US010168430B2

(12) **United States Patent**
Sobol

(10) **Patent No.: US 10,168,430 B2**
(45) **Date of Patent: Jan. 1, 2019**

(54) **WIRELESS DEVICES AND SYSTEMS FOR TRACKING PATIENTS AND METHODS FOR USING THE LIKE**

(71) Applicant: **Adam Sobol**, Dayton, OH (US)

(72) Inventor: **Adam Sobol**, Dayton, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 437 days.

(21) Appl. No.: **14/941,025**

(22) Filed: **Nov. 13, 2015**

(65) **Prior Publication Data**

US 2016/0139273 A1 May 19, 2016

Related U.S. Application Data

(60) Provisional application No. 62/123,440, filed on Nov. 17, 2014.

(51) **Int. Cl.**

G01S 19/14	(2010.01)
G01S 19/31	(2010.01)
A61B 5/0205	(2006.01)
A61B 5/00	(2006.01)
H04W 4/80	(2018.01)
A61B 5/11	(2006.01)
G01S 19/16	(2010.01)

(52) **U.S. Cl.**

CPC ***G01S 19/14*** (2013.01); ***A61B 5/02055*** (2013.01); ***A61B 5/1112*** (2013.01); ***A61B 5/746*** (2013.01); ***G01S 19/16*** (2013.01); ***H04W 4/80*** (2018.02); *A61B 5/681* (2013.01); *A61B 5/7455* (2013.01); *A61B 2560/0242* (2013.01); *A61B 2562/0204* (2013.01); *A61B 2562/0219* (2013.01)

(58) **Field of Classification Search**

CPC G01S 19/14; G01S 19/34; H04W 4/008

USPC 342/357.52, 357.65, 357.71, 357.74; 701/468, 519

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,868,254	B2	10/2014	Louboutin	
2009/0040041	A1	2/2009	Janetis et al.	
2014/0239065	A1	8/2014	Zhou et al.	
2015/0048942	A1	2/2015	Bertagna et al.	
2015/0112158	A1	4/2015	He	
2016/0021506	A1*	1/2016	Bonge, Jr.	A01K 27/009 717/173

(Continued)

FOREIGN PATENT DOCUMENTS

CN 103871197 6/2014

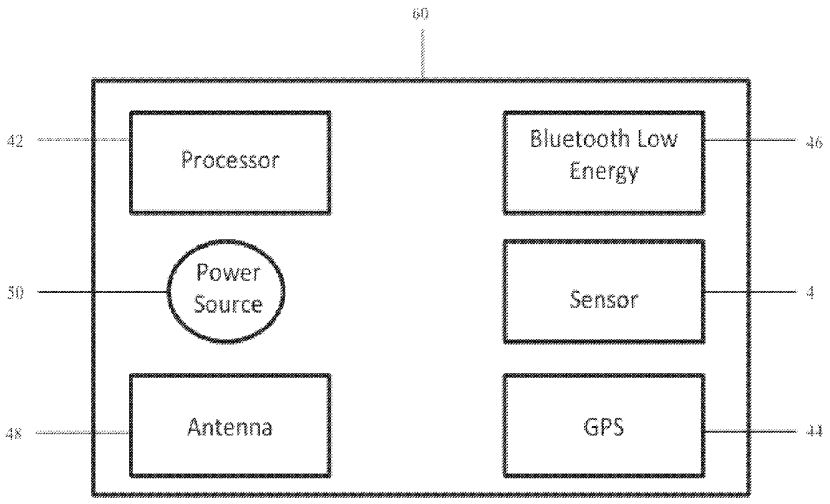
Primary Examiner — Dao L Phan

(74) *Attorney, Agent, or Firm* — Indiana University Maurer School of Law IP Legal Clinic

(57) **ABSTRACT**

Disclosed are apparatuses, systems, and methods for tracking patients that suffer from dementia. The disclosed apparatus is a wearable device capable of micro-tracking through Bluetooth Low Energy technology and capable of macro-tracking through GPS technology. The device may additionally include sensors to monitor other information such as the health of the patient or the patient's surrounding environment. The disclosed systems utilize the disclosed device in an overall system for tracking patients. These systems teach how the device interacts with the other components of the system (e.g., signal beacons, wireless transmitters, a central processing unit, mobile computing devices) to provide an integrated system to tracking the location and monitoring the well being of the patient. Finally, methods for tracking patients that use the disclosed devices and systems are disclosed.

