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[Continued on next page]

(54) Title: NAVIGATION SYSTEM AND METHOD FOR DIFFERENT MOBILITY MODES

(57) Abstract: A system and method enable calculation of navigation data as a function of mobility mode and to transmit the calculated data to devices accordingly. The system and method calculate first navigation data based on a first mobility mode at a first device; receive a mobility mode change indication to a second mobility mode; calculate second navigation data based on the second mobility mode; and then transmit the second navigation data to a second device. The calculations can be done at the first device (e.g., a navigation system installed in a vehicle), the second device (e.g., a mobile device), and/or at a third device (e.g., server).

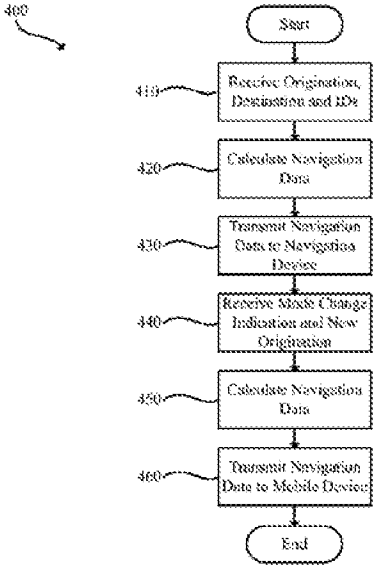


FIG. 4

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NAVIGATION SYSTEM AND METHOD FOR DIFFERENT MOBILITY MODES

FIELD OF THE INVENTION

[0001] At least one embodiment of the present invention pertains to navigation, and more particularly, to a system and method for providing seamless navigation across various devices as a function of mobility mode.

BACKGROUND

[0002] Conventional navigations systems provide navigation solutions based on a single mobility mode and not for transitions between mobility modes. For example, a conventional navigation system may provide directions for driving a car and not for walking or not for driving partially and walking partially. Directions for walking could vary significantly from driving since different routes may be available that are unavailable for cars. For example, a walker can walk on paths or against vehicular traffic on a sidewalk adjacent a one-way street.

[0003] Accordingly, a new system and method may be needed to provide navigation across multiple mobility modes.

SUMMARY

[0004] A system and method enable calculation of navigation data as a function of mobility mode and to transmit the calculated data to devices accordingly. Accordingly, the system and method help a person get to their final desired location. In an embodiment, the method calculates first navigation data based on a first mobility mode at a first device; receives a mobility mode change indication to a second mobility mode; calculates second navigation data based on the second mobility mode; and then transmits the second navigation data to a second device. The first navigation data calculation can be performed between the first device and a server. The second navigation data can be derived directly from the server.

[0005] In an embodiment, the system comprises mode change indication logic, direction logic and transmission logic. The mode logic receives a mobility mode change

indication from a first mobility mode to a second mobility mode. The direction logic calculates first navigation data based on the first mobility mode and second navigation data based on the second mobility mode. The transmission logic transmits the second navigation data to a second device.

[0006] The calculations can be done at the first device (e.g., a navigation system installed in a vehicle), the second device (e.g., a mobile device), and/or at a third device (e.g., server). The navigation data can include directions, a destination, and/or an origination. The first navigation data may include driving directions while the second navigation data may include walking directions. The first device can be installed in a vehicle while the second device may be a mobile device (e.g., mobile phone). The mobility mode change indication can include an indication that the vehicle has been placed in Park and/or that the first device has been powered off (e.g., no further signals are received from the first device).

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] One or more embodiments of the present invention are illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements.

[0008] Figure 1 is a diagram illustrating a network according to an embodiment of the invention.

[0009] Figure 2 is a high-level extent diagram showing an example of architecture of a client, server and/or navigation unit of Figure 1.

[0010] Figure 3 is a block diagram showing contents of the direction system of Figure 1.

[0011] Figure 4 is a flowchart illustrating a navigation technique.

DETAILED DESCRIPTION

[0012] References in this description to "an embodiment", "one embodiment", or the like, mean that the particular feature, function, structure or characteristic being described

is included in at least one embodiment of the present invention. Occurrences of such phrases in this specification do not necessarily all refer to the same embodiment. On the other hand, such references are not necessarily mutually exclusive either.

[0013] Figure 1 is a diagram illustrating a network 100 according to an embodiment of the invention. The network 100 includes a server 110, a computer 112, a network (cloud) 120, a vehicle (e.g., automobile) 130, and a mobile device 140. The server 110 includes a direction system 111 that receives origination and destination data, as well as network 100 node identifiers, and transmits navigation information to the navigation unit 132 and/or the mobile device 140. In an embodiment, the direction system 111 resides instead of or in addition on the navigation unit 132 and/or the mobile device 140. The vehicle 130 includes a navigation unit 132 that is coupled the vehicle 130 (e.g., installed in or detachably coupled to the vehicle 130). In other embodiments, the vehicle 130 can include other vehicles, such as aircraft, ships, motorcycles, submersibles, etc. The navigation unit 132 includes a nav ID 134, such as a MAC address and/or other identifier. The mobile device 140, which can include a laptop, mobile phone, etc. includes a mob ID 144, such as a MAC address and/or other identifier. Note that the network 100 can include other and/or additional nodes.

[0014] The cloud 120 can be, for example, a local area network (LAN), wide area network (WAN), metropolitan area network (MAN), global area network such as the Internet, a Fibre Channel fabric, or any combination of such interconnects. Each of the server 110, the computer 112, and the navigation unit 132 may be, for example, a conventional personal computer (PC), server-class computer, workstation, handheld computing/communication device, or the like.

[0015] During operation of the network 100, the direction system 111 receives an origination, destination and identifiers (134 and 144) from one of the other nodes on the network 100. For example, a user can enter the data on the computer 112, which then transmits the data to the direction system 111 via the cloud 120. The direction system 111 then calculates navigation data based on mobility mode (e.g., driving directions for the navigation unit 132 to the closest point available for the destination and walking

directions from the closest point to the actual destination or just the actual origins and destinations and directions are calculated by the receiving units 132 and 140) and transmits the data to the navigation unit 132 and mobile device 140, respectively. The navigation device 132 and mobile device 140 can then output (visually, aurally, etc.) their respective received data and/or calculated data (e.g., directions) to the user.

[0016] In another embodiment, the direction system 111 calculates navigation data in real-time when receiving a mode change indication and new origination from the navigation unit 132 and/or the mobile device 140. For example, a user may have parked his/her vehicle 130, triggering the navigation unit 132 to determine position using a positioning system (e.g., GPS, Beidou, Glonass, Galileo, Loran, etc.) and transmitting a mobility mode change indication and the position as a new origination to the direction system 111. The direction system 111 then calculates navigation information based on the new mobility mode and new origination and transmits the newly calculated navigation data to the mobile device 140, the vehicle 130 and/or the navigation unit 132, which then outputs (visually, aurally, etc.) it to the user.

[0017] Figure 2 is a high-level extent diagram showing an example of an architecture 200 of the server 110, the computer 112, the navigation unit 132 or mobile device 140 of Figure 1. The architecture 200 includes one or more processors 210 and memory 220 coupled to an interconnect 260. The interconnect 260 shown in Figure 2 is an abstraction that represents any one or more separate physical buses, point-to-point connections, or both, connected by appropriate bridges, adapters, or controllers. The interconnect 260, therefore, may include, for example, a system bus, a form of Peripheral Component Interconnect (PCI) bus, a HyperTransport or industry standard architecture (ISA) bus, a small computer system interface (SCSI) bus, a universal serial bus (USB), IIC (I2C) bus, or an Institute of Electrical and Electronics Engineers (IEEE) standard 1394 bus, also called "Firewire", and/or any other suitable form of physical connection.

[0018] The processor(s) 210 is/are the central processing unit (CPU) of the architecture 200 and, thus, control the overall operation of the architecture 200. In certain embodiments, the processor(s) 210 accomplish this by executing software or firmware

stored in memory 220. The processor(s) 210 may be, or may include, one or more programmable general-purpose or special-purpose microprocessors, digital signal processors (DSPs), programmable controllers, application specific integrated circuits (ASICs), programmable logic devices (PLDs), or the like, or a combination of such devices.

[0019] The memory 220 is or includes the main memory of the architecture 200. The memory 220 represents any form of random access memory (RAM), read-only memory (ROM), flash memory, or the like, or a combination of such devices. In use, the memory 220 may contain, among other things, software or firmware code for use in implementing at least some of the embodiments of the invention introduced herein.

[0020] Also connected to the processor(s) 210 through the interconnect 260 is a communications interface 240, such as, but not limited to, a network adapter, one or more output device(s) 230 and one or more input device(s) 250. The network adapter 240 provides the architecture 200 with the ability to communicate with remote devices over the network cloud 120 and may be, for example, an Ethernet adapter or Fibre Channel adapter. The input device 250 may include a touch screen, keyboard, and/or mouse, etc. The output device 230 may include a screen and/or speakers, etc. In an embodiment, the architecture 200 includes a receiving device (e.g., antenna) to receive satellite or other signals needed to calculate location.

[0021] The techniques introduced herein can be implemented by programmable circuitry programmed/configured by software and/or firmware, or entirely by special-purpose circuitry, or by a combination of such forms. Such special-purpose circuitry (if any) can be in the form of, for example, one or more application-specific integrated circuits (ASICs), programmable logic devices (PLDs), field-programmable gate arrays (FPGAs), etc.

[0022] Software or firmware to implement the techniques introduced here may be stored on a machine-readable storage medium and may be executed by one or more general-purpose or special-purpose programmable microprocessors. A "machine-readable medium", as the term is used herein, includes any mechanism that

can store information in a form accessible by a machine (a machine may be, for example, a computer, network device, cellular phone, personal digital assistant (PDA), manufacturing tool, any device with one or more processors, etc.). For example, a machine-accessible medium includes recordable/non-recordable media (e.g., read-only memory (ROM); random access memory (RAM); magnetic disk storage media; optical storage media; flash memory devices; etc.), etc.

[0023] The term "logic", as used herein, means: a) special-purpose hardwired circuitry, such as one or more application-specific integrated circuits (ASICs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), or other similar device(s); b) programmable circuitry programmed with software and/or firmware, such as one or more programmed general-purpose microprocessors, digital signal processors (DSPs) and/or microcontrollers, or other similar device(s); or c) a combination of the forms mentioned in a) and b).

[0024] Note that any and all of the embodiments described above can be combined with each other, except to the extent that it may be stated otherwise above or to the extent that any such embodiments might be mutually exclusive in function and/or structure.

[0025] Figure 3 is a block diagram showing contents of the direction system 111 of Figure 1. The direction system 111 includes direction logic 300, map data 310, mode logic 320 and transmission logic 330. The direction system 111 receives, with the transmission logic 330, an origination, a destination and IDs 134 and 144 of network 100 nodes. The IDs 134 and 144 are associated with a mobility mode (walking, driving, etc.) indicated in a database (not shown) in the direction system 111 and/or by the IDs themselves. The direction system 111 then calculates navigation data, using the map data 310 if required, and transmits the calculated navigation data, with the transmission logic 330, to the nodes associated with the IDs as a function of mobility mode.

[0026] The calculated navigation data may include driving directions for the navigation unit 132 or the vehicle 130 and walking directions (from the terminus of the driving directions to the actual destination) for the mobile device 140. Alternatively, the navigation data may only include the origination, destination and driving directions

terminus and the devices 132 and 140 can then calculate directions as needed. In an embodiment, the navigation data only includes the destination and origination and driving directions terminus are calculated in real-time by the devices 132 and 140.

[0027] While the vehicle 130 is parked in a current point (CP) before the destination point (DP), it constitutes a necessary condition for the navigation unit 132 to send notification to central server 110 that the distance between the current point (CP) and the destination point (DP) is less than a predetermined value, e.g. 3 KM, preferably 1 KM, and more preferably 0.5 KM.

[0028] The direction logic 300 then sends the walking directions from the current point (CP) to the destination point (DP). In a first embodiment, the mobile device 140 receives a short text message which contains the directions from the current point CP to the destination point DP. In a second embodiment, the mobile device 140 receives a multimedia message containing acoustic directions. The user can reach the destination following the acoustic directions. In a third embodiment, the direction logic 300 will send the navigation data of directions from the current point (CP) to the destination point (DP) to the user's mobile device 140 if the mobile device 140 has a same navigation software as a navigation software in the vehicle 130. Additionally, the user may get a short text message to choose whether to receive the walking direction data, instead of receiving the walking direction data directly.

[0029] The map data 310 includes street, path, sidewalk, etc. data needed for calculating directions. The mode logic 320 determines or receives an indication of a change of mobility mode so that the direction logic 300 can send the appropriate data to the appropriate network 100 node. For example, the mode logic 320 can receive an indication of a switch from the navigation unit 132 (driving) to mobile device 140 (walking) by the navigation unit 132 being powered off; the vehicle 130 being placed in park; the vehicle 130 reaching the determined driving directions terminus; a user transmitting an indication of the switch; an engine is off; a key is removed from an ignition; and/or a door is opened; etc. The transmission logic 330 works with the other logics 300 and 320 to receive and transmit data to other network 100 nodes via the cloud 120.

[0030] Figure 4 is a flowchart illustrating a navigation technique 400. In an embodiment, the direction logic 300 receives (410), with the transmission logic 330, from the computer 112 or other network 100 node, an origination, a destination and IDs 134 and 144. The direction logic 300 then calculates (420) navigation data based on mobility mode and transmits (430), with the transmission logic 330, the navigation data to the navigation unit 132 and/or the mobile device 140. The transmission (430) can start at vehicle 130 ignition or in advance (e.g., after the receiving (410)).

[0031] The navigation unit 132 starts to detect the driving condition (e.g., location) while the navigation is started. In one embodiment, the navigation unit 132 will start to navigate automatically when the user starts the vehicle 130. In another embodiment, the navigation unit 132 will inquire the user whether wants to navigate with the preselected route and destination e.g., by providing a digital option button on the screen of the navigation unit 16 or an acoustic inquiry. The navigation unit 132 determines the driving condition by receiving data from sensors in the different parts of the vehicle 130.

[0032] In another embodiment, in case that the vehicle 130 is parked in the current point (CP) before the destination point (DP), the navigation unit 132 will continue navigating the route from the current point (CP) to the destination point (DP) automatically while the vehicle 130 is restarted. Alternatively, the navigation unit 132 is further configured to inquire whether the user wants to navigate the remaining route from the current point (CP) to the destination point (DP) by providing a digital option button on the screen or an acoustic inquiry.

[0033] The mode logic 320 then optionally receives (440) or determines a mobility mode change and optionally a new origination. The direction logic 300 then calculates (450) navigation data based on the changed mobility mode and transmits (460) the same to the mobile device 140. The method 400 then ends. In an embodiment, parts of the technique 400 can be carried out in a different order or substantially simultaneously. For example, navigation data as a function of mobility mode can be calculated together and transmitted at approximately similar times to the navigation unit 132 and the mobile

device 140. Further, directions can be calculated and transmitted by the direction logic 300 and/or by the devices 132 and/or 140 themselves.

[0034] Although the present invention has been described with reference to specific exemplary embodiments, it will be recognized that the invention is not limited to the embodiments described, but can be practiced with modification and alteration within the spirit and scope of the appended claims. Accordingly, the specification and drawings are to be regarded in an illustrative sense rather than a restrictive sense.

CLAIMS

What is claimed is:

1. A method, comprising:

calculating first navigation data based on a first mobility mode at a first device;

receiving a mobility mode change indication to a second mobility mode;

calculating second navigation data based on the second mobility mode; and

transmitting the second navigation data to a second device; wherein the first navigation data calculation is performed between the first device and a server, the second navigation data is derived directly from the server.

2. The method of claim 1, wherein the first navigation data includes driving directions and transmitting the calculated first navigation data to a vehicle.

3. The method of claim 2, wherein the second navigation data includes walking directions and wherein the transmitting transmits via short text message.

4. The method of claim 3, wherein the walking directions originate from a terminus of the driving directions.

5. The method of claim 3, wherein the walking directions originate at a position of the second device.

6. The method of claim 1, wherein the receiving the mobility mode change indication includes receiving an indication that a vehicle has been placed in park.

7. The method of claim 1, wherein the receiving the mobility mode change indication includes receiving an indication that the first device is within a predetermined distance between a current position and a destination position.

8. A system, comprising:

mode logic configured to receive a mobility mode change indication from a first mobility mode to a second mobility mode;

direction logic configured to calculate first navigation data based on the first mobility mode and to calculate second navigation data based on the second mobility mode; and

transmission logic configured to transmit the second navigation data to a second device.

9. The system of claim 8, wherein the first navigation data includes driving directions and the transmission logic is further configured to transmit the calculated first navigation data to a vehicle.

10. The system of claim 9, wherein the second navigation data includes walking directions and wherein the transmission logic configuration is for transmission via short text message.

11. The system of claim 10, wherein the walking directions originate from a terminus of the driving directions.

12. The system of claim 10, wherein the walking directions originate at a position of the second device.

13. The system of claim 8, wherein the mobility mode change indication includes an indication that a vehicle has been placed in park.

14. The system of claim 8, wherein the mobility mode change indication includes an indication that a first device is within a predetermined distance between a current position and a destination position.

15. A method to perform navigation among a server, a navigation unit of a vehicle, and a mobile device, comprising:

calculating first navigation data based on a first mobility mode at the navigation unit of the vehicle via a direction system in the server;

transmitting the calculated first navigation data to the navigation unit of the vehicle;

receiving a mobility mode change indication to a second mobility mode by the server;

calculating second navigation data based on the second mobility mode at the server; and

transmitting the second navigation data to a mobile device by the server; wherein the first navigation data includes driving directions, the second navigation data includes walking directions.

16. The method of claim 15, wherein the direction system receives data including an origination, destination and device identifiers.

17. The method of claim 16, wherein a user can enter the received data on a personal computer or mobile device that is connected to a network, which then transmits the data to the direction system via a network.

18. The method of claim 16, wherein a user can enter the received data on the navigation unit of the vehicle, which then transmits the data to the direction system via a network.

19. The method of claim 15, wherein the walking directions originate at a current position of the navigation unit of the vehicle.

20. The method of claim 15, wherein the walking directions originate at a position of the mobile device.

21. The method of claim 15, wherein receiving the mobility mode change indication includes receiving an indication that the navigation unit of the vehicle is within a predetermined distance between a current position and a destination position.

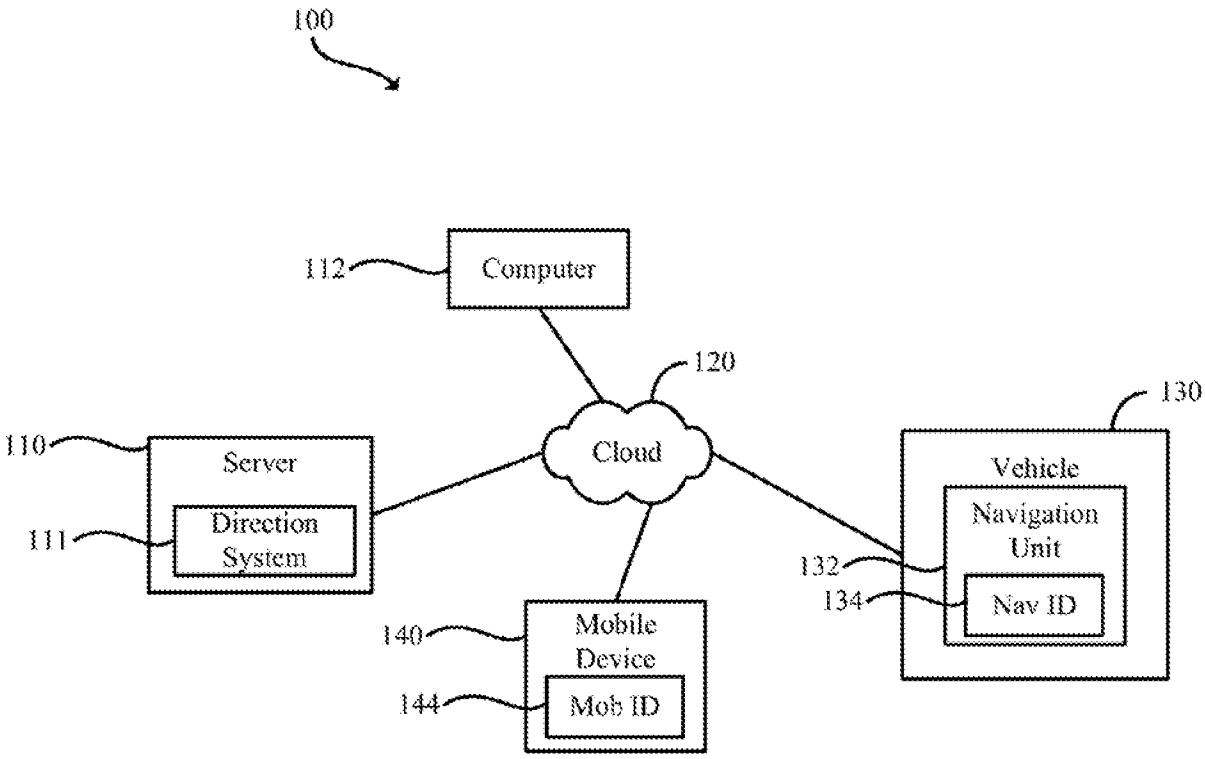

100
112
Computer
120
130
110
Server
Cloud
Vehicle
Navigation Unit
111
Direction System
132
134
Nav ID
140
Mobile Device
144
Mob ID

FIG. 1

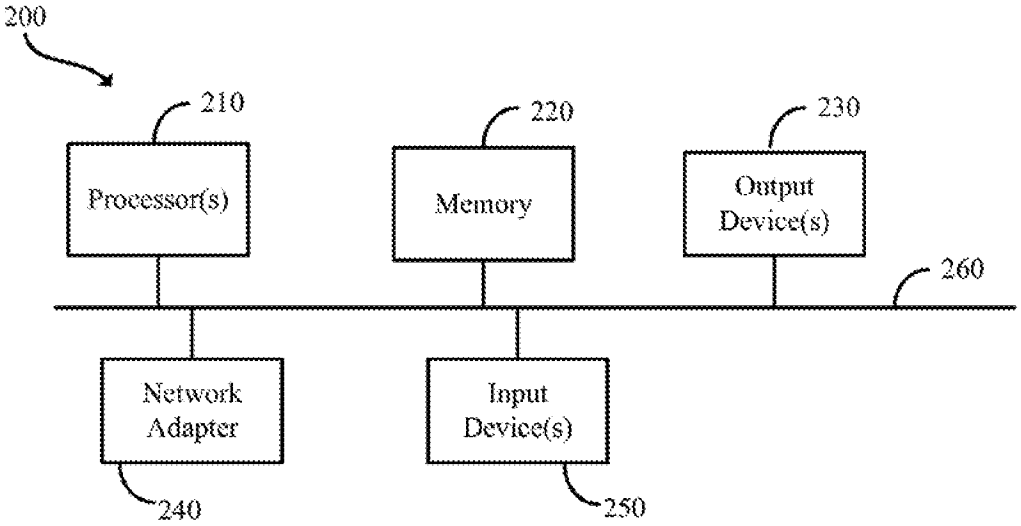

200
210
220
230
Processor(s)
Memory
Output Device(s)
260
Network Adapter
Input Device(s)
240
250

FIG. 2

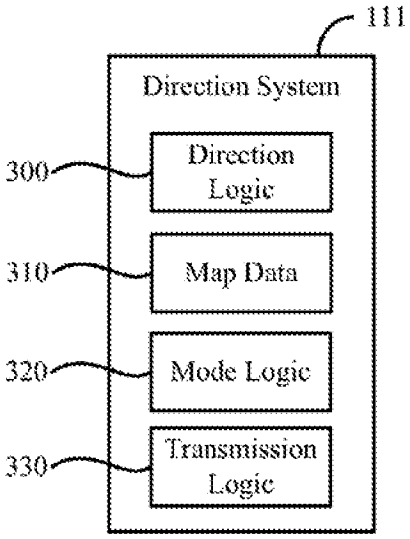

111
Direction System
300
Direction Logic
310
Map Data
320
Mode Logic
330
Transmission Logic

FIG. 3

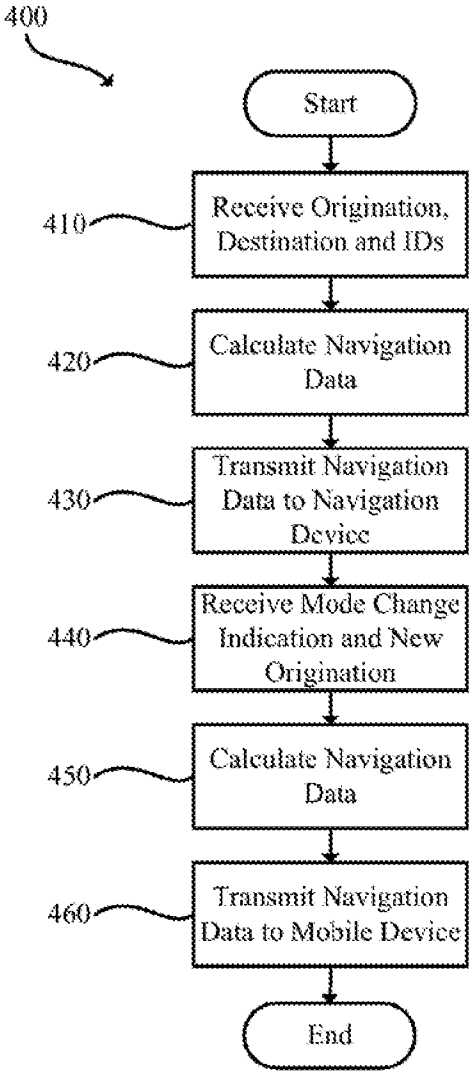

400
Start
410
Receive Origination, Destination and IDs
420
Calculate Navigation Data
430
Transmit Navigation Data to Navigation Device
440
Receive Mode Change Indication and New Origination
450
Calculate Navigation Data
460
Transmit Navigation Data to Mobile Device
End

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

G01C 21/26(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:G01C 21/

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI,EPODOC,CNABS,CNKI: vehicle, car, automobile, walk???, navigat???, mode, mobility, motion, path, route, switch, convert

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 1385673 A(MATSUSHITA DENKI SANGYO KK) 18 Dec. 2002(18.12.2002) description, page 4 line 4 - page 9 line 9, figures 2,6,8	1-21
A	CN 102200443 A(MITAC INT CORP) 28 Sep. 2011(28.09.2011) the whole document	1-21
A	JP 2011209169 A(MATSUSHITA DENKI SANGYO KK) 20 Oct. 2011(20.10.2011) the whole document	1-21
A	JP 2005003526 A(NIPPONDENSO CO LTD) 06 Jan. 2005(06.01.2005) the whole document	1-21

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 Sep. 2012(24.09.2012)	**08 Nov. 2012 (08.11.2012)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer HAO, Xiaoli Telephone No. (86-10)62411770

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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JP 2005003526 A	06.01.2005	NONE	

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(54) **Title**: POWERED HEADSET ACCESSORY DEVICES

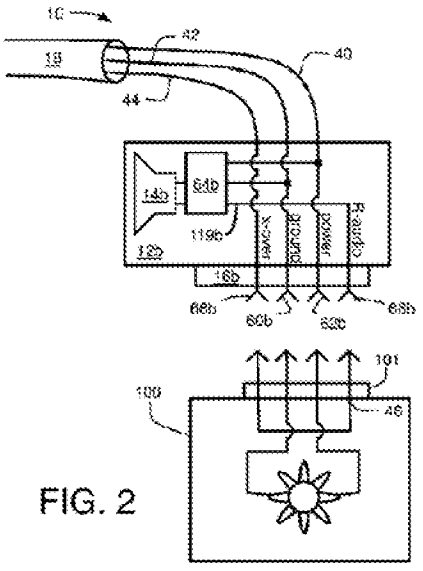


FIG. 2

(57) **Abstract**: A device for coupling to a connector on an ear cup of a headset includes a mating connector corresponding to the connector of the headset. The mating connector includes a crossover conductor coupled to a first and a second terminal within the mating connector. One or more accessory circuits is provided by the device, including a lamp configured to direct light onto a surface external to the device or a position detection circuit usable to adjust three-dimensional audio signals to account for the direction the user is looking.

WO 2014/043179 A2

POWERED HEADSET ACCESSORY DEVICES

BACKGROUND

[0001] This disclosure relates to providing powered accessory devices for headsets.

[0002] U.S. Patent Publication 2010/0260361, fully incorporated herein by reference, describes a headset with a modular connection allowing a down-cable, optionally supporting a boom microphone, to be connected to either ear cup, with a crossover plug connected to the opposite ear cup to connect an audio signal provided by the down-cable to the acoustic driver in the ear cup to which the plug is connected. Figures 1A and 1B are derived from figures 1 and 4 of that publication. As shown in figure 1A, the system incorporates a headset assembly **10**, a down-cable assembly **20** and a crossover plug **30**. The headset assembly **10** incorporates a first ear cup **12a** having an acoustic driver **14a** and a connector **16a** (both seen more clearly in figure 1B), a second ear cup **12b** having an acoustic driver **14b** and a connector **16b**, and a headband **18** that couples together the ear cups **12a** and **12b**. The down-cable assembly **20** incorporates an electrically conductive cable **22**, an upper coupling **24** to couple one end of the conductive cable **22** to either of the connectors **16a** and **16b**, a communications microphone **26a**, a microphone boom **26b** coupling the microphone **26a** to the upper coupling **24**, and a lower coupling **28** for connecting the other end of the conductive cable **22** to another device (not shown) such as an aircraft communications panel, a mobile phone, or a portable radio. The plug **30** is able to be coupled to either of the connectors **16a** and **16b**.

[0003] As shown in figure 1B, multiple electrical conductors (e.g., electrical cabling or other form of electrical conductors) are carried by the headband **18** to convey electrical signals between the earpieces **12a** and **12b**. Power and ground conductors **40** and **42** are connected to corresponding conductors **50** and **52** in the upper coupling **24** of the down-cable **20** via terminals **60a** and **62a** in the connector **16a**. The power and ground conductors **40** and **42** are also connected to power and ground terminals **60b** and **62b** in the second ear cup **12b** so that the down-cable **20** can be connected to that ear cup instead

and still provide power to the headset. The power and ground conductors **40** and **42** provide power to first power electronics **64a** in the first ear cup **12a** and second power electronics **64b** in the second ear cup **12b**. A crossover conductor **44** is connected to crossover terminals **66a** and **66b** in corresponding ear cup connectors **16a** and **16b**, but is not electrically coupled to anything else within either ear cup. The connectors **16a** and **16b** have left and right audio signal terminals **68a** and **68b**, respectively, coupled to the acoustic transducers **14a** and **14b**.

[0004] In the example of figure 1B, a crossover conductor **46** in the crossover plug **30** connects the crossover terminal **66b** to the right audio signal terminal **68b** in connector **16b**. In the upper coupling **24** of the down-cable **20**, a left audio conductor **54** is coupled to the left audio signal terminal **68a** in the connector **16a**, while a right audio conductor **56** is connected to the crossover terminal **66a**, from which the crossover conductor **44** conducts the right audio signal to the crossover terminal **66b** in the connector **16b**. In this way, the crossover conductor **46** couples the right audio from the crossover terminal **66b** to the right audio terminal **68b**. If the down-cable **20** and crossover plug **30** were reversed, the right audio conductor **56** would be connected directly to the right audio terminal **68b** to deliver audio signals to the right transducer **14b** (via the power electronics **64b**), while the crossover conductors **44** and **46** would couple the left audio signals from the to the left audio conductor **54** to the left audio terminal **68a** through the crossover terminals **60a** and **60b**. This allows the down-cable **20** to be connected to either ear cup, without having to provide both left and right signals across the headband, and without any need to detect which side the down cable is connected to.

[0005] The design described in publication 2010/0260361 is implemented commercially in the A20® Aviation Headset from Bose® Corporation of Framingham, Massachusetts.

SUMMARY

[0006] In general, in one aspect, a device for coupling to a connector on an ear cup of a headset includes a mating connector corresponding to the

connector of the headset, the mating connector including a crossover conductor coupled to a first and a second terminal within the mating connector, and a lamp configured to direct light onto a surface external to the device.

[0007] Implementations may include one or more of the following. A power conductor and a ground conductor may couple power and ground terminals of the lamp to third and fourth terminals in the mating connector. A battery compartment may have positive and negative terminals for coupling to a battery, and a power conductor and a ground conductor coupling power and ground terminals of the lamp to the positive and negative battery terminals. A second power conductor and a second ground conductor may couple the positive and negative battery terminals of the lamp to third and fourth terminals in the mating connector. A body may house the mating connector, with a boom extending from the body including a first aperture through which light from the lamp may exit the boom and a cover, rotatable around the boom and having a second aperture, blocks the first aperture when the cover in in a first rotation position and aligns the second aperture with the first aperture when the cover in in a second rotation position, and a switch is electrically coupled to the lamp and mechanically coupled to the cover, such that rotating the cover between the first and second rotation positions activates the switch to turn the lamp on when the cover is in the second rotation position and off when the cover is in the first rotation position.

[0008] In general, in one aspect, a device for coupling to a connector on an ear cup of a headset includes a mating connector corresponding to the connector of the headset, the mating connector including a crossover conductor coupled to a first and a second terminal within the mating connector, a position sensor for determining a position of the device, and a data connection outputting data from the position sensor.

[0009] Implementations may include one or more of the following. A second position sensor may determine a position of the device on a second axis, orthogonal to a first axis on which the first position sensor determines position. The first and second position sensors may include gyroscopes

responsive to rotation around the respective first and second axes. The first and second position sensors may include accelerometers responsive to displacement along the respective first and second axes. The first and second position sensors may include magnetometers responsive to changes in magnetic fields associated with movement of the device around the respective first and second axes.

[0010] In general, in one aspect, a system for providing directional audible information to a user includes a headset having a first ear cup having a first connector and a second ear cup having a second connector, both of the first and the second connectors being operable for connection to an aircraft radio. An acoustic imaging system is operable to receive a sound signal and first data identifying a first directional location, relative to a first external reference, associated with the sound, receive second data identifying a direction the user may be looking relative to a second external reference, generate binaural audio signals that represent the sound at a second directional location when perceived by the user, the second directional location corresponding to the first directional location and adjusted according to the direction the user may be looking, such that the user perceives the direction of the source of the sound to be at the first directional location relative to the first external reference, and output the binaural audio signals. An accessory device for coupling to either of the first or the second connector of the headset includes a mating connector corresponding to the connectors of the headset, the mating connector including a crossover conductor coupled to a first and a second terminal within the mating connector, a position sensor for determining a position of the accessory device, and a data connection outputting data from the position sensor to the acoustic imaging system. The data from the position sensor includes the second data representative of the direction the user may be looking relative to the external reference.

[0011] Implementations may include one or more of the following. The acoustic imaging system may be coupled to the aircraft radio, and the system may be configured to mix the binaural audio signals output by the acoustic imaging system with communications audio signals from the radio and deliver

the mixed signals to the headset. The binaural audio signals output by the acoustic imaging system may be provided to the headset independently of signals from the aircraft radio. The accessory device may include a second data connection receiving the binaural audio signals from the acoustic imaging system and an audio output for providing the binaural audio signals to the headset through the mating connector. The accessory device may include a wireless transmitter for communication with the acoustic imaging system, and the acoustic imaging system may include a wireless receiver for communication with the accessory device. The first and second data may include two-dimensional location data. The two-dimensional location data may a horizontal angle away from a vertical origin of the first or second external reference, and a vertical angle away from a horizontal angle of the first or second external reference. The first external reference may be the Earth, the vertical origin of the first external reference may be a line parallel to gravity and ahead of the direction an aircraft may be traveling, and the horizontal origin of the first external reference may be the horizon. The second external reference may be an aircraft in which the user is located, the vertical origin of the second external reference may be a line directly in front of the aircraft and vertical when the aircraft is level, and the horizontal origin of the second external reference may be in a plane intersecting the user's ears and perpendicular to gravity when the aircraft is level.

[0012] In general, in one aspect, a device for coupling to a connector on an ear cup of a headset includes a mating connector corresponding to the connector of the headset, the mating connector including a crossover conductor coupled to a first and a second terminal within the mating connector, and a wireless transceiver coupled to a third and a fourth terminal within the mating conductor.

[0013] In general, in one aspect, a device for coupling to a connector on an ear cup of a headset includes a mating connector corresponding to the connector of the headset, the mating connector including a crossover conductor coupled to a first and a second terminal within the mating

connector, and a portable power supply coupled to a third and a fourth terminal within the mating conductor.

[0014] Advantages include the ability to provide modular accessories to a headset without requiring cumbersome attachment mechanisms. Power may be provided from the headset to the accessory, from the accessory to the headset, or shared between them.

[0015] Other features and advantages will be apparent from the description and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Figure 1A shows a headset with a cable and terminator that can be attached to either ear cup.

[0017] Figure 1B shows a schematic diagram of example wiring for the headset of figure 1A.

[0018] Figures 2, 4, 5, 6, 7, 8, 9, 10, and 11 show schematic diagrams of modular accessories and their connection to a headset like that of figure 1A.

[0019] Figures 3A, 3B, and 3C show an example of a modular accessory for use with a headset like that of figure 1A.

DESCRIPTION

[0020] Additional capabilities may be added to a headset through the use of modular accessories that connect in place of the crossover plug described above. In figure 1B, note that power and ground conductors **40** and **42** are connected to corresponding terminals **60a**, **60b**, **62a**, and **62b** in each ear cup, but are not used by the crossover plug **30**. As shown in figure 2, a modular accessory **100** with an appropriate mating connector **101** housing the crossover cable **46** and connected in place of the crossover plug **30** may use the power available from the power and ground terminals **60b** and **62b** (or terminals **60a** and **62a** if connected to the first ear cup) for its own operation. Alternatively, the modular accessory **100** may provide power to the headset

via those same conductors, in place of, or to supplement, the power provided by the down-cable **20**. Several such accessories are described below. In other examples, the power available from the headset is insufficient to power the accessory, which supplies its own power, but is used to confirm for the accessory that the headset is in use. In still other examples, the power from the headset isn't needed by the accessory at all, but the connector 16a or 16b provides a useful attachment point for the accessory.

[0021] One type of accessory for this application is a reading lamp **102**, as shown in figures 3A, 3B, 3C, and 4. For aviation headsets, such as the headset **104**, pilots or passengers may need to view flight documents, e.g., a chart **106**, and instrumentation, e.g., a control panel **108**, in dark cockpits. Providing a small lamp **102** connected directly to the headset **10** keeps the light focused on whatever the user is looking at. Using the attachment point provided by the connector **16a** or **16b** (fig. 1B) provides a more elegant and simple solution than other means of attaching a lamp to the headset, such as zip ties, glue, or hook-and-loop fasteners. It also leaves the user with one fewer piece of equipment to keep track of. A LED light source **110** will generally be sufficient, while having a low enough power requirement to either be powered by the headset power or by a small on-board battery **112**. In particular, a red LED will help retain the user's dark-adapted vision and may be compatible with military night vision goggle systems.

[0022] A switch **114** is included which allows the user to turn the lamp on and off as needed. In some examples, the light source **110** is located at the end of a short boom **116**, and the switch **114** is connected to a rotatable section **118** at the end of the boom. Turning the rotatable section **118** (arrow **120** in figure 3B) turns the lamp **102** on and off. In some examples, the light source **110** may be part of the rotatable section **118** and rotate with it, or it may be located within the rotatable section and exposed or concealed by an aperture such as a window **122** in the rotatable section **118**. The act of rotating the section **118** then serves to expose or conceal the light source **110**, along with activating the switch **114 to** turn it on when exposed and off when concealed. This provides a more intuitive interface to the user than a

traditional push-button or toggle switch, in which the operation of the switch has no natural relationship to the state of the lamp.

[0023] Another type of accessory that may be coupled to the headset **10** through the connector **16a** or **16b** is a head-tracking sensor module. As shown in figure 5, a head tracking sensor module **200** includes sensors **202**, such as gyroscopes, accelerometers, or magnetic field sensors, that measure the one-, two-, or three-dimensional angle of the headset, from which the direction the user is looking may be inferred. In a one-dimensional example, the rotation of the user's head in a horizontal plane is measured, i.e., how far left or right the user is looking. A second dimension would typically be elevation from the horizontal plane, i.e., how far up or down from the horizon the user is looking. In some examples, a third dimension, the side-to-side tilt of the user's head could also be measured. The sensor data is provided to an external processing system **204** through a data connection, such as a wireless link **206.**

[0024] This information can then be used by two- or three-dimensional acoustic imaging systems to modify the sounds sent to the headset **10** to that the intended two- or three-dimensional position of a sound, relative to the vehicle, is adjusted to compensate for the actual direction the user is facing. For example, if an audible warning indicating the presence of another aircraft is meant to be positioned at 45 degrees to the right, relative to the aircraft's heading (the direction the aircraft is pointing), but the pilot is already looking 30 degrees to the right, then the sound should be delivered to the headset so that the pilot perceives it to be 15 degrees farther to the right of where he is facing. Vertical information, if present in the audio system and measured by the sensor module 200, can be similarly compensated. In some examples, vertical distance is provided as the relative elevation distance between the two aircraft. This may be combined with the lateral distance between them (absolute or projected into a horizontal plane, such as the ground) to compute the angle up or down at which the other aircraft can be observed.

[0025] In the example of figure 5, the external processing system **204** is connected to the aircraft's warning system **208** and radio **210**. The processing

system **204** receives the audio signals and intended position data from the warning system **208** and the actual head position information from the sensor module **200** (plus any available information about the aircraft's heading, such as from a GPS system **212**), and modifies the audio signals based on the transfer function of the headset **10** so that the sounds will be heard from the correct location. It then provides the modified audio signals to the radio **210** for delivery to the headset.

[0026] Alternatively, the headset **10** may be directly connected to the external processing system **204** through its down-cable **20**, such that the audio from the radio **210** is mixed with the modified directional audio signals within the external processing system **204** and delivered to the headset **10** by the processing system **204**. In this embodiment, the wireless link **206** may be omitted, as the data from the sensors **202** can be delivered to the processing system **204** via the down-cable **20**, for example by modulating it onto the power line **40** in the headset.

[0027] In some examples, directional information for warning sounds is delivered to an aircraft based on the direction the aircraft is moving (its "ground track"), which may not match the aircraft's actual heading (i.e., due to crosswinds adding a sideways component to the aircraft's movement), let alone the direction the pilot is facing within the aircraft. In such a situation, the audio system may compensate for both the aircraft's real heading relative to its ground track as well as the pilot's head position relative to the aircraft heading.

[0028] Similar systems may be used on ground vehicles, such as to warn a driver about nearby vehicles or to inform a gunner of the direction of a target, and on ships for similar purposes, when the available directional information is based on the heading of the vehicle or weapons platform, but the user may be looking another direction. A further example is use by a dismounted soldier, who may have a sniper-detection or other combat information system located in a backpack or otherwise on his body that produces audible indications of the direction of threats or squad mates. Adjusting audio warnings based on the direction the soldier is looking relative to the position of the detection

system allows him to immediately know which direction the threat is located in. Similarly, if the relative position of other soldiers communicating over a radio is known, their voices can be delivered to the soldier's headset in the correct spatial position, helping maintain situational awareness. In a civilian context, such a system may be used to help a crane operator keep track audibly of the direction of a spotter communicating from the ground, to name one example.

[0029] As with the lighting example, using the connector on the headset minimizes the amount of equipment the user must have attached to his head or helmet, while allowing the headset itself to remain relatively simple, that is, the sensors and related circuitry do not need to be integrated into the headset. If power available to the headset, such as from a vehicle intercom to which it is attached, is sufficient to power the sensor system, then the power and ground lines **40** and **42** may be used. If that power is not sufficient, or not always available, as in the case of a dismounted soldier using a portable radio, then an on-board battery **214** within the sensor module **200** may provide the required power.

[0030] Additional accessories that may make use of a connection socket on a headset are shown in figures 6 through 11. In these figures, we refer to the ear cup **12**, connector **16**, and components including driver **14**, ANR circuit **64**, audio conductor **119**, and terminals **60**, **62**, **66**, and **68** generically, without specifying the right or left ear cup. Some figures also show additional signal terminals between the headset and the accessory – while minimizing changes to the headset provides the advantages discussed above, additional accessory features may be enabled by increasing the connectivity between the accessory and the headset, such as providing a data channel between processors located in each. In some examples, the audio and other signals between the headsets may be digitized and multiplexed, allowing the number of wires in the headband to be kept low.

[0031] In figure 6, an accessory **300** includes a battery circuit **302** coupled to the power and ground terminals, and optionally a power switch **304** to control whether power is provided or a power supply circuit **306** to control the

flow of voltage and current between the battery and the headset. Such a battery circuit may be combined with any of the other accessories discussed here, or may be the entire purpose of the accessory device. Additional features may include a charge indicator light **308**, and external charging contacts or plug **310** for recharging the battery. An accessory with such a battery circuit may be used with a variety of other accessories by plugging the accessory with the battery circuit **302** into one ear cup and the other accessory into the other. The battery accessory may also be used on its own to power the ANR circuits of a headset that doesn't otherwise need to be plugged in. In some examples, two accessories with batteries may be used, one attached to each ear cup, to further extend the time in which the headset can be operated. When the headset is plugged into a power supply through the down cable, the power supply circuit **306** may use that power to recharge the battery circuit **302**.

[0032] In figure 7, a biometric monitoring accessory **350** includes biometric or environmental sensors **352** that measure, for example, blood or atmospheric oxygen levels and heart rate of the user. When a processor **354** determines that the sensor data indicates a problem, such as hypoxia or CO poisoning, it injects a warning signal into the crossover conductor **46**, causing the warning to be output by the acoustic driver **14** of the ear cup **12** the monitoring accessory **350** is coupled to. Atmospheric sensors may also be used to derive air pressure in the environment of the headset (i.e., in a cockpit), and adjust performance of the headset, such as by compensating noise cancellation filters based on the speed of sound in the actual cockpit pressure environment. The accessory **350** may make such adjustments itself, if it has appropriate connections to the headset electronics, or it may simply communicate the available data to another controller.

[0033] In some applications, a number of headsets are connected to an aircraft intercom, so that the passengers can communicate with the pilot. In figure 8, a wireless communication accessory **400** includes a short-range two-way radio **402** that allows the passengers' headsets to communicate with each other and the pilot over a local wireless network, avoiding the need to

plug into or even provide wired connections to the aircraft intercom at passenger seating positions. In some examples, the radio circuit **402** provides audio output at terminals **66** and 68, one for the near-side ear cup and one for the cross-over cable for the far side ear cup; in this example, the usual cross-over plug **30** would be attached to the opposite ear cup. In other examples, additional connections may be provided in the connectors, so that the accessory can provide audio to both ear cups when the normal down-cable assembly **20** is used.

[0034] In some examples, the accessory **400** includes a built-in or boom microphone **404**. A push-to-talk button **406** allows the user to indicate when they wish to speak to other passengers. In other examples, no microphone is provided, and the user can only listen to conversations on the intercom. The no-microphone version may also be used by the pilot, since the pilot headset already has the boom microphone from the down-cable assembly **20**, but in that case an additional cable and terminals are needed in the headset to bring the microphone signal across the headband from the down-cable assembly **20** to the wireless accessory **400** for transmission to other wireless headsets. In some examples, the push-to-talk button is provided even when the boom microphone is not, as it may be used with the boom microphone in the down-cable assembly **20** (not shown). Some intercom systems include a receiver for such a switch, and providing the switch in a module that connects integrally to the headset avoids the need to attach a stand-alone switch to the user's clothing or other equipment. In other examples, the pilot may use the version with a microphone to communicate over the aircraft radio, if it is equipped with a compatible transceiver, in place of the wired down-cable assembly **20**. This eliminates the need for the pilot to be tethered to the control panel, though that may not be permitted in some situations.

[0035] In some examples, the radio **402** can also communicate with accessories such as mobile phones or portable music players, allowing the passengers to use their aircraft headsets to make phone calls or listen to entertainment audio. The radio **402** may be a general-purpose radio transceiver circuit such as a Bluetooth® or WiFi® transceiver, or it may be a

custom circuit. The radio **402** may alternatively or additionally receive broadcast radio signals, such as commercial broadcasts or localized broadcasts, such as may be provided at a car race.

[0036] In the example of figure 9, an accessory **450** includes a temperature control system **452** which operates to heat or cool the headset by pumping an appropriate fluid through a tube **454** to modified ear cushions **456**. This may be useful in applications where the user's head is exposed to undesirable temperature environments, such as where the headset prevents the user from wearing a hat in a cold environment, or where the headset itself is the source of discomfort in a hot environment.

[0037] In the example of figure 10, an accessory **500** includes a microphone array **502** and array signal processor **504**. Such a microphone array provides a talk-through feature, allowing the user to hear the sounds in their environment that would otherwise be blocked by the headset. While the array is shown with two microphones, more may be used in some applications. If paired with a similar microphone array in the other ear cup, or even the boom microphone, the talk-through feature may provide directional awareness to the user.

[0038] In some examples, two of the down-cable assembly **20** are used, one for each ear cup. The two assemblies may be slightly different, such as using different connectors for connecting to different types of radio or intercom, or providing different microphone types or bias voltages. One use for such an arrangement is to allow the user to easily connect to both radio types without having to obtain a specialized single down-cable assembly able to connect to both radios.

[0039] In yet another example, shown in figure 11, a camera accessory **550** includes a camera **552**. Applications for a headset-mounted camera include recording the pilot's operation of an aircraft as part of the flight record, allowing an instructor to see what a trainee pilot sees (whether live or after a flight), or simply recording the flight from the pilot's point of view for entertainment purposes. The camera accessory may include a trigger switch

554, built-in or wirelessly connected, to allow the pilot or a third party, such as an instructor, to initiate the capture of a still image or start and stop recording. A camera accessory may also be used with or integrated into the head-tracking accessory **204**. Head motion data may be used to stabilize the image from the camera, or to map it to specific locations in a display when viewed later. For example, if a recording from the pilot's point of view is to be played back on a flight simulator, the picture should stay in place relative to the simulator, rather than moving around to follow where the pilot was looking.

[0040] In various of the above or other applications, two accessory modules may be used which need to communicate with each other. This may be accomplished in several ways, including the provision of additional wires in the headband, running an added wire between the modules separately from the headset, or by providing wireless transceivers, such as those discussed in regard to figure 8, in both modules. Any of the various accessories described may be combined with one or more of the others, such as combining the camera accessory with the wireless audio communication accessory or the head tracking with the biometric monitoring.

[0041] Other implementations are within the scope of the following claims and other claims to which the applicant may be entitled.

WHAT IS CLAIMED IS:

1. A device (102) for coupling to a connector (16a, 16b) on an ear cup (12a, 12b) of a headset (10), the device comprising:
a mating connector (101) corresponding to the connector of the headset, the mating connector including a crossover conductor (46) coupled to a first and a second terminal within the mating connector;
a power conductor and a ground conductor coupled to respective third and fourth terminals in the mating connector; and
an accessory electronic device (100, 102) powered by power received from the headset over the third and fourth terminal within the mating connector.

2. The device of claim 1, wherein the accessory electronic device comprises a lamp (122) configured to direct light onto a surface external to the device.

3. The device of claim 1, further comprising:
a battery compartment having positive and negative terminals for coupling to a battery, and
a power conductor and a ground conductor coupling power and ground terminals of the accessory device to the positive and negative battery terminals.

4. The device of claim 1, further comprising:
a body housing the mating connector;
a boom extending from the body, the boom comprising:
a first aperture through which light from the lamp may exit the boom;
a cover, rotatable around the boom and having a second aperture, such that the cover blocks the first aperture when the cover is in a first rotation position and aligns the second aperture with the first aperture when the cover is in a second rotation position; and

a switch, electrically coupled to the lamp and mechanically coupled to the cover, such that rotating the cover between the first and second rotation positions activates the switch to turn the lamp on when the cover is in the second rotation position and off when the cover is in the first rotation position.

5. The device of claim 1, wherein the accessory electronic device comprises:

a position sensor (202) for determining a position of the device; and

a data connection (206) outputting data from the position sensor.

6. The device of claim 5, further comprising:

a second position sensor for determining a position of the device on a second axis, orthogonal to a first axis on which the first position sensor determines position.

7. The device of claim 6, wherein the first and second position sensors comprise gyroscopes responsive to rotation around the respective first and second axes.

8. The device of claim 6, wherein the first and second position sensors comprise accelerometers responsive to displacement along the respective first and second axes.

9. The device of claim 6, wherein the first and second position sensors comprise magnetometers responsive to changes in magnetic fields associated with movement of the device around the respective first and second axes.

10. A system for providing directional audible information to a user, the system comprising:

a headset (10) having a first ear cup (12a) having a first connector (16a) and a second ear cup (12b) having a second connector (16b), both of the first and the second connectors being operable for connection to an aircraft radio;

an acoustic imaging system operable to:

receive a sound signal and first data identifying a first directional location, relative to a first external reference, associated with the sound,

receive second data identifying a direction the user is looking relative to a second external reference,

generate binaural audio signals that represent the sound at a second directional location when perceived by the user, the second directional location corresponding to the first directional location and adjusted according to the direction the user is looking, such that the user perceives the direction of the source of the sound to be at the first directional location relative to the first external reference, and

output the binaural audio signals; and

an accessory device for coupling to either of the first or the second connector of the headset, the accessory device comprising:

a mating connector corresponding to the connectors of the headset, the mating connector including a crossover conductor coupled to a first and a second terminal within the mating connector;

a position sensor for determining a position of the accessory device; and

a data connection outputting data from the position sensor to the acoustic imaging system;

wherein the data from the position sensor comprises the second data representative of the direction the user is looking relative to the external reference.

11. The system of claim 10, wherein the acoustic imaging system is coupled to the aircraft radio, and the system is configured to mix the binaural audio signals output by the acoustic imaging system with communications audio signals from the radio and deliver the mixed signals to the headset.

12. The system of claim 10, wherein the binaural audio signals output by the acoustic imaging system are provided to the headset independently of signals from the aircraft radio.

13. The system of claim 12, wherein the accessory device further comprises:
a second data connection receiving the binaural audio signals from the acoustic imaging system; and
an audio output for providing the binaural audio signals to the headset through the mating connector.

14. The system of claim 10, wherein:
the accessory device further comprises a wireless transmitter for communication with the acoustic imaging system; and
the acoustic imaging system further comprises a wireless receiver for communication with the accessory device.

15. The system of claim 10, wherein the first and second data comprise two-dimensional location data.

16. The system of claim 15, wherein the two-dimensional location data comprise a horizontal angle away from a vertical origin of the first or second external reference, and a vertical angle away from a horizontal angle of the first or second external reference.

17. The system of claim 16, where the first external reference comprises the Earth, the vertical origin of the first external reference comprises a line parallel to gravity and ahead of the direction an aircraft is traveling, and the horizontal origin of the first external reference is the horizon.

18. The system of claim 16, where the second external reference is an aircraft in which the user is located, the vertical origin of the second external reference is a line directly in front of the aircraft and vertical when the aircraft is level, and the horizontal origin of the second

external reference is in a plane intersecting the user's ears and perpendicular to gravity when the aircraft is level.

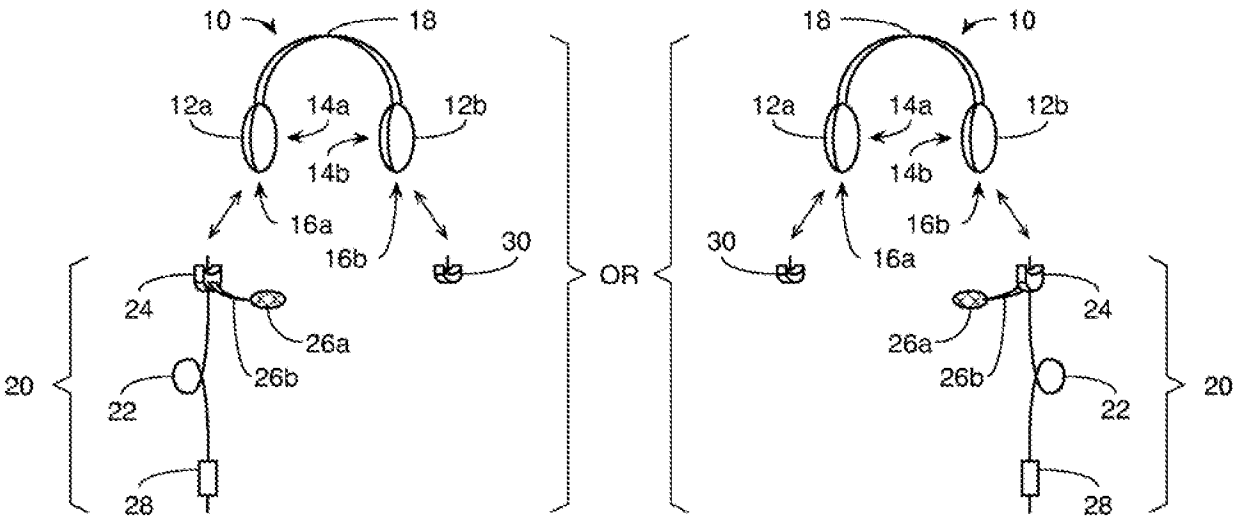


FIG. 1A
(prior art)

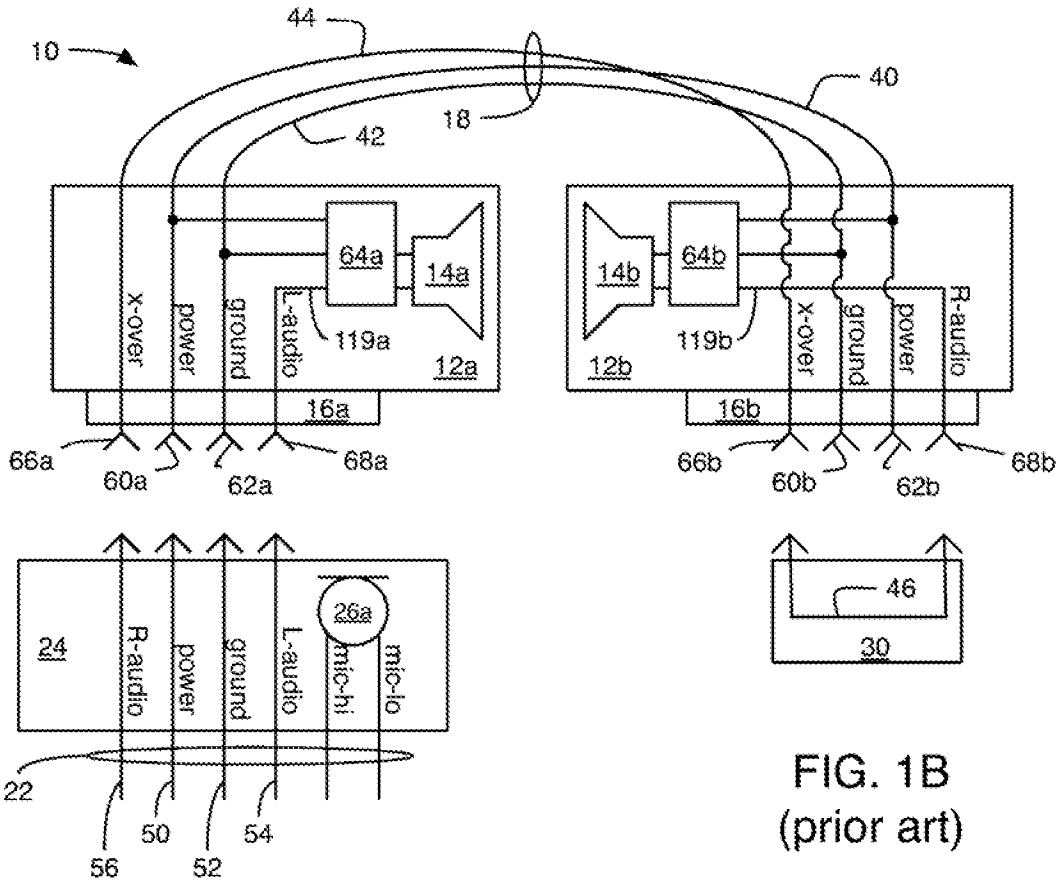


FIG. 1B
(prior art)

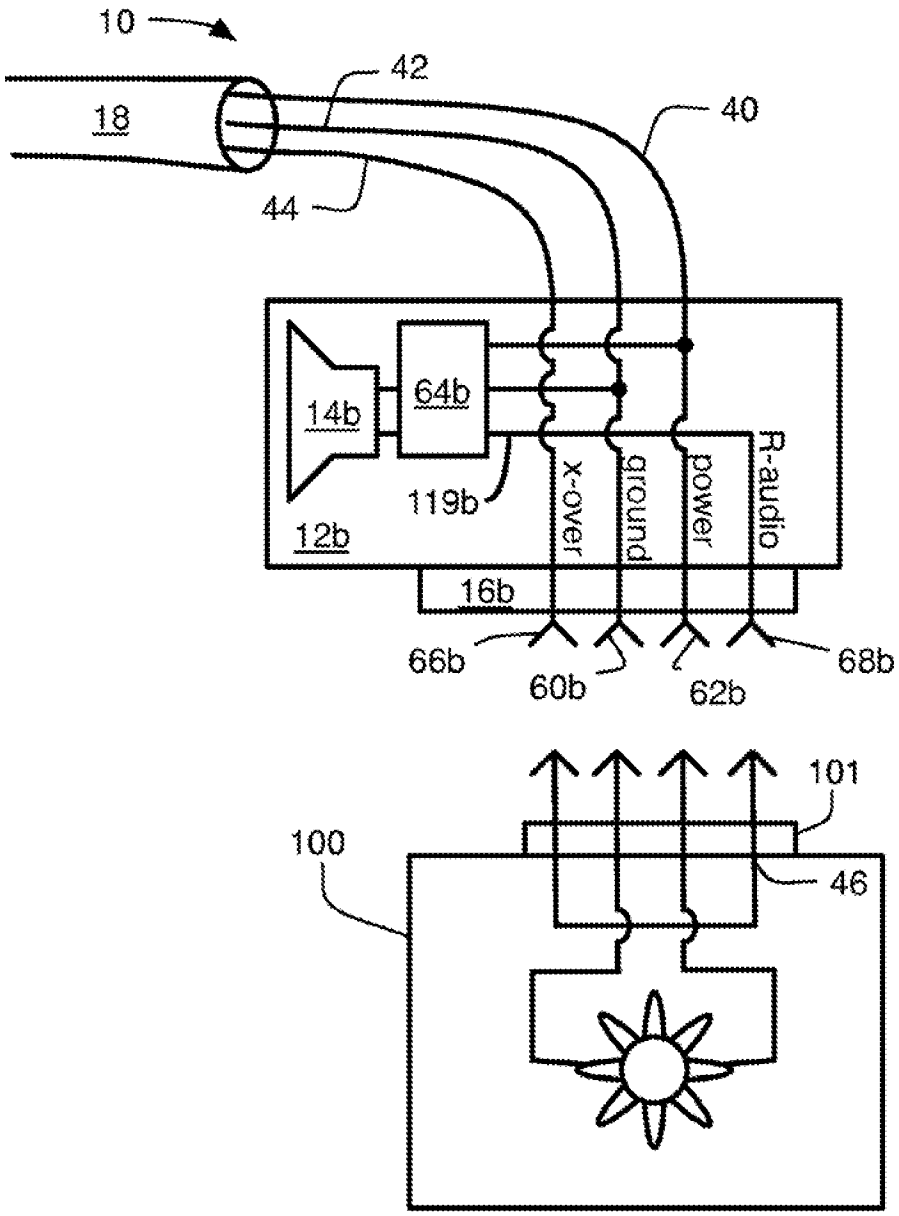

10
42
18
40
44
14b
64b
119b
12b
x-over
ground
power
R-audio
16b
66b
60b
62b
68b
101
100
46

FIG. 2

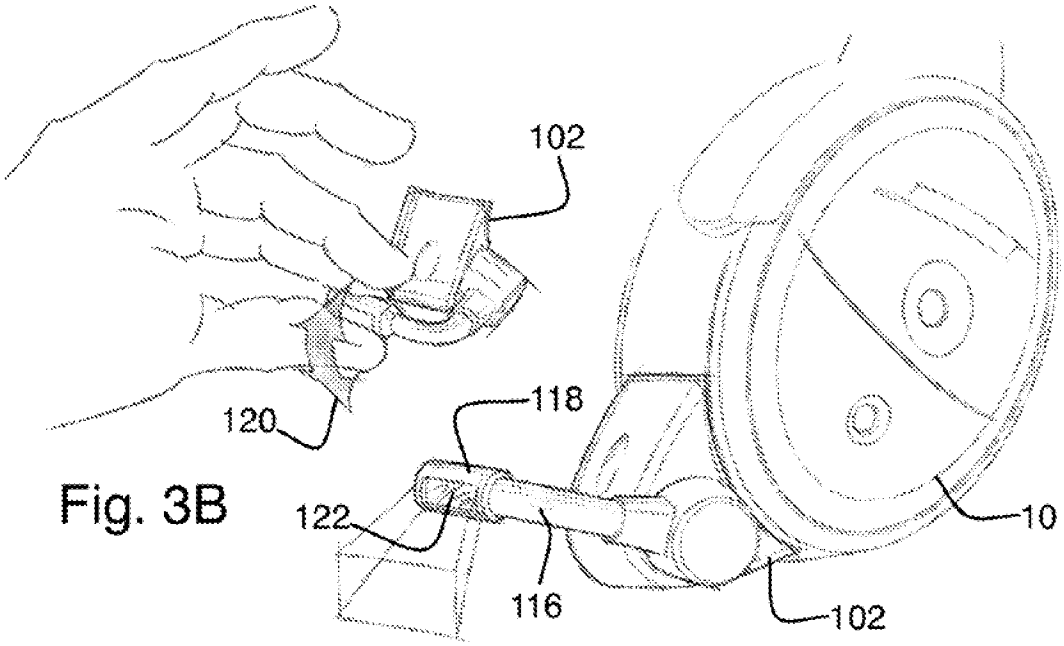


Fig. 3B

Fig. 3A

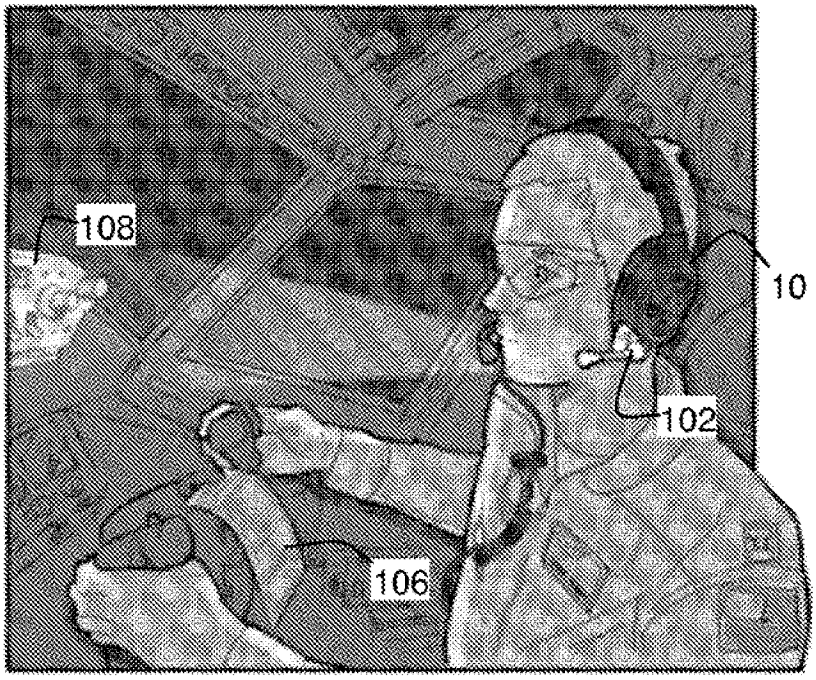


Fig. 3C

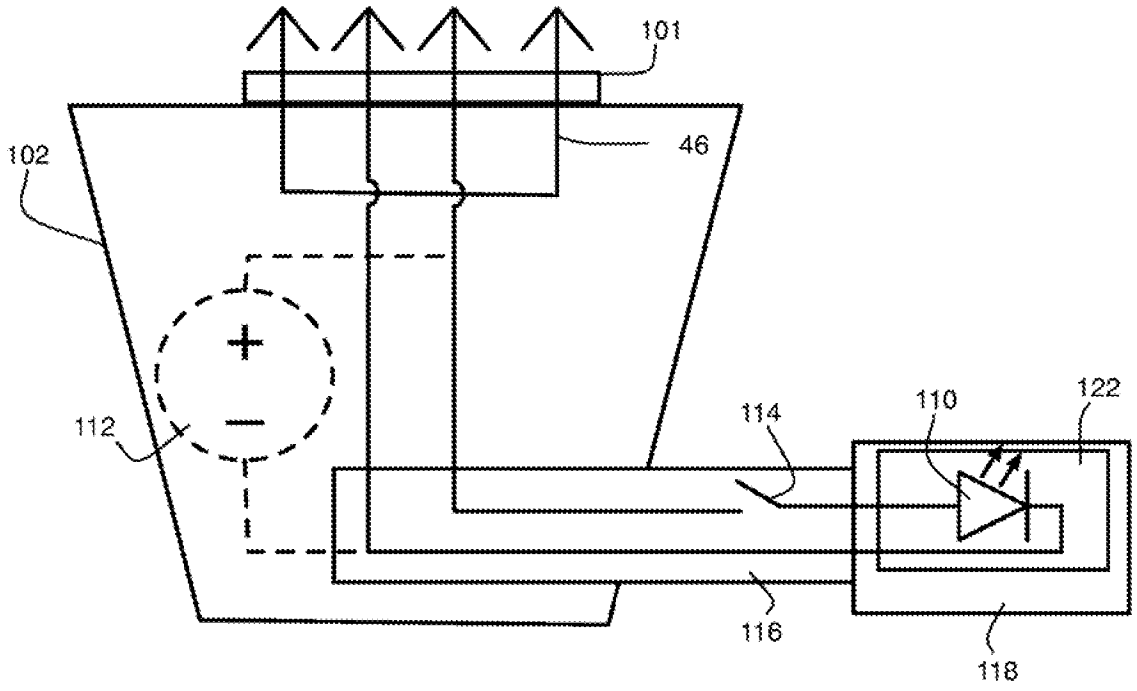


Fig. 4

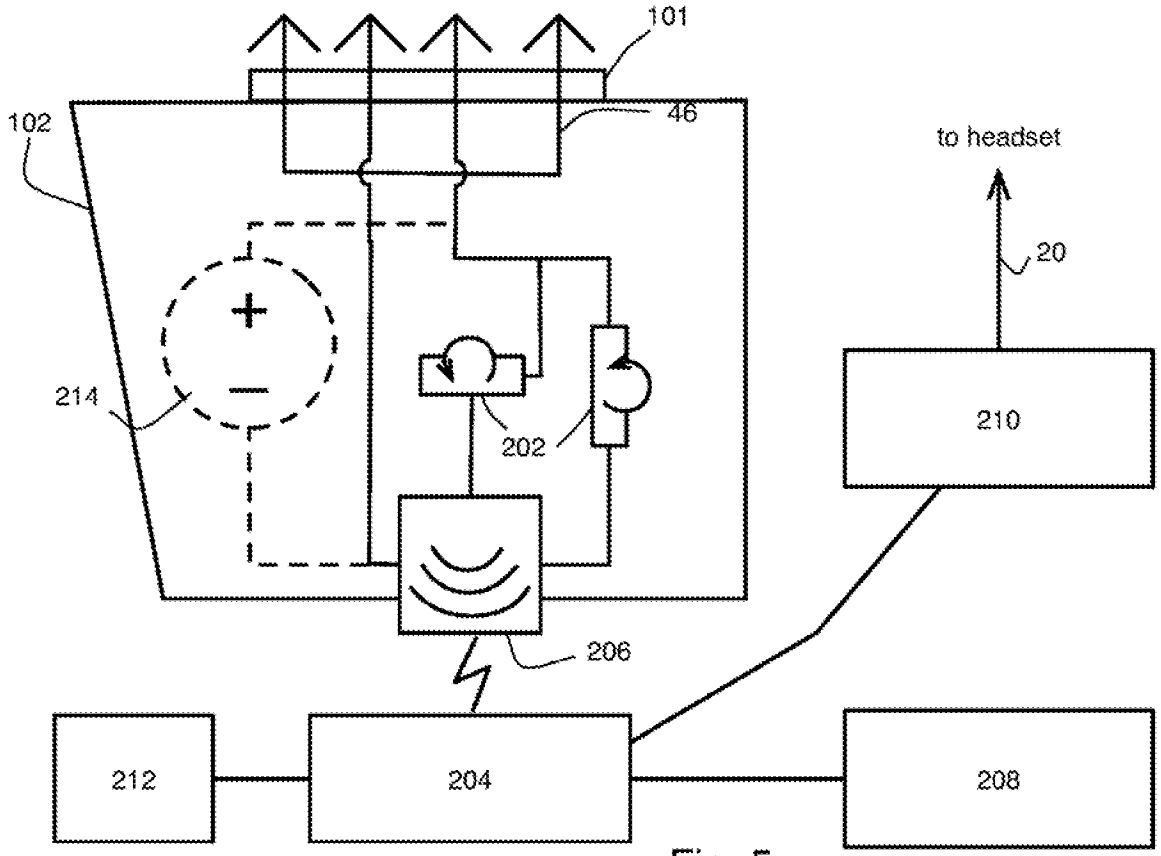


Fig. 5

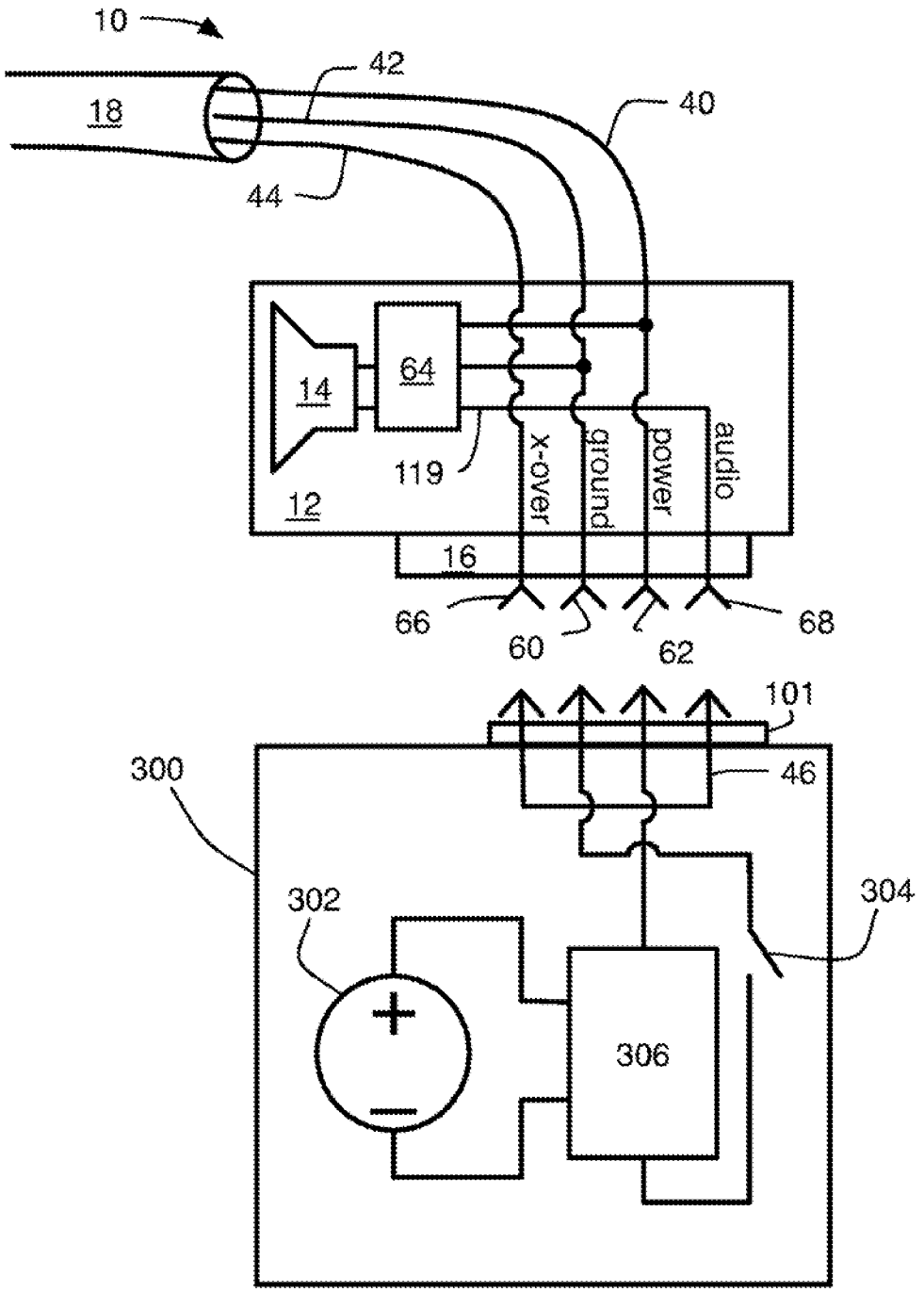

10
42
18
40
44
14
64
119
12
x-over
ground
power
audio
16
66
60
62
68
101
46
300
302
304
306

