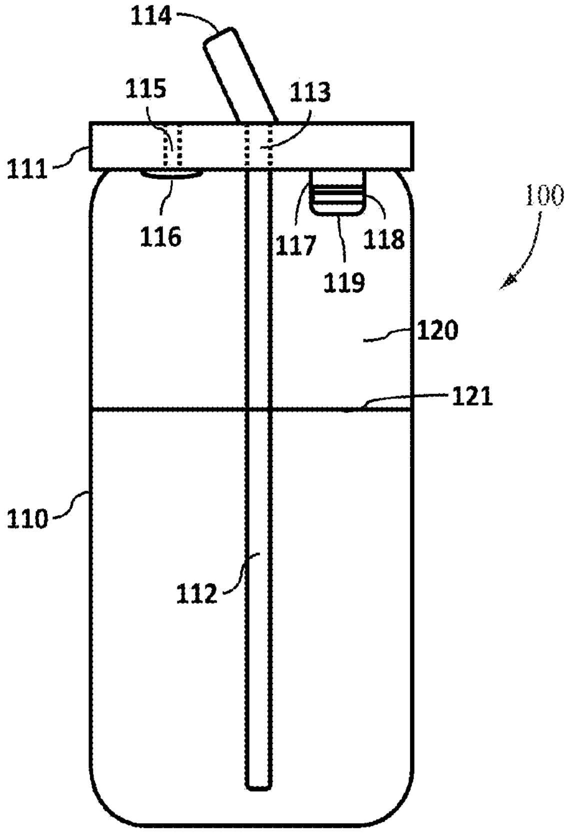


FIG. 1A

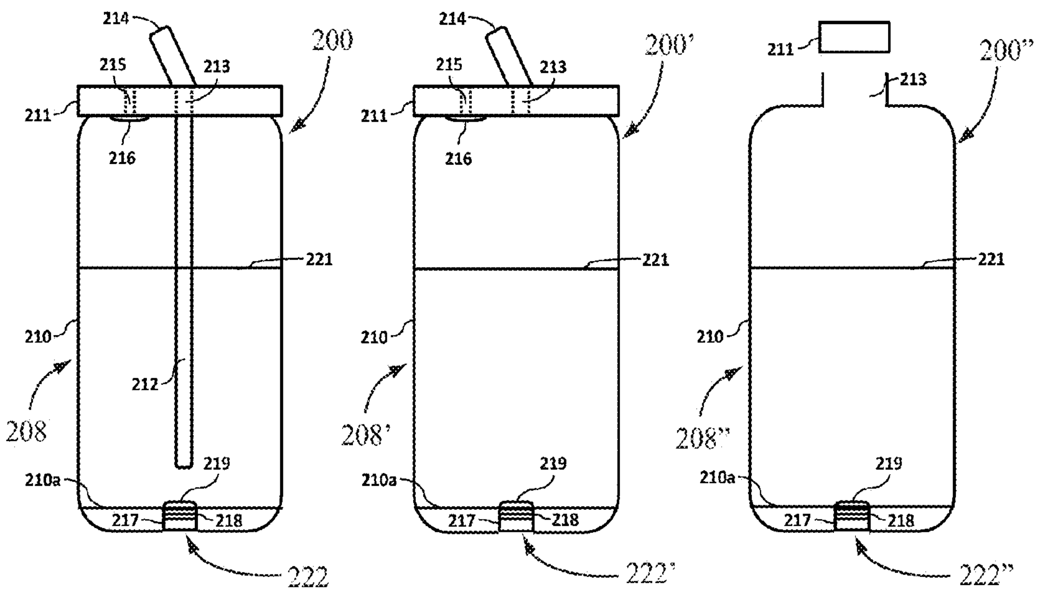


FIG. 2A FIG. 2B FIG. 2C

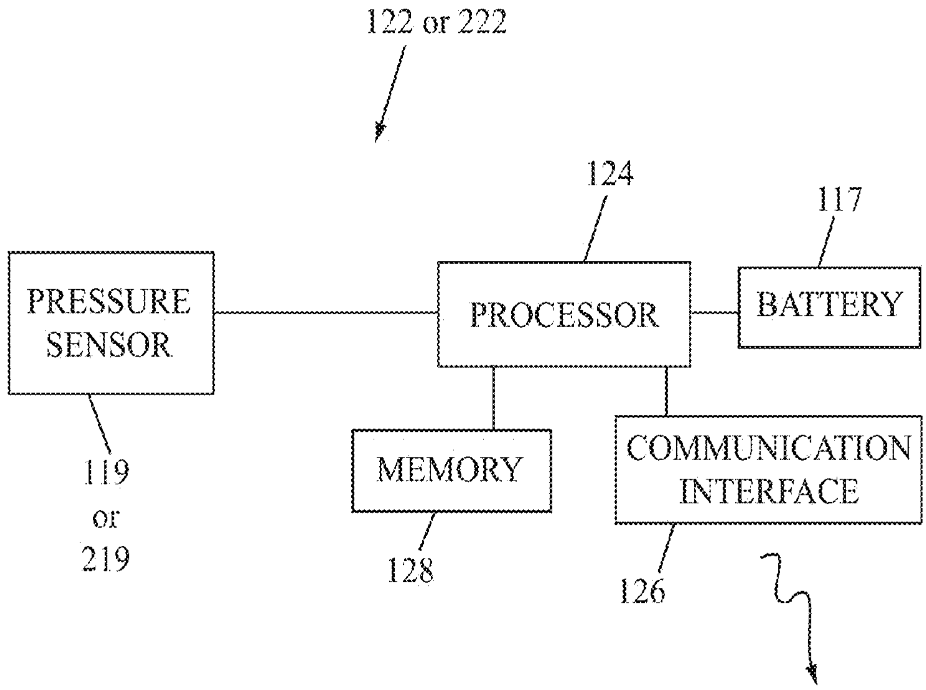

122 or 222
124
117
PRESSURE SENSOR
PROCESSOR
BATTERY
MEMORY
COMMUNICATION INTERFACE
119 or 219
128
126

FIG. 1B

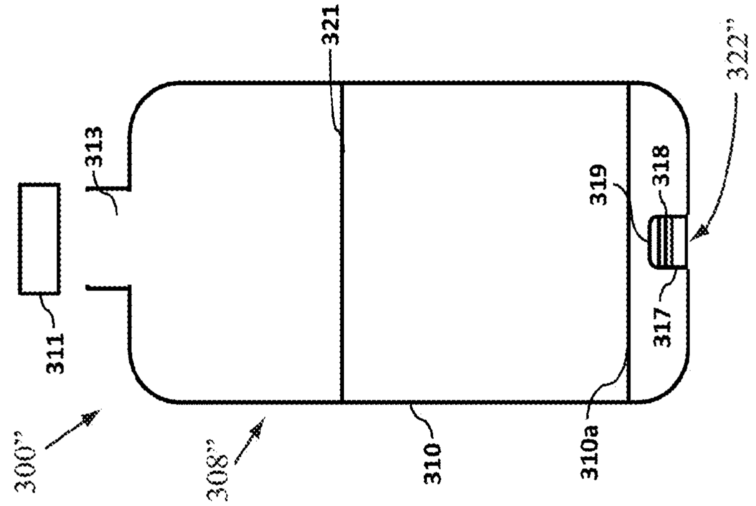


FIG. 3C

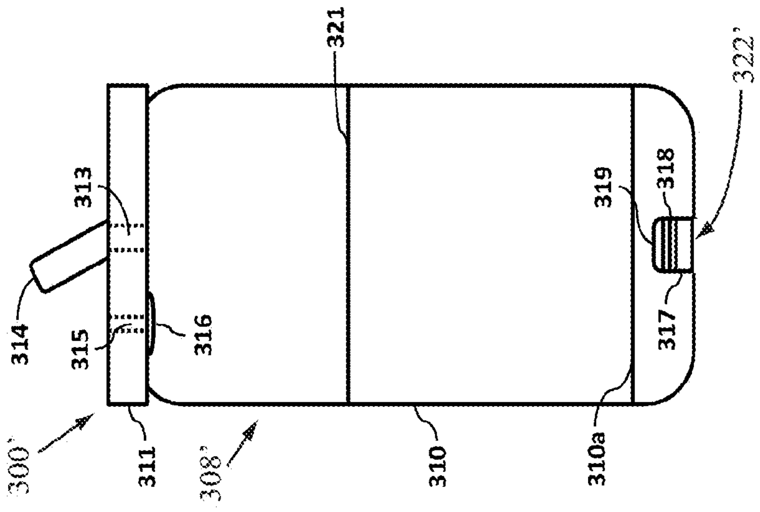


FIG. 3B

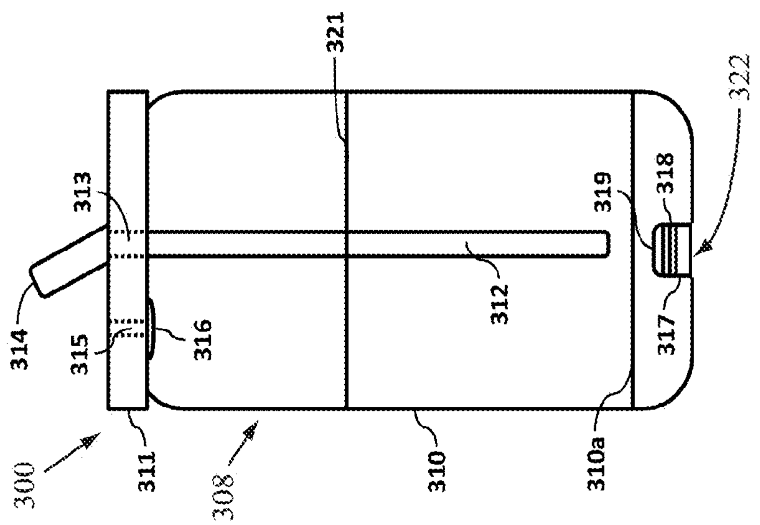
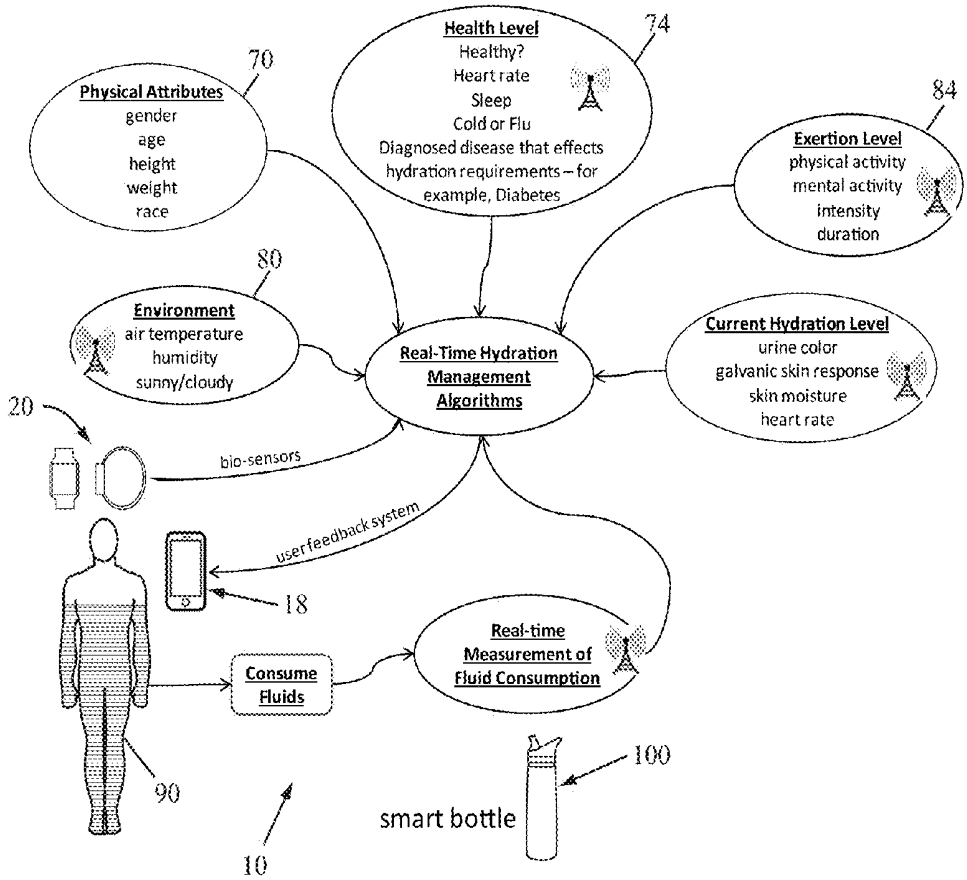


