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(54) **PROVIDING A USER INTERFACE EXPERIENCE BASED ON INFERRED VEHICLE STATE**

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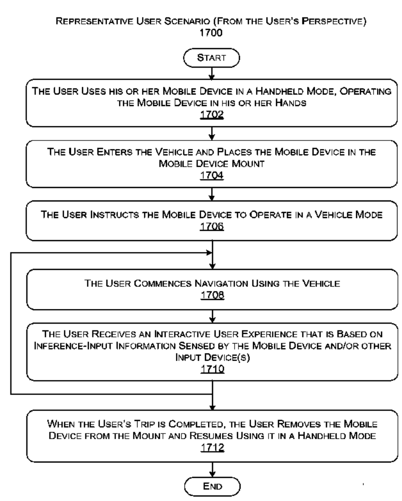
(57) **ABSTRACT**

A mobile device is described herein that provides a user interface experience to a user who is operating the mobile device within a vehicle. The mobile device provides the user interface experience using mode functionality. The mode functionality operates by receiving inference-input information from one or more input sources. At least one input source corresponds to at least one movement-sensing device, provided by the mobile device, that determines movement of the mobile device. The mode functionality then infers a state of the vehicle based on the inference-input information and presents a user interface experience that is appropriate for the vehicle state. In one scenario, the mode functionality can also infer that the vehicle is in a distress condition. In response, the mode functionality can solicit assistance for the user.

20 Claims, 17 Drawing Sheets



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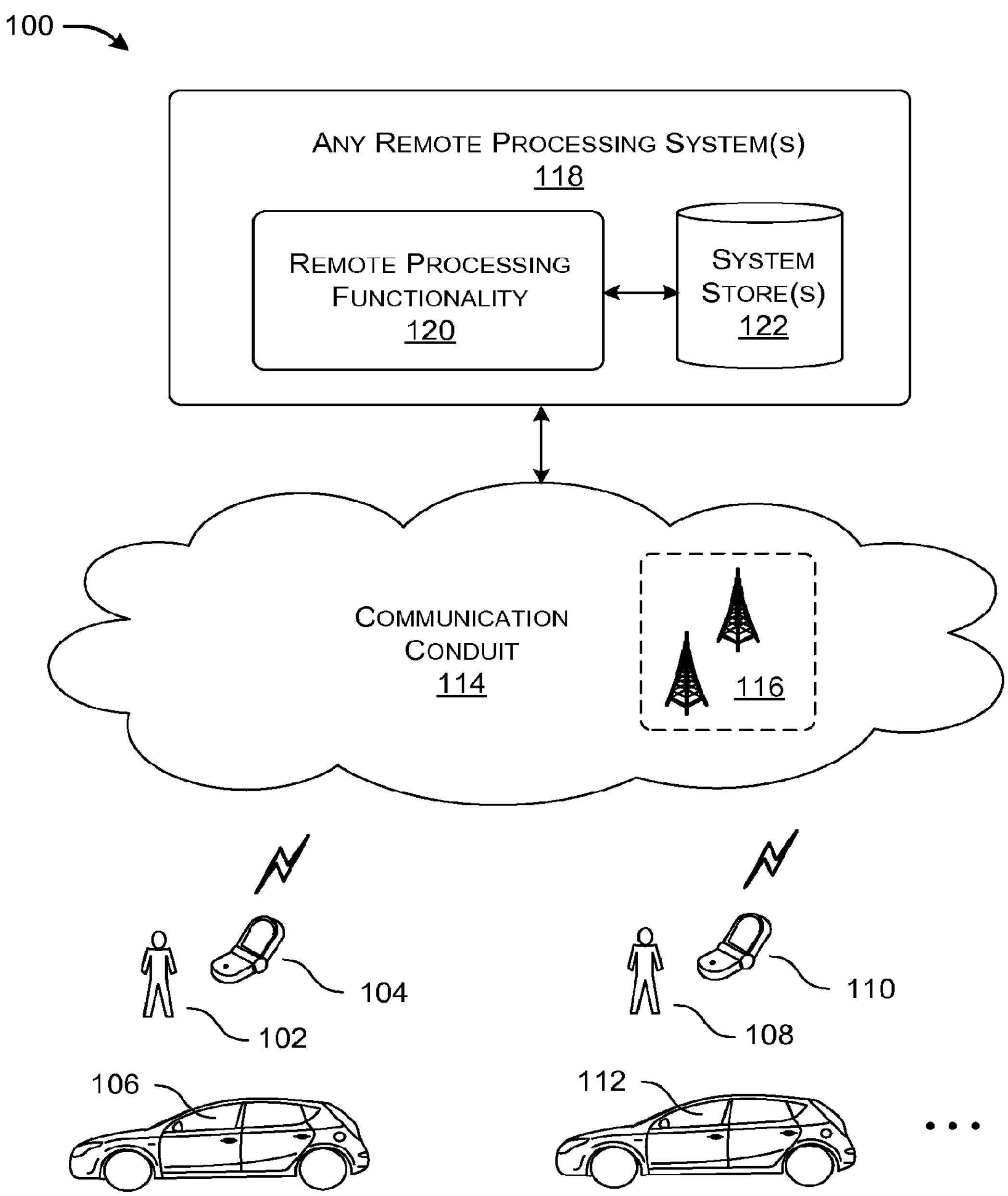
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FIG. 1

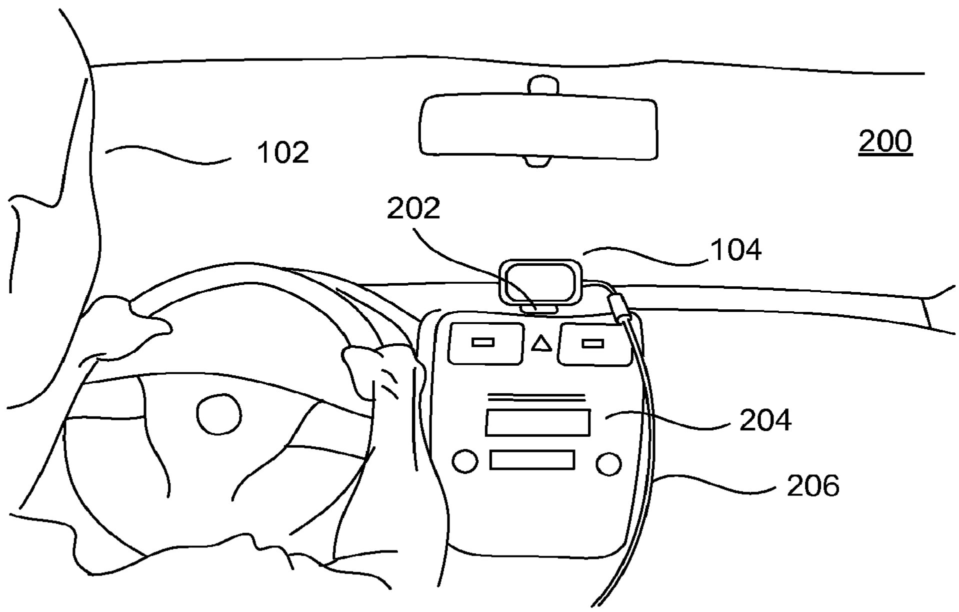
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FIG. 2

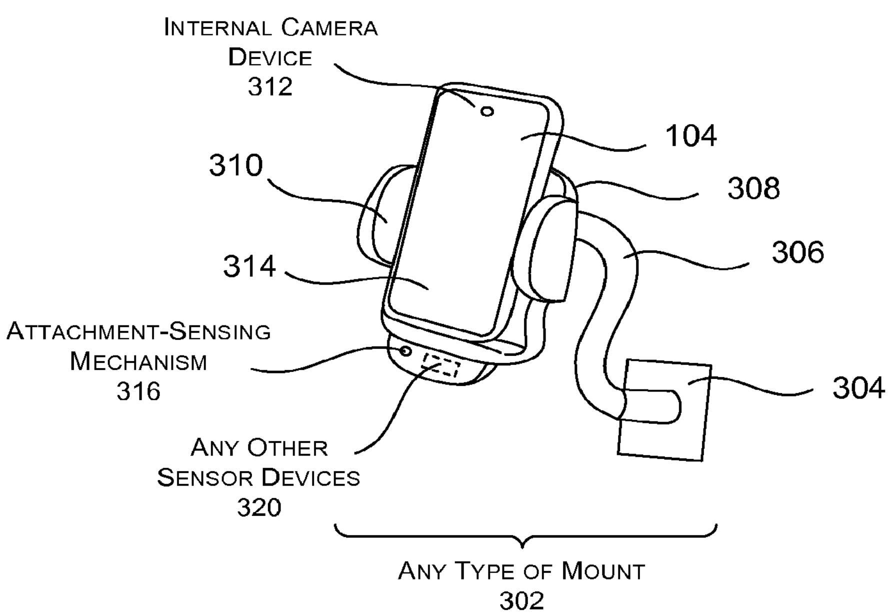
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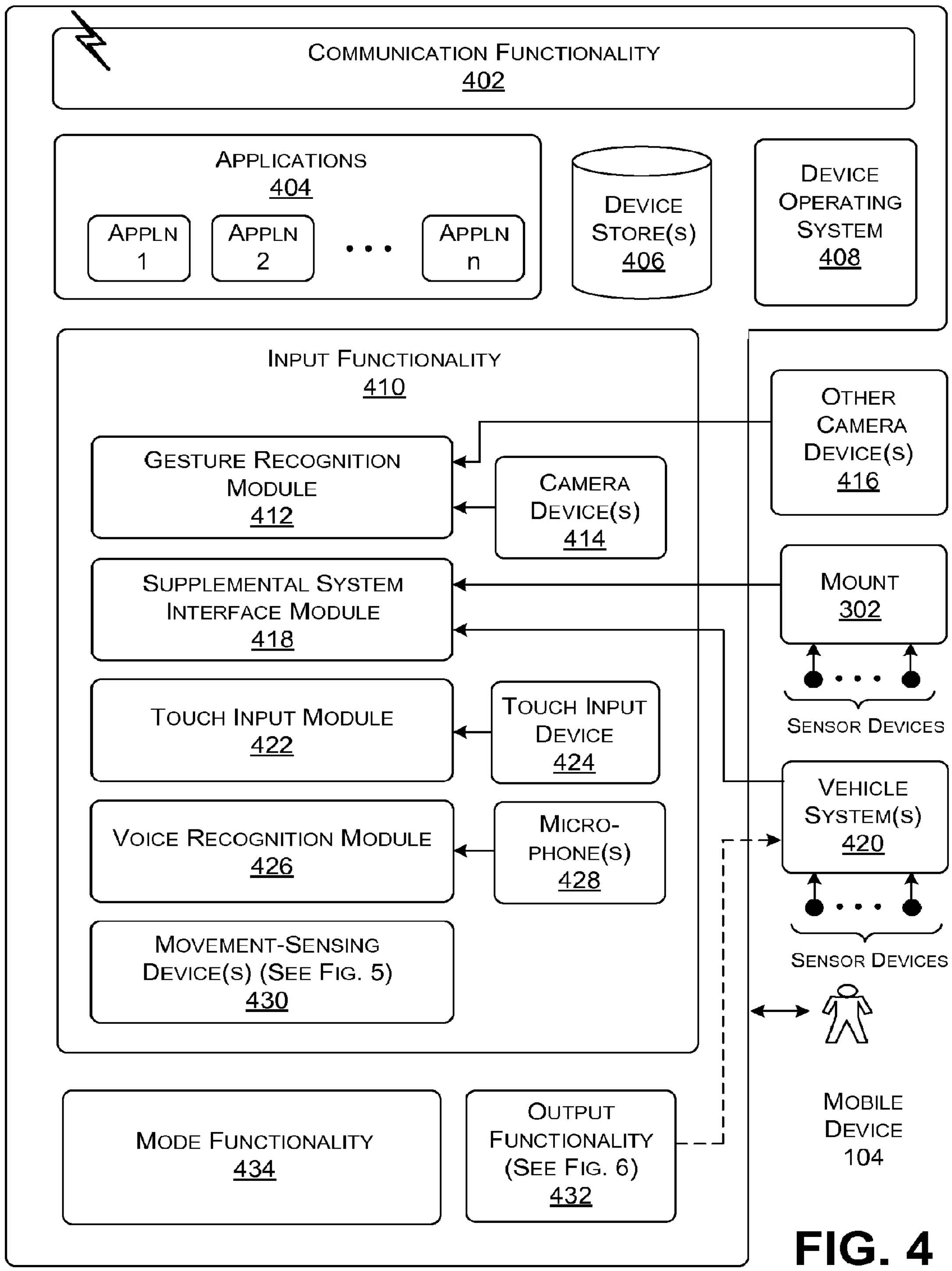
FIG. 3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CAMERA DEVICE(S)
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OTHER CAMERA DEVICE(S)
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SUPPLEMENTAL SYSTEM INTERFACE MODULE
418
MOUNT
302
SENSOR DEVICES
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TOUCH INPUT DEVICE
424
VEHICLE SYSTEM(S)
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VOICE RECOGNITION MODULE
426
MICRO-PHONE(S)
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SENSOR DEVICES
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FIG. 4