20 Claims, 8 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

2016/0165853 A1* 6/2016 Goldfain A01K 29/005
340/573.3

* cited by examiner

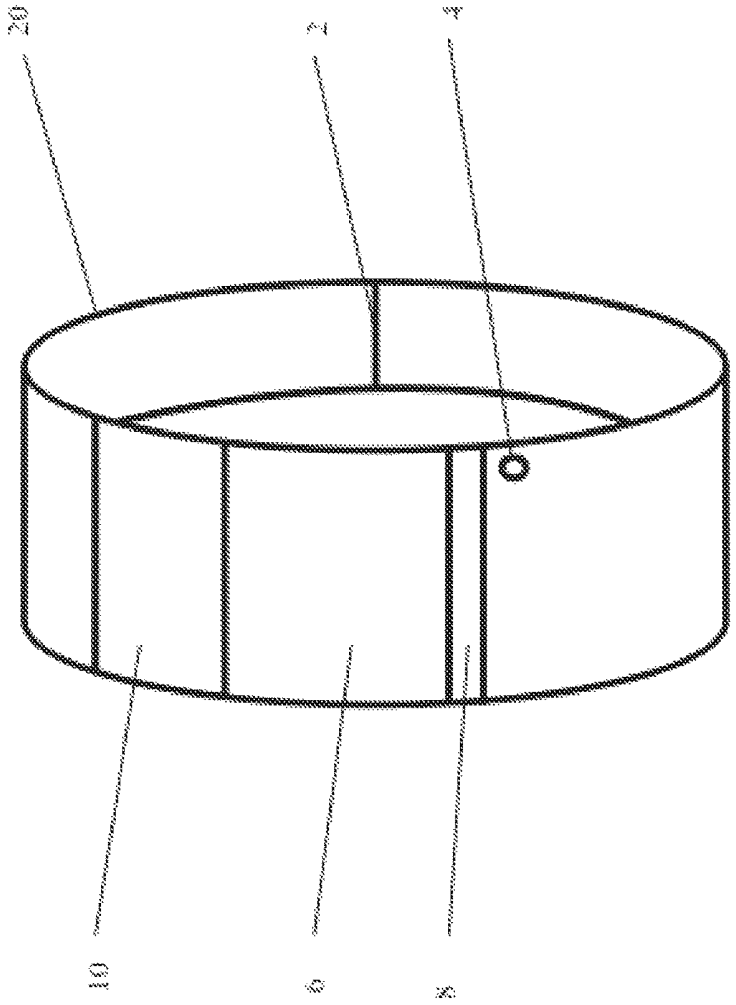


FIG. 1A

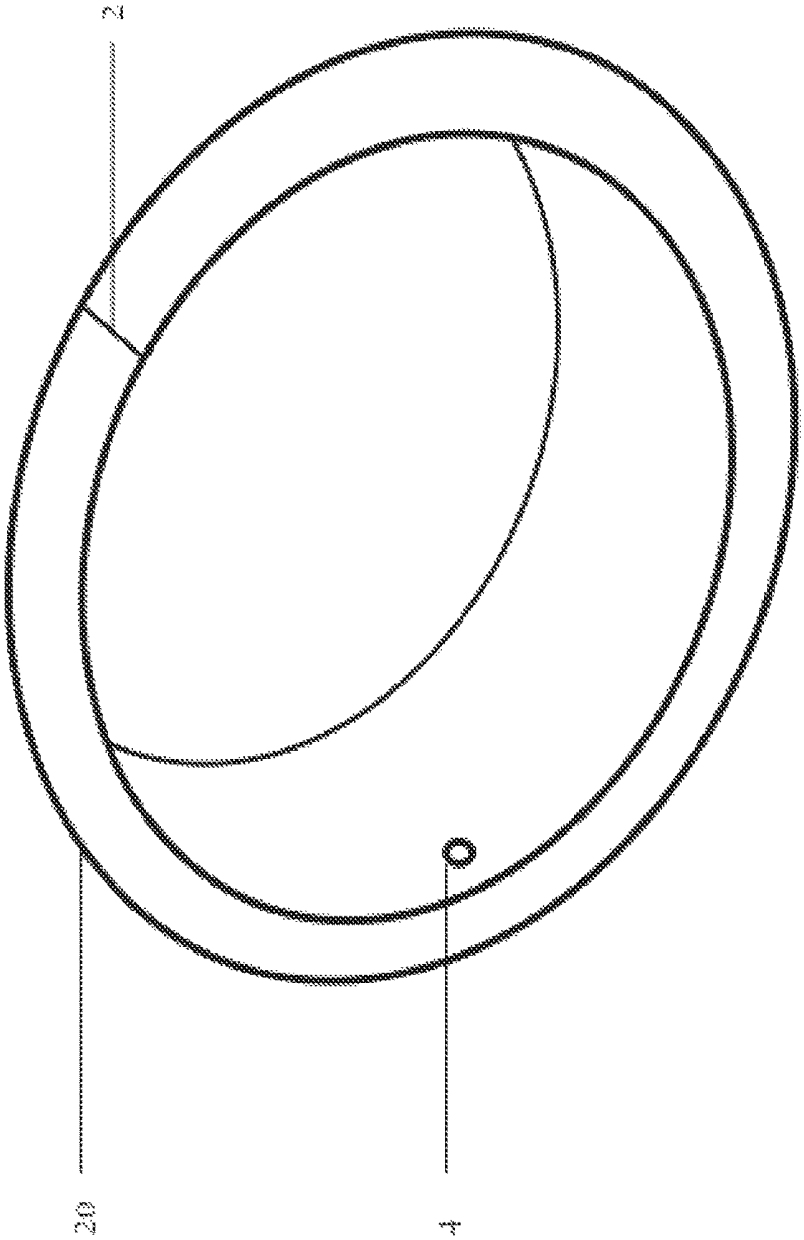


