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(54) ENHANCED VEHICLE KEY FOB

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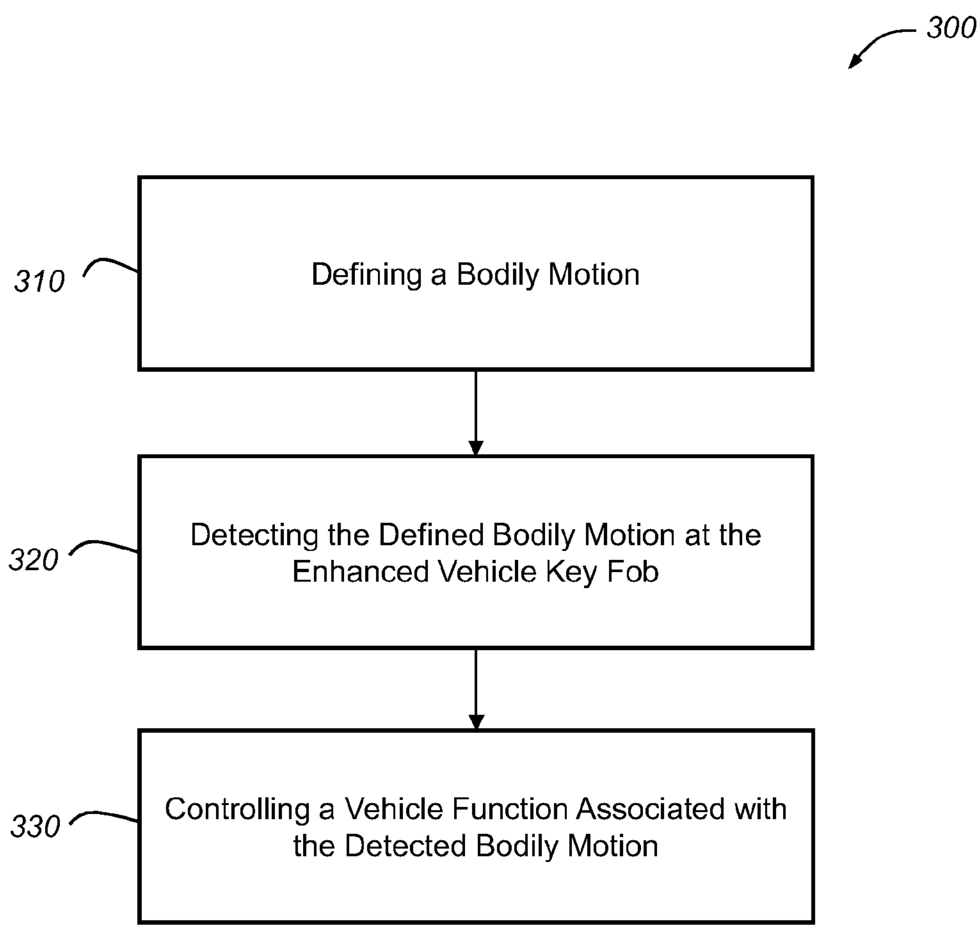
(57) **ABSTRACT**

An enhanced vehicle key fob includes a controller that is coupled to a power source, an antenna, and an accelerometer that measures the acceleration of the enhanced vehicle key fob and outputs the measurement to the controller, wherein the enhanced vehicle key fob controls a vehicle function of a vehicle using the output of the accelerometer.



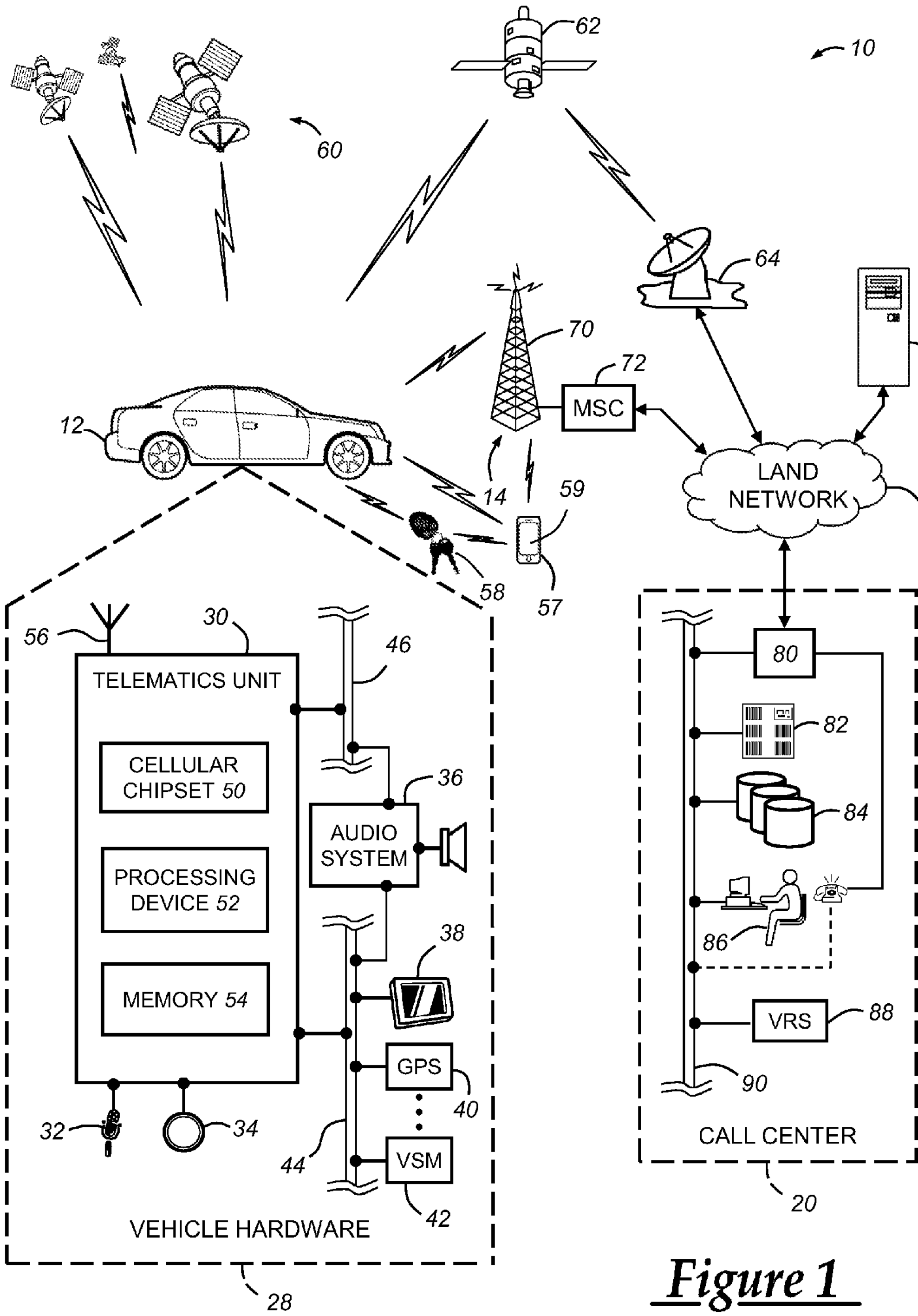

62
10
60
64
70
72
MSC
18
12
14
59
LAND NETWORK
16
58
57
56
30
46
TELEMATICS UNIT
CELLULAR CHIPSET 50
PROCESSING DEVICE 52
MEMORY 54
36
AUDIO SYSTEM
38
GPS
40
VSM
42
44
32
34
VEHICLE HARDWARE
28
80
82
84
86
VRS
88
90
CALL CENTER
20