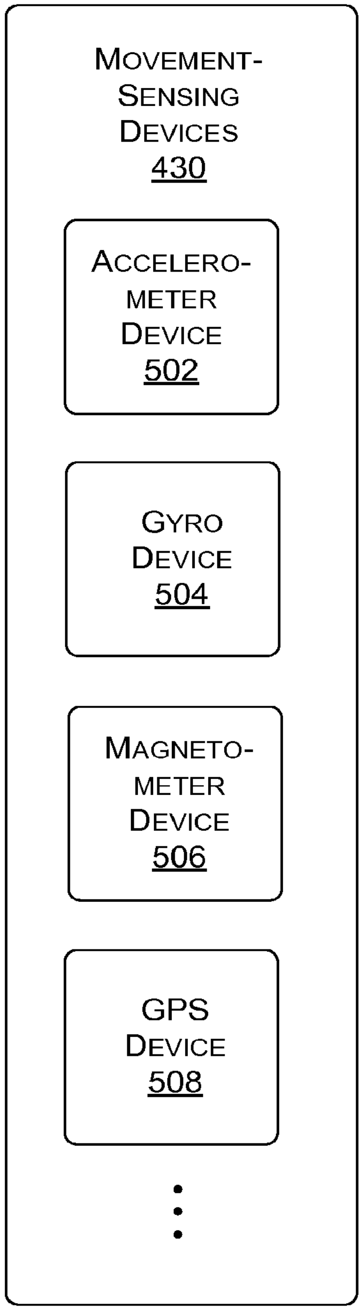
MOVEMENT-SENSING DEVICES 430
ACCELERO-METER DEVICE 502
GYRO DEVICE 504
MAGNETO-METER DEVICE 506
GPS DEVICE 508

FIG. 5

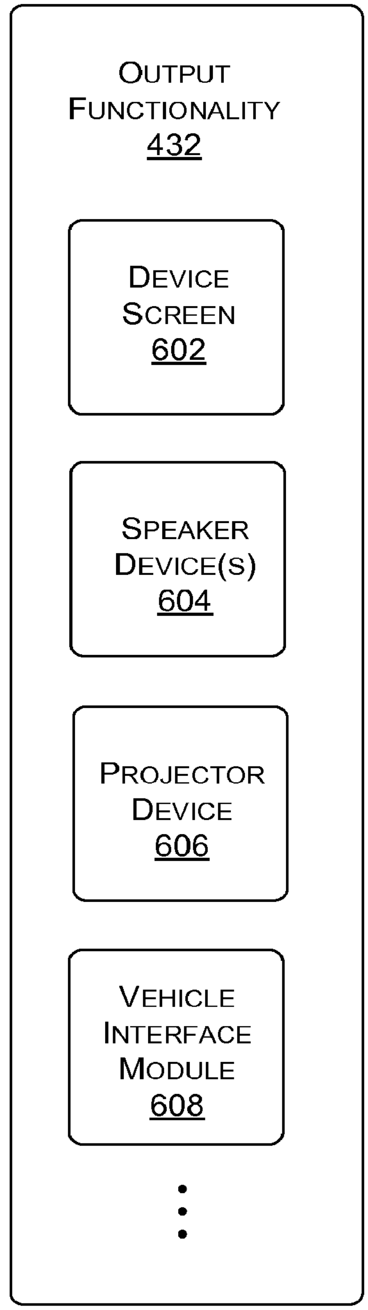
OUTPUT FUNCTIONALITY 432
DEVICE SCREEN 602
SPEAKER DEVICE(S) 604
PROJECTOR DEVICE 606
VEHICLE INTERFACE MODULE 608

FIG. 6

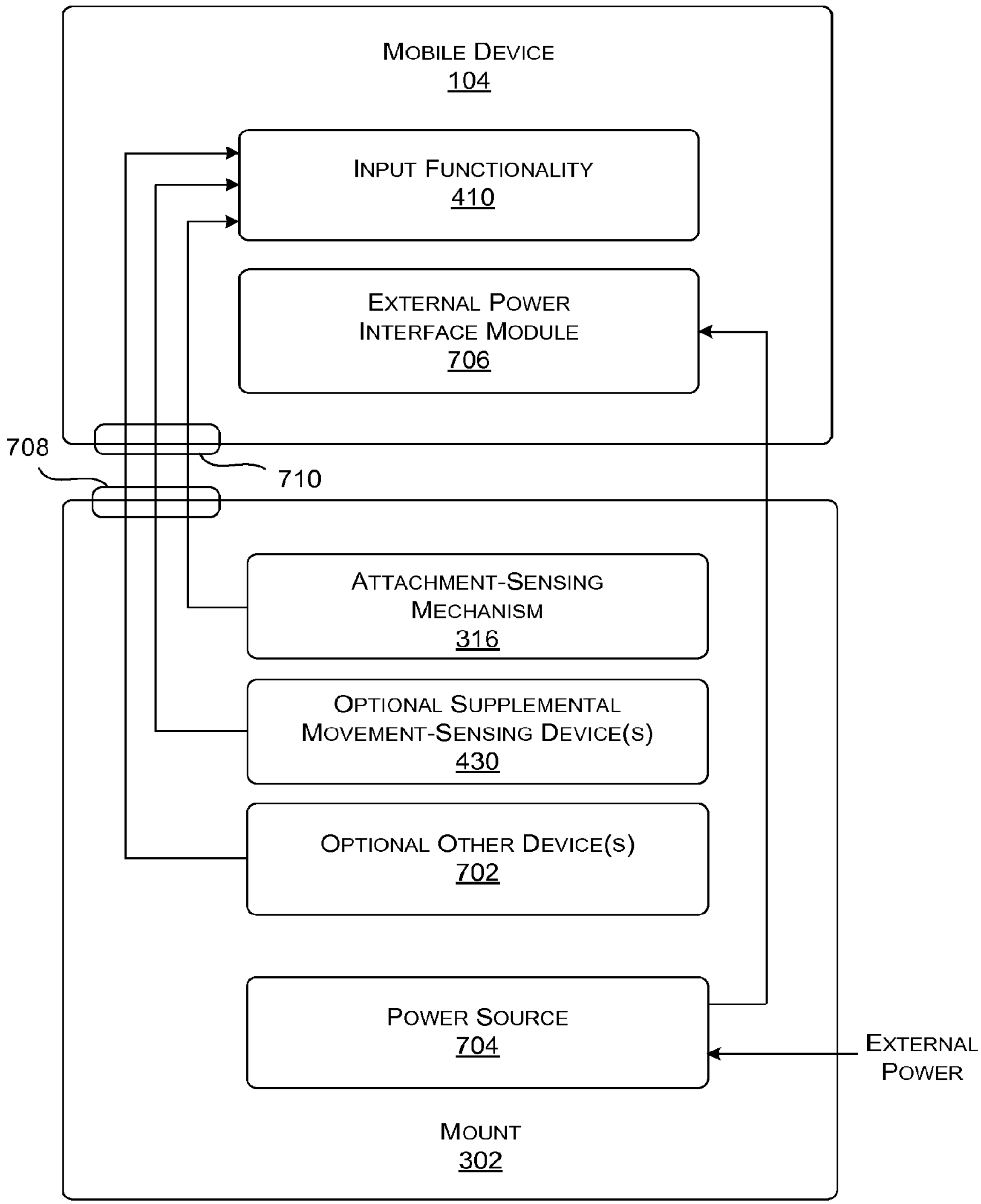
MOBILE DEVICE
104
INPUT FUNCTIONALITY
410
EXTERNAL POWER
INTERFACE MODULE
706
708
710
ATTACHMENT-SENSING
MECHANISM
316
OPTIONAL SUPPLEMENTAL
MOVEMENT-SENSING DEVICE(S)
430
OPTIONAL OTHER DEVICE(S)
702
POWER SOURCE
704
EXTERNAL
POWER
MOUNT
302