FIG. 3A



Physical Attributes
gender
age
height
weight
race
70
Health Level
Healthy?
Heart rate
Sleep
Cold or Flu
Diagnosed disease that effects hydration requirements – for example, Diabetes
74
Exertion Level
physical activity
mental activity
intensity
duration
84
Environment
air temperature
humidity
sunny/cloudy
80
Real-Time Hydration Management Algorithms
Current Hydration Level
urine color
galvanic skin response
skin moisture
heart rate
20
bio-sensors
user feedback system
18
Consume Fluids
Real-time Measurement of Fluid Consumption
90
10
smart bottle
100

FIG. 4

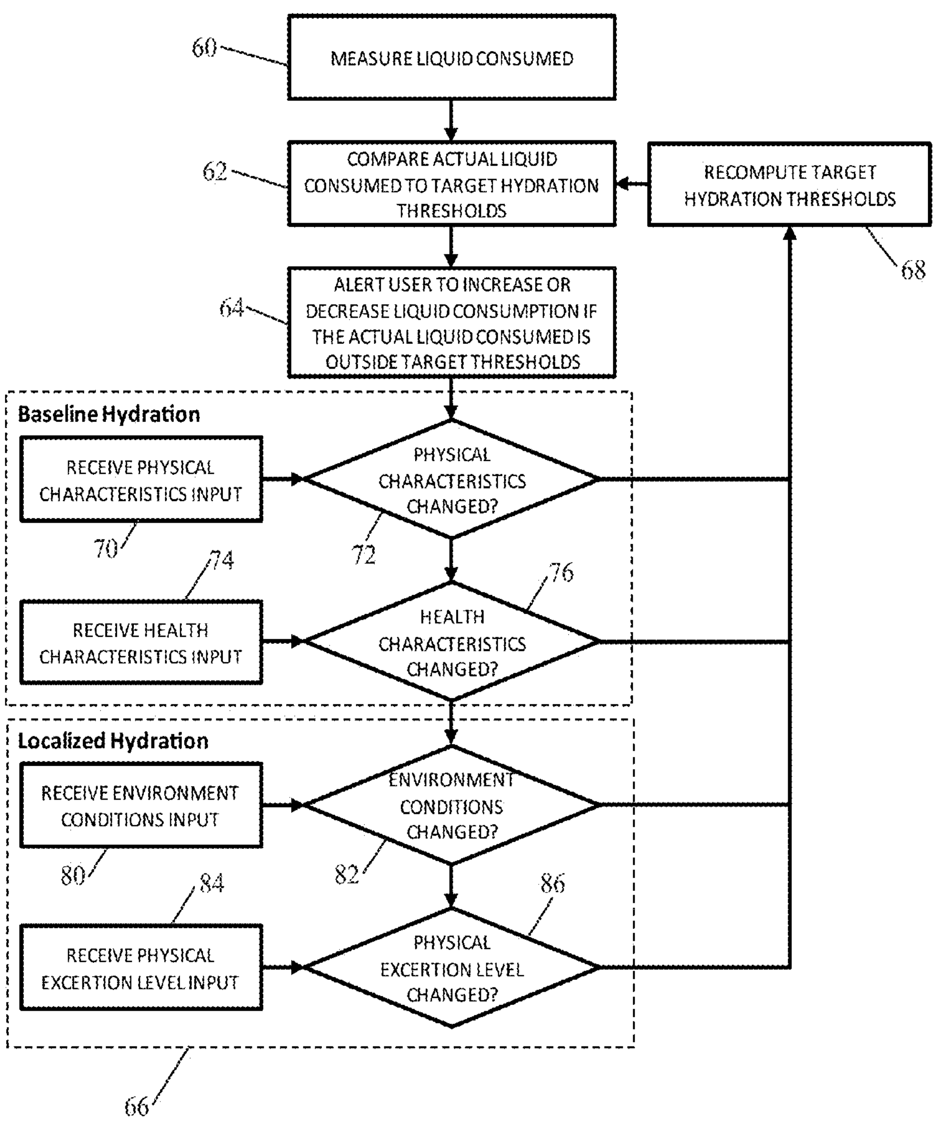

60
MEASURE LIQUID CONSUMED
62
COMPARE ACTUAL LIQUID CONSUMED TO TARGET HYDRATION THRESHOLDS
RECOMPUTE TARGET HYDRATION THRESHOLDS
68
64
ALERT USER TO INCREASE OR DECREASE LIQUID CONSUMPTION IF THE ACTUAL LIQUID CONSUMED IS OUTSIDE TARGET THRESHOLDS
Baseline Hydration
RECEIVE PHYSICAL CHARACTERISTICS INPUT
PHYSICAL CHARACTERISTICS CHANGED?
70
72
74
76
RECEIVE HEALTH CHARACTERISTICS INPUT
HEALTH CHARACTERISTICS CHANGED?
Localized Hydration
RECEIVE ENVIRONMENT CONDITIONS INPUT
ENVIRONMENT CONDITIONS CHANGED?
80
82
84
86
RECEIVE PHYSICAL EXCERTION LEVEL INPUT
PHYSICAL EXCERTION LEVEL CHANGED?
66

FIG. 5

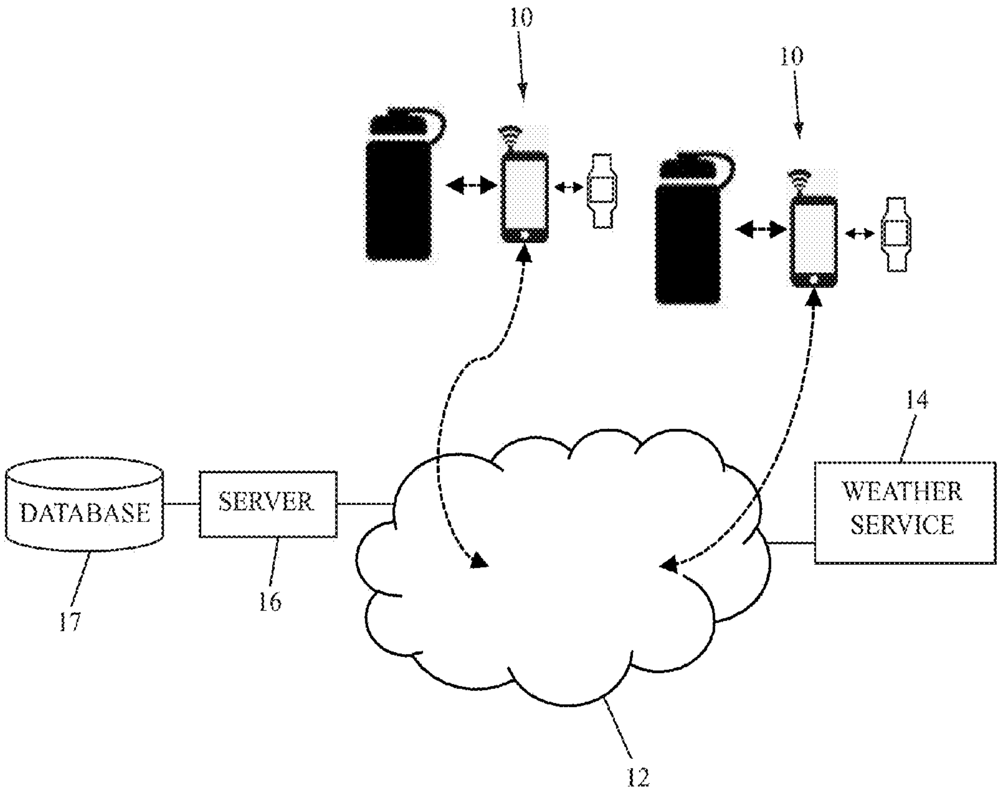


FIG. 6

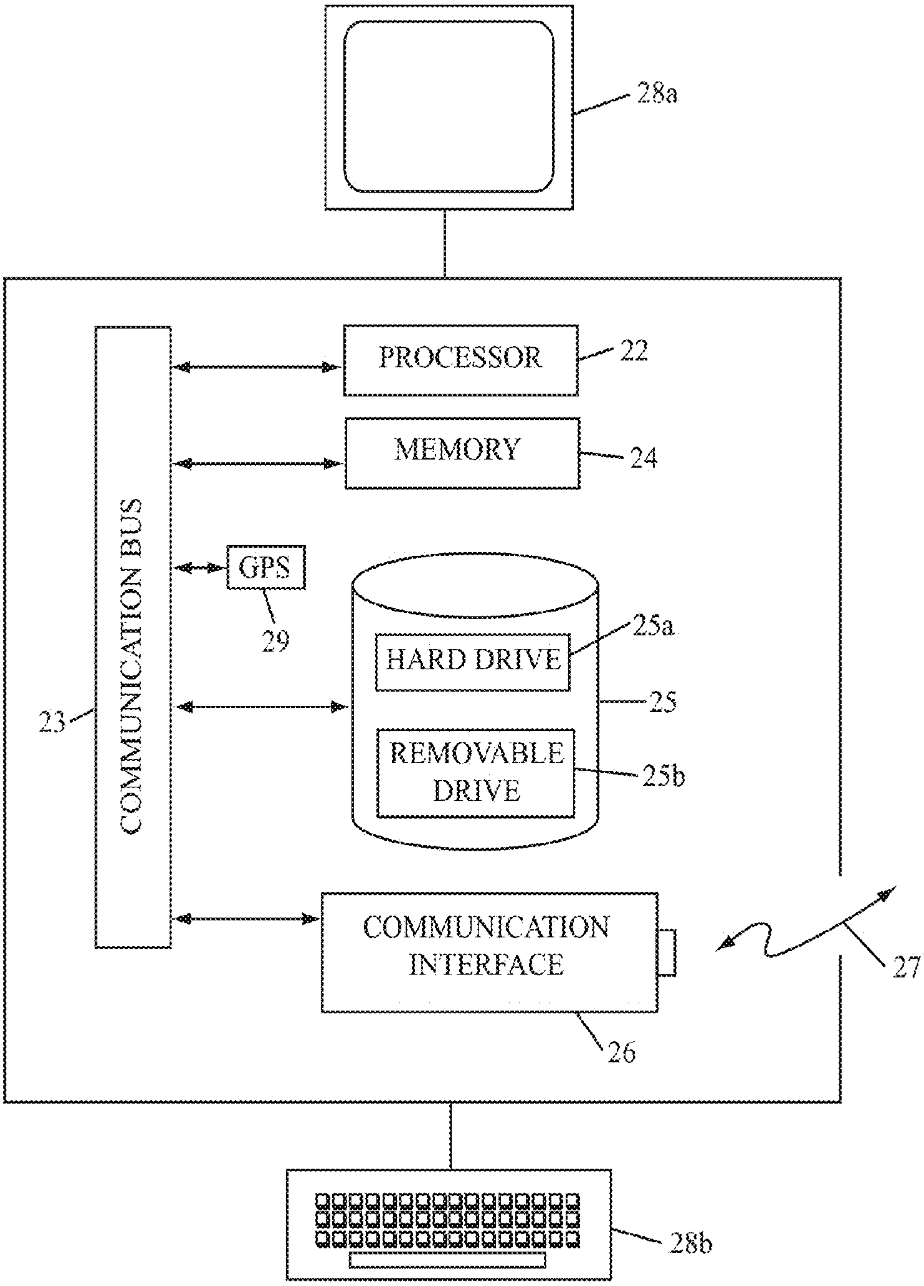

28a
PROCESSOR
22
MEMORY
24
COMMUNICATION BUS
GPS
29
25a
HARD DRIVE
25
23
REMOVABLE DRIVE
25b
COMMUNICATION INTERFACE
27
26
28b