Figure 1

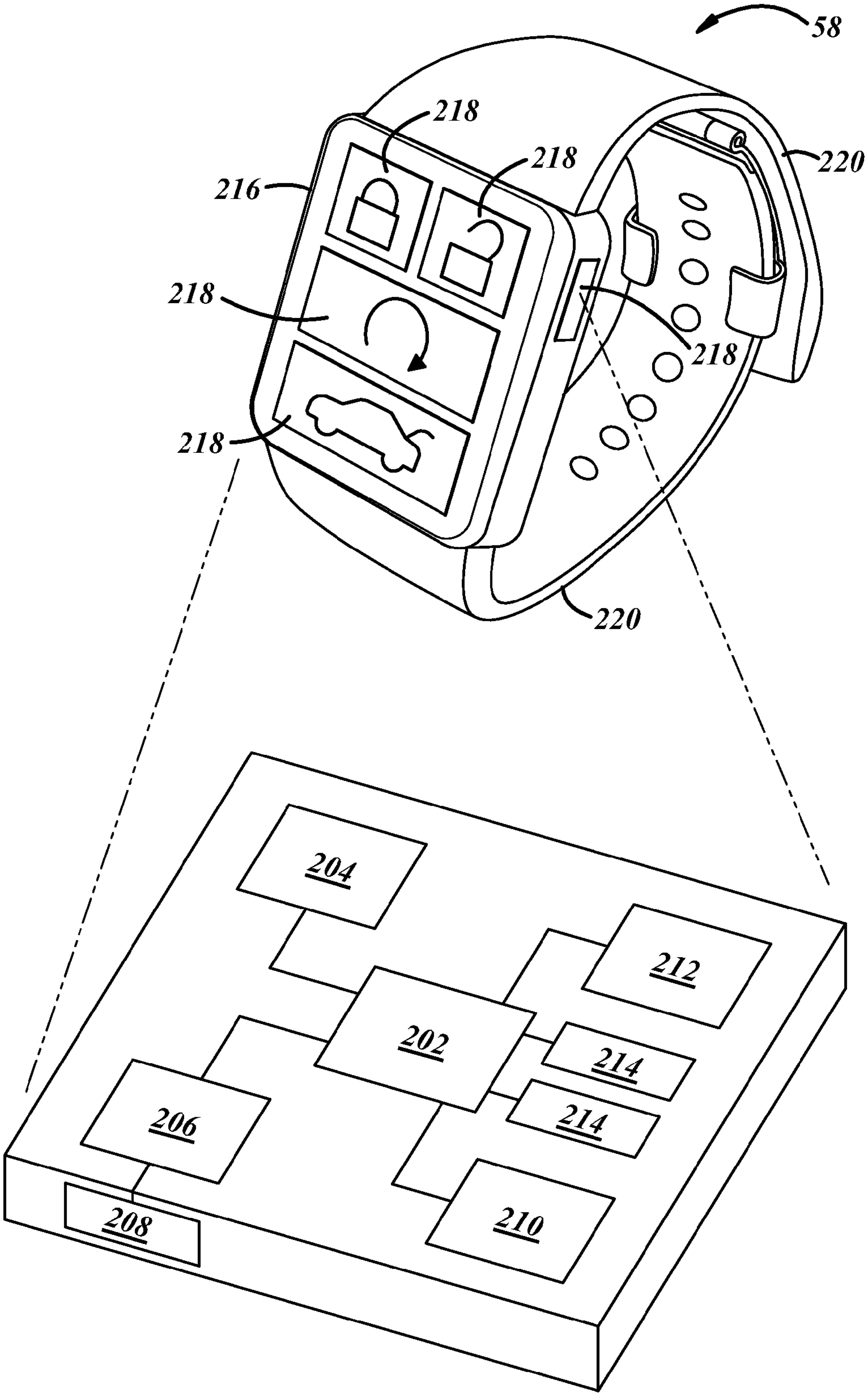

58
218
218
216
220
218
218
218
220
204
212
202
214
214
206
210
208

Figure 2

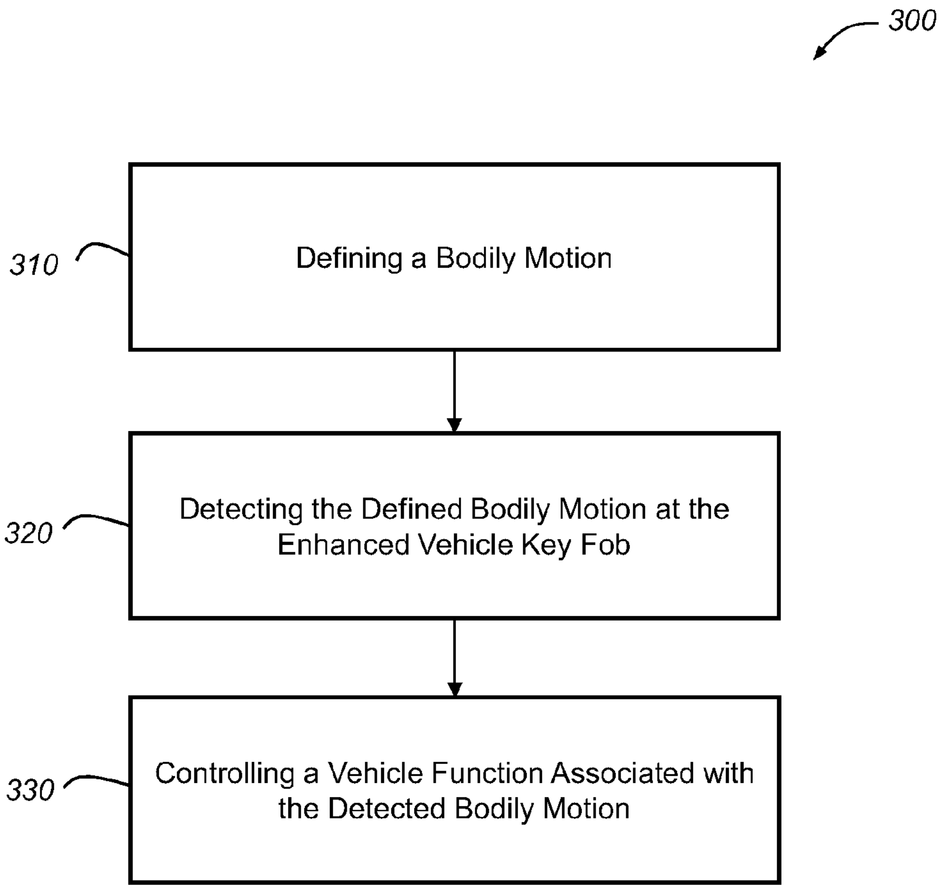

300
310
Defining a Bodily Motion
320
Detecting the Defined Bodily Motion at the Enhanced Vehicle Key Fob
330
Controlling a Vehicle Function Associated with the Detected Bodily Motion

Figure 3

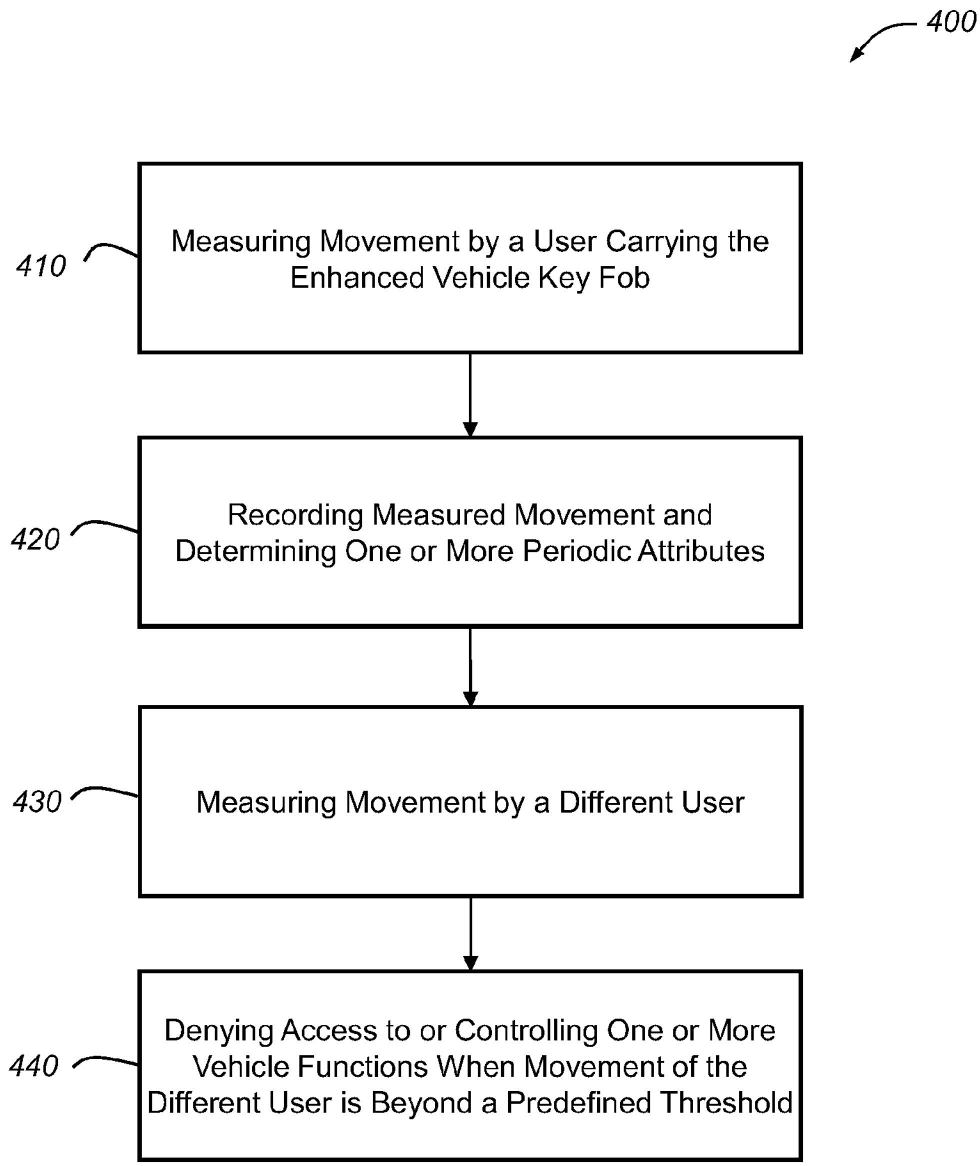

400
410
Measuring Movement by a User Carrying the Enhanced Vehicle Key Fob
420
Recording Measured Movement and Determining One or More Periodic Attributes
430
Measuring Movement by a Different User
440
Denying Access to or Controlling One or More Vehicle Functions When Movement of the Different User is Beyond a Predefined Threshold