FIG. 7

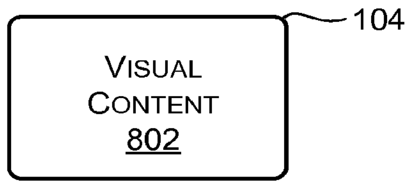

FIG. 8

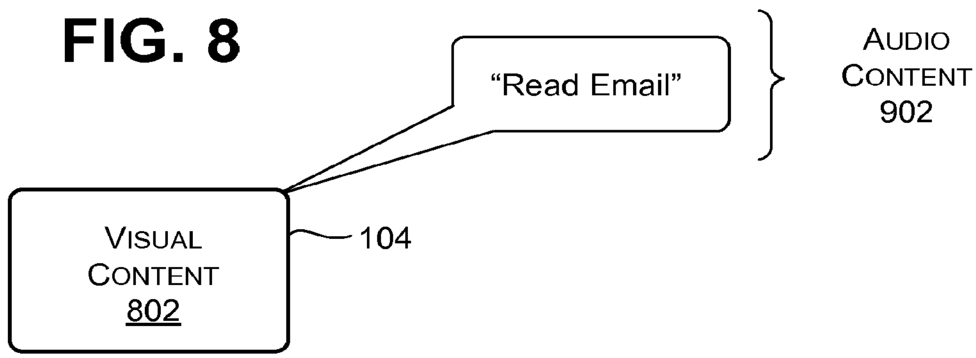

FIG. 9

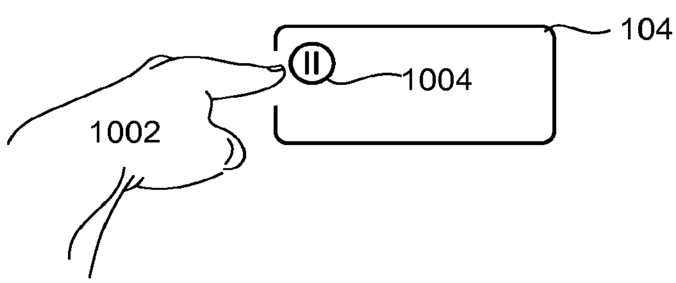

FIG. 10

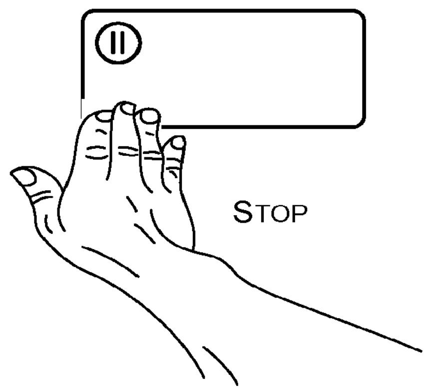

FIG. 11

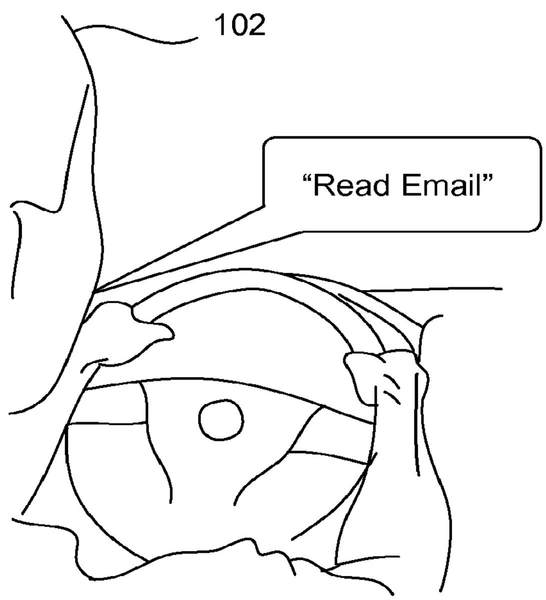

FIG. 12

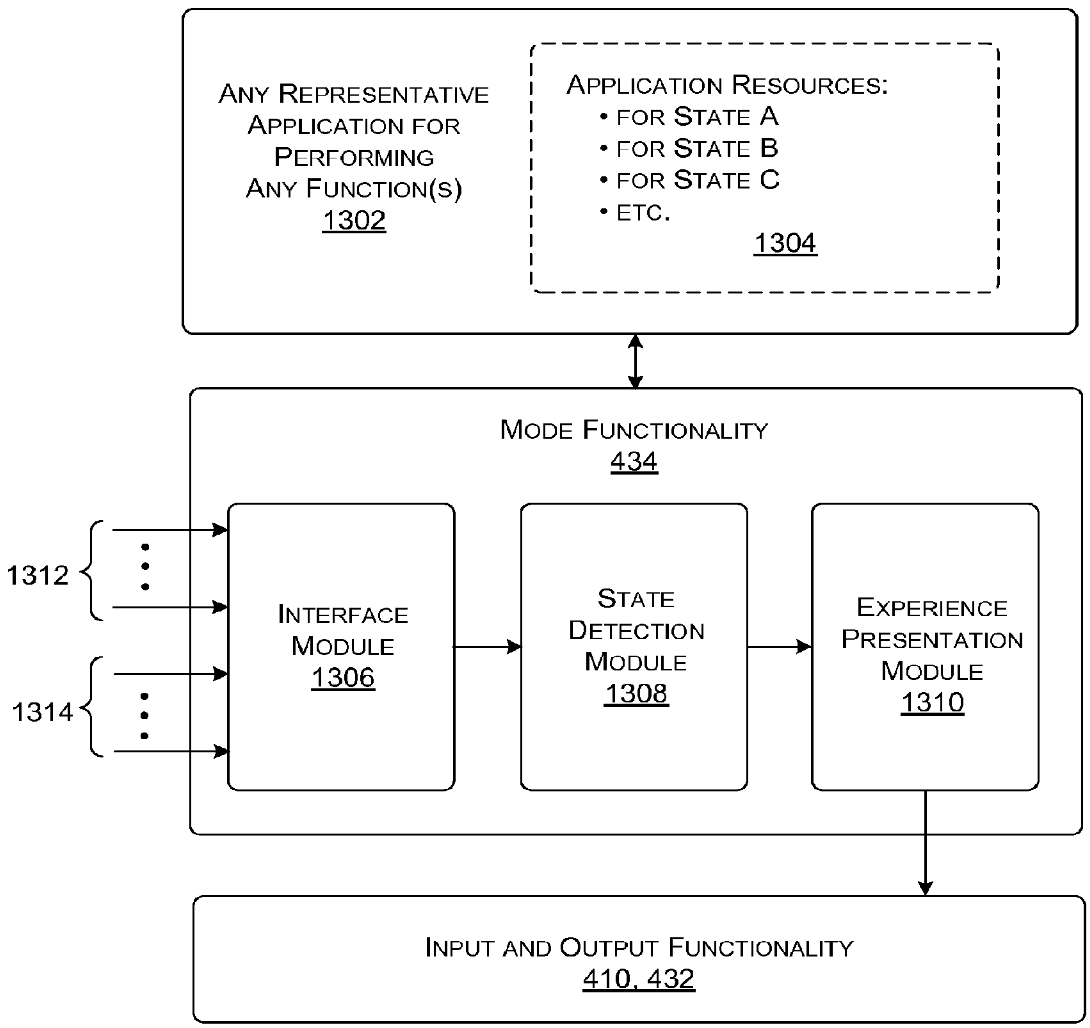
Any Representative Application for Performing Any Function(s) 1302
Application Resources:
• for State A
• for State B
• for State C
• etc.
1304
Mode Functionality 434
1312
1314
Interface Module 1306
State Detection Module 1308
Experience Presentation Module 1310
Input and Output Functionality 410, 432

FIG. 13

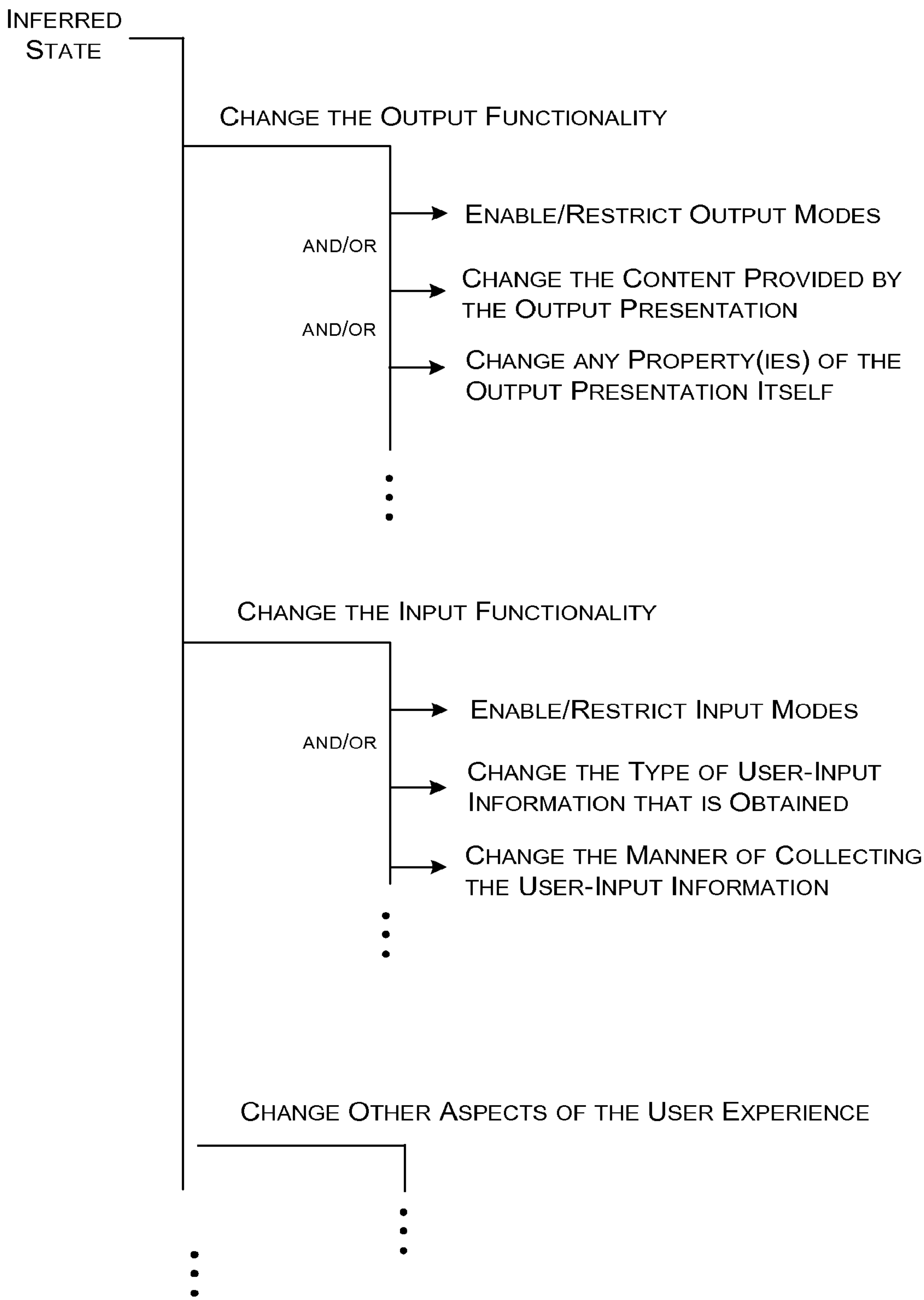
INFERRED STATE
CHANGE THE OUTPUT FUNCTIONALITY
ENABLE/RESTRICT OUTPUT MODES
AND/OR
CHANGE THE CONTENT PROVIDED BY THE OUTPUT PRESENTATION
AND/OR
CHANGE ANY PROPERTY(IES) OF THE OUTPUT PRESENTATION ITSELF
CHANGE THE INPUT FUNCTIONALITY
ENABLE/RESTRICT INPUT MODES
AND/OR
CHANGE THE TYPE OF USER-INPUT INFORMATION THAT IS OBTAINED
CHANGE THE MANNER OF COLLECTING THE USER-INPUT INFORMATION
CHANGE OTHER ASPECTS OF THE USER EXPERIENCE