FIG. 6

8/12

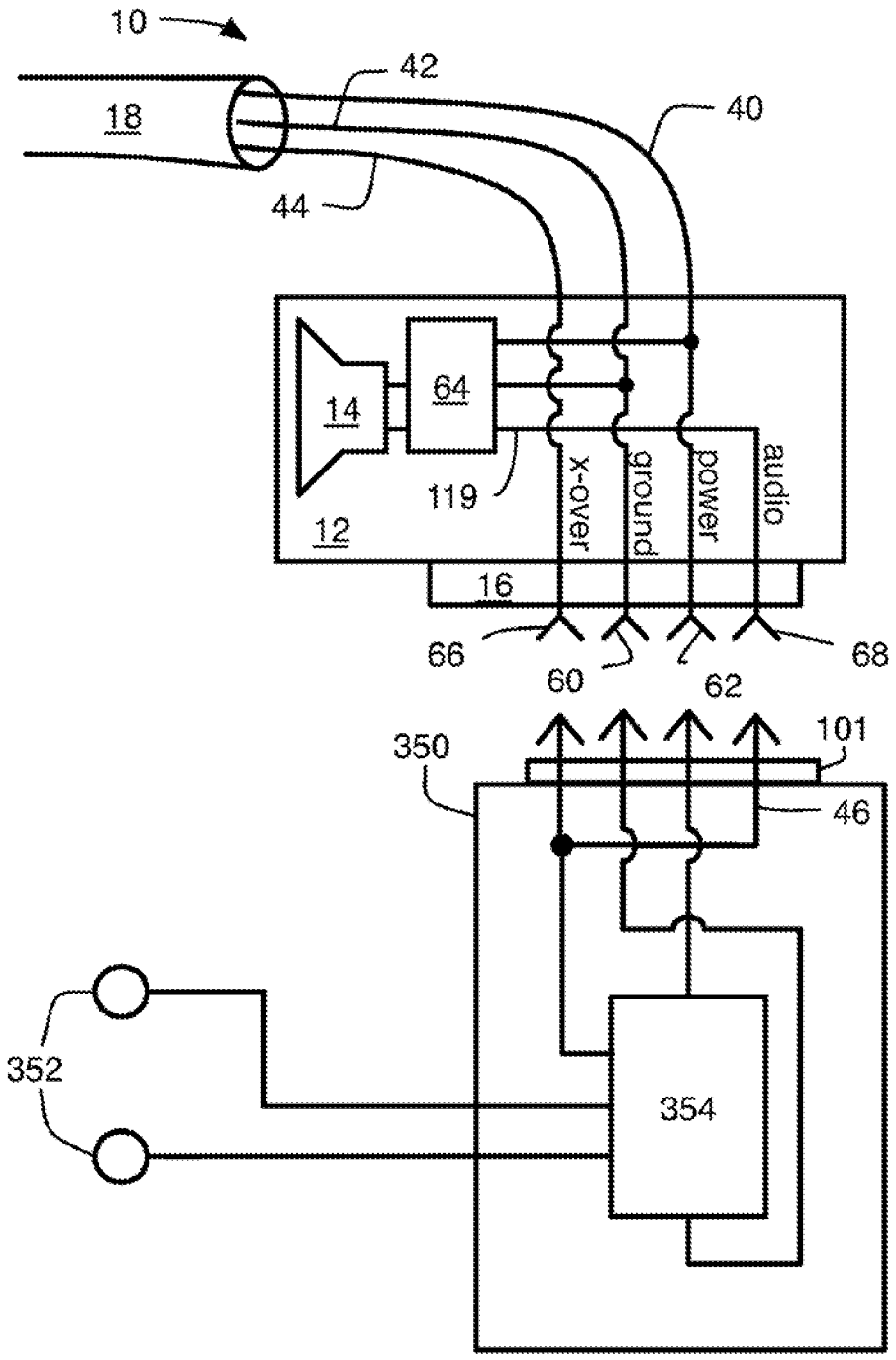

10
42
18
40
44
64
14
119
12
x-over
ground
power
audio
16
66
60
62
68
101
350
46
352
354

FIG. 7

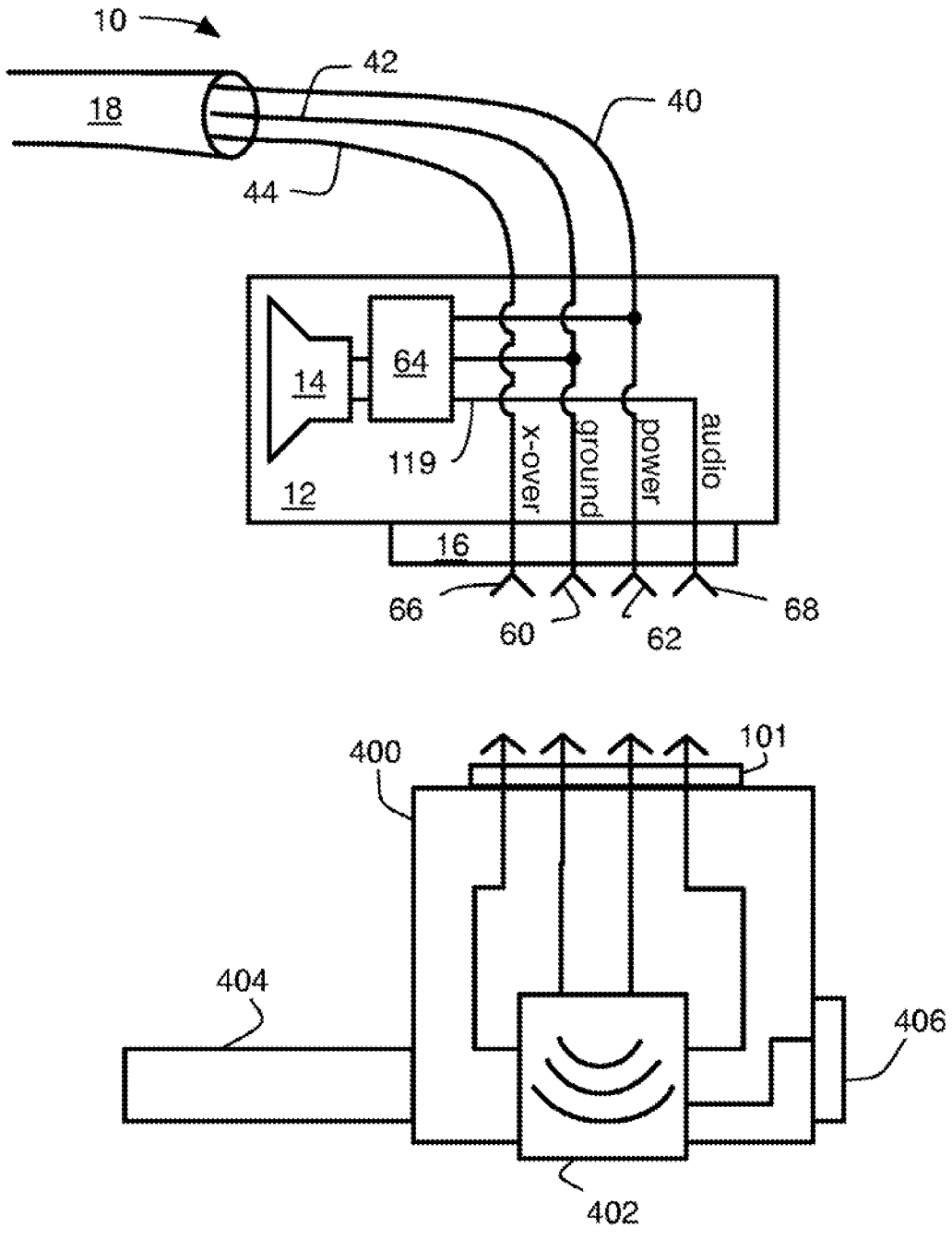

10
42
18
40
44
14
64
119
12
x-over
ground
power
audio
16
66
60
62
68
400
101
404
406
402

FIG. 8

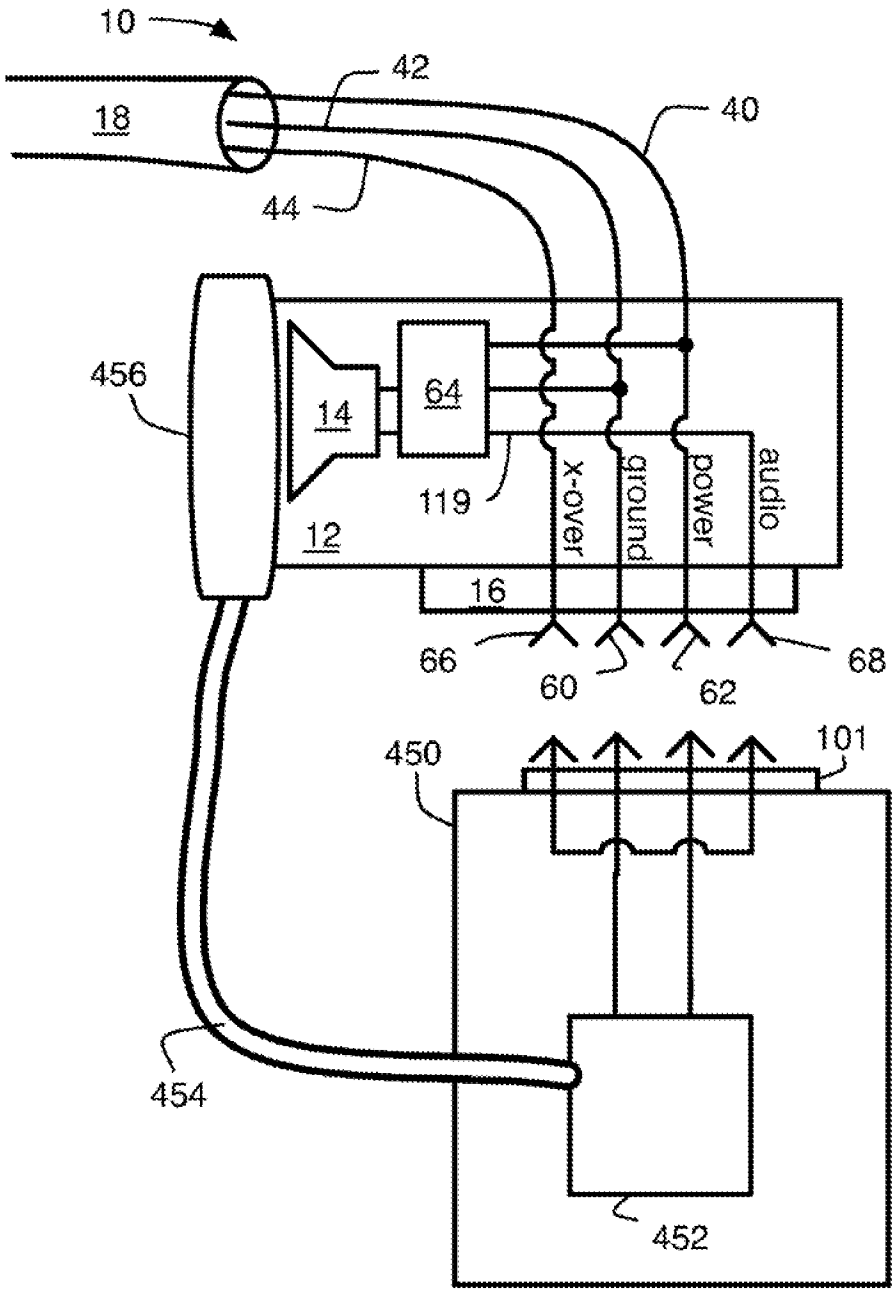

10
42
18
40
44
456
14
64
119
x-over
ground
power
audio
12
16
66
60
62
68
450
101
454
452

FIG. 9

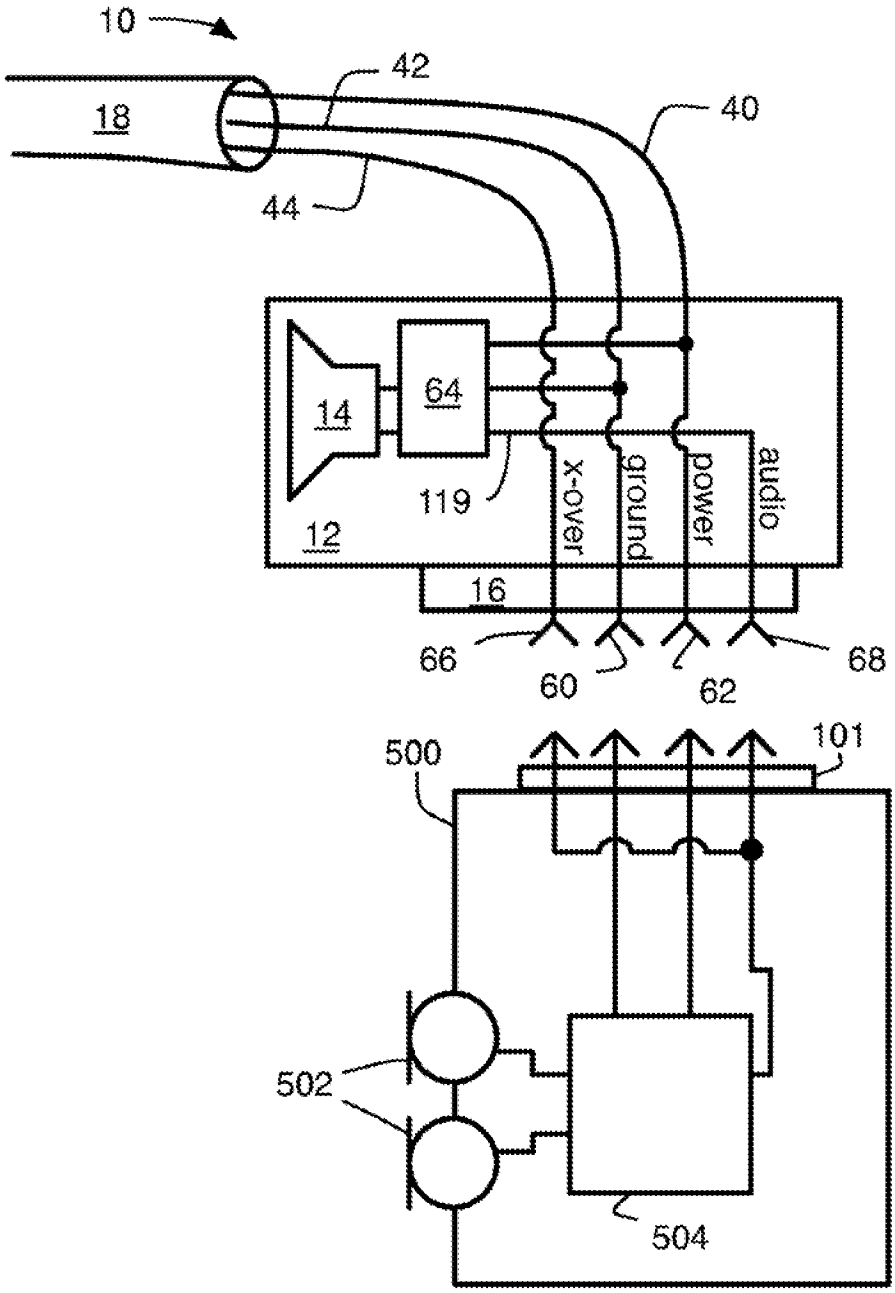

10
42
18
40
44
14
64
119
12
x-over
ground
power
audio
16
66
60
62
68
500
101
502
504

FIG. 10

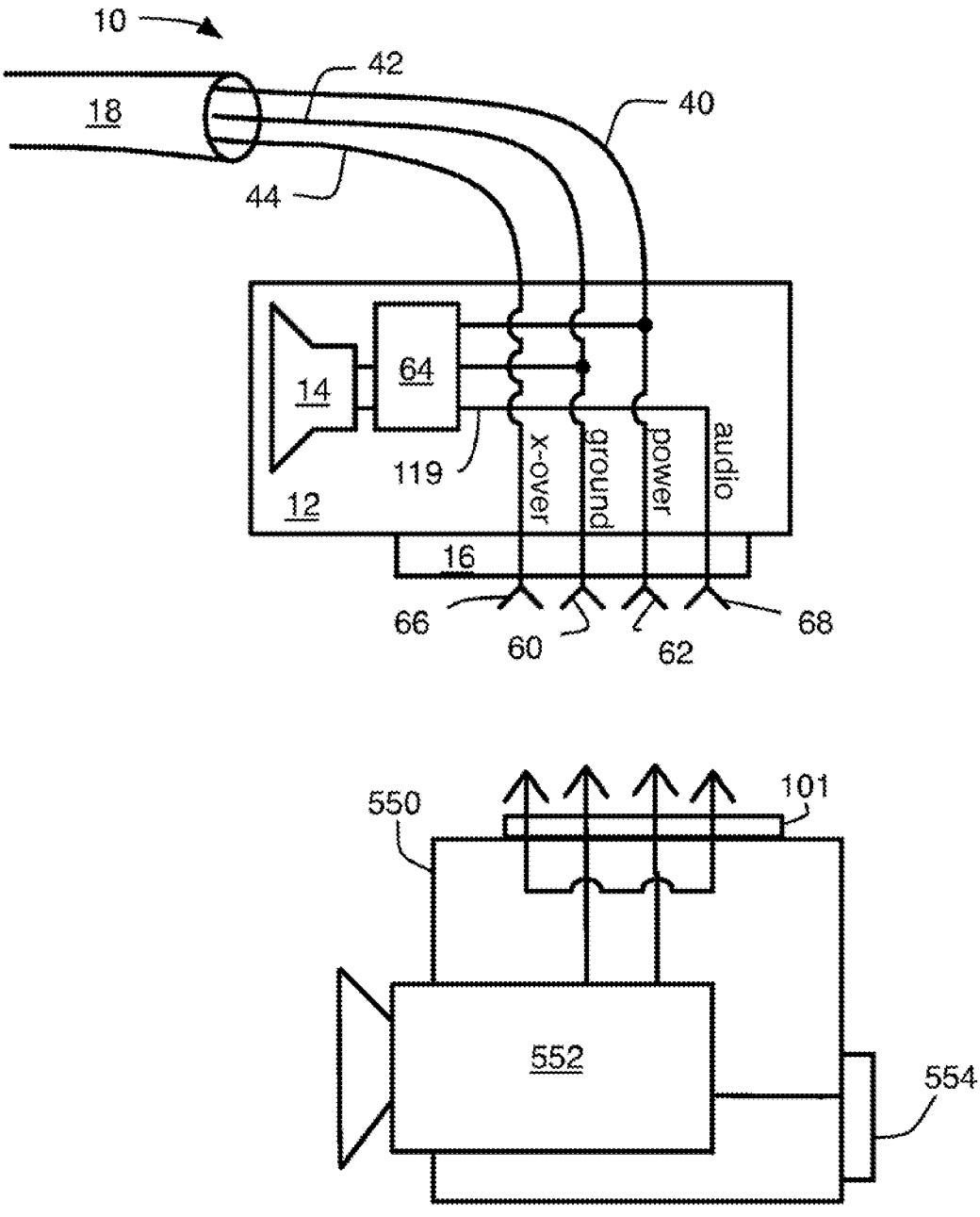

10
42
18
40
44
14
64
119
12
x-over
ground
power
audio
16
66
60
62
68
550
101
552
554

FIG. 11

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[Continued on next page]

(54) Title: METHOD, MEASURING DEVICE AND CONTROL UNIT FOR ADAPTATION OF VEHICLE CONVOY CONTROL

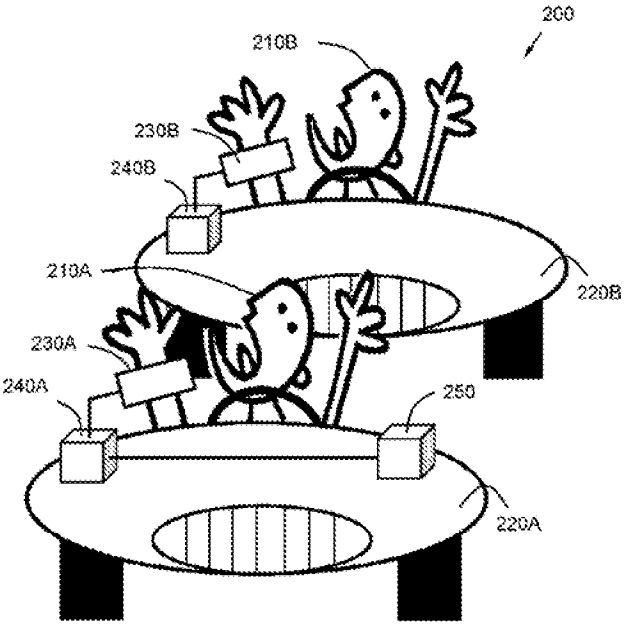


Fig. 2B

(57) Abstract: A method (400), control device (240) and measuring unit (230) for adapting a control algorithm comprising at least one driver-dependent parameter, which control algorithm governs the control of a vehicle convoy (200) in which at least a first vehicle 220A with a first driver (210A) and a second vehicle 220B with a second driver (210B) are included. The method comprises measurement (401) of at least one physical characteristic of the first driver (210A), determination (402) of the stress level of the driver based on the performed measurement (401), and adaptation (403) of the control algorithm to the determined (402) stress level of the driver.

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METHOD, MEASURING DEVICE AND CONTROL UNIT FOR ADAPTATION OF VEHICLE CONVOY CONTROL

TECHNICAL FIELD OF THE INVENTION

The invention concerns a method, a measuring device and a control unit in a vehicle that is included in a vehicle convoy. More specifically the invention describes a mechanism for adapting a control algorithm that governs a vehicle convoy to a stress level of the vehicle driver.

BACKGROUND

For all control systems in a vehicle with which the vehicle driver interacts, it is fundamental to attempt to carry out what the driver requests in a manner that it is believed the driver desires. Vehicle refers in this context to, for example, a goods vehicle, semi, platform truck, carrier vehicle, truck, motor home, pickup, van, personal vehicle, emergency vehicle, watercraft, minivan, four-wheeler, scooter, excavator, car, crane truck, tanker truck, motorcycle, wheel loader, moped, scooter, limousine, sports car, racing car, bumper car, dragster, ride-on lawnmower, tank, snowmobile, snow-cat, all-terrain vehicle, tracked vehicle, tractor, go-cart, bus, combine harvester, agricultural machine or similarly motor-driven manned or unmanned mode of conveyance, adapted for land-based geographical movement.

Platooning is a collective term for methods in which one has a plurality of vehicles on a road drive in locked groups with minimal or reduced distances between the vehicles in

order to reduce fuel consumption and increase the transport capacity of the highway system.

Vehicles in the vehicle convoy can be connected to one another by means of electronic systems that communicate via radio links between the vehicles and the outside world, although various types of mechanical links between the vehicles are also conceivable. A synchronized vehicle convoy moves as a unit wherein the driver of one of the vehicles, normally the driver in the first vehicle, sets the pace for the entire convoy. The distance between the vehicles can be determined by means of sensors that are based on, for example, radar. The vehicles that are included in the vehicle convoy can thereby accelerate and/or brake simultaneously while still maintaining the same distance between the included vehicles.

Individual vehicles with platooning support can join or leave the vehicle convoy whenever so necessitated by their individual transport tasks.

Lower fuel consumption is achieved hereby in that the vehicles that are following the first vehicle encounter reduced air resistance. Reduced fuel consumption leads in turn to lower shipping costs and reduced environmental emissions. Yet another advantage is that it is possible to increase the capacity of the highway system by packing the vehicles more tightly together in the coordinated vehicle convoys while maintaining or possibly even increasing traffic safety. Increased transport capacity can contribute to reduced traffic backups and thus shorter transport times.

Additional advantages of vehicle convoys can consist in that new operating mechanisms can be applied, such as electrical

driving by means of wires, guide tracks in the roadway or the like.

One problem with platooning is that the lead vehicle of the vehicle convoy with its driver is assigned a decisive function in leading the convoy in a safe manner. If, for any reason, this driver experiences panic, heavy stress, sudden illness or is unable for some other biological reason to perform his duties as the leader, the consequence can be that the safety of the entire vehicle convoy and its surroundings will be threatened.

Yet another problem is that even though platooning does not, in theory, require the vehicle drivers other than the leader of the vehicle convoy to be active, there is a moment when the automation is coupled in and out as the individual vehicle joins or leaves the vehicle convoy. Manual activity can be required on the part of the driver of the affected vehicle at such moments, which can threaten the safety of the entire vehicle convoy. In panic situations, the drivers in each individual vehicle can thus also threaten the safety of the vehicle convoy and its surroundings as they join or leave the vehicle convoy.

Furthermore, certain control systems for vehicle convoys are adapted so as to be regulated by the lead vehicle by interpreting the regulating adjustments made by the driver in terms of, for example, velocity or acceleration, including by reading the speed with which the driver changes the position of the gas pedal and/or the position of the brake pedal in different directions in order to gain an idea of the behavior that the driver desires of the vehicle convoy. This generally works well as long as the driver in

the lead vehicle is in a harmonious state and/or is acting rationally; see **Figure 1A.**

However, one problem with the aforedescribed vehicle convoy is its heavy dependency on appropriate behavior on the part of the lead vehicle of the convoy and its driver. A driver in a traffic environment is unfortunately often subjected to stressful traffic situations and does not always behave rationally; see **Figure 1B.** For example, the driver can be stuck in a backup in rush hour traffic, while at the same time having an appointment to keep, or be affected emotionally by perceived or actual deficiencies in the driving by other drivers of their respective vehicles, which can trigger at least temporary irrational driver behavior.

Control systems for vehicle convoys are adapted for rational behavior by the drivers in the vehicles that are included in the vehicle convoy. As a result, the vehicle convoy may behave irrationally if/when the lead driver behaves irrationally, which can threaten the safety of all the vehicles in the vehicle convoy as well as that of other drivers on the road.

It is likely that a driver who is troubled by stress, irritation, anger and/or frustration (see Figure 1B) may amplify the signals that the control system for the vehicle convoy is attempting to interpret, for example by rapidly switching between full depression of the gas pedal and no depression at all, and then full depression again. Such gas pedal fluctuations can, as a result of interpretation problems and possible time delays, cause the control system to react in opposition to what the driver actually wants, i.e. that the clutch may release when the driver actually wants to drive forward and/or vice versa. The result can be

that the vehicles in the vehicle convoy lose pulling force when the driver in the lead vehicle actually wants to increase the pulling force in the stressful situation. This behavior can further result in increased fuel consumption and thus increased environmental impact, but it can also result in increased wear to the vehicles included in the vehicle convoy or components thereof, such as the clutch and/or driveshaft, unnecessary/superfluous gear shifting, or an accident.

It can be shown that drivers, and perhaps in particular professional drivers, are often subjected to situational stress. A driver of a lead vehicle in a vehicle convoy who is driving irrationally risks causing damage to the vehicle, other vehicles in the vehicle convoy and/or other drivers on the road, above and beyond the potential personal suffering that may result.

SUMMARY

One of the objects of this invention is consequently to be able to adapt a control algorithm that is governing a vehicle convoy to a stress level of the driver of a vehicle that is included in the vehicle convoy in order to solve at least one of the aforementioned problems and thereby achieve a vehicle improvement.

According to a first aspect of the invention, this object is achieved by means of a method for adapting a control algorithm comprising at least one driver-dependent parameter, which control algorithm governs the control of a vehicle convoy. The vehicle convoy includes at least a first vehicle with a first driver and a second vehicle with a second driver. The method comprises a measurement of at

least one physical characteristic of the first driver. The stress level of the first driver is determined based on this performed measurement. The control algorithm can subsequently be adapted to the determined stress level of the first driver.

According to a second aspect of the invention, this object is achieved by means of a control unit for governing a vehicle convoy by means of an adaptable control algorithm. The vehicle convoy includes at least a first vehicle with a first driver and a second vehicle with a second driver. The control unit comprises a communication module for receiving a measurement result from a measurement of at least one physical characteristic of the first driver. The control unit also comprises a processor circuit arranged so as to determine the stress level of the first driver based on the performed measurement, and further arranged so as to adapt the control algorithm to the determined stress level of the first driver.

According to a third aspect of the invention, this object is achieved by means of a measuring device for supplying measurement results for adapting a control algorithm that comprises at least one driver-dependent parameter, wherein the control algorithm governs a vehicle convoy. The vehicle convoy includes at least a first vehicle with a first driver and a second vehicle with a second driver. The measuring device comprises a detector for measuring at least one physical characteristic of the first driver. The measuring device further comprises a communication module for communicating the measured value to a control unit.

An elevated stress level on the part of the driver can be detected by measuring at least one physical stress-related

parameter of at least one driver of one vehicle in a vehicle convoy, and by being able to detect an elevated stress level on the part of said driver by comparing said stress-related parameter to a limit value. The detected stress can then trigger an adaptation of the control algorithm that is governing the vehicle convoy to the elevated stress level of the driver. Excessive driver input can thereby be filtered out, suppressed and/or time shifted, and vehicle distances and velocities within the vehicle convoy can be regulated in order to achieve gentler and/or safer control of the vehicle convoy. The safety of the forward travel of the vehicle convoy can thus be increased, whereupon the risk of accident for the vehicles in the vehicle convoy and its drivers is reduced. An improvement in the control of the vehicle convoy is thereby achieved.

Other advantages and additional new features will be presented in the following detailed description of the invention.

LIST OF FIGURES

The invention will now be described in further detail with reference to the accompanying figures, which illustrate embodiments of the invention:

Figure 1A is an illustration of a harmonious and rational vehicle driver.

Figure 1B is an illustration of a disharmonious and irrational vehicle driver.

Figure 2A is a general illustration that shows on embodiment of the invention.

Figure 2B is a general illustration that shows one embodiment of the invention.

Figure 3 is a combined flow and block diagram that shows one embodiment of the invention.

Figure 4 is a flow diagram that illustrates one embodiment of a method for adapting a control algorithm.

Figure 5 is an illustration of a control unit for adapting a control algorithm according to one embodiment of the invention.

Figure 6 is an illustration of a measuring device according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The invention is defined as a method, a control unit and a measuring device, which can be realized in any of the embodiments described below. However, this invention can also be realized in many different forms, and must not be viewed as being limited by the embodiments described herein, which are rather intended to elucidate and clarify various aspects of the invention.

Additional aspects and features of the invention may be identified in the following detailed description when it is viewed in conjunction with the accompanying figures. However, the figures are to be viewed only as examples of various embodiments of the invention, and must not be seen as limiting the invention, which is limited solely by the

accompanying claims. Furthermore, the figures are not necessarily drawn to scale and are, unless otherwise specified, intended to illustrate aspects of the invention conceptually.

Figure 2A shows a vehicle convoy **200** that is controlled by a control algorithm. The vehicle convoy 200 includes a first vehicle **220A** that is driven by a first driver **210A**, and a second vehicle **220B** that is driven by a second driver **210B**. These vehicles 220A, 220B that are included in the vehicle convoy 200 are controlled by the driver 210A of the first vehicle. Furthermore, the vehicles 220A, 220B that are included in the vehicle convoy 200 are adapted so as to communicate wirelessly with one another.

Figure 2B shows a vehicle convoy 200, which is identical, nearly identical or similar to the vehicle convoy 200 that is clarified in Figure 2A.

A first measuring device **230A** is adapted so as to scan one one or certain physical parameters of the driver 210A of the first vehicle. A second measuring device **230B** is adapted so as to scan one or certain physical parameters of the driver 210B of the second vehicle, such as blood pressure and/or pulse. Each respective measuring device 230A, 230B then transmits these measurement values to a corresponding first and/or second control unit **240A**, **240B** over a wireless or wired connection. The control unit 240A, 240B in turn acts upon the control system **250** of the vehicle convoy. An external storage unit **260** is further adapted so as to receive and store the measurement values that the respective measuring devices 230A, 230B register for the driver 210A of

the first vehicle and/or the driver 210B of the second vehicle.

The measuring device 230A, 230B is arranged so as to measure one or several of the following physical parameters of the drivers 210A, 210B, for example systolic blood pressure, diastolic blood pressure, pulse, cardiac minute volume, vascular resistance, respiratory volume, respiratory rate, body temperature, skin temperature, blood adrenalin level, blood cortisol level, blood noradrenalin level, transpiration volume, amount of hand sweat exuded, electrical conductivity of the skin, eye movement, dilated nostrils, muscular tension, body movement, speech volume, voice strength and/or pupil size of the driver 210A, 210B. The system can further comprise a plurality of separate measuring devices 230A, 230B in certain embodiments.

In certain embodiments the measuring device 230A, 230B is arranged so as to worn around the wrist by the driver 210A, 210B. According to other embodiments the measuring device 230A, 230B is connectable to another part of the body of the respective driver 210A, 210B such as, for example, the finger, hand, arm, neck, part of the head, skin, torso, rectum, leg or foot. According to further embodiments the measuring device 230A, 230B consists of a plurality of separate measuring devices, each of which measures various physical parameters on the driver 210A, 210B and sends them to the control device 240A, 240B and/or the control system 250 of the vehicle convoy. The measuring device 230A, 230B, or the measuring devices can also, in certain alternative embodiments, be arranged so as to detect and measure physical parameters of the driver 210A, 210B remotely, and can be secured, for example, in the cab and/or the driver seat. The term measuring device 230A, 230B can thus also

encompass a plurality of separate measuring devices disposed in the same or separate locations on the respective driver 210A, 210B, in proximity to the driver, in the cab or at a certain distance from the respective driver 210A, 210B in different embodiments. To name just one example, a measuring device 230A, 230B that is adapted so as to measure the skin temperature of the driver can comprise a temperature sensor connected to the skin of the driver in one embodiment, but alternatively can instead comprise an infrared camera adapted so as to measure the skin temperature of the driver and disposed at a distance from the driver 210A, 210B, for example in the cab.

The measuring device 230A, 230B is further arranged so as to communicate with a control unit 240A, 240B and/or the control system 250 of the vehicle convoy via an interface, which can consist of a wireless interface in certain embodiments, but can also consist of a wired interface. The wireless interface can consist of a radio transmitter based on wireless communication technology such as 3rd Generation Partnership Project (3GPP) Long Term Evolution (LTE), LTE-Advanced, Evolved Universal Terrestrial Radio Access Network (E-UTRAN), Universal Mobile Telecommunications System (UMTS), Global System for Mobile Communications/Enhanced Data rate for GSM Evolution (GSM/EDGE), Wideband Code Division Multiple Access (WCDMA), World-Wide Interoperability for Microwave Access (WiMax), Wireless Local Area Network (WLAN) Ultra Mobile Broadband (UMB), Bluetooth (BT) or an infrared transmitter, to name just a few conceivable examples of wireless communication.

In certain embodiments the measuring device 230A, 230B is arranged so as to communicate one or some of the measured physical parameters of the driver 210A, 210B to the control

unit 240A, 240B via a communication bus. Such a communication bus is arranged so as to couple a number of electronic control units (ECUs), or controllers, and various components arranged on the vehicle 220A, 220B together.

The control unit 240A, 240B is in turn arranged so as both to communicate with the measuring device 230A, 230B, in order to receive the measurement values, and optionally also trigger a measurement, for example at a given time interval. The control unit 240A, 240B is further arranged so as to communicate with the control system 250 of the vehicle convoy, for example via at least the communication bus of the relevant vehicle, which can consist of one or a plurality of a cable; a data bus, such as a CAN bus (Controller Area Network bus), a MOST bus (Media Oriented Systems Transport), or any other bus configuration; or of a wireless connection according, for example, to any of the previously enumerated technologies.

In certain embodiments the control unit 240A, 240B can further be integrated with the control system 250 of the vehicle convoy.

In certain embodiments the control unit 240A, 240B is arranged so as to forward the measurement values registered for the driver 210A, 210B by the respective measuring device to an external storage unit 260 over a wireless interface according to, for example, any of the previously enumerated wireless communication technologies.

The external storage unit 260 is further adapted so as to receive and store these measurement values, which can then be analyzed. A degraded health condition on the part of an individual driver 210A, 210B can thereby be detected, and an

appropriate health-promoting package of measures can be assigned to the driver 210A, 210B with a view to disrupting his negative health trend and preventing disease, sick-listing and/or accidents, and encouraging a more positive lifestyle. For example, in certain embodiments, abuse of stimulants or performance-enhancing drugs by the driver 210A, 210B can be detected. The stored measurement values can also be used, for example, to investigate accidents that have occurred, and may enable detection of whatever physical parameter or parametric changes preceded an accident. Such detection can be used to further improve the control algorithm for the control system 250 of the vehicle convoy, as well as other control algorithms for, for example, the vehicle brake system or the like.

The control system 250 of the vehicle convoy is arranged so as to affect and control, for example, the distance between the vehicles 220A, 220B that are included in the vehicle convoy 200, the velocity of the vehicles 220A, 220B, the acceleration of the vehicles 220A, 220B that are included in the vehicle convoy 200, and similar parameters.

The control algorithm that governs the control system of the vehicle convoy 250 is affected by one or a plurality of parameters, which can be driver-dependent, indirectly driver-dependent or driver-independent such as, for example, the inclination of the vehicle, vehicle weight, vehicle type, driving comfort, selected performance, vehicle velocity and/or engine rpm.

Aggressive or irrational behavior on the part of the driver 210A of the lead vehicle can be detected by means of the embodiments described herein, and their consequences for the control system 250 and the vehicles 220A, 220B can be

reduced. But a health condition that is hazardous for vehicle traffic, such as a circulatory disorder, blood pressure drop, fainting, heart attack, stroke, epileptic attack or the like can also be detected and/or predicted, and its consequences for the control system 250, the vehicle convoy 200 and the included vehicles 220A, 220B can be reduced.

Figure 3 clarifies a general example of the invention, divided into a number of steps 1-6. Note that certain of these stops are not necessarily included in all embodiments of the invention. Furthermore, these steps can be performed in a order other than that indicated by the numbering in certain embodiments. Certain steps can optionally also be performed in parallel with one another.

Step 1

The measuring device 230A, 230B measures a physical characteristic of at least the first driver 210A. This physical characteristic can consist of, for example, blood pressure or pulse.

Step 2

This measured physical characteristic is sent to the control unit 240A by means of wireless or wired signaling, for example via the communication bus of the vehicle.

Step 3

The control unit 240A receives the measurement values for at least one physical characteristic of the driver 210A. This measurement value is used to determine the stress level of

the driver by, for example, comparing the received value to a limit value, by detecting the magnitude of a change between the two measured values, and/or by detecting the rate of change between two measured values.

Step 4

In certain embodiments the received measurement values are forwarded from the control unit 240A to an external data storage unit 260 in order to enable, for example, a health analysis of the driver 210A.

Step 5

The control unit 240A is arranged so as to adapt a control algorithm comprising at least one driver-dependent parameter, which control algorithm adapts the control system 250 of the vehicle convoy to the determined stress level of the driver.

This adaptation of the control algorithm can include performing filtering to eliminate the movement of the gas pedal, or of another driver-dependent parameter, and/or time filtering of the request for a shift of gears by the driver, with a view to achieving gentler power transfer in certain embodiments.

In certain embodiments the control algorithm is adapted to the determined stress level of the driver in that a suppression of a driver-dependent parameter is introduced that is in proportion to the stress level of the driver.

One advantage that is achieved thereby is that the vehicle convoy 200 will be subjected to more uniform velocity, acceleration, gear shifting etc, regardless of the mental state of the first driver (calm/agitated). Stress-related

differences in driving behavior between different lead drivers 210A for the vehicle convoy 200 are thereby neutralized, which enables greater predictability of the behavior of the vehicle convoy for other drivers 210B in the vehicle convoy 200, and for other drivers on the road, which can have an accident-reducing effect in and of itself.

Step 6

Control data, corrected and adapted to the stress level of the first driver, are then sent to the control system 250 of the vehicle convoy so as, by means thereof, to affect and guide decisions regarding the maneuvering, velocity regulation, gear shifting, vehicle spacing and the like of the vehicle convoy.

Figure 4 illustrates one example of an embodiment of the invention. The flow diagram in Figure 4 clarifies a method 400 for adapting a control algorithm comprising at least one driver-dependent parameter, which control algorithm governs the control of a vehicle convoy 200 in which at least a first vehicle 220A with a first driver 210A and a second vehicle 220B with a second driver 210B are included.

The control algorithm can, in certain embodiments, comprise at least one driver-dependent parameter from among: the inclination of a gas pedal, inclination of a shift pedal, inclination of a brake pedal, change in inclination of the gas pedal, change in inclination of the shift pedal, change in inclination of the brake pedal, change in inclination of the gas pedal per unit of time, change in inclination of the shift pedal per unit of time, change in inclination of the brake pedal per unit of time, steering wheel deflection

and/or rate of change of steering wheel deflection. Furthermore, the control algorithm in certain embodiments can comprise at least one driver-independent parameter from among: vehicle type, inclination of the vehicle 220a, 220B, vehicle weight, comfort level, engine rpm. In certain configurations the parameter comfort level can be adjustable by the driver 210A, 210B, the vehicle owner, the vehicle manufacturer or another actor.

The object of the method is to adapt the control algorithm to the elevated stress level of the driver, whereby the parameters that are not directly driver-dependent are given greater proportional weight compared to directly driver-dependent parameters.

To be able to adapt the control algorithm in a correct manner, the method 400 can comprise a number of method steps 401-405. However, it should be noted that certain of the steps described here are included only in certain alternative embodiments of the invention, such as, for example step 404 and/or 405. It may also be noted that the steps described here can be performed in a somewhat different chronological order than that indicated by the numbering, and that certain of them can be performed in parallel with one another. The method 400 comprises the following method steps:

Step 401

A measurement is made of at least one physical characteristic of the first driver 210A. This measurement can be made by one or a plurality of measuring devices 230A.

In certain embodiments, a measurement is made of at least one physical characteristic of a plurality of drivers 210A,

210B in the vehicle convoy 200. This measurement can be made by one or a plurality of measuring devices 230A, 230B.

The measurement of the physical characteristic of the driver 210A, 210B can be made by the measuring device 230A, 230B which, for example, can designed as a cuff that is connectable to the arm of the driver or another body part of the driver 210A, 210B in certain embodiments, such as, for example, a finger, hand, arm, neck, part of the head, skin, torso, rectum, bone or foot. According to additional embodiments, the measuring device 230A consists of a plurality of separate measuring devices, each of which measures different physical parameters of the driver 210A, 210B and sends them to the control device 240A, 240B. The measuring device 230A, 230B, or the measuring devices, can also, in certain embodiments, be arranged so as to detect and measure physical parameters of the driver 210A, 210B remotely, and can be secured in, for example, the cab and/or driver seat. The term measuring device 230A, 230B can thus also encompass a plurality of separate measuring devices disposed in the same or separate locations on the driver 210A, 210B, in proximity to the driver, in the cab or at a certain distance from the driver 210A, 210B in different embodiments. The measured physical characteristics of the driver 210A, 210B can be sent wirelessly or via cable to a control unit 240A, 240B.

However, the measuring device 230A, 230B can consist of a plurality of measuring devices, or of one measuring device 230A, 230B comprising a number of different detectors, which can have the same or different special locations.

In one embodiment, the measuring device 230A, 230B can comprise or partly comprise the horn of the vehicle, as the

emotionally agitated driver 210A, 210B will likely have a tendency to overuse the horn.

The measured physical characteristics of the driver 210A, 210B can further comprise any of: systolic blood pressure, diastolic blood pressure, pulse, cardiac minute volume, vascular resistance, respiratory volume, respiratory rate, body temperature, skin temperature, blood adrenalin level, blood cortisol level, blood noradrenalin level, transpiration volume, amount of hand sweat exuded, electrical conductivity of the skin, eye movement, dilated nostrils, muscular tension, body movement, speech volume, voice strength and/or pupil size of the driver 210A, 210B according to certain embodiments.

The measured 401 physical characteristic of the driver 210A, 210B can, in certain embodiments, comprise a level change in at least one measured physical characteristic of the driver 210A, 210B.

In certain embodiments the measured physical characteristic of the driver 210A, 210B comprises a level change per unit of time in at least one measured physical characteristic of the driver 210A, 210B.

In certain embodiments only one individual physical driver characteristic is measured, which results in a rapid and simple analysis and a lower price for the measuring device 230A, 230B. In addition, only a limited amount of data needs to be transmitted to the control unit 240A, 240B and processed and analyzed therein.

One advantage of measuring a plurality of physical characteristics of the driver 210A, 210B is that it increases the reliability and/or sensitivity of the

measurement. A change in just a single one of the foregoing parameters can, after all, be attributable to a completely different non-stress-related factor. For example, an elevated skin temperature on the part of the driver 210A, 210B could be the result of a malfunction of the heating system in the cab rather than of the driver 210A, 210B being on the way to an emotional outburst of rage. In the same way, for example, dilated pupils of the driver 210A, 210B may be attributable to an oncoming vehicle having failed to dim its high beams or having poorly adjusted headlights. By measuring a plurality of parameters, such as for example the foregoing, it is possible to filter out at least certain possible alternative explanatory models for the deviant physical parameters of the driver, which increases the traffic safety of this method according to these embodiments.

Measurement of the physical characteristic or characteristics of the driver or drivers can be performed continuously, or at certain time intervals according to certain embodiments. The measurements can also be triggered by another party such as another driver, the vehicle owner, medical personnel; or by an event, such as a vehicle start, vehicle stop or the like.

In certain embodiments a starter interlock on the vehicle 220A, 220B is activated when the driver 210A, 210B removes the measuring device 230A, 230B, which interlock is not lifted until the driver 210A, 210B restores the measuring device 230A, 230B.

In certain alternative embodiments, a starter interlock on the vehicle 220A, 220B is activated when the measuring device 230A, 230B detects physical parameters that deviate

from the normal parameters for the regular driver by a certain threshold value. It thus becomes possible to prevent a different individual such as an authorized driver or thief from operating the vehicle 220A, 220B.

In certain additional embodiments a starter interlock on the vehicle 220A, 220B in the vehicle convoy 200 is activated when the measuring device 230A, 230B detects physical parameters that differ from the normal parameters for the regular driver by a certain threshold value. This makes it possible to prevent an emotionally agitated driver 210A, 210B from initiating vehicle travel.

Step 402

The stress level of the driver is determined based on the performed measurement.

The determination of the stress level of the driver can be based on the performed measurement, and comprises a comparison between the measured value and a limit value.

For example, the physical parameter that is measured can consist of the pulse of the driver. The measured pulse value of the driver, which can be, for example, 72 beats per minute, can then be compared with a limit value that can be predetermined, or configurable to, for example, 85. The limit value can also be adapted for each individual driver 210A, 210B and be at, for example, 10% above the resting pulse of the driver. When the pulse of the driver in this example falls below the limit value, the driver 210A, 210B can be characterized as harmonious, or unstressed. In such a case the ordinary control algorithm can be used, completely unaffected, to act upon the clutch control system with no adaptation to the parameters of the driver, as the driver

210A, 210B can be considered to be harmonious. However, if on another occasion the pulse of the driver temporarily exceeds 85 beats per minute, the driver 210A, 210B can be categorized as stressed, which can in turn trigger an adaptation of the control algorithm in accordance with the following steps.

One advantage hereof is that the control algorithm is not affected at all when the driver 210A, 210B is unstressed. This makes it possible to maintain the sensitivity of the clutch system for the unstressed driver 210A, 210B while, at the same time, a suppression of driver-dependent parameters can be introduced in the control system 250 for the stressed driver, which yields an improved control system 250.

It should perhaps also be noted that the physical parameter that is measured in other examples can consist of changes in the pulse of the driver. Assume that the pulse of the driver is 72 beats per minute on a first measurement occasion and 85 beats per minute on a second measurement occasion. The pulse increase is then 85 - 72 = 13 beats per minute, which value can be compared to a limit value that can be, for example, 7 beats per minute or, for example, 10% of the original value (i.e. of 72). One advantage of measuring changes in the physician parameters of a driver is that it is possible to use the same limit value regardless of which individual driver 210A, 210B is being measured, in certain embodiments.

Furthermore, according to certain additional embodiments, the physical parameter that is measured in yet another example can consist of the change in the pulse of the driver

per unit of time. Assume that the pulse of the driver is 72 beats per minute on a first measurement occasion and 85 beats per minute on a second measurement occasion that occurs one minute later. The pulse change per minute is then 85 - 72 = 13 beats per minute, which value can be compared to a limit value that can, for example, be 7 beats per minute or, for example, 10% of the original value (i.e. of 72). This embodiment also has the advantage that it is possible to use the same limit value regardless of which individual driver 210A, 210B is being measured, in certain embodiments.

Step 403

The control algorithm is adapted to the determined 402 stress level of the driver.

According to certain embodiments, this adaptation of the control algorithm comprises a reduction of the driver-dependent parameter value in proportion to the determined 402 stress level of the driver.

For example, a measured value for a driver parameter that is lower than a limit value can reduce the driver-dependent parameter value by 0%, a measured value for a driver parameter that equals the limit value can reduce the driver-dependent parameter value by 10%, and a measured value for a driver parameter that exceeds the limit value by 10% can reduce the driver-dependent parameter value by 30%, to name just one arbitrary and non-limiting example.

The adaptation of the control algorithm can, in certain embodiments, comprise a mapping of the determined 402 stress level of the driver against a corresponding reduced

parameter value and the insertion of the reduced parameter value into the control algorithm.

It is thereby possible to compare measured values for the measured driver parameter to measured values or a range of measured values in a table and, by means of such mapping, to extract a corresponding reduced parameter value that can then be inserted into the algorithm in order to suppress the request for a shift of gears on the part of the emotional driver and thus enable a gentler transfer of power.

The adaptation of the control algorithm can further comprise the introduction of a time filter, wherein the length of the time delay is in proportion to the determined 402 stress level of the driver.

For example, a measured value for a driver parameter that is below a limit value can result in a non-existent time delay; a measured value for a driver parameter that equals the limit value can result in a time delay of one second, and a measured value for a driver parameter that exceeds the limit value by 10% can result in a time delay of three seconds, just to name one arbitrary and non-limiting example.

In certain embodiments the adaptation of the control algorithm can comprise an expansion of the permissible rpm range within which gear shifting is performed. This expansion can be in proportion to the determined 402 stress level of the driver. A driver parameter that is below a limit value can thus result in a non-existent expansion of the permissible rpm range; a measured value for a driver parameter that equals the limit value can result in an expansion of the permissible rpm range by 10%, and a measured value for a driver parameter that exceeds the limit

value by 10% can result in an expansion of the permissible rpm range by 20%, just to name a few examples. Unnecessary gear shifting can thereby be avoided.

In certain embodiments of the method 400, the control algorithm for the vehicle convoy 200 increases the distance between the vehicles 220A, 220B that are included in the vehicle convoy 200 when the determined 402 stress level of the first driver exceeds a limit value. The level of safety is thereby increased in that the risk of a chain collision is reduced.

In certain embodiments, the method 400 comprises the triggering of an emergency stop of the vehicle convoy 200 when the determined 402 stress level of the driver exceeds a limit value. This makes it possible to prevent, for example, an acute illness on the part of the driver 210A of the lead vehicle from having consequences for the forward travel of the vehicle convoy 200. The emergency stop further enables the first driver 210A to receive medical assistance from his colleagues or other individuals at the scene.

In certain embodiments the distance between the vehicles 220A, 220B in the vehicle convoy 200 is increased by, for example, 50% when the determined 402 stress level of the first driver exceeds a first limit value, by 70% when the stress level exceeds a second limit value, by 100% when the stress level exceeds a third limit value, and an emergency stop is activated when the stress level exceeds a fourth limit value. It should be noted that these values are examples.

In certain embodiments of the method 400, the control algorithm for the vehicle convoy 200 comprises measures to

send an indication from a stress alarm to other drivers 210B of vehicles 220A, 220B in the vehicle convoy 200 when the determined 402 stress level of the first driver exceeds a limit value.

This makes it possible to prevent, for example, an acute illness on the part of the driver 210A of the lead vehicle from having consequences for the forward travel of the vehicle convoy 200. Other drivers 210B in the vehicle convoy 200, or at least one other driver 210B in the vehicle convoy 200 can thus be warned about the degraded health condition of the lead driver and thereby be enabled to perform, or prepare themselves to perform, first aid measures such as cardiopulmonary resuscitation or the like, should such prove relevant.

Step 404

This method step is performed only in certain alternative embodiments of the method 400.

In certain embodiments of the method 400, the control of the vehicle convoy is turned over to another driver 210B in the vehicle convoy 200 when the first driver 210A is the lead vehicle of the vehicle convoy and the determined 402 stress level of said driver exceeds a limit value.

Step 405

This method step is performed only in certain alternative embodiments of the method 400.

According to these alternative embodiments, the measured 401 physical characteristic of the driver 210A, 210B is sent to an external data storage unit 260 to enable a health analysis of the driver 210A, 210B.

The external storage unit 260 can be disposed, for example, at the vehicle owner, the vehicle manufacturer or another third party actor, and arranged so as to store the physical characteristics of the drivers 210A, 210B or a plurality of drivers along with, for example, chronological and/or geographical positioning information. In addition, the external storage unit 260 can be arranged so as to analyze these stored measured values. This information can then be used to detect a severely degraded health condition on the part of individual drivers 210A, 210B, and professional assistance can then be summoned to arrange for additional measures to halt the negative progression of the driver who is getting sick. In the event of a detected acute illness or potential accident, emergency aid can, in some embodiments, be sent to the vehicle position, and/or medical advice of the first aid type can be provided remotely.

The stored measured values can also be used, for example, to investigate accidents that have occurred, in a manner similar to the "black box" in an airplane. This makes it possible to analyze the stored measured values associated with the detected emotional outbursts of the driver, for example by enabling the detection of which physical parameter(s) or parametric changes preceded an accident. Such detection can be used to further improve the control algorithm for the transmission system 250, as well as other control algorithms, such as those for brake systems or the like.

According to certain embodiments, information about measurement results for each individual driver 210A, 210B of vehicles 220A, 220B in the vehicle convoy 200 is sent to a control system 250 that governs the control of the vehicle convoy 200. The driver 210A of the lead vehicle 220A can

thus be warned that another driver 210B of another vehicle 210B in the vehicle convoy 200 has an increased stress level, and take appropriate steps.

Figure 5 illustrates an embodiment of a control unit 240A, 240B for governing the control system 250 of a vehicle convoy by means of an adaptable control algorithm. Said control unit 240A, 240B is configured so as to perform at least certain of the aforedescribed method steps 401-405, included in the description of the method 400 for adapting a control algorithm comprising at least one driver-dependent parameter to the stress level of a driver, which control algorithm governs a control system 250.

The stress level of the driver is determined based on a measured physical characteristic of the driver 210A, 210B comprising at least one of: systolic blood pressure, diastolic blood pressure, pulse, cardiac minute volume, vascular resistance, respiratory volume, respiratory rate, body temperature, skin temperature, blood adrenalin level, blood cortisol level, blood noradrenalin level, transpiration volume, amount of hand sweat exuded, electrical conductivity of the skin, eye movement, dilated nostrils, muscular tension, body movement, speech volume, voice strength and/or pupil size according to various embodiments.

The measured physical characteristic of the driver 210A, 210B can comprise, for example, a level change in at least one measured physical characteristic of the driver 210A, 210B in certain embodiments. The measured physical characteristic of the driver 210A, 210B can further comprise

a level change per unit of time in at least one measured physical characteristic of the driver 210A, 210B.

In order to adapt the control algorithm to the stress level of the driver in a correct manner, the control unit 240A, 240B comprises a number of components that are described in detail in the text below. However, it should be noted that certain of the described secondary components occur in certain embodiments. It may further be noted that additional electronics in the control unit 240A, 240B that are not entirely necessary in order to understand the function of the control unit 240A, 240B according to the invention have not been depicted in Figure 5 in order to avoid making it more difficult to understand the invention.

The control unit 240A, 240B comprises a communication module 510 for receiving a measurement result from a measurement of at least one physical characteristic of the driver 210A, 210B. The measurement result is received over a wireless or wired interface from a measuring unit 230A, 230B. The communication module 510 is, in certain embodiments, further arranged so as to send instructions to a control system 250, which in turn affects the maneuvering of the vehicle convoy. In certain embodiments the communication module 510 is also arranged so as to send measurement data to an external unit 260 for storing and analyzing said measurement data. This communication to the external storage unit 260 is carried out wirelessly.

In certain embodiments the communication module 510 can consist of a separate transmitter and receiver. In certain embodiments the communication module 510 can consist of a transceiver that is adapted so as to transmit and receive radio signals, and wherein parts of the design, for example

the antenna, are common to transmitter and receiver. The communication module 510 can further be adapted for wireless information transfer by means of radio waves, WLAN, Bluetooth or an infrared transmitter/receiver module. However, in certain embodiments the communication module 510 can be specially adapted for wireless information exchange with the measuring device 230 and/or the data bus of the vehicle.

The control unit 240A, 240B further comprises a processor circuit 520 arranged so as to determine the stress level of the driver based on the performed measurement, and also arranged so as to adapt the control algorithm to the determined stress level of the driver.

In certain embodiments the processor circuit 520 can be arranged so as to determine the stress level of the driver based on a comparison between the measured value and a limit value.

In certain embodiments the processor circuit 520 can be arranged so as to adapt the control algorithm by reducing the driver-dependent parameter value in proportion to the determined stress level of the driver.

For example, a measured value for a driver parameter that is below a limit value can reduce the driver-dependent parameter value by 0%, a measured value for a driver parameter that equals the limit value can reduce the driver-dependent parameter value by 10%, and a measured value for a driver parameter that exceeds the limit value by 10% can reduce the driver-dependent parameter value by 30%, to name just one arbitrary and non-limiting example.

In certain embodiments the processor circuit 520 can be arranged so as to adapt the control algorithm by mapping the determined stress level of the driver against a corresponding reduced parameter value and inserting said reduced parameter value into the control algorithm.

This makes it possible to compare a measured value for the measured driver parameter to a measured value or range of measured values in a table and, by means of this mapping, to extract a corresponding reduced parameter value that can then be inserted into the control algorithm in order to in order to suppress the request for a shift of gears by the emotional driver and enable a gentler transfer of power.

In certain embodiments the processor circuit 520 can be arranged so as to adapt the control algorithm by inserting a time filter, wherein the length of the time delay is in proportion to the determined stress level of the driver.

For example, a measured value for a driver parameter that is lower than a limit value can result in an non-existent time delay; a measured value for a driver parameter that equals the limit value can result in a time delay of one second, and a measured value for a driver parameter that exceeds the limit value by 10% can result in a time delay of three seconds, just to mention one arbitrary and non-limiting example.

The processor circuit 520 can consist, for example, of one or a plurality of a Central Processing Unit (CPU), microprocessor or other logic designed so as to interpret and execute instructions and/or to read and write data. The processor circuit 520 can process data for inflows, outflows

or the data processing of data that also comprises buffering of data, control functions and the like.

In certain alternative embodiments the control unit 240A, 240B comprises a memory unit 52, which constitutes a storage medium for data. The memory unit 525 can consist, for example, of a memory card, flash memory, USB memory, hard drive or other similar data storage unit, such as any of the group comprising ROM (Read-Only Memory), PROM (Programmable Read-Only Memory), EPROM (Erasable PROM), Flash memory, EEPROM (Electrically Erasable PROM), etc in various embodiments.

The invention further comprises a computer program for adapting a control algorithm comprising at least one driver-dependent parameter, wherein the control algorithm governs a control system 250. The computer program is arranged so as to perform the method 400 according to at least one of the previously described method steps 401-405 when the computer program is executed in a processor circuit 520 in the control unit 240A, 240B.

The method steps 401-405 for adapting a control algorithm to the stress level of a driver can be implemented by means of one or a plurality of processor circuits 520 in the control unit 240A, 240B together with computer program code for performing one, several, certain or all of the method steps 401-405 that are described above. A computer program can thereby include instructions for performing the method steps 401-405 when the computer program is loaded into the processor circuit 520.

Figure 6 shows a measuring device 230A, 230B. The measuring device 230A, 230B is arranged so as to supply measurement results for adapting a control algorithm comprising at least one driver-dependent parameter, wherein the control algorithm governs a control system 250 for a vehicle convoy 200.

The measuring device 230A, 230B can comprise or at least partly consist of a blood pressure meter, pulse meter, moisture meter, thermometer, motion detector, microphone, voice analysis device, horn, mobile phone, portable computer, laptop computer, tablet computer, network computer, handheld computer or the like.

In order to provide measurement results for at least one driver-dependent physical parameter in a correct manner, the measuring device 230 comprises a number of components that are described in detail in the text below. It must however be noted that certain of the described secondary components occur in certain embodiments. It may further be noted that additional electronics in the measuring device 230A, 230B, which are not entirely necessary to understand the function of the measuring device 230A, 230B according to the invention, have not been depicted in Figure 6 in order to avoid making it more difficult to understand the invention.

The measuring device 230A, 230B comprises a detector 610 for measuring at least one physical characteristic of the driver 210A, 210B.

The detector 610 is further arranged so as to measure at least one of the following physical characteristics of the driver 210a, 210B: systolic blood pressure, diastolic blood pressure, pulse, cardiac minute volume, vascular resistance,

respiratory volume, respiratory rate, body temperature, skin temperature, blood adrenalin level, blood cortisol level, blood noradrenalin level, transpiration volume, amount of hand sweat exuded, electrical conductivity of the skin, eye movement, dilated nostrils, muscular tension, body movement, speech volume, voice strength and/or pupil size.

In certain embodiments the measuring device 230A, 230B can comprise a number of detectors 610, which are adapted so as to measure various physical characteristics of the driver 210A, 210B, i.e. of the characteristics enumerated above. Said detectors 610 can be disposed in a plurality of locations in the cab and/or on the driver 210A, 210B. To name one example, the vehicle steering wheel can contain a moisture detector, thermometer and/or measuring elements for electrical conductivity.

One advantage of measuring a plurality of physical characteristics of the driver 210A, 210B is that the reliability and/or sensitivity of the measurement increases. A change in a single one of the foregoing parameters can, of course, have a completely different non-stress-related cause in and of itself. For example, an elevated skin temperature on the part of the driver 210A, 210B could be the result of a malfunction of the heating system in the cab rather than of the driver 210A, 210B being on the way to an emotional outburst of rage. In the same way, for example, dilated pupils of the driver 210A, 210B may be attributable to an oncoming vehicle having failed to dim its high beams or having poorly adjusted headlights.

The measuring device 230A, 230B also comprises a communication module 630 arranged so as to communicate the measured value to a control unit 240A, 240B. The

communication module 630 is in turn arranged so as to communicate the measured value wirelessly or via cable to the control unit 240A, 240B and/or a data storage unit 260, in certain embodiments.

In certain embodiments the communication module 630 can consist of a separate transmitter and receiver. In certain embodiments the communication module 630 can consist of a transceiver that is adapted so as to transmit and receive radio signals, and wherein parts of the design, for example the antenna, are common to transmitter and receiver. The communication module 630 can further be adapted for wireless information transfer by means of radio waves, WLAN, Bluetooth or an infrared transmitter/receiver module. However, in certain embodiments the communication module 630 can be specially adapted for wireless information exchange with the control unit 240A, 240B and/or the data bus of the vehicle.

In certain embodiments the measuring device 230A, 230B is designed as a cuff, connectable to the arm or another body part of the driver. This makes it possible to measure, for example, the blood pressure, pulse, skin temperature, dermal electrical conductivity and/or transpiration volume of the driver easily and reliably.

In one embodiment the vehicle 220A, 220B cannot be started unless the driver 210A, 210B is wearing the measuring device 230A, 230B.

In certain embodiments the measuring device 230A, 230B is arranged so as to detect a level change in at least one measured physical characteristic of the driver 210A, 210B. The measuring device 230A, 230B can alternatively be adapted

so as to detect a level change per unit of time in at least one measured physical characteristic of the driver 210A, 210B.

Certain embodiments of the invention further comprise a system for adapting a control algorithm comprising at least one driver-dependent parameter, which control algorithm governs a control system 250 of a vehicle convoy 200. Said system comprises a measuring device 230A, 230B according to any of the embodiments described in connection with the presentation in Figure 6. The system also comprises a control unit 240A, 240B according to any of the embodiments described in connection with the presentation in Figure 5, which control unit is adapted so as to determine the stress level of the driver based on the performed measurement, and to adapt a control algorithm to the determined stress level of the driver.

Some embodiments of the invention further include a vehicle 220A, 220B that comprises the aforedescribed system 200.

Certain embodiments of the invention further include a vehicle convoy 200 that comprises at least two of the aforedescribed vehicles 220A, 220B.

According to certain alternative embodiments the vehicle 220A, 220B also comprises or is connectable to a unit for determining geographical position, such as a GPS module. This alternative unit is specially adapted so as to determine the present position of the vehicle and enables, for example, storage or marking in order to mark the location of a stress incident on the part of the driver 210A, 210B, optionally together with a time as well. The geographical positions and/or times of stress reactions on

the part of the driver 210A, 210B and/or a plurality of drivers can thereby be sent to and stored in the external data storage unit 260 for subsequent display. For example, a stress map can be drawn up based on this collected information, which map can be used in planning travel routes, or to warn the driver(s) 210A, 210B that he/she/they are passing into a high-stress area, based on its geographical position/direction of position change. Harmful stress situations can thereby be eliminated or at least mitigated.

According to certain alternative embodiments, feedback can be provided to the driver 210A, 210B in the event that an elevated stress level is detected on the part of the driver 210A, 210B in order to calm him. Such feedback can consist, for example of the playing of peaceful/relaxing music, an increase in the ventilation/air conditioning of the driver compartment with a view to reducing the temperature and increasing the oxygen supply, or the activation of a massage module built into the driver seat, which can have a pacifying effect on the mentally distraught driver 210A, 210B. The risk of stress-related injuries and/or potential accidents can be further reduced thereby.

It can further be shown that embodiments of the invention are applicable both during gear shifting for forward travel and gear shifting for backing the vehicle convoy 200. However, it may be advantageous in certain cases to activate the foregoing method only in connection with travel in the forward direction of the vehicle convoy in order to reduce the risk of triggering additional driver aggression in connection with backing or parallel parking. Furthermore, in certain embodiments the function according to the invention can be turned off selectively in connection with certain

maneuvers, such as during, for example, the forward travel of the vehicle convoy 200 in a shunting mode/maneuvering mode wherein the driver 210A, 210B often drives the vehicle convoy 200 at a very low velocity when, for example, approaching a loading dock or ferry.

The invention according to the foregoing certain embodiments has further been exemplified for a situation in which the driver 210A, 210B requests propulsive power via a driver-controllable acceleration element such as a gas pedal. The invention is, however, also applicable in cases where the driver 210A, 210B requests propulsive power in another way, such as by means of some driver-assistance system or other applicable control unit.

It can further be shown that the present invention can be used both in connection with pedal operation, i.e. wherein the driver 210A, 210B himself regulates the requests for engine torque, and in connection with driving with cruise control. The term pedal operation refers here and in this document to essentially all types of regulation adapted so as to regulate requests for torque, such as for example a gas pedal or manual accelerator device.

CLAIMS

1. A method (400) for adapting a control algorithm comprising at least one driver-dependent parameter, which control algorithm governs the control of a vehicle convoy (200) in which at least a first vehicle (220A) with a first driver (210A) and a second vehicle (220B) with a second driver (210B) are included, **characterized by:**

measurement (401) of at least one physical characteristic of the first driver (210A);

determination (402) of the stress level of the first driver based on the performed measurement (401); and

adjustment (403) of the control algorithm to the determined (402) stress level of the first driver, and wherein the control algorithm for the vehicle convoy (200) comprises the action of sending an indication of a stress alarm to other drivers (210B) of vehicles (220A, 220B) in the vehicle convoy (200) when the determined (402) stress level of the first driver exceeds a limit value.

2. A method (400) according to claim 1, wherein the measured physical characteristic of the first driver (210A) comprises at least one of: systolic blood pressure, diastolic blood pressure, pulse, cardiac minute volume, vascular resistance, respiratory volume, respiratory rate, body temperature, skin temperature, blood adrenalin level, blood cortisol level, blood noradrenalin level, transpiration volume, amount of hand sweat exuded, electrical conductivity of the skin, eye movement, dilated nostrils, muscular tension, body movement, speech volume, voice strength and/or pupil size.

3. A method (400) according to claim 1 or claim 2, wherein the measured (401) physical characteristic of the first driver (210A) comprises a level change or a level change per unit of time in at least one measured physical characteristic of said driver (210A).