Figure 4

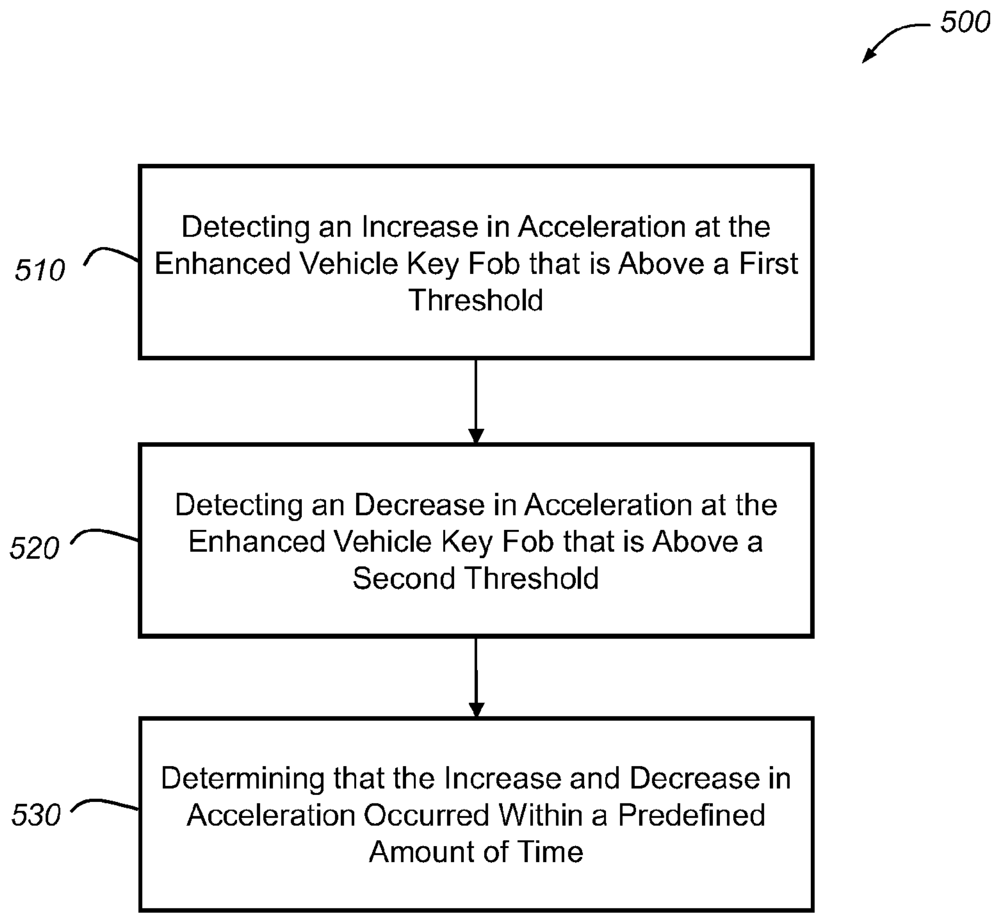

500
510
Detecting an Increase in Acceleration at the Enhanced Vehicle Key Fob that is Above a First Threshold
520
Detecting an Decrease in Acceleration at the Enhanced Vehicle Key Fob that is Above a Second Threshold
530
Determining that the Increase and Decrease in Acceleration Occurred Within a Predefined Amount of Time

Figure 5

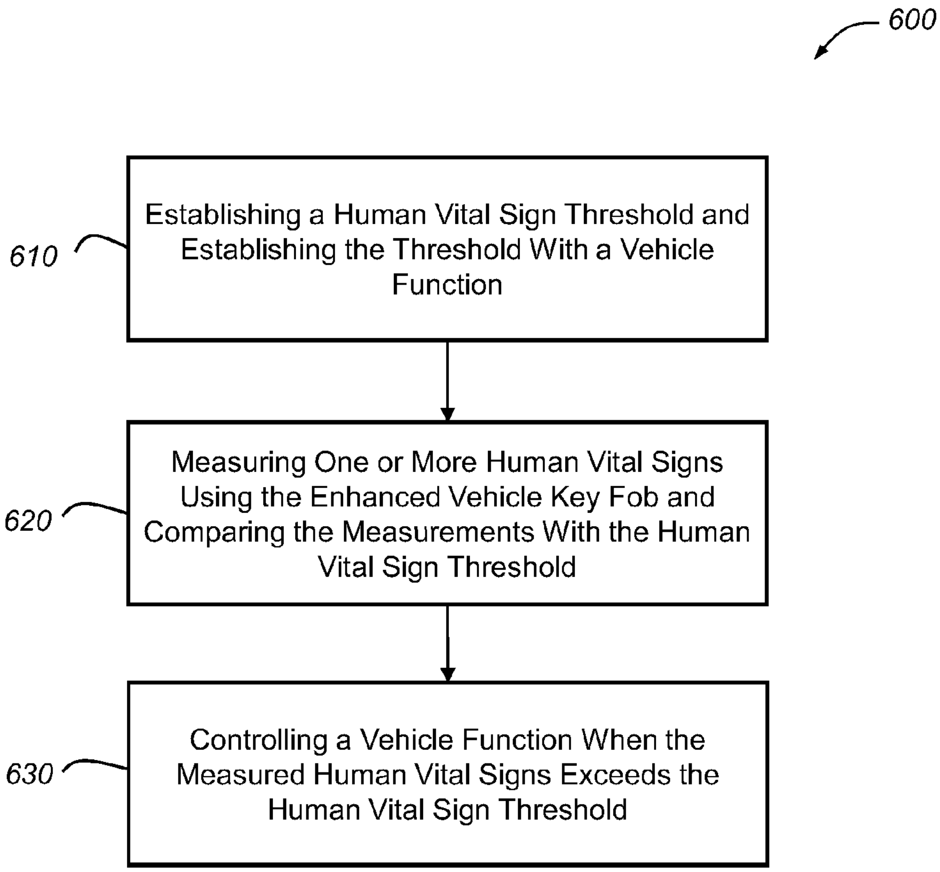

600
610
Establishing a Human Vital Sign Threshold and Establishing the Threshold With a Vehicle Function
620
Measuring One or More Human Vital Signs Using the Enhanced Vehicle Key Fob and Comparing the Measurements With the Human Vital Sign Threshold
630
Controlling a Vehicle Function When the Measured Human Vital Signs Exceeds the Human Vital Sign Threshold

Figure 6

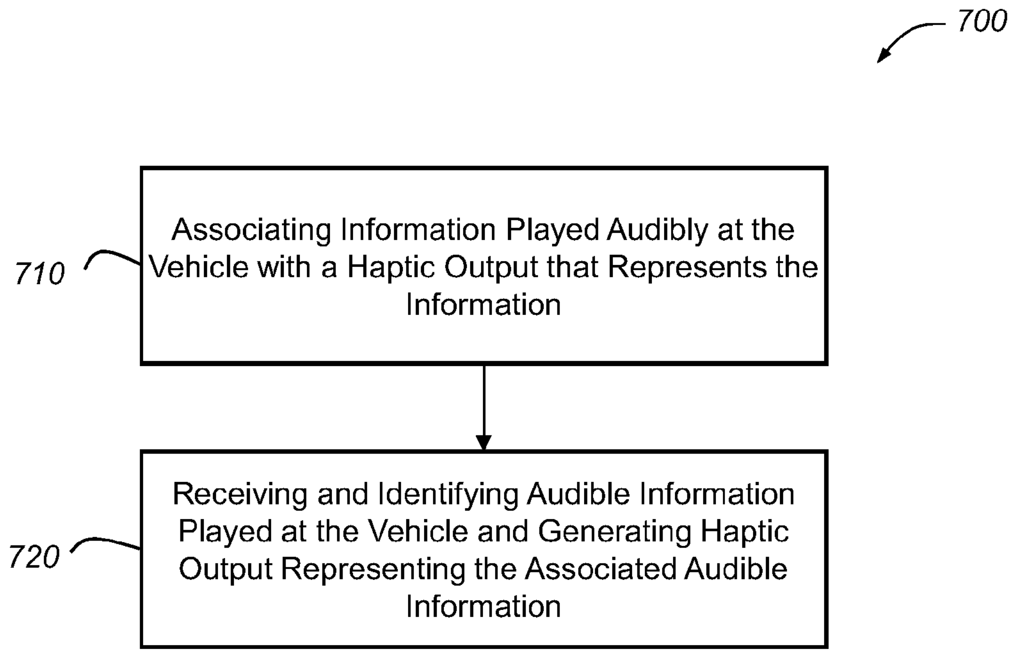

700
710
Associating Information Played Audibly at the Vehicle with a Haptic Output that Represents the Information
720
Receiving and Identifying Audible Information Played at the Vehicle and Generating Haptic Output Representing the Associated Audible Information

Figure 7

ENHANCED VEHICLE KEY FOB

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of U.S. application Ser. No. 14/062,200 filed Oct. 24, 2013, the entire contents of which are hereby incorporated by reference.

TECHNICAL FIELD

[0002] The present invention relates to vehicles and more particularly wireless vehicle key fobs.

BACKGROUND

[0003] Vehicles have traditionally required a set of keys for gaining access to vehicle functions. In the past, these keys have been fashioned out of metal and inserted into mechanical locks. However, modern vehicles commonly use wireless key fobs to control vehicle functions. Using short-range wireless signals between the vehicle key fob and the vehicle, the key fob can remotely control a number of vehicle functions. For example, when a user or vehicle owner approaches a vehicle and wants to unlock the doors, the user can depress a button on the key fob that causes the transmission of a wireless signal to the vehicle causing the unlocking of the doors. Other vehicle functions can also be controlled, such as vehicle locking, trunk opening, or the flashing of exterior lights.