FIG. 7

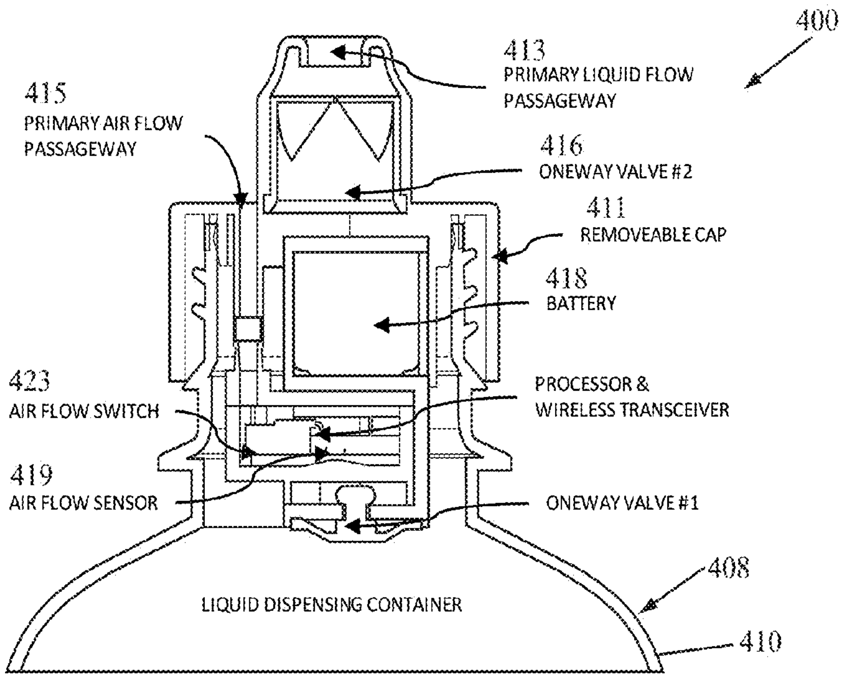

400
413
PRIMARY LIQUID FLOW
PASSAGEWAY
415
PRIMARY AIR FLOW
PASSAGEWAY
416
ONEWAY VALVE #2
411
REMOVEABLE CAP
418
BATTERY
423
AIR FLOW SWITCH
PROCESSOR &
WIRELESS TRANSCEIVER
419
AIR FLOW SENSOR
ONEWAY VALVE #1
408
LIQUID DISPENSING CONTAINER
410

FIG. 8

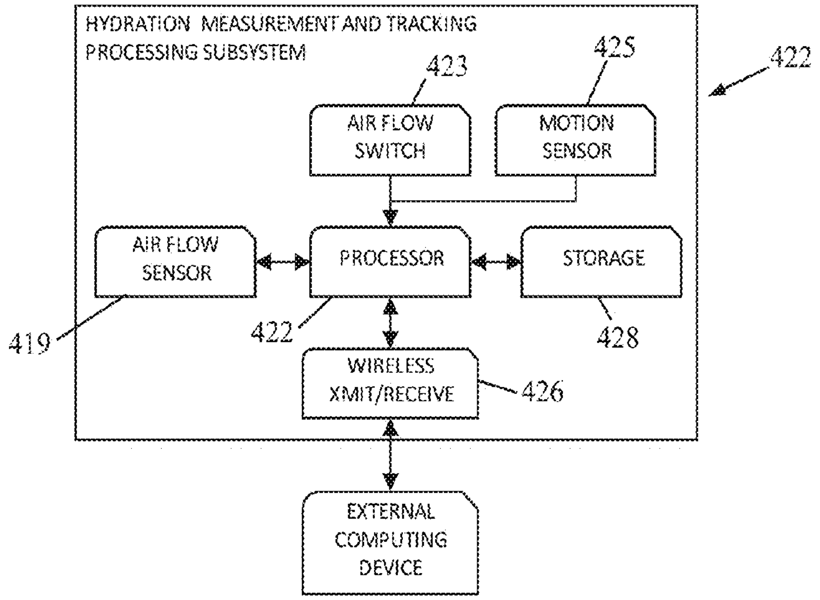

HYDRATION MEASUREMENT AND TRACKING
PROCESSING SUBSYSTEM
422
423
AIR FLOW
SWITCH
425
MOTION
SENSOR
AIR FLOW
SENSOR
PROCESSOR
STORAGE
419
422
428
WIRELESS
XMIT/RECEIVE
426
EXTERNAL
COMPUTING
DEVICE

FIG. 9

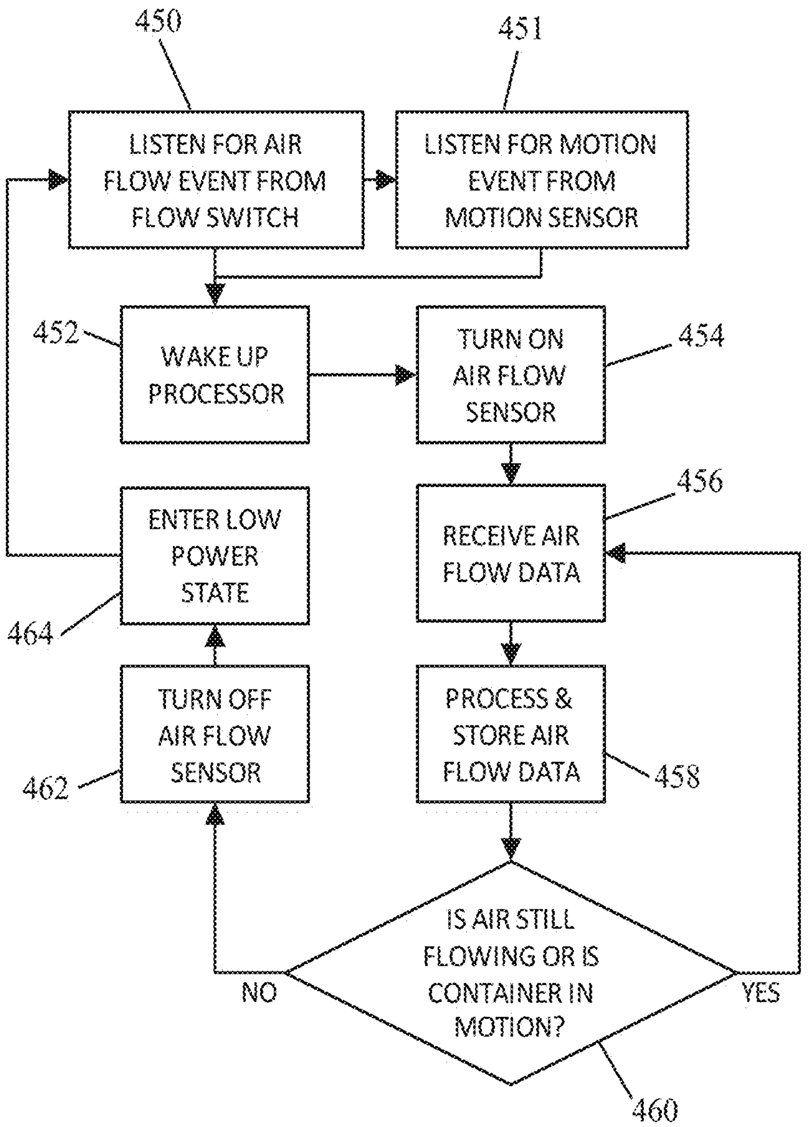

450
451
LISTEN FOR AIR FLOW EVENT FROM FLOW SWITCH
LISTEN FOR MOTION EVENT FROM MOTION SENSOR
452
WAKE UP PROCESSOR
TURN ON AIR FLOW SENSOR
454
456
ENTER LOW POWER STATE
RECEIVE AIR FLOW DATA
464
TURN OFF AIR FLOW SENSOR
PROCESS & STORE AIR FLOW DATA
462
458
IS AIR STILL FLOWING OR IS CONTAINER IN MOTION?
NO
YES
460

FIG. 10

SYSTEMS AND METHODS FOR TRACKING HYDRATION

RELATED APPLICATION DATA

[0001] The present application claims benefit of co-pending provisional applications Ser. No. 62/018,079, filed Jun. 27, 2014, and 62/162,510, filed May 15, 2015, the entire disclosures of which are expressly incorporated by reference herein.

FIELD OF THE INVENTION

[0002] The present invention relates generally to devices for providing fluids to individuals, and more particularly to systems and methods for tracking and/or monitoring hydration of an individual consuming fluid within a fluid container.

BACKGROUND

[0003] As portable electronic devices have proliferated and become increasingly powerful and capable, the features for which they are commonly used have shifted. As pocket-sized devices have transitioned from being purely communication devices, to becoming content-consumption devices, to becoming content-creation devices, and now to becoming health-tracking devices, users have also transitioned towards becoming prodigious health data consumers obsessed with tracking and optimizing their personal health data. The advent of advanced sensors and wearable devices (such as the FitBit, Nike Fuel Band, Jawbone UP, and a host of other health tracking devices) is accelerating the amount and type of data that users wish to capture, track, and share.

[0004] Unfortunately, for many people one important health metric that cannot be easily measured and tracked using portable electronic devices today is hydration. According to the CDC, as of 2013, among adults aged twenty to fifty (20-50), 43% of men and 41% of women failed to meet the daily water intake recommended by the US Institute of Medicine. People aged fifty to seventy (50-70) were less likely to meet the guidelines, and the numbers were even worse among older adults—roughly 95% of men and 83% of women seventy one and older don't drink enough water. Further, for athletes, the military and first-responders maintaining proper hydration levels can be a life or death matter.

[0005] Accordingly, systems and methods for monitoring and/or improving hydration of individuals would be useful.

SUMMARY

[0006] The present invention is directed to devices for providing fluids to individuals, and more particularly to fluid containers that facilitate tracking and/or monitoring hydration of an individual consuming fluid within the fluid container. Further, the present invention is directed to systems and methods for tracking and/or monitoring hydration of an individual consuming fluid within a fluid container, e.g., using a mobile electronic device communicating with one or more sensors on the fluid container and/or communicating with a fitness tracker used by the individual.

[0007] Systems are provided herein, which may be implemented in one or more fluid dispensing containers. In an exemplary embodiment, the system may allow a user to measure and track their hydration level by automatically measuring and tracking the volume of fluid orally consumed from the fluid dispensing container. The system may employ one or more sensors to determine the volume of fluid that flows from the fluid dispensing container. In an exemplary embodiment, the fluid container may include air flow volume measurement or air pressure measurement to determine the proportional liquid flow volume that is displaced by the air flowing into the container. In alternative embodiments, the fluid container may include one or more other liquid measurement sensors, such as a pressure sensor in the bottom of the container to correlate height of fluid within the container to volume of fluid, an accelerometer to correlate movement of fluid within the container to mass and volume of the fluid, or an ultrasonic sensor to correlate height of fluid within the container to volume of fluid. Such sensors may be included in a closed-loop hydration tracking system, e.g., including a mobile electronic device and/or a fitness tracker.

[0008] Also provided herein are methods for determining calculating the volume of liquid consumed by a user, reducing the physical size of the system, conserving the amount of power necessary to operate the system, and/or transmitting data between the system and a mobile device, server, and/or external computer. In both the systems and methods, volume measurement may be combined with data from a fitness tracker and/or other device providing data regarding physical activity of the user, environmental conditions at the user's location, physical characteristics of the user, and/or external data sources, to enhance operation.

[0009] In accordance with one embodiment, a device is provided for monitoring hydration that includes a fluid container comprising a container body defining an interior region and a removable top for enclosing the interior region; a one-way valve in the top biased to a closed position for sealing an opening in the top communicating with an exterior of the fluid container and movable to an open position when the interior region experiences a negative pressure to allow air to flow into the interior region from the exterior via the opening; a drinking tube extending from the top into interior region; an air pressure sensor within the fluid container at a location such that the sensor is exposed to air when the fluid container is filled with a hydration fluid; and a processor coupled to the sensor and configured to detect a first predetermined pressure change within the interior region corresponding to a drink start event when a user begins to drink hydration fluid from the interior region via the drinking tube, the processor further configured to determine a volume of hydration fluid consumed by the user based on changes in air pressure within the interior region.

[0010] In accordance with another embodiment, a device is provided for monitoring hydration that includes a fluid container comprising a container body including a side wall and a bottom wall defining an interior region and a removable top for enclosing the interior region; a drinking port in the top for consuming hydration fluid contained within the fluid container; a liquid pressure sensor mounted to the bottom wall within the interior region; an inclinometer mounted to the fluid container; and a processor coupled to the pressure sensor to acquire pressure data to determine a height of hydration fluid within the interior region and coupled to the inclinometer to acquire orientation data to determine an angular orientation of the fluid container when the height is determined, the processor further configured to determine a volume of hydration fluid consumed by the user based on changes in the height of the hydration fluid air pressure within the interior region corrected by the angular orientation.

[0011] In accordance with still another embodiment, a device is provided for monitoring hydration that includes a fluid container comprising a container body including a side wall and a bottom wall defining an interior region and a removable top for enclosing the interior region; a drinking port in the top for consuming hydration fluid contained within the fluid container; an accelerometer mounted to fluid container; and a processor coupled to the accelerometer to acquire motion data related to motion of the fluid container, the processor configured to incorporate the motion data into a mass analysis algorithm to determine a change in mass of the fluid container and hydration fluid therein and determine a volume of hydration fluid consumed by the user.

[0012] In accordance with yet another embodiment, a device is provided for monitoring hydration that includes a fluid container comprising a container body including a side wall and a bottom wall defining an interior region and a removable top for enclosing the interior region; an ultrasonic sensor mounted within the interior region and oriented towards an upper surface of fluid when the fluid is placed in the container; an inclinometer mounted to the fluid container; and a processor coupled to the ultrasonic sensor to acquire ultrasonic data related to ultrasonic signals transmitted by the ultrasonic sensor and reflected off of the upper surface of the fluid, the processor coupled to the inclinometer to acquire orientation data to determine an angular orientation of the fluid container when ultrasonic data is acquired, the processor further configured to determine a height of hydration fluid within the interior region based at least in part on the ultrasonic data corrected by the angular orientation and determine a volume of hydration fluid consumed by the user based on changes in the height of the hydration fluid within the interior region.