FIG. 14

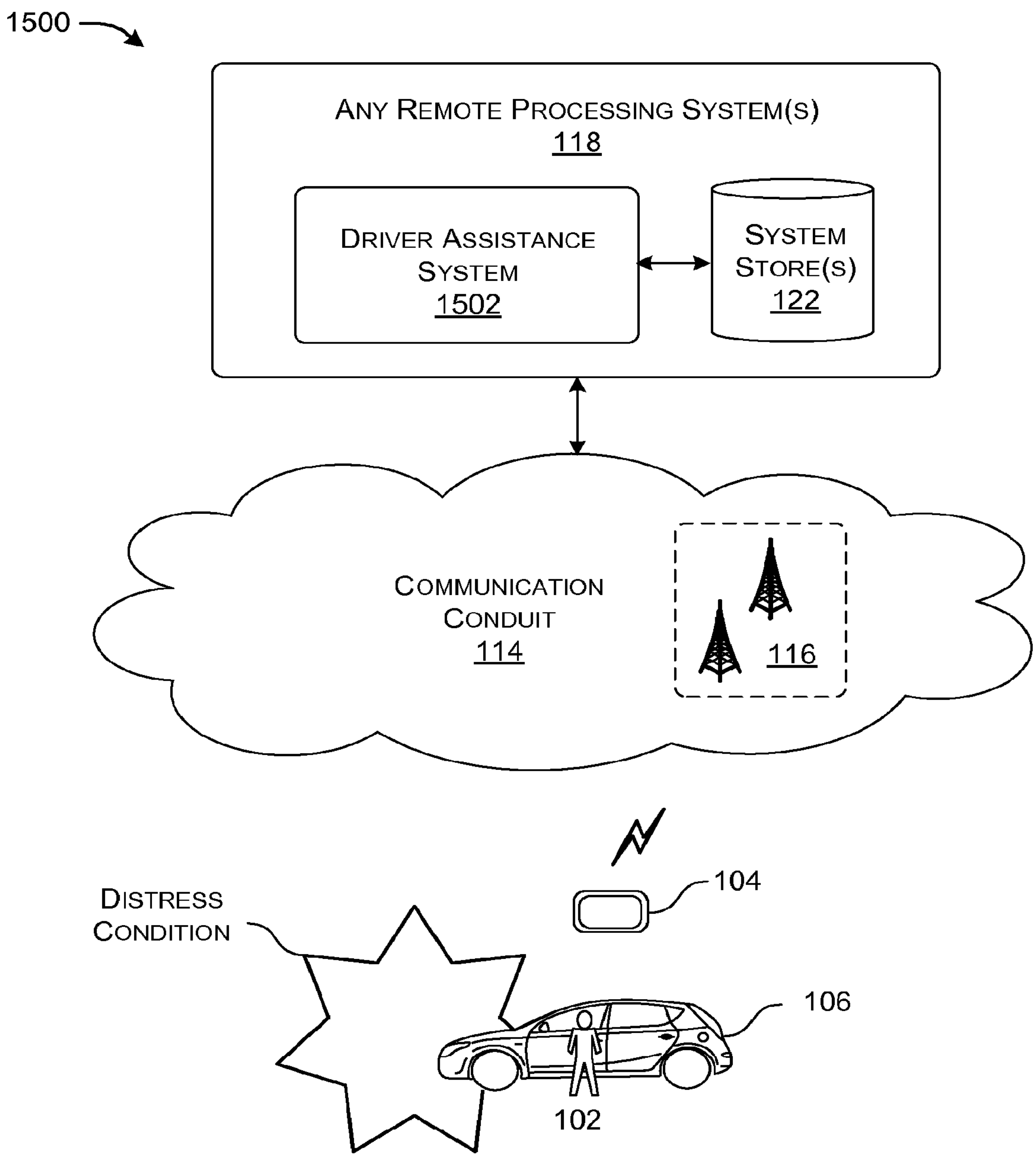
1500
Any Remote Processing System(s)
118
Driver Assistance System
1502
System Store(s)
122
Communication Conduit
114
116
104
Distress Condition
106
102

FIG. 15

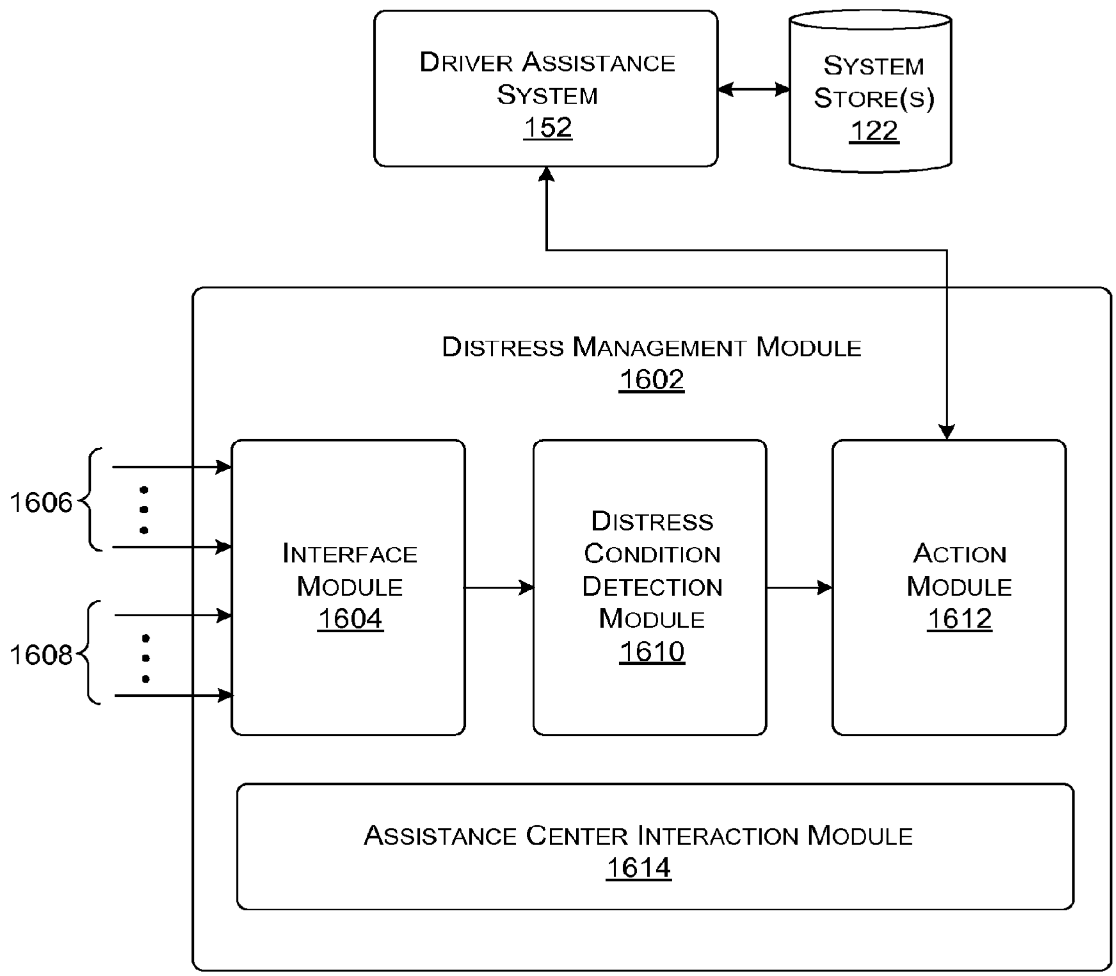
DRIVER ASSISTANCE SYSTEM 152
SYSTEM STORE(S) 122
DISTRESS MANAGEMENT MODULE 1602
1606
1608
INTERFACE MODULE 1604
DISTRESS CONDITION DETECTION MODULE 1610
ACTION MODULE 1612
ASSISTANCE CENTER INTERACTION MODULE 1614

FIG. 16

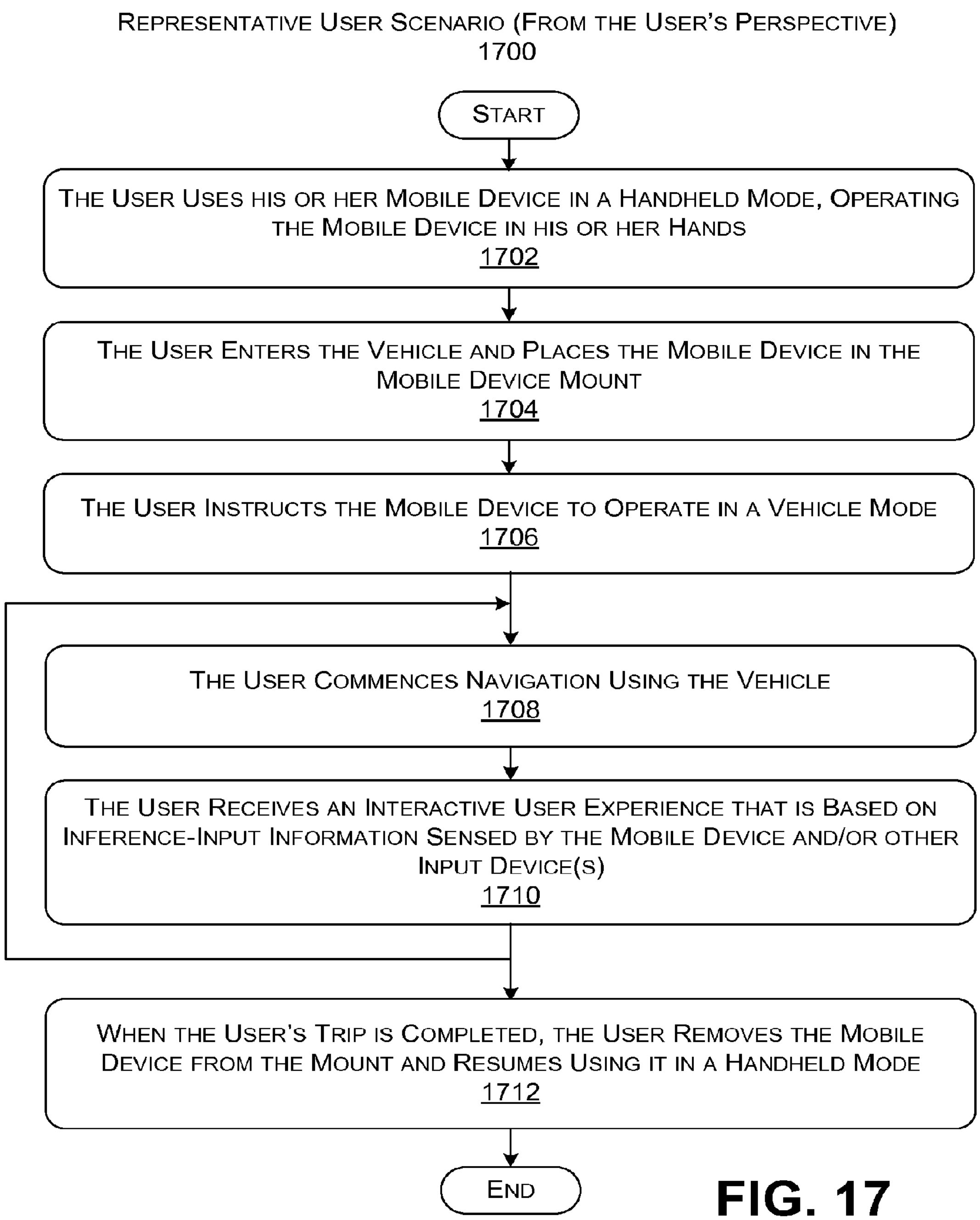
REPRESENTATIVE USER SCENARIO (FROM THE USER'S PERSPECTIVE)
1700
START
THE USER USES HIS OR HER MOBILE DEVICE IN A HANDHELD MODE, OPERATING THE MOBILE DEVICE IN HIS OR HER HANDS
1702
THE USER ENTERS THE VEHICLE AND PLACES THE MOBILE DEVICE IN THE MOBILE DEVICE MOUNT
1704
THE USER INSTRUCTS THE MOBILE DEVICE TO OPERATE IN A VEHICLE MODE
1706
THE USER COMMENCES NAVIGATION USING THE VEHICLE
1708
THE USER RECEIVES AN INTERACTIVE USER EXPERIENCE THAT IS BASED ON INFERENCE-INPUT INFORMATION SENSED BY THE MOBILE DEVICE AND/OR OTHER INPUT DEVICE(S)
1710
WHEN THE USER'S TRIP IS COMPLETED, THE USER REMOVES THE MOBILE DEVICE FROM THE MOUNT AND RESUMES USING IT IN A HANDHELD MODE
1712
END