4. A method (400) according to claims 1-3, wherein the determination (402) of the stress level of the first driver based on the performed measured (401) comprises a comparison between the measured value and a limit value.

5. A method (400) according to claims 1-4, wherein the adaptation (403) of the control algorithm comprises a reduction of the driver-dependent parameter value that is in proportion to the determined (402) stress level of the first driver.

6. A method (400) according to claims 1-5, wherein the adaptation (403) of the control algorithm comprises mapping of the determined (402) stress level of the first driver against a corresponding reduced parameter value and the insertion of said reduced parameter value into the control algorithm.

7. A method (400) according to claims 1-6, wherein the adaptation (403) of the control algorithm comprises the insertion of a time filter, wherein the length of the time delay is proportion to the determined (402) stress level of the first driver.

8. A method (400) according to claims 1-7, in which measurement (401) of at least one physical characteristic of the first driver (210A) is performed by a measuring device (230A) that is connectable to a body part of said driver (210A).

9. A method (400) according to claims 1-8 comprising, when the first driver (210A) is the lead vehicle of the vehicle convoy and the determined (402) stress level of said driver exceeds a limit value:

a transfer (404) of control of the vehicle convoy to another driver (210B) in the vehicle convoy (200).

10. A method (400) according to claims 1-9, wherein the control algorithm for the vehicle convoy (200) triggers an emergency stop of the vehicle convoy (200) when the determined (402) stress level of the first driver exceeds a limit value.

11. A method (400) according to claims 1-10, wherein the control algorithm for the vehicle convoy (200) increases the distance between the vehicles (220A, 220B) that are included in the vehicle convoy (200) when the determined (402) stress level of the first driver exceeds a limit value.

12. A method (400) according to claims 1-11, comprising:

the sending (405) of information about measurement results for each individual driver (210A, 210B) of the vehicles (220A, 220B) in the vehicle convoy (200) to a control system (250) that governs the control of the vehicle convoy (200) and/or to an external data storage unit (260) in order to enable health analyses of the drivers (210A, 210B) in the vehicle convoy (200).

13. A method (400) according to claims 1-12, wherein the control algorithm comprises at least one of:

a driver-dependent parameter from among: inclination of a gas pedal, inclination of a shift pedal, inclination of a brake pedal, change in inclination of the gas pedal,

change in inclination of the shift pedal, change in inclination of the brake pedal, change in inclination of the gas pedal per unit of time, change in inclination of the shift pedal per unit of time, change in inclination of the brake pedal per unit of time, steering wheel deflection and/or rate of change of steering wheel deflection; and/or

a driver-independent parameter from among: vehicle type, inclination of the vehicle (220A, 220B), vehicle weight, comfort level, engine rpm.

14. A computer program for adapting a control algorithm comprising at least one driver-dependent parameter, which control algorithm governs the control of a vehicle convoy (200) in which at least a first vehicle (220A) with a first driver (210A) and a second vehicle (220B) with a second driver (210B) are included, **characterized in that** said computer program performs the method (400) according to any of claims 1-13 when the computer program is executed in a processor circuit (520) in a control unit (240A).

15. A control unit (240A, 240B) for governing the control of a vehicle convoy (200) in which at least a first vehicle (220A) with a first driver (210A) and a second vehicle (220B) with a second driver (210B) are included, by means of an adaptable control algorithm, which control unit (240A, 240B) **is characterized by:**

a communication module (510) for receiving a measurement result from a measurement of at least one physical characteristic of the first driver (210A); and

a processor circuit (520) arranged so as to determine the stress level of the first driver based on the performed measurement, and also arranged so as to adapt the control algorithm to the determined stress level of the first driver.

16. A control unit (240A, 240B) according to claim 15, in which the measured physical characteristic of the first driver (210A) comprises at least one of: systolic blood pressure, diastolic blood pressure, pulse, cardiac minute volume, vascular resistance, respiratory volume, respiratory rate, body temperature, skin temperature, blood adrenalin level, blood cortisol level, blood noradrenalin level, transpiration volume, amount of hand sweat exuded, electrical conductivity of the skin, eye movement, dilated nostrils, muscular tension, body movement, speech volume, voice strength and/or pupil size.

17. A control unit (240A, 240B) according to any of claim 15 or claim 16, in which the measured physical characteristic of the first driver (210A) comprises a level change, or a level change per unit of time in at least one measured physical characteristic of said first driver (210A).

18. A control unit (240A, 240B) according to any of claims 15-17, in which the processor circuit (520) is arranged so as to determine the stress level of the first driver based on a comparison between the measured value and a limit value.

19. A control unit (240A, 240B) according to any of claims 15-18, in which the processor circuit (520) is arranged so as to reduce the driver-dependent parameter value in

proportion to the determined stress level of the first driver.

20. A control unit (240A, 240B) according to any of claims 15-19, in which the processor circuit (520) is arranged so as to map the determined stress level of the first driver against a corresponding reduced parameter value and insert said reduced parameter value into the control algorithm.

21. A control unit (240A, 240B) according to any of claims 15-20, in which the processor circuit (520) is arranged so as to insert a time filter, wherein the length of the time delay is in proportion to the determined stress level of the first driver.

22. A measuring device (230A, 230B) for governing the control of a vehicle convoy (200) in which at least a first vehicle (220A) with a first driver (210A) and a second vehicle (220B) with a second driver are included, by means of an adaptable control algorithm, which measuring device (230A, 230B) **is characterized by:**

a detector (610) for measuring at least one physical characteristic of the first driver (210A); and

a communication module (630) arranged so as to communicate the measured value to a control unit (240A, 240B).

23. A measuring device (230A, 230B) according to claim 22, in which the detector (610) is arranged so as to measure at least one of the following physical characteristics of the first driver (210A): systolic blood pressure, diastolic blood pressure, pulse, cardiac minute volume, vascular resistance, respiratory volume, respiratory rate, body

temperature, skin temperature, blood adrenalin level, blood cortisol level, blood noradrenalin level, transpiration volume, amount of hand sweat exuded, electrical conductivity of the skin, eye movement, dilated nostrils, muscular tension, body movement, speech volume, voice strength and/or pupil size.

24. A measuring device (230A, 230B) according to any of claim 22 or claim 23, wherein the measuring device (230A, 230B) is connectable to a body part of the driver (210A) and arranged so as to communicate the measured value wirelessly or via cable to the control unit (240A, 240B) and/or to an external storage unit (260).

25. A measuring device (230A, 230B) according to any of claims 22-24, adapted so as to detect a level change or level change per unit of time in at least one measured physical characteristic of the first driver (210A).

26. A system for adapting a control algorithm comprising at least one driver-dependent parameter, which control algorithm governs the control of a vehicle convoy (200) in which at least a first vehicle (220A) with a first driver (210A) and a second vehicle (220B) with a second driver (210B) are included, **characterized by:**

a measuring device (230A, 230B) according to any of claims 22-25, adapted so as to measure at least one physical characteristic of the first driver (210A);

a control unit (240A, 240B) according to any of claims 15-21, adapted so as to determine the stress level of the first driver based on the performed measurement, and to adapt the control algorithm to the determined stress level of the first driver.

27. A vehicle (220A, 220B) **characterized in that** it comprises a system according to claim 26.

28. A vehicle convoy (200) **characterized in that** it comprises at least two vehicles (220A, 220B) according to claim 27.

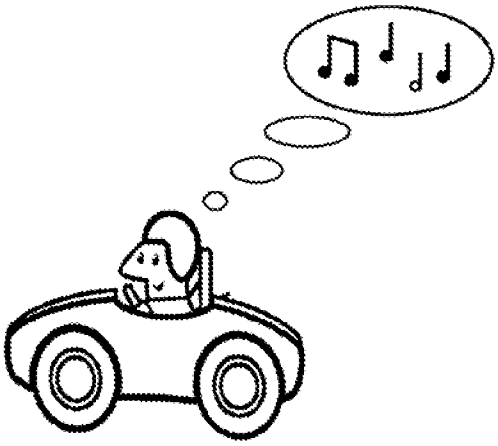


Fig. 1A (PRIOR ART)

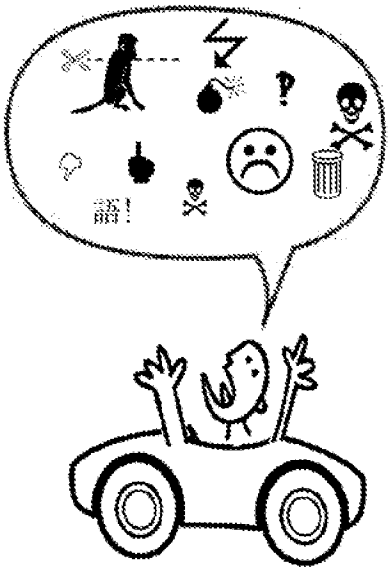


Fig. 1B (PRIOR ART)

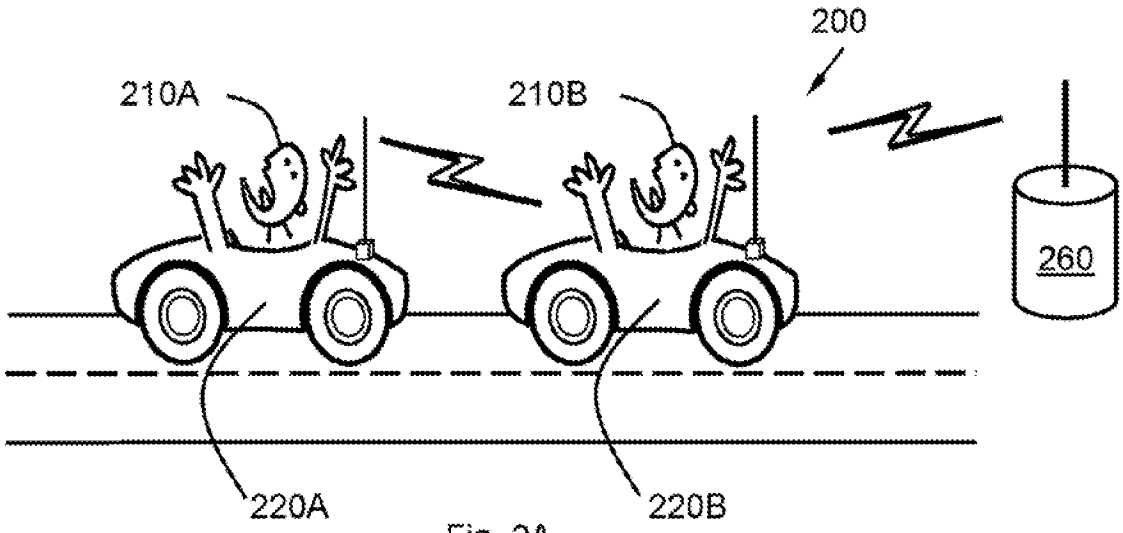

200
210A
210B
260
220A
220B

Fig. 2A

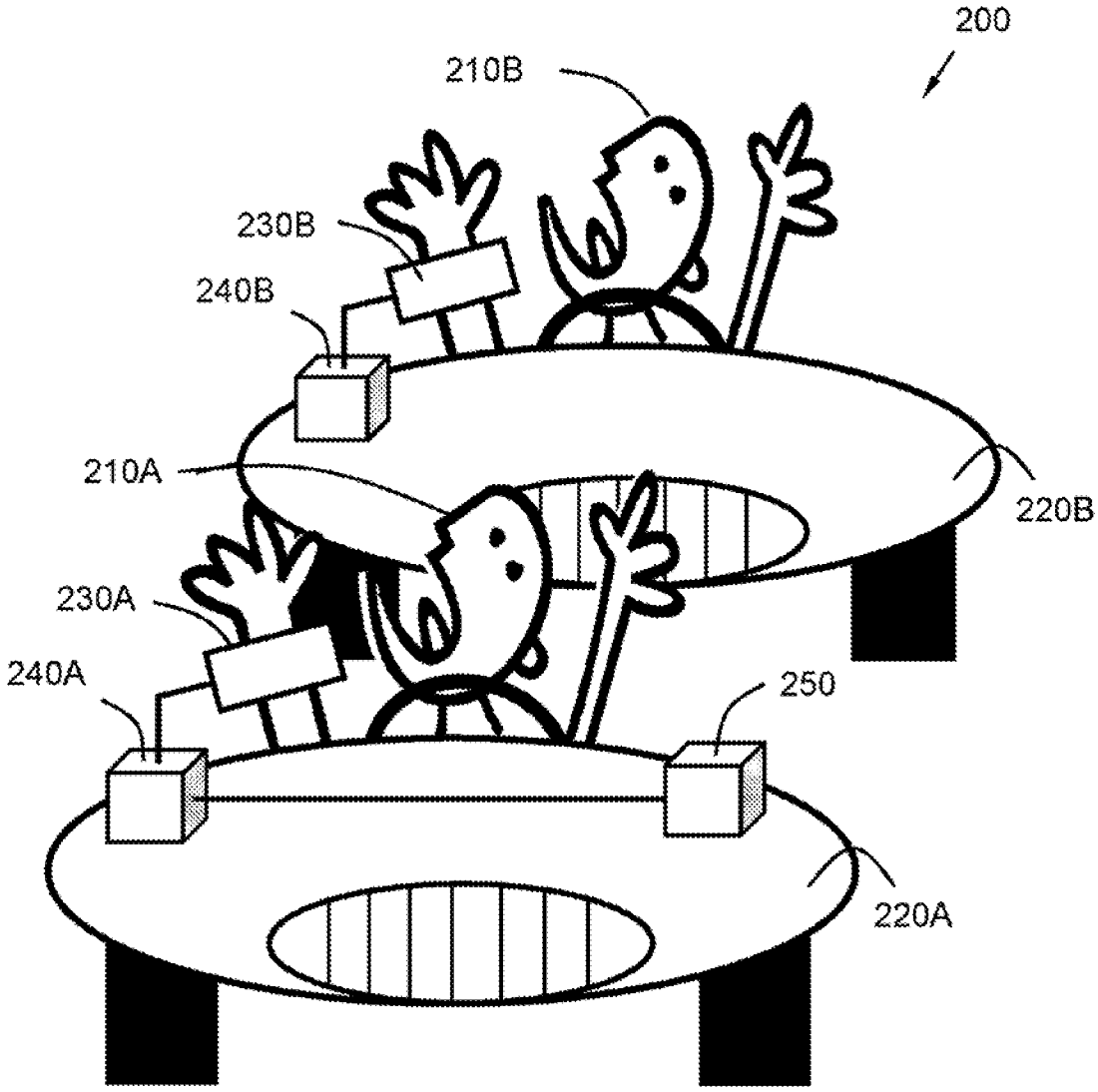

200
210B
230B
240B
210A
220B
230A
240A
250
220A

Fig. 2B

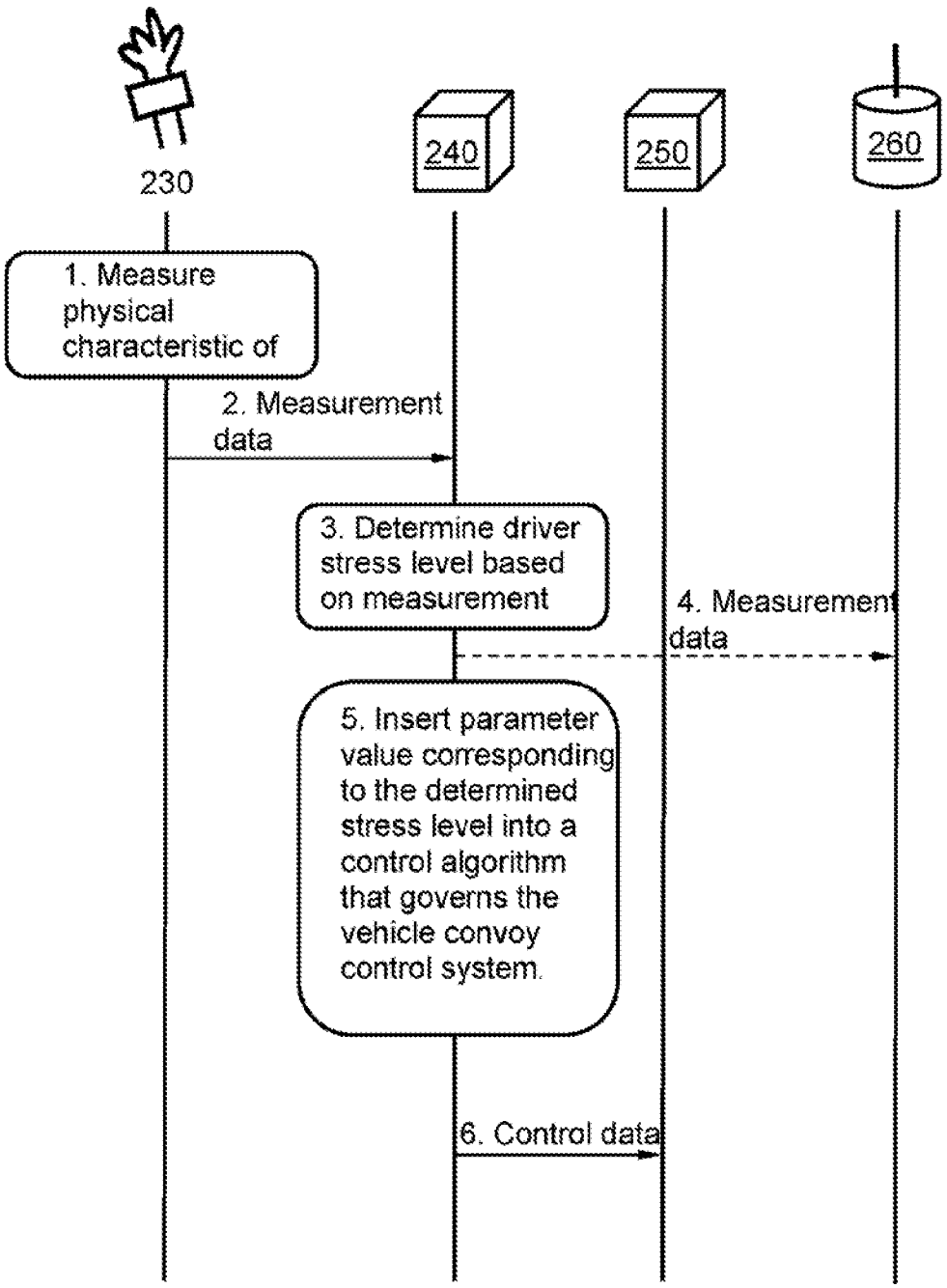

230
240
250
260
1. Measure physical characteristic of
2. Measurement data
3. Determine driver stress level based on measurement
4. Measurement data
5. Insert parameter value corresponding to the determined stress level into a control algorithm that governs the vehicle convoy control system.
6. Control data

Fig. 3

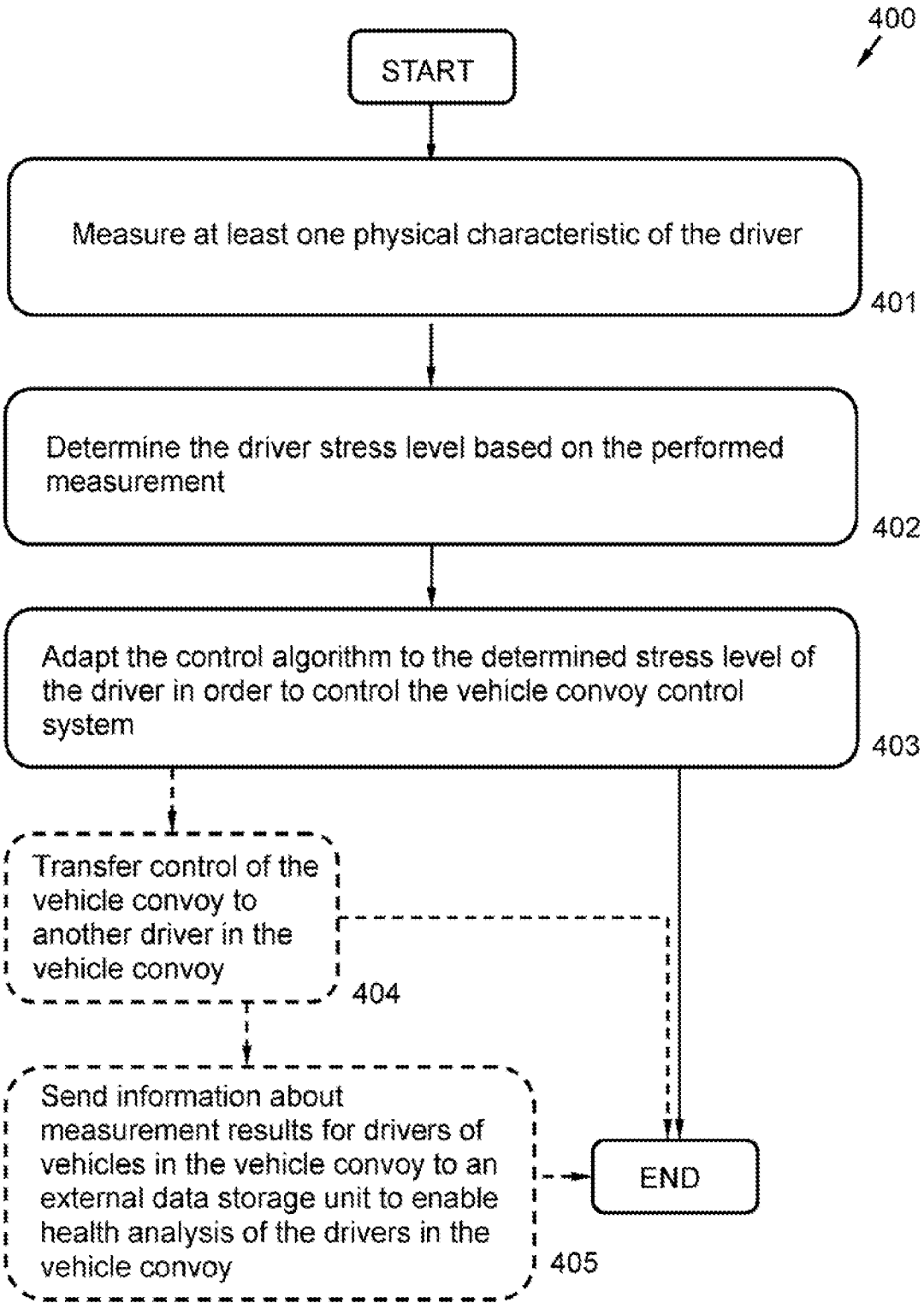

400
START
Measure at least one physical characteristic of the driver
401
Determine the driver stress level based on the performed measurement
402
Adapt the control algorithm to the determined stress level of the driver in order to control the vehicle convoy control system
403
Transfer control of the vehicle convoy to another driver in the vehicle convoy
404
Send information about measurement results for drivers of vehicles in the vehicle convoy to an external data storage unit to enable health analysis of the drivers in the vehicle convoy
405
END

Fig. 4

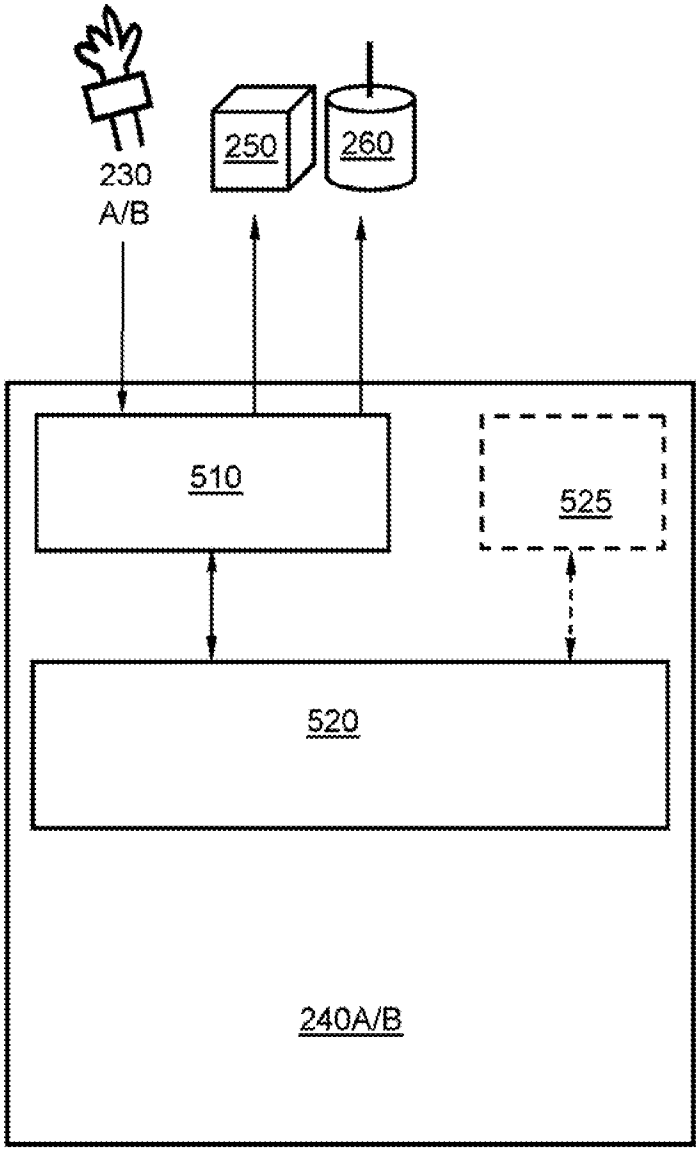


Fig. 5

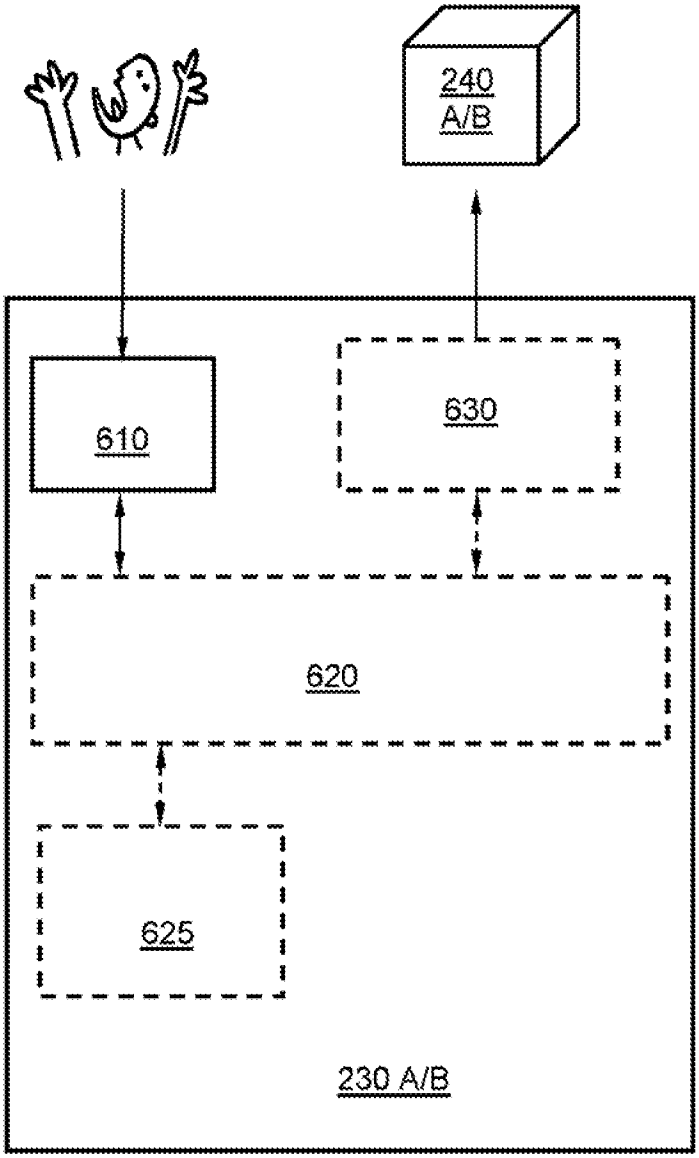


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/051094

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60W, B61L, G05D, G08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2012105889 A1 (SCANIA CV AB ET AL), 9 August 2012 (2012-08-09); abstract; page 7, line 6 - page 9, line 22	1-14
Y	--	15-28
A	US 5781119 A (YAMASHITA MASANOBU ET AL), 14 July 1998 (1998-07-14); paragraphs [0014]-[0026]	1-14
Y	--	15-28
A	US 20110224875 A1 (CUDDIHY MARK A ET AL), 15 September 2011 (2011-09-15); paragraphs [0022]-[0024]	1-28
	--	

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07-02-2014	07-02-2014
Name and mailing address of the ISA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Fredrik Wahlin Telephone No. + 46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 2009)

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2390744 A1 (VOLVO CAR CORP), 30 November 2011 (2011-11-30); paragraphs [0034]-[0048] --	1-28
A	US 20110224844 A1 (FARWELL MARK LALON ET AL), 15 September 2011 (2011-09-15); abstract -- --------	1-28

Continuation of: second sheet

International Patent Classification (IPC)

G05D 1/02 (2006.01)
B60W 30/16 (2012.01)
G08G 1/16 (2006.01)

WO	2012105889	A1	09/08/2012	CN	103403639	A	20/11/2013
				EP	2671124	A1	11/12/2013
				SE	1150075	A1	04/08/2012
US	5781119	A	14/07/1998	JP	8314541	A	29/11/1996
				JP	3191621	B2	23/07/2001
				JP	H08314541	A	29/11/1996
US	20110224875	A1	15/09/2011	NONE			
EP	2390744	A1	30/11/2011	CN	102906654	A	30/01/2013
				JP	2013534655	A	05/09/2013
				US	20130211624	A1	15/08/2013
				WO	2011151274	A1	08/12/2011
US	20110224844	A1	15/09/2011	US	8160809	B2	17/04/2012
				US	8086396	B1	27/12/2011

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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) Title: AUTOMATIC HANDOVER OF POSITIONING PARAMETERS FROM A NAVIGATION DEVICE TO A MOBILE DEVICE

(57) Abstract: Example methods, apparatuses, or articles of manufacture are disclosed herein that may be utilized, in whole or in part, to facilitate or support one or more operations or techniques for automatic or more dynamic handover of one or more positioning parameters from a navigation device, such as a personal navigation device (PND) co-located with a vehicle, for example, to a mobile communication device for use in or with a mobile communication device.

WO 2015/061633 A2

AUTOMATIC HANDOVER OF POSITIONING PARAMETERS FROM A NAVIGATION DEVICE TO A MOBILE DEVICE

RELATED APPLICATIONS

This is a PCT application claiming priority to U.S. Non-provisional Patent Application No. 14/063,688 filed on October 25, 2013 and entitled "AUTOMATIC HANDOVER OF POSITIONING PARAMETERS FROM A NAVIGATION DEVICE TO A MOBILE DEVICE" which is in its entirety incorporated herein by reference.

BACKGROUND

1. Field

[0001] The present disclosure relates generally to position or location estimations of mobile communication devices and, more particularly, to automatic or, at times, more dynamic handover of one or more positioning parameters from a navigation device to a mobile communication device for use in or with mobile communication devices.

2. Information

[0002] Mobile communication devices, such as, for example, cellular telephones, personal digital assistants, electronic book readers, portable navigation units, laptop computers, or the like are becoming more common every day. As geographic barriers to personal travel decrease, mobile communication devices play a role in allowing society to maintain its mobility. Continued advancements in information technology, communications, mobile applications, or the like help to contribute to a rapidly growing market for mobile communication devices, which have become ubiquitous and may already be

viewed as "extensions of the hand" altering the manner in which society communicates, does business, or creates value.

[0003] Certain mobile communication devices may, for example, feature a location-aware capability to assist users in estimating their geographic locations by providing position information obtained or gathered from various systems. For example, a mobile communication device may obtain a location estimate or so-called "position fix" by acquiring wireless signals from a satellite positioning system (SPS), such as the global positioning system (GPS) or other like Global Navigation Satellite System (GNSS), cellular base station, location beacon, or the like via a cellular telephone or other wireless communications network. Received wireless signals may, for example, be processed by or at a mobile communication device, and its location may be estimated using one or more appropriate techniques, such as, for example, Advanced Forward Link Trilateration (AFLT), base station identification, or the like.

[0004] Certain location-aware mobile communication devices, such as personal navigation devices (PNDs), for example, may feature a navigation capability so as to assist users in navigating or traveling to a location of interest by providing navigation instructions via a displayed electronic digital map, voice prompts, schematic pictograms, or the like. At times, a PND may comprise, for example, or be a part of an automotive navigation system. For example, an in-vehicle PND may be capable of overlaying its current location over a displayed street map so as to provide a user with a proposed route to a suitable destination along one or more designated or existing streets. An in-vehicle PND may also provide a user with additional context, frame of reference, or the like. For example, a displayed street map may show points of interest, such as gas stations, public parking, shopping malls, hotels, restaurants, etc.

[0005] At times, an in-vehicle PND may be capable of handling or processing vehicle-related information or functions, such as, for example, driving-related information, safety-related information, entertainment functionalities, or the like. Certain factory-embedded in-vehicle PNDs, however,

cannot be taken out of a vehicle or suitably operated as stand-alone devices, such as if a user desires to continue using such a PND while navigating on foot via a pre-planned route, for example. Thus, in some instances, a user may need to restart a positioning or navigation application on another mobile device, manually reenter a current or target location, download a new pedestrian navigation route, or the like. This may, for example, be inconvenient, time-consuming, or error-prone.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Non-limiting and non-exhaustive aspects are described with reference to the following figures, wherein like reference numerals refer to like parts throughout the various figures unless otherwise specified.

[0007] FIG. 1 is a schematic diagram illustrating features associated with an implementation of an example operating environment.

[0008] FIG. 2 is a flow diagram illustrating a summary of an implementation of an example process for automatic or more dynamic handover of one or more positioning parameters from a PND to a mobile device.

[0009] FIG. 3 is a schematic illustration of an implementation of an example use case of automatic or more dynamic handover of one or more positioning parameters from a PND to a mobile device.

[0010] FIG. 4 is a schematic diagram illustrating an implementation of an example computing environment associated with a PND.

[0011] FIG. 5 is a schematic diagram illustrating an implementation of an example computing environment associated with a server.

SUMMARY

[0012] Example implementations relate to automatic or more dynamic handover of one or more positioning parameters from a navigation device to a mobile communication device for use in or with a mobile communication device. In one implementation, a method may comprise executing one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and at a sub destination, handing over to a mobile device one or more positioning parameters to enable the mobile device to navigate movement of the mobile device from the sub destination to the final destination, the handing over is being triggered in response to a determination that the vehicle has parked.

[0013] In another implementation, an apparatus may comprise a communication interface to communicate with a mobile device; and at least one processor programmed with instructions to execute one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and at a sub destination, hand over to the mobile device one or more positioning parameters to enable the mobile device to navigate movement of the mobile device from the sub destination to the final destination, the handing over is being triggered in response to a determination that the vehicle has parked.

[0014] In yet another implementation, an apparatus may comprise means for executing one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and means for handing over to a mobile device, at a sub destination, one or more positioning parameters to enable the mobile device to navigate movement of the mobile device from the sub destination to the final destination, the handing over is being triggered in response to a determination that the vehicle has parked.

[0015] In yet another implementation, an article may comprise a non-transitory storage medium having instructions stored thereon executable by a special purpose computing platform to execute one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and at a sub destination, hand over to a mobile device one or more positioning parameters to enable the mobile device to navigate movement of the mobile device from the sub destination to the final destination, the handing over is being triggered in response to a determination that the vehicle has parked. It should be understood, however, that these are merely example implementations, and that claimed subject matter is not limited to these particular implementations.

DETAILED DESCRIPTION

[0016] In the following detailed description, numerous specific details are set forth to provide a thorough understanding of claimed subject matter. However, it will be understood by those skilled in the art that claimed subject matter may be practiced without these specific details. In other instances, methods, apparatuses, or systems that would be known by one of ordinary skill have not been described in detail so as not to obscure claimed subject matter.

[0017] Some example methods, apparatuses, or articles of manufacture are disclosed herein that may be implemented, in whole or in part, to facilitate or support one or more operations or techniques for automatic or more dynamic handover of one or more positioning parameters from a navigation device, such as an in-vehicle PND, for example, to a mobile communication device. As used herein, "mobile device," "mobile communication device," "location-aware mobile device," or the plural form of such terms may be used interchangeably and may refer to any kind of special purpose computing platform or apparatus that may from time to time have a position or location that changes. In some instances, a mobile communication device may, for example, be capable of communicating with other devices, mobile or otherwise, through wireless transmission or receipt of information according to one or more communication protocols. As a way of illustration, special purpose mobile communication devices, which may herein be called simply mobile devices, may include, for example, cellular telephones, smart telephones, personal digital assistants (PDAs), laptop computers, personal entertainment systems, tablet personal computers (PC), personal audio or video devices, personal navigation devices (PNDs), or the like. It should be appreciated, however, that these are merely examples of mobile devices that may be used, at least in part, to implement one or more operations or processes for generating a geofence via one or more techniques described herein, and that claimed subject matter is not limited in this regard. It should also be noted that the terms "position" and "location" may be used interchangeably herein.

[0018] As alluded to previously, an in-vehicle PND, such as a PND co-located with an automobile or vehicle, for example, may provide advantages over certain stand-alone PNDs. For example, at times, an in-vehicle PND may comprise a so-called "infotainment console" (e.g., all-in-one device, etc.) capable of handling or processing in-vehicle information, such as navigation information, driving-related information, safety information, vehicle performance information, entertainment functionalities, or the like. In-vehicle PND may also feature more robust electronic digital maps, bigger screens or displays, more superior GPS technology, or more sophisticated or customizable user interfaces than, for example, stand-alone PNDs. In addition, in-vehicle PNDs may rely less on cellular communications infrastructure, thus, reducing cellular network costs for a user, may provide an uninterrupted navigation experience (e.g., no incoming calls, etc.), and may reduce driver distraction by offering voice activated navigation. Of course, these are merely examples relating to in-vehicle PNDs, and claimed subject matter is not so limited. The terms "in-vehicle PND," "PND co-located with a vehicle," or simply "PND" may be used interchangeably herein and may refer to a device that may or may not be removable from a vehicle.

[0019] Typically, an in-vehicle PND may use GPS or other SPS technology to obtain periodic position fixes via a suitable positioning technique (e.g., trilateration, etc.). A PND may be programmed or inputted with a desired destination (e.g., by a user, etc.) and may plot obtained GPS position fixes in a trajectory over a displayed electronic digital map, such as to assist in navigating a vehicle to that destination, for example. Thus, a PND may comprise a receiver capable of acquiring wireless signals transmitted, for example, by SPS satellites and may employ one or more positioning parameters or assistance data, such as ephemeris data, satellite almanac data, time information, or the like to assist with navigation. An example of a PND that may be used, in whole or in part, to facilitate of support one or more processes or operation discussed herein will be described in greater detail below with reference to FIG. 4.

[0020] As was also indicated, in some instances, an in-vehicle PND may be capable of providing a user with additional context or information. For example, a PND may display locations or provide a list of available parking garages, lots, spots or spaces, etc. for a selected final destination, just to illustrate one possible implementation. To illustrate, a user may, for example, input or select a final destination via a PND on an electronic digital map, via drop-down menu, input fields, etc., and the PND may display or provide an option of navigating to one or more sub destinations, such as parking garages, lots, spaces, etc. nearby the final destination. As used herein, "final destination" may refer to an intended or desired end point of a navigation route or journey, for example, and "sub destination" may refer to a reference or way point in a suitable proximity to a final destination. By way of example but not limitation, a final destination may comprise, for example, a shopping mall or restaurant, and a sub destination may comprise, for example, a nearby parking garage or space. Claimed subject matter is not so limited, of course.

[0021] In some instances, such as if a user selects a displayed parking spot via an in-vehicle PND, for example, the PND may designate that parking spot as a final destination rather than as a sub destination. Once parked at a selected parking spot, then, a user may typically navigate to an actual final destination on foot. At times, a parking spot may be relatively far way from a final destination, for example, or the final destination may not be visible from the parking spot. As such, in some instances, it may be rather difficult for a pedestrian user to travel or navigate to a final destination from a sub destination, particularly if the final destination is hidden behind or obscured by buildings, flyovers, underpasses, or the like. Thus, at times, it may be useful for a pedestrian user to carry or employ a navigation device for a final leg of a journey. Certain in-vehicle PNDs, however, may not be removable from a vehicle (e.g., factory-embedded, etc.) or may have limited power resources (e.g., a shorter battery life, etc.) not be capable of longer or suitable stand-alone utilization.

[0022] Thus, at times, to continue navigating a final leg of a journey on foot, a user may start a pedestrian navigation application on another mobile device,

such as a smart telephone, for example, manually set or select a parking spot as a source destination, reenter a final destination, recalculate or accept a new or alternate pedestrian route, or the like. In this context, a smart telephone may refer to any suitable location-aware mobile device featuring a navigation or like capability, for example. Restarting a new application, reentering a final or sub destination, etc. may negatively impact user navigation experience, as previously mentioned. For example, an SPS receiver at a mobile device at a cold start may take more time to get an initial position fix, thus, affecting timing of an initial location estimate. In addition, quality of service of an SPS receiver may, for example, be compromised, battery life of a mobile device may be shortened, or the like. Accordingly, it may be desirable to develop one or more methods, systems, or apparatuses that may enable or otherwise improve navigation services, such as in connection with an in-vehicle PND, for example.

[0023] Thus, as will be described in greater detail below, in an implementation, a state of a vehicle and a final destination metric may be monitored or weighted, such as by an in-vehicle PND, for example. In some instances, a state of a vehicle may comprise, for example, information with respect to vehicle's direction or speed of travel, open position of vehicle's doors, just to name a few examples, and a final destination metric may include, for example, information with respect to a range of a PND to a final destination, geographic coordinates of a final destination, or the like. Weighted information may be combined in some manner, and a confidence-in-parking level representative of a determination that a vehicle has parked may, for example, be assessed. For example, in some instances, a confidence-in-parking level may be compared against a suitable threshold. Based, at least in part, on a confidence-in-parking level, handover of one or more positioning parameters form an in-vehicle PND to a mobile device, such as a smart telephone, for example, may be initiated or triggered.

[0024] As will also be seen, at times, handover of one or more positioning parameters from an in-vehicle PND to a suitable mobile device may be initiated or triggered automatically or, at times, more dynamically, such as with no or little

user input, for example, though claimed subject matter is not so limited. For example, in some instances, handover may be initiated or triggered in response to a user selection received at a user interface of an in-vehicle PND or mobile device (e.g., via a touch screen, voice command, etc.). Once handover is complete, a pedestrian navigation application may be launched or started, such as, for example, automatically on a mobile device capable of being carried by a user (e.g., a smart telephone, etc.). A pedestrian navigation application may, for example, provide navigation details for a final leg of a journey, thus, enabling a mobile device to navigate movement of an associated user from a sub destination to a final destination. As such, automatic or more dynamic handover of positioning parameters may facilitate or support more effective or efficient navigation, which may lead to a better user experience. As also discussed, in some instances, handover of one or more positioning parameters may be implemented in connection with a geofence, such as indicative of an acceptable walking distance to a final destination, for example.

[0025] FIG. 1 is a schematic diagram illustrating features associated with an implementation of an example operating environment 100 capable of facilitating or supporting one or more processes or operations for automatic or more dynamic handover of one or more positioning parameters from a navigation device, such as an in-vehicle PND 102a, for example, to a suitable mobile device 102b, such as a smart telephone, for example. It should be appreciated that operating environment 100 is described herein as a non-limiting example that may be implemented, in whole or in part, in the context of various communications networks or combination of networks, such as public networks (e.g., the Internet, the World Wide Web), private networks (e.g., intranets), wireless local area networks (WLAN), wireless wide area networks (WWAN), mobile ad-hoc networks (MANET), wireless mesh networks (WMN), wireless sensor networks (WSN), wireless personal area network (WPAN), or the like. Operating environment 100 may, for example, be communicatively enabled using one or more special purpose computing platforms, communication devices, information storage devices, databases, computer-readable codes or instructions, e-mail or text messaging information, specific applications or

functionalities, various electrical or electronic circuitry or components, etc., as described herein with reference to one or more example implementations.

[0026] As illustrated, operating environment 100 may comprise, for example, one or more satellites 104, base transceiver stations 106, wireless transmitters 108, etc. capable of communicating with PND 102a or mobile device 102b via wireless communication links 110 in accordance with one or more communication protocols. Satellites 104 may be associated with one or more satellite positioning systems (SPS), such as, for example, the United States Global Positioning System (GPS), the Russian GLONASS system, the European Galileo system, as well as any system that may utilize satellites from a combination of satellite systems, or any satellite system developed in the future. Base transceiver stations 106, wireless transmitters 108, etc. may be of the same or similar type, for example, or may represent different types of devices, such as access points, radio beacons, cellular base stations, femtocells, or the like, depending on an implementation. At times, one or more wireless transmitters, such as wireless transmitters 108, for example, may be capable of transmitting as well as receiving wireless signals.

[0027] In some instances, one or more base transceiver stations 106, wireless transmitters 108, etc. may, for example, be operatively coupled to a network 112 that may comprise one or more wired or wireless communications or computing networks or resources capable of providing suitable information, such as via one or more wireless communication links 114, 110, etc. Information may include, for example, one or more positioning parameters, navigation instructions or tasks, geofence-related parameters (e.g., a location, boundary, etc. of a geofence), estimated location of PND 102a or mobile device 102b (e.g., a GPS position fix, etc.), digital map-related information, or the like. At times, information may include, for example, geographic coordinates of a final destination or sub destination, ephemeris data, SPS almanac data, time estimate, proposed route from a sub destination to a final destination, etc., as will be seen.

[0028] Although not shown, at times, one or more wireless communication links may, for example, be established between PND 102a and mobile device 102b, such as to facilitate or support handover of one or more positioning parameters, for example, as discussed below. In some instances, one or more wireless communication links established between these devices may comprise, for example, peer-to-peer-type communication links. As used herein, "peer-to-peer-type communication link" may refer to one or more wireless signals that may be communicated directly between peer devices, such as, for example, without utilizing a cellular or like wireless communications network. As a way of illustration, one or more peer-to-peer-type communication links may be a part of a short-range wireless communications network, such as, for example, a Bluetooth®-type network, a Home Radio Frequency (RF)-type network, a ZigBee®-type network, an active Radio-Frequency Identification (RFID)-type network, an RF-type network (e.g., ultra-wide band (UWB), Wi-Fi, etc.), a Near Field Communication (NFC) -type network, etc., or any combination thereof. Of course, these are merely examples relating to wireless communication links, and claimed subject matter is not so limited. For example, in some instances, a cellular or like wireless communications network may be utilized, at least in part, to facilitate or support handover of one or more positioning parameters from PND 102a to mobile device 102b. At times, one or more positioning parameters may, for example, be handed over from PND 102a to mobile device 102b via a suitable wired communication link or connection (e.g., a cable, etc.), just to illustrate another possible implementation.

[0029] As was indicated, in some instances, PND 102a may employ a geofence bounding a region of interest within operating environment 100 so as to detect entries into or exits from the region in conjunction with one or more GPS or like GNSS position fixes obtained via a suitable positioning technique. The terms "GPS position fix," "GNSS position fix," "position fix," or the like may be used interchangeably herein. A geofence may comprise, for example, a virtual perimeter on a geographic area established in connection with a suitable location-based service (LBS), such that if PND 102a enters or exits the perimeter a notification is generated or provided. A notification may be provided

via an e-mail, text or voice message, or other communication and may comprise, for example, position fix of PND 102a, time of crossing a geofence boundary or so-called geofence breach, whether a geofence is breached from the inside or outside, or the like. Geofences are generally known and need not be described here in greater detail. As will be seen, in at least one implementation, detection of a geofence breach may, for example, be used, at least in part, to inform or notify a user of in-vehicle PND 102a that a vehicle (and the user) is within a walking distance of a final destination.

[0030] In an implementation, network 112 may be capable of facilitating or supporting communications between or among suitable computing platforms or devices, such as, for example, PND 102a, mobile device 102b, one or more satellites 104, base transceiver stations 106, wireless transmitters 108, etc., as well as one or more servers associated with operating environment 100. In some instances, servers may include, for example, a location server 116, geofence data server 118, as well as one or more other servers, indicated generally at 120 (e.g., navigation, information, map, etc. server), capable of facilitating or supporting one or more operations or processes associated with operating environment 100. Location server 116 may, for example, provide a position fix with respect to PND 102a or mobile device 102b, such as by acquiring wireless signals from satellites 104, base transceiver stations 106, wireless transmitters 108, etc. using one or more appropriate techniques (e.g., AFLT, etc.).

[0031] In some instances, location server 116 may provide positioning assistance data including, for example, one or more positioning parameters, such as ephemeris data, satellite almanac data, time information, etc. (e.g., via assisted GPS or GNSS, Secure User Plane Location (SUPL) protocol, etc.). Optionally or alternatively, one or more positioning parameters may, for example, be provided via one or more satellites 104, base transceiver stations 106, or the like. At times, location server 116 may provide geographic coordinates of a final destination or sub destination, for example. Geofence data server 118 may be used, at least in part, by PND 102a to obtain suitable

geofence-related information (e.g., a location, perimeter, etc. of a geofence) that may, for example, be used, at least in part, in connection with geofence breach detection. Server 120 may provide suitable navigation details, such as a proposed route, turn-by-turn instructions, etc., an electronic digital map, or other suitable information (e.g., street names, gas stations, public parking, etc.) for a vehicle's surrounding geographic location, final or sub destination, or the like.

[0032] It should be appreciated that even though a certain number or type of computing platforms or devices are illustrated herein, any number or type of computing platforms or devices may be implemented herein to facilitate or support one or more techniques or processes associated with operating environment 100. At times, network 112 may, for example, be coupled to one or more other wired or wireless communications networks (e.g., Wi-Fi, WLAN, WWAN, etc.) so as to enhance a coverage area for communications with PND 102a or mobile device 102b, one or more base transceiver stations 106, wireless transmitters 108, servers 116, 118, or 120, etc. For example, in some instances, network 112 may facilitate or support femtocell-based or like operative regions of coverage, just to illustrate one possible implementation. Again, operating environment 100 is merely an example, and claimed subject matter is not limited in this regard.

[0033] With this in mind, attention is now drawn to FIG. 2, which is a flow diagram illustrating an implementation of an example process 200 that may be performed, in whole or in part, to facilitate or support one or more operations or techniques for automatic or more dynamic handover of one or more positioning parameters from a navigation device, such as PND 102a of FIG. 1, for example, to a suitable mobile device, such as mobile device 102b of FIG. 1, for example. As was indicated, a suitable mobile device may comprise any location-aware mobile device featuring a navigation or like capability, such as a smart telephone, for example. It should be noted that information acquired or produced, such as, for example, input signals, output signals, operations, results, etc. associated with example process 200 may be represented via one or more digital signals. It should also be appreciated that even though one or

more operations are illustrated or described concurrently or with respect to a certain sequence, other sequences or concurrent operations may be employed. In addition, although the description below references particular aspects or features illustrated in certain other figures, one or more operations may be performed with other aspects or features.

[0034] Example process 200 may, for example, begin at operation 202 with executing one or more navigation applications to direct movement of a PND co-located with a vehicle (e.g., PND 102a of FIG. 1, etc.) to a final destination. As was indicated, a PND may be programmed or inputted with a desired final destination, such as by a user or driver of an associated vehicle, for example. An in-vehicle PND may, for example, execute a suitable navigation application so as to plot obtained GPS position fixes in a trajectory over a displayed electronic digital map using one or more appropriate techniques. The terms "user" and "driver" may be used interchangeably herein. A final destination may, for example, be programmed or inputted via a user interface of an in-vehicle PND, such as by making a selection on an electronic digital map, via a drop-down menu, input field, or the like. In some instances, such as if applicable or desired, along with selecting a final destination, a user may enable or activate a handover feature so as to facilitate or support handing over of one or more positioning parameters from a PND to a wirelessly connected mobile device (e.g., mobile device 102b of FIG. 1, etc.). For example, a handover feature may be enabled or activated via a user interface of an in-vehicle PND, just to illustrate one possible implementation. Claimed subject matter is not so limited, of course. In some instances, a handover feature may, for example, be enabled or activated without additional or specific user input, such as by simply selecting or choosing a final destination.

[0035] As previously mentioned, at times, an in-vehicle PND may display an indication (e.g., a map icon, text, etc.) of a parking garage or parking space nearby a final destination, for example, which a user may select or set as a sub destination, if available or otherwise useful. At times, an option of selecting a sub destination may not be useful, such as if the sub destination is located

outside of an acceptable walking distance to a final destination, for example. Thus, in some instances, a navigation application may employ or define a geofence, such as around a final destination, for example. In at least one implementation, a geofence may, for example, be defined as having a final destination at its center, though claimed subject matter is not so limited. At times, a range or perimeter of a geofence may be set by a user, for example, and may be dependent on a distance the user is willing to walk. As a way of illustration, a younger or more fit person may select a longer walking range to a final destination (e.g., 500 meters, etc.), for example, and an elderly or infirm user may select a shorter walking range (e.g., 100 meters, etc.). Again, claimed subject matter is not so limited.

[0036] For example, as illustrated in an implementation of an example use case or scenario 300 of FIG. 3, at the beginning of a navigation route or journey, indicated generally via an arrow at 302, a user of a PND co-located with a vehicle 304 may program or input a final destination 306, enable or activate a handover feature, etc., such as discussed above. In some instances, if applicable or useful, a user may also select a sub destination, such as a suitable parking space or spot among one or more parking spaces or spots 308 or 310, for example. As seen, at times, final destination 306 may not be visible, such as from parking spaces or spots 308 or 310 (e.g., obscured by flyovers, overpasses, etc.), for example. Optionally or alternatively, such as instead of selecting a particular parking spot via a PND, for example, or if such an option is not available or useful, a user may attempt to find a parking spot while in a sufficiently close proximity to final destination 306. As was indicated, for this purpose, a user may, for example, employ a geofence 312 with a virtual boundary that may be indicative of an acceptable walking distance to final destination 306. Thus, if vehicle 304 breaches geofence 312, an in-vehicle PND may, for example, provide a notification that a user is within an acceptable walking distance of final destination 306. Accordingly, a user may start looking for a place to park vehicle 304. It should be noted that even though a rectangular geofence is illustrated, any suitable type of a geofence (e.g., circular, three-dimensional, etc.) may be used, in whole or in part.

[0037] Since a breach of geofence 312 may indicate that a user of vehicle 304 is getting sufficiently close to final destination 306, in at least one implementation, handover of certain one or more positioning parameters (e.g., known, suitable, etc.) from a PND to a user's navigation-capable mobile device may, for example, be initiated or triggered. For example, here, handover of geographic coordinates of final destination 306, ephemeris data, SPS almanac data, or estimate of time may be triggered, such as automatically or without user input, though claimed subject matter is not so limited. As discussed above, here, any suitable wireless communication link (e.g., short-range, cellular, etc.) or wired link or connection (e.g., a cable, etc.) may be utilized, in whole or in part. In some instances, handover of one or more positioning parameters may, for example, be triggered in response to a user selection received at a user interface of an associated PND or mobile device, just to illustrate another possible implementation. Handover of one or more positioning parameters prior to reaching a sub destination may provide advantages. For example, timing of an initial position fix at a sub destination may be improved (e.g., no cold start, etc.), handover of other positioning parameters at a sub destination may be shortened (e.g., via reduced communications with an SPS or network, etc.), or the like. Of course, details relating to handover of positioning parameters or benefits are merely examples to which claimed subject matter is not limited. At times, handover of all or most suitable positioning parameters may, for example, be initiated or triggered at a sub destination, just to illustrate another possible implementation.

[0038] In some instances, such as at the time of a breach of geofence 312, for example, certain positioning parameters may not yet be known, suitable, or otherwise useful so as to be handed over to a user's mobile device. For example, a parking spot, such as 308 or 310, initially selected or otherwise, may be occupied by another vehicle, under construction, inaccessible, etc. As such, at times, there may be uncertainty regarding one or more positioning parameters, such as, for example, geographic coordinates of a sub destination (e.g., an actual parking spot is yet to be determined, etc.), a proposed route from a sub destination to a final destination, pedestrian navigation details, or the

like. To illustrate, for this example, at the time of a breach of geofence 312, depending on an availability of parking spots 308 or 310, a user may be unsure which pedestrian navigation route, such as 314 or 316, for example, to take to final destination 306. Accordingly, at times, to initiate or trigger handover of one or more positioning parameters, it may be useful to determine, such as with certain confidence, for example, that vehicle 304 has parked or is about to be parked at a sub destination.

[0039] Referring back to process 200 of FIG. 2, with regard to operation 204, at a sub destination, one or more positioning parameters may, for example, be handed over to a mobile device to enable the mobile device to navigate movement of the mobile device from the sub destination to the final destination, the handing over is being triggered in response to a determination that the vehicle has parked. For example, as previously mentioned, an in-vehicle PND may be capable of handling or processing information associated with a vehicle as well as final destination including on-board diagnostics data with parameters that may be representative of a state of the vehicle as well as one or more final destination metrics (e.g., via various events occurring in or at the vehicle, etc.). To illustrate, via communications with respective sensors, an in-vehicle PND may, for example, detect or determine that the PND is within a certain range to a final destination, that a parking brake of a vehicle has been applied, driver's or passenger's door has been opened, engine has been turned off, or the like. Particular examples of various states of a vehicle and final destination metrics will be described in greater detail below.

[0040] In an implementation, a determination that a vehicle has parked may, for example, be performed as part of or in connection with assessment of a confidence-in-parking level for the vehicle. As alluded to previously, in some instances, a confidence-in-parking level may indicate, such as with certain confidence, for example, that a vehicle has parked or is about to be parked at a sub destination. For example, a state of a vehicle and one or more final destination metrics may be weighted and combined to determine if a confidence-in-parking level meets some threshold. Likewise, here, on-board

diagnostics data with one or more parameters representative of various respective events occurring in or at an associated vehicle may be utilized, in whole or in part. By way of example but not limitation, in one particular simulation or experiment, parameters representative of various events included those listed below, though claimed subject matter is not so limited. As also illustrated, at times, a parameter may correspond to a predefined numerical value, such as a negative or positive numerical value, for example, and may be expressed via a percentage or any other suitable value. Thus, consider:

[0041] A set range of an in-vehicle PND to a final destination: + 20%. To illustrate, this parameter may be used, at least in part, if a vehicle is within 100, 200, etc. meters of a final destination, for example.

[0042] A set range of a vehicle to one or more of a traffic light and a traffic sign: (– 20%). To illustrate, this parameter may be represented via a negative value and may be used, at least in part, if a vehicle is within 10, 15, etc. meters of a traffic light, stop sign, stop light, etc., for example.

[0043] A reverse direction of travel of a vehicle: +20%. To illustrate, this parameter may be used, at least in part, if a vehicle has been driven in reverse for a short distance, such as 2 meters or less, for example, before stopping.

[0044] A low speed of travel of a vehicle: + 10%. To illustrate, this parameter may be used, at least in part, if a vehicle has been moving slower than 0.2 meters per second, for example.

[0045] A stationary state of a vehicle: + 30%. To illustrate, this parameter may be used, at least in part, if a vehicle has stopped outside of a 10 meter-range to a traffic light, stop sign, stop light, etc., for example (e.g., a speed is 0 meters per second).

[0046] A non-operational state of an engine of a vehicle: + 50%. To illustrate, this parameter may be used, at least in part, if a vehicle's engine has

been turned off, for example. Here, a battery-backed up or operated in-vehicle PND may be employed, if applicable.

[0047] An open position of a driver's door of a vehicle: + 40%. To illustrate, this parameter may be used, at least in part, if a front driver's door has been opened, for example.

[0048] An open position of a passenger's door of a vehicle: + 25%. To illustrate, this parameter may be used, at least in part, if any door of a vehicle other than a driver's door has been opened, for example.

[0049] An application of a parking brake of a vehicle: + 50%. To illustrate, this parameter may be used, at least in part, if a parking brake has been engaged or applied, for example. At times, a detection of an application of a parking brake alone may indicate, such as with sufficient confidence, for example, that an associated vehicle has been parked at a sub destination. As such, here, handover of one or more positioning parameters may, for example, be initiated or triggered. For example, geographic coordinates of a sub destination (e.g., an actual parking spot, etc.), a proposed route from a sub destination to a final destination, pedestrian navigation details, etc. may be handed over from a PND to a mobile device of a user. Optionally or alternatively, geographic coordinates of a final destination, ephemeris data, SPS almanac data, estimate of time, or like positioning parameters may also be handed over in response to a detection of an application of a parking brake (e.g., if not previously handed over). For purposes of explanation, a parking brake may comprise any suitable type of a brake, such as, for example, a hand-operated parking brake, a foot-operated parking brake, a voice-operated parking brake, a motion-operated parking brake, a remotely-operated parking brake, etc., or any combination thereof. As was indicated, as soon as handover of suitable positioning parameters is complete, a mobile device may, for example, automatically launch a pedestrian navigation application to enable the mobile device to navigate movement of the mobile device from a sub destination to a final destination. Of course, these are merely details relating to

handover of one or more positioning parameters in connection with a detection of an application of a parking brake, and claimed subject matter is not so limited. For example, if suitable or desired, in some instances, weighted parameters may be combined so as to further assess a confidence-in-parking level, as discussed below.

[0050] Thus, information representative of a state of a vehicle and one or more final destination metrics may be monitored or weighted, such as by determining whether such information satisfies at least one parameter corresponding to a predefined numerical value, such as illustrated above, for example. Weighted parameters may be combined and a confidence-in-parking level may be assessed, such as by comparing, for example, a sum or total of predefined numerical values of combined parameters against some threshold, just to illustrate one possible implementation. If a confidence-in-parking level meets a threshold, it may be inferred, such as with certain confidence, for example, that an associated vehicle has parked or is about to be parked at a sub destination. A threshold may be determined, at least in part, experimentally and may be pre-defined or configured, for example, or otherwise dynamically defined in some manner depending on a particular vehicle, PND, or the like. By way of example but not limitation, in one particular simulation or experiment, it appeared that a threshold in a range between 80% and 90% may prove beneficial for assessing a confidence-in-parking level.

[0051] As a way of illustration, if it is detected that a vehicle, while within a set range to a final destination, has been driven at a low speed, has been reversed for a short distance, and then stopped outside of a 10 meter-range to a traffic light, stop sign, stop light, etc, it may be inferred, such as with certain confidence, for example, that the vehicle has parked or is about to be parked, or:

$$20\% + 10\% + 20\% + 30\% = 80\% \text{ (threshold)}$$

[0052] Accordingly, here, handover of one or more positioning parameters may be initiated or triggered, such as discussed above, for example. One or more positioning parameters may, for example, enable a mobile device to navigate movement of the mobile device from a sub destination (e.g., parking spot 308, 310, etc. of FIG. 3, etc.) to a final destination (e.g., final destination 306 of FIG. 3, etc.). In some instances, one or more positioning parameters that have been handed over prior to reaching a sub destination (e.g., at the time of a geofence breach, etc.) may be updated based, at least in part, on an assessed confidence-in-parking level. Updated parameters may be utilized, in whole or in part, to refine a position fix, offer a better or alternate pedestrian navigation route, or the like. In some instances, handover of one or more positioning parameters may, for example, be terminated if it is detected or determined that a vehicle has exited a certain range (e.g., set via a geofence, etc.) to a final destination (e.g., a change of plans, etc.).

[0053] As another illustration, if it is detected, however, that a vehicle, while within a set range to a final destination, has been driven at a low speed, stopped within 10 meters of a traffic light, stop sign, stop light, etc., and a passenger door has been opened, it may be determined that a threshold for a confidence-in-parking level for the vehicle has not been met, or:

$$20\% + 10\% + (-20\%) + 25\% \approx 35\% \text{ (threshold)}$$

[0054] This scenario may, for example, indicate that a passenger of a vehicle may have been picked up or dropped off (e.g., to get a seat at a movie theater, table at a restaurant, etc.), for example, rather than that the vehicle has parked or is about to be parked at a sub destination, just to illustrate one possibility. Thus, for this example, since a threshold has not been met, triggering or initiating handover of one or more positioning parameters may not be suitable or otherwise useful. As such, a PND may, for example, reset assessment of a confidence-in-parking level, such as to monitor for future events occurring in or at an associated vehicle. Events may be monitored, such as to assess a confidence-in-parking level, for example, periodically, with

certain time intervals, or otherwise as suitable or desired. Of course, details relating to assessment of a confidence-in-parking level, parameters, or threshold are intended as merely examples to which claimed subject matter is not limited. It should be appreciated that, virtually without limit, any of a variety of possible other statistical measures or metrics may be utilized to assess a confidence-in-parking level, such as, for example, a median, a mean, a mode, a percentile of mean, a number of instances, a ratio, a rate, a frequency, an entropy, mutual information, a division, a difference, etc., or any combination thereof.

[0055] Continuing with process 200 of FIG. 2, at operation 206, geographic coordinates of a sub destination (e.g., a location of a parking spot, etc.) may, for example, be maintained in some manner or stored in memory of a PND, mobile device, or any combination thereof. For example, a parking spot may be stored on a mobile device as a "favorite location," just to illustrate one possible implementation. As indicated at operation 208, maintained or stored geographic coordinates of a sub destination may be subsequently accessed to enable a mobile device to navigate movement of the mobile device from a final destination (e.g., final destination 306 of FIG. 3, etc.) to a sub destination (e.g., parking spot 308, 310, etc. of FIG. 3, etc.). For example, upon suitable user input, a navigation application may be launched on a mobile device associated with a user so as to provide navigation instructions to allow the user to easily return back a vehicle via a pedestrian navigation route (e.g., route 314, 316, etc. of FIG. 3, etc.).

[0056] FIG. 4 is a schematic diagram illustrating an implementation of an example computing environment 400 that may include one or more mobile devices capable of partially or substantially implementing or supporting one or more operations or processes for automatic or more dynamic handover of one or more positioning parameters from a PND to a mobile device, such as capable of being employed by a pedestrian user, for example. As previously mentioned, one or more mobile devices of FIG. 4 may comprise an in-vehicle PND, location-aware mobile device featuring a navigation capability, such as smart

telephone, for example, or the like. It should be appreciated that all or part of various devices shown in computing environment 400, processes, or methods, as described herein, may be implemented using various hardware, firmware, or any combination thereof along with software.

[0057] Example computing environment 400 may comprise, for example, a mobile device 402 that may include one or more features or aspects of in-vehicle PND 102a of FIG. 1, though claimed subject matter is not so limited. For example, mobile device 402 may be capable of communicating with one or more other devices, mobile or otherwise, via a cellular telephone network, the Internet, mobile ad-hoc network, wireless sensor network, satellite or like network, or the like. In an implementation, mobile device 402 may be representative of any electronic or computing device, machine, appliance, or platform that may be capable of exchanging information over any suitable network. For example, mobile device 402 may include one or more computing devices or platforms associated with, for example, cellular telephones, satellite telephones, smart telephones, personal digital assistants (PDAs), laptop computers, personal entertainment systems, e-book readers, tablet personal computers (PC), personal audio or video devices, personal navigation devices, or the like. In certain example implementations, mobile device 402 may take the form of one or more integrated circuits, circuit boards, or the like that may be operatively enabled for use in another device. Thus, unless stated otherwise, to simplify discussion, various functionalities, elements, components, etc. are described below with reference to mobile device 402 may also be applicable to other devices not shown so as to support one or more processes associated with example computing environment 400.

[0058] Although not shown, optionally or alternatively, there may be additional devices, mobile or otherwise, communicatively coupled to mobile device 402 to facilitate or otherwise support one or more processes associated with computing environment 400, such as discussed above. For example, computing environment 400 may include various computing or communication resources or devices capable of obtaining all or part of suitable position or

location information, geofence-related information, navigation-related information, driving-related information, safety information, vehicle performance information, etc. based, at least in part, on one or more wireless signals associated with a positioning system, location-based service, cellular or like communications network, or the like. Location information may, for example, be stored in some manner in memory 404 along with other suitable or desired information, such as one or more parameters for a geofence or vehicle, positioning parameters, thresholds, predefined numerical values, or the like.

[0059] Memory 404 may represent any suitable information storage medium. For example, memory 404 may include a primary memory 406 and a secondary memory 408. Primary memory 406 may include, for example, a random access memory, read only memory, etc. While illustrated in this example as being separate from a processing unit 410, it should be appreciated that all or part of primary memory 406 may be provided within or otherwise co-located/coupled with processing unit 410. Secondary memory 408 may include, for example, the same or similar type of memory as primary memory or one or more information storage devices or systems, such as, for example, a disk drive, an optical disc drive, a tape drive, a solid state memory drive, etc. In certain implementations, secondary memory 408 may be operatively receptive of, or otherwise enabled to be coupled to, a computer-readable medium 412.

[0060] Computer-readable medium 412 may include, for example, any medium that may store or provide access to information, code or instructions (e.g., an article of manufacture, etc.) for one or more devices associated with computing environment 400. For example, computer-readable medium 412 may be provided or accessed by processing unit 410. As such, in certain example implementations, the methods or apparatuses may take the form, in whole or part, of a computer-readable medium that may include computer-implementable instructions stored thereon, which may be executed by at least one processing unit or other like circuitry so as to enable processing unit 410 or the other like circuitry to perform all or portions of a location determination processes, executing navigation applications, or any processes to facilitate or

support one or more operations or techniques discussed herein. In certain example implementations, processing unit 410 may be capable of performing or supporting other functions, such as geofence breach detection, communications, video gaming, or the like.

[0061] It should be understood that a storage medium, such as memory 404, computer-readable medium 412, etc. may typically, although not necessarily, be non-transitory or may comprise a non-transitory device. In this context, a non-transitory storage medium may include, for example, a device that is physical or tangible, meaning that the device has a concrete physical form, although the device may change state. For example, one or more electrical binary digital signals representative of information, in whole or in part, in the form of zeros may change a state to represent information, in whole or in part, as binary digital electrical signals in the form of ones, to illustrate one possible implementation. As such, "non-transitory" may refer, for example, to any medium or device remaining tangible despite this change in state.

[0062] Processing unit 410 may be implemented in hardware or a combination of hardware and software. Processing unit 410 may be representative of one or more circuits capable of performing at least a portion of information computing technique or process. By way of example but not limitation, processing unit 410 may include one or more processors, controllers, microprocessors, microcontrollers, application specific integrated circuits, digital signal processors, programmable logic devices, field programmable gate arrays, or the like, or any combination thereof. Thus, at times, processing unit 410 may comprise, for example, or be representative of means for executing one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and means for handing over to a mobile device, at a sub destination, one or more positioning parameters to enable the mobile device to navigate movement of the mobile device from the sub destination to the final destination, the handing over is being triggered in response to a determination that the vehicle has parked, such as discussed above with respect to various example implementations. In some

instances, processing unit 410 may comprise, for example, or be representative of means for maintaining geographic coordinates of a sub destination in memory of a PND or mobile device. In at least one implementation, processing unit 410 may comprise, for example, or be representative of means for accessing maintained geographic coordinates of a sub destination to enable a mobile device to navigate movement of the mobile device from a final destination to the sub destination.

[0063] Mobile device 402 may include various sensors, components, or circuitry, such as, for example, an SPS receiver 414 capable of acquiring wireless signals from a satellite positioning system (SPS), such as the global positioning system (GPS) or other like Global Navigation Satellite System (GNSS), cellular base station, location beacon, or the like. Mobile device 402 may include one or more other sensors 416, such as, for example, an accelerometer, magnetometer, ambient light detector, camera imager, microphone, temperature sensor, atmospheric pressure sensor, etc. to facilitate or otherwise support one or more processes associated with computing environment 400. For example, one or more of sensors 416 may provide analog or digital signals to processing unit 410. Sensors 416 may also include a location-tracking unit that may initiate a position fix of mobile device 402, such as with respect to a sub destination, final destination, geofence, etc., based, at least in part, on one or more received or acquired wireless signals, such as from an SPS, cellular or like communications network, or the like. In some implementations, a location-tracking unit may be at least partially integrated with a suitable processing unit, such as processing unit 410, for example, though claimed subject matter is not so limited.

[0064] Mobile device 402 may include one or more connections 418 (e.g., buses, lines, conductors, optic fibers, etc.) to operatively couple various circuits together, and a user interface 420 (e.g., display, touch screen, keypad, buttons, knobs, microphone, speaker, trackball, information port, etc.) to receive user input, facilitate or support programming or inputting a final or sub destination, defining a geofence, provide information to a user (e.g., a notification, etc.), or

the like. Mobile device 402 may further include a communication interface 422 (e.g., wireless transmitter or receiver, modem, antenna, etc.) to allow for communication with one or more other devices or systems over one or more suitable communications networks, as was also indicated. Although not shown, it should be noted that mobile device 402 may include an analog-to-digital converter (ADC) for digitizing analog signals, such as from appropriate buffers, sensors, components, etc. Optionally or alternatively, such buffers, sensors, components, etc. may include a designated (e.g., an internal, etc.) ADC(s) to digitize applicable signals, although claimed subject matter is not so limited.