[0013] In accordance with another embodiment, a device is provided for monitoring hydration that includes a fluid container comprising a container body including a side wall and a bottom wall defining an interior region and a removable top for enclosing the interior region; an air flow switch in air flow passageway communicating between the interior region and an exterior region outside the container; a processor coupled to the air flow switch for acquiring air flow data to detect flow of air through the air flow passageway to identify the beginning of a drink event, the processor configured to operate electronic components of the device in a low-power state before a drink event to conserve energy and configured to activate the electronic components in a full-power state when a drink event is identified; and one or more sensors coupled to the processor for determining a volume of fluid consumed during the drink event.

[0014] In accordance with still another embodiment, a device is provided for monitoring hydration that includes a fluid container comprising a container body including a side wall and a bottom wall defining an interior region and a removable top for enclosing the interior region; a motion sensor carried by the container; a processor coupled to the motion sensor for acquiring motion data to identify the beginning of a drink event, the processor configured to operate electronic components of the device in a low-power state before a drink event to conserve energy and configured to activate the electronic components in a full-power state when a drink event is identified; and one or more sensors coupled to the processor for determining a volume of fluid consumed during the drink event.

[0015] In accordance with yet another embodiment, a system is provided for managing hydration of a user that includes a fluid container comprising one or more sensors for identifying when the user consumes fluid from the container and a container communication interface; a fitness tracker for monitoring one or more aspects of the user's physical activity; and a mobile device comprising a mobile device communication interface for communicating with the one or more sensors of the fluid container via the container communication interface to monitor at least one of volume and frequency of consumption of hydration fluid from the container and for communicating with the fitness tracker to monitor one or more aspects of the user's physical activity, and a mobile device processor configured to monitor hydration of the user based at least in part on the hydration fluid consumed from the container and the user's physical activity and provide an output on an output device to the user related to compliance with hydration recommendations.

[0016] In accordance with another embodiment, a method is provided for monitoring hydration of a user that includes providing a fluid container comprising a container body, a top, a pressure sensor mounted to a bottom wall of the container body within an interior of the fluid container, and a processor communicating with the pressure sensor; adding hydration fluid to the container body; securing the top to the container body to enclose the interior; and consuming at least a portion of the hydration fluid within the fluid container, thereby triggering the processor to acquire pressure data from the pressure sensor and determine a height of hydration fluid within the fluid container and compare the height with an earlier height of hydration fluid to determine a consumed volume of the at least a portion of the hydration fluid. In one embodiment, an inclinometer may be provided on the fluid container for providing orientation data related to the angular orientation of the fluid container, and the processor may correct the height of hydration fluid based at least in part on orientation data acquired from the inclinometer.

[0017] In accordance with still another embodiment, a method is provided for monitoring hydration of a user of a fluid container including one or more sensors that includes receiving data from the one or more sensors indicating that the container is in motion or a drink event has occurred; determining an amount of fluid consumed from the fluid container during the drink event; acquiring activity data from a fitness tracker worn by the user; and comparing the amount of fluid consumed with a hydration threshold to determine whether the user has consumed sufficient fluid based at least in part on the activity data acquired from the fitness tracker.

[0018] In accordance with another embodiment, a method is provided for monitoring hydration of a user of a fluid container including a motion sensor that includes receiving a signal from the motion sensor indicating that a drink event has begun; based on the signal, transitioning electronic components of the consumption tracking system from a low-power state to a full-power state; and acquiring sensor data from one or more sensors on the fluid container and determining, at the consumption tracking system, an amount of fluid consumed from the fluid container during the drink event based at least in part on the sensor data.

[0019] In accordance with yet another embodiment, a method is provided for monitoring hydration of a user of a fluid container including an air flow switch communicating between an interior region of the container and an exterior region outside the container and coupled to a consumption tracking system, the method including receiving a signal from the air flow switch when air begins flowing through the air flow passageway indicating that a drink event has begun;

based on the signal, transitioning electronic components of the consumption tracking system from a low-power state to a full-power state; and acquiring sensor data from one or more sensors on the fluid container and determining, at the consumption tracking system, an amount of fluid consumed from the fluid container during the drink event based at least in part on the sensor data.

[0020] In accordance with still another embodiment, a method is provided for monitoring hydration of a user of a fluid container including one or more sensors and fluid within an interior region of the container that includes receiving one or more signals from the one or more sensors indicating that a drink event has occurred; acquiring height data from the one or more sensors on the fluid container related to a height of fluid within the container; acquiring orientation data from the one or more sensors on the fluid container to determine an angular orientation of the fluid container when the height data is acquired; and determining a height of fluid within the interior region based at least in part on the height data corrected by the angular orientation and determining a volume of fluid consumed during the drink event based on changes in the height of the hydration fluid within the interior region.

[0021] In accordance with another embodiment, a hydration management system is provided that includes a plurality of individual hydration management systems, each individual system comprising a fluid container including one or more sensors configured to output real-time hydration data indicative of volume of fluid in the container consumed by a user; a fitness tracker configured to monitor one or more characteristics of the user's physical activity; and a mobile electronic device configured to communicate with the fluid container to acquire the hydration data from the one or more sensors to monitor fluid consumption by the user, configured to acquire activity data from the fitness tracker, and configured to provide output to the user regarding the user's hydration. The system also includes a hydration management server configured to communicate with each mobile electronic device of the individual hydration management systems and operative to receive, analyze, and/or aggregate the hydration data, activity data, and user hydration from each of the individual hydration management systems.

[0022] In accordance with still another embodiment, a method is provided for hydration management using a plurality of individual hydration management systems, each individual system comprising a fluid container including one or more sensors configured to output real-time hydration data indicative of volume of fluid in the container consumed by a user; a fitness tracker configured to monitor one or more characteristics of the user's physical activity; and a mobile electronic device configured to communicate with the fluid container to acquire the hydration data from the one or more sensors to monitor fluid consumption by the user, configured to acquire activity data from the fitness tracker, and configured to provide output to the user regarding the user's hydration. The method includes receiving at a hydration management server hydration data, activity data, and user hydration from each mobile electronic device of the individual hydration management systems; generating a hydration database combining the hydration data and activity data with physical characteristics data of the respective individuals; generating recommended hydration thresholds based at least in part on the hydration database; and communicating recommended hydration thresholds to the individual hydration management systems such that each mobile electronic device may provide outputs to the user regarding the user's hydration based at least in part on the recommended hydration thresholds.

[0023] Other aspects and features of the present invention will become apparent from consideration of the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The drawings illustrate exemplary embodiments of the invention, in which:

[0025] FIG. **1**A is a cross-sectional side view of an exemplary hydration tracking system including an air pressure sensor in a fluid container for measuring fluid consumed.

[0026] FIG. **1**B is a schematic showing exemplary components that may be included in the fluid container of FIG. **1**B to monitor hydration of a user of the fluid container.

[0027] FIGS. **2**A-**2**C are cross-sectional side views of alternative embodiments of hydration tracking systems including a pressure sensor in a fluid container for measuring fluid consumed.

[0028] FIGS. **3**A-**3**C are cross-sectional side views of alternative embodiments of hydration tracking systems including an accelerometer coupled to a fluid container for measuring fluid consumed.

[0029] FIG. **4** is a schematic showing an exemplary feedback system that may be used to monitor hydration of one or more individuals using a hydration system, such as those shown in FIGS. **1-3**.

[0030] FIG. **5** is a flowchart showing an exemplary method for monitoring hydration of an individual.

[0031] FIG. **6** is a schematic showing an exemplary network architecture including a plurality of hydration tracking systems, such as that shown in FIG. **4**.

[0032] FIG. **7** is a schematic showing an exemplary embodiment of a mobile electronic device that may be included in the hydration tracking system of FIG. **4**.

[0033] FIG. **8** is a cross-sectional view of another embodiment of a consumption tracking device that may be provided on a fluid container.

[0034] FIG. **9** is a schematic showing an exemplary processing subsystem that may be included in the consumption tracking device of FIG. **8**.

[0035] FIG. **10** is a flowchart showing an exemplary method for using the consumption tracking device of FIG. **8**.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0036] Turning to the drawings, FIGS. **1**A and **1**B illustrate an example of a hydration tracking system or device **100** that generally includes a fluid container **108** and a fluid consumption tracking device **122** for monitoring fluid consumption of a user of the system **100**. The container **108** may include a container body or housing **110**, and one or more of a removable top or cap **111**, straw **112**, connecting tube **113**, drinking tube (bite or open) **114**, primary air flow passageway **115**, and/or a one-way air valve **116**. The container **108** may hold a liquid or other fluid **121** for consumption, which in turn results in an air chamber **120** above the liquid **121** when the top **111** is placed on the container body **110**. A user of the container **108** consumes liquid from the fluid container **108**, e.g., water, electrolyte beverage, energy drink, and the like, through the drinking tube **214**.

[0037] The consumption tracking device **122** may include an air pressure sensor **119** placed within the air chamber **120** of the container **108**, e.g., above the maximum level of the liquid **121**, a replaceable or rechargeable battery or other power source **117** for providing electrical power to components of the consumption tracking device **122**, and one or more electronic components **118**. For example, as shown in FIG. 1B, the consumption tracking device **122** may include a processor unit **124**, memory resource(s) **128** for storing data and instructions executable by the processor **124**, and/or a communication interface **126**, e.g., a wireless transmitter or transceiver, for communicating with a remote device, e.g., a mobile electronic device, external computer, and the like (not shown). Optionally, the consumption tracking device **122** may include one or more additional sensors including an accelerometer, inclinometer, gyroscope, temperature sensor, and/or humidity sensor (not shown), if desired, as described elsewhere herein. In another option, the liquid consumption tracking device **122** may also be electronically connected to an output device, e.g., one or more LEDs and/or a visual display, a speaker, and the like (not shown), mounted anywhere on or in the container body **110** or container top **111**, e.g., to provide various types of feedback to the user of the system **100**, as described elsewhere herein.

[0038] The electronic components of the consumption tracking device **122** may be enclosed in a housing (not shown) that may be designed to easily connect to the container body **110**, top **111**, or straw **112**. The housing may be designed to be water proof and dishwasher safe to protect the electronic components from exposure to the liquid in the container **108** and/or to water or steam during cleaning of the hydration tracking system **100**.

[0039] The consumption tracking device **122** may provide consumption data based at least in part on the air pressure sensor **119**. For example, the processor **124** may acquire pressure data from the air pressure sensor **119** to measure the flow of air into the container **108** through the primary air flow passageway **115**, e.g., by measuring, over time, the air pressure changes in the air chamber **120** above the liquid **121** residing in the container **108**.

[0040] When a user of the system **100** draws liquid up the straw **112**, an air pressure drop occurs in the air chamber **120** above the liquid **121** in the container **108**. This air pressure drop in turn causes the one-way air valve **116** to open, which allows a volume of air to flow into the chamber **120** that is proportional to the liquid flowing out of the container **108**. By measuring the volume of air that flows into the container **108** during a drink, the consumption tracking device **122** may substantially simultaneously measure the volume of liquid flowing out of the container **108**.

[0041] The air pressure sensor **119** may be locally exposed to the primary air flow passageway **115** while not directly connected to either the primary air flow passageway **115** or the one-way air valve **116**. In particular, the air pressure sensor **119** may be spaced sufficiently from the air flow passageway **115** such that the liquid consumption device **122** does not affect either the liquid flow out of the container **108** or the air flow into the container **108**. In addition, this separation enables the addition of the liquid consumption device **122** to conventional containers without modifying the container.

[0042] When a user of the consumption tracking device **122** is not drinking, the processor **124** may acquire pressure data from the air pressure sensor **119** periodically or otherwise intermittently to measure the internal ambient air pressure within the container **108**. This measured internal ambient air pressure may, in turn, be used to calculate the external ambient air pressure using a conversion formula based on the mechanical structure and size of the primary air flow passageway **115** and/or one-way air valve **116**, as is known to those of skill in the art. In this manner, the external ambient air pressure may be calculated as an input into the calculation of air volume flowing through the primary air flow passageway **115** and into the container **108** while a user is drinking.

[0043] Also, since external ambient air pressures outside the container **108** may arbitrarily and constantly change, the processor **124** may acquire pressure data from the air pressure sensor **119** to recalculate and/or store a recent external ambient air pressure value before a drink event starts and/or after a drink event is complete.