FIG. 17

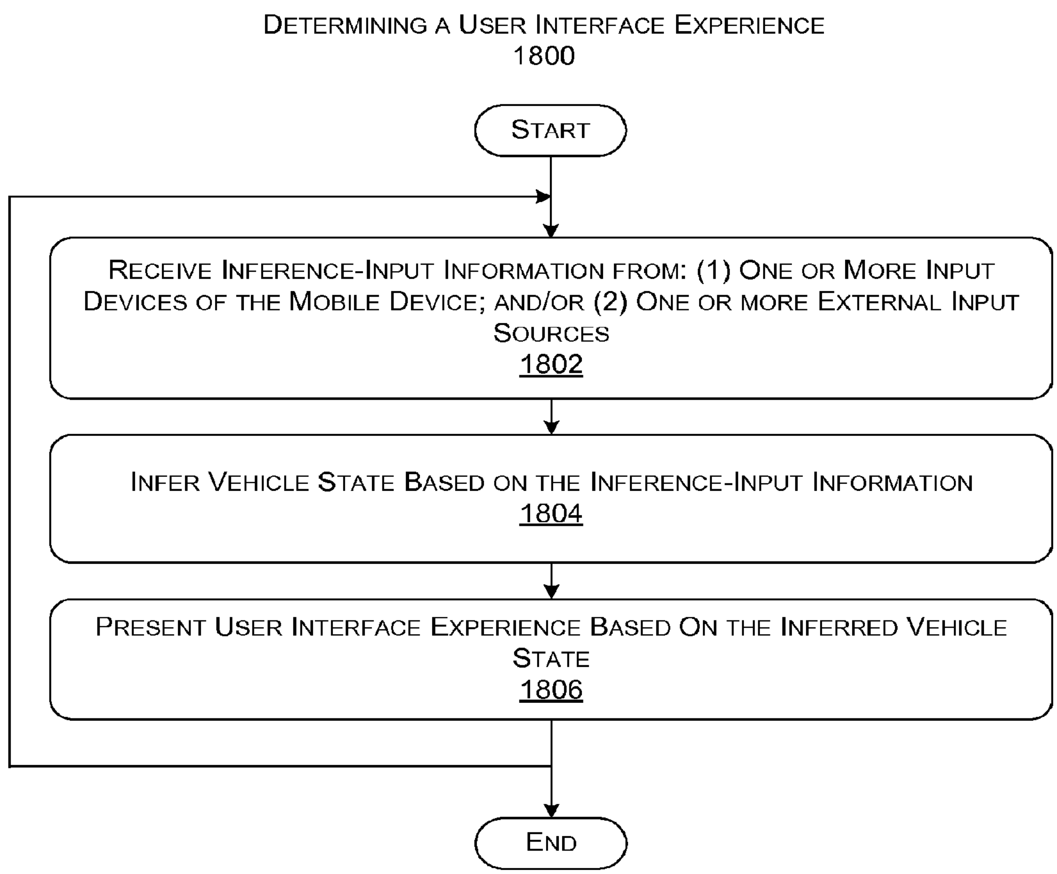
DETERMINING A USER INTERFACE EXPERIENCE
1800
START
RECEIVE INFERENCE-INPUT INFORMATION FROM: (1) ONE OR MORE INPUT DEVICES OF THE MOBILE DEVICE; AND/OR (2) ONE OR MORE EXTERNAL INPUT SOURCES
1802
INFER VEHICLE STATE BASED ON THE INFERENCE-INPUT INFORMATION
1804
PRESENT USER INTERFACE EXPERIENCE BASED ON THE INFERRED VEHICLE STATE
1806
END

FIG. 18

EXAMPLE SCENARIO A: BASED ON WHETHER THE VEHICLE IS MOVING OR NOT MOVING

RECEIVE INFERENCE-INPUT INFORMATION
1902

DETERMINE WHETHER THE VEHICLE IS MOVING BASED ON THE INFERENCE-INPUT INFORMATION
1904

IF THE VEHICLE IS MOVING, MAKE ANY CHANGES OUTLINED IN FIG. 14
1906

FIG. 19

EXAMPLE SCENARIO B: BASED ON THE MANNER IN WHICH THE VEHICLE IS MOVING

RECEIVE INFERENCE-INPUT INFORMATION
2002

CLASSIFY THE MANNER IN WHICH THE VEHICLE IS MOVING BASED ON THE INFERENCE-INPUT INFORMATION
2004

BASED ON THE CLASSIFICATION, MAKE ANY CHANGES OUTLINED IN FIG. 14
2006

FIG. 20

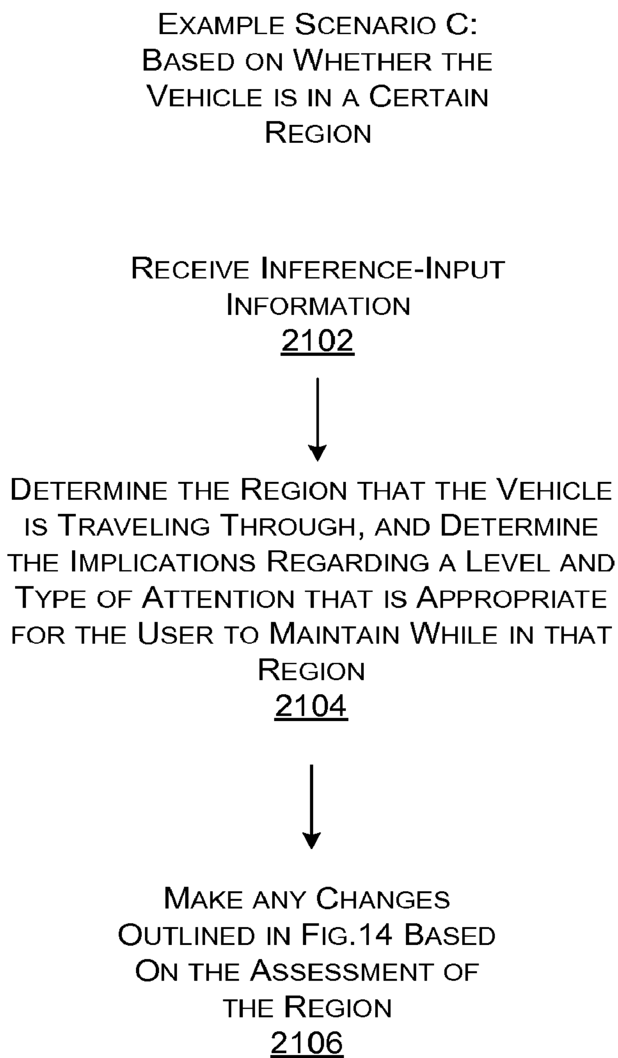
EXAMPLE SCENARIO C: BASED ON WHETHER THE VEHICLE IS IN A CERTAIN REGION
RECEIVE INFERENCE-INPUT INFORMATION
2102
DETERMINE THE REGION THAT THE VEHICLE IS TRAVELING THROUGH, AND DETERMINE THE IMPLICATIONS REGARDING A LEVEL AND TYPE OF ATTENTION THAT IS APPROPRIATE FOR THE USER TO MAINTAIN WHILE IN THAT REGION
2104
MAKE ANY CHANGES OUTLINED IN FIG.14 BASED ON THE ASSESSMENT OF THE REGION
2106

FIG. 21

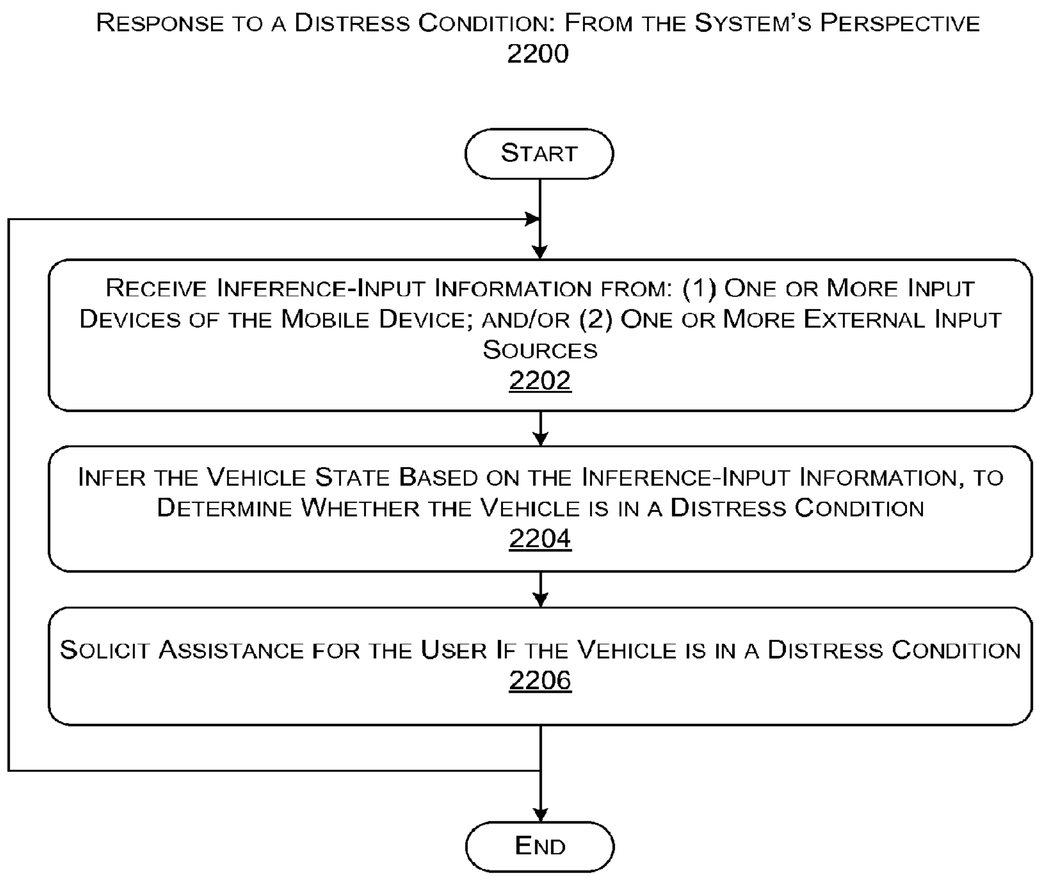
RESPONSE TO A DISTRESS CONDITION: FROM THE SYSTEM'S PERSPECTIVE
2200
START
RECEIVE INFERENCE-INPUT INFORMATION FROM: (1) ONE OR MORE INPUT DEVICES OF THE MOBILE DEVICE; AND/OR (2) ONE OR MORE EXTERNAL INPUT SOURCES
2202
INFER THE VEHICLE STATE BASED ON THE INFERENCE-INPUT INFORMATION, TO DETERMINE WHETHER THE VEHICLE IS IN A DISTRESS CONDITION
2204
SOLICIT ASSISTANCE FOR THE USER IF THE VEHICLE IS IN A DISTRESS CONDITION
2206
END