[0004] In addition to wireless vehicle key fobs, vehicle owners now carry a wide array of other personal electronic devices. For example, vehicle owners have increasingly begun carrying handheld wireless devices that have cellular communication capabilities, such as smartphones. Besides smartphones, vehicle owners choose to carry other devices as well. Some vehicle owners carry "quantified self" devices that can monitor the activity and sleep patterns of the user. A user that carries each device must keep track of a plurality of devices, which increases the probability that one will be lost or forgotten.

SUMMARY

[0005] According to an embodiment of the invention, there is provided a method of controlling a vehicle function with an enhanced vehicle key fob. The method includes defining a bodily motion the execution of which is both detectable by an accelerometer and causes a status change in a vehicle function; associating the bodily motion with one or more vehicle functions; detecting one of the defined bodily motions at the enhanced vehicle key fob using the accelerometer; identifying the vehicle function associated with the detected bodily motion; and controlling the vehicle function.

[0006] According to another embodiment of the invention, there is provided a method of authenticating a user of an enhanced vehicle key fob. The method includes measuring movement by a user carrying the enhanced vehicle key fob using an accelerometer included with the vehicle key fob; recording the measured movement of the user at the enhanced vehicle key fob; determining one or more periodic attributes of the recorded movement; measuring movement by a different user using the accelerometer; comparing the movement by the different user with the periodic attributes of the recorded movement; and controlling one or more vehicle functions when the movement by the different user is beyond a predefined threshold of the periodic attributes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] One or more embodiments of the invention will hereinafter be described in conjunction with the appended drawings, wherein like designations denote like elements, and wherein:

[0008] FIG. **1** is a block diagram depicting an embodiment of a communications system that is capable of using the devices and methods disclosed herein;

[0009] FIG. **2** is an exploded view of one embodiment of an enhanced vehicle key fob;

[0010] FIG. **3** is an embodiment of a method of controlling a vehicle function with a vehicle key fob;

[0011] FIG. **4** is an embodiment of a method of authenticating a user of the enhanced vehicle key fob;

[0012] FIG. **5** is an embodiment of a method of using an accelerometer of the enhanced vehicle key fob to detect enhanced vehicle key fob loss;

[0013] FIG. **6** is an embodiment of a method of locally monitoring human vital signs of an enhanced vehicle key fob user; and

[0014] FIG. **7** is an embodiment of a method of converting audio generated at the vehicle into haptic information using the enhanced vehicle key fob.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0015] The systems and methods described below involve an enhanced vehicle key fob that integrates the elements and functionality of vehicle key fobs with that of quantified-self devices. That is, in addition to controlling vehicle functions, such as door locking/unlocking, the enhanced vehicle key fob can also monitor the motion of the a person carrying the key fob or that person's vital signs. The enhanced vehicle key fob can be a wearable item such that the fob contacts the skin of its user or in close proximity to the skin, such as when it is placed into a pocket. A combination of wireless communication, motion monitoring, and vital sign detection can permit the enhanced vehicle key fob to communicate between the user and a vehicle in novel ways. In one example, the enhanced vehicle key fob can detect pre-defined bodily motions of the user and discern a command from the detected bodily motion. Apart from the pre-defined bodily motions of the user, other motions of a user carrying the enhanced key fob can be measured and used to identify who is carrying the key fob. Depending on the determined identity of the person carrying the enhanced key fob, access to vehicle functions can be selectively permitted and the vehicle can be personalized and appropriately configured immediately prior to the driver boarding the vehicle.

[0016] The enhanced vehicle key fob can carry out other functions as well. Using its ability to detect motion, the enhanced vehicle key fob can detect sharp increase in acceleration closely followed by sharp decreases in acceleration to predict when someone carrying the enhanced vehicle key fob has dropped it. In response, the enhanced vehicle key fob can initiate an alert (visual, audible, haptic, or any combination of these) to gain the attention of the user. Apart from its motion-sensing capabilities, the enhanced vehicle key fob can locally monitor the vital signs of the person carrying it (or wearing it). For instance, the enhanced vehicle key fob can monitor the heart rate, pulse, temperature, or other similar vital sign and based on the levels of these vital signs, the key fob can change the operational settings of vehicle systems or vehicle functions. The enhanced vehicle key fob can also listen for audibly-played information in a vehicle, identify the audible information, and convert the information to pre-defined haptic feedback that can be felt by the user carrying the key fob. The haptic feedback can be understood by users with poor hearing or in noisy environments and ensure that audibly-given information is not ignored.

Communications System—

[0017] With reference to FIG. **1**, there is shown an operating environment that comprises a mobile vehicle communications system **10** and that can be used to implement the method disclosed herein. Communications system **10** generally includes a vehicle **12**, one or more wireless carrier systems **14**, a land communications network **16**, a computer **18**, and a call center **20**. It should be understood that the disclosed method can be used with any number of different systems and is not specifically limited to the operating environment shown here. Also, the architecture, construction, setup, and operation of the system **10** and its individual components are generally known in the art. Thus, the following paragraphs simply provide a brief overview of one such communications system **10**; however, other systems not shown here could employ the disclosed method as well.

[0018] Vehicle **12** is depicted in the illustrated embodiment as a passenger car, but it should be appreciated that any other vehicle including motorcycles, trucks, sports utility vehicles (SUVs), recreational vehicles (RVs), marine vessels, aircraft, etc., can also be used. Some of the vehicle electronics **28** is shown generally in FIG. **1** and includes a telematics unit **30**, a microphone **32**, one or more pushbuttons or other control inputs **34**, an audio system **36**, a visual display **38**, and a GPS module **40** as well as a number of vehicle system modules (VSMs) **42**. Some of these devices can be connected directly to the telematics unit such as, for example, the microphone **32** and pushbutton(s) **34**, whereas others are indirectly connected using one or more network connections, such as a communications bus **44** or an entertainment bus **46**. Examples of suitable network connections include a controller area network (CAN), a media oriented system transfer (MOST), a local interconnection network (LIN), a local area network (LAN), and other appropriate connections such as Ethernet or others that conform with known ISO, SAE and IEEE standards and specifications, to name but a few.

[0019] Telematics unit **30** can be an OEM-installed (embedded) or aftermarket device that is installed in the vehicle and that enables wireless voice and/or data communication over wireless carrier system **14** and via wireless networking. This enables the vehicle to communicate with call center **20**, other telematics-enabled vehicles, or some other entity or device. The telematics unit preferably uses radio transmissions to establish a communications channel (a voice channel and/or a data channel) with wireless carrier system **14** so that voice and/or data transmissions can be sent and received over the channel. By providing both voice and data communication, telematics unit **30** enables the vehicle to offer a number of different services including those related to navigation, telephony, emergency assistance, diagnostics, infotainment, etc. Data can be sent either via a data connection, such as via packet data transmission over a data channel, or via a voice channel using techniques known in the art. For combined services that involve both voice communication (e.g., with a live advisor or voice response unit at the call center **20**) and data communication (e.g., to provide GPS location data or vehicle diagnostic data to the call center **20**), the system can utilize a single call over a voice channel and switch as needed between voice and data transmission over the voice channel, and this can be done using techniques known to those skilled in the art.

[0020] According to one embodiment, telematics unit **30** utilizes cellular communication according to either GSM or CDMA standards and thus includes a standard cellular chipset **50** for voice communications like hands-free calling, a wireless modem for data transmission, an electronic processing device **52**, one or more digital memory devices **54**, and a dual antenna **56**. It should be appreciated that the modem can either be implemented through software that is stored in the telematics unit and is executed by processor **52**, or it can be a separate hardware component located internal or external to telematics unit **30**. The modem can operate using any number of different standards or protocols such as EVDO, CDMA, GPRS, and EDGE. Wireless networking between the vehicle and other networked devices can also be carried out using telematics unit **30**. For this purpose, telematics unit **30** can be configured to communicate wirelessly according to one or more wireless protocols, such as any of the IEEE 802.11 protocols, WiMAX, or Bluetooth. When used for packet-switched data communication such as TCP/IP, the telematics unit can be configured with a static IP address or can set up to automatically receive an assigned IP address from another device on the network such as a router or from a network address server.

[0021] One of the networked devices that can communicate with the telematics unit **30** is a separate wireless device, such as a smart phone **57**. The smart phone **57** can include computer processing capability, a transceiver capable of communicating using a short-range wireless protocol, and a visual smart phone display **59**. In some implementations, the smart phone display **59** also includes a touch-screen graphical user interface and/or a GPS module capable of receiving GPS satellite signals and generating GPS coordinates based on those signals. Examples of the smart phone **57** include the iPhone™ manufactured by Apple, Inc. and the Droid™ manufactured by Motorola, Inc. as well as others. These and other similar devices may be used or considered as a type of separate wireless device for the purposes of the method described herein. While the smart phone **57** is described with the methods below, it should be appreciated that other similar and/or simpler handheld wireless device can be successfully substituted for the smart phone **57** to carry out the method/system described herein. For instance, devices such as the iPad™ or iPod Touch™ can also use the short-range wireless protocols to communicate despite not having the capability to communicate via cellular protocols.

[0022] An enhanced vehicle key fob **58** is also shown having a protective housing and including a combination of electronic components designed to receive signals from switches, process the signals, and wirelessly transmit command signals to vehicle **12**. The enhanced vehicle key fob **58** can also wirelessly communicate with the smartphone **57**. For the enhanced vehicle key fob **58** shown here, it is configured to be attached to mechanical keys and placed in a pocket or a purse; however, it should be appreciated that the key fob **58** could be configured in a variety of different forms and is not limited to the illustrative example shown here. For instance, the vehicle key fob **58** can be a device that is wearable, similar to a bracelet or a wristwatch. A power source (not shown) generally provides vehicle key fob **10** with electrical power and can include any type of appropriate battery or other power providing component known in the art. More details of the enhanced vehicle key fob **58** will be discussed below.