[0044] During a drink event, the processor **124** may acquire pressure data from the air pressure sensor **119** to calculate the volume of air that flows into the container **108** through the primary air flow passageway **115** using Bernoulli's equation:

$$Q=Cf*A*\mathrm{sqrt}((2*(p(t)1-p2(t)))/\mathrm{density})$$

where Q is the air flow rate, A is the surface area of the vent hole, p1(t) is the external ambient air pressure at time t and p2(t) is the chamber air pressure at time t. The air flow volume during a time interval may then be calculated from the air flow rate during that time interval by multiplying Q by the time interval. Finally, the total air flow volume during a drink event may then be calculated by summing the individual air flow volumes from each time interval.

[0045] To improve the accuracy of the air flow calculation, optionally, a temperature sensor (not shown) may be provided on the container **108** to measure the external temperature at time t and/or a humidity sensor may be provided on the container **108** to measure the external humidity at time t. The processor **124** may then use the temperature and/or humidity measurements to accurately calculate air density at the time of a drink.

[0046] Further, to calculate air flow volume, the processor **124** needs to identify when a drink event starts and ends. For example, the processor **124** may acquire pressure data from the air pressure sensor **119** periodically or otherwise intermittently to identify a unique pressure change signature pattern that corresponds to a drink start event and a different unique pressure change signature pattern that corresponds to a drink end event.

[0047] The one-way air valve **116** may be biased to a closed position for sealing the passageway **115** in the top **111** yet movable to an open position when the interior air chamber **120** experiences a negative pressure relative to the exterior of the container **108** to flow into the air chamber **120**. Thus, during a drink event, the one-way air valve **116** opens and closes as the difference between external air pressure and internal air pressure changes. Because of this phenomena, the term A in the flow rate calculation equation constantly changes as a function of the difference between internal air pressure and external ambient air pressure. The processor **124** may include a function that predicts the value of A based upon the instantaneous pressure difference between external and internal ambient.

[0048] Optionally, the system **100** may include a motion sensor (not shown) coupled to the consumption tracking device **122**, e.g., mounted on the container body **110** or container top **111** (on the exterior or interior, as desired). The processor **124** may be coupled to the motion sensor to operate one or more electronic components of the system **100**, e.g., the processor **124** itself, the air pressure sensor **119**, and/or communication interface **126**, at a low-power state for the purpose of reducing overall energy consumption of the system **100** when the system **100** is inactive. For example, when the container **108** is moved, e.g., immediately before a drink event, the processor **124** may identify a motion signal from the motion sensor indicating that the container **108** has moved, and the processor **124** may activate the components of the consumption tracking device **122** and enable the system **100** to transition to a full-power state. The consumption tracking device **122** may remain in the full-power state only while the container **108** is in motion, i.e., while motion signals from the motion sensor indicate the container **108** is in motion, or alternatively the consumption tracking device **122** may remain in the full-power state for a predetermined time, e.g., corresponding to the maximum anticipated duration of a drink event, and then acquire additional motion data to reconfirm whether the container **108** is still in motion.

[0049] Thus, during use, the system **100** may remain in a low-power state until the processor **124** receives a motion signal from the motion sensor, whereupon the system **100** may be converted to the full-power state. Once in the full-power state, the processor **124** may acquire pressure data from the air pressure sensor **119** until the processor **124** identifies that a drink event has begun, e.g., based on a first predetermined pressure change pattern or other indicator. Once the processor **124** identifies that a drink event has begun, the processor **124** may acquire pressure data from the air pressure sensor **119** during the drink event, discontinuing upon completion of the drink event, e.g., based on a second predetermined pressure change pattern or other indicator. The processor **124** may then determine the volume of fluid consumed based at least in part on the pressure data (and optionally other data, such as temperature and/or humidity data to compensate for the air density), as described above.

[0050] The resulting volume consumption data may be stored in memory **128** within the consumption tracking device **122** and/or communicated to another remote electronic device, e.g., a mobile device (not shown, see, e.g., device **18** in FIG. **4**) operating a software or other hydration and/or fitness application, via the interface **126**, as described elsewhere herein. Optionally, the processor **124** may use consumption data to provide an output to the user, e.g., to provide an indication whether the user has consumed sufficient hydration fluid, e.g., based on one or more of the user's physical characteristics, physical activity, environmental conditions, and the like, as described elsewhere herein. For example, the processor **124** may be coupled to an output device on the container **108**, such as one or more LEDs or a display (not shown) for providing a visual indication or a speaker or other device for providing an audible indication, e.g., when the user has consumed sufficient fluid or needs to consume additional fluid.

[0051] In an alternative embodiment, the volume consumption data may be stored in memory **128** until the processor **124** receives a request from a remote device (e.g., the electronic device **18** shown in FIG. **4**), whereupon the consumption data may be transmitted via the communication interface **126** to the remote device. In another alternative, the pressure data (and any other raw data) may be transmitted to the remote device, which may perform any calculations to determine volume consumption and/or any other information. In this alternative, the remote device may provide an output related to the fluid consumption, as described elsewhere herein.

[0052] In an alternative embodiment, other sensors may be mounted to the top **111**, e.g., within the air chamber **120**, for determining the volume of fluid within the container **108**. For example, instead of the air pressure sensor **119**, the sensor **119** may be an ultrasonic sensor that may be oriented downwardly towards the bottom of the container body **110**, e.g., substantially perpendicular to the inner surface of the top **111**, i.e., substantially vertically relative to the container body **110**. The sensor **119** may be configured to transmit ultrasonic signals from the inner surface towards the upper surface of the fluid **121** within the container **208** and detect signals reflected from the upper surface of the fluid **121**. Alternatively, separate ultrasonic transmitter and receivers may be provided (not shown).

[0053] The processor **124** may acquire data from the ultrasonic sensor **119**, e.g., time delay data based on the difference between the time of transmission of an incident ultrasonic wave or signal and a wave or signal reflected from the upper surface of the fluid **121** back to the sensor **119**. Given the known speed of sound within air, the processor **124** may use the difference between the time of the reflected and incident signals to determine a distance between the top **111** and the fluid **121** and correlate the distance to the volume of fluid remaining within the container **208**, e.g., after a drink event.

[0054] In an alternative embodiment, an ultrasonic sensor may be mounted to the bottom wall of the container body **110**, e.g., oriented upwardly towards the top **111**, e.g., substantially perpendicular to the bottom wall. In this alternative, the sensor may be configured to transmit ultrasonic signals from the bottom wall upwardly towards the upper surface of the fluid **121** within the container **208** and detect signals reflected from the upper surface of the fluid **121**. Given the known speed of sound within the fluid **121**, the processor **124** may use the difference between the time of the reflected and incident signals to determine a distance between the bottom wall and the fluid **121** and correlate the distance to the volume of fluid remaining within the container **208**.

[0055] Optionally, the container **108** may include an inclinometer coupled to the processor **124**, which may provide orientation data identifying the orientation of the container **108** relative to vertical, e.g., to compensate for the upper surface of the fluid **121** being non-perpendicular to the vertical axis of the container **108** if the container is oriented non-vertically. Based at least in part on the orientation and the known shape of the container, the processor **124** may determine the volume of fluid remaining within the container **108** after a drink event and determine the volume of fluid consumed during the drink event.

[0056] Turning to FIGS. **2**A-**2**C, additional examples of a hydration tracking system **200, 200,' 200"** are shown that are generally similar to the system **100** although using a different pressure sensor **219**.

[0057] For example, FIG. **2**A illustrates a liquid dispensing container **208** including a container body or housing **210** and one or more of a removable top **211**, straw **212**, connecting tube **213**, drinking tube **214** (e.g., bite or open type), primary air flow passageway **215**, and/or a one-way air valve **216**. The container **108** may be filled with a liquid or other fluid **221** for consumption, which in turn results in an air chamber **220** above the liquid **221** when the top **211** is placed on the container body **210**. A user of the container **210** consumes liquid from the container **210** by drawing liquid through the drinking tube **214**.

[0058] FIG. **2**B illustrates an alternate system **200'** that includes a liquid dispensing container **208'** without a straw member. A user of the container **208'** consumes liquid from the container **208'** by tilting the container **208'** such that liquid is in contact with the drinking tube **214** and then drawing liquid through the drinking tube **214** and/or squeezing the container **208'** to force liquid through the drinking tube **214**.

[0059] FIG. **2**C illustrates an alternate system **200"** that includes a liquid dispensing container **208"** including a drinking orifice **213** without a straw member or drinking tube. A user of the container **208"** consumes liquid from the container **208"** by tilting the container **208"** such that liquid flows out of the drinking orifice **213**.

[0060] Each of the hydration tracking systems **200-200"** also include a liquid consumption tracking device **222**, e.g., including a pressure sensor **219** placed at the bottom of the container **208-208"**, e.g., to the inside of a bottom wall **210***a* of the container **210** such that the pressure sensor **219** is exposed to the liquid **221**. In addition, the consumption tracking device **222** may include a replaceable or rechargeable battery **217** and electronic components **218**, e.g., which may be similar to the components shown in FIG. **1**B, i.e., including a processor unit **124**, memory **128** for storing data and instructions executable by the processor unit, and/or a wireless communication interface **126** for communicating with a remote device. Optionally, the systems **200-200"** may also include one or more additional sensors, such as an accelerometer, inclinometer, gyroscope, temperature sensor, and/or humidity sensor. The consumption tracking device **222** may also be electronically connected to an output device, e.g., one or more LEDs or a visual display (not shown) mounted anywhere on the container body **210** or container top **211** to provide various types of feedback to the user of the systems **200-200**."

[0061] The electronic components of the consumption tracking device **222** may be enclosed in a housing (not shown) that is designed to easily connect to the bottom of the container body **210**. The housing may be designed to be water proof and dishwasher safe to protect the electronic components from exposure to the liquid in the container and/or to water or steam during cleaning of the hydration tracking system.

[0062] The consumption tracking device **222** may provide a liquid volume measurement device based at least in part on a pressure sensor **219**. The processor **124** may acquire pressure data from the pressure sensor **219** positioned at the bottom **210***a* of the container body **210** to determine the volume of liquid in the container **208-208**," e.g., by measuring the pressure of the column of liquid in the container body **210**. The pressure of the column of liquid may be calculated by subtracting the ambient air pressure from the total pressure at the bottom of the container body **210**.

[0063] For example, the pressure within the empty container **208** may be acquired and then any desired compensations may be applied, e.g., based on changes in elevation. Alternatively, the processor **124** may acquire internal air pressure data within the container **208** (e.g., using an air pressure sensor similar to that described above mounted on the top **211**), and the pressure data may be adjusted based on the known behavior of the air valve **216** and the container **208**. Generally, the air valve **216** may close before the internal pressure equalizes with the external pressure; however, the pressure differential at which the air valve **216** closes is substantially fixed by the design of the air valve **216** and so the pressure differential may be added to the internal pressure to estimate the external ambient pressure immediately after a drink event.

[0064] The volume of liquid within the container **208-208"** may be periodically (at regular time intervals) or otherwise intermittently (e.g., at intervals based on identification of a drink event) calculated by measuring the pressure of the column of liquid in the container **208-208"** at each time interval, then calculating any change in liquid volume based on a proportional change in liquid pressure, e.g., similar to the methods disclosed in U.S. Publication No. 2015/0024349, the entire disclosure of which is expressly incorporated by reference herein. However, the systems and methods herein may provide one or more advantages over the devices disclosed in this reference.

[0065] For example, to measure liquid volume consumption using the systems **200-200**," the processor **124** may first measure a starting volume of liquid in the container **208-208**," e.g., when initially filled with hydration fluid. The processor **124** may recognize unique pressure, acceleration, and/or orientation change signature patterns to automatically sense when liquid is entering the container. For example, the processor **124** may acquire pressure data from the pressure sensor **219** and identify a rapid increase in pressure to correspond to a container filling event. Once the processor **124** identifies that the pressure data substantially stabilizes, the processor **124** may conclude that the container **208-208"** has been filled. In addition or alternatively, a motion sensor (not shown) may be provided on the container **208-208"** and the processor **124** may acquire motion data from the motion sensor and analyze the data to identify a filling event. Optionally, the processor **124** may identify pressure data from the pressure sensor **219** immediately before the filling event as corresponding to ambient air pressure and save this value in memory **128** for subsequent use, if desired.

[0066] After liquid filling is complete, the processor **124** may calculate the height H of liquid in the container **208-208"** using the following formula:

$$h=p/(g*D)$$

where h is the height of the liquid, p is the measured pressure of the liquid column, g is the gravity constant, and D is the density of the liquid. The processor **124** may then store the height data of the liquid in the container within memory **128** for later use as fluid is consumed from the container **208-208**." Alternatively, the processor **124** may calculate the initial volume of the fluid from the height data and store the initial volume instead or as well.