FIG. 22

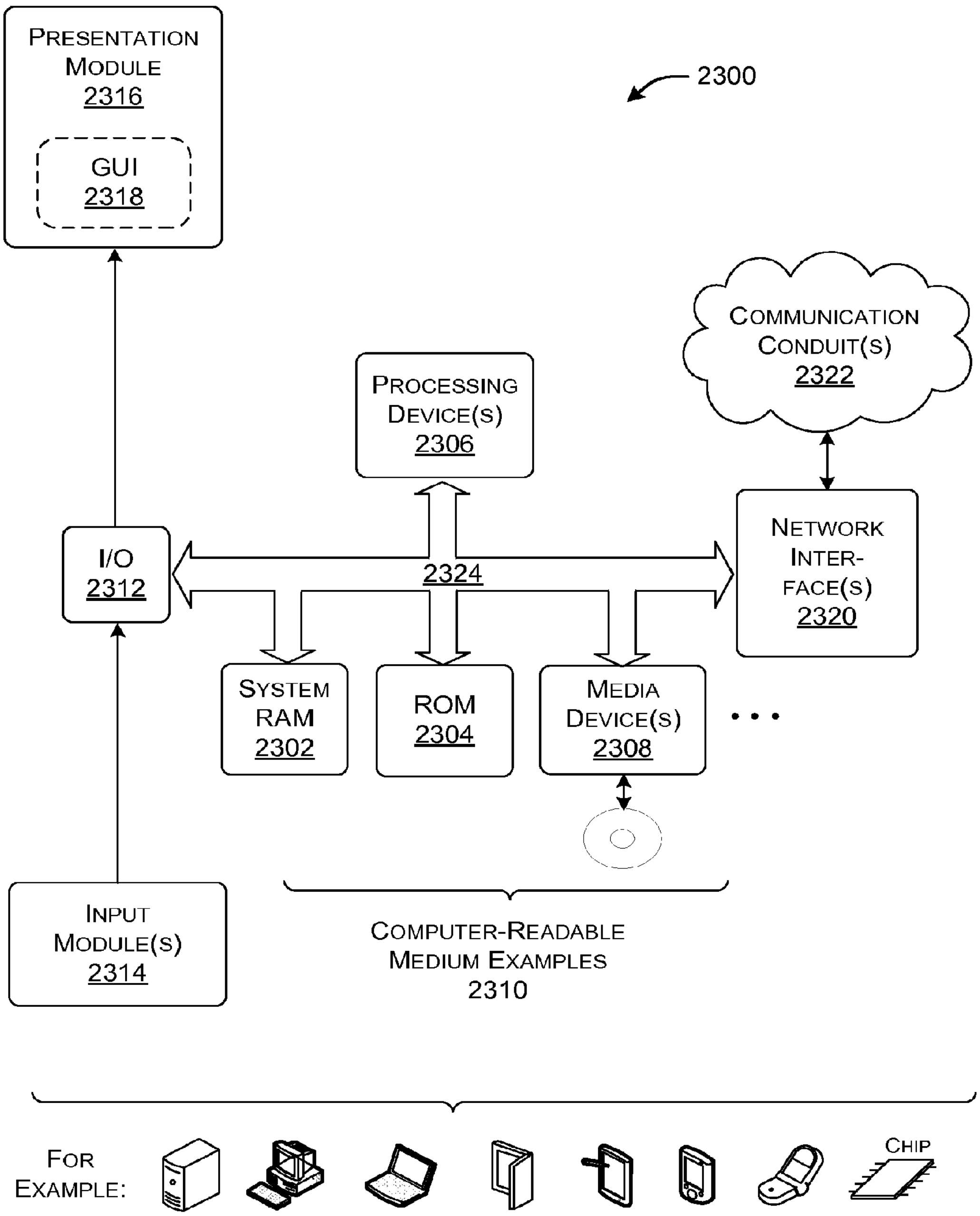
2300
PRESENTATION MODULE 2316
GUI 2318
COMMUNICATION CONDUIT(S) 2322
PROCESSING DEVICE(S) 2306
I/O 2312
2324
NETWORK INTER-FACE(S) 2320
SYSTEM RAM 2302
ROM 2304
MEDIA DEVICE(S) 2308
INPUT MODULE(S) 2314
COMPUTER-READABLE MEDIUM EXAMPLES 2310
FOR EXAMPLE:
CHIP

FIG. 23

PROVIDING A USER INTERFACE EXPERIENCE BASED ON INFERRED VEHICLE STATE

BACKGROUND

A user who is driving a vehicle may wish to interact with his or her mobile device. For example, a user may wish to make and receive calls, conduct searches, read Email, and so forth. These activities may distract the user from the primary task of driving the vehicle, and therefore pose a significant risk to the safety of the user (as well as the safety of others). To address this issue, many jurisdictions have enacted laws which prevent users from manually interacting with mobile devices in their vehicles.

One solution to the above concerns is to outright preclude a user from interacting with his or her mobile phone while driving the vehicle. In another solution, a user can use various hands-free interaction devices. For example, a user can use voice recognition technology to initiate a call. The user can then conduct the call using a headset or the like, without holding the mobile device. While these solutions may help the user reduce the risk of using his or her mobile device in certain circumstances, they do not provide a generally satisfactory solution to the myriad distractions that may confront a user while driving.

SUMMARY

A mobile device is described herein that provides a user interface experience to a user who is operating the mobile device within a vehicle. The mobile device performs this task using mode functionality. The mode functionality operates by receiving inference-input information from one or more input sources. At least one input source corresponds to a movement-sensing device provided by the mobile device. The mode functionality device then infers a state of the vehicle (i.e., a "vehicle state") based on the inference-input information. The mode functionality then presents a user interface experience to the user that is appropriate in view of the vehicle state. More specifically, the mode functionality presents a user interface experience to the user that imposes certain attention-related demands; those attention-related demands are appropriate in view of the vehicle state. For example, the mode functionality may present a user interface experience that provides minimal demands on the attention of the user when the vehicle state indicates that the vehicle is traveling at a high speed.

In one scenario, the mode functionality can also infer, based on the inference-input information, that the vehicle is in a distress condition, e.g., as a result of an accident or other mishap. In response to this assessment, the mode functionality can provide assistance to the user. In one case, the mode functionality can infer that the vehicle is in a distress condition based on evidence, gleaned from the inference-input information, that: (a) the mobile device is located in a vehicle; (b) the vehicle has come to an abrupt stop or otherwise abruptly decelerated; and (c) the mobile device has become dislodged from its mount (or where a subset of these events have occurred).

The above approach can be manifested in various types of systems, components, methods, computer readable media, data structures, articles of manufacture, and so on.

This Summary is provided to introduce a selection of concepts in a simplified form; these concepts are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows an illustrative environment in which a user receives a user interface experience that is based on an inferred state of a vehicle (i.e., a vehicle state).

FIG. **2** depicts an interior region of a vehicle. The interior region includes a mobile device secured to a surface of the vehicle using a mount.

FIG. **3** shows one type of representative mount that can be used to secure the mobile device within a vehicle.

FIG. **4** shows one illustrative implementation of a mobile device, for use in the environment of FIG. **1**.

FIG. **5** shows illustrative movement-sensing devices that can be used by the mobile device of FIG. **4**.

FIG. **6** shows illustrative output functionality that can be used by the mobile device of FIG. **4** to present output information.

FIG. **7** shows illustrative functionality associated with the mount of FIG. **3**, and the manner in which this functionality can interact with the mobile device.

FIGS. **8** and **9** depict two respective output modes provided by the mobile device of FIG. **4**.

FIGS. **10-12** depict three respective input modes provided by the mobile device of FIG. **4**.

FIG. **13** shows further details regarding a representative application and mode functionality, which can be provided by the mobile device of FIG. **4**.

FIG. **14** enumerates illustrative options by which the mobile device of FIG. **4** can control a user interface experience, in response to the state of the vehicle.

FIG. **15** shows an illustrative environment in which functionality can infer and respond to a distress condition that may affect the vehicle. For example, a distress condition may befall the vehicle when it is in an accident.

FIG. **16** shows an illustrative distress management module that can be used in the environment of FIG. **15**.

FIG. **17** shows an illustrative procedure that explains one manner of operation of the environment of FIG. **1**, from the perspective of a user.

FIG. **18** shows an illustrative procedure by which a mobile device can provide a user interface experience based on an inferred state of a vehicle.

FIGS. **19-21** show three different instantiations of the procedure of FIG. **18**, corresponding to three different vehicle state scenarios.

FIG. **22** shows an illustrative procedure by which the distress management module of FIG. **16** can infer and respond to a distress condition that may affect the vehicle.

FIG. **23** shows illustrative computing functionality that can be used to implement any aspect of the features shown in the foregoing drawings.

The same numbers are used throughout the disclosure and figures to reference like components and features. Series 100 numbers refer to features originally found in FIG. **1**, series 200 numbers refer to features originally found in FIG. **2**, series 300 numbers refer to features originally found in FIG. **3**, and so on.

DETAILED DESCRIPTION

This disclosure is organized as follows. Section A describes illustrative functionality for providing a user interface experience that depends on an inferred vehicle state. Section B describes illustrative methods which explain the operation of the functionality of Section A. Section C describes illustrative computing functionality that can be used to implement any aspect of the features described in Sections A and B.

As a preliminary matter, some of the figures describe concepts in the context of one or more structural components, variously referred to as functionality, modules, features, elements, etc. The various components shown in the figures can be implemented in any manner by any physical and tangible mechanisms, for instance, by software, hardware (e.g., chip-implemented logic functionality), firmware, etc., and/or any combination thereof. In one case, the illustrated separation of various components in the figures into distinct units may reflect the use of corresponding distinct physical and tangible components in an actual implementation. Alternatively, or in addition, any single component illustrated in the figures may be implemented by plural actual physical components. Alternatively, or in addition, the depiction of any two or more separate components in the figures may reflect different functions performed by a single actual physical component. FIG. **23**, to be discussed in turn, provides additional details regarding one illustrative physical implementation of the functions shown in the figures.

Other figures describe the concepts in flowchart form. In this form, certain operations are described as constituting distinct blocks performed in a certain order. Such implementations are illustrative and non-limiting. Certain blocks described herein can be grouped together and performed in a single operation, certain blocks can be broken apart into plural component blocks, and certain blocks can be performed in an order that differs from that which is illustrated herein (including a parallel manner of performing the blocks). The blocks shown in the flowcharts can be implemented in any manner by any physical and tangible mechanisms, for instance, by software, hardware (e.g., chip-implemented logic functionality), firmware, etc., and/or any combination thereof.

As to terminology, the phrase "configured to" encompasses any way that any kind of physical and tangible functionality can be constructed to perform an identified operation. The functionality can be configured to perform an operation using, for instance, software, hardware (e.g., chip-implemented logic functionality), firmware, etc., and/or any combination thereof.

The term "logic" encompasses any physical and tangible functionality for performing a task. For instance, each operation illustrated in the flowcharts corresponds to a logic component for performing that operation. An operation can be performed using, for instance, software, hardware (e.g., chip-implemented logic functionality), firmware, etc., and/or any combination thereof. When implemented by a computing system, a logic component represents an electrical component that is a physical part of the computing system, however implemented.

The phrase "means for" in the claims, if used, is intended to invoke the provisions of 35 U.S.C. §112, sixth paragraph. No other language, other than this specific phrase, is intended to invoke the provisions of that portion of the statute.

The following explanation may identify one or more features as "optional." This type of statement is not to be interpreted as an exhaustive indication of features that may be considered optional; that is, other features can be considered as optional, although not expressly identified in the text. Finally, the terms "exemplary" or "illustrative" refer to one implementation among potentially many implementations.