FIG. 1B

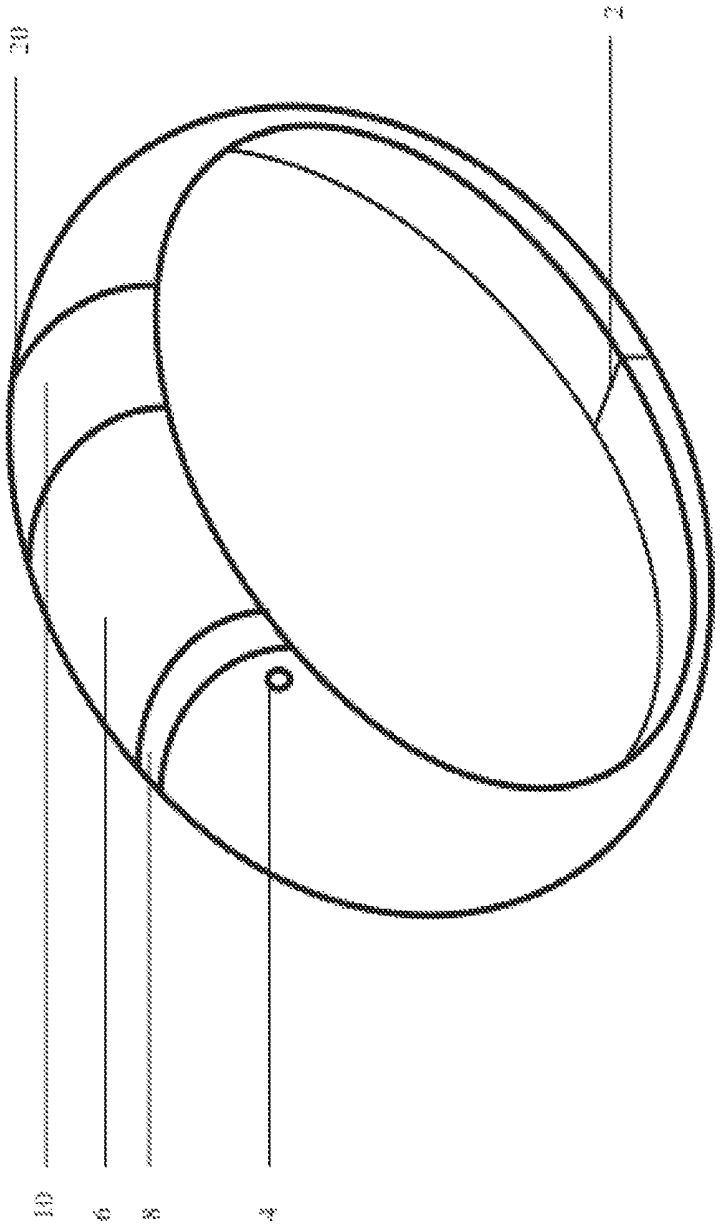


FIG. 1C

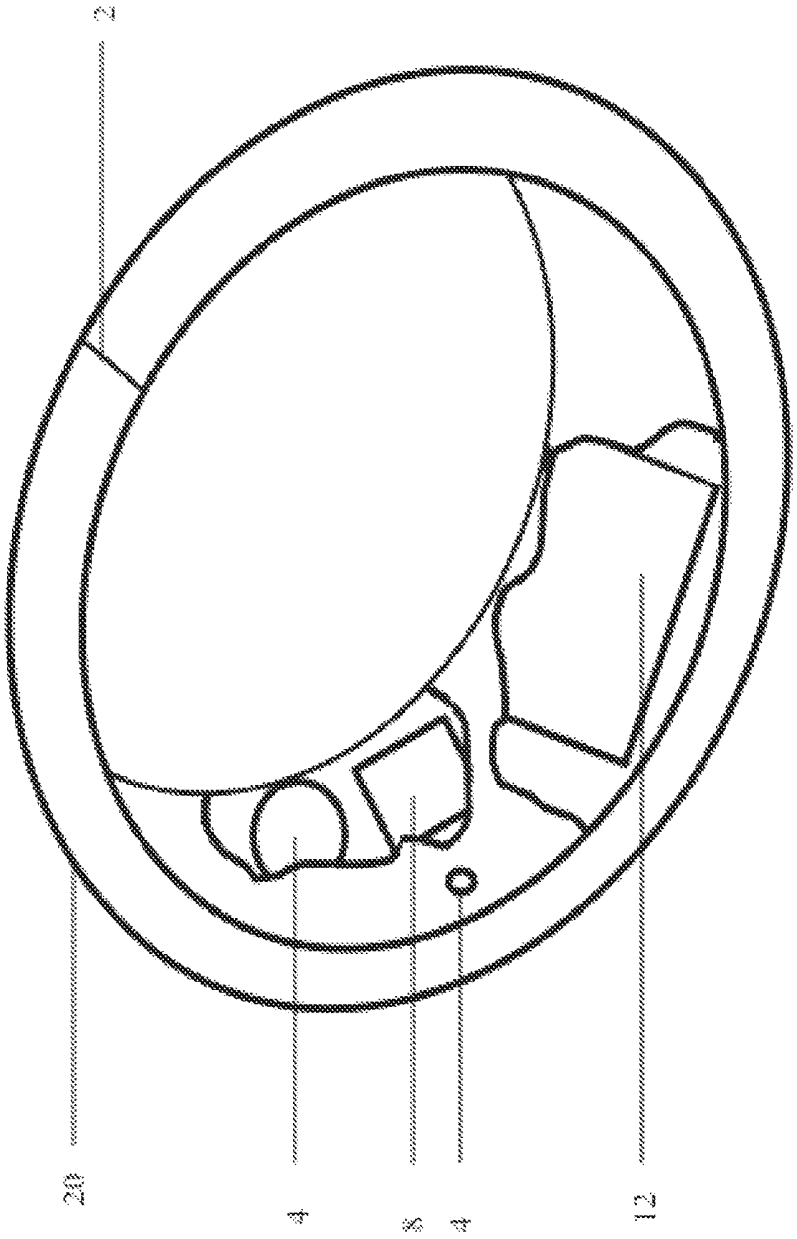


FIG. 2

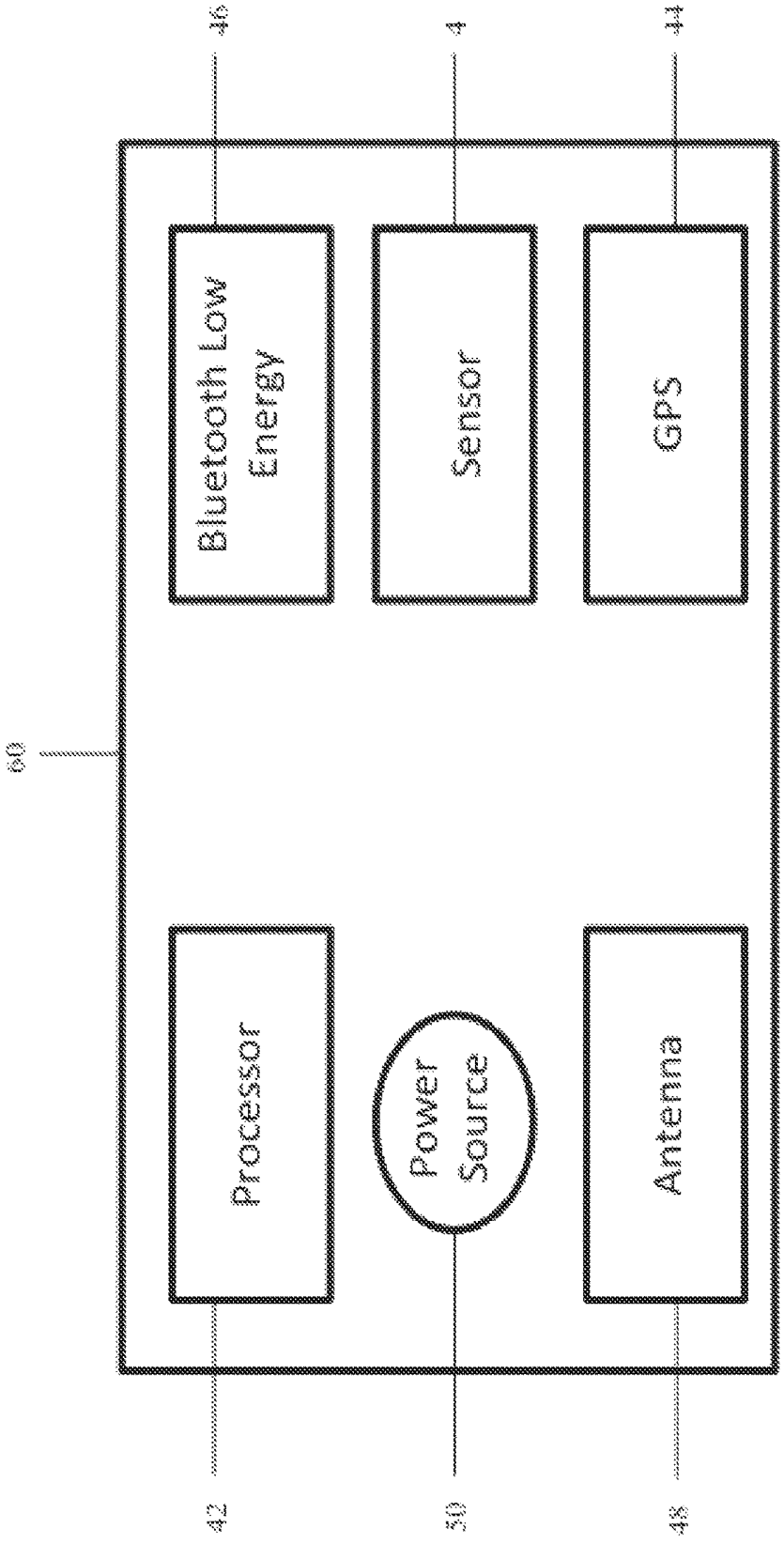

46
4
44
Bluetooth Low Energy
Sensor
GPS
60
Processor
Power Source
Antenna
42
50
48