[0065] In an implementation, mobile device 402 may include a power source 424 to provide power to some or all of the sensors, components, or circuitry. Power source 424 may be a portable power source, such as a battery, for example, or may comprise a fixed power source, such as an outlet (e.g. in a house, electric charging station, etc.) or connection (e.g., wired, factory-embedded, etc.). It should be appreciated that power source 424 may be integrated into (e.g., built-in, etc.) or supported by (e.g., stand-alone, etc.) mobile device 402. Although not shown, mobile device 402 may also include a memory or information buffer to collect suitable or desired information, such as, for example, one or more positioning parameters, information representative of a state of a vehicle or one or more final destination metrics, geofence or vehicle-related parameters, predefined numerical values, or the like.

[0066] FIG. 5 is a schematic diagram illustrating an implementation of an example computing environment 500 that may include one or more servers or other devices capable of partially or substantially implementing or supporting one or more operations or processes for automatic or more dynamic handover of one or more positioning parameters from a navigation device, such as an in-vehicle PND, for example, to a mobile device, such as discussed above in connection with FIGS. 1-3, for example. Computing environment 500 may include, for example, a first device 502, a second device 504, a third device 506, etc., which may be operatively coupled together via a communications network 508.

[0067] First device 502, second device 504, or third device 506 may be representative of any device, appliance, platform, or machine that may be capable of exchanging information over communications network 508. By way of example but not limitation, any of first device 502, second device 504, or third device 506 may include: one or more computing devices or platforms, such as, for example, a desktop computer, a laptop computer, a workstation, a server device, or the like; one or more personal computing or communication devices or appliances, such as, for example, a personal digital assistant, mobile communication device, or the like; a computing system or associated service provider capability, such as, for example, a database or information storage service provider/system, a network service provider/system, an Internet or intranet service provider/system, a portal or search engine service provider/system, a wireless communication service provider/system; or any combination thereof. Any of first, second, or third devices 502, 504, and 506, respectively, may comprise one or more of a mobile device, wireless transmitter or receiver, server, etc. in accordance with example implementations described herein.

[0068] In an implementation, communications network 508 may be representative of one or more communication links, processes, or resources capable of supporting an exchange of information between at least two of first device 502, second device 504, or third device 506. By way of example but not limitation, communications network 508 may include wireless or wired communication links, telephone or telecommunications systems, information buses or channels, optical fibers, terrestrial or space vehicle resources, local area networks, wide area networks, intranets, the Internet, routers or switches, and the like, or any combination thereof. As illustrated, for example, via a dashed lined box partially obscured by third device 506, there may be additional or like devices operatively coupled to communications network 508, mobile or otherwise. It is also recognized that all or part of various devices or networks shown in computing environment 500, or processes or methods, as described herein, may be implemented using or otherwise including hardware, firmware, software, or any combination thereof.

[0069] By way of example but not limitation, second device 504 may include at least one processing unit 510 that may be operatively coupled to a memory 512 via a bus 514. Processing unit 510 may be representative of one or more circuits capable of performing at least a portion of a suitable computing procedure or process. For example, processing unit 510 may include one or more processors, controllers, microprocessors, microcontrollers, application specific integrated circuits, digital signal processors, programmable logic devices, field programmable gate arrays, or the like, or any combination thereof. Although not shown, second device 504 may include a location-tracking unit that may initiate a position fix of a suitable mobile device, such as a PND, for example, based, at least in part, on one or more received or acquitted wireless signals, such as from an SPS, cellular or like wireless communications network, or the like. In some implementations, a location-tracking unit may be at least partially integrated with a suitable processing unit, such as processing unit 510, for example, though claimed subject matter is not so limited. In certain server-based or server-supported implementations, processing unit 510 may comprise, for example, or be representative of means for executing one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and means for handing over to a mobile device, at a sub destination, one or more positioning parameters to enable the mobile device to navigate movement of the mobile device from the sub destination to the final destination, the handing over is being triggered in response to a determination that the vehicle has parked, as illustrated in or described with respect to operations 202-204 of FIG. 2. In some instances, processing unit 510 may comprise, for example, or be representative of means for maintaining geographic coordinates of a sub destination in memory of a PND or mobile device, as illustrated via operation 206 of FIG. 2. In at least one implementation, processing unit 510 may comprise, for example, or be representative of means for accessing maintained geographic coordinates of a sub destination to enable a mobile device to navigate movement of the mobile device from a final destination to the sub destination, as illustrated in or described at operation 208 of FIG. 2.

[0070] Memory 512 may be representative of any information storage mechanism or appliance. Memory 512 may include, for example, a primary memory 516 and a secondary memory 518. Primary memory 516 may include, for example, a random access memory, read only memory, etc. While illustrated in this example as being separate from processing unit 510, it should be understood that all or part of primary memory 516 may be provided within or otherwise co-located/coupled with processing unit 510. Secondary memory 518 may include, for example, same or similar type of memory as primary memory or one or more information storage devices or systems, such as, for example, a disk drive, an optical disc drive, a tape drive, a solid state memory drive, etc. In certain implementations, secondary memory 518 may be operatively receptive of, or otherwise configurable to couple to, a computer-readable medium 520. Computer-readable medium 520 may include, for example, any non-transitory storage medium that may carry or make accessible information, code, or instructions for one or more of devices in computing environment 500. Computer-readable medium 520 may also be referred to as a storage medium.

[0071] Second device 504 may include, for example, a communication interface 522 that may provide for or otherwise support an operative coupling of second device 504 to at least communications network 508. By way of example but not limitation, communication interface 522 may include a network interface device or card, a modem, a router, a switch, a transceiver, and the like. Second device 504 may also include, for example, an input/output device 524. Input/output device 524 may be representative of one or more devices or features that may be configurable to accept or otherwise introduce human or machine inputs, or one or more devices or features that may be capable of delivering or otherwise providing for human or machine outputs. By way of example but not limitation, input/output device 524 may include an operatively configured display, speaker, keyboard, mouse, trackball, touch screen, information port, or the like.

[0072] Methodologies described herein may be implemented by various means depending upon applications according to particular features or

examples. For example, such methodologies may be implemented in hardware, firmware, software, discrete/fixed logic circuitry, any combination thereof, and so forth. In a hardware or logic circuitry implementation, for example, a processing unit may be implemented within one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), processors, controllers, micro-controllers, microprocessors, electronic devices, other devices or units designed to perform the functions described herein, or combinations thereof, just to name a few examples.

[0073] For a firmware or software implementation, the methodologies may be implemented with modules (e.g., procedures, functions, etc.) having instructions that perform functions described herein. Any machine readable medium tangibly embodying instructions may be used in implementing methodologies described herein. For example, software codes may be stored in a memory and executed by a processor. Memory may be implemented within the processor or external to the processor. As used herein the term "memory" refers to any type of long term, short term, volatile, nonvolatile, or other memory and is not to be limited to any particular type of memory or number of memories, or type of media upon which memory is stored. In at least some implementations, one or more portions of the herein described storage media may store signals representative of information as expressed by a particular state of the storage media. For example, an electronic signal representative of information may be "stored" in a portion of the storage media (e.g., memory) by affecting or changing the state of such portions of the storage media to represent information as binary information (e.g., via ones and zeros). As such, in a particular implementation, such a change of state of the portion of the storage media to store a signal representative of information constitutes a transformation of storage media to a different state or thing.

[0074] As was indicated, in one or more example implementations, the functions described may be implemented in hardware, software, firmware, discrete/fixed logic circuitry, some combination thereof, and so forth. If

implemented in software, the functions may be stored on a physical computer-readable medium as one or more instructions or code. Computer-readable media include physical computer storage media. A storage medium may be any available physical medium that may be accessed by a computer. By way of example, and not limitation, such computer-readable media may comprise RAM, ROM, EEPROM, CD-ROM or other optical disc storage, magnetic disk storage or other magnetic storage devices, or any other medium that may be used to store desired program code in the form of instructions or information structures and that may be accessed by a computer or processor thereof. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blue-ray disc where disks usually reproduce information magnetically, while discs reproduce information optically with lasers.

[0075] As discussed above, a mobile device may be capable of communicating with one or more other devices via wireless transmission or receipt of information over various communications networks using one or more wireless communication techniques. Here, for example, wireless communication techniques may be implemented using a wireless wide area network (WWAN), a wireless local area network (WLAN),a wireless personal area network (WPAN), or the like. The term "network" and "system" may be used interchangeably herein. A WWAN may be a Code Division Multiple Access (CDMA) network, a Time Division Multiple Access (TDMA) network, a Frequency Division Multiple Access (FDMA) network, an Orthogonal Frequency Division Multiple Access (OFDMA) network, a Single-Carrier Frequency Division Multiple Access (SC-FDMA) network, a Long Term Evolution (LTE) network, a WiMAX (IEEE 802.16) network, and so on. A CDMA network may implement one or more radio access technologies (RATs) such as cdma2000, Wideband-CDMA (W-CDMA), Time Division Synchronous Code Division Multiple Access (TD-SCDMA), to name just a few radio technologies. Here, cdma2000 may include technologies implemented according to IS-95, IS-2000, and IS-856 standards. A TDMA network may implement Global System for Mobile Communications (GSM), Digital Advanced Mobile Phone System (D-AMPS), or

some other RAT. GSM and W-CDMA are described in documents from a consortium named "3rdGeneration Partnership Project" (3GPP). Cdma2000 is described in documents from a consortium named "3rd Generation Partnership Project 2"(3GPP2). 3GPP and 3GPP2 documents are publicly available. A WLAN may include an IEEE 802.11x network, and a WPAN may include a Bluetooth network, an IEEE 802.15x, or some other type of network, for example. The techniques may also be implemented in conjunction with any combination of WWAN, WLAN, or WPAN. Wireless communication networks may include so-called next generation technologies (e.g., "4G"), such as, for example, Long Term Evolution (LTE), Advanced LTE, WiMAX, Ultra Mobile Broadband (UMB), or the like.

[0076] In an implementation, a mobile device may, for example, be capable of communicating with one or more femtocells, such as for the purpose of estimating its location, handing over one or more positioning parameters, detecting a geofence breach, communicating with a suitable server, or the like. As used herein, "femtocell" may refer to one or more smaller-size cellular base stations that may be capable of detecting a wireless signal transmitted from a mobile device using one or more appropriate techniques. Typically, although not necessarily, a femtocell may utilize or otherwise be compatible with various types of communication technology such as, for example, Universal Mobile Telecommunications System (UTMS), Long Term Evolution (LTE), Evolution-Data Optimized or Evolution-Data only (EV-DO), GSM, Worldwide Interoperability for Microwave Access (WiMAX), Code division multiple access (CDMA) -2000, or Time Division Synchronous Code Division Multiple Access (TD-SCDMA), to name just a few examples among many possible. In certain implementations, a femtocell may comprise integrated WiFi, for example. However, such details relating to femtocells are merely examples, and claimed subject matter is not so limited.

[0077] Also, if applicable, computer-readable code or instructions may be transmitted via signals over physical transmission media from a transmitter to a receiver (e.g., via electrical digital signals). For example, software may be

transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or physical components of wireless technologies such as infrared, radio, and microwave. Combinations of the above may also be included within the scope of physical transmission media. Such computer instructions may be transmitted in portions (e.g., first and second portions) at different times (e.g., at first and second times). Some portions of this Detailed Description are presented in terms of algorithms or symbolic representations of operations on binary digital signals stored within a memory of a specific apparatus or special purpose computing device or platform. In the context of this particular Specification, the term specific apparatus or the like includes a general purpose computer once it is programmed to perform particular functions pursuant to instructions from program software. Algorithmic descriptions or symbolic representations are examples of techniques used by those of ordinary skill in the signal processing or related arts to convey the substance of their work to others skilled in the art. An algorithm is here, and generally, considered to be a self-consistent sequence of operations or similar signal processing leading to a desired result. In this context, operations or processing involve physical manipulation of physical quantities. Typically, although not necessarily, such quantities may take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, or otherwise manipulated.

[0078] It has proven convenient at times, principally for reasons of common usage, to refer to such signals as bits, information, values, elements, symbols, characters, variables, terms, numbers, numerals, or the like. It should be understood, however, that all of these or similar terms are to be associated with appropriate physical quantities and are merely convenient labels. Unless specifically stated otherwise, as is apparent from the discussion above, it is appreciated that throughout this Specification discussions utilizing terms such as "processing," "computing," "calculating," "determining," "ascertaining," "identifying," "associating," "measuring," "performing," or the like refer to actions or processes of a specific apparatus, such as a special purpose computer or a similar special purpose electronic computing device. In the context of this

Specification, therefore, a special purpose computer or a similar special purpose electronic computing device is capable of manipulating or transforming signals, typically represented as physical electronic, electrical, or magnetic quantities within memories, registers, or other information storage devices, transmission devices, or display devices of the special purpose computer or similar special purpose electronic computing device.

[0079] Terms, "and" and "or" as used herein, may include a variety of meanings that also is expected to depend at least in part upon the context in which such terms are used. Typically, "or" if used to associate a list, such as A, B, or C, is intended to mean A, B, and C, here used in the inclusive sense, as well as A, B, or C, here used in the exclusive sense. In addition, the term "one or more" as used herein may be used to describe any feature, structure, or characteristic in the singular or may be used to describe some combination of features, structures or characteristics. Though, it should be noted that this is merely an illustrative example and claimed subject matter is not limited to this example.

[0080] While certain example techniques have been described and shown herein using various methods or systems, it should be understood by those skilled in the art that various other modifications may be made, and equivalents may be substituted, without departing from claimed subject matter. Additionally, many modifications may be made to adapt a particular situation to the teachings of claimed subject matter without departing from the central concept described herein. Therefore, it is intended that claimed subject matter not be limited to particular examples disclosed, but that such claimed subject matter may also include all implementations falling within the scope of the appended claims, and equivalents thereof.

CLAIMS

What is claimed is:

1. A method comprising:

executing one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and

at a sub destination, handing over to a mobile device one or more positioning parameters to enable said mobile device to navigate movement of said mobile device from said sub destination to said final destination, said handing over is being triggered in response to a determination that said vehicle has parked.

2. The method of claim 1, and further comprising:

assessing a confidence-in-parking level for said vehicle; and

initiating said handing over to said mobile device said one or more positioning parameters in response of said confidence-in-parking level meeting a threshold.

3. The method of claim 2, wherein said assessing said confidence-in-parking level comprises:

weighting a state of said vehicle and a final destination metric; and

combining said weighted state of said vehicle and said final destination metric to determine if said confidence-in-parking level meets said threshold.

4. The method of claim 3, wherein said weighting comprises determining whether said state of said vehicle or said final destination metric satisfies at least one parameter corresponding to a predefined numerical value.

5. The method of claim 4, wherein said predefined numerical value is expressed via a percent value.

6. The method of claim 4, wherein said predefined numerical value comprises a negative numerical value.

7. The method of claim 4, wherein said at least one parameter comprises at least one of the following: a set range of said PND to said final destination; a set range of said vehicle to one or more of a traffic light and a traffic sign; a reverse direction of travel of said vehicle; a low speed of travel of said vehicle; a stationary state of said vehicle; a non-operational state of an engine of said vehicle; an open position of a driver's door of said vehicle; an open position of a passenger's door of said vehicle; an application of a parking brake of said vehicle; or any combination thereof.

8. The method of claim 7, wherein said set range of said PND to said final destination is set via a geofence indicative of an acceptable walking distance to said final destination.

9. The method of claim 1, wherein said one or more positioning parameters comprise at least one of the following: geographic coordinates of said final destination; geographic coordinates of said sub destination; an estimate of time; ephemeris data; satellite positioning system (SPS) almanac data; a proposed route from said sub destination to said final destination; navigation details; a notification that said PND is within an acceptable walking distance to said final destination; or any combination thereof.

10. The method of claim 1, and further comprising:
displaying indications of one or more parking spaces; and
receiving selection of one of said displayed indications as said sub destination.

11. The method of claim 1, wherein said handing over is further triggered in response to a user selection received at a user interface of at least one of the following: said PND; said mobile device; or any combination thereof.

12. The method of claim 11, wherein said user selection comprises at least one of the following: a voice command; selection via a touch screen; a detected user gesture; or any combination thereof.

13. The method of claim 1, and further comprising maintaining geographic coordinates of said sub destination in memory of at least one of the following: said PND; said mobile device; or any combination thereof.

14. The method of claim 13, and further comprising accessing said maintained geographic coordinates of said sub destination to enable said mobile device to navigate movement of said mobile device from said final destination to said sub destination.

15. The method of claim 1, and further comprising

determining whether said vehicle has exited a set range to said final destination; and

terminating said handing over to said mobile device said one or more positioning parameters in response to said determination.

16. An apparatus comprising:

a communication interface to communicate with a mobile device; and

at least one processor programmed with instructions to:

execute one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and

at a sub destination, hand over to said mobile device one or more positioning parameters to enable said mobile device to navigate movement of said mobile device from said sub destination to said final destination, said handing over is being triggered in response to a determination that said vehicle has parked.

17. The apparatus of claim 16, wherein said at least one processor further programmed with instructions to:

assess a confidence-in-parking level for said vehicle; and

initiate said handing over to said mobile device said one or more positioning parameters in response of said confidence-in-parking level meeting a threshold.

18. The apparatus of claim 17, wherein said instructions to said assess said confidence-in-parking level further comprise instructions to:

weight a state of said vehicle and a final destination metric; and

combine said weighted state of said vehicle and said final destination metric to determine if said confidence-in-parking level meets said threshold.

19. The apparatus of claim 18, wherein said instructions to weight further comprise instructions to determine whether said state of said vehicle or said final destination metric satisfies at least one parameter that corresponds to a predefined numerical value.

20. The apparatus of claim 19, wherein said at least one parameter comprises at least one of the following: a set range of said PND to said final destination; a set range of said vehicle to one or more of a traffic light and a traffic sign; a reverse direction of travel of said vehicle; a low speed of travel of said vehicle; a stationary state of said vehicle; a non-operational state of an engine of said vehicle; an open position of a driver's door of said vehicle; an open position of a passenger's door of said vehicle; or any combination thereof.

21. The apparatus of claim 20, wherein said set range of said PND to said final destination is set via a geofence indicative of an acceptable walking distance to said final destination.

22. An apparatus comprising:

means for executing one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and

means for handing over to a mobile device, at a sub destination, one or more positioning parameters to enable said mobile device to navigate movement of said mobile device from said sub destination to said final destination, said handing over is being triggered in response to a determination that said vehicle has parked.

23. The apparatus of claim 22, and further comprising:

means for assessing a confidence-in-parking level for said vehicle; and

means for initiating said handing over to said mobile device said one or more positioning parameters in response of said confidence-in-parking level meeting a threshold.

24. The apparatus of claim 23, wherein said means for assessing said confidence-in-parking level comprises:

means for weighting a state of said vehicle and a final destination metric; and

means for combining said weighted state of said vehicle and said final destination metric to determine if said confidence-in-parking level meets said threshold.

25. The apparatus of claim 29, wherein said means for weighting comprises means for determining whether said state of said vehicle or said final destination metric satisfies at least one parameter corresponding to a predefined numerical value.

26. The apparatus of claim 25, wherein said at least one parameter comprises at least one of the following: a set range of said PND to said final destination; a set range of said vehicle to one or more of a traffic light and a traffic sign; a reverse direction of travel of said vehicle; a low speed of travel of said vehicle; a stationary state of said vehicle; a non-operational state of an

engine of said vehicle; an open position of a driver's door of said vehicle; an open position of a passenger's door of said vehicle; an application of a parking brake of said vehicle; or any combination thereof.

27. The apparatus of claim 26, wherein said set range of said PND to said final destination is set via a geofence indicative of an acceptable walking distance to said final destination.

28. The apparatus of claim 22, wherein said one or more positioning parameters comprise at least one of the following: geographic coordinates of said final destination; geographic coordinates of said sub destination; an estimate of time; ephemeris data; satellite positioning system (SPS) almanac data; a proposed route from said sub destination to said final destination; navigation details; a notification that said PND is within an acceptable walking distance to said final destination; or any combination thereof.

29. The apparatus of claim 22, and further comprising means for maintaining geographic coordinates of said sub destination in memory of at least one of the following: said PND; said mobile device; or any combination thereof.

30. The apparatus of claim 29, and further comprising means for accessing said maintained geographic coordinates of said sub destination to enable said mobile device to navigate movement of said mobile device from said final destination to said sub destination.

31. The apparatus of claim 22, and further comprising

means for determining whether said vehicle has exited a set range to said final destination; and

means for terminating said handing over to said mobile device said one or more positioning parameters in response to said determination.

32. An article comprising:

a non-transitory storage medium having instructions stored thereon executable by a special purpose computing platform to:

execute one or more navigation applications to direct movement of a personal navigation device (PND) co-located with a vehicle to a final destination; and

at a sub destination, hand over to a mobile device one or more positioning parameters to enable said mobile device to navigate movement of said mobile device from said sub destination to said final destination, said handing over is being triggered in response to a determination that said vehicle has parked.

33. The article of claim 32, wherein said storage medium further comprises instructions to:

assess a confidence-in-parking level for said vehicle; and

initiate said handing over to said mobile device said one or more positioning parameters in response of said confidence-in-parking level meeting a threshold.

34. The article of claim 33, wherein said storage medium having said instructions to said assess said confidence-in-parking level further comprises instructions to:

weight a state of said vehicle and a final destination metric; and

combine said weighted state of said vehicle and said final destination metric to determine if said confidence-in-parking level meets said threshold.

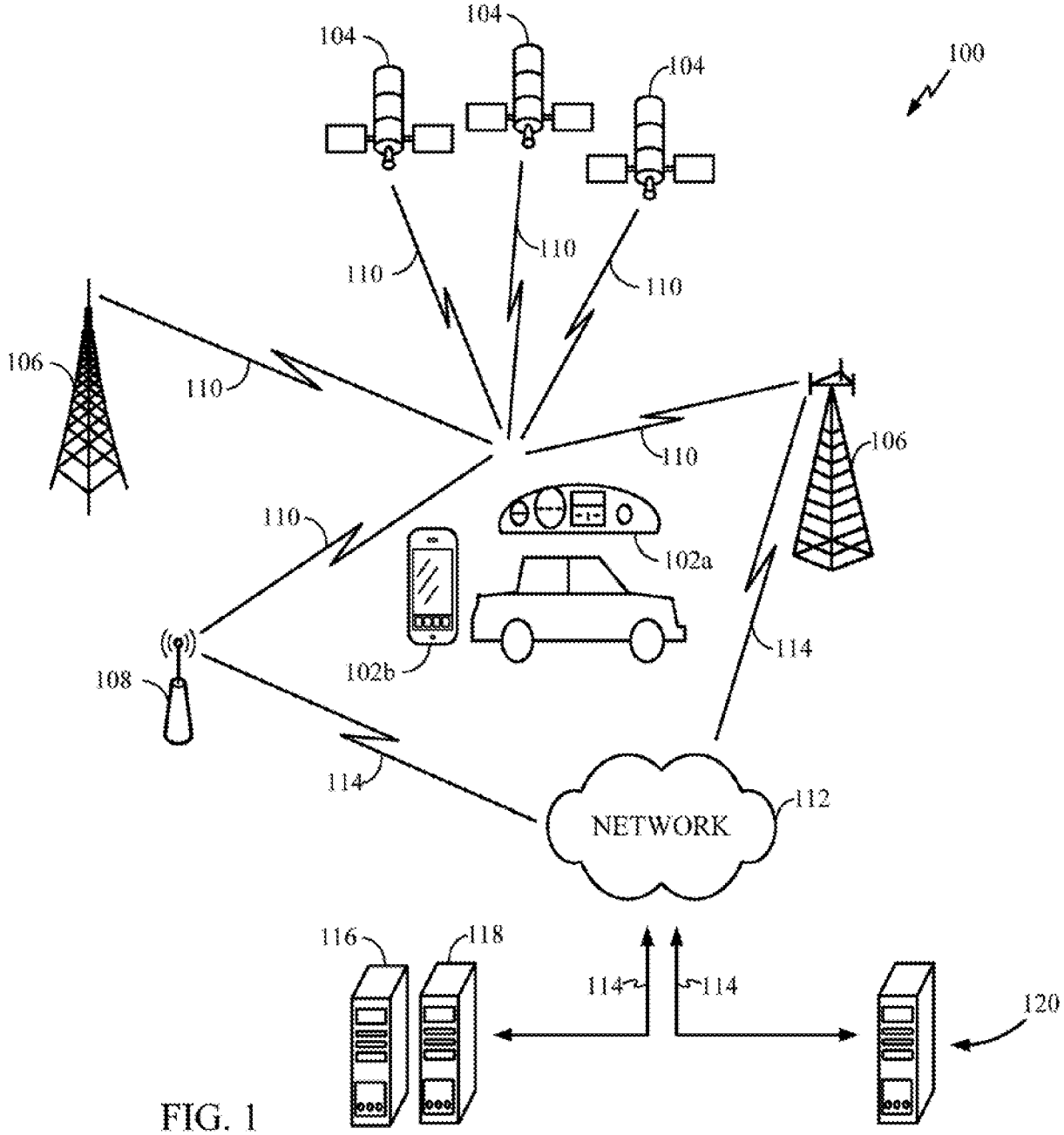

100
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106
110
102a
102b
114
108
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NETWORK
112
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118
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114
120

FIG. 1

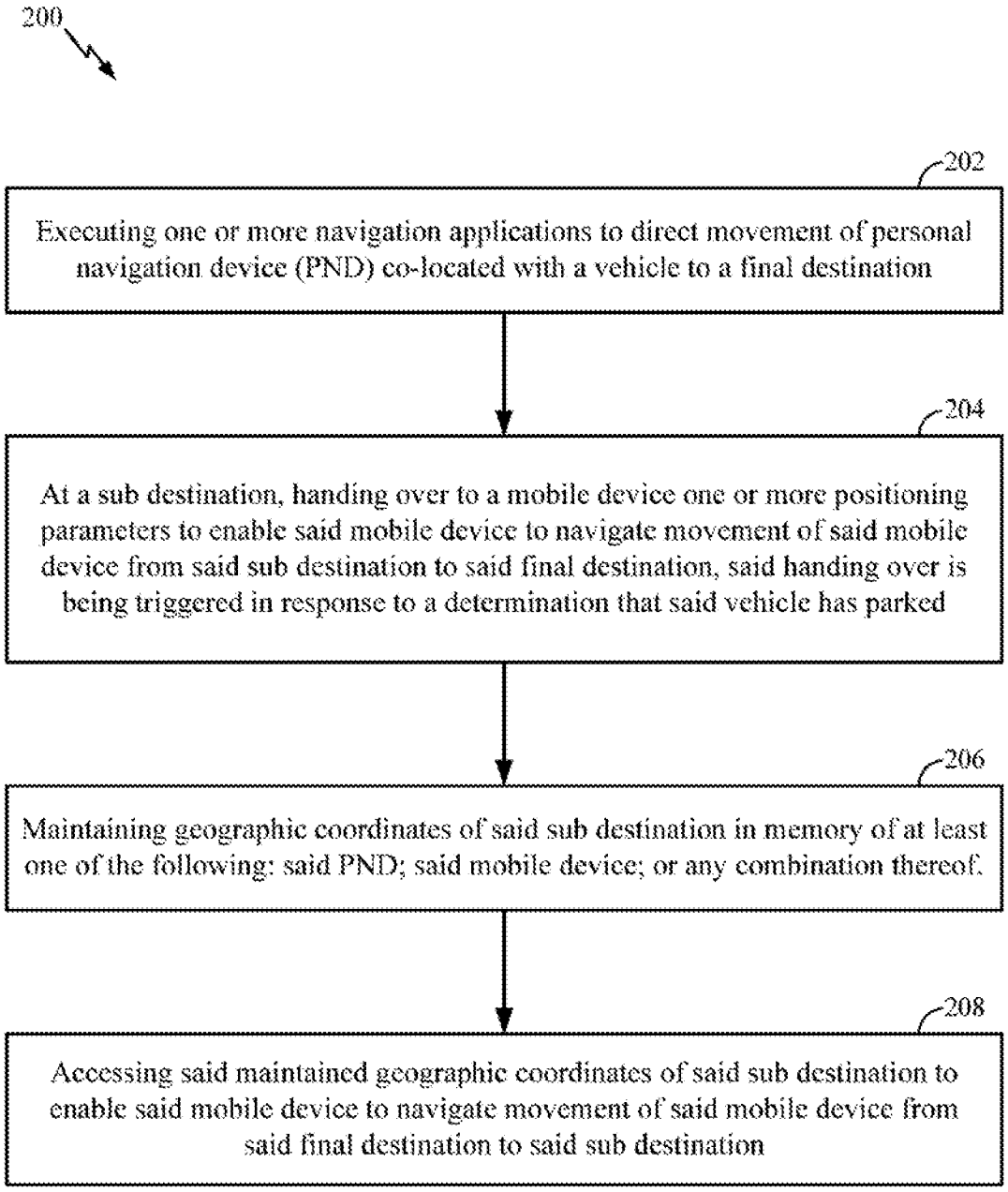

200
202
Executing one or more navigation applications to direct movement of personal navigation device (PND) co-located with a vehicle to a final destination
204
At a sub destination, handing over to a mobile device one or more positioning parameters to enable said mobile device to navigate movement of said mobile device from said sub destination to said final destination, said handing over is being triggered in response to a determination that said vehicle has parked
206
Maintaining geographic coordinates of said sub destination in memory of at least one of the following: said PND; said mobile device; or any combination thereof.
208
Accessing said maintained geographic coordinates of said sub destination to enable said mobile device to navigate movement of said mobile device from said final destination to said sub destination

FIG. 2

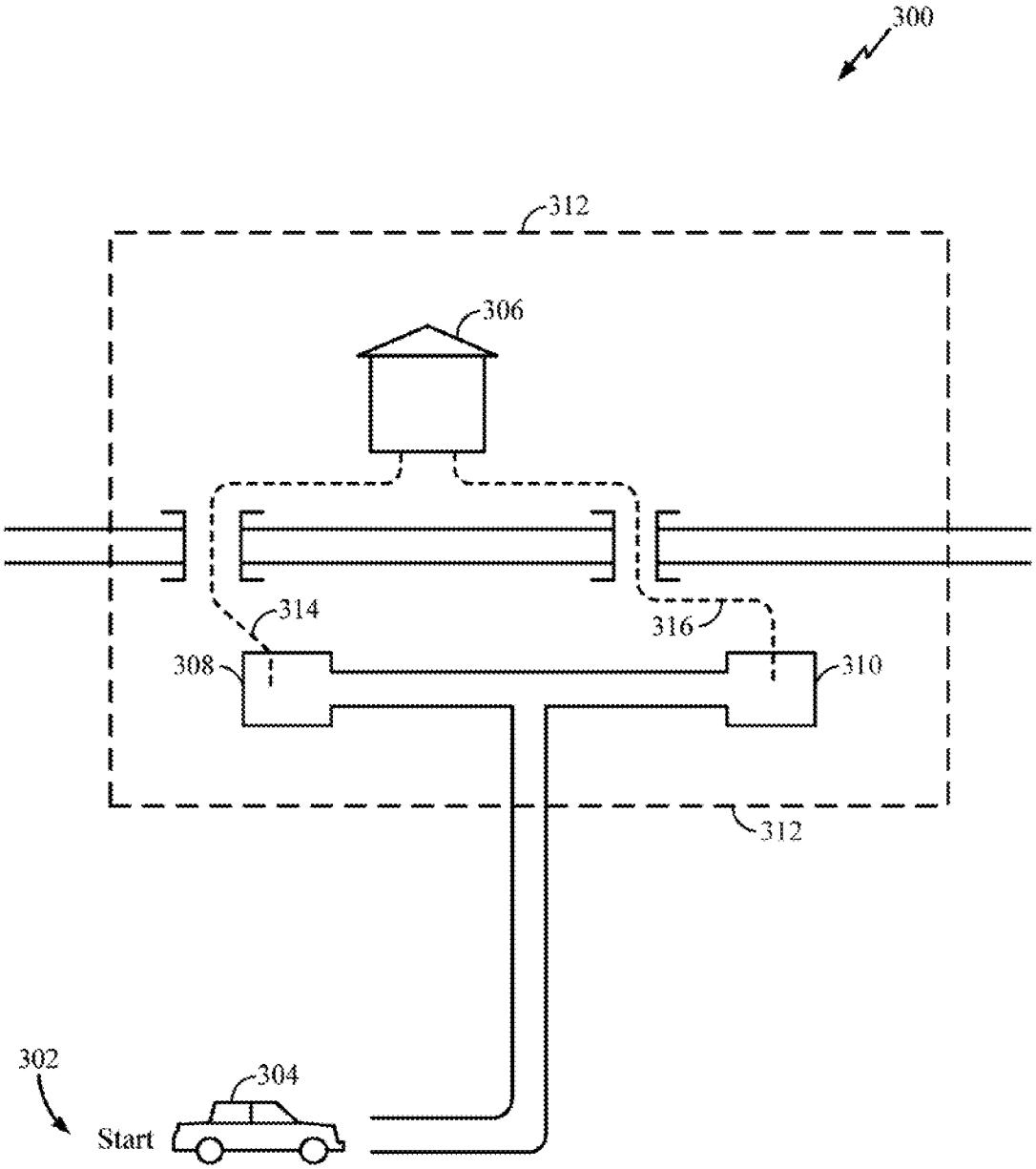


FIG. 3

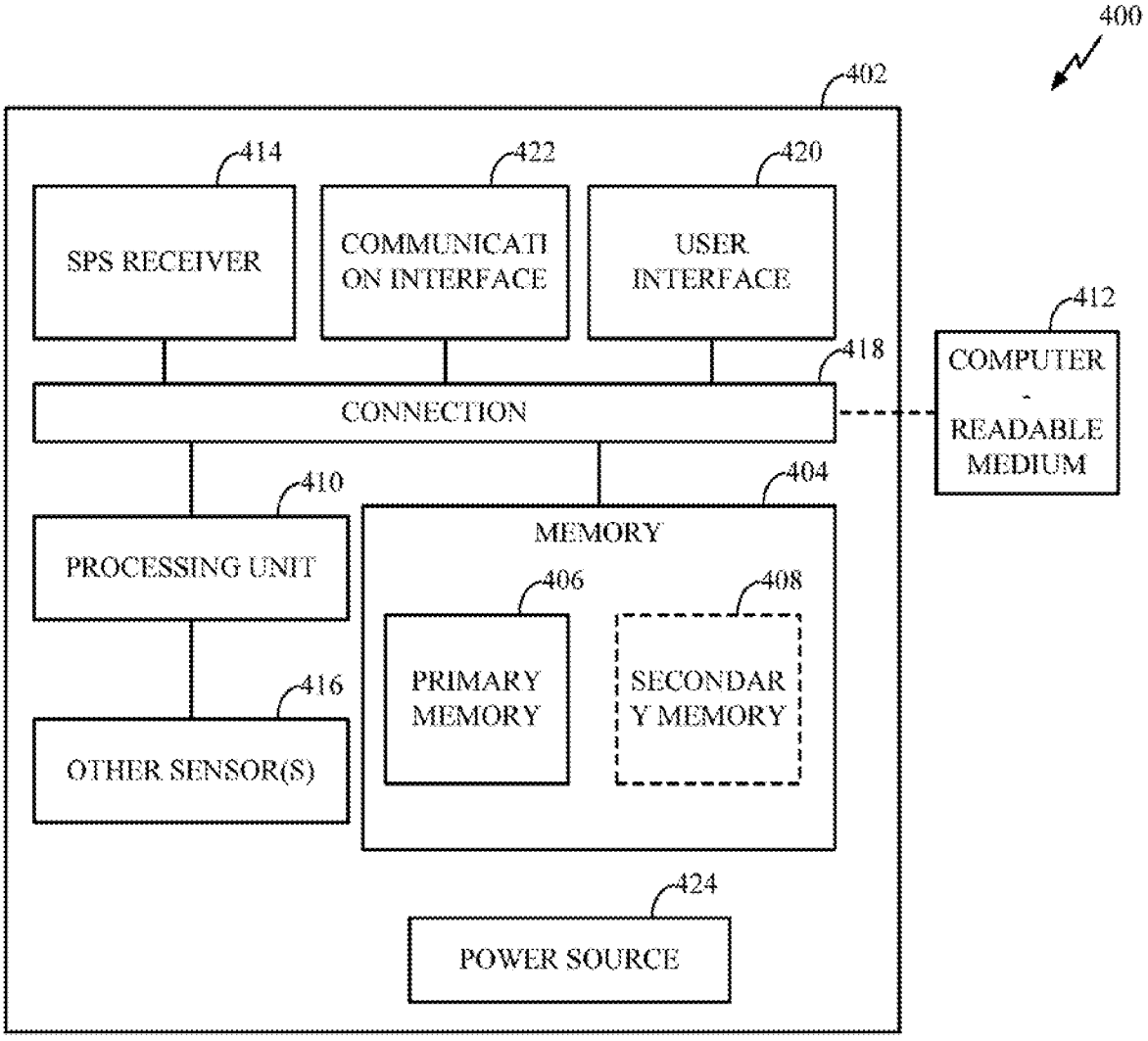

400
402
414
SPS RECEIVER
422
COMMUNICATI ON INTERFACE
420
USER INTERFACE
412
COMPUTER - READABLE MEDIUM
418
CONNECTION
410
PROCESSING UNIT
404
MEMORY
406
PRIMARY MEMORY
408
SECONDAR Y MEMORY
416
OTHER SENSOR(S)
424
POWER SOURCE

FIG. 4

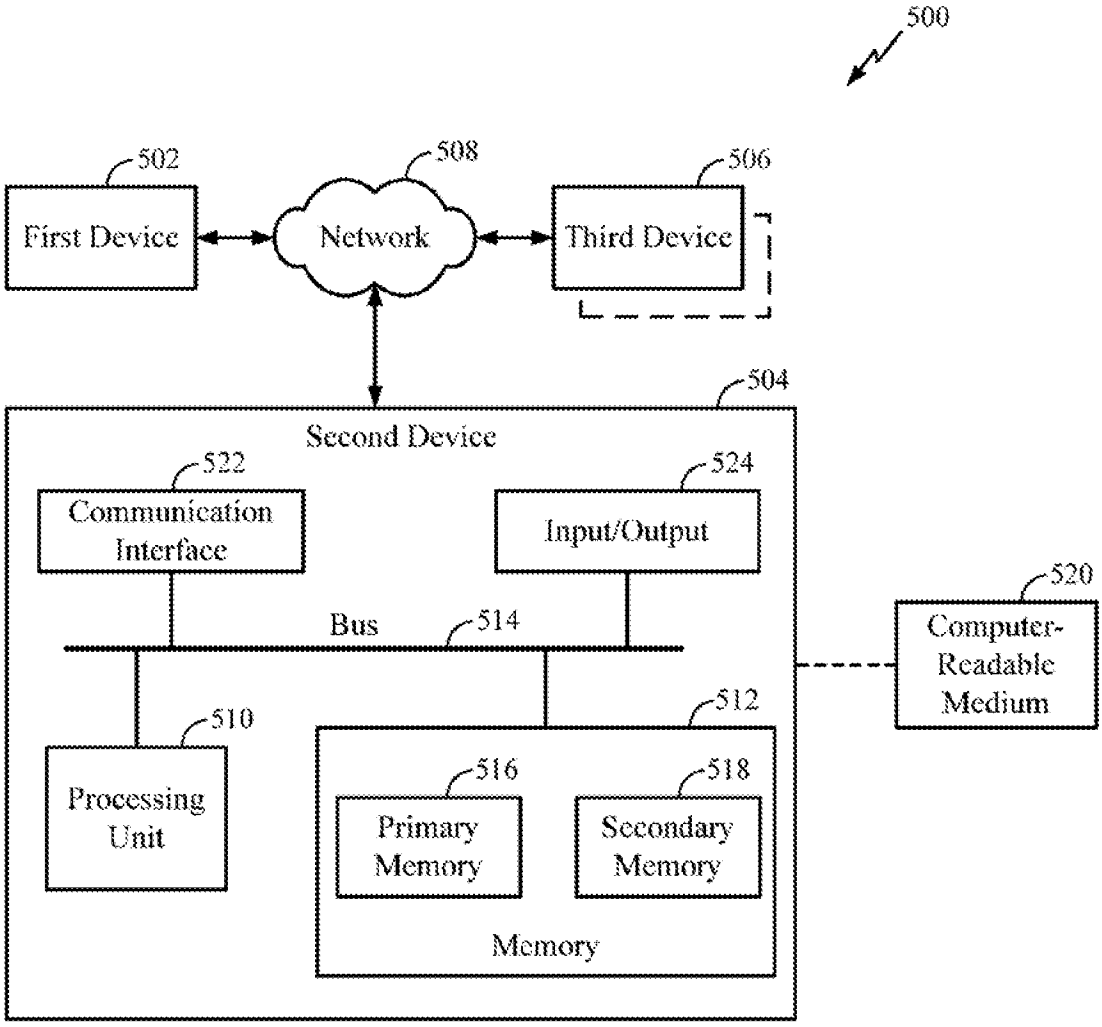

500
502
First Device
508
Network
506
Third Device
504
Second Device
522
Communication Interface
524
Input/Output
520
Computer-Readable Medium
Bus
514
510
Processing Unit
512
516
Primary Memory
518
Secondary Memory
Memory

FIG. 5

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

(54) Title: STAND-ALONE MULTIFUNCTIONAL HEADPHONES FOR SPORTS ACTIVITIES

(54) Bezeichnung : EIGENSTÄNDIGER MULTIFUNKTIONSKOPFHÖRER FÜR SPORTLICHE AKTIVITÄTEN

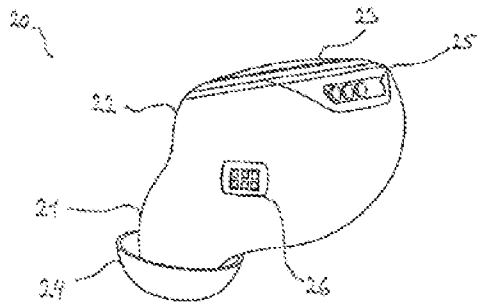


Figure 2a

(57) Abstract: An apparatus is described that has the following: (a) a housing that is set up to be worn in an ear, (b) a motion sensor unit for capturing motion data, (c) a physiological sensor unit for capturing physiological data, (d) a data processing unit that is set up to produce performance data on the basis of the motion data and/or the physiological data, (e) a signal processing unit that is set up to produce an audio signal on the basis of the performance data produced, and (f) a loudspeaker for outputting the audio signal produced, wherein the motion sensor unit, the physiological sensor unit, the loudspeaker, the data processing unit and the signal processing unit are integrated in the housing. In addition, a system, a method and a use are described.

(57) Zusammenfassung: Es wird eine Vorrichtung beschrieben, die folgendes aufweist: (a) ein Gehäuse, das zum Tragen in einem Ohr eingerichtet ist, (b) eine Bewegungssensoreinheit zum Erfassen von Bewegungsdaten, (c) eine physiologische Sensoreinheit zum Erfassen von physiologischen Daten, (d) eine Datenverarbeitungseinheit, die zum Erzeugen von Leistungsdaten basierend auf den Bewegungsdaten und/oder den physiologischen Daten eingerichtet ist, (e) eine Signalverarbeitungseinheit, die zum Erzeugen eines Audiosignals basierend auf den erzeugten Leistungsdaten eingerichtet ist, und (f) einen Lautsprecher zum Ausgeben des erzeugten Audiosignals, wobei die Bewegungssensoreinheit, die physiologische Sensoreinheit, der Lautsprecher, die Datenverarbeitungseinheit und die Signalverarbeitungseinheit in dem Gehäuse integriert sind. Es werden ferner ein System, ein Verfahren und eine Verwendung beschrieben.

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Eigenständiger Multifunktionskopfhörer für sportliche Aktivitäten

Gebiet der Erfindung

Die Erfindung betrifft das Gebiet der Multimediageräte mit Funktionalität zur Erfassung, Auswertung und Ausgabe von Daten in Bezug auf sportliche Aktivitäten oder medizinische Rehabilitationsmaßnahmen, insbesondere das Gebiet der tragbaren Systeme, die zur Erfassung, Auswertung und Ausgabe solcher Daten in Verbindung mit dem Ausüben sportlicher Aktivitäten geeignet sind.

Hintergrund

Es besteht eine Vielzahl von verschiedenen Systemen, die es Benutzer beim Ausüben sportlicher Aktivitäten möglich machen, verschiedenste leistungsrelevante und auf andere Weise interessante Informationen, wie beispielsweise Herzschlagfrequenz, Atemfrequenz, Geschwindigkeit, Zeitdauer und viele weiteren Daten, aufzuzeichnen und zu analysieren, sowohl während des Ausübens als auch nach dem Ausüben der sportlichen Aktivität.

Alle diese Systeme haben gemeinsam, dass sie aus mehreren Teilen bestehen, zum Beispiel einem oder mehreren Sensoren, wie beispielsweise ein Pulsgurt, und einer zentralen Einheit, wie beispielsweise eine Sportuhr, ein Fahrradcomputer oder ein Smartphone.

Da viele Benutzer auch gerne Musik oder Radio hören, während sie sportliche Aktivitäten ausüben, muss der Benutzer oft drei oder mehr Geräte mitbringen, zum Beispiel einen Pulsgurt, einen Fahrradcomputer, einen MP3-Player und einen Kopfhörer.

Der vorliegenden Erfindung liegt die Aufgabe zugrunde, eine Vorrichtung bereitzustellen, die die Funktionalitäten der Vielzahl von bisher benötigten Geräten bereitstellen kann und dazu leicht und komfortabel zu tragen und mitbringen und einfach zu bedienen ist.

Zusammenfassung

Diese Aufgabe wird gelöst durch die Gegenstände der unabhängigen Patentansprüche. Vorteilhafte Ausführungsformen der vorliegenden Erfindung sind in den abhängigen Ansprüchen beschrieben.

Gemäß einem ersten Aspekt der Erfindung wird eine Vorrichtung beschrieben. Die beschriebene Vorrichtung weist folgendes auf: (a) ein Gehäuse, das zum Tragen in einem Ohr eingerichtet ist, (b) eine Bewegungssensoreinheit zum Erfassen von Bewegungsdaten, (c) eine physiologische Sensoreinheit zum Erfassen von physiologischen Daten, (d) eine Datenverarbeitungseinheit, die zum Erzeugen von Leistungsdaten basierend auf den Bewegungsdaten und/oder den physiologischen Daten eingerichtet ist, (e) eine Signalverarbeitungseinheit, die zum Erzeugen eines Audiosignals basierend auf den erzeugten Leistungsdaten eingerichtet ist, und (f) einen Lautsprecher zum Ausgeben des erzeugten Audiosignals, wobei die Bewegungssensoreinheit, die physiologische Sensoreinheit, der Lautsprecher, die Datenverarbeitungseinheit und die Signalverarbeitungseinheit in dem Gehäuse integriert sind.

Die beschriebene Vorrichtung ist zum Tragen im Ohr eingerichtet und dazu fähig, eigenständig ein Audiosignal zu erzeugen und einem Benutzer durch Ausgabe mittels eines Lautsprechers zur Verfügung zu stellen, wobei das ausgegebene Audiosignal auf Bewegungsdaten und/oder physiologischen Daten basiert, die von in der Vorrichtung integrierten Sensoreinheiten erfasst werden. Damit kann der Benutzer Auskünfte in Bezug auf die erfassten

Bewegungsdaten und/oder physiologischen Daten erhalten, ohne die Vorrichtung mit weiteren Geräten verbinden zu müssen. Die Vorrichtung bildet somit eine autonome Einheit, die zum Beispiel in Verbindung mit sportlichen Aktivitäten vom Benutzer im Ohr getragen werden kann und dabei verschiedene Informationen in Bezug auf Bewegung und/oder physiologische Parameter für den Benutzer in Echtzeit bereitstellen kann.

In diesem Dokument bezeichnet „Sensoreinheit" insbesondere eine Einheit mit einem oder mehreren einzelnen Sensoren, die zum Erzeugen eines oder mehrerer elektrischen Signale basierend auf elektrische Signale von jedem einzelnen Sensor eingerichtet ist.

In diesem Dokument bezeichnet „Bewegungssensoreinheit" insbesondere eine Sensoreinheit, die zum Erzeugen eines oder mehrerer elektrischen Signale in Abhängigkeit von Bewegung der Sensoreinheit eingerichtet ist, insbesondere elektrische Signale, die von einer Beschleunigung, Neigung oder Verschiebung der Sensoreinheit relativ zu einer oder mehreren vorbestimmten Richtungen abhängen.

In diesem Dokument bezeichnet „Bewegungsdaten" insbesondere eine digitale Repräsentation von einem oder mehreren elektrischen Signalen, die von der Bewegungssensoreinheit erzeugt werden.

In diesem Dokument bezeichnet „physiologische Sensoreinheit" insbesondere eine Sensoreinheit, die zum Erzeugen eines oder mehrerer elektrischen Signale in Abhängigkeit von einem oder mehreren physiologischen Werten eines Benutzers eingerichtet ist.

In diesem Dokument bezeichnet „physiologische Daten" insbesondere eine digitale Repräsentation von einem oder mehreren elektrischen Signalen, die von der physiologischen Sensoreinheit erzeugt werden.

In diesem Dokument bezeichnet „Leistungsdaten" insbesondere Daten, die Werte in Bezug auf sportliche Aktivitäten aufweisen. Solche Werte umfassen insbesondere Werte, die für die sportliche Aktivität beschreibend sind, wie beispielsweise eine Länge einer gelaufenen, gefahrenen oder geschwommenen Strecke oder einen Höhenunterschied, sowie Werte, die für den Benutzer beschreibend sind, wie beispielsweise Geschwindigkeit, Atemfrequenz, Sauerstoffsättigung des Blutes oder Herzschlagfrequenz.

Die Datenverarbeitungseinheit ist dazu eingerichtet, sowohl die Bewegungsdaten von der Bewegungssensoreinheit als auch die physiologischen Daten von der physiologischen Sensoreinheit, vorzugsweise als digitale Signale, zu erhalten und zu verarbeiten, um Leistungsdaten durch Berechnung zu erzeugen. Dabei können einige Werte der Leistungsdaten allein basierend auf den Bewegungsdaten, andere Werte der Leistungsdaten allein basierend auf den physiologischen Daten und noch weitere Werte der Leistungsdaten basierend auf sowohl den Bewegungsdaten als auch den physiologischen Daten berechnet werden.

Die Signalverarbeitungseinheit ist dazu eingerichtet, ein Audiosignal basierend auf Leistungsdaten derart zu erzeugen, dass ein Benutzer beim Hören des Audiosignals einen oder mehrere spezifischen Werte der Leistungsdaten, Änderungen bei einem oder mehreren spezifischen Werten der Leistungsdaten und/oder eine Relation zwischen einem oder mehreren spezifischen Werten der Leistungsdaten und entsprechenden Referenzwerten, insbesondere Schwellenwerten, erkennen bzw. erfahren kann.

Die Datenverarbeitungseinheit und die Signalverarbeitungseinheit mögen als einzelne Verarbeitungseinheiten (Hardware) oder sie mögen als funktionelle Einheiten auf einem oder mehreren Prozessoren (Software) implementiert sein.

Das Gehäuse, in dem die ganze Vorrichtung integriert ist, ist zum Tragen im Ohr eines Benutzers eingerichtet. Dabei ist das Gehäuse so geformt, dass die Vorrichtung in einem typischen Ohr gut hineinpasst und festgehalten werden kann, auch bei sportlichen Aktivitäten. Das Gehäuse weist vorzugsweise eine Öffnung auf, die so gestaltet und positioniert ist, dass der Lautsprecher Schall in den Gehörgang des Benutzers abgeben kann.

Zusammenfassend ermöglicht die Vorrichtung, dass ein Benutzer beim Ausüben einer sportlichen Aktivität mittels Audioausgabe über Werte von Leistungsdaten informiert wird, wobei die einzelne Werte der Leistungsdaten auf Bewegungsdaten und/oder physiologischen Daten basieren, die während der sportlichen Aktivität jeweils von der Bewegungssensoreinheit und der physiologischen Sensoreinheit erfasst werden.

Somit stellt die Vorrichtung eine Vielzahl von Funktionalitäten bereit, ohne dass weitere Geräte oder externe Sensoren benötigt werden. Dabei ist die Vorrichtung sehr kompakt, diskret und angenehm im Ohr zu tragen.

Gemäß einem Ausführungsbeispiel der Erfindung weist die Bewegungssensoreinheit ein Akzelerometer bzw. einen Beschleunigungssensor auf.

Das Akzelerometer ist eingerichtet zum Erfassen von Beschleunigung und/oder Beschleunigungsänderungen in zumindest einer vorbestimmten Richtung relativ zu dem Gehäuse. In einer bevorzugten Ausführungsform ist das Akzelerometer ein 3D-Akzelerometer, das Beschleunigungen entlang dreier aufeinander senkrechten Richtungen erfassen und drei entsprechende elektrische Signale ausgeben kann.

Durch Bearbeitung der Signale von der Bewegungssensoreinheit, beispielsweise mittels Mustererkennung, kann die Datenverarbeitungseinheit zum Beispiel folgende und weitere Leistungsdaten erzeugen: einen Schrittzahlwert, einen Distanzwert und einen Geschwindigkeitswert.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die physiologische Sensoreinheit einen Pulsoxymetriesensor auf, das heißt einen Sensor zur nicht invasiven Ermittlung der arteriellen Sauerstoffsättigung über die Messung der Lichtabsorption.

Der Pulsoxymetriesensor mag zwei unterschiedlich gefärbte Lichtquellen, insbesondere Leuchtdioden, und einen Fotosensor aufweisen und ist vorzugsweise derart in dem Gehäuse angebracht, dass die Lichtquellen einen Bereich der Hautoberfläche im Ohr des Benutzers beleuchten können und der Fotosensor entsprechende Reflektionen von der Hautoberfläche detektieren kann, wenn die Vorrichtung im Ohr des Benutzers angebracht ist. Der Pulsoxymetriesensor mag insbesondere im Bereich einer Oberfläche des Gehäuses derart angebracht sein, dass der Pulsoxymetriesensor sich beim Tragen der Vorrichtung im Ohr in engem Kontakt mit der Hautoberfläche im Ohr befindet, insbesondere der Hautoberfläche im Bereich hinter dem Tragus. (Als Tragus wird die kleine Knorpelmasse an der Ohrmuschel bezeichnet, die kurz vor dem Gehörgang (Porus acusticus externus) aufliegt). Durch Ansteuerung der Lichtquellen und Verarbeitung des vom Fotosensor ausgegebenen Signals kann die Datenverarbeitungseinheit zum Beispiel unter anderem die folgenden Leistungsdaten erzeugen: einen arteriellen Sauerstoffsättigungswert, einen Atmungsfrequenzwert, einen kardiovaskulären Flusswert, einen Herzzeitvolumenwert, einen Blutdruckwert und einen Blutzuckerwert.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist das von der Signalverarbeitungseinheit erzeugte Audiosignal ein oder mehrere

vorgespeicherte Sprachelemente oder Tonsignale auf, die für zumindest einen Wert der Leistungsdaten indikativ sind, das heißt, dass sie akustisch durch beispielsweise Ton, Tonhöhe, Hall, Echo, Nachklang, Nachschall, Dreidimensionale Wahrnehmung oder weitere den Zustand und die Verfassung des Trägers kommuniziert..

Das erzeugte Audiosignal mag Beispielsweise aus einem Namen eines Leistungswertes gefolgt von dem gegenwärtigen Wert des Leistungswertes bestehen, wie beispielsweise „Geschwindigkeit" gefolgt von „23 Kilometer pro Stunde", „Geschwindigkeit" gefolgt von „5 Minuten und 17 Sekunden pro Kilometer" oder „Herzfrequenz" gefolgt von „155 Schläge pro Minute".

Alternativ mag das erzeugte Audiosignal aus einem Namen des Leistungswertes gefolgt von einem gepulsten Tonsignal bestehen, wobei die Pulsfrequenz und/oder Tonhöhe des gepulsten Tonsignals von dem Wert des Leistungswertes abhängt. Dabei kann der Benutzer Änderungen in dem Leistungswert erkennen, indem die Pulsfrequenz und/oder Tonhöhe des Tonsignals sich ändern.

Weiter alternativ mag das erzeugte Audiosignal lediglich aus einem gepulsten Tonsignal, wie das oben beschriebene, bestehen.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung ist die Signalverarbeitungseinheit zum Modifizieren vorgespeicherter Audiodaten, insbesondere Musik, in Abhängigkeit von zumindest einem Wert der Leistungsdaten eingerichtet.

Das Modifizieren der vorgespeicherten Audiodaten mag insbesondere darin bestehen, eine Lautstärke, eine Wiedergabegeschwindigkeit und/oder eine Tonhöhe der vorgespeicherten Audiodaten in Abhängigkeit von dem zumindest einen Wert der Leistungsdaten zu reduzieren oder erhöhen. Mit anderen

Worten mag die Signalverarbeitungseinheit zum Beispiel die Lautstärke, Wiedergabegeschwindigkeit und/oder Tonhöhe der vorgespeicherten Audiodaten erhöhen, wenn die Herzschlagfrequenz einen oberen Schwellenwert überschreitet, und reduzieren, wenn die Herzschlagfrequenz einen unteren Schwellenwert unterschreitet.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist das Gehäuse einen ersten Abschnitt und einen zweiten Abschnitt auf, wobei der erste Abschnitt zum Einführen in einen Gehörgang und der zweite Abschnitt zur Befestigung in einer Ohrmuschel eingerichtet sind, wobei eine Form und/oder Größe des zweiten Abschnittes anpassbar ist.

Der erste Abschnitt ist im Wesentlichen kegelförmig und so geformt, dass er in einem äußeren Teil des Gehörgangs hineinpasst. Der Lautsprecher ist vorzugsweise innerhalb des ersten Abschnittes angebracht, um Schall direkt in den Gehörgang hinein abzugeben.

Der zweite Abschnitt ist so geformt, dass er in der Concha der Ohrmuschel eines typischen Ohrs eingesetzt und dort festgehalten werden kann. Die Form und/oder Größe des zweiten Abschnittes mag zum Beispiel durch Hinzufügen selbstklebenden Materials auf einem Teil der Oberfläche des zweiten Abschnittes angepasst werden.

Das gesamte Gehäuse mag insbesondere aus Kunststoff gefertigt sein. Die Öffnungen für Lautsprecher, Sensoren usw. mögen wasserdicht abgedichtet sein, so dass die Vorrichtung auch beim Schwimmen verwendet werden kann.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Vorrichtung ferner eine kapazitive Sensoreinheit auf, die an einer Oberfläche des Gehäuses derart angeordnet ist, dass sie von einem Benutzer berührt werden kann, wenn die Vorrichtung im Ohr des Benutzers angebracht ist.

Die kapazitive Sensoreinheit mag insbesondere auf einer Oberfläche des Gehäuses angebracht sein, die nach außen zeigt, wenn die Vorrichtung im Ohr angebracht ist.

Die kapazitive Sensoreinheit ist eingerichtet zum Erfassen von Berührungen, insbesondere klopfenden oder streichenden Berührungen, die zum Beispiel mit einem Finger vom Benutzer getätigt werden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Vorrichtung ferner ein Mikrofon auf, insbesondere ein Knochenleitungsmikrofon, das zum Erfassen von Benutzersprechen, insbesondere von vom Benutzer gesprochenen Sprachbefehle, eingerichtet ist.

Die Verwendung eines Knochenleitungsmikrofons ermöglicht insbesondere, dass Benutzersprechen erfasst werden kann, ohne (oder nur geringfügig) von Umgebungsgeräuschen beeinflusst zu werden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Vorrichtung ferner eine Elektroenzephalografie-Sensoreinheit (Gehirnstrommessung) auf, die zum Erfassen eines elektrischen Signals an einer Hautoberfläche eines Benutzers eingerichtet ist.

Durch Mustererkennung können aus dem erfassten elektrischen Signal vorbestimmte Gehirnaktivitäten beim Benutzer erkannt werden, insbesondere persönlich aufregende Gedanken.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Vorrichtung ferner eine Steuereinheit auf, die in dem Gehäuse integriert ist und ferner zum Steuern der Vorrichtung in Abhängigkeit von Berührungen, die von der kapazitiven Sensoreinheit erfasst werden, und/oder in Abhängigkeit

von Benutzersprechen, das von dem Mikrofon erfasst wird, und/oder in Abhängigkeit von einem elektrischen Signal, das von Elektroenzephalografie-Sensoreinheit erfasst wird.

Somit kann der Benutzer beispielsweise die Funktionalität der Vorrichtung durch Berühren der kapazitiven Sensoreinheit, durch Aussprechen von Sprachbefehlen und/oder durch vorbestimmte Gedanken steuern.

Insbesondere mag eine einzige kurze Berührung (Klopfen) auf der kapazitiven Sensoreinheit ein erstes Steuersignal auslösen, zwei aufeinanderfolgende kurze Berührungen ein zweites Steuersignal auslösen usw. Des Weiteren mag ein Streichen nach oben, nach unten, nach vorne und nach hinten jeweils vorbestimmte Steuersignale auslösen.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Vorrichtung ferner einen Kontaktsensor auf zum Detektieren, ob die Vorrichtung im Ohr angebracht ist.

Der Kontaktsensor mag insbesondere kapazitiv sein und auf einem Teil der Oberfläche des Gehäuses angebracht sein, der beim Tragen im Ohr die Hautoberfläche kontaktiert. Wenn der Kontaktsensor eine Zeit lang kein Kontakt mit einer Hautoberfläche registriert hat, kann die Vorrichtung beispielsweise in einem Standby-Modus geschaltet oder ganz ausgeschaltet werden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Vorrichtung ferner einen Speicher auf zum Speichern der von der Datenverarbeitungseinheit erzeugten Leistungsdaten.

Durch Abspeichern der Leistungsdaten können diese später vom Speicher ausgelesen und extern verarbeitet werden. Des Weiteren können im Laufe

einer sportlichen Aktivität auf die abgespeicherten Leistungsdaten zugegriffen werden, um beispielsweise Durchschnittswerte zu berechnen oder Vergleiche mit früheren Aktivitäten durchzuführen.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Vorrichtung ferner eine im Gehäuse integrierte Kommunikationseinheit auf zur drahtlosen Datenkommunikation mit einem externen Gerät.

Die Kommunikationseinheit mag insbesondere eine Bluetooth-Einheit sein, mit der eine drahtlose Datenkommunikation mit einem oder mehreren externen Geräten durchgeführt werden kann, wie zum Beispiel einem Mobiltelefon, einem Smartphone, einem Tablet, einem Laptop-Computer usw. Des Weiteren kann eine Datenkommunikation mit einer weiteren ähnlichen oder gleichen Vorrichtung erfolgen, zum Beispiel einer Vorrichtung die zum Tragen im anderen Ohr eingerichtet ist. Die Kommunikationseinheit mag alternativ eine Infrarot-Einheit sein, die eine Datenübertragung mit moduliertem infrarotem Licht ermöglicht.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Vorrichtung ferner eine Nahfeldkommunikationseinheit (NFC-Einheit) auf.

Die NFC-Einheit ermöglicht ein Speichern und/oder Auslesen verschiedener Daten in bzw. aus der Vorrichtung, zum Beispiel Identifikationsdaten des Benutzers oder GPS-Daten, die die letzte Position der Vorrichtung angeben. Solche GPS-Daten können zum Beispiel regelmäßig von einem Smartphone übertragen werden.

Gemäß einem zweiten Aspekt der Erfindung wird ein System beschrieben, das zwei Vorrichtungen gemäß dem ersten Aspekt oder einer der obigen Ausführungsformen aufweist, wobei beide Vorrichtungen zum drahtlosen

Datenkommunikation miteinander eingerichtet sind, insbesondere mittels Bluetooth.

Die eine der beiden Vorrichtungen funktioniert vorzugsweise als primäre Vorrichtung (Master) in dem System, in dem Sinne, dass diese Vorrichtung Steuer- und Datensignale an die zweite (sekundäre) Vorrichtung übermittelt, wobei insbesondere Sensorsignale, die von der sekundären Vorrichtung erfasst und an die primäre Vorrichtung übermittelt werden, bei der Erzeugung von Steuer- und Datensignalen in der primären Vorrichtung berücksichtigt werden.

Die beiden Vorrichtungen können das gleiche Audiosignal oder zwei unterschiedliche Audiosignale ausgeben.

Gemäß einem Ausführungsbeispiel der Erfindung ist die Signalverarbeitungseinheit von zumindest einer der beiden Vorrichtungen dazu eingerichtet, ein binaurales Audiosignal basierend auf den erzeugten Leistungsdaten zu erzeugen.

In diesem Dokument bezeichnet „binaurales Audiosignal" insbesondere ein Audiosignal, das beim Ausgeben in den beiden Ohren eines Benutzers einen räumlichen Höreindruck mit genauer Richtungslokalisation hervorruft. Mit anderen Worten kann der Benutzer einer einzelnen Komponente, wie beispielsweise einem gepulsten Tonsignal, eines binauralen Audiosignals eine bestimmte Position im dreidimensionalen Raum zuordnen.

Das binaurale Audiosignal mag dazu verwendet werden, Werte in Bezug auf verschiedene Leistungsdaten an verschiedenen vorbestimmten Stellen im dreidimensionalen Raum um den Kopf des Benutzers herum wiederzugeben, wie zum Beispiel ein erstes gepulstes Tonsignal oder Sprachsignal bzgl eines ersten Leistungswertes an einer Stelle links oben und zweites gepulstes

Tonsignal oder Sprachsignal bzgl. eines zweiten Leistungswertes an einer Stelle vorne unten.

Das binaurale Audiosignal mag ferner dazu verwendet werden, Änderungen bei einem Leistungswert relativ zu einem vorbestimmten Referenzwert durch Änderung der Wiedergabeposition erkennen zu lassen. Dies kann zum Beispiel so erfolgen, dass die Position einer Komponente des Audiosignals nach oben oder vorne verschoben wird, wenn ein Leistungswert einen vorbestimmten Referenzwert oder Schwellenwert übersteigt, wobei die Menge der Verschiebung von der Differenz zwischen dem Leistungswert und dem Referenzwert abhängt. In ähnlicher Weise kann die Position der Komponente des Audiosignals nach hinten oder unten verschoben werden, wenn der Leistungswert den (oder einen anderen) Referenzwert oder Schwellenwert unterschreitet. Veranschaulichend könnte dies so umgesetzt werden, dass ein gepulstes Tonsignal in Bezug auf der Herzfrequenz des Benutzers auf Höhe der Ohren zu hören ist, solange die Herzfrequenz sich in einem vorbestimmten Bereich befindet, wie etwa 130-140 Schläge pro Minute, nach oben verschoben wird, wenn die Herzfrequenz den maximalen Wert des vorbestimmten Bereichs überschreitet, und nach unten verschoben wird, wenn die Herzfrequenz den minimalen Wert des vorbestimmten Bereichs unterschreitet.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest eine der Vorrichtungen ein Knochenleitungsmikrofon auf und beide Vorrichtungen weisen ein Mikrofon auf, das zum Erfassen von Umgebungsschall eingerichtet ist.

Das Knochenleitungsmikrofon ist insbesondere zum Erfassen von Sprachbefehlen eingerichtet, die vom Benutzer zur Steuerung des Systems ausgesprochen werden. Dabei kann der von den externen Mikrofonen erfasste Umgebungsschall zur Rauschminderung verwendet werden, um die Erkennung

der Sprachbefehle zu verbessern. Die Erkennung der Sprachbefehle sowie die Verarbeitung zur Rauschminderung erfolgen vorzugsweise in einer entsprechenden Signalverarbeitungseinheit, die in der primären Vorrichtung des Systems integriert ist.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest eine der Vorrichtungen eine Erkennungseinheit auf, die zum Erkennen vorbestimmter Bewegungsmuster eingerichtet ist, die bei streichenden Berührungen einer Körperoberfläche eines Benutzers entstehen.

Die Erkennungseinheit ist insbesondere dazu eingerichtet, ein Signal von dem Knochenleitungsmikrofon in der primären Vorrichtung und Signale von den nach außen gerichteten Mikrofonen der beiden Vorrichtungen zu erhalten und verarbeiten. Die Verarbeitung weist insbesondere eine Analyse des zeitlichen Verlaufs der Tonhöhe (Frequenz) und Lautstärke für jedes der drei Signale auf. Diese Verarbeitung der Schallsignale, die sich jeweils durch und um den Körper des Benutzers herum fortpflanzt haben, ermöglicht eine Erkennung von vorbestimmten Bewegungsmuster, insbesondere die Erkennung einer Richtung einer streichenden Berührung der Körperoberfläche des Benutzers. Eine solche Erkennung basiert auf die Tatsache, dass die Tonhöhe und Lautstärke des von einem der Mikrofone erfassten Signals im Laufe der Bewegung zunimmt, wenn die Bewegung in Richtung zu dem Mikrofon hin erfolgt, und abnimmt, wenn die Bewegung von dem Mikrofon weg erfolgt. Eine Analyse des Signals von dem Knochenleitungsmikrofon ermöglicht somit eine Erkennung, ob die Bewegung nach oben oder unten gerichtet ist. In ähnlicher Weise ermöglicht eine Analyse der Signale von den beiden nach außen gerichteten Mikrofonen eine Erkennung, ob die Bewegung nach links oder rechts erfolgt. Durch weitere Analyse aller drei Signale können auch schräge Bewegungen erkannt werden.

Mit anderen Worten kann die Erkennungseinheit erkennen, wenn der Benutzer beispielsweise einen Finger von links nach rechts oder von oben nach unten über seine Wange, Brust oder seinen Bauch zieht.

Die Erkennung solcher Bewegungsmuster bzw. Berührungsmuster kann vorteilhafterweise zum Steuern der Vorrichtungen bzw. des Systems verwendet werden. Genauer gesagt kann jedes erfassbares Bewegungsmuster mit einem vorbestimmten Steuerbefehl verknüpft sein. Zum Beispiel kann eine Bewegung nach oben die Wiedergabelautstärke erhöhen und eine Bewegung nach oben die Wiedergabelautstärke reduzieren.

Gemäß einem dritten Aspekt der Erfindung wird ein Verfahren beschrieben. Das beschriebene Verfahren weist die folgenden Schritte auf: (a) Erfassen von Bewegungsdaten mittels einer Bewegungssensoreinheit, (b) Erfassen von physiologischen Daten mittels einer physiologischen Sensoreinheit, (c) Erzeugen von Leistungsdaten basierend auf den Bewegungsdaten und/oder den physiologischen Daten mittels einer Datenverarbeitungseinheit, (d) Erzeugen eines Audiosignals basierend auf den erzeugten Leistungsdaten mittels einer Signalverarbeitungseinheit, und (e) Ausgeben des erzeugten Audiosignals mittels eines Lautsprechers, wobei die Bewegungssensoreinheit, die physiologische Sensoreinheit, der Lautsprecher, die Datenverarbeitungseinheit und die Signalverarbeitungseinheit in einem Gehäuse integriert sind, das zum Tragen im Ohr eingerichtet ist.

Das beschriebene Verfahren basiert im Wesentlichen auf der gleichen Erkenntnis wie die oben beschriebene Vorrichtung gemäß dem ersten Aspekt und den Ausführungsbeispielen davon, nämlich dass Bewegungsdaten und physiologische Daten in einer eigenständigen Vorrichtung erfasst und verarbeitet werden, um ein Audiosignal in Abhängigkeit von erzeugten Leistungsdaten zu erzeugen und auszugeben.

Gemäß einem vierten Aspekt der Erfindung wird eine Verwendung einer Vorrichtung oder eines Systems gemäß dem ersten Aspekt oder zweiten Aspekt oder einem der obigen Ausführungsbeispiele als Headset in Verbindung mit einer mobilen Kommunikationsvorrichtung beschrieben, insbesondere einem Mobiltelefon, Smartphone oder Tablet.

Die Verwendung als Headset ermöglicht unter anderem, dass die verschiedenen Steuerungsfunktionalitäten der Vorrichtung bzw. des Systems zum Steuern der mobilen Kommunikationsvorrichtung eingesetzt werden und dass Daten, wie beispielsweise GPS-Daten oder Sprachbefehle von einer auf der mobilen Kommunikationsvorrichtung laufenden Navigationsanwendung, an die Vorrichtung oder das System übermittelt wird.

Die Erfindung kann sowohl mittels eines Computerprogramms, d.h. einer Software, als auch mittels einer oder mehrerer spezieller elektrischer Schaltungen, d.h. in Hardware oder in beliebig hybrider Form, d.h. mittels Software-Komponenten und Hardware-Komponenten, realisiert werden.