A. Illustrative Mobile Device and its Environment of Use

FIG. **1** shows an illustrative environment **100** in which users can operate mobile devices within vehicles. For example, FIG. **1** depicts an illustrative user **102** who operates a mobile device **104** within a vehicle **106**, and a user **108** who operates a mobile device **110** within a vehicle **112**. However, the environment **100** can accommodate any number of users, mobile devices, and vehicles. To simplify the explanation, this section will set forth the illustrative composition and manner of operation of the mobile device **104** operated by the user **102**, treating this mobile device **104** as representative of any mobile device's operation within the environment **100**. Moreover, in certain cases, this explanation will state that the mobile device **104** performs certain processing functions. This statement is to be construed liberally. In some cases, the mobile device **104** can perform a function by providing logic which executes this function. Alternatively, or in addition, the mobile device **104** can perform a function by interacting with a remote entity, which performs the function on behalf of the mobile device **104**.

More specifically, the mobile device **104** operates in at least two modes. In a handheld mode of operation, the user **102** can interact with the mobile device **104** while holding it in his or her hands. For example, the user **102** can interact with a touch input device of the mobile device **104** and/or a keypad of the mobile device **104** to perform any device function. In a vehicle mode of operation, the user **102** can interact with the mobile device **104** in his or her vehicle **106**. In this mode, the mobile device **104** automatically assesses the state of the vehicle **106** (i.e., the "vehicle state" according to the terminology used herein) based on inference-input information. The mobile device **104** then presents a user interface experience based on the vehicle state, as set forth below in greater detail.

By way of overview, the vehicle state of the vehicle state characterizes the manner in which the vehicle **106** is currently being operated by the user **102**. Some aspects of the vehicle state may directly pertain to the dynamics of the vehicle's movement. Such direct aspects can include, but are not limited to: the speed at which the vehicle **106** is traveling; the manner in which the vehicle **106** is being accelerated and decelerated; the manner in which the vehicle **106** is being steered; the manner in which the breaks of the vehicle **106** are being applied, and so on. Other aspects of the vehicle state may have a more indirect bearing on the manner in which the vehicle **106** is moving. For example, these aspects of the vehicle state may pertain to the qualifying circumstances in which vehicle **106** movement is taking place. Such indirect aspects can include, but are not limited to: the region in which the vehicle **106** is traveling; the time of day in which the vehicle **106** is traveling; the date at which the vehicle **106** is traveling; the weather through which the vehicle **106** is traveling; the road condition over which the vehicle **106** is traveling, and so forth.

The mobile device **104** can determine the vehicle state based on inference-input information. The inference-input information pertains to any information that can be used to infer the vehicle state. Some of the inference-input information may originate from input sources which are internal to the mobile device **104**. Other inference-input information may originate from input sources which are external to the mobile device **104**.

Ultimately, the vehicle state correlates to an attention profile. The attention profile characterizes a level of attention and a type of attention which is appropriate for the user **102** to maintain while driving within the vehicle state. For example, assume that the vehicle state indicates that the user **102** is traveling at a high rate of speed in a congested urban area. Based on these considerations, the mobile device **104** may reach the conclusion that it is appropriate for the user **102** to pay close attention to the task of operating the vehicle **106**. In contrast, assume that the vehicle state indicates that the user **102** is sitting in his vehicle **106**, stopped in a traffic jam. In this circumstance, the mobile device **104** can reach the conclusion that it is permissible for the user **102** to devote greater attention to supplemental non-driving-related tasks (compared to the first scenario).

The mobile device **104** then presents a user interface experience that makes attention-related demands on the user **102** that are commensurate with the vehicle state. In other words, the mobile device **104** engages the user **102** in a manner that is appropriate in view of the attention profile of the vehicle state, e.g., by not demanding a level and type of attention that goes beyond what the user **102** can "afford" to provide while driving the vehicle **106**. For example, in the first scenario described above (in which the user **102** is traveling at high speed in a congested area), the mobile device **104** can present a user interface experience which places few if any demands on the attention of the user **102**. In the second scenario described above (in which the user **102** is sitting in his or her vehicle **106** without moving), the mobile device **104** can place far greater demands on the attention of the user **102**.

The mobile device **104** can provide an appropriate user interface experience in different ways. Generally, a user interface experience refers to the manner in which a user **102** interacts with the mobile device **104**, either by providing user-input information to the mobile device **104** or receiving output information from the mobile device **104**. More specifically, the manner in which the user **102** provides user-input information to the mobile device **104** is defined by various input modes that a user **102** can use to provide the user-input information to the mobile device **104**. Illustrative input modes can include a keypad input mode, a touch screen input mode, a voice-recognition input mode, a gesture-recognition input mode, and so on (to be described in greater detail below). The manner in which the mobile device **104** provides output information to the user is defined by various output modes. Illustrative output modes can include a display output mode, a speech output mode, and so on (to be described in greater detail below). The mobile device **104** can vary the user interface experience by activating and/or deactivating certain input modes and/or output modes. Alternatively, or in addition, the mobile device **104** can vary the user interface experience by changing the manner of operation of any input mode and/or any output mode (again, to be described in greater detail below).

Given the above overview, the description will now advance to a more detailed description of the individual features depicted in FIG. **1**. Starting with the mobile device **104** itself, this apparatus can be implemented in any manner and can perform any function or combination of functions. For example, the mobile device **104** can correspond to a mobile telephone device of any type (such as a smart phone device), a book reader device, a personal digital assistant device, a laptop computing device, a tablet-type computing device, a netbook-type computing device, a portable game device, a portable media system interface module device, and so on.

The vehicle **106** can correspond to any mechanism for transporting the user **102**. For example, the vehicle **106** may correspond to an automobile of any type, a truck, a bus, a motorcycle, a scooter, a bicycle, an airplane, a boat, and so on. However, to facilitate explanation, it will henceforth be assumed that the vehicle **106** corresponds to a personal automobile operated by the user **102**.

The environment **100** also includes a communication conduit **114** for allowing the mobile device **104** to interact with any remote entity (where a "remote entity" means an entity that is remote with respect to the user **102**). For example, the communication conduit **114** may allow the user **102** to use the mobile device **104** to interact with another user who is using another mobile device (such as the user **108** who is using the mobile device **110**). In addition, the communication conduit **114** may allow the user **102** to interact with any remote services. Generally speaking, the communication conduit **114** can represent a local area network, a wide area network (e.g., the Internet), or any combination thereof. The communication conduit **114** can be governed by any protocol or combination of protocols.

More specifically, the communication conduit **114** can include wireless communication infrastructure **116** as part thereof. The wireless communication infrastructure **116** represents the functionality that enables the mobile device **104** to communicate with remote entities via wireless communication. The wireless communication infrastructure **116** can encompass any of cell towers, base stations, central switching stations, satellite functionality, and so on. The communication conduit **114** can also include hardwired links, routers, gateway functionality, name servers, etc.

The environment **100** also includes one or more remote processing systems **118**. The remote processing systems **118** provide any type of services to the users. In one case, each of the remote processing systems **118** can be implemented using one or more servers and associated data stores. For instance, FIG. **1** shows that the remote processing systems **118** can include at least one instance of remote processing functionality **120** and an associated system store **122**. The ensuing description will set forth illustrative functions that the remote processing functionality **120** can perform that are germane to the operation of the mobile device **104** within the vehicle **106**.

Advancing to FIG. **2**, this figure shows a portion of a representative interior region **200** of the vehicle **106**. A mount **202** secures the mobile device **104** within the interior region **200**. More specifically, the mount **202** secures the mobile device **104** to the top of the vehicle's dashboard, to the left of the user **102**, just above the vehicle control panel region **204**. A power cord **206** supplies power from any power source provided by the vehicle **106** to the mobile device **104** (either directly or indirectly, as will be described in connection with FIG. **7**).

The mobile device **104** can include at least one internal camera device (not shown in FIG. **2**) having a field of view that projects out from a face of the mobile device **104**, towards the user **102**. More specifically, the user **102** can place the mobile device **104** within the interior region **200** in such a manner that the field of view of the camera device encompasses at least a part of the anatomy of the user **102**. In one implementation, this placement enables the internal camera device to establish an interaction space. The internal camera device can capture gestures made by the user **102** within that interaction space. In one illustrative implementation, the interaction space may generally correspond to a conic volume that extends approximately 60 cm from the face of the mobile device **104**, pointed towards the user **102** who is driving the vehicle **106** (although different end-use environments can adopt interaction spaces having different "sizes" and shapes).

However, the placement of the mobile device **104** shown in FIG. **2** is merely representative, meaning that the user **102** can choose other locations and orientations of the mobile device **104**. For example, the user **102** can place the mobile device **104** in a left region with respect to the steering wheel, instead of a right region with respect to the steering wheel (as shown in FIG. **2**). This might be appropriate, for example, in countries in which the steering wheel is provided on the right side of the vehicle **106**. Alternatively, the user **102** can place the mobile device **104** directly behind the steering wheel or on the steering wheel. Alternatively, the user **102** can secure the mobile device **104** to the windshield of the vehicle **106**. These options are mentioned by way of illustration, not limitation; still other placements of the mobile device **104** are possible.

FIG. **3** shows one merely representative mount **302** that can be used to secure the mobile device **104** to some surface of the interior region **200** of the car. (Note that this mount **302** is a different type of mount than the mount **202** shown in FIG. **2**). Without limitation, the mount **302** of FIG. **3** includes any type of coupling mechanism **304** for fastening the mount **302** to a surface within the interior region **200**. For instance, the coupling mechanism **304** can include a clamp or protruding member (not shown) that attaches to an air movement grill of the vehicle **106**. In other cases, the coupling mechanism **304** can include a plate or other type of member which can be fastened to any surface of the vehicle **106** using any type of fastener (e.g., screws, clamps, a Velcro coupling mechanism, a sliding coupling mechanism, a snapping coupling mechanism, a suction cup coupling mechanism, etc.). In still other cases, the mount **302** can merely sit on a generally horizontal surface of the interior region **200**, such as on the top of the dashboard, without being fastened to that surface. To reduce the risk of this type of mount sliding on the surface during movement of the vehicle **106**, it can include a weighted member, such as a sand-filled malleable base member.

In one merely illustrative implementation, the representative mount **302** shown in FIG. **3** includes a flexible arm **306** which extends from the coupling mechanism **304** and terminates in a cradle **308**. The cradle **308** can include an adjustable clamp mechanism **310** for securing the mobile device **104** to the cradle **308**. In this particular scenario, the user **102** has attached the mobile device **104** to the cradle **308** so that it can be operated in a portrait mode. But the user **102** can alternatively attach the mobile device **104** so that it can be operated in a landscape mode (as shown in FIG. **2**).

As mentioned above, the mobile device **104** includes at least one internal camera device **312** which projects out from a front face **314** of the mobile device **104** (or other face of the mobile device **104**). The internal camera device **312** is identified as "internal" insofar as it is typically considered an integral part of the mobile device **104**. In addition, the mobile device **104** can receive image information from one or more external camera devices (not shown).

Further, the mount **302** may incorporate any attachment-sensing mechanism **316** for determining when the mobile device **104** has been inserted in the cradle **308** of the mount **302**. For example, the attachment-sensing mechanism **316** can comprise a mechanical switch that that is toggled from an OFF to an ON state when the user **102** inserts the mobile device **104** into the cradle **308**, and from an ON to OFF state when the mobile device **104** becomes dislodged from the cradle **308**. Other implementations of the attachment-sensing device include a light-sensing switch, a pressure-sensing switch, and so on. Alternatively, or in addition, the mobile device **104** can implement an attachment sensing mechanism (not shown). That is, in complementary fashion, a device-implemented attachment sensing mechanism is configured to be activated when the user **102** places the mobile device **104** in the cradle **308**. Alternatively, or in addition, the mobile device **104** can infer the fact that it has become dislodged from the cradle **308** based on indirect evidence. In any implementation, as will be described below, the attachment-sensing mechanism **316** plays a role in determining whether the vehicle **106** is in a distress condition.