FIG. 3

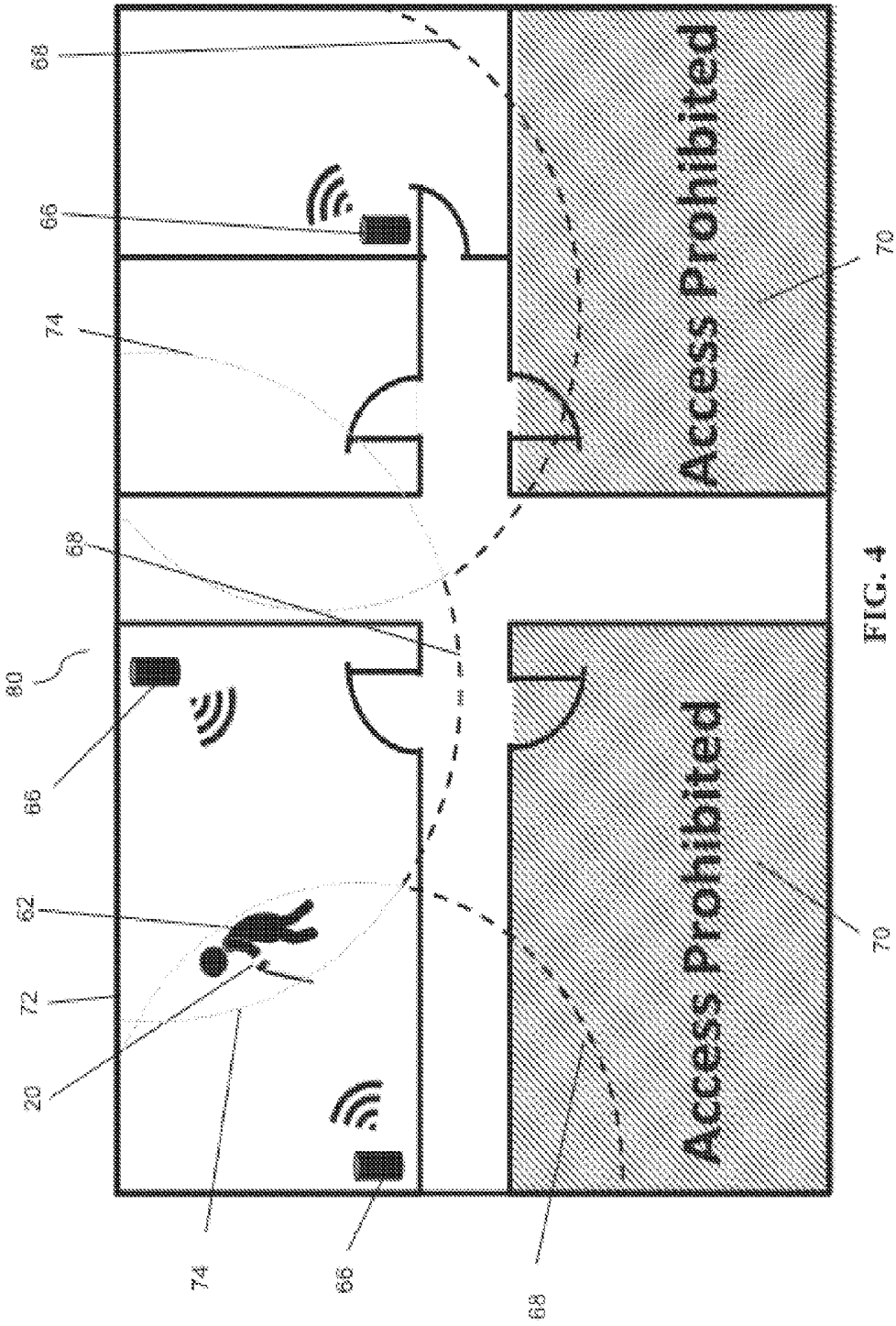

Access Prohibited
Access Prohibited
68
66
74
68
80
66
62
72
20
74
66
68
70
70

FIG. 4

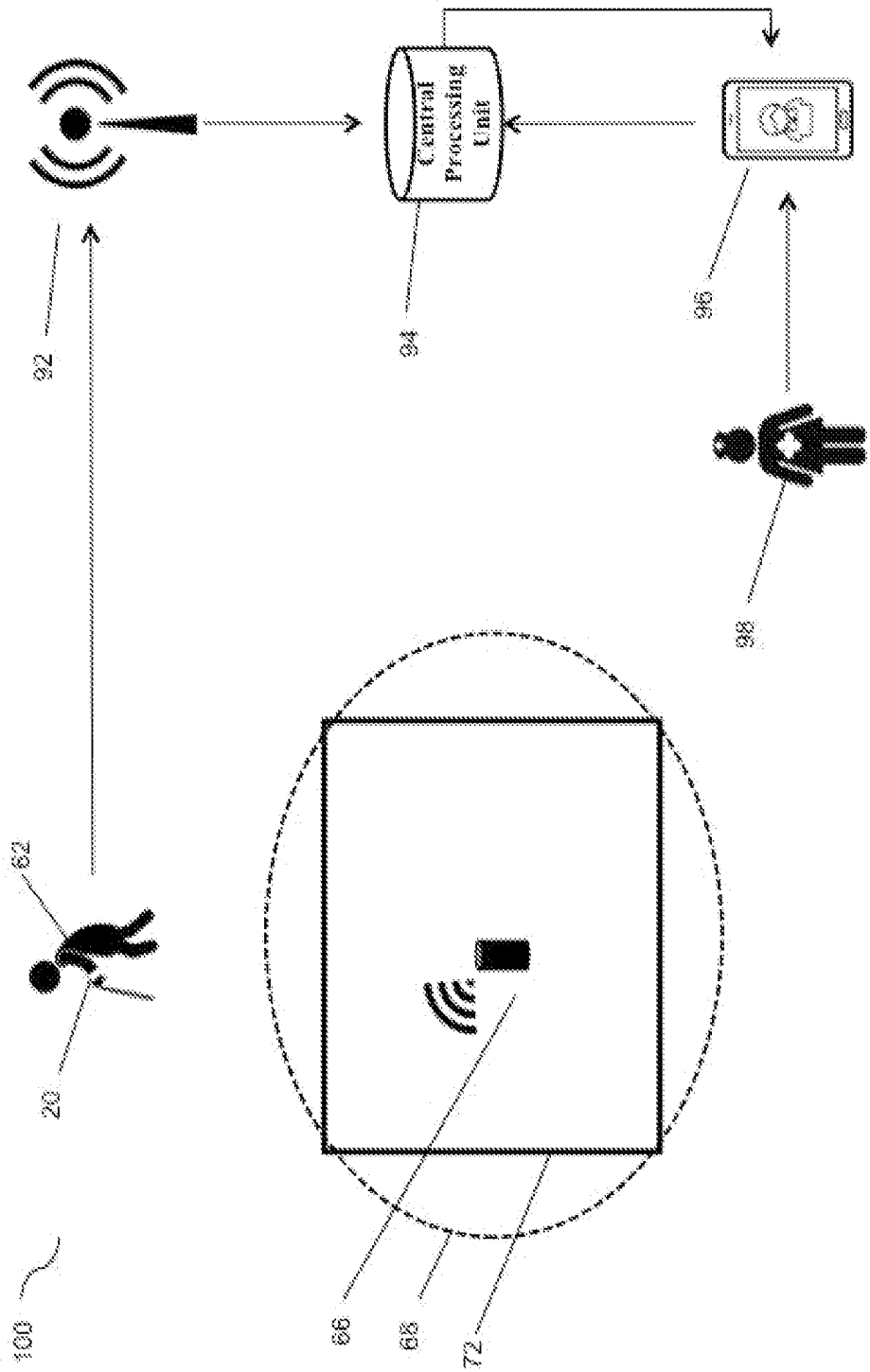


FIG. 5

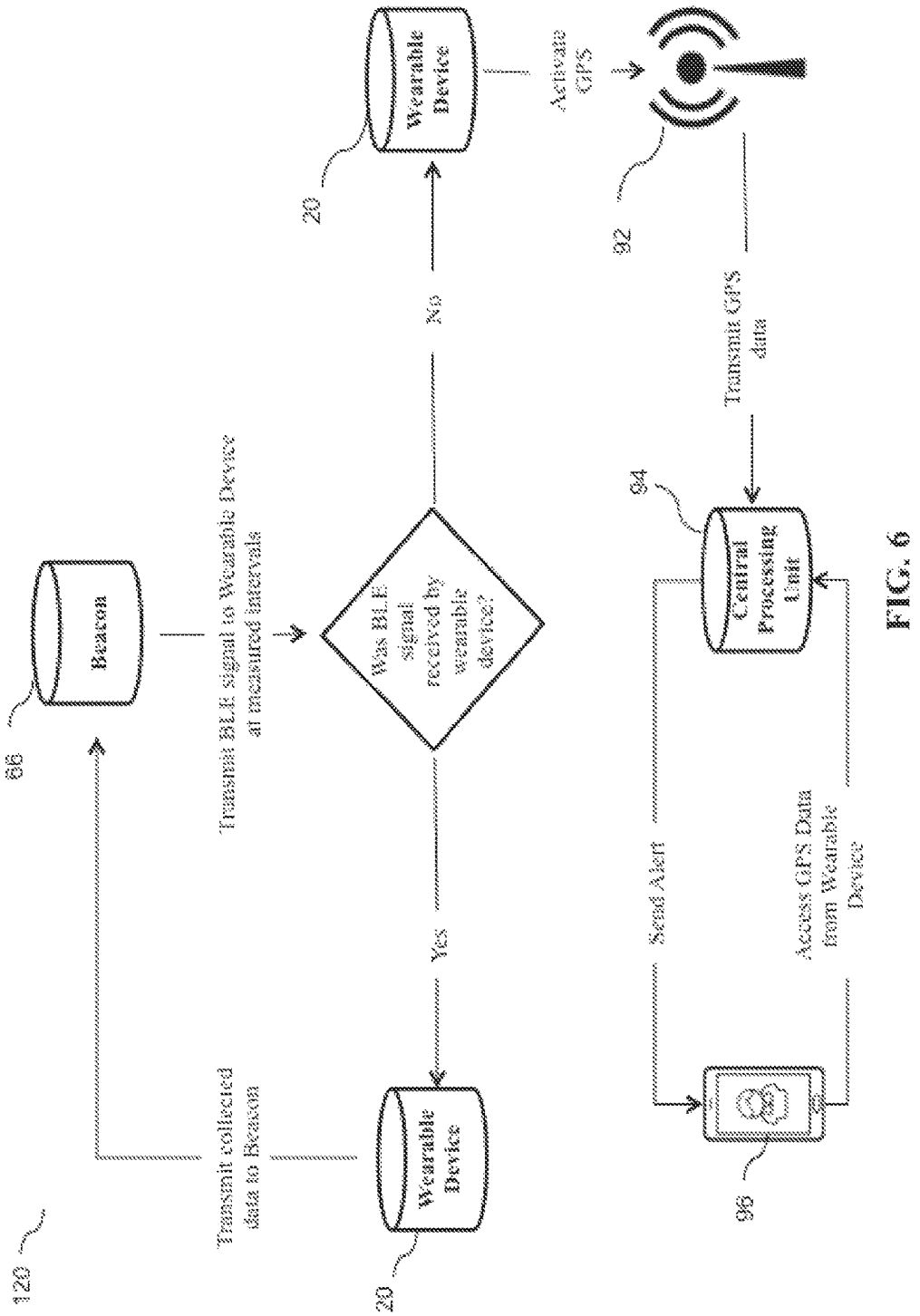

120
Beacon
86
Transmit collected data to Beacon
Wearable Device
30
Transmit BLE signal to Wearable Device at measured intervals
Was BLE signal received by wearable device?
Yes
No
Wearable Device
20
Activate GPS
92
Transmit GPS data
Central Processing Unit
94
Send Alert
Access GPS Data from Wearable Device
96

FIG. 6

WIRELESS DEVICES AND SYSTEMS FOR TRACKING PATIENTS AND METHODS FOR USING THE LIKE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 62/123,440 titled "Wireless Wearable Device Having Care Functionality," to Adam G. Sobol, filed Nov. 17, 2014, the entire disclosure of which is expressly incorporated by reference herein.

FIELD OF THE DISCLOSURE

The present disclosure relates generally to a wearable tracking device for monitoring the location of a wearer. Particularly, it relates to a wearable device that wirelessly communicates information. The disclosure also relates to wireless proximity tracking to track the movement of a wearer of the device, particularly those at risk of wandering, including children or individuals with mental disease such as dementia. The present disclosure also relates to a tracking system utilizing the device and methods for using the device.

BACKGROUND AND BRIEF SUMMARY

Dementia is defined as a decline in mental ability severe enough to interfere with one's daily life. Over five million people suffer from dementia in the United States alone and this number is predicted to increase. Alzheimer's and Parkinson's are common examples of dementia.

One problem in caring for those suffering from dementia is that they may become confused of their surroundings and tend to wander and get lost. If these individuals are not located in a timely manner, they are at risk of injury. To compound the problem, many of the individuals suffering from dementia will not have the mental acuity to remember their name or address even in the event they encounter someone trying to assist them.

The present disclosure is designed to reduce this problem by providing a wearable device designed to track individuals with relation to a predefined geographical area such as one's home or care facility and also one's general location once they are outside of the predefined geographical area. The device is wirelessly connected to a tracking system utilizing macro- and micro-location monitoring technology. The device may also include additional features useful for dementia patients such as the ability to lock and unlock certain doors. Although the device is designed to track patients, it could also be employed for alternative uses. For example, the devices and systems presently disclosed may be used for pets as an alternative to a traditional invisible electronic fence. Another example would be to use the presently disclosed devices and systems for tracking valuable items such as laptop computers, mobile phones, or any other valuable item.