[0023] Processor **52** can be any type of device capable of processing electronic instructions including microprocessors, microcontrollers, host processors, controllers, vehicle communication processors, and application specific integrated circuits (ASICs). It can be a dedicated processor used only for telematics unit **30** or can be shared with other vehicle systems. Processor **52** executes various types of digitally-stored instructions, such as software or firmware programs stored in memory **54**, which enable the telematics unit to provide a wide variety of services. For instance, processor **52** can execute programs or process data to carry out at least a part of the method discussed herein.

[0024] Telematics unit **30** can be used to provide a diverse range of vehicle services that involve wireless communication to and/or from the vehicle. Such services include: turn-by-turn directions and other navigation-related services that are provided in conjunction with the GPS-based vehicle navigation module **40**; airbag deployment notification and other emergency or roadside assistance-related services that are provided in connection with one or more collision sensor interface modules such as a body control module (not shown); diagnostic reporting using one or more diagnostic modules; and infotainment-related services where music, webpages, movies, television programs, videogames and/or other information is downloaded by an infotainment module (not shown) and is stored for current or later playback. The above-listed services are by no means an exhaustive list of all of the capabilities of telematics unit **30**, but are simply an enumeration of some of the services that the telematics unit is capable of offering. Furthermore, it should be understood that at least some of the aforementioned modules could be implemented in the form of software instructions saved internal or external to telematics unit **30**, they could be hardware components located internal or external to telematics unit **30**, or they could be integrated and/or shared with each other or with other systems located throughout the vehicle, to cite but a few possibilities. In the event that the modules are implemented as VSMs **42** located external to telematics unit **30**, they could utilize vehicle bus **44** to exchange data and commands with the telematics unit.

[0025] GPS module **40** receives radio signals from a constellation **60** of GPS satellites. From these signals, the module **40** can determine vehicle position that is used for providing navigation and other position-related services to the vehicle driver. Navigation information can be presented on the display **38** (or other display within the vehicle) or can be presented verbally such as is done when supplying turn-by-turn navigation. The navigation services can be provided using a dedicated in-vehicle navigation module (which can be part of GPS module **40**), or some or all navigation services can be done via telematics unit **30**, wherein the position information is sent to a remote location for purposes of providing the vehicle with navigation maps, map annotations (points of interest, restaurants, etc.), route calculations, and the like. The position information can be supplied to call center **20** or other remote computer system, such as computer **18**, for other purposes, such as fleet management. Also, new or updated map data can be downloaded to the GPS module **40** from the call center **20** via the telematics unit **30**.

[0026] Apart from the audio system **36** and GPS module **40**, the vehicle **12** can include other vehicle system modules (VSMs) **42** in the form of electronic hardware components that are located throughout the vehicle and typically receive input from one or more sensors and use the sensed input to perform diagnostic, monitoring, control, reporting and/or other functions. Each of the VSMs **42** is preferably connected by communications bus **44** to the other VSMs, as well as to the telematics unit **30**, and can be programmed to run vehicle system and subsystem diagnostic tests. As examples, one VSM **42** can be an engine control module (ECM) that controls various aspects of engine operation such as fuel ignition and ignition timing, another VSM **42** can be a powertrain control module that regulates operation of one or more components of the vehicle powertrain, and another VSM **42** can be a body control module that governs various electrical components located throughout the vehicle, like the vehicle's power door locks and headlights. According to one embodiment, the engine control module is equipped with on-board diagnostic (OBD) features that provide myriad real-time data, such as that received from various sensors including vehicle emissions sensors, and provide a standardized series of diagnostic trouble codes (DTCs) that allow a technician to rapidly identify and remedy malfunctions within the vehicle. As is appreciated by those skilled in the art, the above-mentioned VSMs are only examples of some of the modules that may be used in vehicle **12**, as numerous others are also possible.

[0027] Vehicle electronics **28** also includes a number of vehicle user interfaces that provide vehicle occupants with a means of providing and/or receiving information, including microphone **32**, pushbuttons(s) **34**, audio system **36**, and visual display **38**. As used herein, the term 'vehicle user interface' broadly includes any suitable form of electronic device, including both hardware and software components, which is located on the vehicle and enables a vehicle user to communicate with or through a component of the vehicle. Microphone **32** provides audio input to the telematics unit to enable the driver or other occupant to provide voice commands and carry out hands-free calling via the wireless carrier system **14**. For this purpose, it can be connected to an on-board automated voice processing unit utilizing human-machine interface (HMI) technology known in the art. The push-button(s) **34** allow manual user input into the telematics unit **30** to initiate wireless telephone calls and provide other data, response, or control input. Separate pushbuttons can be used for initiating emergency calls versus regular service assistance calls to the call center **20**. Audio system **36** provides audio output to a vehicle occupant and can be a dedicated, stand-alone system or part of the primary vehicle audio system. According to the particular embodiment shown here, audio system **36** is operatively coupled to both vehicle bus **44** and entertainment bus **46** and can provide AM, FM and satellite radio, CD, DVD and other multimedia functionality. This functionality can be provided in conjunction with or independent of the infotainment module described above. Visual display **38** is preferably a graphics display, such as a touch screen on the instrument panel or a heads-up display reflected off of the windshield, and can be used to provide a multitude of input and output functions. Various other vehicle user interfaces can also be utilized, as the interfaces of FIG. **1** are only an example of one particular implementation.

[0028] Wireless carrier system **14** is preferably a cellular telephone system that includes a plurality of cell towers **70** (only one shown), one or more mobile switching centers (MSCs) **72**, as well as any other networking components required to connect wireless carrier system **14** with land network **16**. Each cell tower **70** includes sending and receiving antennas and a base station, with the base stations from different cell towers being connected to the MSC **72** either directly or via intermediary equipment such as a base station controller. Cellular system **14** can implement any suitable communications technology, including for example, analog technologies such as AMPS, or the newer digital technologies such as CDMA (e.g., CDMA2000) or GSM/GPRS. As will be appreciated by those skilled in the art, various cell tower/base station/MSC arrangements are possible and could be used with wireless system **14**. For instance, the base station and cell tower could be co-located at the same site or they could be remotely located from one another, each base station could be responsible for a single cell tower or a single base station could service various cell towers, and various base stations could be coupled to a single MSC, to name but a few of the possible arrangements.

[0029] Apart from using wireless carrier system **14**, a different wireless carrier system in the form of satellite communication can be used to provide uni-directional or bi-directional communication with the vehicle. This can be done using one or more communication satellites **62** and an uplink transmitting station **64**. Uni-directional communication can be, for example, satellite radio services, wherein programming content (news, music, etc.) is received by transmitting station **64**, packaged for upload, and then sent to the satellite **62**, which broadcasts the programming to subscribers. Bi-directional communication can be, for example, satellite telephony services using satellite **62** to relay telephone communications between the vehicle **12** and station **64**. If used, this satellite telephony can be utilized either in addition to or in lieu of wireless carrier system **14**.

[0030] Land network **16** may be a conventional land-based telecommunications network that is connected to one or more landline telephones and connects wireless carrier system **14** to call center **20**. For example, land network **16** may include a public switched telephone network (PSTN) such as that used to provide hardwired telephony, packet-switched data communications, and the Internet infrastructure. One or more segments of land network **16** could be implemented through the use of a standard wired network, a fiber or other optical network, a cable network, power lines, other wireless networks such as wireless local area networks (WLANs), or networks providing broadband wireless access (BWA), or any combination thereof. Furthermore, call center **20** need not be connected via land network **16**, but could include wireless telephony equipment so that it can communicate directly with a wireless network, such as wireless carrier system **14**.

[0031] Computer **18** can be one of a number of computers accessible via a private or public network such as the Internet. Each such computer **18** can be used for one or more purposes, such as a web server accessible by the vehicle via telematics unit **30** and wireless carrier **14**. Other such accessible computers **18** can be, for example: a service center computer where diagnostic information and other vehicle data can be uploaded from the vehicle via the telematics unit **30**; a client computer used by the vehicle owner or other subscriber for such purposes as accessing or receiving vehicle data or to setting up or configuring subscriber preferences or controlling vehicle functions; or a third party repository to or from which vehicle data or other information is provided, whether by communicating with the vehicle **12** or call center **20**, or both. A computer **18** can also be used for providing Internet connectivity such as DNS services or as a network address server that uses DHCP or other suitable protocol to assign an IP address to the vehicle **12**.

[0032] Call center **20** is designed to provide the vehicle electronics **28** with a number of different system back-end functions and, according to the exemplary embodiment shown here, generally includes one or more switches **80**, servers **82**, databases **84**, live advisors **86**, as well as an automated voice response system (VRS) **88**, all of which are known in the art. These various call center components are preferably coupled to one another via a wired or wireless local area network **90**. Switch **80**, which can be a private branch exchange (PBX) switch, routes incoming signals so that voice transmissions are usually sent to either the live adviser **86** by regular phone or to the automated voice response system **88** using VoIP. The live advisor phone can also use VoIP as indicated by the broken line in FIG. **1**. VoIP and other data communication through the switch **80** is implemented via a modem (not shown) connected between the switch **80** and network **90**. Data transmissions are passed via the modem to server **82** and/or database **84**. Database **84** can store account information such as subscriber authentication information, vehicle identifiers, profile records, behavioral patterns, and other pertinent subscriber information. Data transmissions may also be conducted by wireless systems, such as 802.11x, GPRS, and the like. Although the illustrated embodiment has been described as it would be used in conjunction with a manned call center **20** using live advisor **86**, it will be appreciated that the call center can instead utilize VRS **88** as an automated advisor or, a combination of VRS **88** and the live advisor **86** can be used.