Es wird darauf hingewiesen, dass Ausführungsformen der Erfindung mit Bezug auf unterschiedliche Erfindungsgegenstände beschrieben wurden. Insbesondere sind einige Ausführungsformen der Erfindung mit Verfahrensansprüchen und andere Ausführungsformen der Erfindung mit Vorrichtungsansprüchen beschrieben. Dem Fachmann wird jedoch bei der Lektüre dieser Anmeldung sofort klar werden, dass, sofern nicht explizit anders angegeben, zusätzlich zu einer Kombination von Merkmalen, die zu einem Typ von Erfindungsgegenstand gehören, auch eine beliebige Kombination von Merkmalen möglich ist, die zu unterschiedlichen Typen von Erfindungsgegenständen gehören.

Weitere Vorteile und Merkmale der vorliegenden Erfindung ergeben sich aus der folgenden beispielhaften Beschreibung einer bevorzugten Ausführungsform.

Kurze Beschreibung der Zeichnungen

Figur 1 zeigt ein Blockdiagramm von einer Vorrichtung gemäß einem Ausführungsbeispiel.

Figur 2A zeigt eine erste Ansicht einer Vorrichtung gemäß einem Ausführungsbeispiel.

Figur 2B zeigt eine zweite Ansicht einer Vorrichtung gemäß einem Ausführungsbeispiel.

Figur 2C zeigt eine dritte Ansicht einer Vorrichtung gemäß einem Ausführungsbeispiel.

Detaillierte Beschreibung

Figur 1 zeigt ein Blockdiagramm einer Vorrichtung gemäß einem Ausführungsbeispiel. Die Vorrichtung ist in einem Gehäuse integriert, das zum Tragen im Ohr eingerichtet ist und weiter unten in Verbindung mit den Figuren 2A, 2B und 2C näher beschrieben wird, und weist eine Datenverarbeitungseinheit 1, eine Signalverarbeitungseinheit 2, einen Lautsprecher 3, ein Akzelerometer 4 und ein Pulsoximeter bzw. einen Pulsoximetriesensor 5 auf.

Die Datenverarbeitungseinheit 1 erhält Daten von dem Akzelerometer 4 und dem Pulsoximeter 5 und verarbeitet diese, um Leistungsdaten, wie zum Beispiel eine Schrittzahl, eine Distanz, eine Geschwindigkeit, eine arterielle Sauerstoffsättigung, eine Atmungsfrequenz, einen kardiovaskulären Fluss, ein Herzzeitvolumen, einen Blutdruck, einen Blutzuckerwert usw., zu erzeugen bzw. berechnen. Die Leistungsdaten werden an die Signalverarbeitungseinheit 2 übermittelt und von dieser zum Erzeugen eines Audiosignals verwendet, das durch den Lautsprecher 3 ins Ohr des Benutzers ausgegeben wird. Das Audiosignal wird so erzeugt, dass der Benutzer beim Hören des entsprechenden Schalls Informationen über zumindest einen Wert der Leistungsdaten erfahren kann. Dies kann durch Ausgabe von Sprachelementen (zum Beispiel vorgespeicherten Zahlen und Wörtern) oder gepulsten Tonsignalen, durch Manipulation von Musik oder in sonstiger Weise erfolgen.

Die Vorrichtung weist ferner eine zentrale Steuereinheit bzw. Steuerung 9 und einen Speicher 11 auf. Die Steuerung 9 ist mit der Datenverarbeitungseinheit 1, der Signalverarbeitungseinheit 2, und dem Speicher 11 verbunden und dazu eingerichtet, diese Einheiten zu steuern und Informationen von diesen Einheiten zu erhalten oder auszulesen. Die Steuerung 9 steuert zum Beispiel welche der von der Datenverarbeitungseinheit 1 erzeugten Leistungsdaten, die Signalverarbeitungseinheit 2 beim Erzeugen des Audiosignals berücksichtigen soll, zum Beispiel ob das Audiosignal gerade Auskunft über Herzfrequenz, Geschwindigkeit oder was anderes geben soll. Die Steuerung kann auch die Signalverarbeitungseinheit 2 derart steuern, dass im Speicher 11 abgespeicherte Musik oder ähnliches (beispielsweise ein Hörbuch) unabhängig von den Leistungsdaten wiedergegeben wird.

Die Steuereinheit 9 ist des Weiteren mit einem ersten Mikrofon 7, einem zweiten Mikrofon 14, einer Berührungssensoreinheit 6, einer EEG-Einheit - (Elektroenzephalografie-Einheit) 8, einer Kontaktsensoreinheit 10, einer Bluetooth-Einheit 12 und einer NFC-Einheit (Nahfeldkommunikationseinheit)

13 verbunden. Diese Einheiten sind auch im Gehäuse integriert und ermöglichen generell, dass der Benutzer die Funktionalitäten der Vorrichtung beeinflussen bzw. steuern kann und dass die Vorrichtung mit einem externen Gerät, wie beispielsweise einer ähnlichen Vorrichtung, einem Smartphone oder einem Rechner kommunizieren kann.

Das erste Mikrofon 7 ist ein Knochenleitungsmikrofon, das so im Gehäuse angebracht ist, dass es Schall erfassen kann, der durch den Schädelknochen geleitet wird, zum Beispiel beim Sprechen. Eine Funktion des ersten Mikrofons 7 ist Benutzersprechen zu erfassen, zum Beispiel Sprachbefehle zur Steuerung der Vorrichtung oder das Benutzersprechen, wenn die Vorrichtung als Headset in Verbindung mit einem externen Gerät verwendet wird.

Das zweite Mikrofon 14 ist so im Gehäuse angebracht, dass es insbesondere Umgebungsschall erfassen kann. Durch Verarbeitung der Signale von sowohl dem ersten Mikrofon 7 als auch dem zweiten Mikrofon 14 können störende Umgebungsgeräusche von dem Benutzersprechen filtriert werden, was die Verwendung als Headset sowie die Erkennungsqualität von Sprachbefehlen verbessert. Eine weitere Anwendung der beiden Mikrofonsignale ist die Erkennung von akustischen Gesten, das heißt die Erkennung von bestimmten bewegten oder streichenden Berührungen der Körperoberfläche. Genauer gesagt mag eine akustische Geste zum Beispiel darin bestehen, dass der Benutzer eine schnelle streichende Bewegung über seine Haut oder Kleidung in eine bestimmte Richtung (senkrecht, waagerecht usw.) mit einem Finger macht, wobei der Finger durch die ganze Bewegung die Haut oder Kleidung berührt. Durch solche streichende Bewegungen entsteht Schall und durch Analyse der von den Mikrofonen 7 und 14 aufgenommenen Signale kann Richtung, Geschwindigkeit und weitere Eigenschaften der Geste erkannt und in Steuersignale umgesetzt werden.

Die Berührungssensoreinheit 6 weist eine Platte mit einer Vielzahl von kapazitiven Sensoren auf und ist auf einem Teil der Oberfläche des Gehäuses so angebracht, dass der Benutzer sie mit dem Finger berühren kann, wenn die Vorrichtung im Ohr getragen wird. Mit anderen Worten befindet sich die Berührungssensoreinheit 6 auf einer Oberfläche des Gehäuses, die vom Gehörgang weg zeigt. Durch Streichen und/oder Klopfen mit dem Finger auf der Berührungssensoreinheit 6, kann der Benutzer die Vorrichtung steuern. Beispielsweise kann die Steuereinheit 9 eine streichende Bewegung nach oben mit einer Lautstärkeerhöhung und eine streichende Bewegung nach unten mit einer Lautstärkenreduktion verknüpfen und die Signalverarbeitungseinheit 2 dementsprechend ansteuern. In ähnlicher Weise kann die Steuereinheit zum Beispiel ein einmaliges Klopfen auf der Berührungssensoreinheit 6 mit einem Funktionswechsel und ein zweimal wiederholtes Klopfen mit einem Auswahl einer Funktion verknüpfen.

Die EEG-Einheit 8 weist eine Mehrzahl von Elektroden auf, die so an der Oberfläche des Gehäuses angebracht sind, dass Messungen von elektrischen Potenzialen an der Hautoberfläche im Ohr durchgeführt werden können. Diese Messungen werden von der Steuereinheit analysiert und mit vorgespeicherten Messungen verglichen, um bestimmte Gedanken des Benutzers zu erkennen und als Steuerbefehle zu benutzen. Zum Beispiel kann das intensive Denken an das eigene Lieblingsessen eine Ansage des bisherigen Kalorienverbrauchs auslösen.

Die Kontaktsensoreinheit 10 weist einen kapazitiven Sensor auf, der so im Oberflächenbereich des Gehäuses angebracht ist, dass er beim Tragen im Ohr die Hautoberfläche des Benutzers kontaktiert. Somit kann die Steuerung 9 erkennen, ob die Vorrichtung verwendet wird oder nicht und dementsprechend verschiedene Steuersignale erzeugen. Zum Beispiel können Stromverbrauchintensive Funktionalitäten ausgeschaltet werden einige Minuten nachdem die Vorrichtung aus dem Ohr genommen wurde.

Die Bluetooth-Einheit 12 dient zur drahtlosen Kommunikation mit anderen Vorrichtungen (zum Beispiel einer im anderen Ohr getragenen Vorrichtungen) oder externen Geräten (Mobiltelefon, PC usw.). Bei Kommunikation mit einer Vorrichtung im anderen Ohr des Benutzers können Sensorsignale von beiden Seiten berücksichtigt werden, um eine verbesserte Präzision in den Leistungsdaten zu erreichen. Ferner kann das erzeugte Audiosignal stereofonisch oder binaural bearbeitet werden. In solchen Systemen funktioniert die eine Vorrichtung als primäre Vorrichtung oder Master in dem Sinne, dass sie Daten von beiden Vorrichtungen erhält und verarbeitet und die jeweils auszugebende Audiosignale definiert.

Kommunikation mit einem externen Gerät kann während Benutzung der Vorrichtung, das heißt während der Ausübung einer sportlichen Aktivität, stattfinden. In diesem Falle können Daten, wie beispielsweise Musik- oder GPS-Daten, von dem Gerät an die Vorrichtung übertragen werden und dort verwendet oder gespeichert werden. Gleichzeitig können Daten, wie beispielsweise erfasste Sensordaten oder berechnete Leistungsdaten, von der Vorrichtung an das Gerät übertragen werden. Dies ermöglicht auch eine Benutzung der Vorrichtung als Headset in Verbindung mit Kommunikationsanwendungen.

Kommunikation mit dem externen Gerät kann auch erfolgen, wenn die Vorrichtung nicht im Ohr benutzt wird, beispielsweise um die verschiedenen oben beschriebenen Steuerungsmöglichkeiten zu konfigurieren, um Schwellenwerte (zum Beispiel für Herzfrequenz, Atemfrequenz, Distanz, Zeit oder Geschwindigkeit etc.) festzulegen oder um Leistungsdaten zur externen Verarbeitung auszulesen. Dies erfolgt zweckmäßig mittels einer speziellen Anwendung oder App.

Die NFC-Einheit 13 ermöglicht Kommunikation mit einem Nahfeldkommunikationsfähigen Gerät, zum Beispiel ein Smartphone, wenn dieses in die Nähe von der Vorrichtung gebracht wird. Dabei können Konfigurationsdaten vom Smartphone an die Vorrichtung übertragen werden oder in der Vorrichtung gespeicherte Daten, wie zum Beispiel Kontaktinformationen für den Benutzer, können ausgelesen werden. Diese Informationen können nützlich sein, wenn die Vorrichtung verloren aufgefunden wird oder in Verbindung mit einem Unfall.

Die Figuren 2A, 2B und 2C zeigen verschiedene Ansichten einer Vorrichtung 20 gemäß einem Ausführungsbeispiel, insbesondere die Form des Gehäuses, in welchem sämtliche Einheiten der Vorrichtung 20 integriert sind.

Die Figur 2A zeigt eine Ansicht einer Vorrichtung 20, die ein Gehäuse aufweist. Das Gehäuse ist aus Kunststoff, beispielsweise Silikon, gefertigt und weist grundsätzlich einen ersten Abschnitt 21 und einen zweiten Abschnitt 22 auf. Der erste Abschnitt 21 ist zum Einführen in den Gehörgang eines Benutzers und der zweite Abschnitt 22 ist zur Befestigung in der Ohrmuschel des Benutzers gebildet. Dabei ist der erste Abschnitt 21 im Wesentlichen Kegelförmig, um in dem äußeren Teil des Gehörgangs gut hineinzupassen. Im Endbereich des ersten Abschnittes 21 ist ein elastischer Kragen 24 vorgesehen, der beim Tragen der Vorrichtung 20 im Ohr als Abdichtung funktioniert, so dass die Vorrichtung 20 den Gehörgang des Benutzers blockiert. Der zweite Abschnitt 22 ist so geformt, dass er in Concha der Ohrmuschel eines typischen Ohrs eingesetzt und dort festgehalten werden kann.

Das Gehäuse weist ferner eine Oberfläche 23 auf, die dem Gehörgang abgewandt ist und somit vom Benutzer zum Beispiel mit einem Finger erreichbar ist. Die Oberfläche 23 weist insbesondere eine kapazitive Sensoreinheit auf zum Erfassen von Steuerbefehle vom Benutzer, zum Beispiel

wenn der Benutzer mit seinem Finger an der Oberfläche 23 klopft oder über die Oberfläche 23 in einer bestimmten Richtung streicht. In der Nähe von der Oberfläche 23 weist das Gehäuse eine schließbare Öffnung 25 auf, durch welche einen (nicht gezeigten) Stecker an einen Buchse gekoppelt werden kann, um die Batterie der Vorrichtung 20 aufzuladen oder um Daten mit der Vorrichtung 20 auszutauschen.

Das Gehäuse weist ferner eine Öffnung 26 auf, die an einer Stelle in der Oberfläche des Gehäuses angebracht ist, die beim Tragen der Vorrichtung 20 im Ohr die Haut, insbesondere im Bereich hinter dem Tragus, eng kontaktiert. Die Öffnung 26 mag einen Pulsoxymetriesensor enthalten, der zwei unterschiedlich gefärbte Lichtquellen, insbesondere Leuchtdioden, und einen Fotosensor aufweist. In diesem Fall ist die Öffnung 26 so in dem Gehäuse angebracht, dass die Lichtquellen einen Bereich der Hautoberfläche im Ohr des Benutzers beleuchten können und der Fotosensor entsprechende Reflektionen von der Hautoberfläche detektieren kann. Die Öffnung 26 mag alternativ ein Knochenleitungsmikrofon enthalten. In einem System mit zwei Vorrichtungen, eine für das linke Ohr und eine für das rechte Ohr, mag die eine Vorrichtung den Pulsoximetriesensor und die andere Vorrichtung das Knochenleitungsmikrofon aufweisen.

Die Figur 2B zeigt eine weitere Ansicht der Vorrichtung 20, wobei die Oberfläche 23 im Vordergrund zu sehen ist. Die Oberfläche 23 weist eine spalt- oder schlitzförmige Öffnung 27 auf, die von außen kommender Schall an ein (nicht gezeigtes) Mikrofon durchlässt. Die Vorrichtung 20 weist ferner eine Manschette oder Hülse 28 auf, die einen Teil der Oberfläche 23 umschließt und zum Anpassen der Größe der Vorrichtung an dem Ohr eines Benutzers dient. Die Manschette 28 ist aus weichem Kunststoff gefertigt und lösbar von dem Gehäuse. Somit kann der Benutzer verschiedene Hülsen 28 mit verschiedenen Größen ausprobieren und diejenige auswählen, die die beste Passform bereitstellt.

Die Figur 2C zeigt noch eine weitere Ansicht der Vorrichtung 20, wobei die Vorrichtung in Vergleich mit der Ansicht in Figur 2B um 180° gedreht ist. Sowie der Kragen 24 als auch das Ende des ersten Abschnittes, das in den Gehörgang am tiefsten hineinragt, weisen Öffnungen 29 auf, durch welche der Schall, der von einem in der Vorrichtung integrierten Lautsprecher erzeugt wird, ausgegeben werden kann.

Die Öffnungen 25, 26, 27 und 29 sind alle wasserdicht abgedichtet, so dass die Vorrichtung 20 auch beim Schwimmen oder Regen verwendet werden kann.

Patentansprüche

1. Vorrichtung aufweisend:

ein Gehäuse, das zum Tragen in einem Ohr eingerichtet ist,

eine Bewegungssensoreinheit zum Erfassen von Bewegungsdaten,

eine physiologische Sensoreinheit zum Erfassen von physiologischen Daten,

eine Datenverarbeitungseinheit, die zum Erzeugen von Leistungsdaten basierend auf den Bewegungsdaten und/oder den physiologischen Daten eingerichtet ist,

eine Signalverarbeitungseinheit, die zum Erzeugen eines Audiosignals basierend auf den erzeugten Leistungsdaten eingerichtet ist, und

einen Lautsprecher zum Ausgeben des erzeugten Audiosignals,

wobei die Bewegungssensoreinheit, die physiologische Sensoreinheit, der Lautsprecher, die Datenverarbeitungseinheit und die Signalverarbeitungseinheit in dem Gehäuse integriert sind.

2. Vorrichtung gemäß Anspruch 1, wobei die Bewegungssensoreinheit ein Akzelerometer aufweist.

3. Vorrichtung gemäß Anspruch 1 oder 2, wobei die physiologische Sensoreinheit einen Pulsoxymetriesensor.

4. Vorrichtung gemäß einem der vorhergehenden Ansprüche, wobei das von der Signalverarbeitungseinheit erzeugte Audiosignal ein oder mehrere vorgespeicherte Sprachelemente oder Tonsignale aufweist, die für zumindest einen Wert der Leistungsdaten indikativ sind.

5. Vorrichtung gemäß einem der vorhergehenden Ansprüche, wobei die Signalverarbeitungseinheit zum Modifizieren vorgespeicherter Audiodaten in Abhängigkeit von zumindest einem Wert der Leistungsdaten eingerichtet ist.

6. Vorrichtung gemäß einem der vorhergehenden Ansprüche, wobei das Gehäuse einen ersten Abschnitt und einen zweiten Abschnitt aufweist, wobei der erste Abschnitt zum Einführen in einen Gehörgang und der zweite Abschnitt zur Befestigung in einer Ohrmuschel eingerichtet sind, wobei eine Form und/oder Größe des zweiten Abschnittes anpassbar ist.

7. Vorrichtung gemäß einem der vorhergehenden Ansprüche, ferner aufweisend eine kapazitive Sensoreinheit, die an einer Oberfläche des Gehäuses derart angeordnet ist, dass sie von einem Benutzer berührt werden kann, wenn die Vorrichtung im Ohr des Benutzers angebracht ist.

8. Vorrichtung gemäß einem der vorhergehenden Ansprüche, ferner aufweisend ein Mikrofon, insbesondere ein Knochenleitungsmikrofon, das zum Erfassen von Benutzersprechen, insbesondere von vom Benutzer gesprochenen Sprachbefehle, eingerichtet ist.

9. Vorrichtung gemäß einem der vorhergehenden Ansprüche, ferner aufweisend eine Elektroenzephalografie-Sensoreinheit, die zum Erfassen eines elektrischen Signals an einer Hautoberfläche eines Benutzers eingerichtet ist.

10. Vorrichtung gemäß einem der Ansprüche 7 bis 9, ferner aufweisend eine Steuereinheit, die in dem Gehäuse integriert ist und ferner zum Steuern der Vorrichtung in Abhängigkeit von Berührungen, die von der kapazitiven Sensoreinheit erfasst werden, und/oder in Abhängigkeit von Benutzersprechen, das von dem Mikrofon erfasst wird, und/oder in Abhängigkeit von einem elektrischen Signal, das von Elektroenzephalografie-Sensoreinheit erfasst wird.

11. Vorrichtung gemäß einem der vorhergehenden Ansprüche, ferner aufweisend einen Kontaktsensor zum Detektieren, ob die Vorrichtung im Ohr angebracht ist.

12. Vorrichtung gemäß einem der vorhergehenden Ansprüche, ferner aufweisend einen Speicher zum Speichern der von der Datenverarbeitungseinheit erzeugten Leistungsdaten.

13. Vorrichtung gemäß einem der vorhergehenden Ansprüche, ferner aufweisend eine im Gehäuse integrierte Kommunikationseinheit zur drahtlosen Datenkommunikation mit einem externen Gerät.

14. Vorrichtung gemäß einem der vorhergehenden Ansprüche, ferner aufweisend eine Nahfeldkommunikationseinheit.

15. System aufweisend zwei Vorrichtungen gemäß einem der vorhergehenden Ansprüche, wobei beide Vorrichtungen zum drahtlosen Datenkommunikation miteinander eingerichtet sind.

16. System gemäß dem vorhergehenden Anspruch, wobei die Signalverarbeitungseinheit von zumindest einer der beiden Vorrichtungen dazu eingerichtet ist, ein binaurales Audiosignal basierend auf den erzeugten Leistungsdaten zu erzeugen.

17. System gemäß Anspruch 15 oder 16, wobei zumindest eine der Vorrichtungen ein Knochenleitungsmikrofon aufweist und beide Vorrichtungen ein Mikrofon aufweisen, das zum Erfassen von Umgebungsschall eingerichtet ist.

18. System gemäß dem vorhergehenden Anspruch, wobei zumindest eine der Vorrichtungen eine Erkennungseinheit aufweist, die zum Erkennen

vorbestimmter Bewegungsmuster eingerichtet ist, die bei streichenden Berührungen einer Körperoberfläche eines Benutzers entstehen.

19. Verfahren aufweisend:

Erfassen von Bewegungsdaten mittels einer Bewegungssensoreinheit,

Erfassen von physiologischen Daten mittels einer physiologischen Sensoreinheit,

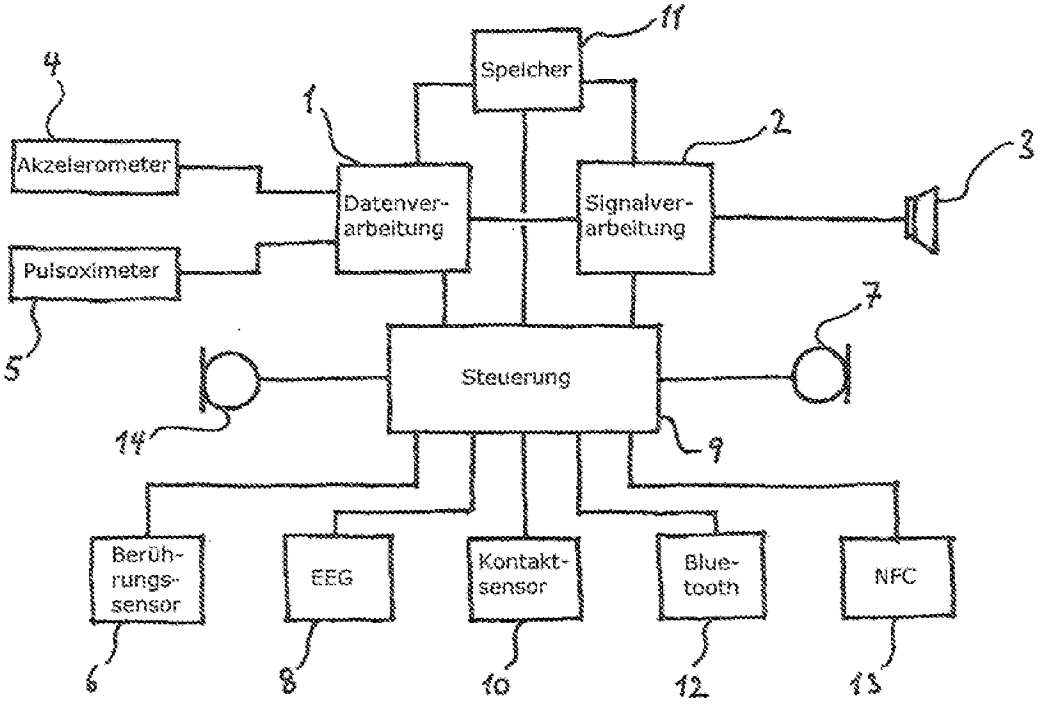
Erzeugen von Leistungsdaten basierend auf den Bewegungsdaten und/oder den physiologischen Daten mittels einer Datenverarbeitungseinheit,

Erzeugen eines Audiosignals basierend auf den erzeugten Leistungsdaten mittels einer Signalverarbeitungseinheit, und

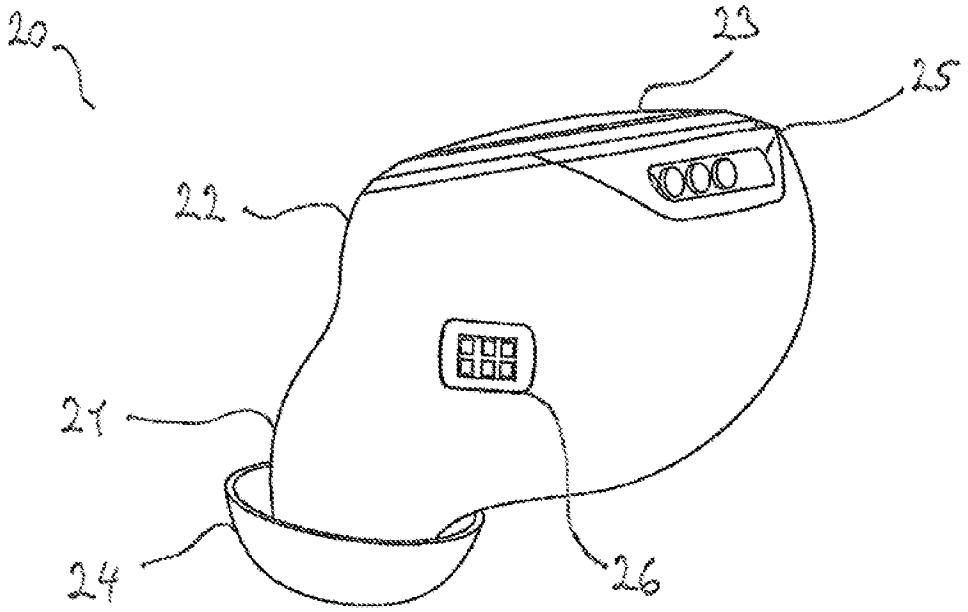
Ausgeben des erzeugten Audiosignals mittels eines Lautsprechers,

wobei die Bewegungssensoreinheit, die physiologische Sensoreinheit, der Lautsprecher, die Datenverarbeitungseinheit und die Signalverarbeitungseinheit in einem Gehäuse integriert sind, das zum Tragen im Ohr eingerichtet ist.

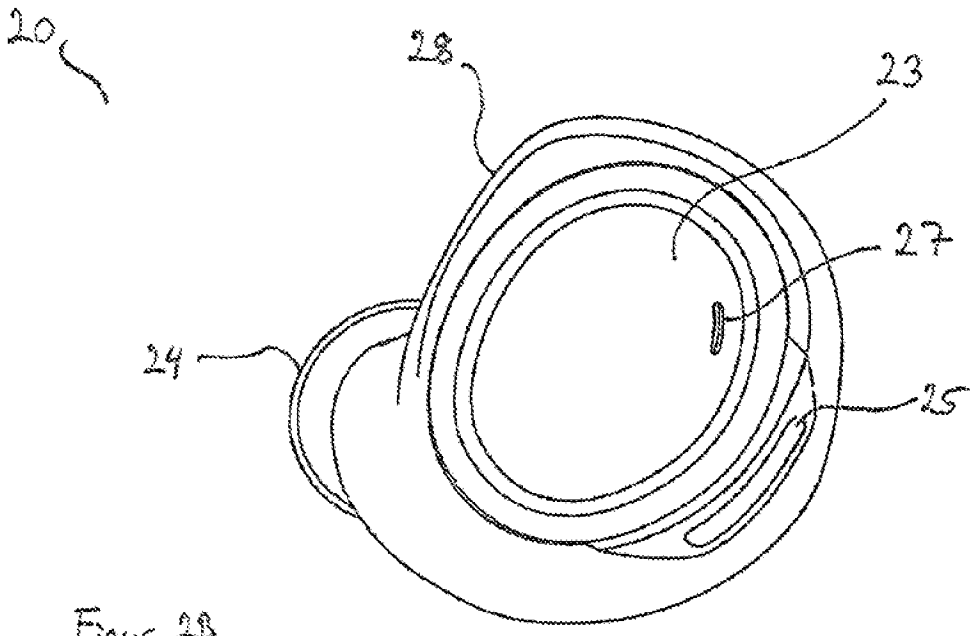
20. Verwendung einer Vorrichtung gemäß einem der Ansprüche 1 bis 14 oder ein System gemäß einem der Ansprüche 15 bis 18 als Headset in Verbindung mit einer mobilen Kommunikationsvorrichtung.


Speicher
11
4
1
2
3
Akzelerometer
Datenver-
arbeitung
Signalver-
arbeitung
Pulsoximeter
5
7
Steuerung
14
9
Berüh-
rungs-
sensor
EEG
Kontakt-
sensor
Blue-
tooth
NFC
6
8
10
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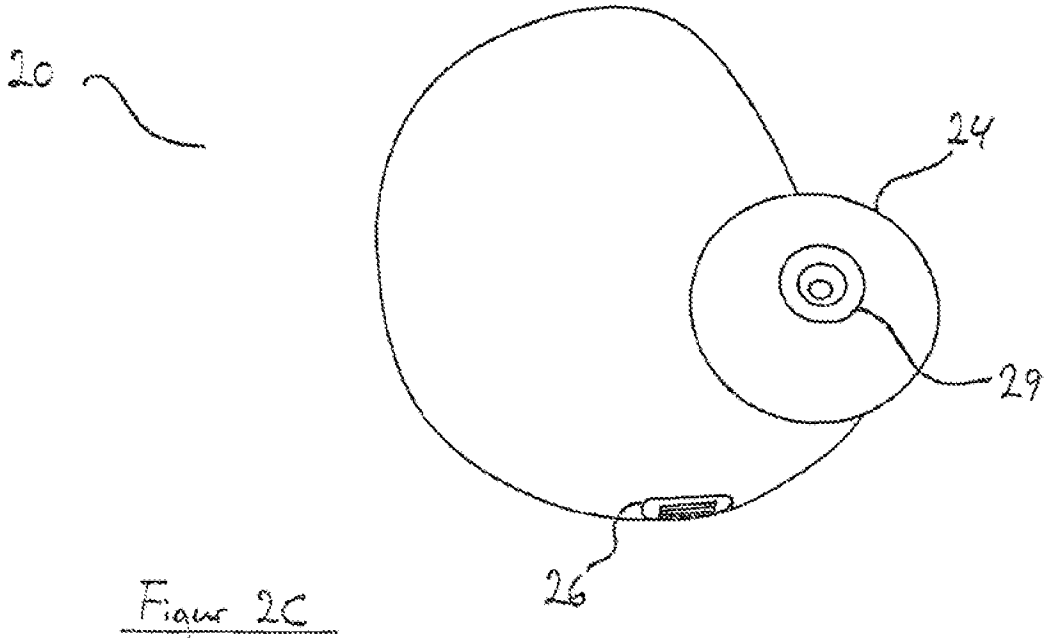
Figur 1



Figur 2A



Figur 2B



Figur 2C

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/051356

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04R1/10 H04R5/033
ADD. H04R1/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/097689 A1 (PREST CHRISTOPHER [US] ET AL) 16 April 2009 (2009-04-16)	1,2,4-7, 10-16, 18-20
Y	abstract paragraph [0008] paragraph [0010] paragraph [0032] - paragraph [0038] paragraph [0054] - paragraph [0055] figures 1A,1D,2	3,8,9,17
Y	US 2008/076972 A1 (DOROGUSKER JESSE LEE [US] ET AL) 27 March 2008 (2008-03-27) abstract paragraph [0041] - paragraph [0042]	3,9

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 April 2015	11/05/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Fülöp, István

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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/255430 A1 (ALEXANDERSSON GUSTAF [SE] ET AL) 16 October 2008 (2008-10-16) abstract paragraph [0090] paragraph [0097] figures 4B,4C	3,9
Y	US 2009/105548 A1 (BART GARY F [US]) 23 April 2009 (2009-04-23) abstract figure 4	8,17

1

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009097689 A1	16-04-2009	US 2009097689 A1	16-04-2009
		US 2014161300 A1	12-06-2014
US 2008076972 A1	27-03-2008	US 2008076972 A1	27-03-2008
		US 2009287067 A1	19-11-2009
		WO 2008118261 A1	02-10-2008
US 2008255430 A1	16-10-2008	US 2008255430 A1	16-10-2008
		WO 2008125151 A1	23-10-2008
US 2009105548 A1	23-04-2009	NONE	

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP2015/051356

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
INV. H04R1/10 H04R5/033
ADD. H04R1/14

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
H04R

Recherchierte, aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal, WPI Data

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	US 2009/097689 A1 (PREST CHRISTOPHER [US] ET AL) 16. April 2009 (2009-04-16)	1,2,4-7, 10-16, 18-20
Y	Zusammenfassung Absatz [0008] Absatz [0010] Absatz [0032] - Absatz [0038] Absatz [0054] - Absatz [0055] Abbildungen 1A,1D,2	3,8,9,17
Y	US 2008/076972 A1 (DOROGUSKER JESSE LEE [US] ET AL) 27. März 2008 (2008-03-27) Zusammenfassung Absatz [0041] - Absatz [0042]	3,9

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[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen [X] Siehe Anhang Patentfamilie

* Besondere Kategorien von angegebenen Veröffentlichungen :
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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
30. April 2015	11/05/2015

Name und Postanschrift der internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Fülöp, István

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Formblatt PCT/ISA/210 (Blatt 2) (April 2005)

C. (Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
Y	US 2008/255430 A1 (ALEXANDERSSON GUSTAF [SE] ET AL) 16. Oktober 2008 (2008-10-16) Zusammenfassung Absatz [0090] Absatz [0097] Abbildungen 4B,4C	3,9
Y	US 2009/105548 A1 (BART GARY F [US]) 23. April 2009 (2009-04-23) Zusammenfassung Abbildung 4	8,17

1

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
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		US 2014161300 A1	12-06-2014
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		WO 2008118261 A1	02-10-2008
US 2008255430 A1	16-10-2008	US 2008255430 A1	16-10-2008
		WO 2008125151 A1	23-10-2008
US 2009105548 A1	23-04-2009	KEINE	

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
30. Juli 2015 (30.07.2015)

WIPO | PCT

(10) Internationale Veröffentlichungsnummer
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(51) Internationale Patentklassifikation:
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H04R 5/033 (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2015/051374

(22) Internationales Anmeldedatum:
23. Januar 2015 (23.01.2015)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2014 100 824.3
24. Januar 2014 (24.01.2014) DE
10 2014 109 007.1 26. Juni 2014 (26.06.2014) DE

(72) Erfinder; und
(71) Anmelder : **HVIID, Nikolaj** [DK/DE]; Kreuzweg 37C, 82131 Stockdorf (DE).

(74) Anwalt: **DILG, Andreas**; Dilg, Haeusler, Schindelmann Patentanwaltsgesellschaft mbH, Leonrodstr. 58, 80636 München (DE).

(81) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

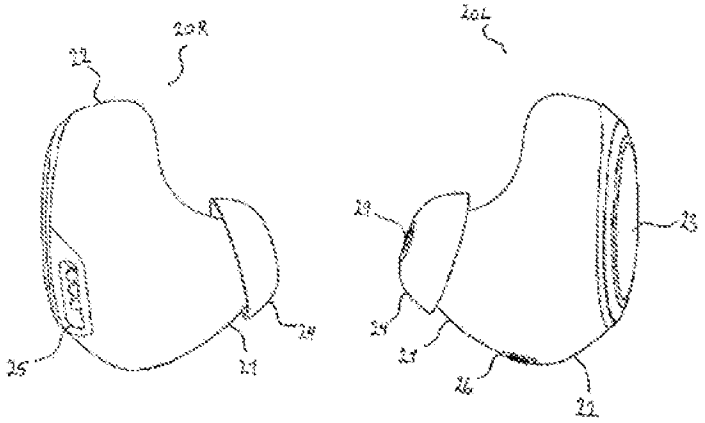
(84) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, RU, TJ, TM), europäisches (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

(54) **Title**: MULTIFUNCTIONAL HEADPHONE SYSTEM FOR SPORTS ACTIVITIES

(54) **Bezeichnung** : MULTIFUNKTIONSKOPFHÖRERSYSTEM FÜR SPORTLICHE AKTIVITÄTEN



Figur 3

(57) **Abstract**: A multifunctional headphone system for sports activities is described that has the following: a first apparatus that is set up to be worn in one ear of a user and has a first data communication unit and a first loudspeaker, and a second apparatus that is set up to be worn in the other ear of the user and has a second data communication unit and a second loudspeaker, wherein at least one of the first and second apparatuses has a sensor unit and a data processing unit, wherein the data processing unit is set up to produce performance data on the basis of measurement data captured by the sensor unit, wherein the first apparatus additionally has a signal processing unit that is set up to produce a binaural audio signal on the basis of the performance data, the binaural audio signal having a first signal component for output by the first loudspeaker and a second signal component for output by the second loudspeaker, and wherein the first data communication unit is set up to transmit the second signal component of the binaural audio signal to the second data communication unit. In addition, a method is described.

(57) **Zusammenfassung**:

[Fortsetzung auf der nächsten Seite]

WO 2015/110587 A1

Es wird ein Multifunktionskopfhörersystem für sportliche Aktivitäten beschrieben, das folgendes aufweist: eine erste Vorrichtung, die zum Tragen in einem Ohr eines Benutzers eingerichtet ist und eine erste Datenkommunikationseinheit und einen ersten Lautsprecher aufweist, und eine zweite Vorrichtung, die zum Tragen im anderen Ohr des Benutzers eingerichtet ist und eine zweite Datenkommunikationseinheit und einen zweiten Lautsprecher aufweist, wobei zumindest eine der ersten und zweiten Vorrichtungen eine Sensoreinheit und eine Datenverarbeitungseinheit aufweist, wobei die Datenverarbeitungseinheit zum Erzeugen von Leistungsdaten basierend auf von der Sensoreinheit erlassten Messdaten eingerichtet ist, wobei die erste Vorrichtung ferner eine Signalverarbeitungseinheit aufweist, die zum Erzeugen eines binauralen Audiosignals basierend auf den Leistungsdaten eingerichtet ist, das binaurale Audiosignal aufweisend einen ersten Signalteil zur Ausgabe durch den ersten Lautsprecher und einen zweiten Signalteil zur Ausgabe durch den zweiten Lautsprecher, und wobei die erste Datenkommunikationseinheit zum Übertragen des zweiten Signalteils des binauralen Audiosignals an die zweite Datenkommunikationseinheit eingerichtet ist. Es wird ferner ein Verfahren beschrieben.

Multifunktionskopfhörersystem für sportliche Aktivitäten

Gebiet der Erfindung

Die Erfindung betrifft das Gebiet der Multimediageräte mit Funktionalität zur Erfassung, Auswertung und Ausgabe von Daten in Bezug auf sportliche Aktivitäten oder medizinische Rehabilitationsmaßnahmen, insbesondere das Gebiet der tragbaren Systeme, die zur Erfassung, Auswertung und Ausgabe solcher Daten in Verbindung mit dem Ausüben sportlicher Aktivitäten geeignet sind.

Hintergrund

Es besteht eine Vielzahl von verschiedenen Systemen, die es Benutzer beim Ausüben sportlicher Aktivitäten möglich machen, verschiedenste leistungsrelevante und auf andere Weise interessante Informationen, wie beispielsweise Herzschlagfrequenz, Atemfrequenz, Geschwindigkeit, Zeitdauer und viele weiteren Daten, aufzuzeichnen und zu analysieren, sowohl während des Ausübens als auch nach dem Ausüben der sportlichen Aktivität.

Ein Teil dieser Systeme gibt mangels einer Anzeigevorrichtung dem Benutzer Auskunft über die vorgenannten Informationen durch Ausgabe verschiedener Audiosignale, wie etwa Töne oder Sprachsignale, die die Informationen quantifizieren sollen. Diese Ausgabeform ist aber mit erheblichen Einschränkungen verbunden. Somit kann beispielsweise nur Auskunft über eine einzelne Information nach der anderen gegeben werden. Ferner fehlt es an eine einfache und intuitive Methode, Auskunft über die Relation zwischen einem gegenwärtigen Wert und einem voreingestellten Schwellenwert zu geben.

Der vorliegenden Erfindung liegt die Aufgabe zugrunde, ein Kopfhörersystem für sportliche Aktivitäten bereitzustellen, das Auskunft über leistungsrelevante Informationen in einer einfachen und intuitiv leicht erfassbaren Art und Weise geben kann.

Zusammenfassung

Diese Aufgabe wird gelöst durch die Gegenstände der unabhängigen Patentansprüche. Vorteilhafte Ausführungsformen der vorliegenden Erfindung sind in den abhängigen Ansprüchen beschrieben.

Gemäß einem ersten Aspekt der Erfindung wird ein Multifunktionskopfhörersystem für sportliche Aktivitäten beschrieben. Das beschriebene System weist folgendes auf: (a) eine erste Vorrichtung, die zum Tragen in einem Ohr eines Benutzers eingerichtet ist und eine erste Datenkommunikationseinheit und einen ersten Lautsprecher aufweist, und (b) eine zweite Vorrichtung, die zum Tragen im anderen Ohr des Benutzers eingerichtet ist und eine zweite Datenkommunikationseinheit und einen zweiten Lautsprecher aufweist, (c) wobei zumindest eine der ersten und zweiten Vorrichtungen eine Sensoreinheit und eine Datenverarbeitungseinheit aufweist, wobei die Datenverarbeitungseinheit zum Erzeugen von Leistungsdaten basierend auf von der Sensoreinheit erfassten Messdaten eingerichtet ist, (d) wobei die erste Vorrichtung ferner eine Signalverarbeitungseinheit aufweist, die zum Erzeugen eines binauralen Audiosignals basierend auf den Leistungsdaten eingerichtet ist, das binaurale Audiosignal aufweisend einen ersten Signalteil zur Ausgabe durch den ersten Lautsprecher und einen zweiten Signalteil zur Ausgabe durch den zweiten Lautsprecher, und (e) wobei die erste Datenkommunikationseinheit zum

Übertragen des zweiten Signalteils des binauralen Audiosignals an die zweite Datenkommunikationseinheit eingerichtet ist.

Das beschriebene System besteht aus zwei Vorrichtungen, die jeweils zum Tragen in einem Ohr (links und rechts) eingerichtet ist und einen Lautsprecher sowie eine Datenkommunikationseinheit aufweist. Die erste und zweite Vorrichtung können mittels der jeweiligen Datenkommunikationseinheiten mit einander kommunizieren, insbesondere können sie beide Daten an die andere Vorrichtung übertragen und Daten von der anderen Vorrichtung empfangen. Zumindest eine der beiden Vorrichtungen weist eine Sensoreinheit und eine Datenverarbeitungseinheit auf, wobei letztere zum Erzeugen von Leistungsdaten basierend auf Messdaten eingerichtet ist, die von der Sensoreinheit erfasst werden. Die erste (oder die zweite) Vorrichtung weist ferner eine Signalverarbeitungseinheit auf, die zum Erzeugen eines binauralen Audiosignals basierend auf den Leistungsdaten eingerichtet ist. Das binaurale Audiosignal besteht aus einem ersten Signalteil, der zur Ausgabe durch den ersten Lautsprecher vorgesehen ist, und einem zweiten Signalteil, der zur Ausgabe durch den zweiten Lautsprecher vorgesehen ist. Die erste Datenkommunikationseinheit ist zum Übertragen des zweiten Signalteils des binauralen Audiosignals an die zweite Datenkommunikationseinheit eingerichtet, so dass der zweite Signalteil von dem zweiten Lautsprecher ausgegeben werden kann. Durch synchronisierte Ausgabe des ersten Signalteils im einen Ohr und des zweiten Signalteils im anderen Ohr, kann der Benutzer das binaurale Audiosignal wahrnehmen und dadurch Informationen erhalten, die für das Ausüben einer sportlichen Aktivität relevant sind.

In diesem Dokument bezeichnet „binaurales Audiosignal" insbesondere ein Audiosignal, das beim Ausgeben in den beiden Ohren eines Benutzers einen räumlichen Höreindruck mit genauer Richtungslokalisation hervorruft. Mit anderen Worten kann der Benutzer einer einzelnen Komponente, wie

beispielsweise einem gepulsten Tonsignal, eines binauralen Audiosignals eine bestimmte Position im dreidimensionalen Raum zuordnen.

In diesem Dokument bezeichnet „Sensoreinheit" insbesondere eine Einheit mit einem oder mehreren einzelnen Sensoren, die zum Erzeugen eines oder mehrerer elektrischen Signale (Messdaten) basierend auf elektrische Signale von jedem einzelnen Sensor eingerichtet ist.

In diesem Dokument bezeichnet „Leistungsdaten" insbesondere Daten, die Werte in Bezug auf sportliche Aktivitäten aufweisen. Solche Werte umfassen insbesondere Werte, die für die sportliche Aktivität beschreibend sind, wie beispielsweise eine Länge einer gelaufenen, gefahrenen oder geschwommenen Strecke oder einen Höhenunterschied, sowie Werte, die für den Benutzer beschreibend sind, wie beispielsweise Geschwindigkeit, Atemfrequenz, Sauerstoffsättigung des Blutes oder Herzschlagfrequenz.

Die Datenverarbeitungseinheit ist dazu eingerichtet, die Messdaten von der Sensoreinheit, vorzugsweise als digitale Signale, zu erhalten und zu verarbeiten, um Leistungsdaten durch Berechnung zu erzeugen.

Die Signalverarbeitungseinheit ist dazu eingerichtet, ein binaurales Audiosignal basierend auf Leistungsdaten derart zu erzeugen, dass ein Benutzer beim Hören des binauralen Audiosignals einen oder mehrere spezifischen Werte der Leistungsdaten, Änderungen bei einem oder mehreren spezifischen Werten der Leistungsdaten und/oder eine Relation zwischen einem oder mehreren spezifischen Werten der Leistungsdaten und entsprechenden Referenzwerten, insbesondere Schwellenwerten, erkennen bzw. erfahren kann. Das binaurale Audiosignal ermöglicht insbesondere, dass Informationen über mehrere Werte gleichzeitig an verschiedenen räumlichen Positionen zu hören sind.

Die Datenverarbeitungseinheit und die Signalverarbeitungseinheit mögen als einzelne Verarbeitungseinheiten (Hardware) oder sie mögen als funktionelle Einheiten auf einem oder mehreren Prozessoren (Software) implementiert sein.

Jede Vorrichtung weist ein Gehäuse auf, in dem die jeweilige ganze Vorrichtung integriert ist. Jedes Gehäuse ist zum Tragen im Ohr eines Benutzers eingerichtet. Dabei ist jedes Gehäuse so geformt, dass die jeweilige Vorrichtung in einem typischen (linken oder rechten) Ohr gut hineinpasst und festgehalten werden kann, auch bei sportlichen Aktivitäten. Jedes Gehäuse weist vorzugsweise eine Öffnung auf, die so gestaltet und positioniert ist, dass der (erste oder zweite) Lautsprecher Schall in den Gehörgang des Benutzers abgeben kann.

Zusammenfassend ermöglicht das System, dass ein Benutzer beim Ausüben einer sportlichen Aktivität mittels binauraler Audioausgabe über Werte von Leistungsdaten informiert wird, wobei die einzelne Werte der Leistungsdaten auf Messdaten basieren, die während der sportlichen Aktivität von der Sensoreinheit erfasst werden.

Somit stellt das System eine Vielzahl von Funktionalitäten bereit, ohne dass weitere Geräte oder externe Sensoren benötigt werden, und ermöglicht insbesondere eine Ausgabe von leistungsrelevanten Informationen in einer einfachen und intuitiv leicht erfassbaren Art und Weise. Dabei sind die Vorrichtungen des Systems sehr kompakt, diskret und angenehm im Ohr zu tragen.

Gemäß einem Ausführungsbeispiel der Erfindung weist das von der Signalverarbeitungseinheit erzeugte binaurale Audiosignal eine Signalkomponente auf, die für einen Wert der Leistungsdaten indikativ ist.

In diesem Dokument bezeichnet „Signalkomponente" insbesondere einen Bestandteil des binauralen Audiosignals, den der Benutzer von anderen Bestandteilen des Audiosignals unterscheiden kann bzw. eindeutig identifizieren kann. Insbesondere kann der Benutzer der Signalkomponente eine räumliche Position zuordnen, das heißt, er kann eine Richtung erkennen, aus welcher die Signalkomponente wiedergeben wird.

Die Signalkomponente mag insbesondere vorgespeicherte Sprachelemente oder ein Tonsignal aufweisen.

Die Signalkomponente mag beispielsweise aus einem Namen des Wertes gefolgt von dem gegenwärtigen Wert des Wertes bestehen, wie beispielsweise „Geschwindigkeit" gefolgt von „23 Kilometer pro Stunde", „Geschwindigkeit" gefolgt von „5 Minuten und 17 Sekunden pro Kilometer" oder „Herzfrequenz" gefolgt von „155 Schläge pro Minute".

Alternativ mag die Signalkomponente aus einem Namen des Wertes gefolgt von einem gepulsten Tonsignal bestehen, wobei die Pulsfrequenz und/oder Tonhöhe des gepulsten Tonsignals von dem Wert der Leistungsdaten abhängt. Dabei kann der Benutzer Änderungen in dem Wert erkennen, indem die Pulsfrequenz und/oder Tonhöhe des Tonsignals sich ändern.

Weiter alternativ mag die Signalkomponente lediglich aus einem gepulsten Tonsignal, wie das oben beschriebene, bestehen.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung ist die Signalverarbeitungseinheit ferner dazu eingerichtet, das binaurale Audiosignal so zu erzeugen, dass eine räumliche Position der Signalkomponente von dem Wert der Leistungsdaten abhängig ist.

Mit anderen Worten wird die räumliche Position der Signalkomponente verschoben, wenn der entsprechende Wert sich ändert. Dies kann zum Beispiel so erfolgen, dass die Signalkomponente nach vorne oder nach oben verlagert wird, wenn der Wert zunimmt, und nach hinten oder nach unten verlagert wird, wenn der Wert abnimmt.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung ist die räumliche Position der Signalkomponente relativ zu einer Ebene abhängig von einer Differenz zwischen dem Wert der Leistungsdaten und einem vorbestimmten Referenzwert.

Die Ebene mag insbesondere eine vertikale Ebene durch den Körper des Benutzers oder eine horizontale Ebene durch den Kopf (auf Höhe der Ohren) des Benutzers sein. Solange die Signalkomponente in einer dieser Ebenen wiedergeben wird, das heißt, direkt an der linken oder rechten Seite des Benutzers oder auf Höhe der Ohren des Benutzers, dann ist der Wert gleich oder nahe an dem vorbestimmten Referenzwert.

Wenn der Wert den vorbestimmten Referenzwert oder Schwellenwert übersteigt, wird die Position der Signalkomponente zum Beispiel nach vorne oder nach oben verschoben, wobei die Menge der Verschiebung von der Differenz zwischen dem Leistungswert und dem Referenzwert abhängt. In ähnlicher Weise kann die Position der Signalkomponente nach unten oder nach hinten verschoben werden, wenn der Wert den (oder einen anderen) Referenzwert oder Schwellenwert unterschreitet. Veranschaulichend könnte dies so umgesetzt werden, dass ein gepulstes Tonsignal in Bezug auf die Herzfrequenz des Benutzers auf Höhe der Ohren zu hören ist, solange die Herzfrequenz sich in einem vorbestimmten Bereich befindet, wie etwa 130-140 Schläge pro Minute, nach oben verschoben wird, wenn die Herzfrequenz den maximalen Wert des vorbestimmten Bereichs überschreitet, das heißt 140 Schläge pro Minute, und nach unten verschoben wird, wenn die Herzfrequenz

den minimalen Wert des vorbestimmten Bereichs unterschreitet, das heißt 130 Schläge pro Minute.

Somit kann der Benutzer leicht und intuitiv erkennen, ob der Wert von dem vorbestimmten Referenzwert abweicht und, wenn dies der Fall ist, entsprechend agieren, um den Wert wieder an den vorbestimmten Referenzwert anzunähern.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist das von der Signalverarbeitungseinheit erzeugte binaurale Audiosignal eine weitere Signalkomponente auf, die für einen weiteren Wert der Leistungsdaten indikativ ist, und die Signalverarbeitungseinheit ist ferner dazu eingerichtet, das binaurale Audiosignal so zu erzeugen, dass eine räumliche Position der weiteren Signalkomponente unterschiedlich von der räumlichen Position der Signalkomponente ist.

Wenn das binaurale Audiosignal mehrere Signalkomponenten aufweist, können damit Werte in Bezug auf verschiedene Leistungsdaten an verschiedenen vorbestimmten Stellen im dreidimensionalen Raum um den Kopf des Benutzers herum wiedergegeben werden. Zum Beispiel kann ein erstes gepulstes Tonsignal oder Sprachsignal bzgl eines ersten Leistungswertes an einer Stelle links oben und ein zweites gepulstes Tonsignal oder Sprachsignal bzgl. eines zweiten Leistungswertes an einer Stelle vorne unten wiedergeben werden. Die Wiedergabe der einzelnen Signalkomponente mag gleichzeitig oder zeitversetzt stattfinden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung ist die Signalverarbeitungseinheit zum Modifizieren vorgespeicherter Audiodaten in Abhängigkeit von zumindest einem Wert der Leistungsdaten eingerichtet.

Das Modifizieren der vorgespeicherten Audiodaten mag insbesondere darin bestehen, eine Lautstärke, eine Wiedergabegeschwindigkeit und/oder eine Tonhöhe der vorgespeicherten Audiodaten in Abhängigkeit von dem zumindest einen Wert der Leistungsdaten zu reduzieren oder erhöhen. Mit anderen Worten mag die Signalverarbeitungseinheit zum Beispiel die Lautstärke, Wiedergabegeschwindigkeit und/oder Tonhöhe der vorgespeicherten Audiodaten erhöhen, wenn die Herzschlagfrequenz einen oberen Schwellenwert überschreitet, und reduzieren, wenn die Herzschlagfrequenz einen unteren Schwellenwert unterschreitet.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung sind die erste Datenkommunikationseinheit und die zweite Datenkommunikationseinheit drahtlose Datenkommunikationseinheiten, die zum Kommunizieren mit einander eingerichtet sind.

Die Datenkommunikationseinheiten mögen insbesondere Bluetooth-Einheiten sein, mit der eine drahtlose Datenkommunikation zwischen den beiden Vorrichtungen durchgeführt werden kann, um Messdaten, Leistungsdaten und Audiosignale von einer Vorrichtung zur anderen Vorrichtung und umgekehrt zu übertragen.

Zumindest eine der drahtlosen Datenkommunikationseinheiten mag ferner zur drahtlosen Datenkommunikation mit einem externen Gerät eingerichtet sein, wie zum Beispiel einem Mobiltelefon, einem Smartphone, einem Tablet, einem Laptop-Computer usw. Die Datenkommunikationseinheit mag optional eine Infrarot-Einheit aufweisen, die eine Datenübertragung mit moduliertem infrarotem Licht ermöglicht.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Sensoreinheit eine physiologische Sensoreinheit auf.

In diesem Dokument bezeichnet „physiologische Sensoreinheit" insbesondere eine Sensoreinheit, die zum Erzeugen eines oder mehrerer elektrischen Signale in Abhängigkeit von einem oder mehreren physiologischen Werten eines Benutzers eingerichtet ist.

Die physiologische Sensoreinheit mag insbesondere einen Pulsoxymetriesensor aufweisen, das heißt einen Sensor zur nicht invasiven Ermittlung der arteriellen Sauerstoffsättigung über die Messung der Lichtabsorption. Dieser mag zwei unterschiedlich gefärbte Lichtquellen, insbesondere Leuchtdioden, und einen Fotosensor aufweisen und ist vorzugsweise derart in dem Gehäuse der Vorrichtung angebracht, dass die Lichtquellen einen Bereich der Hautoberfläche im Ohr des Benutzers beleuchten können und der Fotosensor entsprechende Reflektionen von der Hautoberfläche detektieren kann, wenn die Vorrichtung im Ohr des Benutzers angebracht ist. Der Pulsoxymetriesensor mag insbesondere im Bereich einer Oberfläche des Gehäuses derart angebracht sein, dass der Pulsoxymetriesensor sich beim Tragen der Vorrichtung im Ohr in engem Kontakt mit der Hautoberfläche im Ohr befindet, insbesondere der Hautoberfläche im Bereich hinter dem Tragus. (Als Tragus wird die kleine Knorpelmasse an der Ohrmuschel bezeichnet, die kurz vor dem Gehörgang (Porus acusticus externus) aufliegt).Durch Ansteuerung der Lichtquellen und Verarbeitung des vom Fotosensor ausgegebenen Signals kann die Datenverarbeitungseinheit zum Beispiel unter anderem die folgenden Leistungsdaten erzeugen: einen arteriellen Sauerstoffsättigungswert, einen Atmungsfrequenzwert, einen kardiovaskulären Flusswert, einen Herzzeitvolumenwert, einen Blutdruckwert und einen Blutzuckerwert.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist die Sensoreinheit eine Bewegungssensoreinheit auf.

In diesem Dokument bezeichnet „Bewegungssensoreinheit" insbesondere eine Sensoreinheit, die zum Erzeugen eines oder mehrerer elektrischen Signale in

Abhängigkeit von Bewegung der Sensoreinheit eingerichtet ist, insbesondere elektrische Signale, die von einer Beschleunigung, Neigung oder Verschiebung der Sensoreinheit relativ zu einer oder mehreren vorbestimmten Richtungen abhängen.

Die Bewegungssensoreinheit mag insbesondere ein Akzelerometer bzw. einen Beschleunigungssensor aufweisen, das bzw. der zum Erfassen von Beschleunigung und/oder Beschleunigungsänderungen in zumindest einer vorbestimmten Richtung relativ zu dem Gehäuse der Vorrichtung eingerichtet ist. In einer bevorzugten Ausführungsform ist das Akzelerometer ein 3D-Akzelerometer, das Beschleunigungen entlang dreier aufeinander senkrechten Richtungen erfassen und drei entsprechende elektrische Signale ausgeben kann.

Durch Bearbeitung der Signale von der Bewegungssensoreinheit, beispielsweise mittels Mustererkennung, kann die Datenverarbeitungseinheit zum Beispiel folgende und weitere Leistungsdaten erzeugen: einen Schrittzahlwert, einen Distanzwert und einen Geschwindigkeitswert.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weisen beide Vorrichtungen eine Bewegungssensoreinheit auf.

Durch Verarbeitung von Bewegungsdaten, die im Bereich beider Ohren des Benutzers erfasst werden, kann eine erhöhte Präzision der Leistungsdaten erreicht werden.

Die Datenverarbeitungseinheit mag insbesondere dazu eingerichtet sein, sowohl die Messdaten von der Bewegungssensoreinheit (Bewegungsdaten) als auch die Messdaten von der physiologischen Sensoreinheit (physiologischen Daten), vorzugsweise als digitale Signale, zu erhalten und zu verarbeiten, um Leistungsdaten durch Berechnung zu erzeugen. Dabei können einige Werte der

Leistungsdaten allein basierend auf den Bewegungsdaten, andere Werte der Leistungsdaten allein basierend auf den physiologischen Daten und noch weitere Werte der Leistungsdaten basierend auf sowohl den Bewegungsdaten als auch den physiologischen Daten berechnet werden.

Zusammenfassend ermöglicht das System, dass ein Benutzer beim Ausüben einer sportlichen Aktivität mittels binauraler Audioausgabe über mehrere Werte von Leistungsdaten informiert wird, wobei die einzelne Werte der Leistungsdaten auf Bewegungsdaten und/oder physiologischen Daten basieren, die während der sportlichen Aktivität jeweils von der Bewegungssensoreinheit und/oder der physiologischen Sensoreinheit erfasst werden, und durch an verschiedenen räumlichen Positionen um den Kopf des Benutzers herum erklingende Signalkomponente dargestellt werden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist das Gehäuse jeder Vorrichtung einen ersten Abschnitt und einen zweiten Abschnitt auf, wobei der erste Abschnitt zum Einführen in einen Gehörgang und der zweite Abschnitt zur Befestigung in einer Ohrmuschel eingerichtet sind, wobei eine Form und/oder Größe des zweiten Abschnittes anpassbar ist.

Der erste Abschnitt ist im Wesentlichen kegelförmig und so geformt, dass er in einem äußeren Teil des Gehörgangs hineinpasst. Der Lautsprecher ist vorzugsweise innerhalb des ersten Abschnittes angebracht, um Schall direkt in den Gehörgang abzugeben.

Der zweite Abschnitt ist so geformt, dass er in der Concha der Ohrmuschel eines typischen Ohrs eingesetzt und dort festgehalten werden kann. Die Form und/oder Größe des zweiten Abschnittes mag zum Beispiel durch Hinzufügen selbstklebenden Materials auf einem Teil der Oberfläche des zweiten Abschnittes angepasst werden.

Das gesamte Gehäuse mag insbesondere aus Kunststoff gefertigt sein. Die Öffnungen für Lautsprecher, Sensoren usw. mögen wasserdicht abgedichtet sein, so dass die Vorrichtung auch beim Schwimmen verwendet werden kann.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest eine der Vorrichtungen ferner eine kapazitive Sensoreinheit auf, die an einer Oberfläche des Gehäuses derart angeordnet ist, dass sie von einem Benutzer berührt werden kann, wenn die Vorrichtung im Ohr des Benutzers angebracht ist.

Die kapazitive Sensoreinheit mag insbesondere auf einer Oberfläche des Gehäuses angebracht sein, die nach außen zeigt, wenn die Vorrichtung im Ohr angebracht ist.

Die kapazitive Sensoreinheit ist eingerichtet zum Erfassen von Berührungen, insbesondere klopfenden oder streichenden Berührungen, die zum Beispiel mit einem Finger vom Benutzer getätigt werden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest eine der Vorrichtungen ferner ein Mikrofon auf, insbesondere ein Knochenleitungsmikrofon, das zum Erfassen von Benutzersprechen, insbesondere von vom Benutzer gesprochenen Sprachbefehle, eingerichtet ist.

Die Verwendung eines Knochenleitungsmikrofons ermöglicht insbesondere, dass Benutzersprechen erfasst werden kann, ohne (oder nur geringfügig) von Umgebungsgeräuschen beeinflusst zu werden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest eine der Vorrichtungen ferner eine Elektroenzephalografie-Sensoreinheit (Gehirnstrommessung) auf, die zum Erfassen eines elektrischen Signals an einer Hautoberfläche eines Benutzers eingerichtet ist.

Durch Mustererkennung können aus dem erfassten elektrischen Signal vorbestimmte Gehirnaktivitäten beim Benutzer erkannt werden, insbesondere persönlich aufregende Gedanken.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest eine der Vorrichtungen ferner eine Steuereinheit auf, die in dem Gehäuse integriert ist und ferner zum Steuern der Vorrichtung in Abhängigkeit von Berührungen, die von der kapazitiven Sensoreinheit erfasst werden, und/oder in Abhängigkeit von Benutzersprechen, das von dem Mikrofon erfasst wird, und/oder in Abhängigkeit von einem elektrischen Signal, das von Elektroenzephalografie-Sensoreinheit erfasst wird.

Somit kann der Benutzer beispielsweise die Funktionalität der Vorrichtung durch Berühren der kapazitiven Sensoreinheit, durch Aussprechen von Sprachbefehlen und/oder durch vorbestimmte Gedanken steuern.

Insbesondere mag eine einzige kurze Berührung (Klopfen) auf der kapazitiven Sensoreinheit ein erstes Steuersignal auslösen, zwei aufeinanderfolgende kurze Berührungen ein zweites Steuersignal auslösen usw. Des Weiteren mag ein Streichen nach oben, nach unten, nach vorne und nach hinten jeweils vorbestimmte Steuersignale auslösen.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest einer der Vorrichtungen ferner einen Kontaktsensor auf zum Detektieren, ob die Vorrichtung im Ohr angebracht ist.

Der Kontaktsensor mag insbesondere kapazitiv sein und auf einem Teil der Oberfläche des Gehäuses angebracht sein, der beim Tragen im Ohr die Hautoberfläche kontaktiert. Wenn der Kontaktsensor eine Zeit lang kein Kontakt mit einer Hautoberfläche registriert hat, kann die Vorrichtung

beispielsweise in einem Standby-Modus geschaltet oder ganz ausgeschaltet werden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest einer der Vorrichtungen ferner einen Speicher auf zum Speichern der von der Datenverarbeitungseinheit erzeugten Leistungsdaten.

Durch Abspeichern der Leistungsdaten können diese später vom Speicher ausgelesen und extern verarbeitet werden. Des Weiteren können im Laufe einer sportlichen Aktivität auf die abgespeicherten Leistungsdaten zugegriffen werden, um beispielsweise Durchschnittswerte zu berechnen oder Vergleiche mit früheren Aktivitäten durchzuführen.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest einer der Vorrichtungen ferner eine Nahfeldkommunikationseinheit (NFC-Einheit) auf.

Die NFC-Einheit ermöglicht ein Speichern und/oder Auslesen verschiedener Daten in bzw. aus der Vorrichtung, zum Beispiel Identifikationsdaten des Benutzers oder GPS-Daten, die die letzte Position der Vorrichtung angeben. Solche GPS-Daten können zum Beispiel regelmäßig von einem Smartphone übertragen werden.

Generell funktioniert eine der beide Vorrichtungen des Systems vorzugsweise als primäre Vorrichtung (Master) in dem System, in dem Sinne, dass diese Vorrichtung Steuer- und Datensignale an die zweite (sekundäre) Vorrichtung übermittelt, wobei insbesondere Sensorsignale, die von der sekundären Vorrichtung erfasst und an die primäre Vorrichtung übermittelt werden, bei der Erzeugung von Steuer- und Datensignalen in der primären Vorrichtung berücksichtigt werden.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest eine der Vorrichtungen des Systems ein Knochenleitungsmikrofon auf und beide Vorrichtungen weisen ein Mikrofon auf, das zum Erfassen von Umgebungsschall eingerichtet ist.

Das Knochenleitungsmikrofon ist insbesondere zum Erfassen von Sprachbefehlen eingerichtet, die vom Benutzer zur Steuerung des Systems ausgesprochen werden. Dabei kann der von den externen Mikrofonen erfasste Umgebungsschall zur Rauschminderung verwendet werden, um die Erkennung der Sprachbefehle zu verbessern. Die Erkennung der Sprachbefehle sowie die Verarbeitung zur Rauschminderung erfolgen vorzugsweise in einer entsprechenden Signalverarbeitungseinheit, die in der primären Vorrichtung des Systems integriert ist.

Gemäß einem weiteren Ausführungsbeispiel der Erfindung weist zumindest eine der Vorrichtungen des Systems eine Erkennungseinheit auf, die zum Erkennen vorbestimmter Bewegungsmuster eingerichtet ist, die bei streichenden Berührungen einer Körperoberfläche eines Benutzers entstehen.

Die Erkennungseinheit ist insbesondere dazu eingerichtet, ein Signal von dem Knochenleitungsmikrofon in der primären Vorrichtung und Signale von den nach außen gerichteten Mikrofonen der beiden Vorrichtungen zu erhalten und verarbeiten. Die Verarbeitung weist insbesondere eine Analyse des zeitlichen Verlaufs der Tonhöhe (Frequenz) und Lautstärke für jedes der drei Signale auf. Diese Verarbeitung der Schallsignale, die sich jeweils durch und um den Körper des Benutzers herum fortpflanzt haben, ermöglicht eine Erkennung von vorbestimmten Bewegungsmuster, insbesondere die Erkennung einer Richtung einer streichenden Berührung der Körperoberfläche des Benutzers. Eine solche Erkennung basiert auf die Tatsache, dass die Tonhöhe und Lautstärke des von einem der Mikrofone erfassten Signals im Laufe der Bewegung zunimmt, wenn die Bewegung in Richtung zu dem Mikrofon hin erfolgt, und abnimmt, wenn

die Bewegung von dem Mikrofon weg erfolgt. Eine Analyse des Signals von dem Knochenleitungsmikrofon ermöglicht somit eine Erkennung, ob die Bewegung nach oben oder unten gerichtet ist. In ähnlicher Weise ermöglicht eine Analyse der Signale von den beiden nach außen gerichteten Mikrofonen eine Erkennung, ob die Bewegung nach links oder rechts erfolgt. Durch weitere Analyse aller drei Signale können auch schräge Bewegungen erkannt werden.

Mit anderen Worten kann die Erkennungseinheit erkennen, wenn der Benutzer beispielsweise einen Finger von links nach rechts oder von oben nach unten über seine Wange, Brust oder seinen Bauch zieht.

Die Erkennung solcher Bewegungsmuster bzw. Berührungsmuster kann vorteilhafterweise zum Steuern der Vorrichtungen bzw. des Systems verwendet werden. Genauer gesagt kann jedes erfassbares Bewegungsmuster mit einem vorbestimmten Steuerbefehl verknüpft sein. Zum Beispiel kann eine Bewegung nach oben die Wiedergabelautstärke erhöhen und eine Bewegung nach oben die Wiedergabelautstärke reduzieren.

Das System mag als Headset in Verbindung mit einer mobilen Kommunikationsvorrichtung verwendet werden, insbesondere einem Mobiltelefon, Smartphone oder Tablet.

Die Verwendung als Headset ermöglicht unter anderem, dass die verschiedenen Steuerungsfunktionalitäten des Systems zum Steuern der mobilen Kommunikationsvorrichtung eingesetzt werden und dass Daten, wie beispielsweise GPS-Daten oder Sprachbefehle von einer auf der mobilen Kommunikationsvorrichtung laufenden Navigationsanwendung, an das System übermittelt wird.

Gemäß einem zweiten Aspekt der Erfindung wird ein Verfahren beschrieben. Das beschriebene Verfahren weist die folgenden Schritte auf: (a) Erfassen von Messdaten mittels einer Sensoreinheit, (b) Erzeugen von Leistungsdaten basierend auf den Messdaten mittels einer Datenverarbeitungseinheit, wobei die Sensoreinheit und die Datenverarbeitungseinheit in einer ersten Vorrichtung, die zum Tragen in einem Ohr eines Benutzers eingerichtet ist und eine erste Datenkommunikationseinheit und einen ersten Lautsprecher aufweist, oder in einer zweiten Vorrichtung, die zum Tragen im anderen Ohr des Benutzers eingerichtet ist und eine zweite Datenkommunikationseinheit und einen zweiten Lautsprecher aufweist, enthalten sind, (c) Erzeugen eines binauralen Audiosignals basierend auf den Leistungsdaten mittels einer Signalverarbeitungseinheit, die in der ersten Vorrichtung enthalten ist, das binaurale Audiosignal aufweisend einen ersten Signalteil zur Ausgabe durch den ersten Lautsprecher und einen zweiten Signalteil zur Ausgabe durch den zweiten Lautsprecher, und (d) Übertragen des zweiten Signalteils des binauralen Audiosignals an die zweite Datenkommunikationseinheit mittels der ersten Datenkommunikationseinheit.

Das beschriebene Verfahren basiert im Wesentlichen auf der gleichen Erkenntnis wie das oben beschriebene System gemäß dem ersten Aspekt und den Ausführungsbeispielen davon, nämlich dass Messdaten, wie beispielsweise Bewegungsdaten und/oder physiologische Daten in zumindest einer von zwei eigenständigen Vorrichtung erfasst und verarbeitet werden, um ein binaurales Audiosignal in Abhängigkeit von erzeugten Leistungsdaten zu erzeugen und auszugeben.

Die Erfindung kann sowohl mittels eines Computerprogramms, d.h. einer Software, als auch mittels einer oder mehrerer spezieller elektrischer Schaltungen, d.h. in Hardware oder in beliebig hybrider Form, d.h. mittels Software-Komponenten und Hardware-Komponenten, realisiert werden.

Es wird darauf hingewiesen, dass Ausführungsformen der Erfindung mit Bezug auf unterschiedliche Erfindungsgegenstände beschrieben wurden. Insbesondere sind einige Ausführungsformen der Erfindung mit Verfahrensansprüchen und andere Ausführungsformen der Erfindung mit Vorrichtungsansprüchen beschrieben. Dem Fachmann wird jedoch bei der Lektüre dieser Anmeldung sofort klar werden, dass, sofern nicht explizit anders angegeben, zusätzlich zu einer Kombination von Merkmalen, die zu einem Typ von Erfindungsgegenstand gehören, auch eine beliebige Kombination von Merkmalen möglich ist, die zu unterschiedlichen Typen von Erfindungsgegenständen gehören.

Weitere Vorteile und Merkmale der vorliegenden Erfindung ergeben sich aus der folgenden beispielhaften Beschreibung einer bevorzugten Ausführungsform.

Kurze Beschreibung der Zeichnungen

Figur 1 zeigt ein Blockdiagramm von einer der beiden Vorrichtungen eines Systems gemäß einem Ausführungsbeispiel.