The device can be in the form of a stand-alone device such as wristband, anklet, or it can be imbedded in the patient's clothing or accessories; alternatively, the device can be in a form that clips on to the patient's clothing or accessories. The device includes a power source, a processor, an antenna, a Global Positioning Receiver (GPS) chip, and a Low Energy Bluetooth (BLE) chip. In some embodiments, the device may include additional sensors and equipment to monitor a patient's well-being such as a blood pressure monitor, a heart rate monitor, a gyroscope, an accelerometer,

or other sensor that can detect or monitor information related to the patient's health. Some embodiments of the device may also include sensors designed to acquire information about the wearer's environment such as a thermometer, a light sensor, magnetic field detector, or a microphone. The device may also be equipped with notifiers configured to notify the patient of any alert generated by the central processing unit. These notifiers can be in the form of any technology that would catch the attention of the patient so that he or she is aware that the central processing unit has received information that may mean the patient could be in danger. Some exemplary notifiers include vibration motors, LED lights, and an audible speaker.

In addition to the device, the present disclosure teaches a system that may track and monitor the device, log the collected information, send the information to a central processing unit, and generate alerts. The data received by the central processing unit and alerts generated by the central processing unity may be accessed through a user interface that can be displayed on any computing device with Internet access. Another component of the system may be a specified predetermined area in which the patient can move freely. The predetermined area can be set by placing beacons throughout the area in which the patient can move freely, beyond which it may be unsafe or undesirable for the patient to venture without supervision. If the patient wanders outside the predetermined area, a signal is sent to the central processing unit, which then generates a signal or alarm to notify the patient and/or the patient's caregiver. Once outside the predetermined area, the GPS functionality will activate so that the patient can be located.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and many of the intended advantages of this disclosure will grow to be appreciated at a greater level once references to the following accompanying illustrations are expounded upon.