[0067] For example, once the height of the liquid in the container **208-208"** is known, the volume of the liquid may be computed using a volume function that is dependent on the shape of the container **208-208**." For example, the volume V function for a cylindrical bottle is:

$$V=h\pi r2$$

where h is the previously computed height of the liquid in the container, pi is a constant, and r is the radius of the bottle.

[0068] Once the initial volume of liquid in the container **200-208"** has been calculated, the consumption tracking device **222** may use an algorithm based on various thresholds to determine how to classify subsequent changes in the liquid volume over time. For example, if a volume change is a decrease by an amount greater than the typical human drink volume V(human) within a short period of time T(human), the volume change is likely resulting from the user dumping liquid and is not considered as being consumed by the user. If the volume change is an increase by any amount, the volume change is likely resulting from the user adding liquid to the container. This added height and/or volume amount may be added to the stored height and/or volume, e.g., from the initial filling event less any intervening drinks. If a volume change is a decrease by an amount typical of human drink volume, e.g., falling within predetermined threshold values, then the processor **124** may consider the volume change as being consumed by the user and process and/or store the height and/or volume data.

[0069] Alternatively, if the container **208** is of the type described in FIG. **2**A, the processor **124** may acquire pressure data from the pressure sensor **219** to measure pressure changes during a user drink event to calculate the volume of air flow through the primary airflow passageway **215**, e.g., using Bernoulli's equation as previously described. In this method, the volume of liquid consumed is equal to the volume of air that flowed into the container **208** during the drink event.

[0070] Alternatively, the processor **124** may acquire pressure data from the pressure sensor **219** to determine the volume of liquid consumed by subtracting the pressure just before a unique drink start event from the pressure just after a corresponding drink end event. The calculated pressure change may then be used to calculate the liquid volume consumed during the drink event.

[0071] To perform this method, the processor **124** determines the drink start and drink end events. If the container **208** is of the type described in FIG. **2**A, then the processor **124** may acquire pressure data periodically from the pressure sensor **219** to identify a unique pressure change signature pattern that corresponds to a drink start event and a different unique pressure change signature pattern that corresponds to a drink end event. Alternatively, if the container **208** includes an accelerometer, the processor **124** may acquire motion data from the accelerometer to identify a unique container motion signature pattern that corresponds to a drink start event and a different unique container motion signature pattern that corresponds to a drink end event.

[0072] Optionally, any of the systems **200-200"** may also include an accelerometer or other motion sensor (not shown) mounted on the container body **210** or container top **211**. The motion sensor may communicate with the processor **124** so that the processor **124** and/or other electronic components may be powered off or placed in a low-power state for the purpose of reducing overall energy consumption of the system **200-200**." When the processor **124** detects movement of the container **208-208"** based on motion data from the motion sensor, the processor **124** may activate the components of the detection device **222**, enabling the device **222** and/or system **200** to transition to a full-power state, e.g., while the container **208-208"** is in motion and/or for a predetermined time, similar to other embodiments herein.

[0073] Additionally, the accelerometer may provide an inclinometer that may be used to automatically correct pressure sensor measurements based on simultaneously measured angle of the container **208-208"** relative to vertical. For example, the processor **124** may acquire pressure data from the pressure sensor **219** and orientation data from the accelerometer to determine the orientation of the container **208-208"** corresponding to the pressure data. Thus, the processor **124** may compensate for pressure data acquired while the container **208-208"** is at an angle other than vertical (for example, orientation data indicating the container **208** to be at a thirty degree angle from vertical may be used to increase the actual height of the liquid relative to the pressure data acquired from the pressure sensor **219**). By automatically correcting all pressure sensor measurements using the accelerometer, the volume of liquid in the container **208-208"** may be accurately computed largely independent of the position or angle that the user is holding the container **208-208**." Optionally, the processor **124** may identify that the container **208-208"** is tilted at an angle greater than ninety degrees (90°) or other threshold and discard pressure data acquired at this orientation and/or defer acquiring pressure data until the orientation data indicates the container **208-208"** is between zero and ninety degrees (0-90°) from vertical. Another challenge overcome by the systems **200-200"** is how to measure pressure while the container **208-208"** is in motion. The systems **200-200"** may be used in many real world situations including while sitting, walking, hiking, running, riding a bike, riding in a car, or other common activities. Since most of these activities cause the container **208-208"** to be in motion, the liquid in the container **208-208"** is also in motion and sloshing in the container **208-208**," which in turn causes unstable pressure measurements while the system is attempting to measure the liquid column pressure. The processor **124** may analyze pressure data from the pressure sensor **219** to distinguish an actual drink event from such other movements.

[0074] In addition to the angle adjustment techniques already mentioned, the consumption tracking device **222** may also employ noise identification and filtering algorithms to ignore pressure readings that are not valid and/or to remove random noise and motion induced noise from the pressure measurements. When combined, these techniques may dramatically improve the accuracy and usability of the system, enabling the system **200-200"** to be used in calm or harsh environments.

[0075] Turning to FIGS. **3**A-**3**C, alternative examples of another hydration tracking system **300-300"** are shown that are generally similar to the systems **100**, **200** although using an accelerometer instead of pressure sensors **119** or **219**.

[0076] For example, FIG. **3**A illustrates a liquid dispensing container **308** including a container body **310** having a container floor **310***a*, and one or more of a removable top **311**, straw **312**, connecting tube **313**, drinking tube (bite or open) **314**, primary air flow passageway **315**, and/or a one-way air valve **316**. The container **308** may be filled with a liquid or other fluid **321** for consumption, which in turn may result in an air chamber **320** above the liquid when the top **311** is placed on the container body **310**. A user of the container **308** consumes liquid from the container by drawing liquid through the drinking tube **314**.

[0077] FIG. **3**B illustrates an alternate liquid dispensing container **308'** without a straw member. A user of the container **308'** consumes liquid from the container **308'** by tilting the container **308'** such that liquid is in contact with the drinking tube **314** and then drawing liquid through the drinking tube **314** and/or squeezing the container **308'** to force liquid through the drinking tube **314**.

[0078] FIG. **3**C illustrates another alternate liquid dispensing container **308"** without a straw member or drinking tube. A user of the container **308"** consumes liquid from the container **308**" by tilting the container **308**" such that liquid flows out of the drinking orifice **313**.

[0079] Each of these hydration tracking systems **300-300**" may also include a liquid consumption tracking device **322** including a mass measurement device, e.g., based on an accelerometer **319** attached to the bottom **310***a* of the container body **310** below the container floor as shown in FIGS. 3A-3C or otherwise attached to any other part of the container **308-308**." For example, the accelerometer **319** may be attached to the outside of the container **308-308**" such that it is never in contact with the liquid or air in the container **308-308**," or may be attached to the inside of the container **308-308**" such that it may come in contact with the liquid or air. The consumption tracking device **322** may also include a replaceable or rechargeable battery **317** and electronic components **318**, e.g., similar to the consumption tracking device shown in FIG. 1B including a processor **124**, memory **128** for storing data and instructions executable by the processor **124**, and/or a wireless communication interface **126** for communicating with an external computer or mobile device (not shown).

[0080] Optionally, the consumption tracking device **322** may include one or more additional sensors such as an accelerometer, inclinometer, gyroscope, temperature sensor, and/or humidity sensor. In addition or alternatively, the consumption tracking device **322** may also be electronically connected to one or more LEDs or a visual display (not shown) mounted anywhere on or in the container body **310** or container top **311** to provide various types of feedback to the user of the system **300-300**."

[0081] The electronic components of the consumption tracking device **322** may be enclosed in a housing that is designed to easily connect to the container **308-308**." The housing may be designed to be water proof and dishwasher safe to protect the electronic components from exposure to the liquid in the container **308-308**" and/or to water or steam during cleaning of the hydration tracking system **300-300**."

[0082] The processor **124** may acquire motion data from the accelerometer **319** to measure tiny changes in the motion of the container **308-308**" in three dimensional space and these measured changes may be used by a unique mass analysis algorithm to accurately calculate the mass of the container **308-308**." The mass of the liquid at any point in time may then be determined by subtracting the pre-determined fixed mass of the empty container **308-308**" from the total mass of the container **308-308**" including liquid at the time of data acquisition. The processor **124** may then determine the volume of liquid consumed in any time interval by periodically (or in response to an identified drink event, similar to other embodiments herein) measuring the mass of liquid to calculate the change in liquid volume during the time interval.

[0083] Whenever the container **308-308**" is held by a human hand, the container **308-308**" is partially free to move independent of the human hand. This is due to the fact that a human typically does not grasp the container **308-308**" so tightly as to fully restrict the container motion relative to the human motion. Further, since the liquid in the container **308-308**" is not part of the container **308-308**" and can independently move within the container **308-308**," causing detectable variations in accelerations based only on the liquid motion. These unique observations make it possible to use an accelerometer to measure the motion of the container **308-308**" including the effect of the liquid sloshing in the container **308-308**" in order to determine the total mass of the container **308-308**."

[0084] The accelerometer mass estimation approach is based on conservation of inertial periodicity in the presence of a gravitational field, which is similar to a pendulum equation after finding a parametric association of moment distance to liquid/bottle mass assuming a known mass density.

[0085] The mass analysis algorithm first identifies specific acceleration characteristics that are independent of the container motion Ai. These acceleration characteristics are determined by examining acceleration variances as the container **308-308**" is in motion, e.g., in real time during use by the processor **124**. The mass analysis algorithm then uses multiple difference functions on Ai to identify additional characteristics Am that vary directly as a function of the mass of the container **308-308**," for example, the sloshing motion of the fluid within the container **308-308**." Once the Am characteristics have been identified, they can be used to analyze typical container motion in order to accurately predict the mass of the container **308-308**."

[0086] Algorithm Description:

[0087] a. Subtract macro acceleration components using a method similar to high-filtering.

[0088] b. Perform a secondary low-pass filtering process of the residual signal.

[0089] c. Identify the relative deviation of the normalized post-filtered mean-deviations.

[0090] d. Identify macro kinetic energy from sum of all channel second order variances (variance of the variance).

[0091] e. Perform mapping of mass to characteristic periodicity of residual signal.

[0092] Additionally, the processor **124** may acquire data from the accelerometer **319** (or other motion sensor on the container **308-308**") to identify drink start and drink end events such that the mass calculation is performed only while the user is drinking, similar to other embodiments herein. This approach may improve the accuracy of the mass calculation.

[0093] Similar to other embodiments, the processor **124** may acquire motion data from the motion sensor so that the processor **124** and/or other electronic components may be powered off or placed in a low-power state for the purpose of reducing overall energy consumption of the system **300-300**." When the processor **124** detects movement of the container **308-308**" based on motion data from the motion sensor, the processor **124** may activate the components of the detection device **322**, enabling the device **322** and/or system **300-300**" to transition to a full-power state, e.g., while the container **308-308**" is in motion and/or for a predetermined time, similar to other embodiments herein.

[0094] Turning to FIG. **4**, any of the fluid containers herein may be incorporated into a hydration and/or fitness management system **10** that includes a fluid container **100** (which may be any of the embodiments herein), an electronic device **18**, and a fitness tracker **20**, which may be used together by a user **90** to monitor the user's hydration while engaged in various physical activities, such as walking, hiking, running, bicycling, and the like. The electronic device **18** may communicate with the fluid container **100** and fitness tracker **20** wirelessly, e.g., using Bluetooth, radiofrequency and/or other known communication protocols, e.g., to acquire data, perform various functions, and provide recommendations and/or other output to the user **90** during various activities. FIG. **5** illustrates an example of a method that may be used by the system **10** to monitor hydration of the user **90**.

[0095] One or more of the steps of the method may be performed by the electronic device **18**, e.g., by accessing a database and/or functionality stored in memory of the mobile device **18**. Alternatively, as shown in FIG. **6**, the electronic device **18** communicate via a network **12** to receive additional data, e.g., environmental conditions from a weather service **14**, and/or exchange data with a central server **16** and/or database **17**. Optionally, multiple systems **10** (each including an electronic device **18**, fluid container **100**, and optionally a fitness tracker **20**) may communicate with the server **16** and/or database **17** via the network **12**, e.g., to share information, allow collection and/or analysis of data related to hydration of multiple users, and the like, as described elsewhere herein.

[0096] In exemplary embodiments, the network **12** may be a telecommunications network, including a wide area network ("WAN"), a local area network ("LAN"), an intranet, a wireless network, and/or a telephony network. For example, the network **10** may incorporate several different types of networks including a WAN, a LAN, and/or a wireless network; one such network including multiple different types of networks is the Internet.