Figur 2A zeigt eine erste Ansicht einer Vorrichtung gemäß einem Ausführungsbeispiel.

Figur 2B zeigt eine zweite Ansicht einer Vorrichtung gemäß einem Ausführungsbeispiel.

Figur 2C zeigt eine dritte Ansicht einer Vorrichtung gemäß einem Ausführungsbeispiel.

Figur 3 zeigt ein System gemäß einem Ausführungsbeispiel.

Detaillierte Beschreibung

Figur 1 zeigt ein Blockdiagramm von einer der beiden Vorrichtungen eines Systems gemäß einem Ausführungsbeispiel. Die Vorrichtung ist in einem Gehäuse integriert, das zum Tragen im Ohr eingerichtet ist und weiter unten in Verbindung mit den Figuren 2A, 2B und 2C näher beschrieben wird, und weist eine Datenverarbeitungseinheit 1, eine Signalverarbeitungseinheit 2, einen Lautsprecher 3, ein Akzelerometer 4 und ein Pulsoximeter bzw. einen Pulsoximetriesensor 5 auf.

Die Datenverarbeitungseinheit 1 erhält Daten von dem Akzelerometer 4 und dem Pulsoximeter 5 und verarbeitet diese, um Leistungsdaten, wie zum Beispiel eine Schrittzahl, eine Distanz, eine Geschwindigkeit, eine arterielle Sauerstoffsättigung, eine Atmungsfrequenz, einen kardiovaskulären Fluss, ein Herzzeitvolumen, einen Blutdruck, einen Blutzuckerwert usw., zu erzeugen bzw. berechnen. Die Leistungsdaten werden an die Signalverarbeitungseinheit 2 übermittelt und von dieser zum Erzeugen eines Audiosignals verwendet, das durch den Lautsprecher 3 ins Ohr des Benutzers ausgegeben wird. Das Audiosignal wird so erzeugt, dass der Benutzer beim Hören des entsprechenden Schalls Informationen über zumindest einen Wert der Leistungsdaten erfahren kann. Dies kann durch Ausgabe von Sprachelementen (zum Beispiel vorgespeicherten Zahlen und Wörtern) oder gepulsten Tonsignalen, durch Manipulation von Musik oder in sonstiger Weise erfolgen.

Die Vorrichtung weist ferner eine zentrale Steuereinheit bzw. Steuerung 9 und einen Speicher 11 auf. Die Steuerung 9 ist mit der Datenverarbeitungseinheit 1, der Signalverarbeitungseinheit 2, und dem Speicher 11 verbunden und dazu eingerichtet, diese Einheiten zu steuern und Informationen von diesen Einheiten zu erhalten oder auszulesen. Die Steuerung 9 steuert zum Beispiel

welche der von der Datenverarbeitungseinheit 1 erzeugten Leistungsdaten, die Signalverarbeitungseinheit 2 beim Erzeugen des Audiosignals berücksichtigen soll, zum Beispiel ob das Audiosignal gerade Auskunft über Herzfrequenz, Geschwindigkeit oder was anderes geben soll. Die Steuerung kann auch die Signalverarbeitungseinheit 2 derart steuern, dass im Speicher 11 abgespeicherte Musik oder ähnliches (beispielsweise ein Hörbuch) unabhängig von den Leistungsdaten wiedergegeben wird.

Die Steuereinheit 9 ist des Weiteren mit einem ersten Mikrofon 7, einem zweiten Mikrofon 14, einer Berührungssensoreinheit 6, einer EEG-Einheit - (Elektroenzephalografie-Einheit) 8, einer Kontaktsensoreinheit 10, einer Bluetooth-Einheit 12 und einer NFC-Einheit (Nahfeldkommunikationseinheit) 13 verbunden. Diese Einheiten sind auch im Gehäuse integriert und ermöglichen generell, dass der Benutzer die Funktionalitäten der Vorrichtung beeinflussen bzw. steuern kann und dass die Vorrichtung mit einem externen Gerät, wie beispielsweise einer ähnlichen Vorrichtung, einem Smartphone oder einem Rechner kommunizieren kann.

Das erste Mikrofon 7 ist ein Knochenleitungsmikrofon, das so im Gehäuse angebracht ist, dass es Schall erfassen kann, der durch den Schädelknochen geleitet wird, zum Beispiel beim Sprechen. Eine Funktion des ersten Mikrofons 7 ist Benutzersprechen zu erfassen, zum Beispiel Sprachbefehle zur Steuerung der Vorrichtung oder das Benutzersprechen, wenn die Vorrichtung als Headset in Verbindung mit einem externen Gerät verwendet wird.

Das zweite Mikrofon 14 ist so im Gehäuse angebracht, dass es insbesondere Umgebungsschall erfassen kann. Durch Verarbeitung der Signale von sowohl dem ersten Mikrofon 7 als auch dem zweiten Mikrofon 14 können störende Umgebungsgeräusche von dem Benutzersprechen filtriert werden, was die Verwendung als Headset sowie die Erkennungsqualität von Sprachbefehlen verbessert. Eine weitere Anwendung der beiden Mikrofonsignale ist die

Erkennung von akustischen Gesten, das heißt die Erkennung von bestimmten bewegten oder streichenden Berührungen der Körperoberfläche. Genauer gesagt mag eine akustische Geste zum Beispiel darin bestehen, dass der Benutzer eine schnelle streichende Bewegung über seine Haut oder Kleidung in eine bestimmte Richtung (senkrecht, waagerecht usw.) mit einem Finger macht, wobei der Finger durch die ganze Bewegung die Haut oder Kleidung berührt. Durch solche streichende Bewegungen entsteht Schall und durch Analyse der von den Mikrofonen 7 und 14 aufgenommenen Signale kann Richtung, Geschwindigkeit und weitere Eigenschaften der Geste erkannt und in Steuersignale umgesetzt werden.

Die Berührungssensoreinheit 6 weist eine Platte mit einer Vielzahl von kapazitiven Sensoren auf und ist auf einem Teil der Oberfläche des Gehäuses so angebracht, dass der Benutzer sie mit dem Finger berühren kann, wenn die Vorrichtung im Ohr getragen wird. Mit anderen Worten befindet sich die Berührungssensoreinheit 6 auf einer Oberfläche des Gehäuses, die vom Gehörgang weg zeigt. Durch Streichen und/oder Klopfen mit dem Finger auf der Berührungssensoreinheit 6, kann der Benutzer die Vorrichtung steuern. Beispielsweise kann die Steuereinheit 9 eine streichende Bewegung nach oben mit einer Lautstärkeerhöhung und eine streichende Bewegung nach unten mit einer Lautstärkenreduktion verknüpfen und die Signalverarbeitungseinheit 2 dementsprechend ansteuern. In ähnlicher Weise kann die Steuereinheit zum Beispiel ein einmaliges Klopfen auf der Berührungssensoreinheit 6 mit einem Funktionswechsel und ein zweimal wiederholtes Klopfen mit einem Auswahl einer Funktion verknüpfen.

Die EEG-Einheit 8 weist eine Mehrzahl von Elektroden auf, die so an der Oberfläche des Gehäuses angebracht sind, dass Messungen von elektrischen Potenzialen an der Hautoberfläche im Ohr durchgeführt werden können. Diese Messungen werden von der Steuereinheit analysiert und mit vorgespeicherten Messungen verglichen, um bestimmte Gedanken des Benutzers zu erkennen

und als Steuerbefehle zu benutzen. Zum Beispiel kann das intensive Denken an das eigene Lieblingsessen eine Ansage des bisherigen Kalorienverbrauchs auslösen.

Die Kontaktsensoreinheit 10 weist einen kapazitiven Sensor auf, der so im Oberflächenbereich des Gehäuses angebracht ist, dass er beim Tragen im Ohr die Hautoberfläche des Benutzers kontaktiert. Somit kann die Steuerung 9 erkennen, ob die Vorrichtung verwendet wird oder nicht und dementsprechend verschiedene Steuersignale erzeugen. Zum Beispiel können Stromverbrauchintensive Funktionalitäten ausgeschaltet werden einige Minuten nachdem die Vorrichtung aus dem Ohr genommen wurde.

Die Bluetooth-Einheit 12 dient zur drahtlosen Kommunikation mit anderen Vorrichtungen (zum Beispiel einer im anderen Ohr getragenen Vorrichtungen) oder externen Geräten (Mobiltelefon, PC usw.). Bei Kommunikation mit einer Vorrichtung im anderen Ohr des Benutzers können Sensorsignale von beiden Seiten berücksichtigt werden, um eine verbesserte Präzision in den Leistungsdaten zu erreichen. Ferner kann das erzeugte Audiosignal stereofonisch oder binaural bearbeitet werden. In solchen Systemen funktioniert die eine Vorrichtung als primäre Vorrichtung oder Master in dem Sinne, dass sie Daten von beiden Vorrichtungen erhält und verarbeitet und die jeweils auszugebende Audiosignale definiert.

Kommunikation mit einem externen Gerät kann während Benutzung der Vorrichtung, das heißt während der Ausübung einer sportlichen Aktivität, stattfinden. In diesem Falle können Daten, wie beispielsweise Musik- oder GPS-Daten, von dem Gerät an die Vorrichtung übertragen werden und dort verwendet oder gespeichert werden. Gleichzeitig können Daten, wie beispielsweise erfasste Sensordaten oder berechnete Leistungsdaten, von der Vorrichtung an das Gerät übertragen werden. Dies ermöglicht auch eine

Benutzung der Vorrichtung als Headset in Verbindung mit Kommunikationsanwendungen.

Kommunikation mit dem externen Gerät kann auch erfolgen, wenn die Vorrichtung nicht im Ohr benutzt wird, beispielsweise um die verschiedenen oben beschriebenen Steuerungsmöglichkeiten zu konfigurieren, um Schwellenwerte (zum Beispiel für Herzfrequenz, Atemfrequenz, Distanz, Zeit oder Geschwindigkeit etc.) festzulegen oder um Leistungsdaten zur externen Verarbeitung auszulesen. Dies erfolgt zweckmäßig mittels einer speziellen Anwendung oder App.

Die NFC-Einheit 13 ermöglicht Kommunikation mit einem Nahfeldkommunikationsfähigen Gerät, zum Beispiel ein Smartphone, wenn dieses in die Nähe von der Vorrichtung gebracht wird. Dabei können Konfigurationsdaten vom Smartphone an die Vorrichtung übertragen werden oder in der Vorrichtung gespeicherte Daten, wie zum Beispiel Kontaktinformationen für den Benutzer, können ausgelesen werden. Diese Informationen können nützlich sein, wenn die Vorrichtung verloren aufgefunden wird oder in Verbindung mit einem Unfall.

Die Figuren 2A, 2B und 2C zeigen verschiedene Ansichten einer Vorrichtung 20 gemäß einem Ausführungsbeispiel, insbesondere die Form des Gehäuses, in welchem sämtliche Einheiten der Vorrichtung 20 integriert sind.

Die Figur 2A zeigt eine Ansicht einer Vorrichtung 20, die ein Gehäuse aufweist. Das Gehäuse ist aus Kunststoff, beispielsweise Silikon, gefertigt und weist grundsätzlich einen ersten Abschnitt 21 und einen zweiten Abschnitt 22 auf. Der erste Abschnitt 21 ist zum Einführen in den Gehörgang eines Benutzers und der zweite Abschnitt 22 ist zur Befestigung in der Ohrmuschel des Benutzers gebildet. Dabei ist der erste Abschnitt 21 im Wesentlichen Kegelförmig, um in dem äußeren Teil des Gehörgangs gut hineinzupassen. Im

Endbereich des ersten Abschnittes 21 ist ein elastischer Kragen 24 vorgesehen, der beim Tragen der Vorrichtung 20 im Ohr als Abdichtung funktioniert, so dass die Vorrichtung 20 den Gehörgang des Benutzers blockiert. Der zweite Abschnitt 22 ist so geformt, dass er in Concha der Ohrmuschel eines typischen Ohrs eingesetzt und dort festgehalten werden kann.

Das Gehäuse weist ferner eine Oberfläche 23 auf, die dem Gehörgang abgewandt ist und somit vom Benutzer zum Beispiel mit einem Finger erreichbar ist. Die Oberfläche 23 weist insbesondere eine kapazitive Sensoreinheit auf zum Erfassen von Steuerbefehle vom Benutzer, zum Beispiel wenn der Benutzer mit seinem Finger an der Oberfläche 23 klopft oder über die Oberfläche 23 in einer bestimmten Richtung streicht. In der Nähe von der Oberfläche 23 weist das Gehäuse eine schließbare Öffnung 25 auf, durch welche einen (nicht gezeigten) Stecker an einen Buchse gekoppelt werden kann, um die Batterie der Vorrichtung 20 aufzuladen oder um Daten mit der Vorrichtung 20 auszutauschen.

Das Gehäuse weist ferner eine Öffnung 26 auf, die an einer Stelle in der Oberfläche des Gehäuses angebracht ist, die beim Tragen der Vorrichtung 20 im Ohr die Haut, insbesondere im Bereich hinter dem Tragus, eng kontaktiert. Die Öffnung 26 mag einen Pulsoxymetriesensor enthalten, der zwei unterschiedlich gefärbte Lichtquellen, insbesondere Leuchtdioden, und einen Fotosensor aufweist. In diesem Fall ist die Öffnung 26 so in dem Gehäuse angebracht, dass die Lichtquellen einen Bereich der Hautoberfläche im Ohr des Benutzers beleuchten können und der Fotosensor entsprechende Reflektionen von der Hautoberfläche detektieren kann. Die Öffnung 26 mag alternativ ein Knochenleitungsmikrofon enthalten. In einem System mit zwei Vorrichtungen, eine für das linke Ohr und eine für das rechte Ohr, mag die eine Vorrichtung den Pulsoximetriesensor und die andere Vorrichtung das Knochenleitungsmikrofon aufweisen.

Die Figur 2B zeigt eine weitere Ansicht der Vorrichtung 20, wobei die Oberfläche 23 im Vordergrund zu sehen ist. Die Oberfläche 23 weist eine spalt- oder schlitzförmige Öffnung 27 auf, die von außen kommender Schall an ein (nicht gezeigtes) Mikrofon durchlässt. Die Vorrichtung 20 weist ferner eine Manschette oder Hülse 28 auf, die einen Teil der Oberfläche 23 umschließt und zum Anpassen der Größe der Vorrichtung an dem Ohr eines Benutzers dient. Die Manschette 28 ist aus weichem Kunststoff gefertigt und lösbar von dem Gehäuse. Somit kann der Benutzer verschiedene Hülsen 28 mit verschiedenen Größen ausprobieren und diejenige auswählen, die die beste Passform bereitstellt.

Die Figur 2C zeigt noch eine weitere Ansicht der Vorrichtung 20, wobei die Vorrichtung in Vergleich mit der Ansicht in Figur 2B um 180° gedreht ist. Sowie der Kragen 24 als auch das Ende des ersten Abschnittes, das in den Gehörgang am tiefsten hineinragt, weisen Öffnungen 29 auf, durch welche der Schall, der von einem in der Vorrichtung integrierten Lautsprecher erzeugt wird, ausgegeben werden kann.

Die Öffnungen 25, 26, 27 und 29 sind alle wasserdicht abgedichtet, so dass die Vorrichtung 20 auch beim Schwimmen oder Regen verwendet werden kann.

Figur 3 zeigt ein System gemäß einem Ausführungsbeispiel. Das System weist eine erste Vorrichtung 20R und eine zweite Vorrichtung 20L auf. Die erste Vorrichtung 20R ist zum Tragen im rechten Ohr eingerichtet und die zweite Vorrichtung ist zum Tragen im linken Ohr eingerichtet. Jede Vorrichtung 20R und 20L entsprechen im Wesentlichen die oben beschriebene Vorrichtung 20, doch weist die erste Vorrichtung 20R ein Knochenleitungsmikrofon 7 in ihrer Öffnung 26 auf, wobei die zweite Vorrichtung 20L einen Pulsoxymetriesensor 5 in ihrer Öffnung 26 aufweist.

Die erste Vorrichtung 20R funktioniert als primäre Vorrichtung oder Master in dem Sinne, dass sie Daten von beiden Vorrichtungen 20R, 20L erhält und verarbeitet und die jeweils auszugebende Audiosignale definiert. Die beiden Vorrichtungen 20R und 20L kommunizieren miteinander über ihre jeweilige Bluetooth-Einheit 12 (siehe Figur 1) und können somit Sensordaten, Leistungsdaten, Audiodaten, Steuerdaten etc. austauschen. Im Betrieb sendet die sekundäre Vorrichtung 20L insbesondere Pulsoximeterdaten und Bewegungssensordaten bzw. Leistungsdaten, die von Pulsoximeterdaten und/oder Bewegungssensordaten abgeleitet sind, an die primäre Vorrichtung 20R. Die Datenverarbeitungseinheit 1 der ersten Vorrichtung 20R erzeugt Leistungsdaten basierend auf den von der zweiten Vorrichtung 20L erhaltenen Daten und den von seiner eigenen Sensoreinheit erfassten Messdaten. Die Leistungsdaten werden von der Signalverarbeitungseinheit 2 der ersten Vorrichtung zum Erzeugen eines binauralen Audiosignals verwendet.

Das binaurale Audiosignal besteht aus einem ersten (rechten) Signalteil, der durch den Lautsprecher 3 der ersten Vorrichtung 20R ausgegeben wird, und einem zweiten (linken) Signalteil, der über die Bluetooth-Verbindung an die zweite Vorrichtung übertragen wird und von deren Lautsprecher 3 ausgegeben wird. Durch synchronisierte Ausgabe des ersten Signalteils im rechten Ohr und des zweiten Signalteils im linken Ohr, kann der Benutzer das binaurale Audiosignal wahrnehmen und dadurch Informationen erhalten, die für das Ausüben einer sportlichen Aktivität relevant sind. Insbesondere kann der Benutzer beim Hören des binauralen Audiosignals einen oder mehrere spezifischen Werte der Leistungsdaten, Änderungen bei einem oder mehreren spezifischen Werten der Leistungsdaten und/oder eine Relation zwischen einem oder mehreren spezifischen Werten der Leistungsdaten und entsprechenden Referenzwerten, insbesondere Schwellenwerten, erkennen bzw. erfahren. Das binaurale Audiosignal ermöglicht insbesondere, dass

Informationen über mehrere Werte gleichzeitig (oder nahezu gleichzeitig) an verschiedenen räumlichen Positionen zu hören sind.

Das erzeugte binaurale Audiosignal enthält eine Signalkomponente, wie beispielsweise ein gepulstes Tonsignal oder eine Folge von vorgespeicherten Sprachelementen, die für einen Wert der Leistungsdaten indikativ ist. Diese Signalkomponente ist für den Benutzer an einer bestimmten räumlichen Position zu hören. Diese räumliche Position kann verschoben bzw. geändert werden, wenn sich der entsprechende Wert der Leistungsdaten ändert. Dies kann zum Beispiel so erfolgen, dass die Signalkomponente nach vorne oder nach oben verlagert wird, wenn der Wert zunimmt, und nach hinten oder nach unten verlagert wird, wenn der Wert abnimmt. Die Verschiebung der Position kann insbesondere relativ zu einer vertikalen Ebene, die sich durch den Körper des Benutzers erstreckt, oder einer horizontalen Ebene, die sich durch den Kopf (auf Höhe der Ohren) des Benutzers erstreckt, erfolgen. Solange die Signalkomponente in einer dieser Ebenen wiedergeben wird, das heißt, direkt an der linken oder rechten Seite des Benutzers oder auf Höhe der Ohren des Benutzers, dann ist der Wert gleich oder nahe an einem vorbestimmten Referenzwert. Wenn der Wert den vorbestimmten Referenzwert oder Schwellenwert übersteigt, wird die Position der Signalkomponente zum Beispiel nach vorne oder nach oben verschoben, wobei die Menge der Verschiebung von der Differenz zwischen dem Leistungswert und dem Referenzwert abhängt. In ähnlicher Weise kann die Position der Signalkomponente nach unten oder nach hinten verschoben werden, wenn der Wert den (oder einen anderen) Referenzwert oder Schwellenwert unterschreitet.

Somit kann der Benutzer leicht und intuitiv erkennen, ob der Wert von dem vorbestimmten Referenzwert abweicht und, wenn dies der Fall ist, entsprechend agieren, um den Wert wieder an den vorbestimmten Referenzwert anzunähern.

Das erzeugte binaurale Audiosignal kann weitere Signalkomponente enthalten, die für weitere Werte der Leistungsdaten indikativ sind. In diesem Falle wird das binaurale Audiosignal so erzeugt, dass eine räumliche Position jeder Signalkomponente unterschiedlich von der räumlichen Position der anderen Signalkomponenten ist. Damit können Werte in Bezug auf verschiedene Leistungsdaten an verschiedenen vorbestimmten Stellen im dreidimensionalen Raum um den Kopf des Benutzers herum wiedergegeben werden. Zum Beispiel kann ein erstes gepulstes Tonsignal oder Sprachsignal bzgl der Herzschlagfrequenz an einer Stelle links oben und ein zweites gepulstes Tonsignal oder Sprachsignal bzgl. einer Geschwindigkeit an einer Stelle vorne unten wiedergeben werden. Die Wiedergabe der einzelnen Signalkomponente mag gleichzeitig oder leicht zeitversetzt stattfinden, um die Wahrnehmung durch den Benutzer zu erleichtern.

Patentansprüche

1. Multifunktionskopfhörersystem für sportliche Aktivitäten, das System aufweisend:

eine erste Vorrichtung, die zum Tragen in einem Ohr eines Benutzers eingerichtet ist und eine erste Datenkommunikationseinheit und einen ersten Lautsprecher aufweist, und

eine zweite Vorrichtung, die zum Tragen im anderen Ohr des Benutzers eingerichtet ist und eine zweite Datenkommunikationseinheit und einen zweiten Lautsprecher aufweist,

wobei zumindest eine der ersten und zweiten Vorrichtungen eine Sensoreinheit und eine Datenverarbeitungseinheit aufweist, wobei die Datenverarbeitungseinheit zum Erzeugen von Leistungsdaten basierend auf von der Sensoreinheit erfassten Messdaten eingerichtet ist,

wobei die erste Vorrichtung ferner eine Signalverarbeitungseinheit aufweist, die zum Erzeugen eines binauralen Audiosignals basierend auf den Leistungsdaten eingerichtet ist, das binaurale Audiosignal aufweisend einen ersten Signalteil zur Ausgabe durch den ersten Lautsprecher und einen zweiten Signalteil zur Ausgabe durch den zweiten Lautsprecher, und

wobei die erste Datenkommunikationseinheit zum Übertragen des zweiten Signalteils des binauralen Audiosignals an die zweite Datenkommunikationseinheit eingerichtet ist.

2. Das System gemäß dem vorhergehenden Anspruch, wobei das von der Signalverarbeitungseinheit erzeugte binaurale Audiosignal eine Signalkomponente aufweist, die für einen Wert der Leistungsdaten indikativ ist.

3. Das System gemäß dem vorhergehenden Anspruch, wobei die Signalverarbeitungseinheit ferner dazu eingerichtet ist, das binaurale

Audiosignal so zu erzeugen, dass eine räumliche Position der Signalkomponente von dem Wert der Leistungsdaten abhängig ist.

4. Das System gemäß dem vorhergehenden Anspruch, wobei die räumliche Position der Signalkomponente relativ zu einer Ebene abhängig von einer Differenz zwischen dem Wert der Leistungsdaten und einem vorbestimmten Referenzwert ist.

5. Das System gemäß einem der Ansprüche 2 bis 4, wobei das von der Signalverarbeitungseinheit erzeugte binaurale Audiosignal eine weitere Signalkomponente aufweist, die für einen weiteren Wert der Leistungsdaten indikativ ist, und wobei die Signalverarbeitungseinheit ferner dazu eingerichtet ist, das binaurale Audiosignal so zu erzeugen, dass eine räumliche Position der weiteren Signalkomponente unterschiedlich von der räumlichen Position der Signalkomponente ist.

6. Das System gemäß einem der vorhergehenden Ansprüche, wobei die Signalverarbeitungseinheit zum Modifizieren vorgespeicherter Audiodaten in Abhängigkeit von zumindest einem Wert der Leistungsdaten eingerichtet ist.

7. Das System gemäß einem der vorhergehenden Ansprüche, wobei die erste Datenkommunikationseinheit und die zweite Datenkommunikationseinheit drahtlose Datenkommunikationseinheiten sind, die zum Kommunizieren mit einander eingerichtet sind.

8. Das System gemäß einem der vorhergehenden Ansprüche, wobei die Sensoreinheit eine physiologische Sensoreinheit aufweist.

9. Das System gemäß einem der vorhergehenden Ansprüche, wobei die Sensoreinheit eine Bewegungssensoreinheit aufweist.

10. Das System gemäß dem vorhergehenden Anspruch, wobei beide Vorrichtungen eine Bewegungssensoreinheit aufweisen.

11. Verfahren aufweisend:

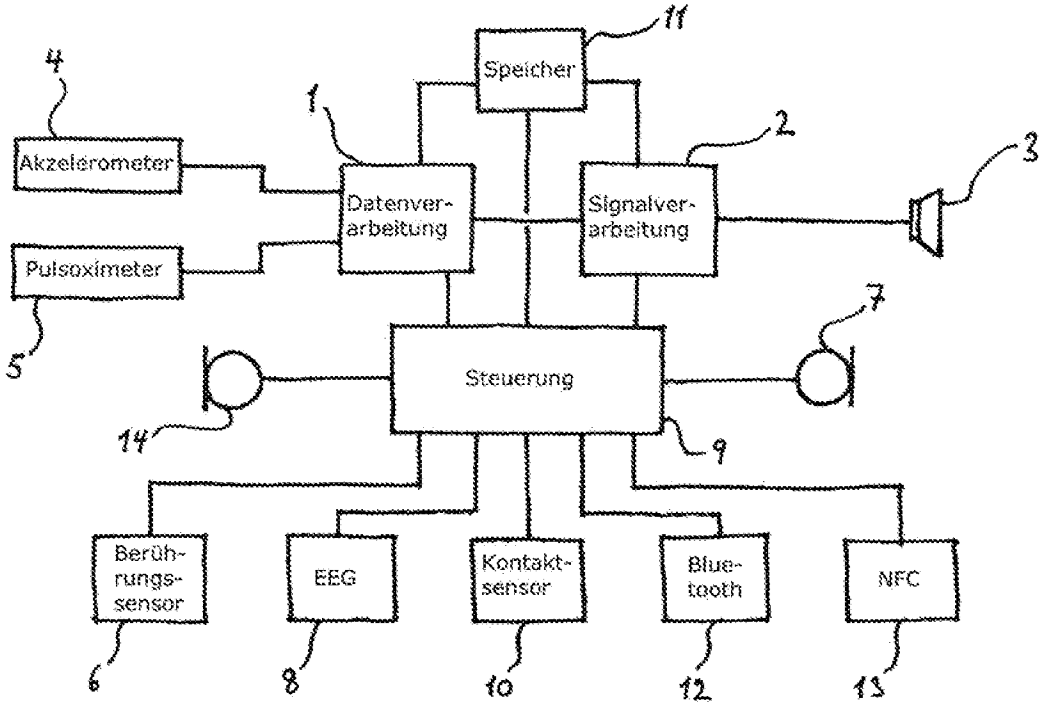
Erfassen von Messdaten mittels einer Sensoreinheit,

Erzeugen von Leistungsdaten basierend auf den Messdaten mittels einer Datenverarbeitungseinheit,

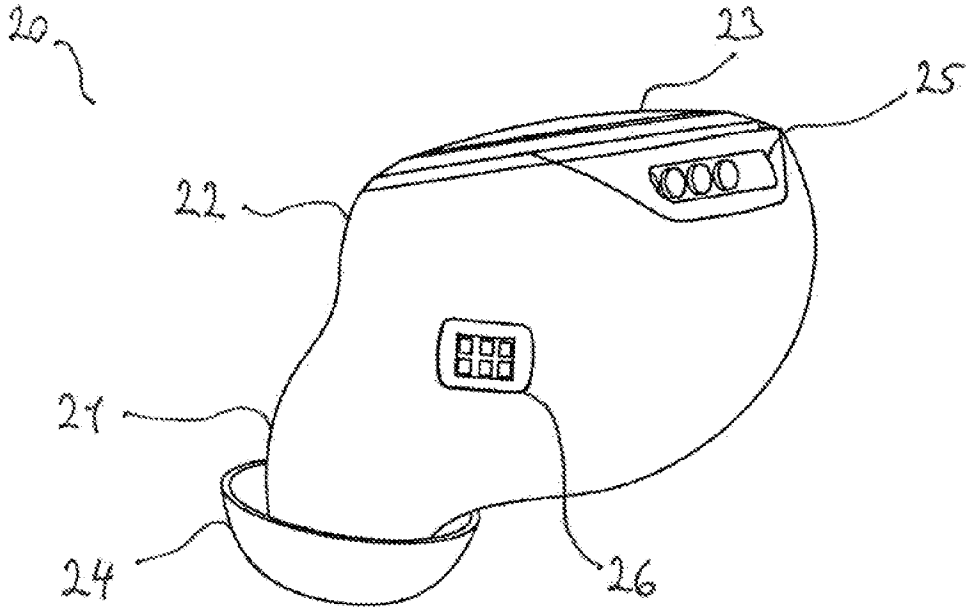
wobei die Sensoreinheit und die Datenverarbeitungseinheit in einer ersten Vorrichtung, die zum Tragen in einem Ohr eines Benutzers eingerichtet ist und eine erste Datenkommunikationseinheit und einen ersten Lautsprecher aufweist, oder in einer zweiten Vorrichtung, die zum Tragen im anderen Ohr des Benutzers eingerichtet ist und eine zweite Datenkommunikationseinheit und einen zweiten Lautsprecher aufweist, enthalten sind,

Erzeugen eines binauralen Audiosignals basierend auf den Leistungsdaten mittels einer Signalverarbeitungseinheit, die in der ersten Vorrichtung enthalten ist, das binaurale Audiosignal aufweisend einen ersten Signalteil zur Ausgabe durch den ersten Lautsprecher und einen zweiten Signalteil zur Ausgabe durch den zweiten Lautsprecher, und

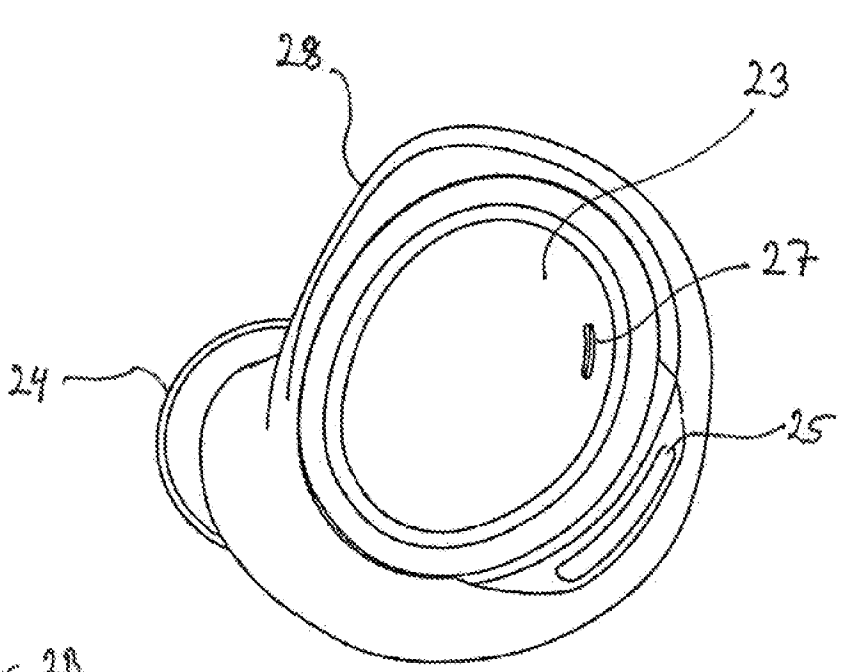
Übertragen des zweiten Signalteils des binauralen Audiosignals an die zweite Datenkommunikationseinheit mittels der ersten Datenkommunikationseinheit.


Speicher
11
4
1
2
3
Akzelerometer
Datenver-
arbeitung
Signalver-
arbeitung
Pulsoximeter
5
7
Steuerung
14
9
Berüh-
rungs-
sensor
EEG
Kontakt-
sensor
Blue-
tooth
NFC
6
8
10
12
13

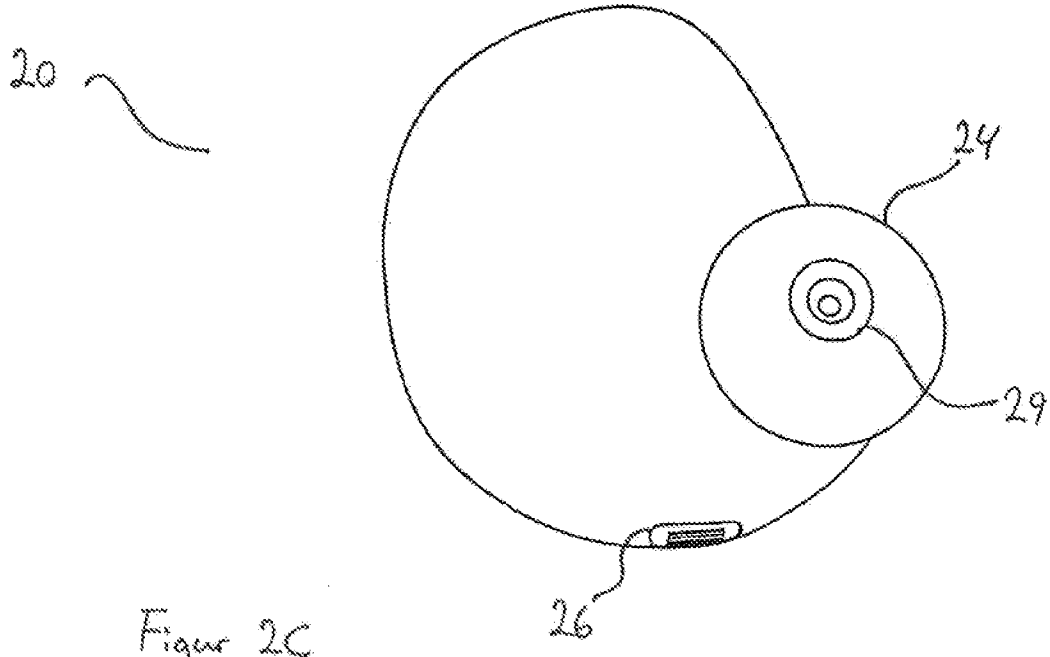
Figur 1



Figur 2A



Figur 2B



Figur 2C

Figur 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/051374

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04R1/10 H04R5/033
ADD. H04R25/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 2014/043179 A2 (BOSE CORP [US]; RUWE MATTHEW N [US]; GONSALVES DANIEL D [US]) 20 March 2014 (2014-03-20)	1-5,7-9, 11
Y,P	abstract paragraph [0023] - paragraph [0024] paragraph [0032] paragraph [0040] figures 1B,7 claim 10	6,10
Y	US 2009/097689 A1 (PREST CHRISTOPHER [US] ET AL) 16 April 2009 (2009-04-16) abstract paragraph [0034] figure 3	6,10
T	US 2008/076972 A1 (DOROGUSKER JESSE LEE [US] ET AL) 27 March 2008 (2008-03-27)	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
29 April 2015	11/05/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax. (+31-70) 340-3016	Fülöp, István

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2015/051374

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014043179 A2	20-03-2014	US 2014079257 A1	20-03-2014
		WO 2014043179 A2	20-03-2014
US 2009097689 A1	16-04-2009	US 2009097689 A1	16-04-2009
		US 2014161300 A1	12-06-2014
US 2008076972 A1	27-03-2008	US 2008076972 A1	27-03-2008
		US 2009287067 A1	19-11-2009
		WO 2008118261 A1	02-10-2008

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP2015/051374

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
INV. H04R1/10 H04R5/033
ADD. H04R25/00

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
H04R

Recherchierte, aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal, WPI Data

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X,P	WO 2014/043179 A2 (BOSE CORP [US]; RUWE MATTHEW N [US]; GONSALVES DANIEL D [US]) 20. März 2014 (2014-03-20)	1-5,7-9, 11
Y,P	Zusammenfassung Absatz [0023] - Absatz [0024] Absatz [0032] Absatz [0040] Abbildungen 1B,7 Anspruch 10	6,10

Y	US 2009/097689 A1 (PREST CHRISTOPHER [US] ET AL) 16. April 2009 (2009-04-16) Zusammenfassung Absatz [0034] Abbildung 3	6,10

T	US 2008/076972 A1 (DOROGUSKER JESSE LEE [US] ET AL) 27. März 2008 (2008-03-27)	

☐ Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen ☒ Siehe Anhang Patentfamilie

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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
29. April 2015	11/05/2015

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax. (+31-70) 340-3016	Fülöp, István

Formblatt PCT/ISA/210 (Blatt 2) (April 2005)

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
WO 2014043179 A2	20-03-2014	US 2014079257 A1	20-03-2014
		WO 2014043179 A2	20-03-2014
US 2009097689 A1	16-04-2009	US 2009097689 A1	16-04-2009
		US 2014161300 A1	12-06-2014
US 2008076972 A1	27-03-2008	US 2008076972 A1	27-03-2008
		US 2009287067 A1	19-11-2009
		WO 2008118261 A1	02-10-2008

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WIPO | PCT

(10) International Publication Number
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B60K 37/06 (2006.01) *G06F 21/32* (2013.01)
G06F 21/36 (2013.01) *G06F 21/31* (2013.01)

(21) International Application Number:
PCT/US2015/046626

(22) International Filing Date:
25 August 2015 (25.08.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
14/469,041 26 August 2014 (26.08.2014) US

(71) Applicant: **TOYOTA MOTOR SALES, U.S.A., INC.** [US/US]; 19001 South Western Avenue, Torrance, California 90509 (US).

(72) Inventor: **PISZ, James T.**; c/o Toyota Motor Sales, U.S.A., Inc., 19001 South Western Avenue, Torrance, California 90509 (US).

(74) Agents: **DARROW, Christopher G.** et al.; DARROW MUSTAFA P.C., 410 N. Center St., Suite 200, Northville, Michigan 48167 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: INTEGRATED WEARABLE ARTICLE FOR INTERACTIVE VEHICLE CONTROL SYSTEM

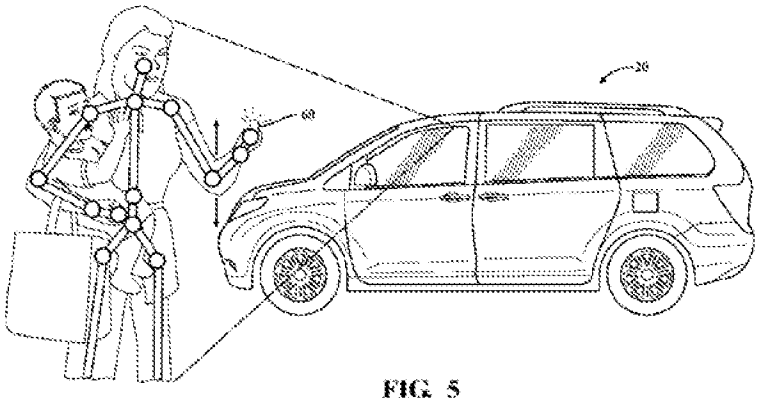


FIG. 5

(57) Abstract: A method for operating a vehicle includes receiving, at a wearable article, a first input from a user indicating a vehicle function to be performed on a vehicle, receiving a second input indicating a gesture by the user for authentication, and generating, at the wearable article, a control signal for performing the vehicle function on the vehicle based on a successful authentication of the user.

WO 2016/032990 A1

INTEGRATED WEARABLE ARTICLE FOR INTERACTIVE VEHICLE CONTROL SYSTEM

BACKGROUND

[0001] The present disclosure relates to a vehicle and more particularly to systems and methods therefor. A key fob allows a driver to perform remote control functions such as locking or starting a vehicle. However, the driver needs to carry the key fob around, such as in a key chain, a pocket, or a purse. Recent development of wearable technology has made it possible for people to interact with the vehicle through a wearable article, such as a smart watch or wristband.

SUMMARY

[0002] This disclosure relates to integrated wearable article for an interactive vehicle control system. In one aspect, a system can include a user input subsystem and a user recognition and authentication subsystem in communication with the user input subsystem. The user input subsystem includes a wearable article and is configured to receive inputs from a user. The user recognition and authentication subsystem is configured to detect and authenticate the user based on the inputs received from the wearable article, or the vehicle, or both. The inputs received from the wearable article can include, for example, a user input indicating a vehicle function to be performed, a gesture input by the user for authentication, or both. The inputs received from the vehicle can include, for example, a gesture input by the user for authentication. The wearable article can include a wearable computing device configured to perform at least one vehicle function on a vehicle. The wearable article can be, for example, a smart watch, a smart clothing article, a transdermal chip or a wearable sensor. A driver score can be generated for driver actions associated with vehicle functions performed by the user on the vehicle. The driver score can be transmitted to the wearable article, and can be uploaded, for example, to a home computer or an external database via cloud.

[0003] In another aspect, a method for operating a vehicle can include receiving, at a wearable article, a first input from a user indicating a vehicle function to be performed on a vehicle, receiving a second input indicating a gesture by the user for authentication, and generating, at the wearable article, a control signal for performing the

vehicle function on the vehicle based on a successful authentication of the user. The wearable article can be, for example, a smart watch, a smart clothing article, a transdermal chip or a wearable sensor. A driver score can be generated for driver actions associated with vehicle functions performed by the user on the vehicle. The driver score can be transmitted to the wearable article, and can be uploaded, for example, to a home computer or an external database via cloud.

[0004] In another aspect, a wearable article can include one or more processors and a memory. The memory stores data and program instructions that can be executed by the processors. The wearable article can be a wearable computing device, such as a smart watch or a wearable sensor. The processors are configured to execute instructions stored in the memory. The instructions include receiving a first input from a user indicating a vehicle function to be performed on a vehicle, receiving a second input indicating a gesture by the user for authentication, and generating a control signal to perform the vehicle function based on a successful authentication of the user. The wearable article can be, for example, a smart watch, a smart clothing article, a transdermal chip or a wearable sensor. A driver score can be generated for driver actions associated with vehicle functions performed by the user on the vehicle. The driver score can be transmitted to the wearable article, and can be uploaded, for example, to a home computer or an external database via cloud.

[0005] The foregoing features and elements may be combined in various combinations without exclusivity, unless expressly indicated otherwise. These features and elements as well as the operation thereof will become more apparent in light of the following description and the accompanying drawings. It should be understood, however, the following description and drawings are intended to be exemplary in nature and non-limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Various features will become apparent to those skilled in the art from the following detailed description of the disclosed non-limiting embodiment. The drawings that accompany the detailed description can be briefly described as follows:

[0007] Figure 1 is a pictorial representation of an example vehicle for use with an interactive vehicle window display system;

[0008] Figure 2 is a schematic block diagram of the interactive vehicle window display system according to one non-limiting embodiment;

[0009] Figure 3 is a partial interior view of the vehicle with the interactive vehicle window display system;

[0010] Figure 4 is a top view of the vehicle illustrating an exterior user identification subsystem of the interactive vehicle window display system;

[0011] Figure 5 is a pictorial representation of the vehicle illustrating user identification via a wearable article, skeletal joint relationship, key fob and/or user gesture;

[0012] Figure 6 is a schematic block diagram of an algorithm for operation of the system according to one non-limiting embodiment;

[0013] Figure 7 is a pictorial representation of an example skeletal joint relationship recognizable by the system;

[0014] Figure 8 is an illustration of an example wearable article and an example user gesture recognizable by the system according to one non-limiting embodiment;

[0015] Figure 9 is an example landing page displayed by the interactive vehicle window display system;

[0016] Figure 10 is an example route page displayed by the interactive vehicle window display system;

[0017] Figure 11 is an example calendar page displayed by the interactive vehicle window display system;

[0018] Figure 12 is an example weather page displayed by the interactive vehicle window display system;

[0019] Figure 13 is an example vehicle status page displayed by the interactive vehicle window display system;

[0020] Figure 14 is an example to-do page displayed by the interactive vehicle window display system;

[0021] Figure 15 is a partial interior view of a vehicle cabin illustrating an interactive environment for the driver and/or passengers to utilize functionalities of a vehicle head unit;

[0022] Figure 16 is a partial interior view of the vehicle cabin illustrating discrimination of a driver and/or passenger to selectively permit utilization of functionalities of a vehicle head unit during vehicle operation;

[0023] Figure 17 is a pictorial representation of a vehicle passenger facial map for use with the system to track occupant location;

[0024] Figure 18 is an overhead interior view of the vehicle illustrating a sensor arrangement to track occupant location within the vehicle cabin;

[0025] Figure 19 is a schematic block diagram of a wearable article according to one non-limiting embodiment;

[0026] Figure 20A is an example wearable article;

[0027] Figure 20B is another example wearable article;

[0028] Figure 20C is another example wearable article;

[0029] Figure 21 is a flow diagram of process performed by a wearable article according to one non-limiting embodiment;

[0030] Figures 22A-C are example screen displays of an example wearable article according to one implementation;

[0031] Figures 23A-F are example screens of the remote control mode of the example wearable article in Figures 22A-C;

[0032] Figure 24A is an example screen that displays a notification of a vehicle function performed on a vehicle;

[0033] Figure 24B is an example driver score alert screen for the example wearable article in Figures 22A-22C; and

[0034] Figures 25A-25C are examples screens of the panic mode for the example wearable article in Figures 22A-22C.

DETAILED DESCRIPTION

[0035] Wearable technology has developed over the years to allow people to interact with smart home appliances or a vehicle. A wearable article can be integrated with a key fob for operating an automobile so that the user will no longer need to carry the key fob separately. For example, with the digital key fob functionalities incorporated into a smart watch, a user can put on the smart watch every morning without struggling to find the key. The user will no longer need to carry the key fob separately. In addition to being used as a watch or wristband, the smart watch can be worn by the user to perform vehicle functions on the vehicle.

[0036] In some instances, the wearable article can be implemented to receive user indications of the vehicle functions to be performed on the vehicle and gesture inputs for user authentication in order for such vehicle functions to be performed. A control signal to perform the vehicle functions can be generated based on a successful authentication. In some implementations (e.g., the multi-factor authentication), the gesture input can be used in the multi-factor authentication in conjunction with the user input received from the wearable

article to authenticate the user. The second gesture input can be detected by a sensor, which can be coupled to the vehicle or the wearable article. The sensor can be used to detect whether the user is wearing the wearable article. When the user is not wearing the wearable article, access to some or all vehicle functions can be denied.

[0037] The wearable article can be used to sense information from a user, such as biometrics and driving information. In some implementations, a driver score can be generated for driver actions performed on the vehicle. The driver score can be used to help the driver improving driving skills and alert the driver when deteriorating performance occurs. For example, the driver score can be an option selectable from the menu screen of the wearable article and calculated based on sensed information of driver actions. When the driver keys off the vehicle, the driver score can be sent to the wearable article for display, storage or further processing. The driver score received at the wearable article can be uploaded to, for example, a personal computer, a smartphone, or an external database via the cloud. Data analysis can be used to improve safe driving skills or for other application-specific purposes. For example, the driver scores can be placed into a social ranking system and the user can review and evaluate his driving performances relative to others in the social ranking system.

[0038] Figure 1 schematically illustrates a vehicle 20 with a window 22 and an interactive vehicle window display system 30. Although the window 22 is here shown as a driver's side passenger window of a minivan type vehicle in the disclosed, non-limiting embodiment, it should be appreciated that various vehicle types and windows will also benefit herefrom.

[0039] With reference to Figure 2, selected portions of the system 30 are schematically illustrated. The system 30 generally includes an interactive display subsystem 32, a control subsystem 34, a user input subsystem 36, a user identification subsystem 38, and a user location subsystem 39. In some embodiments, the user identification subsystem 38 can be implemented as a user recognition and authentication subsystem. It should be appreciated that although particular subsystems are separately defined, each or any of the subsystems may be combined or segregated via hardware and/or software of the system 30. Additionally, each or any of the subsystems can be implemented using one or more computing devices including conventional central processing units or other devices capable of manipulating or processing information.

[0040] The interactive display subsystem 32 can include any device or devices capable of displaying images on a vehicle window 22 under the control of system 30,

and can be adapted for viewing from outside the vehicle, inside the vehicle, or both. In one non-limiting example the interactive display subsystem 32 can include a display device integral to the window 22, such as an LCD. Such a display can be illuminated by ambient light or by one or more light sources under the control of system 30. Such light sources can be mounted at any operable locations enabling light emission onto a window from inside or outside the vehicle, depending on whether the display is to be viewed by a user located outside or inside the vehicle. Examples of such mounting locations can include in the floor, in the vehicle headliner, within the vehicle door structure, or in the exterior door panel.

[0041] In another non-limiting example, the interactive display subsystem 32 can include a coating 40 and a projector 42. The coating 40, for example, may be a polymer dispersed liquid crystal (PDLC) film, applied to the window 22 to provide both transparency when inactive and partial or complete opacity when active. The window 22 treated with the coating 40 is thereby operable to display content as a projection page visible from outside and/or inside the vehicle 20 (Figure 1). The projector 42 can be mounted in the floor (Figure 3) or other locations within the vehicle 20, such as the vehicle headliner or within the vehicle door structure as well as in locations on the vehicle exterior such as in an exterior door panel. The illustrated shaded area extending from the projector 42 toward the window 22 schematically represents the projection of output in the form of content pages provided by the projector 42. In response to the approach of a recognized user, the coating 40 changes from transparent to opaque so that the projector 42 may project the output onto the window 22.

[0042] As will be further described, the displayed content can include personalized information or entertainment content such as videos, games, maps, navigation, vehicle diagnostics, calendar information, weather information, vehicle climate controls, vehicle entertainment controls, email, internet browsing, or any other interactive applications associated with the recognized user, whether the information originates onboard and/or off board the vehicle 20.

[0043] The control subsystem 34 generally includes a control module 50 with a processor 52, a memory 54, and an interface 56. The processor 52 may be any type of microprocessor having desired performance characteristics. The memory 54 may include any type of computer readable medium which stores the data and control algorithms described herein such as a user support system algorithm 58. The functions of the algorithm 58 are disclosed in terms of functional block diagrams (Figure 6) and representative pages (Figures 9-14), and it should be understood by those skilled in the art with the benefit of this disclosure that these functions may be enacted in either dedicated hardware circuitry or

programmed software routines capable of execution in a microprocessor based electronics control embodiment.

[0044] With continued reference to Figure 2, the control module 50 may be a portion of a central vehicle control, a stand-alone unit, or other system such as a cloud-based system. Other operational software for the processor 52 may also be stored in the memory 54. The interface 56 facilitates communication with other subsystems such as the interactive display subsystem 32, the user input subsystem 36, the user identification subsystem 38, and the user location subsystem 39. It should be understood that the interface 56 may also communicate with other onboard vehicle systems and offboard vehicle systems. Onboard systems include but are not limited to, a vehicle head unit 300 which communicates with vehicle sensors that provide, for example, vehicle tire pressure, fuel level and other vehicle diagnostic information. Offboard vehicle systems can provide information which includes but is not limited to, weather reports, traffic, and other information which may be provided via cloud 70.

[0045] The user input subsystem 36 can include one or more input sensors including onboard input sensors 60, offboard input devices, or both. Onboard input sensors 60 can include one or more motion cameras or other light sensors configured to detect gesture commands, one or more touch sensors configured to detect touch commands, one or more microphones configured to detect voice commands, or other onboard devices configured to detect user input. The user input subsystem can also include offboard input devices such as a wearable article 61, a key fob 62 and/or a personal electronic device 63 of the user, e.g. a tablet, smart phone, or other mobile device. The wearable article 61 can be a wearable computing device, such as a smart watch or a wearable sensor.

[0046] In some instances, the wearable article 61 can be integrated with the key fob 62 so that the user will no longer need to carry the key fob 62 separately. As will be described in further detail below, the wearable article 61 can be configured to receive user inputs to indicate the vehicle functions to be performed on the vehicle 20. The wearable article 61 can also be configured to receive gesture inputs from the user for authentication before such vehicle functions can be performed.

[0047] In some embodiments, the system 30 utilizes a multi-factor authentication for security and authorization. The authentication can be implemented, for example, in the user identification subsystem 38. Example multi-factor authentication may include receiving inputs from the wearable article 61, the key fob 62, skeleton joint relationship recognition (Figure 5), and/or a gesture password (Figure 8). The user may be

provisionally identified with one of these factors, but may require a total of at least two factors to authenticate the user prior to display of certain content. That is, the user will not be granted access to all the features in user mode 104 until a multi-factor authentication is passed and the user is within a predetermine range of the vehicle 20. This authentication process ensures the security of the vehicle and the personal information embedded in the system 30. In one disclosed non-limiting embodiment, the first authentication factor can be the wearable article 61, which integrates the functionalities of a digital key fob, and the second can be the skeleton joint relationship (Figure 7) of the user. If the user does not have their wearable article 61 or the key fob 62, the skeleton joint relationship may become the first authentication factor and a gesture password such as a wave or particular arm movement (Figure 8) becomes the second. In another example, the first authentication factor can be the wearable article with the integrated key fob functionalities, and the second can be a gesture input from the user, such as the gesture password or the skeleton joint relationship. Other combinations of authentication factors are also possible and the second factor can be optional. For example, the second factor can be required when there is a heightened need for security, *e.g.*, when the vehicle is parked in a public location or in a high crime area. In another example, the user can be authenticated only when it is detected that he is wearing the wearable article 61 or carrying the key fob 62.

[0048] The wearable article 61 in one disclosed non-limiting embodiment may be encrypted to uniquely identify each user to the system 30. Additional security protocols such as a rolling time key to ensure that even the encrypted key cannot be intercepted and re-used by unauthorized devices may additionally be utilized.

[0049] Once the wearable article 61 is recognized, the user will be welcomed and pre-authenticated to allow limited access to selected content in the user mode 104. This will provide the user with enough time to cycle through multiple content features during the walkup experience, yet maintain security with respect to other content features e.g., a destination. Once the user has been fully authenticated, all content features, e.g. destination made during the pre-authenticated state, are validated for display. If the authentication fails, the user will not be granted access to the vehicle 20 or any sensitive information. The system 30 in this disclosed non-limiting embodiment allows pre-authenticated access at about 30-40 feet and full access at about 15- 25 feet from the vehicle.

[0050] With respect to Figure 7, to provide further authentication, the system 30 is operable to recognize a user by his skeleton joint relationships. Skeleton joint relationships in this disclosed non-limiting embodiment facilitate pre-authentication but not

full authentication that grants full access to the vehicle 20. However, if the user has been pre-authenticated via the wearable article 61 or the key fob 62, a matching skeleton joint relationship will fully authenticate the user. That is, the user identification subsystem 38 may utilize skeleton joint relationships as the second point of identification.

[0051] Figure 19 is a block diagram of a computing device 1000 for implementing a wearable article 61. The wearable article 61 can include some or all functionalities of a digital key fob such as key fob 62. For example, with the digital key fob being incorporated into a smart watch, a user can put on the smart watch every morning without having to struggle to find the key. The computing device 1000 can be any type of wearable, handheld, or other form of single computing device, or can include multiple computing devices. For example, the computing device 1000 can be a smart watch 2002 (Figure 20A), a personal mobile device, a smart clothing article 2004 (Figure 20B), a transdermal chip (not shown), a wearable sensor (not shown), or a smartglasses article 2006 (Figure 20C).

[0052] The processing unit in the computing device 1000 can be a conventional central processing unit (CPU) 1102 or any other type of device, or multiple devices, capable of manipulating or processing information. The memory 1104 in the computing device 1000 can be a random access memory device (RAM) or any other suitable type of storage device. The memory 1104 can include data 1106 that is accessed by the CPU using a bus 1108. The memory 1104 can also include an operating system 1110 and installed applications 1112, the installed applications 1112 including programs that permit the CPU 1102 to implement the instructions to generate control signals for performing vehicle functions on a vehicle as described. The instructions can also include performing functions that are not related to a vehicle, such as to track a user's biometrics or to display time. The computing device 1100 can also include secondary, additional or external storage 1114, for example, a memory card, flash drive, or any other form of computer readable medium. In one embodiment, the installed applications 1112 can be stored in a whole or in part in the external storage 1114 and loaded into the memory 1104 as needed for processing.

[0053] The computing device 1000 can include one or more output devices, such as a display 1116 and one or more input 1118 devices, such as a keypad, a touch sensitive device, a sensor, or a gesture sensitive input device that can receive user inputs. The computing device 1000 can be in communication with one or more of the subsystems via a communication device (not shown) such as a transponder/transceiver device or a Wi-Fi,

infrared, or Bluetooth device. For example, the computing device 1000 can communicate with the control subsystem 34 through interface 56.

[0054] The computing device 1000 can be coupled to one or more vehicle devices configured to receive inputs from the user and provide feedback to the driver of the vehicle 20. As will be described, the computing device 1000 can also include a sensor (not shown) to take sensed information from the user such as voice commands, ultrasound, gesture or other inputs.

[0055] In some embodiments, the computing device 1000 can be a wearable computing device configured to perform vehicle functions on the vehicle 20. The vehicle functions can be implemented in the installed applications described above. As described in further detail below, the vehicle functions can include, among others, various remote control functions (Figures 23A-F), driver score function (Figure 24B), panic mode (Figures 25A-C), a navigation function, an audio/video function, a climate control function, an internet access function, and a remote control function for controlling the vehicle. The remote control functions can include, for example, unlocking, locking (2308 in Figure 23A), switching on flashlight (2310 in Figure 23A), switching off flashlight, horn honk (2312 in Figure 23A), starting (2302 in Figure 23A), stopping (2306 in Figure 23C), powering on, or powering off of the vehicle.

[0056] In the computing device 1000 described in Figure 19, the applications 1112 stored in the memory 1104 can include vehicle applications such as application 2204 shown in Figure 22B. The applications 1112 can also include autonomous driving applications such as a data analyzer, a path planner, a target value generator, an error detector, an adaptive module, or any other application configured to implement the autonomous driving system by performing such actions as identifying the driver, planning a route for autonomous operation of the vehicle, and improving positional accuracy of the vehicle.

[0057] Figures 20A-C show several non-limiting examples of the wearable article 61. Referring to Figure 20A, the wearable article 61 can be implemented as a smart watch 2002. For example, with the digital key fob functionalities incorporated into the smart watch 2002, a user can put on the smart watch every morning without struggling to find the key. The user will no longer need to carry the key fob 62 separately. In addition to being used as a watch or wristband, the smart watch 2002 can be worn by the user to perform vehicle functions on the vehicle 20. Referring to Figure 20B, the integrated wearable article 61 can be implemented as a smart clothing article 2004. The user can operate the smart

clothing article 2004 by controlling certain vehicle functions incorporated into the smart clothing article 2004. Referring to Figure 20C, the integrated wearable article 61 can also be implemented as smartglasses 2006. Other implementations of the wearable article 61 are also possible. For example, the wearable article 61 can be implemented as a smart phone device, a transdermal chip, a wearable sensor, or a remote access key fob.

[0058] Figure 21 is a flow diagram of an example process 2100 performed by the wearable computing device 1000 of Figure 19, which will be described in details further below.

[0059] Figures 22A through 25C are example screen displays 2202 of a wearable article 2200 according to one implementation. Figure 22A illustrates a screen that displays date and time. Figure 22B illustrates a main menu from which a vehicle application icon 2204 can be selected. Figure 22C illustrates a menu screen with three icons: remote control 2206, driver score 2208, and panic mode 2210.

[0060] Figures 23A-F are example screen displays when remote control 2206 is selected. Figure 23A illustrates a remote control screen showing a list of remote control functions to be selected by the user. The user can navigate the list up and down by scrolling or using up and down buttons. For example, when the user clicks on "Vehicle START" icon 2302, a control signal for starting the vehicle is sent to vehicle. A status message 2304 can be displayed on the control screen, as illustrated in Figure 23B. Once the start function is performed, the icon can be switched or toggled to show "VEHICLE STOP" icon 2306 as illustrated in Figure 23C. In another example illustrated in Figures 23D-F, "Horn Honk" icon 2312 can be selected and a status message 2314 can be generated for display on the screen. Once the horn honk is performed, the user can click on "Horn Honk" icon 2316 again to repeat the action.

[0061] Figure 24A illustrates a screen that displays an example notification 2402 ("Vehicle started"). The user can click on the notification 2402 to go back to the earlier screen. Figure 24B illustrates a driver score alert screen 2404, which will be described in more details below.

[0062] Figures 25A-C are example screen displays for the panic mode of the vehicle application 2204 on the wearable article 2200. Figure 25A illustrates the main menu where the panic mode icon 2210 can be selected. Figure 25B illustrates a screen 2502 where the user is indicated to long press the select button to activate the panic mode. Figure 25C shows a message 2504 indicating the panic mode has been activated.

[0063] As illustrated in Figures 22A through 25C, vehicle functions to be performed on the vehicle 20 can include various remote control functions (Figures 23A-F), driver score function (Figure 24B), and panic mode (Figures 25A-C). The remote control functions can include, for example, unlocking, locking (2308 in Figure 23A), switching on flashlight (2310 in Figure 23A), switching off flashlight, horn honk (2312 in Figure 23A), starting (2302 in Figure 23A), stopping (2306 in Figure 23C), powering on, or powering off of the vehicle. Other vehicle functions can include, for example, a navigation function, an audio/video function, a climate control function, or an internet access function.

[0064] The wearable article can be used to sense information from a user, such as biometrics and driving information. For example, the wearable article 61 can be used to store and forward a driver score. When the driver keys off the vehicle 20, the driver score can be sent from the vehicle 20 to the wearable article 61. After a certain time interval, the wearable article 61 can upload the driver score to a remote server or cloud 70, which can perform further analysis on the driver score to help the driver improving driving skills and become a safer driver. As previously discussed, data analysis based on the driver scores can be used to improve safe driving skills or for other purposes. For example, the user can review and evaluate his driving performances relative to others in a social ranking system based on the driver scores.

[0065] In some embodiments, a driver score can be generated for driver actions performed on the vehicle 20. The driver score can be used to help the driver improving driving skills and alert the driver when deteriorating performance occurs. The driver actions can be associated with or triggered by the vehicle functions performed on the vehicle 20. The driver score can be calculated based on, for example, information from a sensor such as a motion camera or light sensor that detect gesture commands, an onboard device, and/or the wearable article 61. For example, once the vehicle is started, information about driver actions can be gathered for calculating the driver score. Once the vehicle is stopped and locked, the driver action information gathered during this trip can be used to calculate the driver score. In case the driver score is calculated by a device other than the wearable article 61, it can be transmitted to the wearable article 61 for display and/or storage.

[0066] In one implementation, the driver score can be an option selectable from the menu screen of the wearable article. As shown in Figure 22C, driver score option 2208 can be selected on the menu screen 2202 of the wearable article 2200. Referring to Figure 24B, an example driver score of "87" is generated and displayed on a driver score alert screen 2404 when the driver score option 2208 is selected. As previously discussed, the

driver score can be uploaded and further processed for various applications-specific purposes such as to improve driving skills.

[0067] The wearable article 61 can also be used to control multiple vehicles, or to allow multiple users to share control of a vehicle. As will be described, encryption techniques may be implemented on the wearable articles and/or some of the vehicle subsystems for security purposes.

[0068] In some instances, at least one onboard input sensor 60 or offboard input device can be integrated into, or operate in conjunction with, the interactive display subsystem 32. In one non-limiting example, the interactive display subsystem 32 includes an LCD display integrated into a window 22 and can operate in conjunction with one or more touch sensors integrated into the window 22, causing the window to function as a touchscreen. In another non-limiting example, the interactive display subsystem 32 includes a projector 42 and coating 40 on the window 22 and can operate in conjunction with one or more motion detectors configured to detect user gesture commands, causing the window to operate as a gesture-based interactive display. Subsystem combinations involving the interactive display subsystem 32 and the user input subsystem and enabling user interaction with a display on a vehicle window 22 will be referred to herein as an interactive window display.

[0069] The user identification subsystem 38, also referred to herein as the user recognition and authentication subsystem, includes one or more identification sensors 64 such as a closed-circuit television (CCTV) camera, infrared, thermal or other sensor mounted to the vehicle 20 to provide a desired field of view external to the vehicle 20 as shown in Figure 4, internal to the vehicle, or both. One example user identification subsystem 38 can recognize the driver and/or passenger based on image data captured by identification sensors 64, e.g. a skeletal joint relationship 66 and/or other user form data (Figure 5), separate from, or along with, wireless devices such as the wearable article 61 associated with that particular driver and/or passenger. The wearable article 61 can also include a sensor (not shown) to take sensed information from the user, such as pulse or heart rate. The sensor on the wearable article 61 can be, for example, a wrist-mounted sensor that recognizes the user based on voice commands, ultrasound, gesture or other inputs. Based at least in part on this identification, the system 30 provides access to interactive interfaces on the interactive display subsystem 32 associated with the particular driver and/or passenger.

[0070] Figure 21 is a flow diagram of an example process 2100 performed by the wearable computing device 1000 of Figure 19. Process 2100 can be implemented as a

software program executed by computing device 1000. The software program can include machine-readable instructions that may be stored in a memory such as memory 1104, and that, when executed by a processor, such as CPU 1102, may cause the wearable computing device 1000 to perform process 2100. Process 2100 can also be implemented using specialized hardware or firmware.

[0071] At a step 2102, a user input indicative of a vehicle function to be performed on the vehicle can be received on the wearable article, such as the wearable computing device 1000. In one example, the user can press on a touch button on a display of the smart watch 2002 to activate the vehicle function to unlock the front door of the vehicle 20. In another example, the user can select a vehicle function by pressing an icon on the smart clothing article 2004 worn by the user. The user input can also include, for example, an indication to activate the window display in the interactive display subsystem. Other types of inputs are also possible. For example, the user can use voice commands to activate the vehicle functions.

[0072] At a step 2104, a gesture input by the user can be received at the wearable article such as the wearable computing device 1000. The gesture input can be used for authentication of the user. In some embodiments (e.g., the multi-factor authentication), the gesture input can be used in the multi-factor authentication in conjunction with the user input received from the wearable article at step 2102 to authenticate the user. The user can be authenticated based on a first input received from the wearable article indicating a vehicle function to be performed and a second gesture input detected by a sensor. The sensor can be, for example, coupled to the vehicle 20 or to the wearable article 61. The sensor can also be integrated with the vehicle 20 or the wearable article 61. For example, the sensor can be an onboard input sensor, such as a camera or light sensor configured to detect gesture commands, or a microphone configured to detect voice commands. The sensor can also be an offboard input device coupled with the wearable article 61, or another device, such as key fob 62 or personal electronic device 63.

[0073] In some embodiments, the second input can include a gesture input by the user detected by the sensor when the user is within a predetermined range of the vehicle 20. The sensor can be used to detect whether the user is wearing the wearable article. When the user is not wearing the wearable article, access to some or all vehicle functions can be denied.

[0074] At a step 2106, a vehicle function can be performed on the vehicle 20 based on a successful authentication of the user. The vehicle function can be one indicated at

step 2102, such as, for example, an input indication to unlock or switch on the vehicle 20. As shown in the examples of Figures 22A through 25C, the vehicle functions can include various remote control functions, a driver score function, and a panic mode. The remote control functions can include, for example unlocking, locking, switching on flashlight, switching off flashlight, horn honk, starting, stopping, powering on, or powering off of the vehicle. The vehicle functions can also include a navigation function, an audio/video function, a climate control function, or an internet access function.

[0075] Information used for user authentication can include user input received at step 2102, the gesture input received at step 2104, or any of the multi-factors described above. Example multi-factor authentication may include receiving inputs from the wearable article 61, the key fob 62, skeleton joint relationship recognition (Figure 5), and/or a gesture password (Figure 8). The user may be provisionally identified with one of these factors, but may require a total of at least two factors to perform some or all of the vehicle functions.

[0076] After the user is successfully authenticated, the control signal for performing the vehicle function indicated at step 2102 can be generated and sent to the vehicle 20. Once successfully authenticated, the user can interact with the display subsystem through the integrated wearable article 61 and output can be generated for display on the vehicle window.

[0077] The system 30 can store user profiles of known users, the user profiles including identification information relevant to individual users. For example, a user profile can contain skeleton joint relationship data or facial recognition data useable by the user identification subsystem 38 to identify or authenticate a user. A user profile can additionally contain personal interest information, such as personal calendar and event information, driving/destination history, web browsing history, entertainment preferences, climate preferences, etc. In some variations, any or all information contained in a user profile can be stored on or shared with the wearable article 61, a personal electronic device 63, remote server, or other cloud 70 based system. Such offboard storage or sharing of user profile data can facilitate utilization of user profile data in other vehicles such as any additional vehicles owned by the user, rental vehicles, etc. Such user profile data can be secured by being accessible through a password protected application running on the cloud 70 based system, by biometric authentication, or by other effective means.

[0078] In some instances, a user profile can additionally contain user access information; data pertaining to whether the user is allowed to control a given vehicle

function. For example, the user profile associated with a user can indicate full user access, or function control rights for that user. This can be analogous to the control rights of the administrator of a personal computer. A user profile can alternatively indicate restricted user access. For example, the user profile associated with a child can be set to block the user from accessing certain audio or video controls, the navigation system, altering user profiles, or the like.

[0079] Registration of various user profiles with the system 30 can be completed in any manner, for example, over the internet or with a direct vehicle interface. User profiles can be based on the identities of individual users known to or registered with the system, or to user categories, such as "unknown user", or "valet". In different variations, a default user category such as "unknown user" or "valet" can be associated with limited, default access, or can be associated with no access, i.e. complete prohibition of access to the system 30.

[0080] The user location subsystem 39, operable to determine the location of one or more users inside or outside the vehicle, includes one or more location sensors 66 such as a pressure sensor, temperature sensor, or camera deployed inside or outside the vehicle. In some cases, a device can serve as both an identification sensor 64 and a location sensor 66. For example, a camera mounted within the vehicle can provide information on a user's specific identity, by means described above, and on the user's location within the vehicle, such as the driver's seat or the front-row passenger's seat. In some cases, elements of the interactive display subsystem 32 can also operate as location sensors 66 within the user location subsystem 39. For example, pressure sensors within a smartscreen or motion detectors operating as part of an interactive display can be used to obtain user location information.

[0081] In some instances, user access can be based on user location as determined by the user location subsystem 39. For example, second or third row passengers can be allowed or disallowed access to various vehicle functions such as the navigation system. Optionally, a user with a user profile that is associated with unlimited access per the access information associated with the user profile can specify such settings. In some instances, user access can be based on a combination of the user profile as applied by the user identification subsystem 38, and the user location as detected by the user location subsystem 39. For example, a user with unlimited access as specified by the applied user profile can nonetheless be blocked from accessing certain vehicle functions when occupying the driver's seat of a moving vehicle.

[0082] With reference to Figure 6, operation of the system 30 according to one disclosed non-limiting embodiment generally includes a sleeper mode 100, a watcher mode 102 and a user mode 104. It should be appreciated that other modes may additionally or alternatively be provided.

[0083] If the system 30 is active but has yet to detect a user, the system 30 will be in sleeper mode 100 until awakened by the user identification subsystem 38. After detection but prior to identification by the system 30, the watcher mode 102 may be utilized to interact with authenticated as well as un-authenticated persons. For example, when a person approaches the vehicle 20, the system 30 recognizes the direction from which the person has approached then activates the interactive display subsystem 32 to display an avatar, eyes or other graphic. The graphic may be directed specifically toward the direction from which the person approaches, e.g., the graphical eyes "look" toward their approach. Alternatively, an audio capability allows the system 30 to respond to commands and initiate interaction from a blind side of the vehicle 20, i.e., a side without the interactive display subsystem 32. The watcher mode 102 utilizes the user identification subsystem 38 to discriminate between authenticated and un-authenticated persons.

[0084] The user mode 104 allows a user with a known operator and/or passenger user profile in the system 30 to make decisions on approach to the vehicle 20 so that so that certain vehicle interactions need not await entry into the vehicle 20. The user mode 104 reduces distractions through the reduction of travel-associated decisions from the driver's cognitive, visual and manual workload streams once within the vehicle 20. In furtherance of this, the user is presented with an overview of information to include, for example, weather, traffic, calendar events and vehicle health. As will be further described, predictive functions of the system 30 identify likely actions, and offer optimal paths to completion, such as planning an efficient route.

[0085] A maximum range of content provision by the interactive display subsystem 32 may be associated with a maximum distance at which that content can be effectively interacted with by the user. In one disclosed non-limiting embodiment, the maximum range of each content feature is prioritized with respect to legibility range of content displayed by the interactive display subsystem 32. This range metric facilitates the determination of the order in which content appears in the walkup experience. Access to prioritized content with greater maximum range allows the walkup experience to begin further from the vehicle 20 to provide the user with more overall time to interact with the system 30.