FIG. **1**A is a front perspective view of an example of a wearable device in accordance with certain embodiments;

FIG. **1**B is a top perspective view of the wearable device of FIG. **1**A in accordance with certain embodiments;

FIG. **1**C is a bottom perspective view of the wearable device in accordance with certain embodiments;

FIG. **2** is a bottom view of the wearable device with a portion cutaway showing the device in accordance with some embodiments to illustrate the interior mechanics:

FIG. **3** is a diagrammatic view of a circuit board component of the wearable device of FIG. **1**;

FIG. **4** is a diagrammatic view illustrating a tracking system that operates in a patient's residence using the wearable device of FIG. **1**;

FIG. **5** is a diagrammatic view illustrating the tracking system operating outside of the patient's residence; and

FIG. **6** is a diagrammatic view showing a processes by which the system may operate depending on whether the patient is inside or outside their residence.

Equivalent reference components point to corresponding parts throughout the several views. Even though the drawings depict manifestations of components and attributes to the present disclosure, certain features are magnified due to the fact that not only are the drawings not scalable, but also because this method is the best way to illustrate the present disclosure. Wherein, the illustrations depicted are manifes-

tations of the disclosure, and such illustrations shall in no way be interpreted as limiting the scope of the disclosure.

DETAILED DESCRIPTION

Providing adequate care for individuals at risk of wandering poses a unique problem. The present disclosure contemplates devices, systems, and methods for tracking and monitoring patients. The disclosed devices, systems, and methods provide an integrated approach to tracking patients that allows for low energy wireless tracking and monitoring in predetermined areas, such as the patient's residence. Additionally, the disclosed devices, systems, and methods provide an approach to tracking and monitoring patients that have wandered outside of the predetermined area.

Referring to FIGS. **1**A-C, an exemplary device **20** is provided. FIG. **1**A shows device **20** from the front and FIG. **1**B depicts device **20** from the top. In the disclosed embodiment, the form of device **20** is similar to a watch or a bracelet. In alternative embodiments, device **20** may be in the form of an ankle band, a finger ring, a toe ring, a necklace, an earring, glasses, a hearing aid, or any other wearable accessory. In other embodiments, device **20** may be imbedded in the patient's clothing such as a shirt, underwear, shorts, pants, socks, hat, bra, or any other article of clothing. Device **20** may also be in the form of a clip that can be attached to an accessory such as a backpack in certain embodiments.

In some embodiments, device **20** may include a lock **2** that can prevent the patient from removing device **20**. Lock **2** may be secured using magnets, RFID technology, a wireless signal, or any other mechanism that allows only a caregiver or authorized personnel to remove device **20**. In certain embodiments, device **20** may include a screen **6** capable of displaying information collected by device **20**, including any alerts generated. Such information may include, for example, patient's location, information collected by any sensors **4** included in device **20**, or information pre-programmed into device **20** such patient's name, address, or health information (e.g., illnesses, allergies, medication). Some embodiments of device **20** may also include a button that allows patient to generate an alert to be sent to a caregiver.

Certain embodiments of device **20** may include sensors **4** on top of device **20** as depicted in FIGS. **1**A and **1**B. In addition, sensors **4** may also be located on the inside of device **20** as depicted in FIG. **1**C. Sensors **4** may be on the inside of device **20** in some embodiments because they may require contact with patient to properly measure patient's health-related information. In some embodiments it may be preferable to place certain sensors **4** on the outside of device **20** as well.

In some embodiments, device **20** may include notifiers **8** that can notify patient that he or she has wandered outside a predetermined area or that data collected by at least one sensor **4** is outside a predetermined threshold meaning patient may be experiencing an adverse health event.

FIGS. **1**A and **1**C also disclose solar cells **10** that may be present in certain embodiments of device **20**. In embodiments where device **20** includes solar cells **10**, solar cells **10** would be used as a renewable source of power that would allow device **20** to operate for longer continuous time periods than possible without solar cells **10**.

Referring to FIG. **2**, a cutaway view of the bottom of the exemplary device **20** is depicted. FIG. **2** again discloses lock **2** that may be included in some embodiments to prevent the patient from removing device **20**. The cutaway view from FIG. **2** demonstrates the location of the interior circuitry **12** as well as interior sensors **4** and notifiers **8** that may be included in certain embodiments of device **20**. Some sensors **4** may be advantageously located inside device **20**. For example, a gyroscope and/or an accelerometer, which can be used to determine if the patient has fallen, and require no direct contact with the external environment and therefore can be located inside device **20**. Similarly, certain notifiers **8** can also be entirely enclosed within device **20**. One example of such notifier **8** would be a vibrating electric motor that would cause device **20** to vibrate upon receiving an alert. Device **20** is preferably waterproof or water resistant.

Referring now to FIG. **3**, a circuit board **60** of device **20** is depicted. Circuit board **60** contains a power source **50**, such as a battery, electronically connected to a processor **42**. Power source **50** is included to provide electric current to a processor **42** of device **20**, a Bluetooth Low Energy (BLE) chip **46**, a Global Positioning System (GPS) chip **44**, antenna **48**, and any other component of device **20** requiring electric power to function. Processor **42** includes logic circuitry that responds to and processes basic instructions. Antenna **48** is communicatively connected to processor **42** and allows device **20** to wirelessly communicate with other devices—such as a cellular phone or computer. According to some embodiments, antenna **48** may include a modem such as a Long Range Radio Frequency (LRRF) modem or a mobile broadband modem. In some embodiments, antenna **48** will transmit signals containing data collected by sensors **4** as well as location information collected by BLE **46** and GPS chip **44**. In some embodiments, antenna **48** may also receive information from a wirelessly connected device. One example of a signal that antenna **48** may receive is an alert generated by a central processing unit **94** in systems **100**, **120** described herein.

Circuit board **60** also contains BLE chip **46** for micro-location tracking and GPS chip **44** for macro-location tracking. The BLE technology utilizes less energy than GPS technology meaning that regularly utilizing BLE **46** to locate and monitor the patient will allow device **20** to increase the life of power source **50**. When device **20** is within an area **68** in which he or she is permitted to roam freely, BLE chip **46** will monitor the patient's movements and transmit them using antenna **48**. While in this area **68**, BLE chip **46** will also transmit information collected by any sensors **4** and receive any alerts. However, Bluetooth technology may only have a limited range however. Therefore, when the patient wanders outside predetermined area **68**, device **20** will switch to location tracking via GPS chip **44**. The data collected by GPS chip **44** and any sensors **4** will then be transmitted via antenna **48** by a wireless communication system **92** with a longer range than Bluetooth, such as a cellular phone system. According to the preferred embodiment, GPS chip **44** receives GPS location information (ex. signals used to determine location) from a plurality of satellites. It then calculates the location of device **20** (longitude and latitude) using the GPS location information. This location information is then sent by antenna **48** via wireless communication system **92** to central processing unit **94**. According to an alternative embodiment, the raw GPS location information is sent to central processing unit **94** without processing by device **20** and central processing unit **94** calculates the location. Thus, the information received and sent by device **20** may be identical or the information sent by device **20** may be completely or only partially processed.