[0097] The central server **16** may include one or more computer systems including one or more processors, memory and/or storage devices, and communication interfaces for communicating via the network **12**, e.g., with the electronic devices **18**. The central server **16** may include one or more hardware-based components and/or software-based modules for performing the various functions related to the system **10**, as described elsewhere herein. Although only one vendor server **16** and database **17** are shown, it will be appreciated that multiple servers and/or databases (not shown) may be provided at the same or different locations for performing the various functions described herein.

[0098] The fitness tracker **20** may include any device that monitors one or more characteristics of the user's activities. For example, the fitness tracker **20** may be a GPS device that monitors movement of the user, an electronic pedometer or other device that detects steps and/or other motion to estimate activities, a heart rate monitor, and the like, such as those available from Garmin, Fitbit, and the like.

[0099] Turning to FIG. **7**, an exemplary embodiment of an electronic device **18** is shown that includes one or more hardware and/or software components for performing the methods described herein. As shown, the electronic device **18** may be a wireless device, e.g., a mobile, smart, and/or cellular telephone, a tablet computer, a personal digital assistant, a Wi-Fi device, a laptop computer, and the like, capable of communicating via the network **12** (not shown, see FIG. **6**). The electronic device **18** includes one or more processors, such as exemplary processor **22**, for completing the various tasks described herein, e.g., to acquire data from the sensors of the fluid container **100** to determine fluid consumption of the user, to acquire data from the fitness tracker **20** to determine exertion levels of the user, and/or to provide recommendations to the user, as described elsewhere herein. Additional processors may be provided, such as an auxiliary processor to manage input/output or perform floating point mathematical operations, a special-purpose microprocessor having an architecture rapid execution of signal processing algorithms, a slave processor subordinate to the main processing system ("back-end processor"), and/or a coprocessor (not shown). Such auxiliary processors may be discrete processors or may be integrated with the processor **22** and collectively may still be referred to as "a processor."

[0100] The processor **22** is generally connected to a communication bus **23**. The communication bus **23** may include a data channel for facilitating information transfer between storage and/or other components of the electronic device **18**. The communication bus **23** may also provide signals required for communication with the processor **22**, including a data bus, address bus, and/or control bus (not shown). The communication bus **23** may include any known bus architecture, for example, industry standard architecture (ISA), extended industry standard architecture (EISA), Micro Channel Architecture (MCA), peripheral component interconnect (PCI) local bus, IEEE 488 general-purpose interface bus (GPIB), IEEE 696/S-100, and the like.

[0101] The electronic device **18** also includes memory and/or storage devices, e.g., main memory **24** and secondary memory or storage devices **25**. The main memory **24** may provide storage of instructions and/or data for programs executed on the processor **22**. In exemplary embodiments, the main memory **24** may be semiconductor-based memory, such as dynamic random access memory (DRAM) and/or static random access memory (SRAM). In addition, other semiconductor-based memory may also be provided, such as synchronous dynamic random access memory (SDRAM), Rambus dynamic random access memory (RDRAM), ferroelectric random access memory (FRAM), and the like, as well as read only memory (ROM).

[0102] The secondary memory **25** may include a hard disk drive **25***a* and/or a removable storage drive **25***b*, for example, a flash drive, a floppy disk drive, a magnetic tape drive, an optical disk drive, a CDROM drive, a DVDROM drive, and the like (not shown). The removable storage drive **25** may read from and/or write to a removable storage unit (not shown) in a well-known manner. In exemplary embodiments, the removable storage unit may include a floppy disk, magnetic tape, optical disk, CDROM disk, DVDROM disk, and the like that may be read from and/or written to by removable storage drive **25***b*. Additionally, the removable storage unit may include a computer usable storage medium with computer software and computer data stored thereon.

[0103] Optionally, the secondary memory **25** may include other components allowing computer programs and/or other instructions to be loaded into the electronic device **18**. For example, such components may include semiconductor-based memory such as programmable read-only memory (PROM), erasable programmable read-only memory (EPROM), electrically erasable read-only memory (EEPROM), or flash memory (block oriented memory similar to EEPROM). Also included are any other interfaces and removable storage units that allow software and data to be transferred from the removable storage unit to the electronic device **18**.

[0104] The electronic device **18** also generally includes one or more communication interfaces **26**, e.g., one or more transceivers, receivers, and/or transmitters. Communication interface(s) **26** may allow software and/or data to be transferred between the electronic device **18** and the fluid container **100**, fitness tracker **20**, a weather service **14**, central server **16** and/or other external devices, networks, or information sources. Examples of communication interface **26** include but are not limited to an infrared or radiofrequency ("RF") interface (such as those that use the Bluetooth standard), a modem, a network interface (for example an Ethernet card), a communications port, a PCMCIA slot and card, and the like. The communication interface(s) **26** may implement industry promulgated architecture standards, such as Ethernet IEEE 802 standards, Fibre Channel, digital subscriber line (DSL), asymmetric digital subscriber line (ASDL), frame relay, asynchronous transfer mode (ATM), integrated digital services network (ISDN), personal communications services (PCS), transmission control protocol/Internet protocol (TCP/IP), serial line Internet protocol/point to point protocol (SLIP/PPP), and the like. Software and/or data transferred via the communication interface **26** may be transferred using signals **27**, such as electronic, electromagnetic, optical signals, and the like. The signals **27** may be implemented using wires, cables, fiber optics, telephone lines, cellular phone links, radio frequency (RF) links, and/or other communications channels.

[0105] Computer programming instructions, e.g., computer programs, software, or firmware, may be stored in the main memory **24** and/or the secondary memory **25**. Computer programs may also be received via the communication interface **26**. Such computer programs, when executed, may enable the electronic device **18** to perform one or more of the features described elsewhere herein.

[0106] As used herein, "computer program product" may refer to any media used to provide programming instructions to the electronic device **18**. Examples of such media include removable storage units in removable storage drive **25***b*, a hard disk installed in hard disk drive **25***a*, and signals **27**. Thus, a computer program product may include means for providing programming instructions to the electronic device **18**.

[0107] Where the methods and/or features described herein are completed using software, the software may be stored in a computer program product and loaded into the electronic device **18**, e.g., using the hard disk drive **25***a*, removable storage drive **25***b*, and/or communication interface **26**. The computer programming instructions, when executed by the processor **22**, may cause the processor **22** to perform the methods and/or features described herein. In addition or alternatively, one or more of the methods and/or features may be implemented primarily in hardware using hardware components, such as application specific integrated circuits ("ASICs").

[0108] In addition, the electronic device **18** may include one or more user interfaces **28**, e.g., a keyboard **28***b*, mouse, touch screen, touch pad (not shown), and/or other input device. The user interface **28** may allow a person using the electronic device **18** to download software, launch one or more programs, and the like, as described elsewhere herein.

[0109] Further, the electronic device **18** may include one or more output devices, e.g., a display **28***a*, and the like. The output device(s) **28***a* may facilitate a user controlling and/or otherwise communicating with the processor **22** or other components of the electronic device **18**. In addition, the output device(s) **28***a* may allow information to be presented and/or manipulated in a desired manner, as described elsewhere herein. In one embodiment, the electronic device **18** may include a touch screen (not shown) that may act as a display **28***a* and as an input device **28***b*, allowing the user to scroll through menus and/or select icons, e.g., by touching the corresponding images on the touch screen, as described elsewhere herein.

[0110] Optionally, the electronic device **18** may include one or more additional hardware components and/or software modules. For example, the electronic device **18** may include a GPS **29** or other device or system for identifying a location of the electronic device **18**, e.g., to facilitate identifying the user's location.

[0111] Returning to FIGS. **4-6**, the system **10** may be used to track the volume of liquid consumed from a container **100** over time in order to determine the hydration level of the user **90** and/or to provide recommendations to the user. The system **10** may be further enhanced with real-time environmental condition data and real-time physical exertion data about a user to create a closed loop hydration tracking system. For example, the fitness tracker **20** and/or the electronic device **18** may include a GPS device, which may provide the user's location, and the electronic device **18** may communicate with a weather service **14** to provide environmental conditions at the user's location that may affect the desired hydration level of the user, e.g., temperature, humidity, how sunny/cloudy the location is, and the like. Alternatively, environmental conditions may be acquired directly from one or more sensors, e.g., a temperature and/or humidity sensor on the fluid container **100** or other component of the system, as described elsewhere herein.

[0112] For example, with particular reference to FIG. **5**, the hydration level of the user at any time may be compared to a hydration plan specific to the user to determine if the user is within desired hydration thresholds. As shown, the thresholds may be set and/or modified based on a "baseline hydration plan," which may be derived from predetermined physical and/or health characteristics of the user and/or a "localized hydration plan, which may be based on environmental conditions and/or physical activity of the user.

[0113] Generally, the processor **22** of the electronic device **18** (or optionally the consumption tracking device carried by the fluid container **100** itself) may perform the substantially continuous loop shown in FIG. **5** once the desired devices are activated. For example, initially, the user may activate a hydration application on the electronic device **18**, the fitness tracker **20**, and/or the consumption tracking device on the fluid container **100**, e.g., immediately before engaging in a desired activity, such as walking, hiking, running, bicycling, and the like. Alternatively, the devices may be activated to monitor the user's hydration at any time, e.g., from the beginning and during the course of an ordinary day.

[0114] When the container **100** is filled (and/or subsequently refilled), the consumption tracking device may identify and store fluid data (e.g., the volume of fluid provided in the container **100**) and/or communicate the fluid data to the electronic device **18**. Thereafter, at step **60** in FIG. **5**, the consumption tracking device may measure fluid consumed by the user, e.g., as described elsewhere herein with reference to any of the fluid containers, which may be stored by the consumption tracking device and/or communicated to the electronic device **18**.

[0115] At step **62**, the actual consumed liquid may be compared to target thresholds, e.g., established by the application running on the electronic device **18**. If the user is determined to be outside of desired hydration thresholds, at step **64**, the electronic device **18** may notify or alert the user in real-time to drink more or less fluid, e.g., via one or more output devices on the fluid container **100**, or on the display **28***a* of the electronic device **18**. At steps **66-68**, the application may set and/or recalculate the target hydration thresholds, e.g., based on one or more characteristics of the user and/or their environment.

[0116] For example, the baseline hydration characteristics **70** (shown in FIGS. **4** and **5**) may be initially set by the user when the application is installed on the electronic device **18**. For example, the application may prompt the user to enter standard characteristics, such as gender, age, race, height, and/or weight. Similarly, the application may prompt the user to provide relevant health characteristics **74**, e.g., general healthiness, current health conditions, amount of sleep, heart rate, and the like. Alternatively, such characteristics may be provided automatically, e.g., based on the information from other applications or the fitness tracker **20**.

[0117] Generally, these characteristics remain substantially static, although during the recalculation step **66**, e.g., at regularly scheduled intervals, the application may prompt the user to enter any changes at steps **72**, **76**, or the application may automatically update such changes.

[0118] Optionally, the baseline hydration plan may be further enhanced with real-time local environmental conditions, at steps **80**, **82**, including temperature, humidity, or altitude, and/or further enhanced when combined with real-time measured physical activity of the user at steps **84**, **86**. This enhanced "localized hydration plan" may be uniquely personalized and updated in a closed-loop real-time feedback system to more accurately measure the actual hydration requirements of a user and set new hydration thresholds. At step **68**, the new hydration thresholds may replace the previous thresholds and used in subsequent comparisons with the user's actual fluid consumption.

[0119] In one embodiment, at step **80**, if the container **100** includes temperature and/or humidity sensors, the application on the electronic device **18** may acquire temperature and/or humidity data to measure the real-time environmental conditions and check for changes at step **82** in order to enhance the baseline hydration plan, e.g., increasing the recommended volume of fluid as temperature increase. Alternatively, the environmental conditions may be acquired from a weather service **14**, as described previously.

[0120] Further, at step **66**, the application on the electronic device may communicate with the fitness tracker **20**, e.g., to measure physical energy expended during a time interval and/or other exertion parameters. At step **84**, the physical energy expended during a time interval may be measured in various units including calories burned, heart rate patterns, and/or other units of measure based at least in part on the data provided by the fitness tracker **20**. Any changes in physical activity may be updated at step **86** and used to automatically and dynamically adjust hydration targets and thresholds.

[0121] Thus, the hydration tracking system **10** shown in FIG. **4** may provide a unique coupling of a hydration tracking device, environmental measurements, and physical exertion information to implement a feedback loop wherein processor algorithms may update both the hydration plan and target hydration thresholds to more accurately predict the user's hydration requirements in real-time. By more accurately tracking the user's hydration requirements and current status, the system **10** may more accurately notify the user when to drink or when not to drink in order to maintain proper hydration.

[0122] Turning to FIGS. **8-10**, another exemplary embodiment of a device and system **400** for monitoring fluid consumption are shown that generally include a fluid container **408** and a consumption tracking device **422**, similar to other embodiments herein. However, unlike previous embodiments the consumption tracking device **422** includes an air flow sensor **419** and an air flow switch **423**.