[0086] Once successfully authenticated, the interactive display subsystem can also enable the user to interact with the display subsystem through the integrated wearable article 61 and generate output for display on the vehicle window.

[0087] With reference to Figure 9, once authenticated, the "landing" or "home" page 200 provides a summary of alerts and important information to the user. The landing page 200 provides the user with a readily reviewable overview of the status of the vehicle and how it may affect his schedule and activities. In this example, the content includes time information, vehicle diagnostic information, and personal calendar information. Here shown, a low fuel warning is provided in addition to a traffic-based route update for use by the vehicle navigation system and a calendar event reminder to "Pick up Kids in 20 minutes." In another example, the system 30 will include a fuel station as a stop during route guidance if the destination is a distance greater than the available fuel range. Notably, preferred fuel stations or other stops may be predefined in the user profile.

[0088] The landing page 200 further displays a plurality of icons to indicate additional content pages that can be viewed by the authorized user. The landing page 200 itself may be accessed on each content page as an icon such as a vehicle manufacturer mark icon on each content page. The landing page 200 allows the authorized user to understand what vehicle systems or personal user profile items may require further attention and provides access to additional content feature details with regard to these items in the form of navigable icons that lead to additional content pages. The landing page 200 can additionally or alternatively integrate an interactive display, for example, a smart page or video game. Other interactive vehicle display page configurations are also possible.

[0089] Selection of content is accomplished with, for example, wearable article 61, the key fob 62, user gestures, voice commands, touch inputs, etc. In one example, the user utilizes the input of the wearable article 61 to cycle through various pages displayed by the interactive display subsystem 32. In one example, the wearable article 61 may include a four button directional pad and two auxiliary buttons. Alternatively, hand gestures may be used to "swipe" between pages. In another example, the user can utilizes the key fob 62 to cycle through the pages. It should be appreciated that although particular pages are illustrated in the disclosed non-limiting embodiment, various alternative or additional pages may be provided.

[0090] With reference to Figure 10, a route page 202 defaults to the predicted best route for the user with respect to an explicit or inferred next destination. Any alternate destinations or routes that can be explicit or inferred with confidence from, for example, a

user personal electronic device such as the wearable article 61, are presented to permit user selection by scrolling through the options. The suggested route screen is here shown accessed using the folded-map icon, however, other icons may be utilized.

[0091] With reference to Figure 11, a calendar page 204 displays the user's calendar. In this example, the view is near-term, and shows only the next 2-3 upcoming appointments. If the event includes location information the user is also given the option to use the event for destination selection. Here shown, the calendar page 204 provides content with respect to the next appointment highlighted for the user and provides a reminder to "Pick Up Kids." The calendar screen is here shown accessed using a flip calendar icon, however, other icons may be utilized.

[0092] With reference to Figure 12, a weather page 206 leverages information about the route to provide relevant weather information – this may be especially effective when the user is travelling away from home. For example, the system 30 determines whether it is more valuable to present the user with local weather information, destination weather information, or both, depending on the settings selected by the user or the type of weather information available. Here shown, the weather forecast is chronological. The weather page 206 can be accessed with a sun icon, however, other icons may be utilized. In addition, weather conditions can be utilized to generate a reminder for display on the landing screen 200 that, for example, suggests an umbrella be placed in the vehicle if rain is forecasted.

[0093] With reference to Figure 13, a vehicle status page 208 provides the user with a view of impending vehicle maintenance needs that requires attention. Notifications can include source details of the notification, severity, and options to resolve the potential issue. For example, given the notification of "Low Fuel," the system 30 can suggest a route to a nearby fuel station within the range of the vehicle. The vehicle status page 208 is here shown accessed with a vehicle icon, however, other icons may be utilized.

[0094] With reference to Figure 14, a to-do list page 210 presents the authorized user with information from any associated to-do list available on, for example, that user's personal wearable device 61. Here shown, the recognized user is tasked to "Send Package," "Submit Taxes," and "Renew Car Registration," among other items. The to-do list page 210 can alternatively be integrated into the route selection page if location information is included in a given list item in the personal electronic device to-do list. An example of this integration includes the provision of route details to a dry cleaner if the dry cleaning pickup is on the to-do list and the current route is proximate to the location of the dry cleaner location.

The to-do list page is here shown accessed using a check-mark icon, however, other icons may be utilized.

[0095] As noted above, information of this nature, which can be included in a user profile, can in some variations be stored on or shared with wearable device 61, another a personal electronic device 63, remote server, or other cloud 70 based system, facilitating utilization in more than one vehicle. Any such information can be secured by being accessible through a password protected application running on the cloud 70 based system, by biometric authentication, or by other effective means. In some such variations, a first user can be granted partial or complete access to a second user's profile by password sharing, for example. Such sharing of access could enable a first user to write reminders or tasks from a remote location to the user profile of a second user, such as a family member, such that the reminders or tasks written by the first user will be displayed on a window when the second user approaches or enters the vehicle, or any vehicle equipped with system 30 enabled to access the user profile of the second user.

[0096] With reference to Figure 15, user access to various vehicle functions can include direct or remote access to utilize functionalities of a vehicle head unit 300.

[0097] With the interactivity between the vehicle head unit 300 and the system 30, and in particular between the vehicle head unit 300 and various interactive window displays, passengers can make selections with regard to vehicle systems typically performed by driver and in some cases only when the vehicle is stationary. Allowing only passengers to interact with certain vehicle systems while the vehicle is in motion increases safety by minimization of driver distraction. Passenger interaction can also enable greater functionality for the system 30. For example, a front-seat passenger can be offered more menu selections than the driver, while 2nd and 3rd row passengers can be offered even greater menu selections than the front-seat passenger. In these embodiments, the passengers can take over portions of the driver workload.

[0098] The vehicle passengers may, for example, interact with the system 30 and thereby the vehicle head unit 300 via an interactive window display or through the wearable article 61 which communicates therewith, through Bluetooth, RFID or other wireless technology standards to exchange data. Further, the system 30 may permit the formation of personal area networks (PANs) for vehicle passengers to share information. For example, a passenger's wearable article 61 may include a mapping app operable to communicate with the vehicle navigation system on the vehicle head unit 300 with no

features locked out such that the passenger can search destinations and selectively send to the vehicle navigation system via the vehicle head unit 300.

[0099] Interaction of the system 30 with the vehicle head unit 300 also allows the driver and/or passengers to select content for other vehicle passengers and/or the driver. For example, one of the passengers can select a destination to display on the navigation system for the driver while the vehicle is in motion. In another example, the driver can select entertainment content for display to child passengers. In yet another example, the passenger can control infotainment or climate control features controlled by the vehicle head unit 300.

[00100] With reference to Figure 16, and in one non-limiting example of the operation of the user location subsystem 39, to still further increase safety through driver distraction minimization, the system 30, by utilizing user location subsystem 39, is operable to track the location or position of the vehicle occupants within the vehicle cabin 400 (Figure 18) through skeletal position (Figure 16), facial map data (Figure 17), pressure sensors, interactive window display input sensors, or others. For a three row vehicle, for example, three distinct areas are tracked – front row, middle row and rear row. Typically, at least two sensors 402 per row are required to track a state of each occupant within the vehicle 20. In some instances, each individual seat in the vehicle 20 can be tracked. The data from all sensors 402 may alternatively or additionally be combined to create one central map (2D or 3D) for use by the system 30. It should be appreciated that the sensors 402 may communicate with, or be a portion of, the user identification subsystem 38, the user location subsystem 39, or both.

[00101] Given that the vehicle occupants are typically seated and belted, the multi-point skeletal joint relationship and facial recognition map data provides a relatively accurate position of each occupant captured on an XYZ axis map that can track, to a desired level of precision, the state of each occupant at a specific snapshot in time. The state of each occupant facilitates further tailored operations for various vehicle functions. For example, the user location subsystem 39 detects and discriminates between a driver's hand from that of a vehicle front row passenger hand to selectively unlock various head unit functionality such as navigation route selection (Figure 16). Dependent, for example, on which user (driver or passenger) is attempting to access the system 30 and whether the vehicle is in motion, content menu items of the vehicle head unit 300 are selectively displayed. For example, certain content such as route selection may be color coded for only passenger access, while other content such as zooming and scrolling may always be available regardless of user.

[00102] Upon approach to the vehicle, the system 30 beneficially recognizes a user with a first and second point of identification to display information for that particular, authorized user. This authentication process ensures the security of the vehicle and the personal information embedded in the system 30 yet permits vehicle interaction prior to user entry into the vehicle cabin. The system 30 also beneficially discriminates passengers from the driver to selectively permit access to personalized content or specific vehicle system interfaces.

The use of the terms "a" and "an" and "the" and similar references in the context of description (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or specifically contradicted by context. The modifier "about" used in connection with a quantity is inclusive of the stated value and has the meaning dictated by the context (e.g., it includes the degree of error associated with measurement of the particular quantity). All ranges disclosed herein are inclusive of the endpoints. It should be appreciated that relative positional terms such as "forward," "aft," "upper," "lower," "above," "below," and the like are with reference to the normal operational attitude of the vehicle and should not be considered otherwise limiting.

[00103] Although the different non-limiting embodiments have specific illustrated components, the embodiments of this invention are not limited to those particular combinations. It is possible to use some of the components or features from any of the non-limiting embodiments in combination with features or components from any of the other non-limiting embodiments.

[00104] It should be appreciated that like reference numerals identify corresponding or similar elements throughout the several drawings. It should also be appreciated that although a particular component arrangement is disclosed in the illustrated embodiment, other arrangements will benefit herefrom.

[00105] Although particular step sequences are shown, described, and claimed, it should be understood that steps may be performed in any order, separated or combined unless otherwise indicated and will still benefit from the present disclosure.

[00106] The foregoing description is exemplary rather than defined by the limitations within. Various non-limiting embodiments are disclosed herein, however, one of ordinary skill in the art would recognize that various modifications and variations in light of the above teachings will fall within the scope of the appended claims. For example, in the embodiments described above, the vehicle 20 is generally described as an automobile. However, the vehicle 20 is not limited to an automobile, as the integrated wearable article can

also be implemented with other vehicles generally controlled by a driver, or operator, such as airplanes, boats etc. In addition, the vehicle 20 need not be limited to one controlled by a driver or operator, and could be one or more robots or robotic tools performing operations under the control of an equivalent application to a path planner application. It is therefore to be appreciated that within the scope of the appended claims, the disclosure may be practiced other than as specifically described. For that reason the appended claims should be studied to determine true scope and content. The scope of the claims is thus to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures as is permitted under the law.

CLAIMS

What is claimed is:

1. A system for operating a vehicle, comprising:

a user input subsystem comprising a wearable article, the user input subsystem configured to receive inputs from a user; and

a user recognition and authentication subsystem in communication with the user input subsystem, the user recognition and authentication subsystem configured to detect and authenticate the user associated with the received inputs.

2. The system of claim 1, wherein the wearable article comprises at least one of a smart watch, a personal mobile device, a smart clothing article, a transdermal chip, a wearable sensor, or a smartglasses article.

3. The system of claim 1, wherein the wearable article comprises a wearable computing device configured to perform at least one vehicle function on the vehicle.

4. The system of claim 3, wherein the at least one vehicle function is at least one of a remote control function, a driver score function, a panic mode function, a navigation function, an audio/video function, a climate control function, or an internet access function.

5. The system of claim 4, wherein the remote control function is one of unlocking, locking, switching on flashlight, switching off flashlight, horn honk, starting, stopping, powering on, or powering off of the vehicle.

6. The system of claim 1, wherein the user recognition and authentication subsystem comprises a sensor configured to detect at least one gesture input by the user.

7. The system of claim 6, wherein the user is authenticated based on a first input received from the wearable article indicating a vehicle function to be performed and a second input detected by the sensor associated with the vehicle or the wearable article.

8. The system of claim 6, wherein the sensor is further configured to detect whether the user is wearing the wearable article, wherein the user is authenticated based on the at least one gesture input by the user detected within a predetermined range of the vehicle.

9. The system of claim 3, further comprising:

a control subsystem configured to enable the user to control the at least one vehicle function from the wearable article.

10. The system of claim 9, wherein the control subsystem is further configured to:

generate a driver score for at least one driver action associated with one or more vehicle functions performed by the user on the vehicle; and

transmit the driver score to the wearable article.

11. A wearable article, comprising:

one or more processors; and

a memory for storing data and program instructions executed by the one or more processors, wherein the one or more processors are configured to executed instructions stored in the memory to:

receive a first input from a user indicating a vehicle function to be performed on a vehicle;

receive a second input indicating a gesture by the user for authentication; and

generate a control signal to perform the vehicle function based on a successful authentication of the user.

12. The wearable article of claim 11, wherein the vehicle function is one of a remote control function, a driver score function, a panic mode function, a navigation function, an audio/video function, a climate control function, or an internet access function.

13. The wearable article of claim 12, wherein the remote control function is one of unlocking, locking, switching on flashlight, switching off flashlight, horn honk, starting, stopping, powering on, or powering off of the vehicle.

14. The wearable article of claim 11, further comprising:

a sensor configured to detect the gesture by the user and generate the second input based on the gesture.

15. The wearable article of claim 11, wherein the one or more processors are further configured to execute instructions stored in the memory to:

receive a driver score generated for at least one driver action associated with one or more vehicle functions performed by the user on the vehicle.

16. A method for operating a vehicle, comprising:

receiving, at a wearable article, a first input from a user indicating a vehicle function to be performed on a vehicle;

receiving a second input indicating a gesture by the user for authentication; and

generating, at the wearable article, a control signal for performing the vehicle function on the vehicle based on a successful authentication of the user.

17. The method of claim 16, further comprising:

detecting whether the user is wearing the wearable article, wherein the successful authentication of the user is based on the user wearing the wearable article.

18. The method of claim 16, wherein the vehicle function is one of a remote control function, a driver score function, a panic mode function, a navigation function, an audio/video function, a climate control function, or an internet access function.

19. The method of claim 18, wherein the remote control function is one of unlocking, locking, switching on flashlight, switching off flashlight, horn honk, starting, stopping, powering on, or powering off of the vehicle.

20. The method of claim 16, wherein the successful authentication of the user is based on the first input received from the wearable article indicating the vehicle function to be performed and the second input detected by a sensor associated with the vehicle or the wearable article.

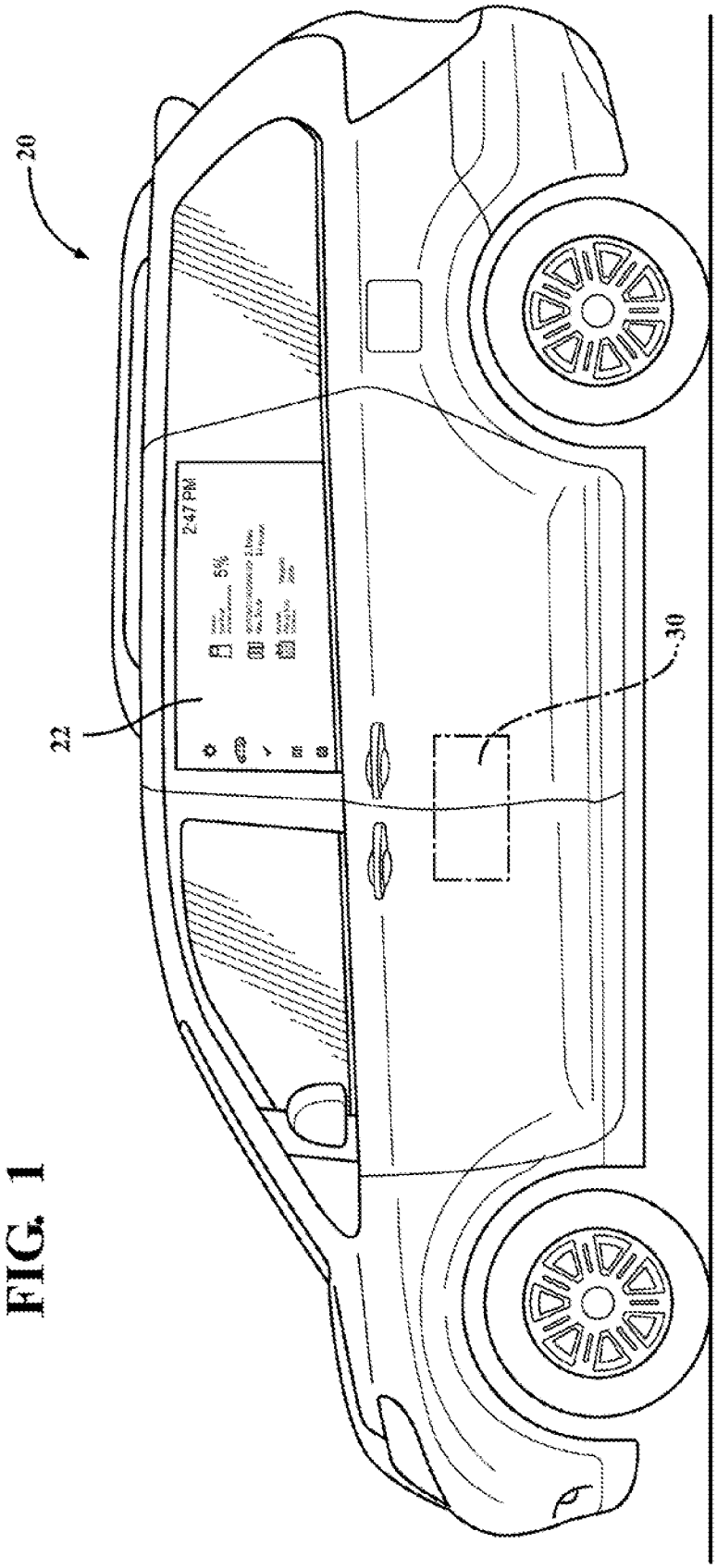


FIG. 1

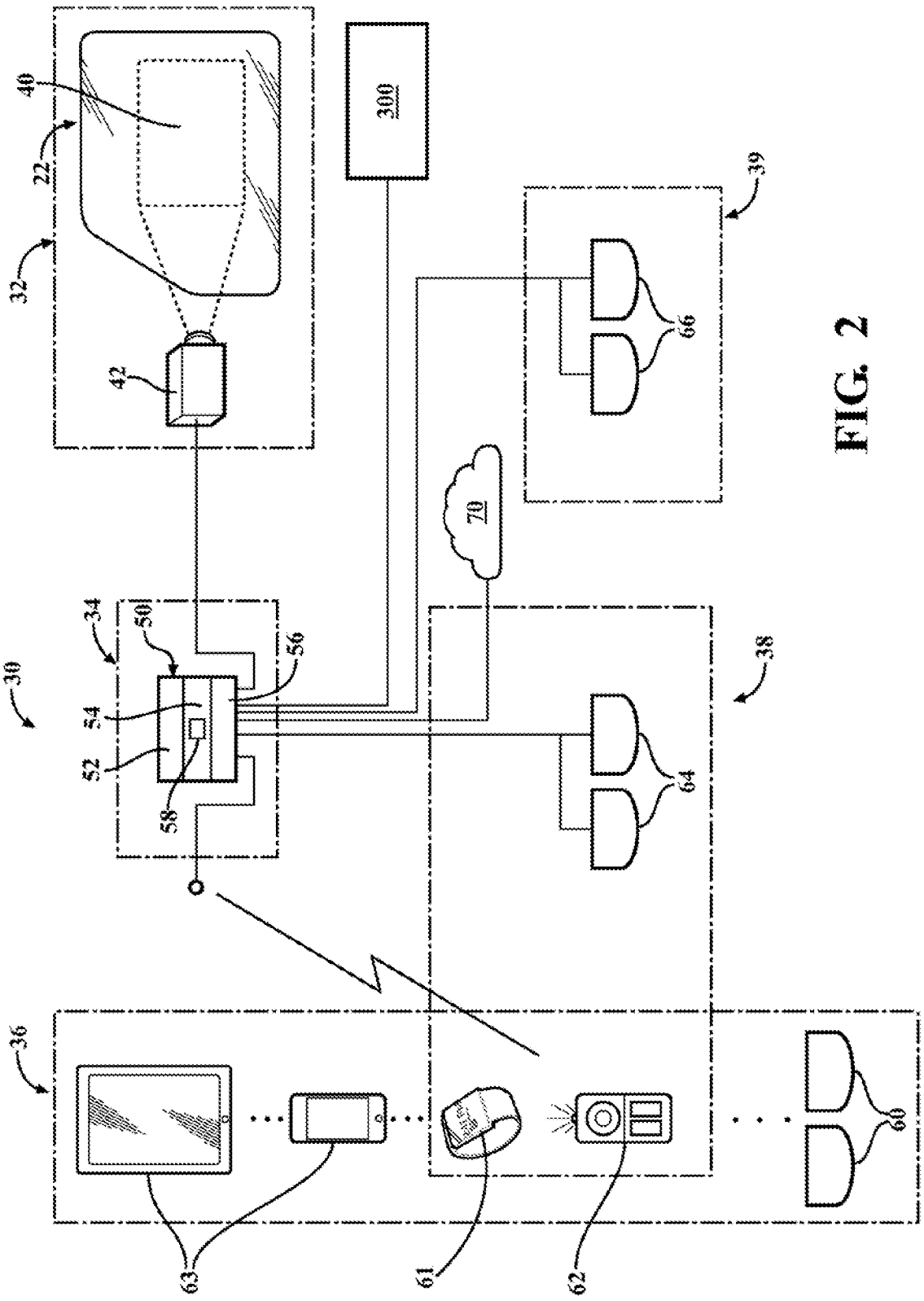
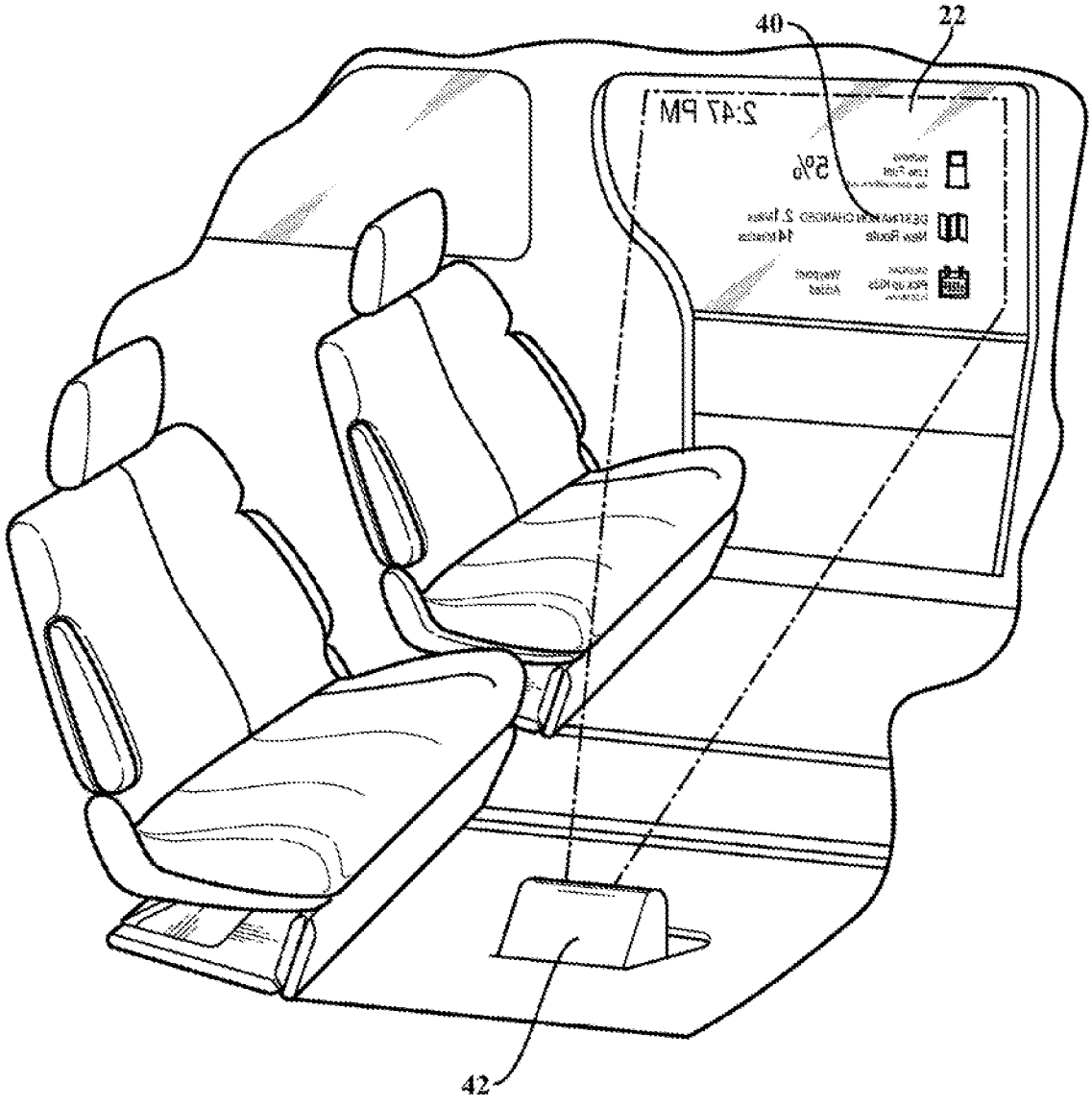


FIG. 2

FIG. 3



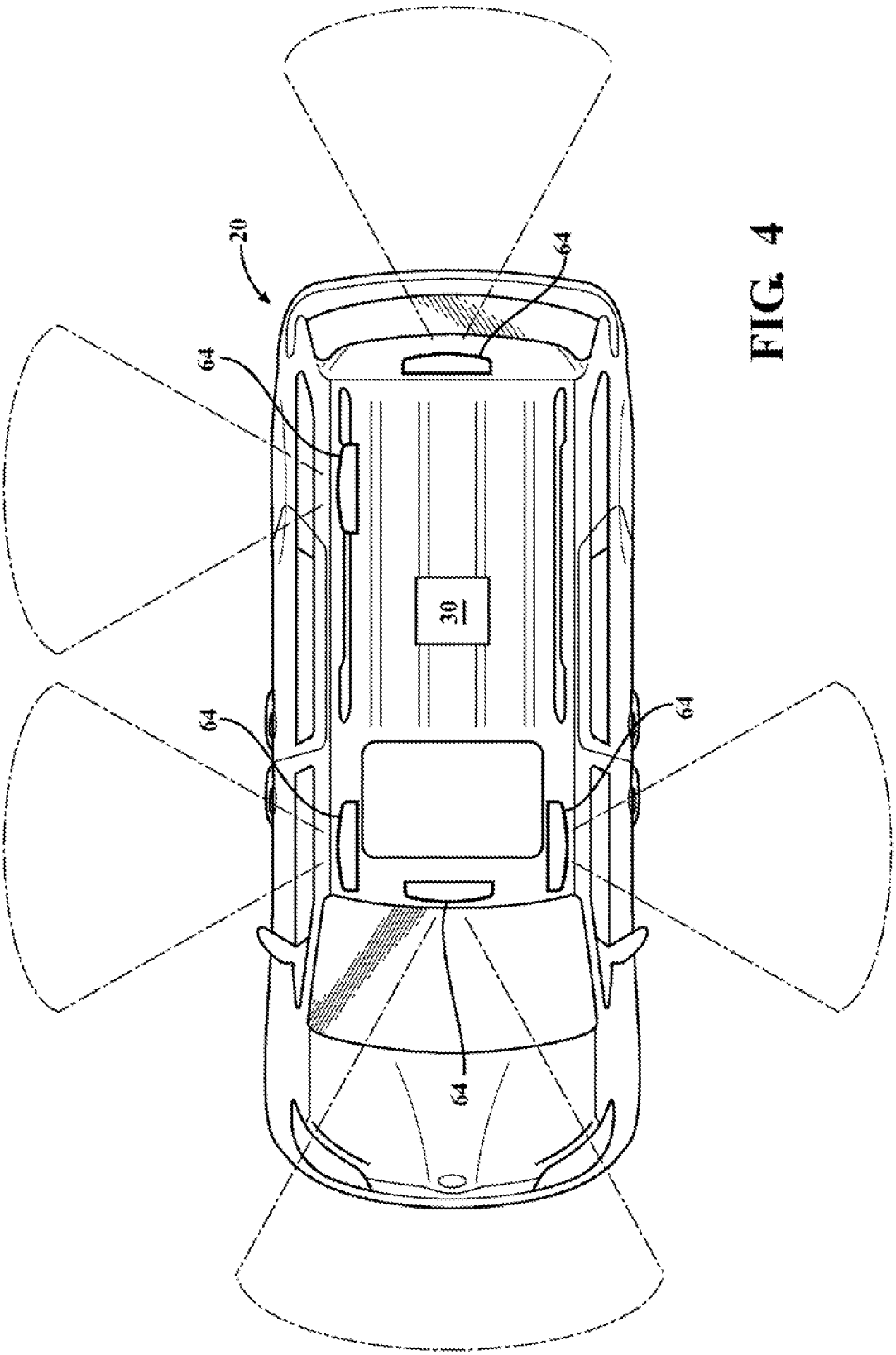


FIG. 4

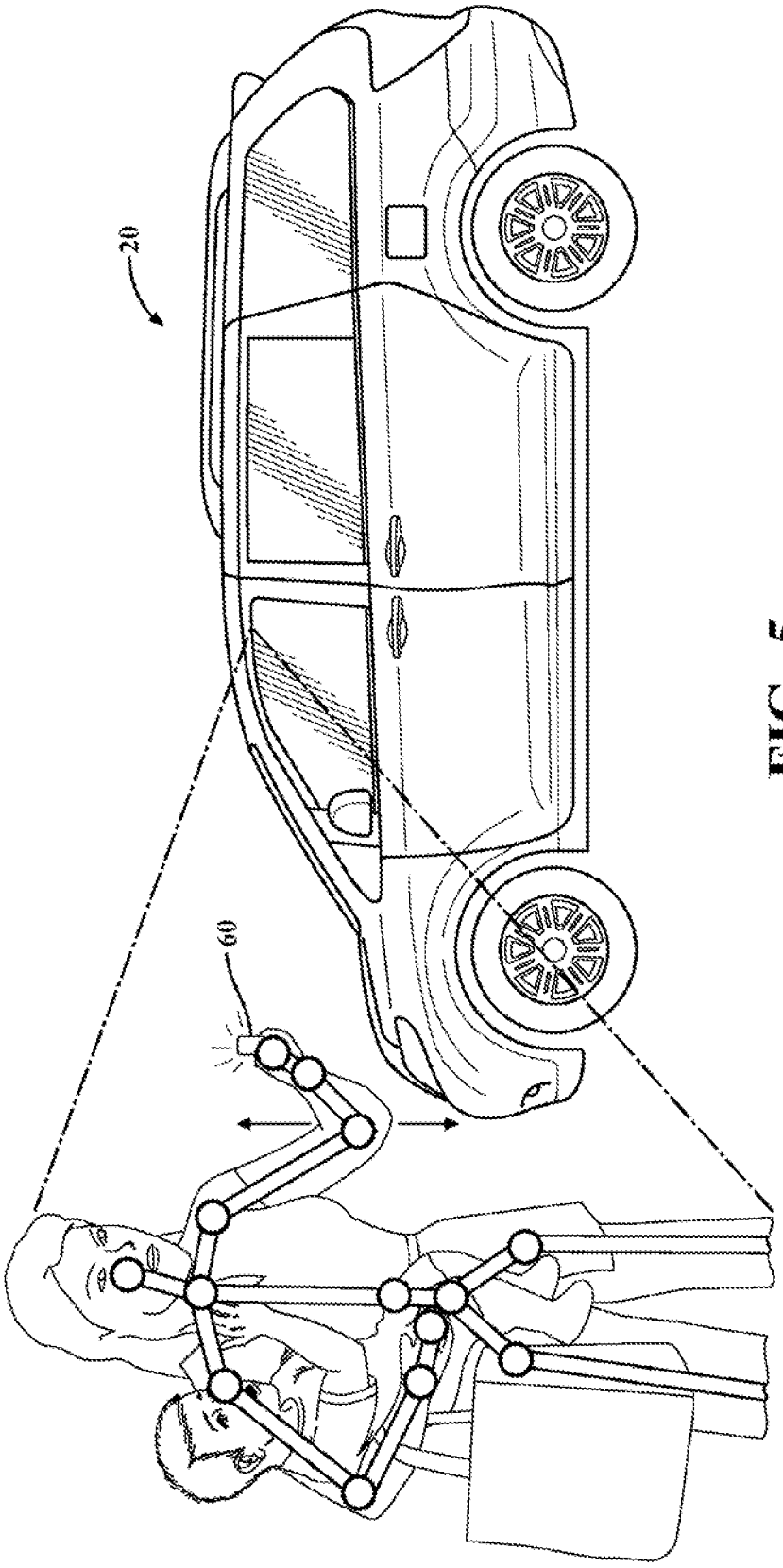


FIG. 5

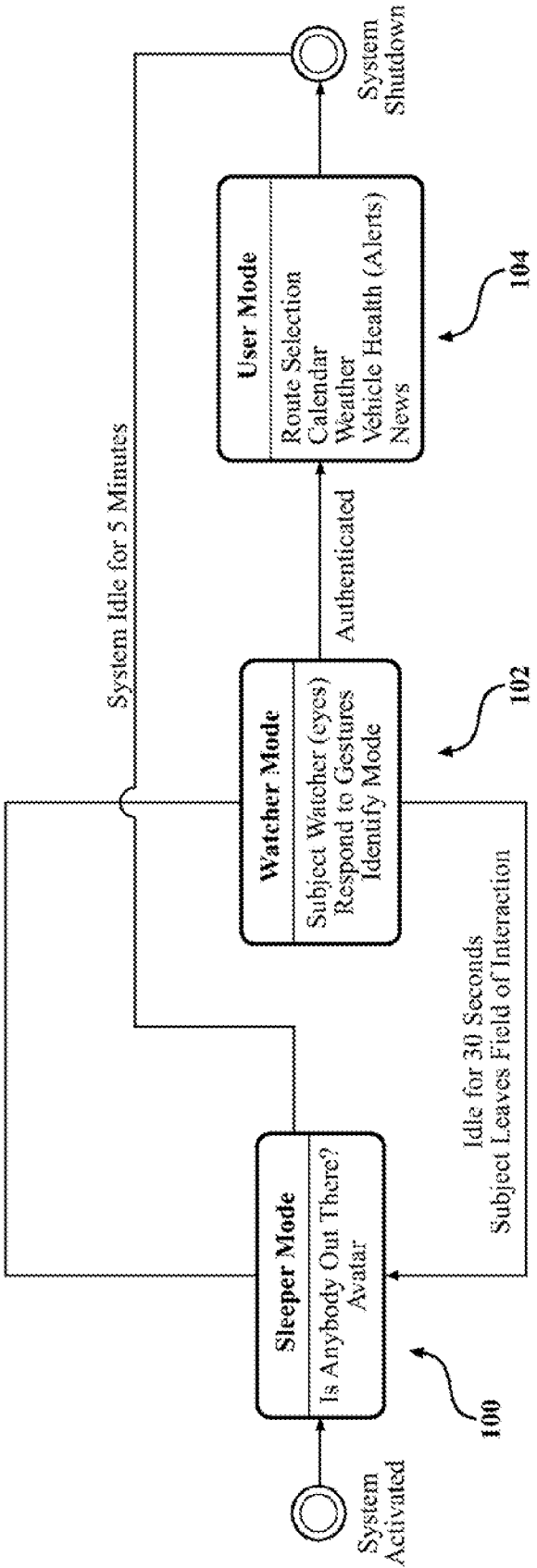

System Activated
Sleeper Mode
Is Anybody Out There?
Avatar
100
Watcher Mode
Subject Watcher (eyes)
Respond to Gestures
Identify Mode
102
User Mode
Route Selection
Calendar
Weather
Vehicle Health (Alerts)
News
104
System Shutdown
System Idle for 5 Minutes
Authenticated
Idle for 30 Seconds
Subject Leaves Field of Interaction

FIG. 6

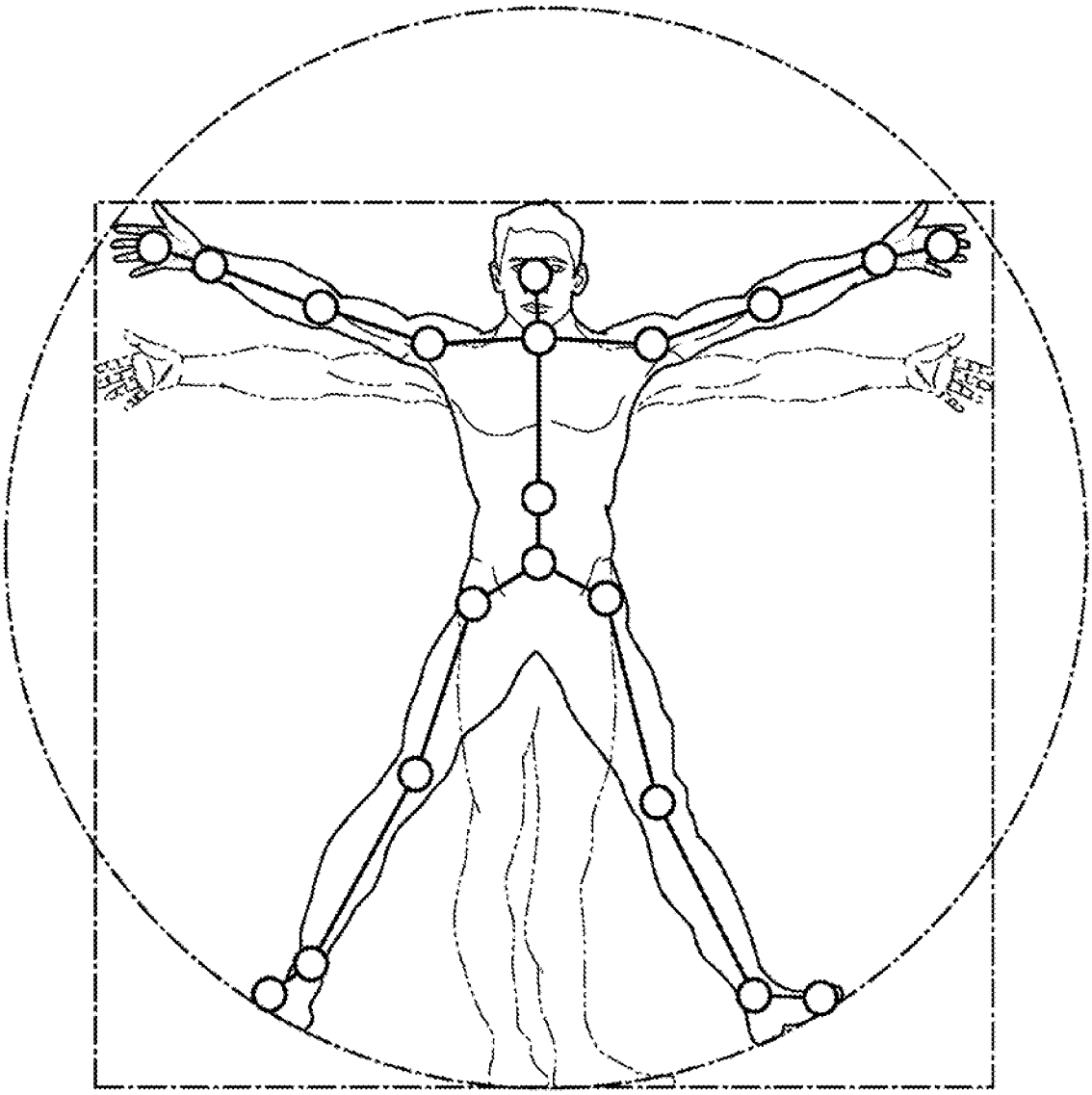


FIG. 7

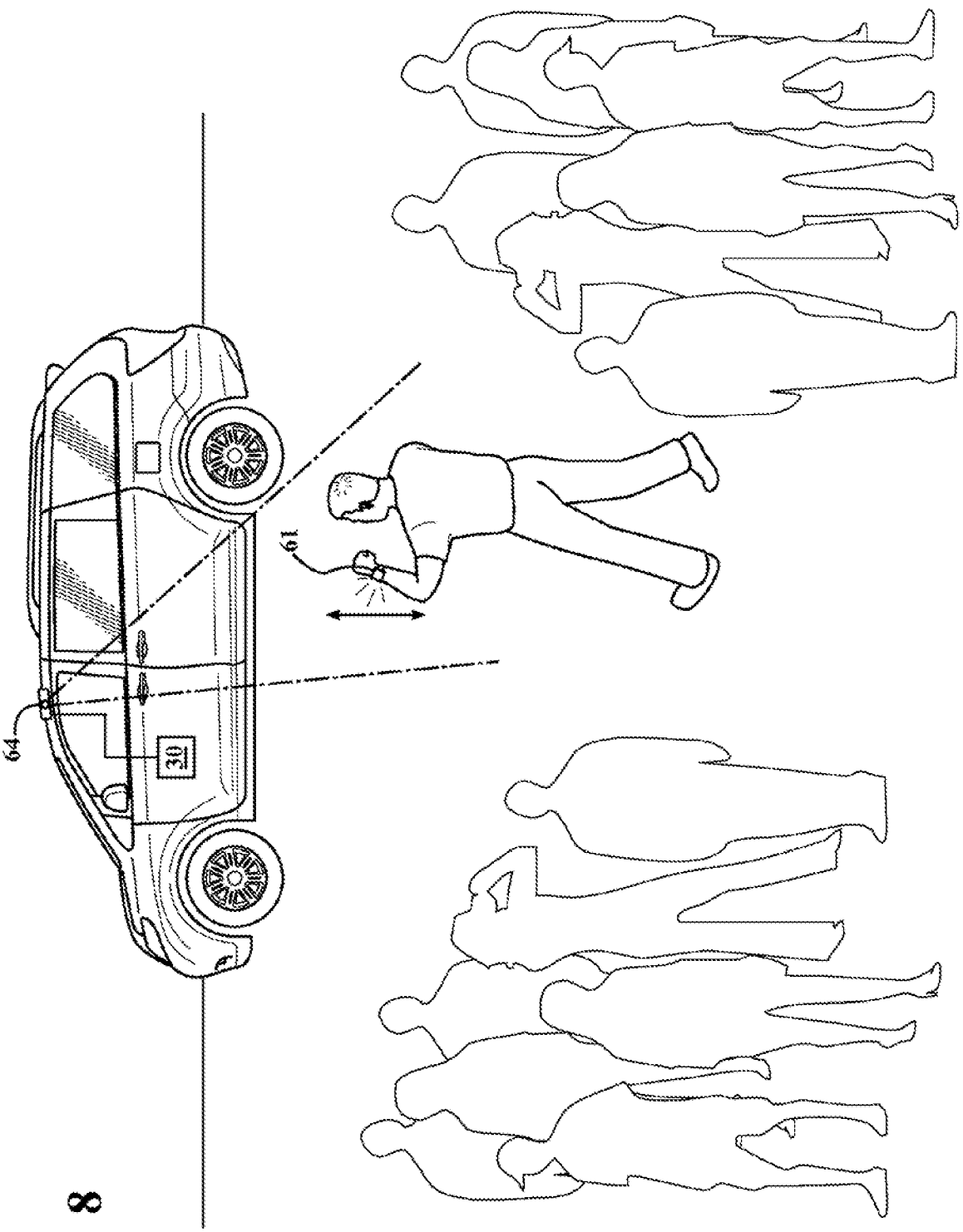
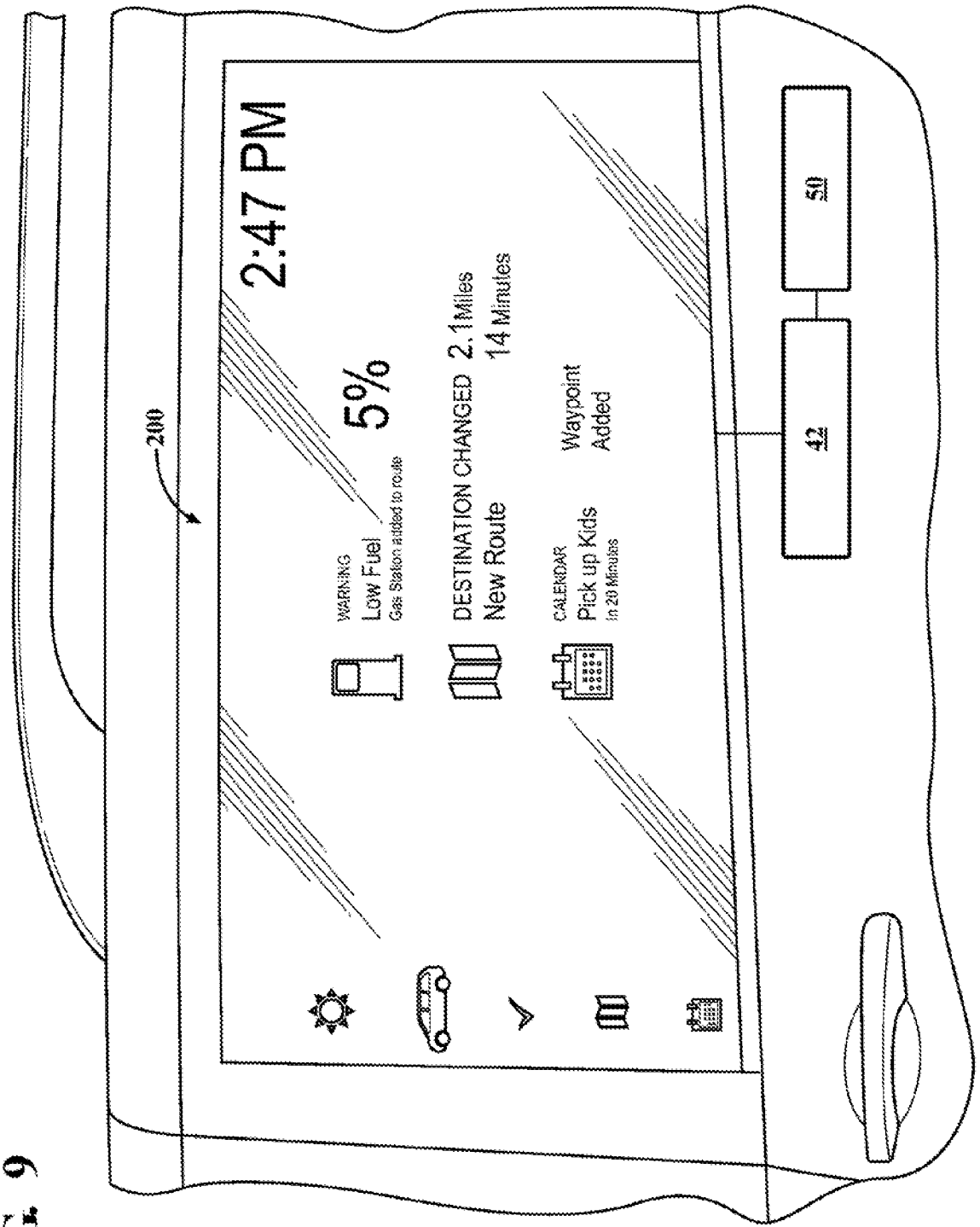


FIG. 8

FIG. 9


200
2:47 PM
5%
WARNING
Low Fuel
Gas Station added to route
DESTINATION CHANGED
New Route
2.1 Miles
14 Minutes
CALENDAR
Pick up Kids
in 20 Minutes
Waypoint
Added
42
50

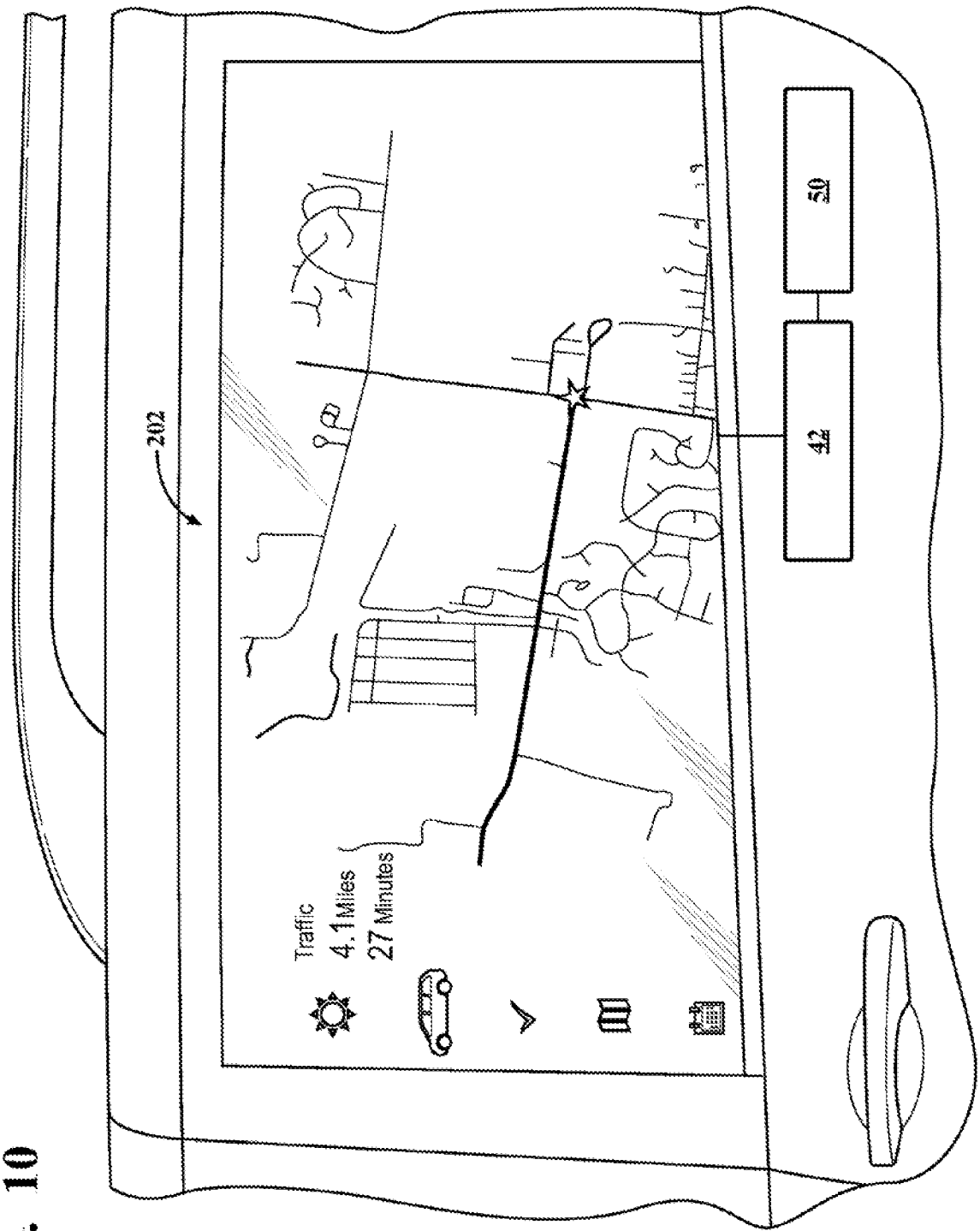


FIG. 10

FIG. 11

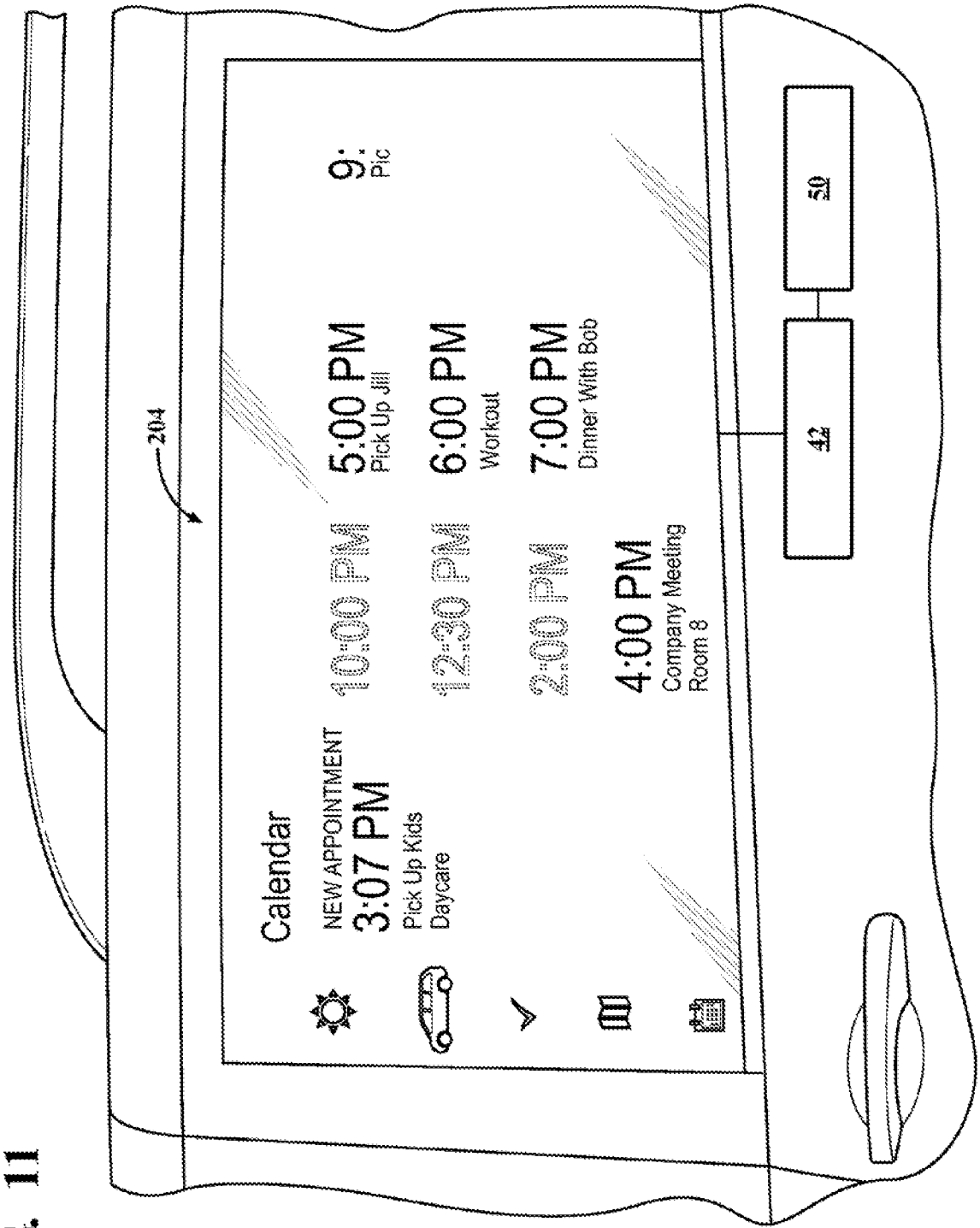
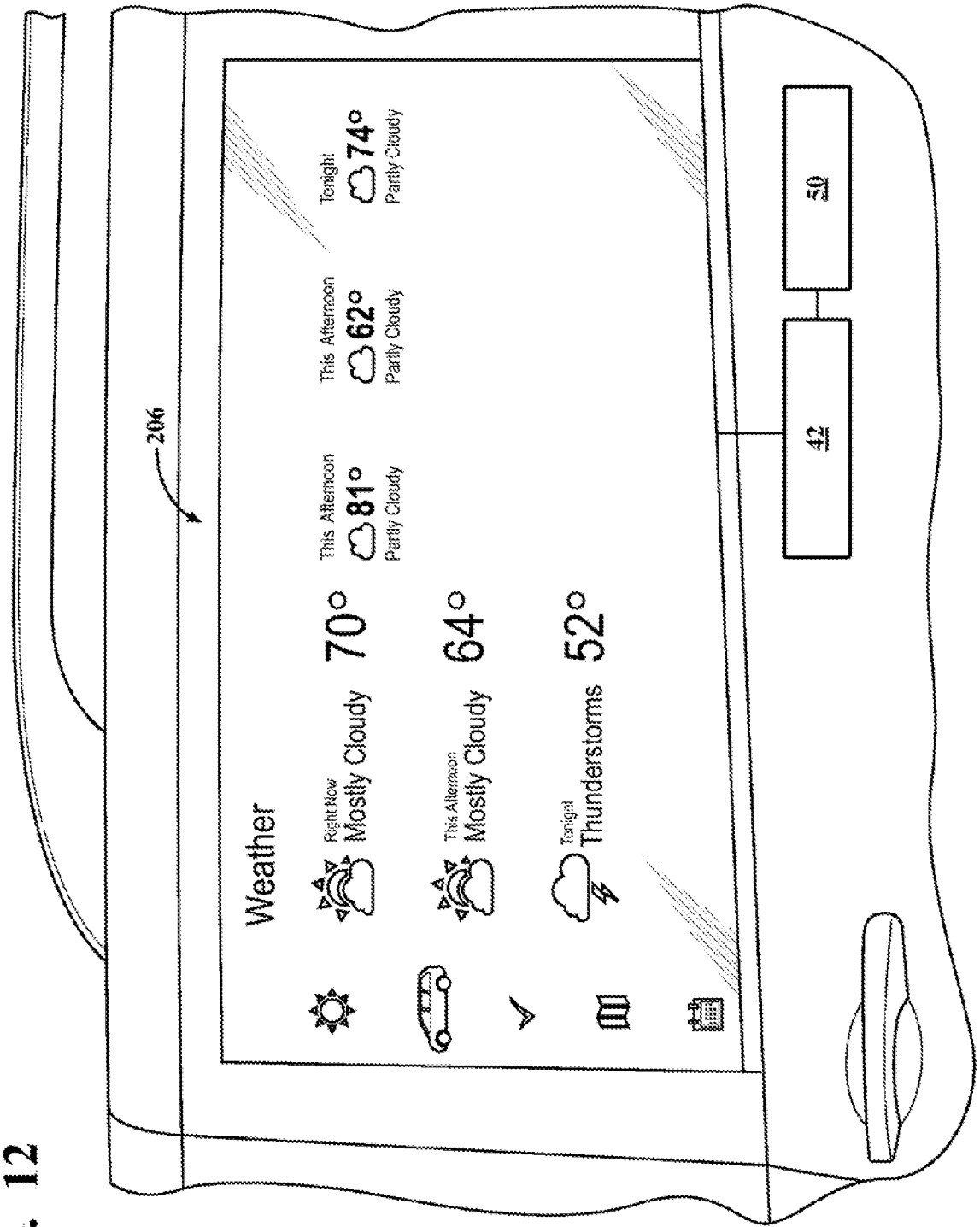

204
Calendar
NEW APPOINTMENT
3:07 PM
Pick Up Kids
Daycare
10:00 PM
12:30 PM
2:00 PM
4:00 PM
Company Meeting
Room 8
5:00 PM
Pick Up Jill
6:00 PM
Workout
7:00 PM
Dinner With Bob
9:
Pic
42
50

FIG. 12


206
Weather
Right Now
Mostly Cloudy
70°
This Afternoon
81°
Partly Cloudy
This Afternoon
Mostly Cloudy
64°
This Afternoon
62°
Partly Cloudy
Tonight
Thunderstorms
52°
Tonight
74°
Partly Cloudy
42
50

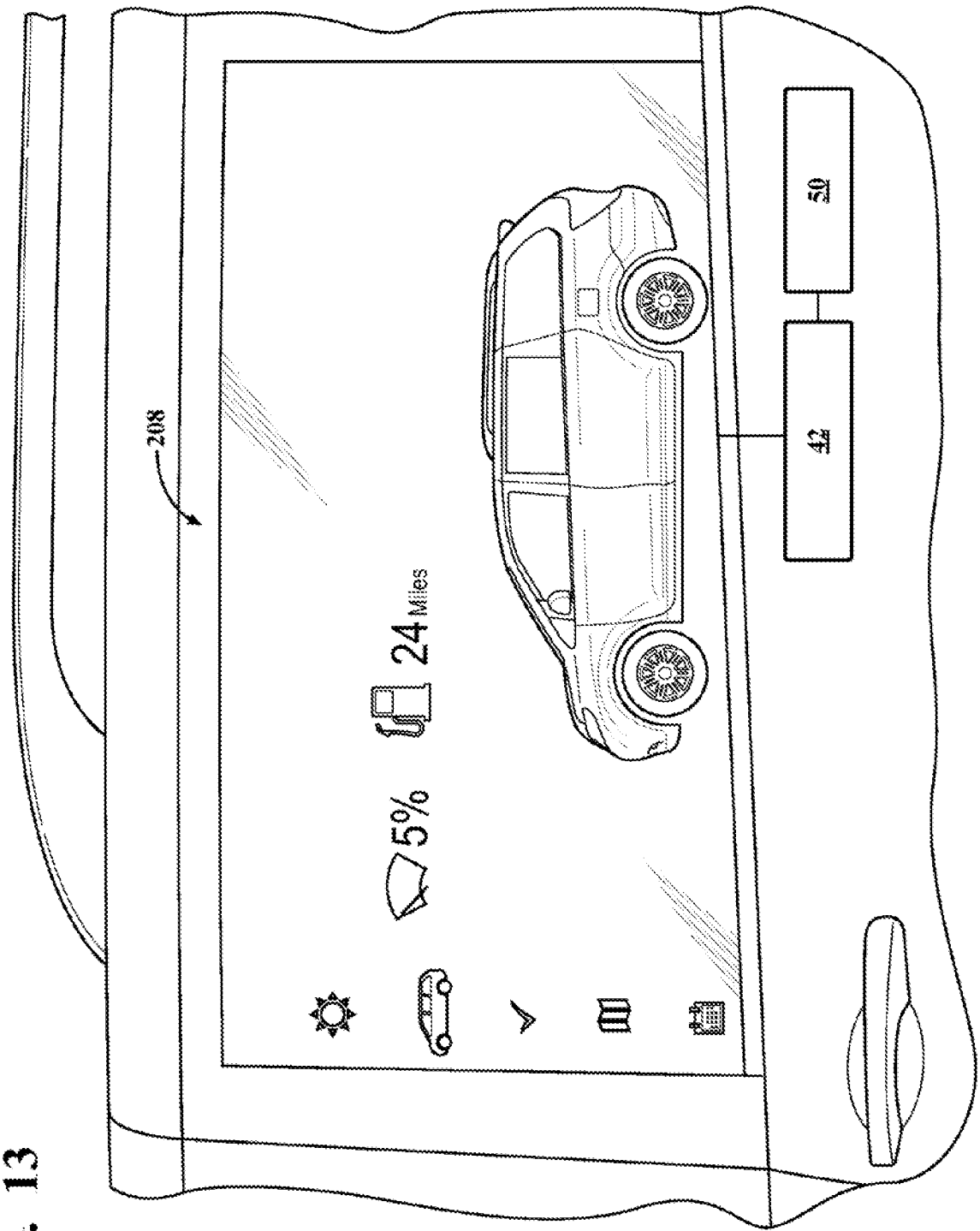
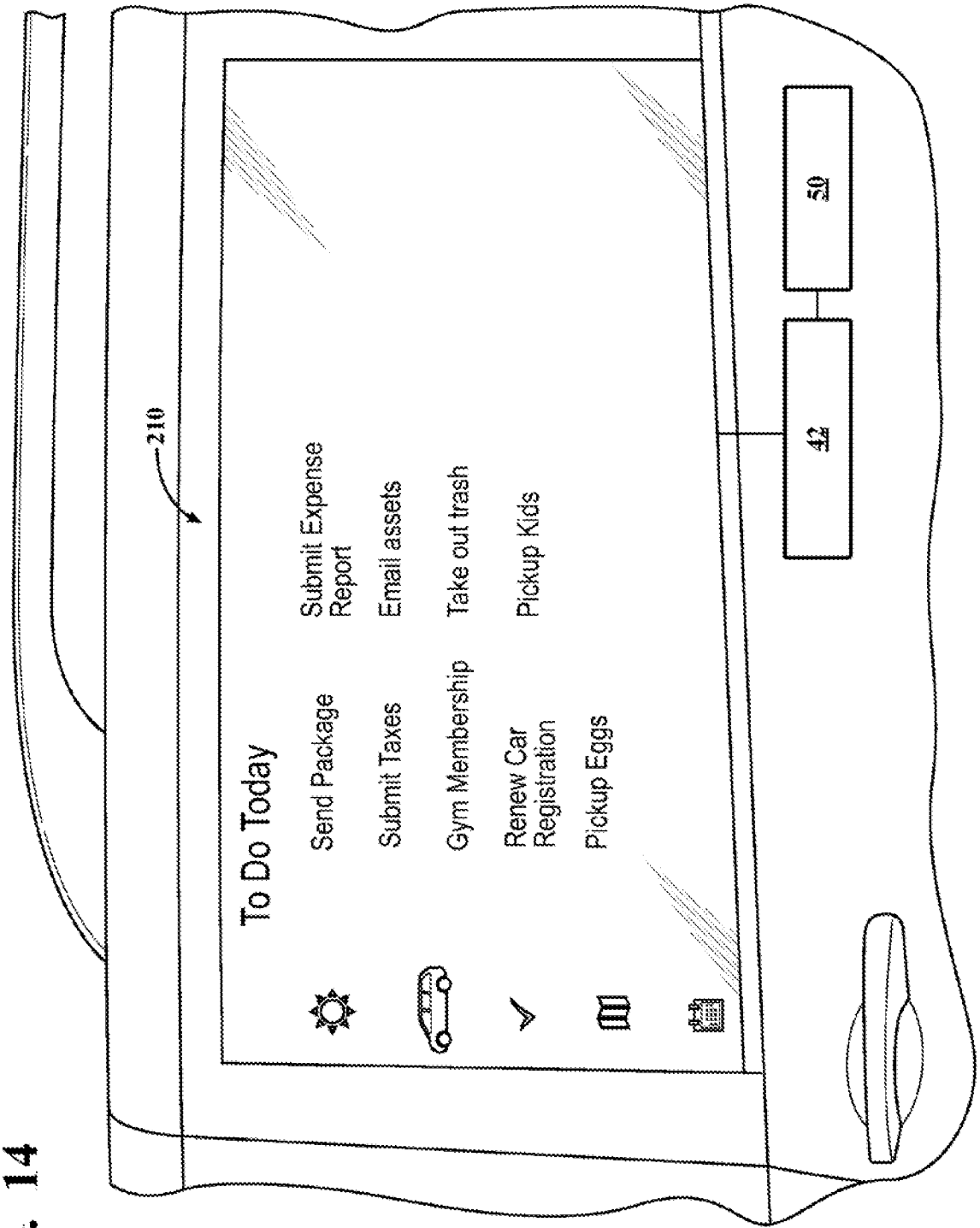


FIG. 13

FIG. 14


210
To Do Today
Send Package
Submit Taxes
Gym Membership
Renew Car Registration
Pickup Eggs
Submit Expense Report
Email assets
Take out trash
Pickup Kids
42
50

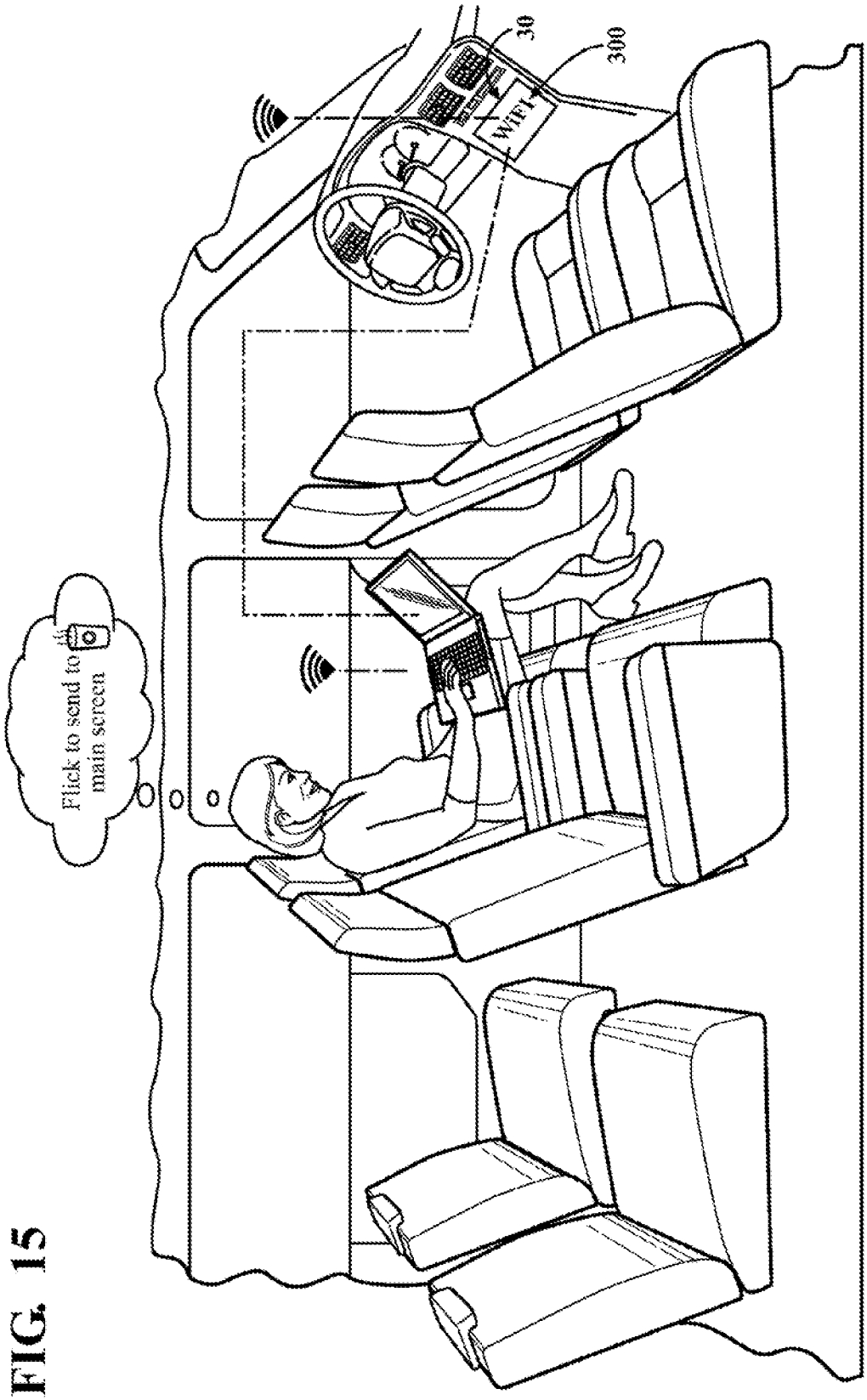


FIG. 15

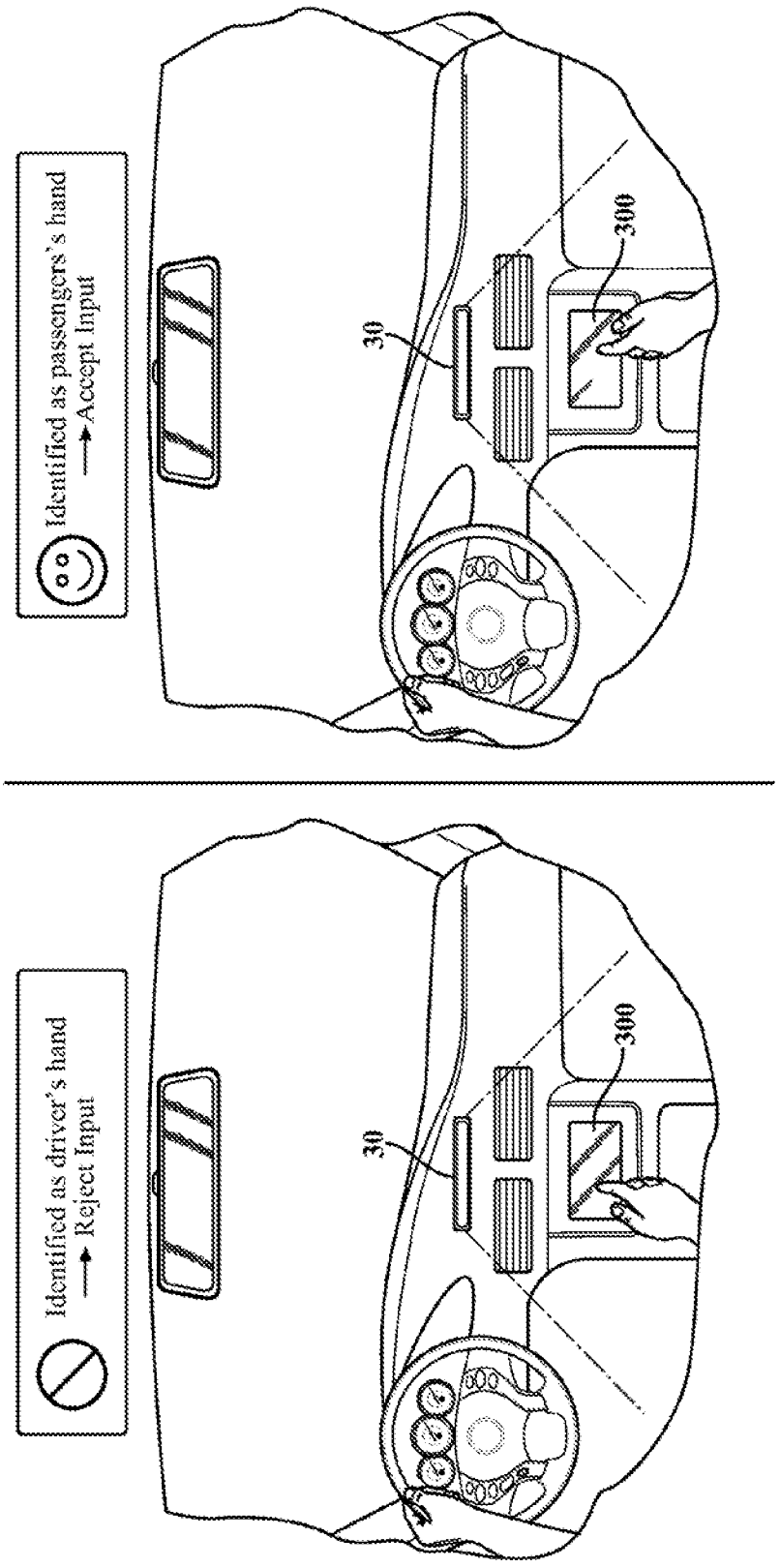

Identified as passengers's hand
Accept Input
30
300
Identified as driver's hand
Reject Input
30
300