Enhanced Vehicle Key Fob Architecture—

[0033] Turning to FIG. **2**, an exemplary implementation of the enhanced vehicle key fob **58** is shown. In this implementation, the enhanced vehicle key fob **58** includes a processor **202**, a memory device **204**, a power source **206**, an external port **208** for receiving charge, an accelerometer **210**, a vibrating electric motor **212**, one or more sensors **214**, an enclosure **216**, and a plurality of switches **218** located on the enclosure **216**. These elements can be communicatively linked via a printed circuit board (PCB) or other similar electrically-communicative circuit-rendering implementation. While the enhanced vehicle key fob **58** is shown with straps **220** for wearing the key fob **58** in a way similar to how a person would wear a wristwatch, it should be appreciated that in other implementations of the enhanced vehicle key fob **58** includes forming the key fob **58** into a bracelet or a strap-less device designed to be put in a pocket or a purse like a traditional key fob, as is shown in FIG. **1**. It is also possible that at least a portion of the enhanced vehicle key fob can be separated from a mechanical emergency key that is attached to the key ring and could be worn as a wearable device on wrist, belt, pocket, or similar locations to control the vehicle **12** as well as act as an activity tracker for fitness.

[0034] The processor **202** (also referred to as a controller) of the enhanced vehicle key fob **200** can control the operation of the key fob **58** and be programmed to carry out a number of customizable algorithms, the content of which will be discussed in more detail below. While the processor **202** itself can include dedicated memory that includes computer-readable instructions, those instructions can also be accessible from the memory device **204** that is separate from the processor **202**. One example of processor **202** is a Nordic nRF51822 processor configured to carry out Bluetooth Low Energy (LE) communication protocols and ultra-low energy 2.4 GHz wireless communications. The processor **202** can use the Bluetooth LE capabilities to communicate with a variety of external sources, such as the smartphone **57** and the vehicle **12** as well as Wi-Fi hotspots (not shown). It should be appreciated that other Wi-Fi bandwidths can also be used, such 5 GHz. Using these communications capabilities, the processor **202** can also oversee over-the-air (OTA) software updates at the enhanced vehicle key fob **58**. It is also possible to use the smartphone **57** and the Bluetooth capabilities to locate the enhanced vehicle key fob **58** and cause it to make noise or otherwise alert the user or indicate the location of the key fob **58**. By measuring the wireless signal strength generated by the enhanced vehicle key fob **58**, the smartphone **57** can determine a range to the key fob **58** and also send a wireless signal via a short-range wireless protocol commanding the device to make sound. In this implementation, the processor **202** includes 256 kilobytes (KB) of flash memory and 16 KB of random access memory (RAM). The processor **202** is communicatively and electrically linked to the power source **206**. Depending on the particular processor **202** and other hardware, the voltage and current ratings of the power source **206** may differ. But in one embodiment, the power source **206** can be a lithium-ion (Li-Ion) battery rated at 3.7 Volts (V) and 130 milliamp hours (mAH). In addition, an external port **208** can be used for receiving power that can be applied to the power source **206** and/or be used to power the processor **202** and other components. A linear voltage regulator (not shown) can be used between both the power source **206**/external port **208** and the processor **202**. An example of such a voltage regulator is manufactured by Texas Instruments (TI) model number TPS73633. In one implementation, the external port **208** can be configured to receive universal serial bus (USB) port plugs through which power can be applied and/or data can be communicated. However, other commercially-known ports are known and can be implemented.

[0035] The accelerometer **210** can be communicatively linked to the processor **202** such that the accelerometer **210** sends the processor **202** output or data and receives from the processor **202** operating instructions. As the enhanced vehicle key fob **58** moves, the accelerometer **210** can create precise data reflecting this movement and output the data in a form readable by the processor **202**. The output received by the processor **202** and the instructions sent to the accelerometer **210** can be communicated using a serial peripheral interface (SPI) bus. Any one of a number of commercially-available three-axes linear accelerometers can be used, such as an LIS3DH model manufactured by STMicroelectronics. The accelerometer **210** can also include a gyroscope for measuring angular movement. In one implementation, the gyroscope is included with the accelerometer **210**. However, it should be appreciated that the accelerometer can be a stand-alone component. For purposes of the description herein, the data generated by the accelerometer **210** can also be viewed as including an angular component generated by a gyroscope.

[0036] The vibrating electric motor **212** can be directed by the processor **202** to provide haptic feedback to a user who carries the enhanced vehicle key fob **58**. In one example, the vibrating electric motor **212** can communicate with the processor **202** via a single serial-ended bus, such as an inter-integrated circuit (I^2C) bus. And the vibrating electric motor can be implemented using a Texas Instruments TI DRV2605 haptic driver.

[0037] The enhanced vehicle key fob **58** can also include one or more sensors **214** in addition to the accelerometer **210** that can provide information gathered at the key fob **58** to the processor **202**. Examples of these sensors **214** include temperature sensors, pulse-rate sensors, and light sensors, to name a few. Like the accelerometer **202**, the sensors **214** can pass information/data to the processor **202** using an SPI bus.

[0038] The elements above are protectively housed by the enclosure **216** that carries a plurality of switches **218** for controlling vehicle functions. The enclosure **216** serves to protect the components of the enhanced vehicle key fob **58** described above and can be configured into a variety of shapes using materials such as plastic, metal, and glass. In one embodiment, the size of the enclosure is less than 40 millimeters (mm) long by 40 mm wide. The switches **218** can be located on an exterior surface of the enclosure **216** so that they can be actuated by the user carrying the enhanced vehicle key fob **58**. In that sense, the switches **218** can be momentary switches that are actuated by pressing an exterior surface of the enclosure **216**. Or in another example, the enclosure **216** can include a plurality of apertures through which switches **218** can pass in a way that the switches **218** are in communication with the processor **202** within the enclosure **216** but also accessible by a user from the outside of the enclosure **216**. It should also be appreciated that other types of switches are possible, such as toggle-type switches or switches that are virtually shown on a display, such as one made from liquid crystals (e.g., an LCD).

Methods of Using the Enhanced Vehicle Key Fob—

[0039] Turning now to FIG. **3**, there is shown a method **300** of controlling a vehicle function with the enhanced vehicle key fob **58**. The method **300** begins at step **310** by defining a bodily motion the execution of which is both detectable by the accelerometer **210** and causes a status change in a vehicle function. The associated bodily motion can then be associated with one or more vehicle functions. A wide variety of vehicle functions can be associated with bodily motion. Examples of vehicle functions include, locking/unlocking vehicle doors, opening trunk lids, activating exterior illumination, activating vehicle alarms, causing the vehicle honk its horn, activating/deactivating Wi-Fi hotspots at the vehicle **12**, opening/closing windows, or other similar actions carried out using the vehicle **12**.

[0040] A user can move the enhanced vehicle key fob **58** in a particular pattern, the key fob **58** can detect this movement, and one or more vehicle functions can be controlled in response to the movement. For example, the enhanced vehicle key fob **58** can be programmed to detect output from the accelerometer **210** that reflects a pattern of user movement, such as the user moving the key fob **58** two times in an up-and-down motion. The two times up-and-down movement can be identified as a defined bodily motion. Then, the up-and-down motion executed two times (i.e., the defined bodily motion) can then be associated with locking and unlocking the doors (i.e., the vehicle function). As a result, if a user of the enhanced vehicle key fob **58** wants to unlock the door of the vehicle **12**, the user can execute the defined bodily motion (e.g., two up-and-down motions).

[0041] The defined bodily motions can be detected by the enhanced vehicle key fob **58** not only when they are carried out using a user's hand/arm combination to execute the motion but also a motion of the user's leg while the key fob **58** is located in his/or her pocket. In that case, the user could stomp his or her foot twice to execute the two up-and-down motions that would be recognized by the enhanced vehicle key fob **58**. While this example is described with respect to an up-and-down movement that is done twice, the movement shape as well as the number of times the movement is carried out are highly customizable and many different combinations can be used in order to differentiate one defined bodily motion from another. For instance, the defined bodily motion can be circular rather than up-and-down and could be completed less frequently (e.g., once) or more frequently (e.g., three times). In another example, the defined bodily motion can include raising one hand with the enhanced vehicle key fob **58** held high causing the panic alarm to trigger. And in another example, a horizontal sweep of the hand from the right side to the left (or vice versa) can cause the car horn to trigger in a non-panic mode to alert the driver of the location of the car in a parking building for instance.

[0042] Using the different defined bodily motions, one vehicle function can be assigned to one defined bodily motion, such as the two up-and-down motions to unlock doors while another vehicle function can be attributed to a second defined bodily motion, such as using three up-and-down motions to open the trunk lid. As can be appreciated from this description, many different combinations of movement and vehicle functions are possible. It is also possible to incorporate multiple vehicle functions with one defined bodily motion. For instance, the two up-and-down motions can be associated not only with unlocking the doors of the vehicle **12** but also illuminating exterior vehicle lights as well. In that way, two different vehicle functions can be controlled with one bodily motion. The method **300** proceeds to step **320**.