[0123] In particular, as shown, the fluid container **408** includes a container body **410** and a removable top **411** including a liquid flow passageway **413**, an air flow passageway **415**, and a one-way air valve **416**. The container **408** may be filled with a liquid or other fluid for consumption, which in turn may result in an air chamber above the liquid when the top **411** is placed on the container body **410**. A user of the container **408** consumes liquid from the container **408** by drawing liquid through the liquid flow passageway **413**, thereby causing air to flow into the container **408** through the air flow passageway **415**, opening the air valve **416**, similar to other embodiments. However, unlike the previous embodiments, the air flow sensor **419** and air flow switch **423** communicate with the air flow passageway **415**, e.g., to detect and measure air flow through the air flow passageway **415**.

[0124] In addition, the system **400** includes a liquid consumption tracking device **422** coupled to the air flow sensor **419** and air flow switch **423** that includes a processor **424**, memory **428** for storing data and instructions executable by the processor **424**, and a wireless communication interface **426** for communicating with a remote device (not shown).

[0125] By sealing the liquid dispensing container **408** and providing a controlled air flow passageway **415** for air to enter the container **408** as liquid is flowing out of the container **408** through the liquid flow passageway **413**, the processor **424** may acquire flow data from the air flow sensor **419** to measure the amount of air that is flowing into the container **408** during a liquid consumption event. The volume of air flowing into the container **408** is displacing the liquid flowing out of the container **408** and is proportional to the volume of liquid flowing out of the container **408**. In alternative embodiments, the air flow sensor **419** may be replaced with one or more different sensors, such as any of those described elsewhere herein.

[0126] The air flow switch **423** may be a very low power device coupled to the processor **424** such that the processor **424** may detect whenever the slightest air flow is detected in the air flow passageway **415**. Because of the presence of the air flow switch **423**, the other components of the system **400** may be transitioned into a low-power state while there is no air flow detected, thereby saving significant power consumption in the overall system over time. Thus, the air flow switch **423** may dramatically reduce power consumption of the system **400** and therefore dramatically improve usability.

[0127] FIG. **10** shows an exemplary method for using the system **400** of FIGS. **8** and **9**. In an exemplary embodiment, initially, the system **400** may be in a low-power state. At step **450**, the processor **424** may acquire data from the air flow switch **423** to identify an air flow event. In addition or alternatively, at step **451**, the processor **424** may acquire motion data from a motion sensor (not shown) to identify a potential consumption event, similar to other embodiments herein.

[0128] Once such an event is identified, at step **452**, the system may be awakened and the air flow sensor **419** may be turned on. The processor **424** may then acquire air flow data at step **456** and process and/or store the data at step **458**. At step **460**, this process may be repeated until air is now flowing through the air flow passage **415**, whereupon the processor

424 may turn off the air flow sensor 419 at step 462 and the system 400 may reenter the low-power state at step 464 in preparation for another event.

[0129] Turning to FIG. 6, once a given embodiment of a system measures the volume of liquid consumed from an individual liquid dispensing container, the next major challenge is to communicate hydration and other locally collected data to remote device, such as electronic device 18 located near the liquid dispensing container 100; and to a central server 16. In order to improve usability, this communication channel may be implemented using wireless technology such as Bluetooth or WiFi. If the server 16 is collecting data from a plurality of liquid dispensing containers 100, the server 16 may perform analysis that is not possible with data only from a single liquid dispensing container 100. Such analysis may include providing hydration information across a population of users or identifying trends by combining hydration data stored in the database 17 at the server 16 with any external data source including time, season, weather, geography, population, demographics, income, social networks, or any other data that is external to the data collected from the liquid dispensing containers.

[0130] Optionally, in any of the embodiments herein, the container, e.g., the top or container body, may include a connector, e.g., a USB connector, for coupling the battery and/or other power source for the consumption tracking device to an external energy source, e.g., electrical outlet, computer, and the like.

[0131] It will be appreciated that elements or components shown with any embodiment herein are exemplary for the specific embodiment and may be used on or in combination with other embodiments disclosed herein.

[0132] While the invention is susceptible to various modifications, and alternative forms, specific examples thereof have been shown in the drawings and are herein described in detail. It should be understood, however, that the invention is not to be limited to the particular forms or methods disclosed, but to the contrary, the invention is to cover all modifications, equivalents and alternatives falling within the scope of the appended claims.

1. A device for monitoring hydration, comprising:
- a fluid container comprising a container body defining an interior region and a removable top for enclosing the interior region;
- a one-way valve in the top biased to a closed position for sealing an opening in the top communicating with an exterior of the fluid container and movable to an open position when the interior region experiences a negative pressure to allow air to flow into the interior region from the exterior via the opening;
- a drinking tube extending from the top into interior region;
- an air pressure sensor within the fluid container at a location such that the sensor is exposed to air when the fluid container is filled with a hydration fluid; and
- a processor coupled to the sensor and configured to detect a first predetermined pressure change within the interior region corresponding to a drink start event when a user begins to drink hydration fluid from the interior region via the drinking tube,
- the processor further configured to determine a volume of hydration fluid consumed by the user based on changes in air pressure within the interior region.

2. The device of claim 1, wherein the processor is further configured to detect a second predetermined pressure change within the interior region corresponding to a drink end event when the user discontinues drinking hydration fluid from the interior region via the drinking tube.

3. The device of claim 1, further comprising memory communicating with the processor for storing consumption data determined by the processor.

4. The device of claim 1, further comprising a communication interface communicating with the processor for communicating consumption data determined by the processor to a remote device.

5. The device of claim 1, further comprising a temperature sensor on the fluid container, the processor coupled to the temperature sensor for determining air temperature of air entering the interior region when the one-way valve is opened, the process configured to calculate the volume of hydration fluid consumed based at least in part on the determined air temperature.

6. The device of claim 1, further comprising a humidity sensor on the fluid container, the processor coupled to the humidity sensor for determining humidity of air entering the interior region when the one-way valve is opened, the process configured to calculate the volume of hydration fluid consumed based at least in part on the determined humidity.

7. The device of claim 1, further comprising a motion sensor coupled to the processor, the processor configured to operate in a first, low-power state until the motion sensor provides a signal indicating that the fluid container is moving, whereupon the processor is configured to activate in a second state anticipating a drink start event.

8. The device of claim 1, further comprising an output device on the fluid container, the processor coupled to the output device for presenting information related to the user's hydration.

9. The device of claim 1, wherein the air pressure sensor is mounted to the top at a location spaced apart from the one-way valve.

10. (canceled)

11. A device for monitoring hydration, comprising:
- a fluid container comprising a container body including a side wall and a bottom wall defining an interior region and a removable top for enclosing the interior region;
- a drinking port in the top for consuming hydration fluid contained within the fluid container;
- a liquid pressure sensor mounted to the bottom wall within the interior region;
- an inclinometer mounted to the fluid container; and
- a processor coupled to the pressure sensor to acquire pressure data to determine a height of hydration fluid within the interior region and coupled to the inclinometer to acquire orientation data to determine an angular orientation of the fluid container when the height is determined, the processor further configured to determine a volume of hydration fluid consumed by the user based on changes in the height of the hydration fluid within the interior region corrected by the angular orientation.

12. The device of claim 11, wherein the processor is configured to identify a fill event when the fluid container is filled with hydration fluid based on a predetermined change in pressure data from the pressure sensor, the processor configured to determine an initial volume of the hydration fluid based on pressure data and orientation data immediately after identifying the fill event.

13. The device of claim 11, wherein the processor is configured to identify a first drink event when a user first con-

sumes hydration fluid from the fluid container, the processor configured to a remaining volume of the hydration fluid based on pressure data and orientation data immediately after identifying the first drink event, the processor configured to determine the volume of hydration fluid consumed based on the difference between the initial volume and the remaining volume.

14. The device of claim **11**, further comprising a motion sensor coupled to the processor, the processor configured to operate in a first, low-power state until the motion sensor provides a signal indicating that the fluid container is moving, whereupon the processor is configured to activate in a second state anticipating a drink event.

15. The device of claim **11**, wherein the inclinometer comprises an accelerometer, and wherein the processor is configured to operate in a first, low-power state until the accelerometer provides a signal indicating that the fluid container is moving, whereupon the processor is configured to activate in a second state anticipating a drink event.

16. The device of claim **11**, further comprising a motion sensor coupled to the processor, the processor configured to acquire motion data from the motion sensor to identify a drink event and determine a change in volume of the hydration fluid based on changes in the height of the hydration fluid air pressure within the interior region corrected by the angular orientation.

17-27. (canceled)

28. A method for monitoring hydration of a user of a fluid container including a motion sensor, comprising:

receiving a signal from the motion sensor indicating that the container is in motion or a drink event has begun;

based on the signal, transitioning electronic components of the consumption tracking system from a low-power state to a full-power state; and

acquiring sensor data from one or more sensors on the fluid container and determining, at the consumption tracking system, an amount of fluid consumed from the fluid container during the drink event based at least in part on the sensor data.

29-50. (canceled)

51. A system for managing hydration of a user, comprising:

a fluid container comprising one or more sensors for identifying when the user consumes fluid from the container and a container communication interface;

a fitness tracker for monitoring one or more aspects of the user's physical activity; and

a mobile device comprising a mobile device communication interface for communicating with the one or more sensors of the fluid container via the container communication interface to monitor at least one of volume and frequency of consumption of hydration fluid from the container and for communicating with the fitness tracker to monitor one or more aspects of the user's physical activity, and a mobile device processor configured to monitor hydration of the user based at least in part on the hydration fluid consumed from the container and the user's physical activity and provide an output on an output device to the user related to compliance with hydration recommendations.

52. The system of claim **51**, wherein the one or more sensors comprise a motion sensor and a pressure sensor, the container further comprising a container processor coupled to the motion sensor to identify a drink event when the user consumes fluid from the container and coupled to the pressure sensor for acquiring consumption data to determine a volume of fluid consumed from the container during the drink event, the container processor communicating volume of fluid consumed data to the mobile device via a container communication interface.

53-54. (canceled)

55. The system of claim **51**, wherein the one or more sensors comprise a motion sensor and a pressure sensor, the container further comprising a container processor coupled to the motion sensor to identify a drink event when the user consumes fluid from the container and coupled to the pressure sensor for acquiring consumption data related to the volume of fluid consumed from the container during the drink event, the container further comprising a container communication interface for transmitting the consumption data to the mobile device.

56-61. (canceled)

62. A method for monitoring hydration of a user of a fluid container including one or more sensors and fluid within an interior region of the container, comprising:

receiving one or more signals from the one or more sensors indicating that a drink event has occurred;

acquiring height data from the one or more sensors on the fluid container related to a height of fluid within the container;

acquiring orientation data from the one or more sensors on the fluid container to determine an angular orientation of the fluid container when the height data is acquired; and

determining a height of fluid within the interior region based at least in part on the height data corrected by the angular orientation and determining a volume of fluid consumed during the drink event based on changes in the height of the hydration fluid within the interior region.

63-91. (canceled)

* * * * *

patsnap

专利名称(译)	用于跟踪水合作用的系统和方法		
公开(公告)号	US20160022209A1	公开(公告)日	2016-01-28
申请号	US14/754599	申请日	2015-06-29
[标]申请(专利权)人(译)	HYDR8		
申请(专利权)人(译)	HYDR8 INC.		
当前申请(专利权)人(译)	HYDR8 INC.		
[标]发明人	FRAISL DANIEL J		
发明人	FRAISL, DANIEL, J.		
IPC分类号	A61B5/00 A61B5/11 A63B24/00		
CPC分类号	A61B5/4875 A61B2560/0209 A61B5/4205 A61B5/6887 A61B5/7278 A61B5/0024 A61B5/7282 A61B5/486 A61B5/1118 A63B2024/0065 A61B2560/0462 A61B2562/0247 A61B2560/0475 A61B2562/0271 A61B2562/029 A61B2562/0219 A63B24/0062 A45F3/16		
优先权	62/018079 2014-06-27 US 62/162510 2015-05-15 US		
外部链接	Espacenet USPTO		

摘要(译)

提供用于监测用户的水合作用的装置，系统和方法，其包括包括一个或多个传感器（例如，压力传感器，加速度计等）的流体容器，用于识别用户何时从容器消耗流体和/或确定消耗的液体量。流体容器可以与移动电子设备通信，以监测流体消耗的体积和频率中的至少一个，并向用户提供与水合建议的符合性相关的输出。可选地，该系统还可以包括健身跟踪器，用于监控用户的身体活动的一个或多个方面;并且移动设备可以至少部分地基于用户的身体活动来监控用户的水合作用。