Device **20** is intended to track the location of a patient **62**. As such, FIGS. **4-6** depict systems **80**, **100**, **120** for tracking patients **62** wearing device **20**. In these embodiments, device **20** should first be activated to be used in system **80**, **100**, **120**. Each device **20** will have a universally unique identifier (UUID) that would allow patient **62** or a caregiver **98** to create an account for patient **62** and associate device **20** with that account using the device's UUID. A central processing unit **94** will store the patient's account information, link collected data to that account, generate alerts based on account preferences, and allow users to view the collected data on any computing device **96** with an internet connection. Central processing unit **94** may consist of a server(s) located offsite from patient **62** and/or a hub located onsite with patient **62**. As such, communications between central processing unit **94** and other components (ex. device **20**, beacons **66**, wireless transmitter **92**, etc.) may occur internal to the patient's residence or in and out of the patient's residence using wireless and/or wired communication. Communication between the various components may occur directly between the components or through other components. For example, device **20** may communicate directly with central processing unit **94** or through beacons **66** and/or wireless transmitter **92**). According to one embodiment, when central processing unit **94** is located onsite, beacons **66** and/or device **20** may communicate directly with central processing unit **94** in a hub-like manner using wireless and/or wired communication. Beacons **66** may also communicate with other beacons **66** creating a communication chain that ultimately leads to central processing unit **94**.

Once device **20** has been registered with an account using the UUID, device **20** is activated. In some embodiments, device **20** may be activated by pairing it (i.e., holding it in close proximity) to a smartphone **96**. Once active, device **20** is paired with at least one beacon **66** through a BLE connection.

FIG. **4** discloses one exemplary embodiment of system **80** where patient **62** is inside his or her residence **72**. According to this embodiment, inside of his or her residence **72**, patient **62** wears device **20** that then interacts with beacons **66** located throughout residence **72**. Beacons **66** disclosed as a part of this system **80** may be any device with BLE functionality. In certain embodiments, beacon **66** may be a smartphone, a tablet computer, a desktop computer, a standalone device, or any similar electronic device with BLE functionality.

Patient **62** will be virtually restricted to areas in which the patient's caregiver has previously authorized (i.e., predetermined area) **68**. According to the disclosed embodiment, once this predetermined area **68** has been set, beacons **66** are placed in locations throughout residence **72** to define predetermined area **68**. In certain embodiments, beacons **66** may be programmed so that predetermined range **68** is set as a fixed distance from beacon **66**. For example, if the residence **72** is an apartment, beacon **66** may be programmed to set predetermined area **68** to extend in a ten foot radius from beacon **66**. If the residence **72** is larger, a house for example, beacon **66** may be programmed to extend in a twenty foot radius from beacon **66**. When patient **62** is in predetermined area **68**, device **20** would communicate with beacons **66** via BLE. Any area outside that fixed distance from a beacon **66** would be a restricted area **70** that patient **62** would not be permitted to access without caregiver assistance. When patient **62** is in predetermined area **68**, device **20** communicates all collected data to beacons **66** at regular intervals. Beacons **66** then transmit this data to a central processing server **94** where the data is then linked to patient's personal account. In alternative embodiments, beacons **66** may not be fixed in location. According to this embodiment, the previously determined area would have to be set electronically (i.e., programmed) rather than proximately.

According to the embodiment disclosed in FIG. **4**, if patient **62** wanders outside of predetermined area **68**, beacons **66** may generate an alert that warns a caregiver or other party that patient **62** has wandered into a restricted area **70**. In certain embodiments, the alert could be delivered directly to a previously identified caregiver as a notification on his or her personal phone, computer, or tablet. Alerts may also be delivered to the caregiver through a text message, an email, or a phone call. In some embodiments, an alert could also be sent to device **20** if patient **62** wanders into a restricted area **70**.

Inside predetermined area **68**, data collected by beacons **66** is transmitted to a central processing unit and linked to the patient's personal account. When inside of predetermined area **68**, a caregiver may monitor patient **62** by accessing the patient's personal account. For example, micro-tracking in predetermined area **68** may be accomplished by measuring the strength of the BLE connection between device **20** and beacon **66**. A stronger signal indicates patient **62** is closer to beacon **66**, while a weaker signal indicates the opposite. In some embodiments of system **80**, multiple beacons **66** may be used. If multiple beacons **66** are programmed to have overlapping ranges, a caregiver may be able to track a patient's location more precisely. For example, FIG. **4** depicts an embodiment of system **80** wherein patient's residence contains three beacons **66**. In such an embodiment of system **80**, the BLE signal transmitted by multiple beacons **66** creates a signal overlap area **74**. Where patient **62** is in a signal overlap area **74**, micro-tracking through BLE will become more accurate as the position of patient **62** can be calculated relative to multiple beacons **66**.

In alternative embodiments, device **20** may include sensors **4** for monitoring the health information of patient **62** or patient's surrounding environment. According to this embodiment, device **20** may be programmed to monitor data collected by these sensors **4**. If this data is outside of a predetermined range (e.g., heart rate or blood pressure exceeds a threshold set by the patient's physician), an alert may be generated that will warn a caregiver. In some embodiments of this system **80**, the alerts may also be delivered to device **20**.

Referring now to FIG. **5**, an exemplary system **100** for tracking patients **62** wearing device **20** when patient **62** wanders outside a predetermined area **68** is disclosed. Some embodiments of system **100** include beacon **66** located in patient's residence **72** that is programmed to set predetermined area **68**, outside of which patient **62** is not authorized to roam without the supervision of or permission from a caregiver **98**. In some embodiments, if device **20** travels outside of predetermined area **68**, beacon **66** will recognize that device **20** is outside predetermined area **68** or, if device **20** is outside range of BLE, beacon **66** will not be able to communicate with device **20**. In this embodiment, when device **20** travels outside predetermined area **68**, device **20** will continue to monitor the location of patient **62** via GPS instead of BLE. Accordingly, the GPS data is wirelessly transmitted through any wireless signal **92** to central processing unit **94**. Wireless signal **92** may be any wireless communication technology including Bluetooth, BLE, RFID, NFC, Zigbee, Z-Wave, Wi-Gi, GSM, CDMA, GPRS, 3G, 4G, WiMax, LTE, Wi-Fi, low power Wi-Fi, Wireless

USB, GPS, IPS, LRRF, RF, infrared, satellite communication, or any similar wireless communication technology.

According to this embodiment, once central processing unit **94** receives information indicating that device **20** is outside predetermined area **68**, it will generate an alert. The alert may be delivered to any wirelessly connected computing device **96**. In alternative embodiments, the alert may also be delivered to device **20**. An alert delivered to a wirelessly connected computing device **96** will signal to a caregiver **98** that patient **62** has wandered outside of predetermined area **68**. In alternative embodiments, device **20** may also be programmed to monitor data collected by sensors on device **20** and generate an alert when that collected data exceeds a previously determined range.

Referring now to FIG. **6**, a process chart for an exemplary system **120** for tracking patients is disclosed. According to this system **120**, beacon **66** transmits signals to device **20** at regular intervals. If device **20** is within the range of beacon's BLE transmission, device **20** transmits collected information back to beacon **66**. If device **20** does not receive a regular BLE signal from beacon **66**, device **20** will activate GPS chip **44** and activate antenna **48** to communicate with a wireless transmitter **92**. Wireless transmitter **92** may be configured to transmit and receive any wireless communication technology including Bluetooth, BLE, RFID, LRRF, NFC, Zigbee, Z-Wave, Wi-Gi, GSM, CDMA, GPRS, 3G, 4G, WiMax, LTE, Wi-Fi, low power Wi-Fi, Wireless USB, GPS, LRRF, RF, IPS, infrared, satellite communication, or any similar wireless communication technology.