FIG. 16

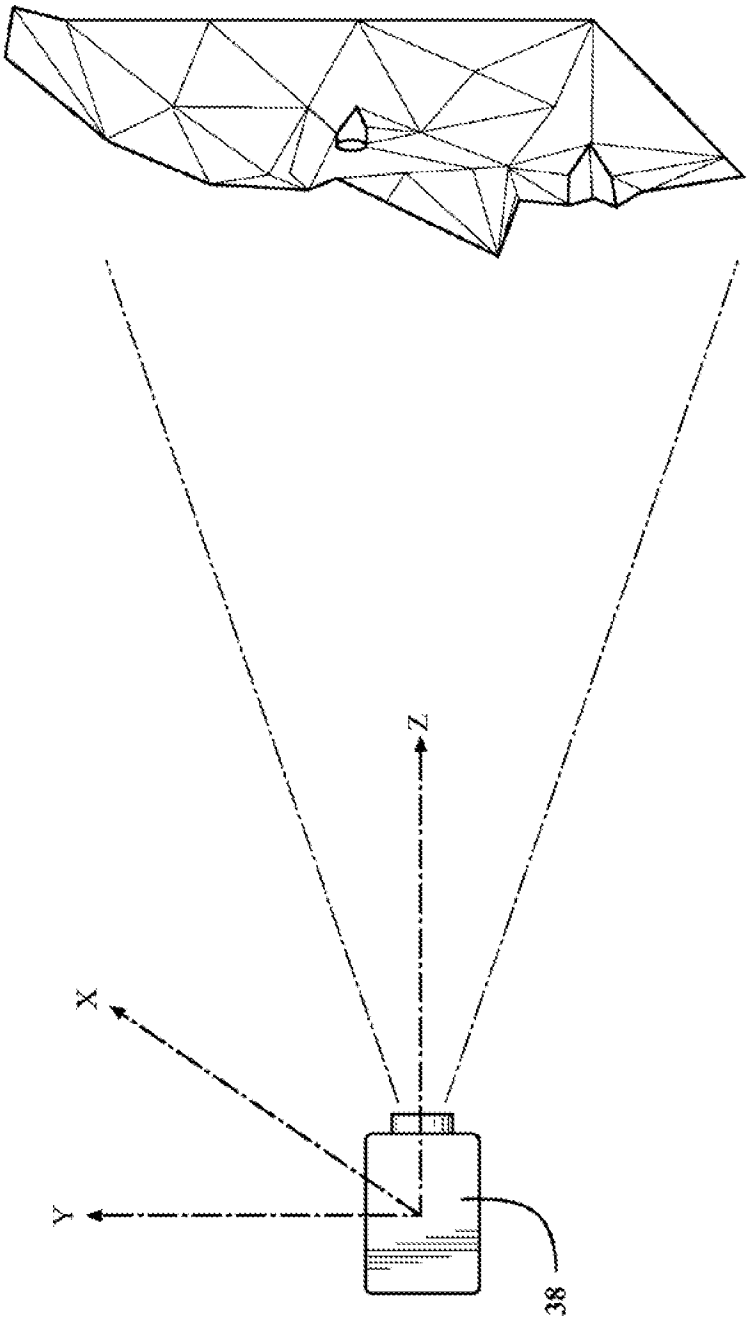


FIG. 17

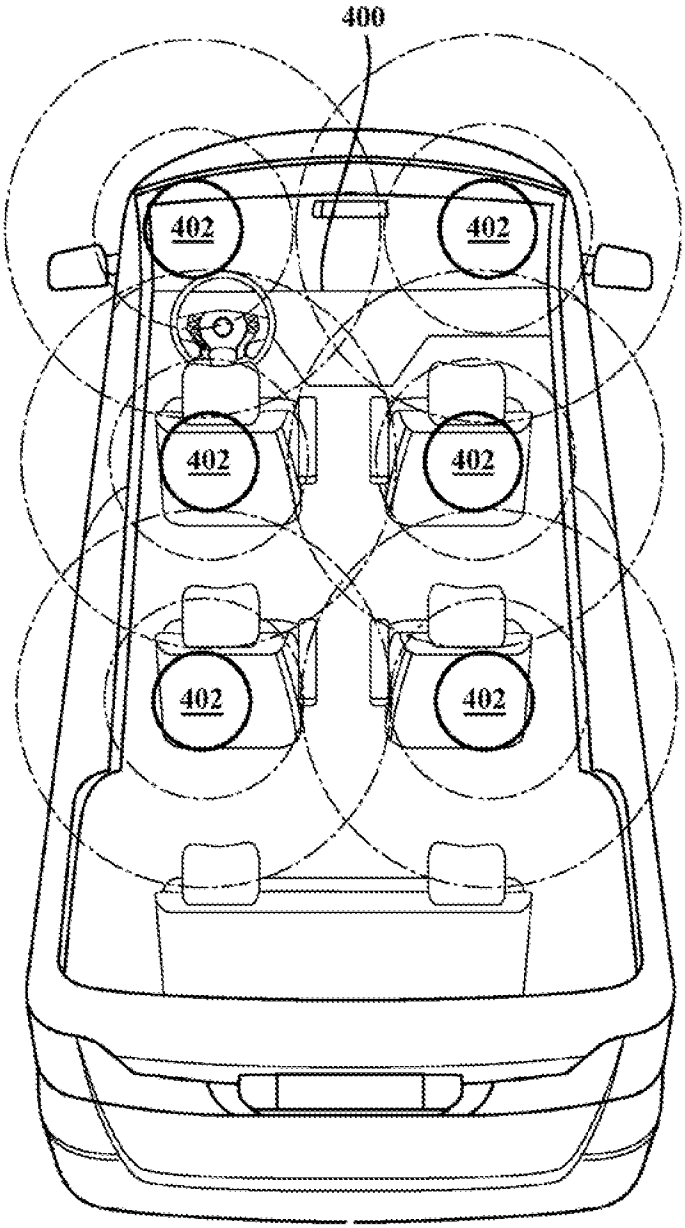


FIG. 18

FIG. 19

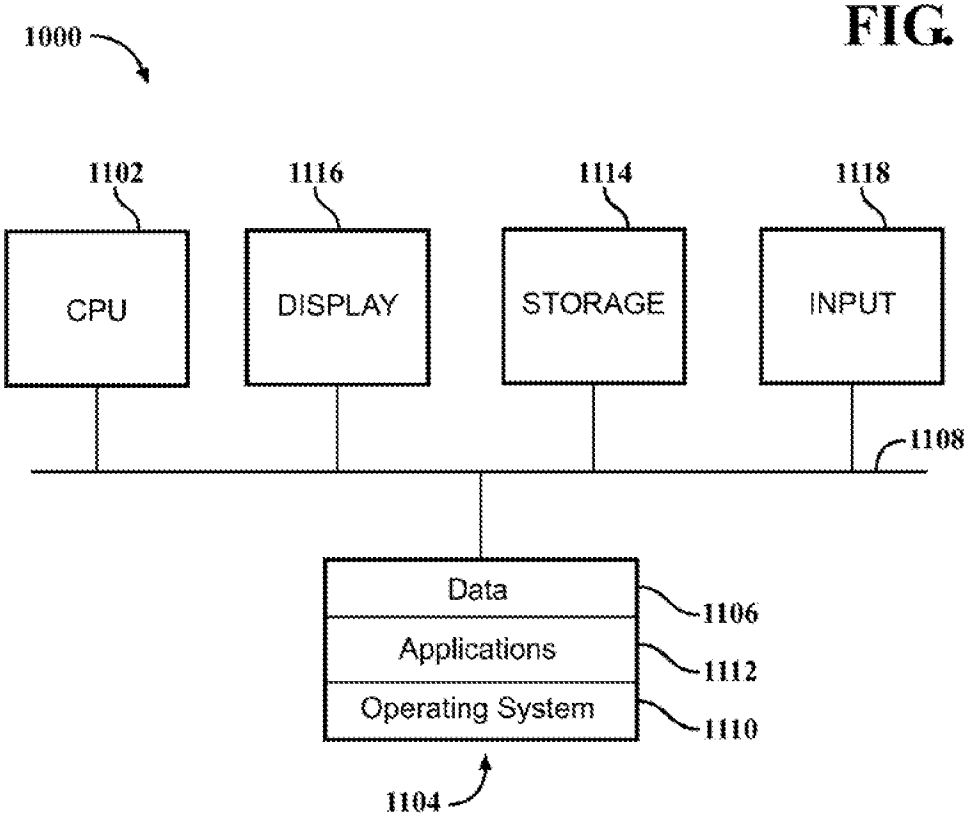

1000
1102
1116
1114
1118
CPU
DISPLAY
STORAGE
INPUT
1108
Data
Applications
Operating System
1106
1112
1110
1104

FIG. 21

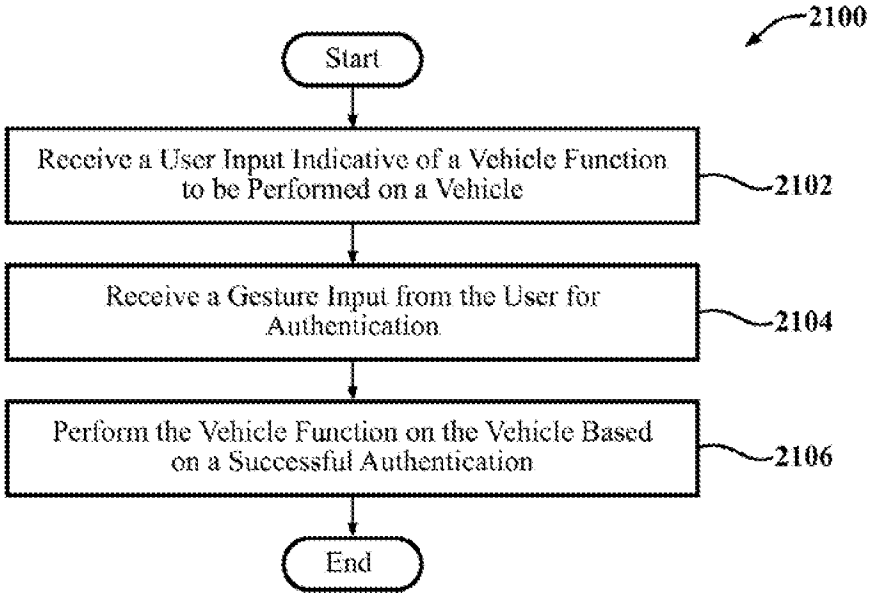

2100
Start
Receive a User Input Indicative of a Vehicle Function to be Performed on a Vehicle
2102
Receive a Gesture Input from the User for Authentication
2104
Perform the Vehicle Function on the Vehicle Based on a Successful Authentication
2106
End

FIG. 20A

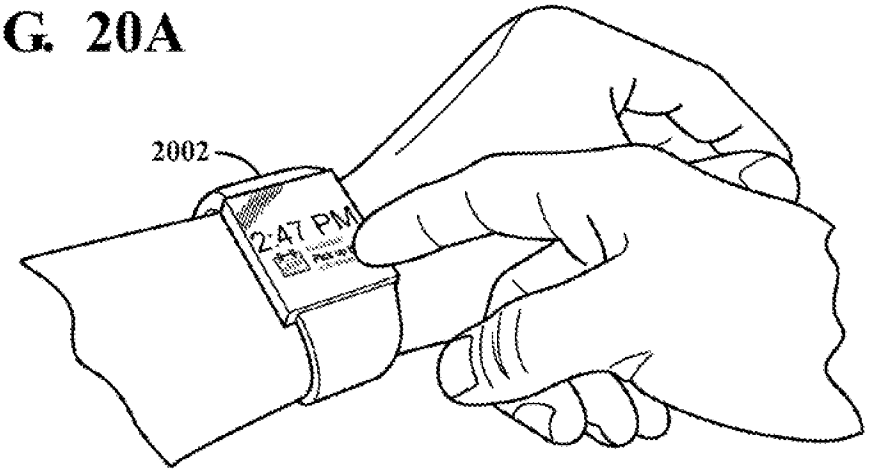
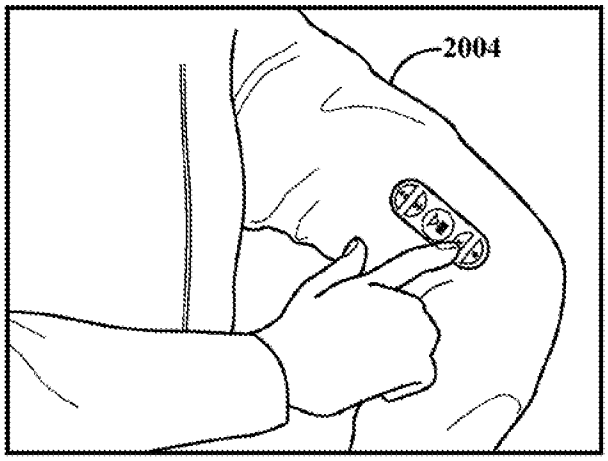


FIG. 20B



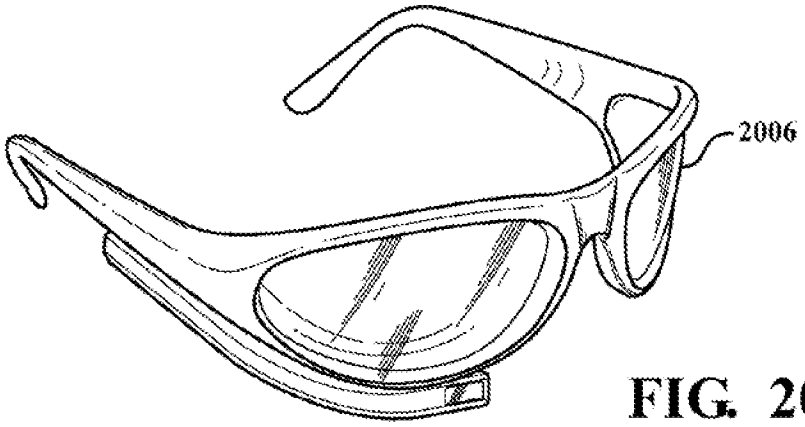


FIG. 20C

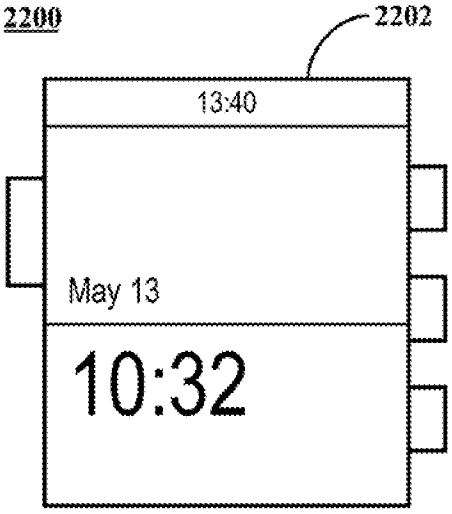


FIG. 22A

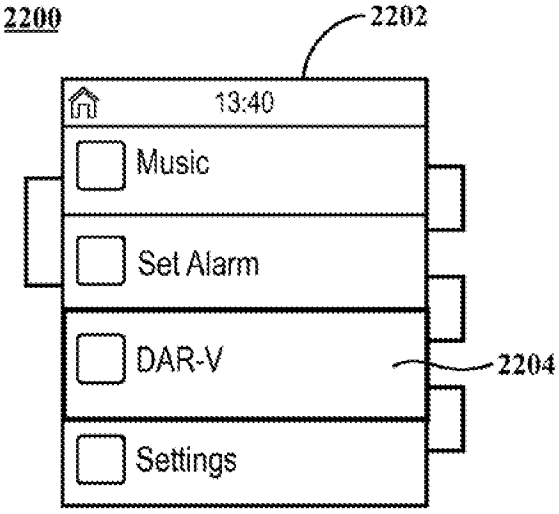


FIG. 22B

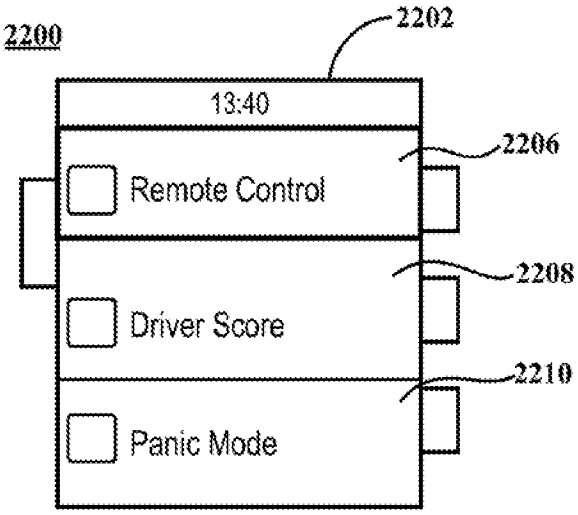


FIG. 22C

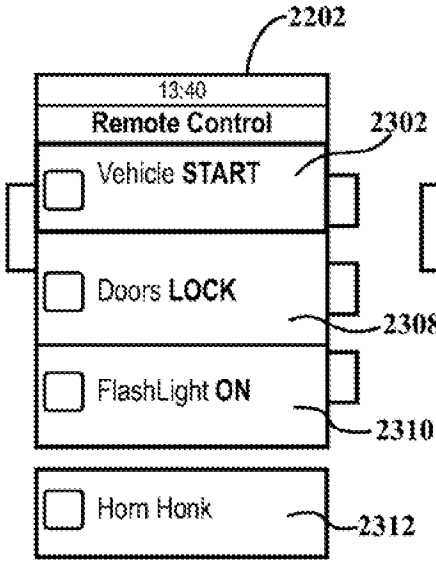


FIG. 23A

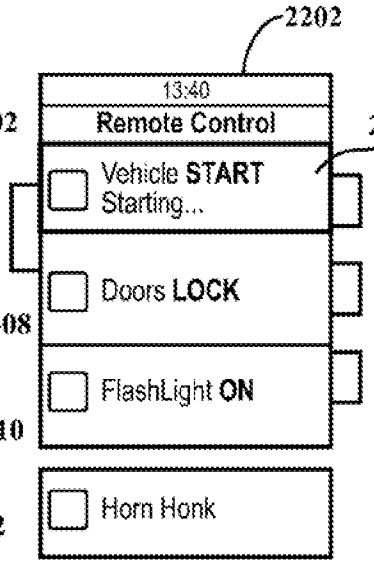


FIG. 23B

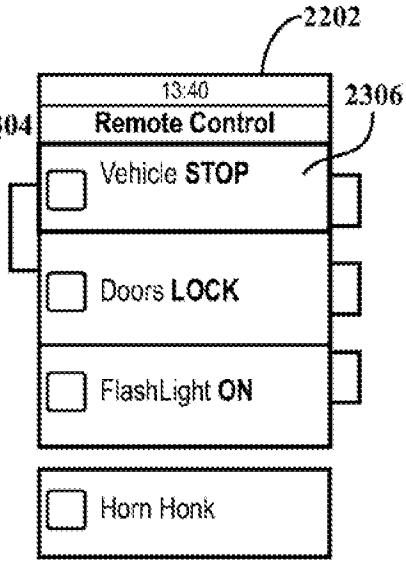


FIG. 23C

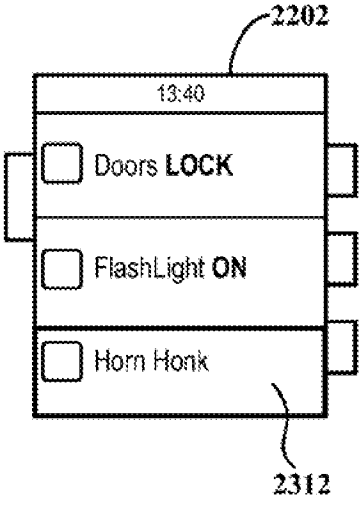


FIG. 23D

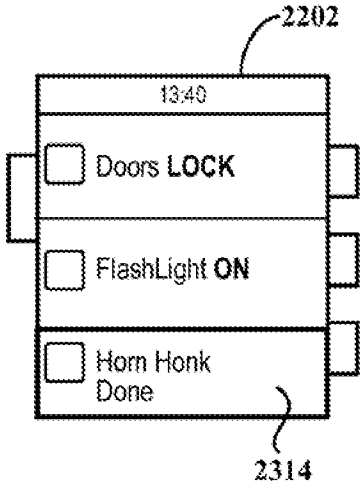


FIG. 23E

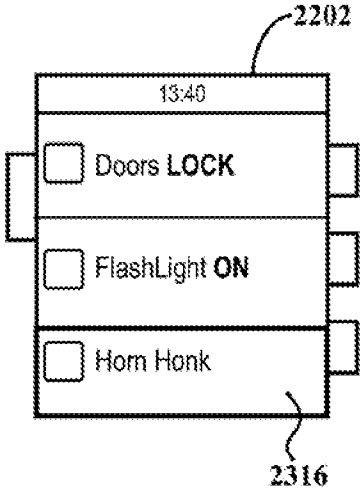


FIG. 23F

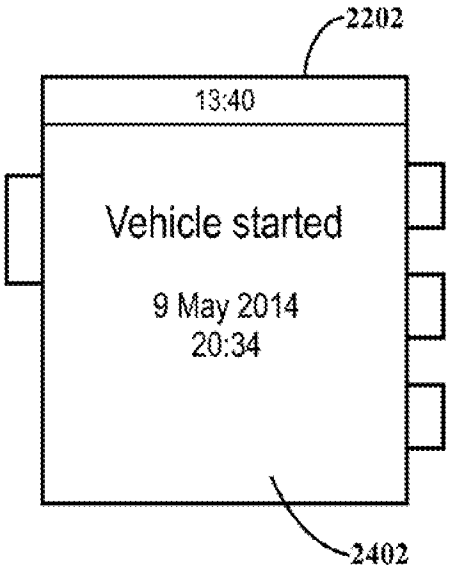


FIG. 24A

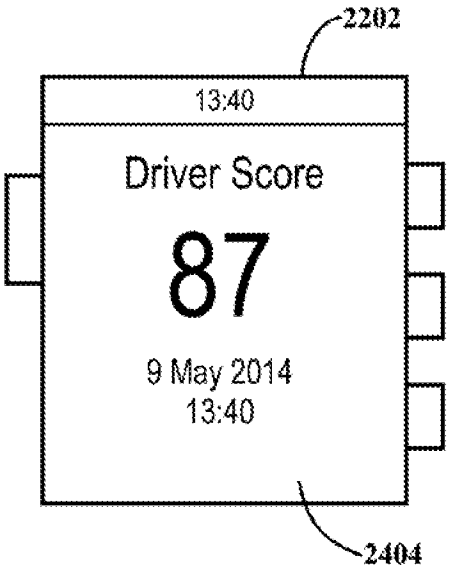


FIG. 24B

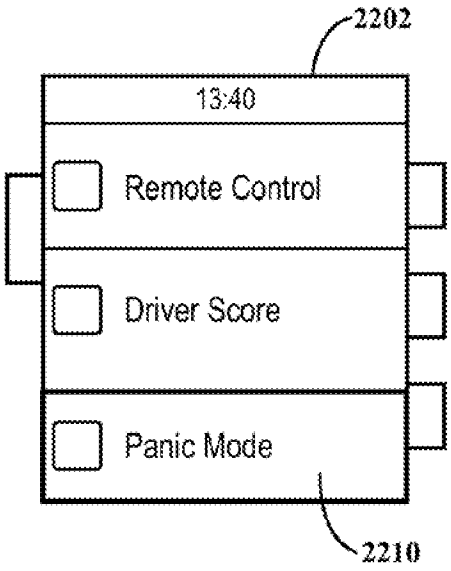


FIG. 25A

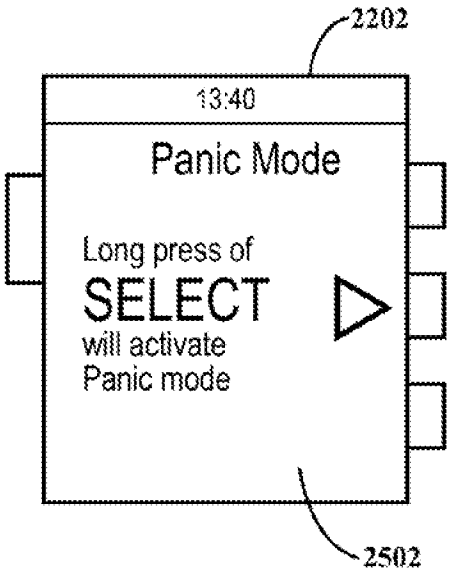


FIG. 25B

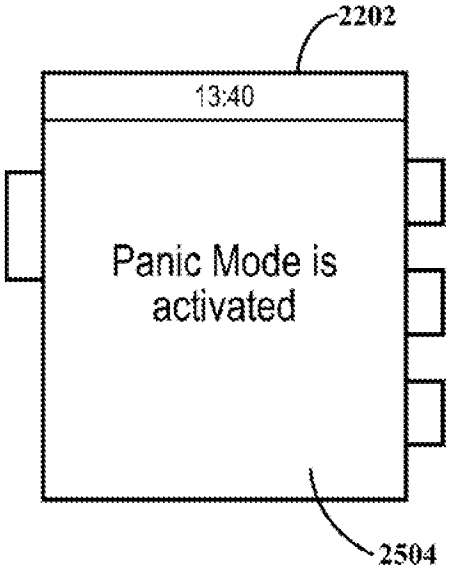


FIG. 25C

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/046626

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F3/01 B60K37/06 G06F21/36 G06F21/34 G06F21/32
G06F21/31
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F B60K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/083373 A1 (WHITE SCOTT [US] ET AL) 1 April 2010 (2010-04-01) paragraphs [0001], [0011], [0014], [0021], [0022], [0030], [0034], [0042] - [0043]; claims 15,17; figure 7	1,2,6
X	US 2009/146947 A1 (NG JAMES [US]) 11 June 2009 (2009-06-11) paragraphs [0009], [0013], [0014], [0022], [0023]; figure 1	1-6,9, 11-14, 16,18,19
X	DE 10 2012 203535 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 12 September 2013 (2013-09-12)	1,6-8, 11,16, 17,20
Y	* the corresponding paragraphs *	10,15

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 November 2015	07/12/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	del Rey Zapatero, M

4

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	& US 2014/379175 A1 (MITTERMEIER RAINER [DE]) 25 December 2014 (2014-12-25) paragraphs [0009], [0011], [0016], [0023], [0046], [0047]; figure 2a	
Y	US 2012/296559 A1 (GUEZIEC ANDRE [US] ET AL) 22 November 2012 (2012-11-22) paragraphs [0017], [0040]; figures 1,2,5-7	10,15
A	US 8 463 488 B1 (HART PAUL [US]) 11 June 2013 (2013-06-11) column 8, line 64 - column 9, line 17 column 4, line 62 - column 5, line 14	10,15
A	US 2010/075656 A1 (HOWARTER JAMIE C [US] ET AL) 25 March 2010 (2010-03-25) the whole document	1-15
A	EP 1 970 265 A2 (JAGUAR CARS [GB]) 17 September 2008 (2008-09-17) the whole document	1-15
A	US 2013/231800 A1 (RICCI CHRISTOPHER P [US]) 5 September 2013 (2013-09-05) the whole document	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2015/046626

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010083373 A1	01-04-2010	NONE	
US 2009146947 A1	11-06-2009	NONE	
DE 102012203535 A1	12-09-2013	CN 104246834 A	24-12-2014
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EP 1970265 A2	17-09-2008	EP 1970265 A2	17-09-2008
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		WO 2013074897 A1	23-05-2013
		WO 2013074899 A1	23-05-2013
		WO 2013074901 A2	23-05-2013
		WO 2013074919 A2	23-05-2013
		WO 2013074981 A1	23-05-2013
		WO 2013074983 A1	23-05-2013
		WO 2013075005 A1	23-05-2013

PUB-NO: WO2016187869A1

DOCUMENT-IDENTIFIER: WO 2016187869 A1

TITLE: BONE CONDUCTION EARPHONE DEVICE WITH HEART RATE TESTING FUNCTION

PUBN-DATE: December 1, 2016

PATENT-FAMILY-ID: 57392439

INVENTOR-INFORMATION:

NAME	COUNTRY
ZHANG XIAOCHENG	CN

APPLICANT:

NAME	COUNTRY
SUZHOU YOKO BCT ELECTRONICS CORP	CN

APPL-NO: CN 2015080040 W

APPL-DATE: May 28, 2015

PRIORITY-DATA:

PRIORITY-NO	PRIORITY-APPL-DATE
CN 2015080040 W	20150528

CPC-CURRENT:

TYPE	CPC/DATE
CPCI	H 04 R 1/10 20130101

INT-CL-CURRENT:

TYPE	IPC/DATE
IPCP	H04 R 1/10 20060101

REF-CITED:

PHASE-COUNTRY/NUMBER/KIND/DATE-NPL-INFO

CN 104257381 A 20150107

CN 204269949 U 20150415

US 2008205679 A1 20080828

ABSTRACT:

The present invention relates to a bone conduction earphone device with a heart rate testing function, comprising a bone conduction earphone, a four-color sensor, and a vibrating signal converter; the bone conduction earphone comprises a housing, a control circuit board, an optical sensor, an LED light source, a voice coil, a magnet, and an elastic piece; a light transmitting outer cover is additionally arranged on the rear surface of the housing corresponding to the optical sensor and the LED light source; the magnet is embedded in the voice coil, and is connected to the inner wall of the housing; the elastic piece is connected to the inner part of the housing and covers the front end surface of the magnet, the control circuit board is also provided with a flexible circuit board, and the flexible circuit board is located at the outer part of the housing; and a locating groove is also provided on the housing, and the four-color sensor and the vibrating signal converter are both arranged on the flexible circuit board, are embedded in the locating groove, and are flush with the surface of the housing. The present invention effectively overcomes the influence of external noise on audio listening of an earphone, increases the using reliability of an earphone device and can continuously monitor heartbeats of a user, thereby aiding in increment of supervision ability on body health of the user.

Electronic Acknowledgement Receipt

EFS ID:	34148006
Application Number:	16144338
International Application Number:	
Confirmation Number:	3503
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Customer Number:	133690
Filer:	Kyle S. Coleman/Ashlyn Nguyen
Filer Authorized By:	Kyle S. Coleman
Attorney Docket Number:	BRAGI GmbH-P0017C2
Receipt Date:	29-OCT-2018
Filing Date:	27-SEP-2018
Time Stamp:	16:30:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Foreign Reference	WO2013134956A1.pdf	2648711 fbef60ca64cf8eb06437330561f06de88982f77d	no	20

Warnings:

Information:					
2	Foreign Reference	WO2014043179A2_efs.pdf	4270285 30cbd59e12438c8ded26e930c89e309d0d43ad3b	no	32
Warnings:					
Information:					
3	Foreign Reference	WO2014046602A1.pdf	7721925 639ed0829bbf6477ca38298f0f5fcd8854470092	no	58
Warnings:					
Information:					
4	Foreign Reference	WO2015061633A2.pdf	7957604 e796979108192dd202cefc5249057933be1cc644	no	50
Warnings:					
Information:					
5	Foreign Reference	WO2015110577A1_efs.pdf	6041904 6c451659e007aee890e9f11b4671463628164bb9	no	38
Warnings:					
Information:					
6	Foreign Reference	WO2015110587A1_efs.pdf	8333864 ed40d3cb270822769861fb3523f62178727c4639	no	42
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Information:					
7	Foreign Reference	WO2016032990A1.pdf	8169270 2c5ff326255fe27e6039681a8250c9a662700a86	no	55
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Information:					
8	Foreign Reference	WO2016187869_Abstract.pdf	256035 a5a04c0a56442b2282c9c1313ec3ef19566450d4	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):		45399598

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/AIA/82A (07-13)
Approved for use through 01/31/2018. OMB 0651-0035
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Application Number	16/144,338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Title	Power Control for Battery Powered Personal Area Network Device System and Method
Art Unit	2667
Examiner Name	Brenda C BERNARDI
Attorney Docket Number	BRAGI GmbH-P0017C2

SIGNATURE of Applicant or Patent Practitioner

Signature	/JOHN D. GOODHUE/	Date (Optional)	
Name	John D. Goodhue	Registration Number	47603
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Doc Code: PA..
Document Description: Power of Attorney

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 133690

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

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OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

BRAGI GmbH

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	/peter v. boesen/	Date (Optional)	
Name	Peter V. Boesen		
Title	Vice President of Intellectual Property, Bragi GmbH		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Acknowledgement Receipt

EFS ID:	34354063
Application Number:	16144338
International Application Number:	
Confirmation Number:	3503
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Customer Number:	133690
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Filer Authorized By:	John Darrell Goodhue
Attorney Docket Number:	BRAGI GmbH-P0017C2
Receipt Date:	19-NOV-2018
Filing Date:	27-SEP-2018
Time Stamp:	19:13:13
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	BRAGI_GmbH-P0017C2_16144338_FILED-POA.pdf	515779 6567e5c66afdbe9ae4be9eb2f1466890562512af	no	2

Warnings:

Information:	
Total Files Size (in bytes):	515779

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New Applications Under 35 U.S.C. 111

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National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/144,338	09/27/2018	Eric Christian Hirsch	BRAGI GmbH-P0017C2

CONFIRMATION NO. 3503

133690
Goodhue, Coleman & Owens, P.C.
12951 University Ave
Suite 201
Clive, IA 50325

POA ACCEPTANCE LETTER

OC00000103979211

Date Mailed: 11/23/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/19/2018.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/cnguyen/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/144,338	09/27/2018	Eric Christian Hirsch	BRAGI GmbH-P0017C2

CONFIRMATION NO. 3503

PUBLICATION NOTICE

133690
Goodhue, Coleman & Owens, P.C.
12951 University Ave
Suite 201
Clive, IA 50325

OC000000105309809

Title: Power Control for Battery Powered Personal Area Network Device System and Method

Publication No.US-2019-0028795-A1
Publication Date:01/24/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of: Hirsch et al. **Application No.** 16/144,338 **Filing Date:** September 27, 2018 **For:** Power Control for Battery Powered Personal Area Network Device System and Method	**Confirmation No.** 3503 **Group Art Unit:** 2667 **Examiner:** Brenda C BERNARDI

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

VIA EFS-WEB

Commissioner:

In reply to the Office Action mailed October 29, 2018, the shortened statutory period for response to which expires on January 29, 2019 and extends through April 29, 2019, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims in this paper.

Remarks follow the amendments section of this paper.

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

Claim 1 (Original): A method for power control for a wireless earpiece, comprising:

powering circuitry of the wireless earpiece utilizing a low power mode in response to detecting a magnetic field is applied to the wireless earpiece;

powering circuitry of the wireless earpieces utilizing a high-power mode in response to detecting a magnetic field is not applied to one or more of the wireless earpieces;

altering the power sent to the circuitry of the wireless earpiece to a high-power mode in response to detecting a magnetic field is not applied to one or more of the wireless earpieces;

altering the power sent to the circuitry of the wireless earpieces to a low power mode in response to detecting a magnetic field is applied to one or more of the wireless earpieces; and

charging an onboard battery of the wireless earpiece in response to detecting a magnetic field is applied to the wireless earpiece.

Claim 2 (Original): The method of claim 1, further comprising:

operating the wireless earpiece utilizing an onboard battery in response to detecting the magnetic field is not applied to the wireless earpiece.

Claim 3 (Original): The method of claim 1, wherein the magnetic field is applied by

a magnet of a smart case configured to receive the wireless earpiece.

Claim 4 (Original): The method of claim 1, wherein the magnetic field is detected by a reed switch of the wireless earpiece.

Claim 5 (Original): The method of claim 1, further comprising:

coupling the wireless earpiece to a smart case, wherein the smart case applies a magnetic field to the wireless earpiece.

Claim 6 (Original): The method of claim 1, wherein the magnetic field is detected by a reed switch integrated in magnetic contacts that interface with a smart case for securing the wireless earpiece.

Claim 7 (Original): The method of claim 1, further comprising:

synchronizing data between the wireless earpiece and a smart case in response to detecting the magnetic field.

Claim 8 (Original): The method of claim 1, wherein the low power mode is a power saver mode.

Claim 9 (Original): A method for power control for a wireless earpiece, comprising:

determining if a magnetic field is present at the wireless earpiece in a powered state;

opening a reed switch located within the wireless earpiece when the magnetic field is detected and placing the wireless earpiece in a low-power mode;

coupling the wireless earpiece to a smart case;

charging a battery located within the wireless earpiece with power supplied by a second battery within the smart case;

remaining in a high-power mode if no magnetic field is detected; and

operating the wireless earpiece with power supplied by the battery within the wireless earpiece.

Claim 10 (Original): The method of claim 9, wherein the magnetic field is applied by a magnet of the smart case configured to receive the wireless earpiece.

Claim 11 (Original): The method of claim 10, wherein the magnetic field is detected by the reed switch of the wireless earpiece.

Claim 12 (Original): The method of claim 11, wherein the magnetic field is detected by the reed switch integrated in magnetic contacts interfacing with a smart case for securing the wireless earpiece.

Claim 13 (Original): The method of claim 12, further comprising the step of synchronizing data between the wireless earpiece and a smart case in response to detecting the magnetic field.

Claim 14 (Original): The method of claim 1, wherein the low power mode is a power saver mode.

REMARKS

In the Office Action, the Examiner took the following actions:

I. Claims 1-14 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 3, 2, 4, 5, 6, 7, 8, 9, 3, 4, 5, 7, 8 and 9, respectively, of US Patent No. 10,117,014.

II. Claims 1-14 are allowable over the prior art and are allowed if the nonstatutory obviousness-type double patenting rejection above is overcome. Nothing in the prior art showed or suggested the specific limitations of these claims.

The Office Action may contain statements characterizing the related art and/or the claims. Regardless of whether any such statement is expressly identified and/or discussed herein, Applicant reserves the right to disagree with any such statement or characterization in the Office Action.

DOUBLE PATENTING

Claims 1-14 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 3, 2, 4, 5, 6, 7, 8, 9, 3, 4, 5, 7, 8 and 9, respectively, of US Patent No. 10,117,014. A terminal disclaimer is being filed herewith. Therefore, it is respectfully submitted that these rejections should be withdrawn and the claims allowed.

ALLOWABLE SUBJECT MATTER

Claims 1-14 are allowable over the prior art and are allowed if the nonstatutory obviousness-type double patenting rejection above is overcome.

CONCLUSION

In view of the foregoing, Applicant respectfully requests reconsideration of this application and the timely allowance of the pending claims.

This is a request for a three month extension of time the fee for which is being paid at the time of filing. Please grant any extensions of time required to enter this response and charge any additional required fees to Deposit Account 506801.

Respectfully submitted,

Goodhue, Coleman & Owens, P.C.

Dated: April 8, 2019

By: /JOHN D. GOODHUE/
John D. Goodhue
Reg. No. 47603
(515) 218-7888

Electronic Patent Application Fee Transmittal

Application Number:	16144338
Filing Date:	27-Sep-2018
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Attorney Docket Number:	BRAGI GmbH-P0017C2

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	2253	1	700	700
Miscellaneous:				
			Total in USD ($)	**700**

Electronic Acknowledgement Receipt

EFS ID:	35654339
Application Number:	16144338
International Application Number:	
Confirmation Number:	3503
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Customer Number:	133690
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Filer Authorized By:	John Darrell Goodhue
Attorney Docket Number:	BRAGI GmbH-P0017C2
Receipt Date:	08-APR-2019
Filing Date:	27-SEP-2018
Time Stamp:	13:03:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$700
RAM confirmation Number	040819INTEFSW00012903506801
Deposit Account	506801
Authorized User	Ashlyn Nguyen

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		BRAGIGmbH-P0017C2_16144338_FILED-RESPONSE-NON-FINAL_4-8-19.pdf	99960 169b8f1488ed720a11df0836cce089bc0a64376d	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	7

Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30856 a41b25cb72d68124d59c17301e864e7a1f61c6ef	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	130816	

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	16144338
Filing Date	27-Sep-2018
First Named Inventor	Eric Hirsch
Attorney Docket Number	BRAGI GmbH-P0017C2
Title of Invention	Power Control for Battery Powered Personal Area Network Device System and Method

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
BRAGI GmbH	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

10117014

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○	I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

Applicant claims the following fee status:

◉ Small Entity

○ Micro Entity

○ Regular Undiscounted

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number 47603

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this request

Signature	/JOHN D. GOODHUE/
Name	JOHN D. GOODHUE

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	16144338
Filing Date:	27-Sep-2018
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Attorney Docket Number:	BRAGI GmbH-P0017C2

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	2814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**160**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16144338

Filing Date: 27-Sep-2018

Applicant/Patent under Reexamination: Hirsch

Electronic Terminal Disclaimer filed on April 8, 2019

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	35655734
Application Number:	16144338
International Application Number:	
Confirmation Number:	3503
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Customer Number:	133690
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Filer Authorized By:	John Darrell Goodhue
Attorney Docket Number:	BRAGI GmbH-P0017C2
Receipt Date:	08-APR-2019
Filing Date:	27-SEP-2018
Time Stamp:	14:05:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$160
RAM confirmation Number	040919INTEFSW00000382506801
Deposit Account	506801
Authorized User	Ashlyn Nguyen

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	33289 0830ba7991f1e33fc78153bd06a88336e4be7246	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30845 e3856a8a437b14babd8a9c6fb97cd98b764bf5ce	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	64134		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/144,338	Filing Date 09/27/2018	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $230 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	04/08/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $230 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/VINCENT S BUTLER/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	2667
Examiner Name	Brenda C BERNARDI
Attorney Docket Number	BRAGI GmbH-P0017C2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20150245126	A1	2015-08-27	Shaffer	Entire Document

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16144338
	Filing Date	2018-09-27
	First Named Inventor	Eric Christian Hirsch
	Art Unit	2667
	Examiner Name	Brenda C BERNARDI
	Attorney Docket Number	BRAGI GmbH-P0017C2

	1	European Patent Office: "Communication pursuant to Article 94(3) EPC", European Application No. 16 757 885.5-1219, 1/24/19, 4 pages

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16144338
	Filing Date	2018-09-27
	First Named Inventor	Eric Christian Hirsch
	Art Unit	2667
	Examiner Name	Brenda C BERNARDI
	Attorney Docket Number	BRAGI GmbH-P0017C2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/JOHN D. GOODHUE/	Date (YYYY-MM-DD)	2019-04-16
Name/Print	John D. Goodhue	Registration Number	47603

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	16144338
Filing Date:	27-Sep-2018
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Attorney Docket Number:	BRAGI GmbH-P0017C2

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	120	120
		Total in USD ($)		**120**

Electronic Acknowledgement Receipt

EFS ID:	35737534
Application Number:	16144338
International Application Number:	
Confirmation Number:	3503
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Customer Number:	133690
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Filer Authorized By:	John Darrell Goodhue
Attorney Docket Number:	BRAGI GmbH-P0017C2
Receipt Date:	16-APR-2019
Filing Date:	27-SEP-2018
Time Stamp:	12:10:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$120
RAM confirmation Number	041619INTEFSW00011161506801
Deposit Account	506801
Authorized User	Ashlyn Nguyen

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	BRAGIGmbH-P0017C2_16144338_FILED-SUPPL-IDS.pdf	1053255 df8525bd4e787ffe87f3a6da9b69c7e946078aac	no	4
Warnings:					
Information:					
2	Non Patent Literature	Communication-pursuant-to-Art94_3-EPC.pdf	968756 f4f2fed35433f9c13f1db14cef04a47cb0d03b6d	no	4
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30737 27ca763c6df286b4b7be8630991254ab14b7431a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2052748		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

133690 7590 04/18/2019
Goodhue, Coleman & Owens, P.C.
12951 University Ave
Suite 201
Clive, IA 50325

EXAMINER
BERNARDI, BRENDA C

ART UNIT	PAPER NUMBER
2667	

DATE MAILED: 04/18/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/144,338	09/27/2018	Eric Christian Hirsch	BRAGI GmbH-P0017C2	3503

TITLE OF INVENTION: Power Control for Battery Powered Personal Area Network Device System and Method

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	07/18/2019

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

133690 7590 04/18/2019
Goodhue, Coleman & Owens, P.C.
12951 University Ave
Suite 201
Clive, IA 50325

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/144,338	09/27/2018	Eric Christian Hirsch	BRAGI GmbH-P0017C2	3503

TITLE OF INVENTION: Power Control for Battery Powered Personal Area Network Device System and Method

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	07/18/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
BERNARDI, BRENDA C	2667	381-074000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/144,338	09/27/2018	Eric Christian Hirsch	BRAGI GmbH-P0017C2	3503

133690 7590 04/18/2019

Goodhue, Coleman & Owens, P.C.
12951 University Ave
Suite 201
Clive, IA 50325

EXAMINER	
BERNARDI, BRENDA C	
ART UNIT	PAPER NUMBER
2667	

DATE MAILED: 04/18/2019

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/144,338	Applicant(s) Hirsch et al.	
	Examiner BRENDA C BERNARDI	Art Unit 2667	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to amendment filed 8 April 2019.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-14 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file areply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☑ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/BRENDA C BERNARDI/
Primary Examiner, Art Unit 2667

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Allowable Subject Matter

2. Claims 1-14 were rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 3, 2, 4, 5, 6, 7, 8, 9, 3, 4, 5, 7, 8 and 9, respectively, of US Patent No. 10,117,014. Applicant has filed a terminal disclaimer which was approved on April 8, 2019, therefore the rejection of claims 1-14 on the ground of nonstatutory obviousness-type double patenting is withdrawn.

Allowable Subject Matter

3. **Claims 1-14** are allowed. Nothing in the prior art showed or suggested the specific limitations of these claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRENDA C BERNARDI whose telephone number is (571)270-7125. The examiner can normally be reached on M-F 8am-5pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MATTHEW BELLA can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service

Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BRENDA C BERNARDI/
Primary Examiner, Art Unit 2667

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/144,338	Hirsch et al.
	Examiner	**Art Unit**
	BRENDA C BERNARDI	2667

CPC						
Symbol					**Type**	**Version**
H04R	/	1	/	1041	F	2013-01-01
H04W	/	52	/	0225	I	2013-01-01
H02J	/	7	/	025	I	2013-01-01
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Y02D	/	70	/	00	A	2018-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/BRENDA C BERNARDI/ Primary Examiner, Art Unit 2667	15 April 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/144,338	Hirsch et al.
	Examiner	**Art Unit**
	BRENDA C BERNARDI	2667

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H02J7/00	/	7	/	00
H02J7/02	/	7	/	02
H04M1/60	/	1	/	60
H04R1/02	/	1	/	02
H04R1/10	/	1	/	10
H02J50/10	/	50	/	10
H04W52/02	/	52	/	02

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
381	74

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 14	
/BRENDA C BERNARDI/ Primary Examiner, Art Unit 2667 (Primary Examiner)	15 April 2019 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/144,338	Hirsch et al.
	Examiner	**Art Unit**
	BRENDA C BERNARDI	2667

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
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(Primary Examiner)	(Date)	1	1

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Symbol	Date	Examiner
H04R1/1041	10/24/2018	/bb/
H04W52/0225	10/24/2018	/bb/
H02J7/025	10/24/2018	/bb/
H02J7/007	10/24/2018	/bb/
H02J50/10	10/24/2018	/bb/
H04R1/1025	10/24/2018	/bb/
H04R1/028	10/24/2018	/bb/
H04R2420/07	10/24/2018	/bb/
H04M1/6066	10/24/2018	/bb/

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

/BRENDA C BERNARDI/ Primary Examiner, Art Unit 2667	

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	BRENDA C BERNARDI	2667

Search Notes		
Search Notes	**Date**	**Examiner**
H04R1/1041 (text search only - see attached search history printout)	10/24/2018	/bb/
H04W52/0225 (text search only - see attached search history printout)	10/24/2018	/bb/
H02J7/025 (text search only - see attached search history printout)	10/24/2018	/bb/
H02J7/007 (text search only - see attached search history printout)	10/24/2018	/bb/
H02J50/10 (text search only - see attached search history printout)	10/24/2018	/bb/
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H04R1/028 (text search only - see attached search history printout)	10/24/2018	/bb/
H04R2420/07 (text search only - see attached search history printout)	10/24/2018	/bb/
H04M1/6066 (text search only - see attached search history printout)	10/24/2018	/bb/
Inventor search, Applicant search, EAST search, NPL search.	10/24/2018	/bb/
Additional search.	04/15/2019	/bb/

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
	Text search for claimed subject matter in EAST US Patent and PG Publication databases. See attached search history printout.	04/15/2019	/bb/

/BRENDA C BERNARDI/
Primary Examiner, Art Unit 2667

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
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(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	
Examiner Name	
Attorney Docket Number	BRAGI GmbH-P0017C2

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	Examiner Name	
	Attorney Docket Number	BRAGI GmbH-P0017C2

	9	Wikipedia, "Gamebook", https://en.wikipedia.org/wiki/Gamebook, September 3, 2017, 5 pages.	
	10	Wikipedia, "Kinect", "https://en.wikipedia.org/wiki/Kinect", 18 pages, (September 9, 2017).	
	11	Wikipedia, "Wii Balance Board", "https://en.wikipedia.org/wiki/Wii_Balance_Board", 3 pages, (July 20, 2017).	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/BRENDA C BERNARDI/	Date Considered	04/15/2019

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	
Examiner Name	
Attorney Docket Number	BRAGI GmbH-P0017C2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/JOHN D. GOODHUE/	Date (YYYY-MM-DD)	2018-10-29
Name/Print	John D. Goodhue	Registration Number	47603

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"15245031"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/07 14:33
S2	19	(("HIRSCH") near3 ("Eric")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/30 17:00
S3	79	(("BOESEN") near3 ("Peter")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/30 17:02
S4	5353	H04R1/1041.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:40
S5	5531	H04W52/0225.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:41
S6	26396	H02J7/025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:41
S7	8154	H02J7/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:41
S8	4310	H02J50/10.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:41
S10	1249	H04R1/1025.cpc.	US-PGPUB; USPAT;	OR	OFF	2017/03/30 17:42

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S11	5062	H04R1/028.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:42
S12	8565	H04R2420/07.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:42
S14	5997	H04M1/6066.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:43
S15	62601	S4 or S5 or S6 or S7 or S8 or S10 or S11 or S12 or S14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:43
S16	2028	(wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:44
S20	538	S15 and S16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/30 17:46
S21	2	"20100320961".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/31 09:41
S22	1	(12/459466).APP.	USPAT; USOCR	OR	OFF	2017/03/31 09:41
S23	193	((wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)) with power$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2017/03/31 09:46

			DERWENT; IBM_TDB			
S24	100	("3934100" | "4150262" | "4334315" | "4375016" | "4588867" | "4654883" | "4682180" | "4791673" | "4865044" | "5191602" | "5201007" | "5280524" | "5295193" | "5298692" | "5343532" | "5363444" | "5497339" | "5606621" | "5613222" | "5692059" | "5721783" | "5749072" | "5771438" | "5802167" | "5929774" | "5933506" | "5949896" | "5987146" | "6339754" | "6021207" | "6054989" | "6081724" | "6094492" | "6111569" | "6112103" | "6157727" | "6167039" | "6181801" | "6208372" | "6275789" | "6408081" | "6470893" | "6542721" | "6560468" | "6654721" | "6664713" | "6694180" | "6718043" | "6738485" | "6748095" | "6754358" | "6784873" | "6823195" | "6852084" | "6879698" | "6892082" | "6920229" | "6952483" | "6987986" | "7136282" | "7203331" | "7209569" | "7215790" | "7463902" | "7508411" | "7983628" | "8140357" | "D464039" | "D468299" | "D468300" | "20010005197" | "20010027121" | "20010056350" | "20020002413" | "20020007510" | "20020010590" | "20020030637" | "20020046035" | "20020057810" | "20020076073" | "20020118852" | "20030065504" | "20030100331" | "20030104806" | "20030115068" | "20030125096" | "20030218064" | "20040070564" | "20040160511" | "20050043056" | "20050125320" | "20050148883" | "20050165663" | "20050196009" | "20050251455" | "20050266876" | "20060029246" | "20060074671" | "20060074808" | "20080254780").PN.	US-PGPUB; USPAT	OR	OFF	2017/03/31 10:55
S25	2	("20120309453" | "20140004912").PN.	US-PGPUB; USPAT	OR	OFF	2017/03/31 11:14
S26	1	(14/478774).APP.	USPAT; USOCR	OR	OFF	2017/03/31 11:30
S27	8	("20080181442" | "20100290637" | "20130238829" | "20140120983" | "20140166122" | "20150245127" | "20150350762" | "8891800").PN. OR ("9532128").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/31 11:30
S28	1	(13/829524).APP.	USPAT; USOCR	OR	OFF	2017/03/31 11:32
S29	22	("20030050011" | "20040242264" | "20050107120" | "20050130593" | "20050208893" | "20060166715" | "20070025194" | "20070058819" | "20070079692" | "20070154047" | "20070230736" | "20080031475" | "20080049961" | "20080298606" | "20090063975" | "20100042920" | "20110170703" | "20130028434" | "20140219467" | "7206429" |	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/31 11:32

		"7548040" | "7558529").PN. OR ("9210493").URPN.				
S30	10	("20040090773" | "20050140331" | "20060226805" | "20080119241" | "5253300" | "5590417" | "7548040" | "7825626" | "7855529" | "8115451").PN. OR ("9013145").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/31 11:38
S31	0	(11/129478).APP.	USPAT; USOCR	OR	OFF	2017/03/31 11:58
S32	9	("5333176" | "5918189" | "6265844" | "6308074" | "6760459" | "6868284" | "6978163" | "7096048" | "7110798").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/31 12:00
S33	1	(14/604082).APP.	USPAT; USOCR	OR	OFF	2017/03/31 12:09
S34	22	("20050225292" | "20050255898" | "20060177082" | "20070032274" | "20080090622" | "20080090626" | "20080125164" | "20090296968" | "20110077061" | "20130083456" | "20130129138" | "20130148839" | "20130238829" | "20130265702" | "7555134" | "7889498" | "8485404" | "8891800").PN. OR ("9148717").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/31 12:09
S35	21	("20060177082" | "20080090622" | "20080090626" | "20090296968" | "20110077061" | "20130083456" | "20130129138" | "20130148839" | "20130238829" | "20130265702" | "7889498" | "8485404").PN. OR ("8891800").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/31 12:19
S36	0	(12/131603).APP.	USPAT; USOCR	OR	OFF	2017/03/31 12:34
S37	12	("20050190936" | "20060147068" | "7465867" | "20060093997" | "20030067585" | "6729726" | "7289825" | "20080049961" | "20050202843" | "5815634" | "20070223721" | "7496205").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/31 12:35
S38	1	("2006/0258412").URPN.	USPAT	OR	OFF	2017/03/31 12:36
S39	14	("2008/0298606").URPN.	USPAT	OR	OFF	2017/03/31 12:37
S40	5818	H04R1/1041.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S41	5814	H04W52/0225.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51

S42	28820	H02J7/025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S43	8968	H02J7/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S44	5597	H02J50/10.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S45	1383	H04R1/1025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S46	5457	H04R1/028.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S47	9239	H04R2420/07.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S48	6156	H04M1/6066.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S49	67879	S40 or S41 or S42 or S43 or S44 or S45 or S46 or S47 or S48	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S50	2153	(wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2017/08/04 10:51

			DERWENT; IBM_TDB			
S51	616	S49 and S50	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/04 10:51
S53	4	"15837386"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/01/19 14:00
S54	4	"9843853".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/01/20 13:22
S55	6520	H04R1/1041.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:25
S56	6078	H04W52/0225.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:28
S57	38106	H02J7/025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:28
S58	10079	H02J7/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:28
S59	16468	H02J50/10.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:29
S60	1547	H04R1/1025.cpc.	US-PGPUB; USPAT; USOCR;	OR	ON	2018/01/20 13:29

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S61	5991	H04R1/028.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:29
S62	10211	H04R2420/07.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:29
S63	6357	H04M1/6066.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:29
S64	81685	S55 or S56 or S57 or S58 or S59 or S60 or S61 or S62 or S63	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:30
S65	2855	(wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:30
S66	884	S64 and S65	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:30
S67	1102877	(low or high) near power	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:31
S68	1035394	magnetic near field	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/20 13:31
S69	10	S66 and (S67 same S68)	US-PGPUB;	OR	ON	2018/01/20

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S70	19	S65 and (S67 same S68)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/01/20 13:36
S72	29	(("HIRSCH") near3 ("Eric")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/01/20 13:53
S73	142	(("BOESEN") near3 ("Peter")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/01/20 13:54
S74	8	(("BRAGI") near3 ("GMBH")).AS,AANM.	USPAT	ADJ	ON	2018/01/20 14:11
S75	7022	H04R1/1041.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S76	6363	H04W52/0225.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S77	37581	H02J7/025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S78	10848	H02J7/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S79	18242	H02J50/10.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S80	1680	H04R1/1025.cpc.	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2018/06/18 12:01

			EPO; JPO; DERWENT; IBM_TDB			
S81	6500	H04R1/028.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S82	10907	H04R2420/07.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S83	6524	H04M1/6066.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S84	85686	S75 or S76 or S77 or S78 or S79 or S80 or S81 or S82 or S83	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S85	3121	(wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S86	1005	S84 and S85	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S87	1143734	(low or high) near power	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S88	1067843	magnetic near field	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/06/18 12:01
S89	12	S86 and (S87 same S88)	US-PGPUB; USPAT;	OR	ON	2018/06/18 12:01

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S90	22	S85 and (S87 same S88)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/06/18 12:04
S91	102	("20010005197" | "20010027121" | "20010056350" | "20020002413" | "20020007510" | "20020010590" | "20020030637" | "20020046035" | "20020057810" | "20020076073" | "20020118852" | "20030065504" | "20030100331" | "20030104806" | "20030115068" | "20030125096" | "20030218064" | "20040070564" | "20040160511" | "20050043056" | "20050125320" | "20050148883" | "20050165663" | "20050196009" | "20050251455" | "20050266876" | "20060029246" | "20060074671" | "20060074808" | "20080254780" | "20120309453" | "20140004912" | "3934100" | "4150262" | "4334315" | "4375016" | "4588867" | "4654883" | "4682180" | "4791673" | "4865044" | "5191602" | "5201007" | "5280524" | "5295193" | "5298692" | "5343532" | "5363444" | "5497339" | "5606621" | "5613222" | "5692059" | "5721783" | "5749072" | "5771438" | "5802167" | "5929774" | "5933506" | "5949896" | "5987146" | "6021207" | "6054989" | "6081724" | "6094492" | "6111569" | "6112103" | "6157727" | "6167039" | "6181801" | "6208372" | "6275789" | "6339754" | "6408081" | "6470893" | "6542721" | "6560468" | "6654721" | "6664713" | "6694180" | "6718043" | "6738485" | "6748095" | "6754358" | "6784873" | "6823195" | "6852084" | "6879698" | "6892082" | "6920229" | "6952483" | "6987986" | "7136282" | "7203331" | "7209569" | "7215790" | "7463902" | "7508411" | "7983628" | "8140357" | "D464039" | "D468299" | "D468300").PN.	US-PGPUB; USPAT	ADJ	ON	2018/06/18 12:07
S93	0	"16144338"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/10/23 09:08
S94	3	"15245031"	US-PGPUB; USPAT; USOCR; FPRS;	OR	OFF	2018/10/23 09:10

			EPO; JPO; DERWENT; IBM_TDB			
S95	44	((("BRAGI") near3 ("GMBH"))).AS,AANM.	USPAT	ADJ	ON	2018/10/23 20:25
S96	34	(("HIRSCH") near3 ("Eric")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/10/23 20:30
S97	223	(("BOESEN") near3 ("Peter")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/10/23 20:33
S98	512	((wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:37
S99	93	S97 and S98	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:37
S100	7915	H04R1/1041.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S101	6920	H04W52/0225.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S102	42828	H02J7/025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S103	12423	H02J7/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S104	21615	H02J50/10.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44

S105	1936	H04R1/1025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S106	7513	H04R1/028.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S107	12426	H04R2420/07.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S108	6815	H04M1/6066.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S109	96689	S100 or S101 or S102 or S103 or S104 or S105 or S106 or S107 or S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S110	2689	(wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S111	926	S109 and S110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:44
S112	561107	charg$4 near3 battery	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:45
S113	1037387	magnetic near3 field	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2018/10/23 20:46

			DERWENT; IBM_TDB			
S114	86	S111 and S112 and S113	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:46
S115	3345	(wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/23 20:55
S116	1175290	(low or high) near power	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/23 20:55
S117	1092869	magnetic near field	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/23 20:55
S118	27	S115 and (S116 same S117)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/23 20:55
S119	6	"10117014".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/24 08:34
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S122	463	((wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)) with power$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:34
S123	8801	H04R1/1041.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:34

S124	7301	H04W52/0225.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:34
S125	47209	H02J7/025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:35
S126	13613	H02J7/007.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:35
S127	24263	H02J50/10.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:35
S128	2162	H04R1/1025.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:35
S129	8325	H04R1/028.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:35
S130	13886	H04R2420/07.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:35
S131	7057	H04M1/6066.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:35
S132	105897	S123 or S124 or S125 or S126 or S127 or S128 or S129 or S130 or S131	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/04/15 09:35

			DERWENT; IBM_TDB			
S133	276	S132 and S122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:36
S134	318	((wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)) with power$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/15 09:36
S135	99	S133 not S134	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:36
S136	3638	(wireless$3 or wire-less$3) near3 (earpiece or ear-piece or earbud or ear-bud)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:48
S137	1046	(S132 and S136) not S133	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:49
S138	1220146	(low or high) near power	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:50
S139	1129517	magnetic near field	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:50
S140	6	S137 and (S138 same S139)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/04/15 09:50

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S52	0	(((wireless$3 or wire-less$3) near3 (earpiece or ear-piece)) and (high$3 near power near mode) and (detect$4 near3 magnetic near field) and ((chang$4 or alter$4) near power) and (low$3 near power near mode)).clm.	USPAT	OR	OFF	2017/08/04 11:21
S71	0	(((wireless$3 or wire-less$3) near3 (earpiece or ear-piece)) and (high$3 near power near mode) and (detect$4 near3 magnetic near field) and ((chang$4 or alter$4) near power) and (low$3 near power near mode)).clm.	USPAT	OR	OFF	2018/01/20 13:38
S92	0	(((wireless$3 or wire-less$3) near3 (earpiece or ear-piece)) and (high$3 near power near mode) and (detect$4 near3 magnetic near field) and ((chang$4 or alter$4) near power) and (low$3 near power near mode)).clm.	USPAT	OR	OFF	2018/06/18 12:06
S141	0	(((wireless$3 or wire-less$3) near3 (earpiece or ear-piece)) and (high$3 near power near mode) and (detect$4 near3 magnetic near field) and ((chang$4 or alter$4) near3 battery)).clm.	US-PGPUB; USPAT	OR	OFF	2019/04/15 09:54

4/ 15/ 2019 9:55:26 AM
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	
Examiner Name	
Attorney Docket Number	BRAGI GmbH-P0017C2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2325590	A	1943-08-03	Carlisle et al.	Entire Document
	2	2430229	A	1947-11-04	Kelsey; Elizabeth L	Entire Document
	3	3047089	A	1962-07-31	Zwislocki; Jozef J.	Entire Document
	4	3586794	A	1971-06-22	Michaelis; Erhard	Entire Document
	5	3696377	A	1972-10-03	Wall; Thomas P.	Entire Document
	6	3934100	A	1976-01-20	Harada	Entire Document
	7	3983336	A	1976-09-28	Malek et al.	Entire Document
	8	4069400	A	1978-01-17	Johanson et al.	Entire Document

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	
Examiner Name	
Attorney Docket Number	BRAGI GmbH-P0017C2

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/144,338	09/27/2018	Eric Christian Hirsch	BRAGI GmbH-P0017C2	3503

133690 7590 06/13/2019

Goodhue, Coleman & Owens, P.C.
12951 University Ave
Suite 201
Clive, IA 50325

EXAMINER	
BERNARDI, BRENDA C	

ART UNIT	PAPER NUMBER
2667	

NOTIFICATION DATE	DELIVERY MODE
06/13/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USPTO@dockettrak.com
docketing@goodhue.com
eofficeaction@appcoll.com

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR/ PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
16/144,338	09/27/2018	Hirsch et al.	BRAGI GmbH-P0017C

	EXAMINER	
Goodhue, Coleman & Owens, P.C. 12951 University Ave Suite 201 Clive, IA 50325	BRENDA C BERNARDI	
	ART UNIT	PAPER
	2667	20190609

DATE MAILED: _____

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The information disclosure statements (IDS) submitted on 4/16/2018 was filed after the Notice of Allowance was posted. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement has been considered by the examiner. Attached herewith is a copy of an initialed Form PTO-1449.

/BRENDA C BERNARDI/
Primary Examiner, Art Unit 2667

PTO-90C (Rev.04-03)

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	2667
Examiner Name	Brenda C BERNARDI
Attorney Docket Number	BRAGI GmbH-P0017C2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20150245126	A1	2015-08-27	Shaffer	Entire Document

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	2667
Examiner Name	Brenda C BERNARDI
Attorney Docket Number	BRAGI GmbH-P0017C2

	1	European Patent Office: "Communication pursuant to Article 94(3) EPC", European Application No. 16 757 885.5-1219, 1/24/19, 4 pages	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/BRENDA C BERNARDI/	Date Considered	06/09/2019

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	2667
Examiner Name	Brenda C BERNARDI
Attorney Docket Number	BRAGI GmbH-P0017C2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/JOHN D. GOODHUE/	Date (YYYY-MM-DD)	2019-04-16
Name/Print	John D. Goodhue	Registration Number	47603

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY.DOCKET NO./TITLE	REQUEST ID
16/144,338	09/27/2018	BRAGI GmbH	BRAGI GmbH-P0017C2	91696

Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 07/15/2019 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

X Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/JOHN D. GOODHUE/
Name:	JOHN D. GOODHUE
Registration Number:	47603

Document Description: Issue Fee Payment (PTO-85B)

Issue Fee Transmittal Form

Application Number	Filing Date	First Named Inventor	Atty. Docket No.	Confirmation No.
16144338	27-Sep-2018	Eric Hirsch	BRAGI GmbH-P0017C2	3503

TITLE OF INVENTION :

Power Control for Battery Powered Personal Area Network Device System and Method

Entity Status	Application Type	Art Unit	Class - Subclass	EXAMINER
Regular Undiscounted	Utility under 35 USC 111(a)	2667	074000	BRENDA BERNARDI

Issue Fee Due	Publication Due	Total Fee(s) Due	Date Due	Prev. Paid Fee
$1000	$0	$1000	18-Jul-2019	$0

1.Change of Correspondence Address and/or Indication Of Fee Address (37 CFR 1.33 & 1.363)

Current Correspondence Address:	Current Indicated Fee Address :
133690 Goodhue, Coleman & Owens, P.C. 12951 University Ave Suite 201 Clive IA 50325 UNITED STATES 515-218-7758 USPTO@dockettrak.com	
☐ Change of correspondence address requested, system generated AIA/122-EFS form attached	☐ Fee Address indication requested, system generated SB/47-EFS form attached

2.Entity Status

Change in Entity Status

○ Applicant certifying micro entity status; system generated Micro Entity certification form attached. See 37 CFR 1.29.
Note: Absent a valid certification of micro entity status, issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. If this box is checked, you will be prompted to choose a micro entity status on the gross income basis (37 CFR 1.29(a)) or the institution of higher education basis (37 CFR 1.29(d)), and make the applicable certification online.

○ Applicant asserting small entity status. See 37 CFR 1.27.
Note: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

◉ Applicant changing to regular undiscounted fee status.
Note: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

Document Description: Issue Fee Payment (PTO-85B)

3.The Following Fee(s) Are Submitted:

☒ Issue Fee	☐ I authorize USPTO to apply my previously paid issue fee to the current fees due
☐ Publication Fee	☐ The Director is hereby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number _____
☐ Advance Order - # of copies _____	☐ If **in addition to** the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number _____ . The **issue fee must be submitted** with this form. **If payment of the issue fee does not accompany this form, checking this box and providing a deposit account number will NOT be effective to satisfy full payment of the fee(s) due.**

4.Firm and/or Attorney Names To Be Printed

NOTE: If no name is listed, no name will be printed
For printing on the patent front page, list to be displayed as entered

1. GOODHUE, COLEMAN & OWENS, P.C.
2.
3.

5.Assignee Name(s) and Residence Data To Be Printed

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

Name	City	State	Country	Category
BRAGI GmbH	München		germany	corporation

6.Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via EFS-WEB on the date indicated below.

Signature	/JOHN D. GOODHUE/	**Date**	07-15-2019
Name	John Darrell Goodhue	**Registration Number**	47603

Electronic Patent Application Fee Transmittal

Application Number:	16144338
Filing Date:	27-Sep-2018
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Attorney Docket Number:	BRAGI GmbH-P0017C2

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

Electronic Acknowledgement Receipt

EFS ID:	36588674
Application Number:	16144338
International Application Number:	
Confirmation Number:	3503
Title of Invention:	Power Control for Battery Powered Personal Area Network Device System and Method
First Named Inventor/Applicant Name:	Eric Christian Hirsch
Customer Number:	133690
Filer:	John Darrell Goodhue/Ashlyn Nguyen
Filer Authorized By:	John Darrell Goodhue
Attorney Docket Number:	BRAGI GmbH-P0017C2
Receipt Date:	15-JUL-2019
Filing Date:	27-SEP-2018
Time Stamp:	18:11:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1000
RAM confirmation Number	071619INTEFSW00005578506801
Deposit Account	506801
Authorized User	Ashlyn Nguyen

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.20 (Post Issuance fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Web85b.pdf	46000 1901bca737852c9ebd6cf17c29cd0b5068ac1203	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32426 8c4a360d2223d5c71b629c43b556ece0c523e262	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	78426		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16144338
Filing Date	2018-09-27
First Named Inventor	Eric Christian Hirsch
Art Unit	
Examiner Name	
Attorney Docket Number	BRAGI GmbH-P0017C2

	119	9767709	B2	2017-09-19	Ellis	Entire Document
	120	9818005	B2	2017-11-14	Yeager et al.	Entire Document
	121	9821767	B2	2017-11-21	NIXON; Robin Geoffrey	Entire Document
Change(s) applied to document, /M.E.G./ 6/13/2019	122	9848257	A1	12/2017 ~~2018-05-05~~	Ambrose et al.	Entire Document
	123	D208784	S	1967-10-03	Sanzone	Entire Document
	124	D266271	S	1982-09-21	Johanson et al.	Entire Document
	125	D340286	S	1993-10-12	Seo; Jinseong	Entire Document
	126	D367113	S	1996-02-13	Weeks; Eric L.	Entire Document
	127	D397796	S	1998-09-01	Yabe et al.	Entire Document
	128	D410008	S	1999-05-18	Almqvist; Christer	Entire Document
	129	D455835	S1	2002-04-16	Anderson et al.	Entire Document

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.C.B/

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Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/144,338	08/27/2019	10397688	BRAGI GmbH-P0017C2	3503

133690 7590 08/07/2019

Goodhue, Coleman & Owens, P.C.
12951 University Ave
Suite 201
Clive, IA 50325

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

BRAGI GmbH, Munchen, GERMANY;
Eric Christian Hirsch, München, GERMANY;
Peter Vincent Boesen, München, GERMANY;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.