[0043] At step **320**, one of the defined bodily motions is detected at the vehicle key fob **58** using the accelerometer **210**. Once one or more defined bodily motions have been established along with the vehicle functions that those motions will govern, the enhanced vehicle key fob **58** can monitor the movement of the key fob **58**. The processor **202** and/or memory device **204** can store a plurality of movement ranges for each defined bodily motion that, when detected, indicate with a reasonable certainty that the user is executing a particular defined bodily motion. The microprocessor **202** can initiate a period of monitoring the enhanced vehicle key fob **58** when the key fob **58** becomes relatively motionless. For instance, a user can hold the enhanced vehicle key fob **58** steadily in a hand for a moment and this relative non-movement can signal the processor **202** to begin monitoring movement of the key fob **58** and comparing that motion with defined bodily motions. The microprocessor **202** can end the period of monitoring when the enhanced vehicle key fob **58** is motionless again and/or begin a new period of monitoring. The method **300** proceeds to step **330**.

[0044] At step **330**, the vehicle function associated with the detected bodily motion is detected and controlled by the enhanced vehicle key fob **58**. When the motion output from the accelerometer **210** is determined by the microprocessor **202** to fall within the movement ranges that identify a defined bodily motion, the microprocessor **202** can identify the defined bodily motion, access the one or more vehicle functions that are associated with the motion, and then control the vehicle function(s). Using the example discussed above, a user can grasp the enhanced vehicle key fob **58** holding it motionless for a moment, execute two up-and-down movements holding the key fob **58**, and the key fob **58** can determine that the user movement falls within the movement ranges that define the two up-and-down movements. The microprocessor **202** can then determine that a vehicle door unlock function is associated with the detected movement and wirelessly send a command signal from the enhanced vehicle key fob **58** to the vehicle **12** commanding the vehicle telematics unit **30** to unlock the vehicle doors. Once the vehicle function (in this example, door unlocking) has been accomplished, the enhanced vehicle key fob **58** can confirm that the function has been controlled (e.g., the doors are now unlocked) by generating haptic feedback. The haptic feedback can be created by activating the vibrating electric motor **212**. The method **300** then ends.

[0045] Turning to FIG. **4**, another method **400** of using the enhanced vehicle key fob **58** is shown. The method **400** can authenticate a user of the enhanced vehicle key fob **58** and begins at step **410** by measuring movement by a user carrying the enhanced vehicle key fob **58** using the accelerometer **210** included with the vehicle key fob **58**. As people walk, they move forward using a gait that can be as unique as a person's fingerprint. That is, each person has limbs, indeed bones that comprise limbs, of differing lengths and shapes. In addition, the muscles used to actuate these limbs are of different sizes and length and are attached to the bones at different points for each person. The unique limb/bone/muscle architecture creates a unique motion for each person when they walk and that individuality can be interpreted from output by the accelerometer **210**. It is also possible to differentiate between male movements and female movements by calculating movement of the enhanced vehicle key fob **58** being located in a pocket versus a purse. In one example, a user of the enhanced vehicle key fob **58** can walk for a period of time and the accelerometer **210** can detect a defined range of up and down movement over a period of time and this detected movement can be quantified as a maximum y-axis movement, a minimum y-axis movement, as well as a time period between which the processor **202** outputs maximum y-axis measurements. In this example, the measurements are described solely in terms of time and y-axis measurements however, the method **400** can be modified so that x-axis measurements are measured with y-axis measurements or x, y, and z-axis measurement generated by the accelerometer **210** can be monitored. Generally speaking, any sub-combination of x-, y-, and z-axis measurements can be monitored. The method **400** proceeds to step **420**.

[0046] At step **420**, the measured movement of the user can be recorded at the enhanced vehicle key fob **58** and one or more periodic attributes of the recorded movement are determined. When a user or vehicle owner carries or wears the enhanced vehicle key fob **58**, it can learn the unique periodic movements of the owner. The enhanced vehicle key fob **58** can monitor these unique movements over a period of time and record them at the key fob **58** using memory device **204**. For instance, the enhanced vehicle key fob **58** can be initiated by the user to begin monitoring motion over a period of time. Using one of the switches **218**, the user can initiate a learning period (e.g., 24 hours) and over this period the enhanced vehicle key fob **58** can record the output from the accelerometer **210**. This recording of movement can include minimums and maximums along the x-, y-, or z-axes as well as time periods between these maximums and minimums. The recorded movement can be used to control access to the vehicle **12** and/or can be used to control vehicle function settings on the vehicle **12**. For example, the recorded movement can be used to identify the user and a number of personalized settings, such as HVAC levels, seating positions, etc. It should also be appreciated that the enhanced vehicle key fob **58** can include the capability to remember the movement of more than one user and differentiate between these users. Once the unique movements have been established and the learning period has passed, the user or vehicle owner can lock the enhanced vehicle key fob **58** in various ways, such as by pressing the switches **218** in a user-defined sequence or by creating a password that is communicated to the key fob **58** wirelessly or via the external port **208**. The method **400** proceeds to step **430**.

[0047] At step **430**, movement by a different user is measured using the accelerometer **210**. The movement by the different user is compared to the periodic attributes of the recorded movement. Sometimes people other than the vehicle owner may use the enhanced vehicle key fob **58**. These people could be valet workers or other family members, for instance. When these people use the enhanced vehicle key fob **58**, it can be used to maintain or alter control of vehicle functions. In one example, after the learning period has expired and the enhanced vehicle key fob **58** has stored the recorded movement of one or more users, the key fob **58** can monitor movement over a second period of time, which can be initiated in response to the key fob **58** remaining motionless for some period (e.g., 30 minutes). When the enhanced vehicle key fob **58** begins detecting movement again, it can compare the minimum and maximum x-, y-, or z-axis movements and periods between the minimums and maximums with those recorded during the learning period and representing the stored users. The method **400** proceeds to step **440**.

[0048] At step **440**, access to one or more vehicle functions is denied when the movement by the different user is beyond a predefined threshold of the periodic attributes. When the movements measured during the learning period for stored users do not match those detected during movement afterward, the enhanced vehicle key fob **58** can be programmed to block access to the vehicle **12**. In one example, the enhanced vehicle key fob **58** can block, deny access, or ask for additional security checks (such as a PIN or mechanical key) before access to the vehicle **12** when the movements do not match or are not within a predetermined threshold of each other. However, it is also possible to determine that the movements match a user different from the vehicle owner, such as a family member, and the enhanced vehicle key fob **58** can then wirelessly alter the settings of one or more vehicle functions in response to detecting the family member's use of the key fob **58**. For example, the enhanced vehicle key fob **58** can wirelessly command the vehicle **12** through the vehicle telematics unit **30** to change seat positions, radio station presets, or temperature settings. The method **400** then ends.

[0049] Turning to FIG. **5**, another method **500** of using the enhanced vehicle key fob **58** is shown. The method **500** uses the accelerometer **210** of the enhanced vehicle key fob **58** to detect vehicle key loss. The method **500** begins at step **510** by detecting an increase in acceleration at the enhanced vehicle key fob **58** using the accelerometer **210** that is determined to be above a first threshold. When something is dropped, it begins to fall until it hits the ground. For example, if someone drops the enhanced vehicle key fob **58**, it will move from a substantially-motionless state and then accelerate sharply as the key fob begins to free fall. The processor **202** can receive output from the accelerometer **210** measuring motion in the y-axis and be programmed to calculate the rate of change of y-axis motion. When the rate of change or the second derivative of y-axis motion output from the accelerometer **210** rises above a threshold, the processor **202** can determine that an increase in acceleration has occurred. The method **500** proceeds to step **510**.

[0050] At step **520**, a decrease in acceleration at the enhanced vehicle key fob **58** is detected using the accelerometer **210** and determined to be above a second threshold. A short time after the enhanced vehicle key fob **58** begins its fall it may also abruptly stop falling when it hits the ground. This motion can be detected using the accelerometer **210** and the processor **202** as a sharp decrease in acceleration. Using techniques similar to those discussed above with respect to step **510**, the processor **202** can monitor y-axis movement using the accelerometer and determine movement reflective of the enhanced vehicle key fob **58** reaching the bottom of its fall on the floor. The method **500** proceeds to step **530**.

[0051] At step **530**, it is determined whether the increase and decrease in acceleration occurred both within a predefined amount of time. Increases and decreases in acceleration occurring as a result of dropping the enhanced vehicle key fob **58** occur within a short time of each other (e.g., <1 second). Thus, an isolated but sharp increase or decrease in acceleration of the enhanced vehicle key fob **58** alone may not be indicative of the key fob **58** falling. Instead, such isolated increased or decreases in acceleration could result from air travel or other motion. Thus, determining whether the combination of increase and decrease in acceleration within a predetermined time period can provide assurance that the enhanced vehicle key fob **58** indeed did fall rather that detect some other motion. If the enhanced vehicle key fob **58** detects motion meeting the thresholds for an increase in acceleration and a decrease in acceleration, as well as detecting this motion with the predetermined time interval, the key fob **58** can activate an alert that informs a user that the key fob **58** has been lost. This alert can be an audible noise, a visual flashing if the enhanced vehicle key fob **58** include a display, or both. The method **500** then ends.