According to this embodiment of system **120**, once device **20** is connected to wireless transmitter **92**, device **20** then transmits GPS data wirelessly to central processing unit **94**. Central processing unit **94** can then generate an alert sent to any computing device **96** that has an Internet connection. In alternative embodiments, central processing unit **94** may also send alerts to device **20**. Any computing device **96** connected to the Internet will be able to pull up a user interface that allows a caregiver or any other person access to a patient's account which may display all the data collected by device **20** that has been transmitted to a beacon **66** or central processing unit **94**. Computing device **96** may be a smartphone, a tablet computer, a laptop computer, a desktop computer, or any other computing device capable of accessing the Internet. In certain embodiments of this system **120**, the user interface for displaying information collected by device **20** and transmitted to either beacon **66** or central processing unit **94** may be configured to the computing device **20** being utilized. For example, in one embodiment where computing device **96** is a smartphone with the Android mobile operating system, the graphical user interface may be an application built specifically for the Android mobile operating system. In other embodiments, computing device **20** may be running a different operating system (e.g., OS X, Windows, Blackberry. Linux) with a user interface built specifically for that operating system. In other embodiments, the user interface will be web-based so that any device with Internet capabilities may access it.

The invention claimed is:

1. A wearable device for tracking a patient comprising:

a processor;

a power source electronically connected to the processor;

at least one antenna communicatively connected to the processor;

a Bluetooth Low Energy (BLE) chip communicatively connected to the processor; and

a Global Positioning System (GPS) chip communicatively connected to the processor;

the GPS chip being configured to receive GPS location information;

the at least one antenna being configured to transmit data to at least one signal beacon when the wearable device is inside of a predetermined distance from the at least one beacon, and

the at least one antenna being configured to transmit information based on the GPS location information when the wearable device is outside of a predetermined distance from the at least one beacon.

2. The wearable device of claim **1**, further including at least one sensor to detect health-related information of the patient.

3. The wearable device of claim **2**, wherein the at least one sensor includes at least one of a heart rate monitor, a thermometer, an accelerometer, and a gyroscope.

4. The wearable device of claim **1**, further including at least one sensor to detect environmental conditions.

5. The wearable device of claim **4**, wherein the at least one sensor includes at least one of a thermometer, a light sensor, and a microphone.

6. The wearable device of claim **1**, further comprising a lock configured to block removal of the wearable device by the patient.

7. The wearable device of claim **6**, wherein the lock is disengaged by at least one of at least one magnet, RFID technology, and a wireless signal.

8. The wearable device of claim **1**, further comprising a notifier device configured to notify the patient of any alerts sent wirelessly to the tracking device.

9. The wearable device of claim **8**, wherein the notifier is at least one of a light, a speaker, and a vibration motor.

10. A system for tracking patients comprising:

a wearable tracking device configured to be worn by a patient wirelessly connected to a central processing unit, the device including:

a processor;

a power source electronically connected to the processor;

at least one antenna communicatively connected to the processor;

a BLE chip communicatively connected to the processor; and

a GPS receiver communicatively connected to the processor;

at least one beacon configured to transmit BLE signals to and receive BLE signals from the wearable tracking device within a predetermined range of the at least one beacon and configured to wirelessly transmit data received from the wearable tracking device to the central processing unit; and

at least one computing device wirelessly configured to be connected to the central processing unit capable of displaying data received by the central processing unit the at least one computing device having a user interface.

11. The system for tracking patients of claim **10**, wherein the wearable tracking device is wirelessly connected to the central processing unit.

12. The system for tracking patients of claim **10**, wherein the wearable tracking device automatically transmits information collected by the wearable tracking device to the at least one beacon when wirelessly connected to the at least one beacon.

13. The system for tracking patients of claim **10**, wherein the GPS receiver is activated by the processor to receive

GPS data when the wearable tracking device is outside of the predetermined range of the at least one beacon.

14. The system for tracking patients of claim **10**, wherein the wearable tracking device includes at least one sensor to monitor the patient's health information.

15. The system for tracking patients of claim **14**, wherein the at least one sensor is at least includes at least one of a heart rate monitor, a thermometer, an accelerometer, or a gyroscope.

16. The system for tracking patients of claim **10**, wherein the central processing unit is configured to monitor data collected from at least one of the wearable tracking device and the at least one beacon and generate an alert if the collected data is outside the predetermined range, the alert being delivered to the at least one computing device.

17. The system for tracking patients of claim **16**, wherein the antenna is configured to receive the alert from the central processing unit.

18. A method for tracking patients using a wearable tracking device with BLE and GPS capabilities, the method comprising:

securing a wearable tracking device to a patient capable of short-range tracking and long-range tracking;

placing at least one beacon capable of wirelessly connecting to the wearable tracking device in an area where the patient is to be monitored to a predetermined space of movement of the patient;

wirelessly transmitting data collected by the wearable tracking device to the at least one beacon through BLE technology when the wearable tracking device is within the predetermined space;

displaying data that has been transmitted to the central processing unit on a user interface displayable on a computing device wirelessly connected to the central processing unit.

19. The method of claim **17**, wherein the short-range tracking utilizes BLE technology.

20. The method of claim **17**, wherein the long-range tracking utilizes GPS technology.

* * * * *

专利名称(译)	用于跟踪患者的无线设备和系统以及使用该类似物的方法		
公开(公告)号	US10168430	公开(公告)日	2019-01-01
申请号	US14/941025	申请日	2015-11-13
[标]申请(专利权)人(译)	Sobol亚当		
申请(专利权)人(译)	SOBOL，ADAM		
当前申请(专利权)人(译)	SOBOL，ADAM		
[标]发明人	SOBOL ADAM		
发明人	SOBOL, ADAM		
IPC分类号	G01S19/14 G01S19/31 A61B5/0205 A61B5/00 H04W4/80 A61B5/11 G01S19/16		
CPC分类号	G01S19/14 A61B5/02055 A61B5/1112 A61B5/746 G01S19/16 H04W4/80 A61B2562/0219 A61B5/681 A61B5/7455 A61B2560/0242 A61B2562/0204		
优先权	62/123440 2014-11-17 US		
其他公开文献	US20160139273A1		
外部链接	Espacenet		

摘要(译)

公开了用于跟踪患有痴呆的患者的装置，系统和方法。所公开的装置是能够通过蓝牙低功耗技术进行微跟踪并且能够通过GPS技术进行宏观跟踪的可穿戴设备。该装置可另外包括传感器以监测其他信息，例如患者的健康或患者的周围环境。所公开的系统在用于跟踪患者的整个系统中利用所公开的设备。这些系统教导设备如何与系统的其他组件（例如，信号信标，无线发射器，中央处理单元，移动计算设备）交互以提供集成系统以跟踪位置并监视患者的健康状况。最后，公开了用于跟踪使用所公开的装置和系统的患者的方法。