[0052] Turning to FIG. **6**, another method **600** of using the enhanced vehicle key fob **58** is shown. The method **600** locally monitors human vital signs of an enhanced vehicle key fob user. The method **600** begins by establishing a human vital sign threshold and associating the human vital sign threshold with a vehicle function. Depending on the variety and number of sensors **214** included with the enhanced vehicle key fob **58**, a number of human vital signs of the enhanced vehicle key fob user can be monitored. Human vital signs include body temperature, pulse rate, blood pressure, or other such measurable body metric. And thresholds can be established for each human vital sign of each enhanced vehicle key fob user. For example, the enhanced vehicle key fob **58** can include a sensor **214** that measures temperature of the enhanced vehicle key fob user and provides that information to the processor **202** of the enhanced vehicle key fob **58**. A healthy temperature of the human body is 98.6° Fahrenheit (F). Upper and lower thresholds above and below 98.6° F. can be established that indicate that the enhanced vehicle key fob user is warmer or colder than ideal or normal. Similarly, ideal values of pulse rate, blood pressure, or other human vital signs can be determined and then upper and lower thresholds can then be established that surround those ideals. The upper and lower thresholds can each be viewed as a human vital sign threshold. In addition, a vehicle function that is related to the human vital sign can also be associated with that vital sign. For instance, using body temperature as an example of the monitored human vital sign, the vehicle HVAC system can be a vehicle function that is associated with that human vital sign. In this case, the enhanced vehicle key fob **58** can detect the temperature of the human body and if it is above/below ideal, the HVAC system can be controlled to increase or decrease its temperature. Or in another example, when the enhanced vehicle key fob user's heart rate is the human vital sign being measured, then the vehicle function can be the HVAC system control and/or control of the interior lighting levels. When the user's heart rate is below and ideal value, the HVAC system can be directed to lower the temperature in the vehicle **12** and also increase the amount of light provided by an instrument panel in an effort to increase the heart rate. The method **600** proceeds to step **620**.

[0053] At step **620**, one or more human vital signs are measured using the enhanced vehicle key fob **58** and compared with the established human vital sign threshold. The enhanced vehicle key fob **58** can store the upper and lower thresholds surrounding the ideal value for one or more human vital signs and compare the monitored human vital signs with these thresholds. For instance, the enhanced vehicle key fob **58** can monitor the body temperature of the enhanced vehicle key fob user using a sensor **214** that sends data to the processor **202**. The processor **202** can then compare the sensor output to the upper and lower thresholds to determine whether or not the output exceeds those thresholds. The method **600** then proceeds to step **630**.

[0054] At step **630**, the vehicle function associated with the human vital sign threshold is controlled when the measured human vital sign exceeds the established human vital sign threshold. When the processor **202** determines that the monitored human vital sign is outside of either the upper or lower threshold, the processor **202** can access instructions for controlling a vehicle function associated with the monitored human vital sign. Using body temperature as an example, the sensor **214** can begin sending output to the processor **202** that falls outside of either the upper or lower threshold. When the monitored body temperature is above the upper threshold, then the processor **202** can generate a command to increase the cooling mechanism of the vehicle **12** and wirelessly transmit that command to the vehicle telematics unit **30** via a short-range wireless communication link. The vehicle **12** can receive this command and respond by controlling the vehicle HVAC system. Similarly, if the monitored body temperature is below the lower threshold, then the processor **202** can generate a command to increase the heating mechanism of the vehicle **12** and wirelessly transmit that command to the vehicle telematics unit **30** via a short-range wireless communication link. In another implementation, the enhanced vehicle key fob **58** can be wirelessly paired with the smartphone **57** and can transmit the monitored human vital sign(s) to a central facility, such as computer **18** or call center **20**. For example, the human vital signs can be continually monitored during and after an accident and wirelessly transmitted to first responders using the vehicle telematics unit **30** or through the smartphone **57** by using the Bluetooth LE connection between the smartphone **57** and the enhanced vehicle key fob **58**. The method **600** then ends.

[0055] Turning to FIG. **7**, yet another method **700** of using the enhanced vehicle key fob **58** is shown. The method **700** converts audio generated at the vehicle **12** into haptic information using the enhanced vehicle key fob **58** and begins at step **710** by associating information played audibly at the vehicle **12** with a haptic output that represents the information. The vehicle **12** can audibly play a number of recorded phrases or statements through a vehicle audio system **36**. Often, these statements are recorded and stored at the vehicle **12** or are otherwise known by the vehicle **12** before they are played. These phrases or statements can also be stored at the enhanced vehicle key fob **58**, which can use automatic speech recognition (ASR) techniques to detect the phrases/statements when they are played. The enhanced vehicle key fob **58** can include a microphone (not shown) to listen for the audibly played phrases/statements to occur. In addition, the enhanced vehicle key fob **58** can associate a haptic output with each phrase. For example, one of the statements that can be audibly played by the vehicle **12** is "low fuel" when fuel levels fall below a predetermined level. The enhanced vehicle key fob **58** can understand the "low fuel" message and associate with it a particular haptic output, such as three one-second vibrations that can be generated by the vibrating electric motor **212**. In addition, the vehicle **12** can include a number of safety features, such as blind-spot detection or an imminent collision alert. Each of these safety features often have audible alerts but can also be identified using a haptic output. These safety features can provide haptic output in a seat. But providing the haptic output at the enhanced vehicle key fob **58** is more effective because it is closer to the user's skin and can provide a more direct path to convey the haptic output. The method **700** proceeds to step **720**.

[0056] At step **720**, audible information played at the vehicle **12** is received at the enhanced vehicle key fob **58**, identified, and the haptic output representing the associated audible information is generated. When the vehicle **12** generates an audible message, the enhanced vehicle key fob **58** can perform ASR on the message and determine whether or not the audible message is one stored at the key fob **58** and/or associated with a particular haptic feedback. Using the "low fuel" message discussed with respect to step **710**, the enhanced vehicle key fob **58** can detect this message in the vehicle **12**, determine that the "low fuel" message has a haptic feedback of three one-second vibrations, and then direct the vibrating electric motor **212** to activate for the three one-second vibrations. The user holding or wearing the enhanced vehicle key fob **58** can then feel the vibrations and without hearing the audible low fuel message associate the vibrations with the low fuel condition of the vehicle **12**. It should be appreciated that this can also be implemented without ASR. In that case, the vehicle **12**, such as through its vehicle telematics unit **30**, can generate a short-range wireless signal each time a safety feature generates an audible alert instructing the enhanced vehicle key fob **58** to generate haptic feedback. The method **700** then ends.

[0057] It is to be understood that the foregoing is a description of one or more embodiments of the invention. The invention is not limited to the particular embodiment(s) disclosed herein, but rather is defined solely by the claims below. Furthermore, the statements contained in the foregoing description relate to particular embodiments and are not to be construed as limitations on the scope of the invention or on the definition of terms used in the claims, except where a term or phrase is expressly defined above. Various other embodiments and various changes and modifications to the disclosed embodiment(s) will become apparent to those skilled in the art. All such other embodiments, changes, and modifications are intended to come within the scope of the appended claims.

[0058] As used in this specification and claims, the terms "e.g.," "for example," "for instance," "such as," and "like," and the verbs "comprising," "having," "including," and their other verb forms, when used in conjunction with a listing of one or more components or other items, are each to be construed as open-ended, meaning that the listing is not to be considered as excluding other, additional components or items. Other terms are to be construed using their broadest reasonable meaning unless they are used in a context that requires a different interpretation.

1. A method of controlling a vehicle function with an enhanced vehicle key fob, comprising the steps of:

(a) defining a bodily motion the execution of which is both detectable by an accelerometer and causes a status change in a vehicle function;

(b) associating the bodily motion with one or more vehicle functions;

(c) detecting one of the defined bodily motions at the enhanced vehicle key fob using the accelerometer;

(d) identifying the vehicle function associated with the detected bodily motion; and

(e) controlling the vehicle function identified in step (d).

2. The method of claim **1**, further comprising the bodily motion defined as an up-and-down motion.

3. The method of claim **1**, further comprising the step of detecting that the enhanced vehicle key fob remains motionless.

4. The method of claim **1**, further comprising the step of confirming the control of the vehicle function at the enhanced vehicle key fob with a haptic response.

5. A method of authenticating a user of an enhanced vehicle key fob, comprising the steps of:

(a) measuring movement by a user carrying the enhanced vehicle key fob using an accelerometer included with the vehicle key fob;

(b) recording the measured movement of the user at the enhanced vehicle key fob;

(c) determining one or more periodic attributes of the recorded movement;

(d) measuring movement by a different user using the accelerometer;

(e) comparing the movement by the different user with the periodic attributes of the recorded movement; and

(f) controlling one or more vehicle functions when the movement by the different user is beyond a predefined threshold of the periodic attributes.

6. The method of claim **5**, further comprising the step of denying access to one or more vehicle functions when the movement by the different user is beyond a predefined threshold of the periodic attributes.

7. The method of claim **5**, further comprising the step of requiring additional security checks for vehicle access.

8. The method of claim **5**, further comprising the step of measuring movement using a gyroscope.

9. The method of claim **5**, further comprising the step of measuring a maximum or a minimum of x-, y-, or z-axis movement and a time period between successive maximums or minimums.

10. The method of claim **5**, wherein steps (a) and (b) are carried out during a learning period.

11. The method of claim **5**, wherein the movement is measured using an accelerometer included with the enhanced vehicle key fob.

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