Further, the mount **302** can include one or more supplemental sensor devices **320** (depicted generically in FIG. **3** by a dashed box). For example, the sensor devices **320** can encompass one or more of the types of movement-sensing devices **430** shown in FIG. **5** (to be described below). In addition, the mount **302** can encompass additional image-sensing mechanisms, such one or more additional camera devices of any type, etc.

FIG. **4** shows various components that can be used to implement the mobile device **104**. This figure will be described in a generally top-to-bottom manner. To begin with, the mobile device **104** includes communication functionality **402** for receiving and transmitting information to remote entities via wireless communication. That is, the communication functionality **402** may comprise a transceiver that allows the mobile device **104** to interact with the wireless communication infrastructure **116** of the communication conduit **114**.

The mobile device **104** can also include a set of one or more applications **404**. The applications **404** represent any type of functionality for performing any respective tasks. In some cases, the applications **404** perform high-level tasks. To cite representative examples, a first application may perform a map navigation task, a second application can perform a media presentation task, a third application can perform an Email interaction task, and so on. In other cases, the applications **404** perform lower-level management or support tasks. The applications **404** can be implemented in any manner, such as by executable code, script content, etc., or any combination thereof. The mobile device **104** can also include at least one device store **406** for storing any application-related information, as well as other information.

In other implementations, at least part of the applications **404** can be implemented by the remote processing systems **118**. For example, in certain implementations, some of the applications **404** may represent network-accessible pages and/or other type of functionality.

The mobile device **104** can also include a device operating system **408**. The device operating system **408** provides functionality for performing low-level device management tasks. Any application can rely on the device operating system **408** to utilize various resources provided by the mobile device **104**.

The mobile device **104** can also include input functionality **410** for receiving and processing input information. Generally, the input functionality **410** includes some functionality for receiving input information from internal input devices (which represent components that are part of the mobile device **104** itself), and some functionality for receiving input information from external input devices. The input functionality **410** can receive input information from external input devices using any coupling technique or combination of coupling techniques, such as hardwired connections, wireless connections (e.g., Bluetooth® connections), and so on.

This explanation refers to the input information that is ultimately used to infer the state of the vehicle **106** as inference-input information. This explanation refers to the input information that is provided by the user **102** as user-input information. These two classes of input information are not necessarily mutually exclusive; that is, some of the information that is input by a user **102** may constitute inference-input information. A generic reference to "input information," without the qualifier "user" or "inference," refers to any type of input information.

The input functionality **410** includes an optional gesture recognition module **412** for receiving image information from at least one internal camera device **414**, and/or from at least one external camera device **416**. (For example, the external camera device **416** can be associated with the mount **302**, or by some other unit within the vehicle **106**.) Any of these camera devices can provide any type of image information. For example, in one case, a camera device can provide video image information, produced by receiving visible-spectrum radiation, infrared-spectrum radiation, etc., or combination thereof. In another case, a camera device can provide image information that can be further processed to provide depth information. Depth information provides an indication of the distances between different points in a captured scene and a reference point (e.g., corresponding to the location of the camera device). Depth processing functionality can generate depth information using any technique, such as a time-of-flight technique, a structured light technique, a stereoscopic technique, and so on. After receiving the image information, the gesture recognition module **412** can determine whether the image information reveals that the user **102** has made a recognizable gesture.

The input functionality **410** can also receive image information from one or more camera devices that capture a scene that is external to the vehicle **106**. For example, an internal or external camera device can capture a scene in front of the vehicle **106**, in back of the vehicle **106**, to either side of the vehicle **106**, etc. These camera devices can also be used in conjunction with any type depth processing functionality described above. The use of depth processing functionality allows the mobile device **104** to assess the distance between the vehicle **106** and other nearby vehicles and obstacles. The input functionality **410** can also receive inference-input information from any other type of distance sensing mechanism, such as a Light Detection And Ranging (LIDAR) sensing device, etc.

The input functionality **410** can also include a supplemental system interface module **418**. The supplemental system interface module **418** receives inference-input information from any vehicle system **420**, and/or from the mount **302**, and/or from any other external system. For example, the supplemental system interface module **418** can receive any type of OBDII information provided by the vehicle's information management system. Such information can describe the operating state of the vehicle **106** at a particular point in time, such as by providing information regarding the vehicle's speed, steering state, breaking state, engine temperature, engine performance, odometer reading, oil level, fuel level, the presence of passengers in the vehicle **106**, and so on. To provide this information, the vehicle system **420** can receive sensor information from a plurality of sensing devices provided by the vehicle **106**. Alternatively, or in addition, the supplemental system interface module **318** can receive inference-input information collected by one or more sensor devices (such as one or more supplemental accelerometer devices provided by the mount **302**).

The input functionality **410** can also include a touch input module **422** for receiving user-input information when a user **102** touches a touch input device **424**. Although not depicted in FIG. **4**, the input functionality **410** can also include any type of physical keypad input mechanism, any type of joystick control mechanism, any type of mouse device mechanism, and so on. The input functionality **410** can also include a voice recognition module **426** for receiving voice commands from one or more microphone devices **428**.

The input functionality **410** can also include one or more movement-sensing devices **430**. Generally, the movement-sensing devices **430** determine the manner in which the mobile device **104** is being moved at any given time. That information, in turn, can pertain to either the dynamic movement of the mobile device **104** and/or its position at any given time. Advancing momentarily to FIG. **5**, this figure indicates that the movement-sensing devices **430** can include any of an accelerometer device **502**, a gyro device **504**, a magnetometer device **506**, a GPS device **508** (or other satellite-based position-determining mechanism), a dead-reckoning position-determining device (not shown), a cell tower or WiFi triangulation device (not shown), and so on. Further, the movement-sensing device **430** can include any type of vision device described above, e.g., corresponding to one or more camera devices and associated functionality. That is, the images captured by the vision device comprise evidence regarding the movement of the vehicle **106**; therefore, the vision device can be considered as a type of movement-sensing device. This set of possible devices is representative, rather than exhaustive. In other cases, some other entity (besides, or in addition to the mobile device **104**) can assess the movement of the mobile device **104**, such as any functionality provided by the remote processing systems **118**.

The mobile device **104** also includes output functionality **432** for conveying information to a user **102** in an output presentation. Advancing momentarily to FIG. **6**, this figure indicates that the output functionality **432** can include any of a device screen **602**, one or more speaker devices **604**, a projector device **606** for projecting output information onto any surface, and so on.

The output functionality **432** also includes a vehicle interface module **608** that enables the mobile device **104** to send output information to any vehicle system **420** associated with the vehicle **106**. This allows the user **102** to interact with the mobile device **104** to control the operation of any functionality associated with the vehicle **106** itself. For example, the user **102** can interact with the mobile device **104** to control the playback of media content on a separate vehicle media system. The user **102** may prefer to directly interact with the mobile device **104** rather than the systems of the vehicle **106** because the user **102** is presumably already familiar with the manner in which the mobile device **104** operates. Moreover, the mobile device **104** has access to a remote system store **122** which can provide user-specific information. The mobile device **104** can leverage this information to control any vehicle system **420** in a manner that is customized for a particular user **102**.

Finally, the mobile device **104** can optionally include mode functionality **434**. The mode functionality **434** performs the core functions summarized above, which include assessing the state of the vehicle **106** at a particular point in time and providing a user interface experience that takes into consideration the vehicle state. Alternatively, at least parts of the mode functionality **434** can be implemented by the remote processing systems **118**.

FIG. 7 illustrates one manner in which the functionality provided by the mount **302** (of FIG. **3**) can interact with the mobile device **104**. The mount **302** can include the attachment sensing mechanism **316** (described above) which provides an attachment signal to the input functionality **410** of the mobile device **104**. The attachment signal indicates whether or not the mobile device **104** is presently coupled to the mount **302**. The mount **302** can also include any of the type of the movement-sensing devices **430** shown in FIG. **5** for providing inference-input information to the input functionality **410** of the mobile device **104**. The mount **302** can also include any other optional devices **702** for providing inference-input information to the input functionality **410** of the mobile device **104**. Alternatively, or in addition, the devices **702** can perform various processing functions, and can then send the results of such processing to the mobile device **104**.

The mount **302** can also include a power source **704** which feeds power to the mobile device **104**, e.g., via an external power interface module **706** provided by the mobile device **104**. The power source **704** may, in turn, receive power from any external source, such as a power source (not shown) associated with the vehicle **106**. In this implementation, the power source **704** powers both the components of the mount **302** and the mobile device **104**. Alternatively, each of the mobile device **104** and the mount **302** can be supplied with separate sources of power.

Finally, FIG. **7** shows interfaces (**708**, **710**) that allow the input functionality **410** of the mobile device **104** to communicate with the components of the mount **302**.

FIGS. **8** and **9** pictorially summarize two output modes. That is, in FIG. **8**, the mobile device **104** presents visual content **802** on the display screen **602** of the mobile device **104**. In FIG. **9** the mobile device **104** presents audio content **902** that supplements or replaces the visual content **802**.

FIGS. **10-12** pictorially summarize three input modes. That is, in FIG. **10**, the touch input module **422** accepts user-input information when the user **102** uses a hand **1002** to touch an icon **1004** or other object presented on a touch input screen of the mobile device **104**. In FIG. **11**, the gesture recognition module **412** receives user-input information when the user **102** makes a gesture that is captured by the internal camera device **414** of the mobile device **104**, without touching the mobile device **104**. The gesture recognition module **412** can recognize this gesture by comparing the captured image information with candidate gesture information associated with each of a set of possible candidate gestures. In FIG. **12**, the voice recognition module **426** receives user-input information when the user **102** annunciates a voice command.

FIG. **13** shows additional information regarding a subset of the components of the mobile device **104**, introduced above in the context of FIGS. **4-7**. The components include a representative application **1302** and the mode functionality **434**. As the name suggests, the "representative application" **1302** represents one of the set of applications **404** that may run on the mobile device **104** (and/or may run on remote processing functionality).

More specifically, FIG. **13** depicts the representative application **1302** and the mode functionality **434** as separate entities that perform respective functions. However, any aspect of the mode functionality **434** can be alternatively, or in addition, be performed by the representative application **1302**. Similarly, any aspect of the representative application **1302** can alternatively, or in addition, be performed by the mode functionality **434**. Further, the components shown in FIG. **13** are described herein as being performed by the mobile device **104**. However, alternatively, or in addition, at least some of the functions of the representative application **1302** and the mode functionality **434** can be performed by any functionality of the remote processing systems **118** and/or the mount **302**.

The representative application **1302** can be conceptualized as comprising a set of resources **1304**. The application resources **1304** represent image content, text content, audio content, programmatic content, control settings, etc. that the representative application **1302** may use to provide its services. Moreover, in some cases, a developer can provide multiple collections of resources for invocation in different vehicle states. For example, assume that there are two principal vehicle states: moving and not moving. The developer can provide a first collection of interface icons and prompting messages that the mobile device **104** can present in the moving state, and a second collection of interface icons and prompting messages that the mobile device **104** can present in a non-moving state. The moving-state collection can differ from the non-moving-state collection. For example, the moving-state collection can use larger size icons and fonts compared to the non-moving-state collection. During execution of the application, the mode functionality **434** can determine the vehicle state at a particular time. In response, the mode functionality **434** can invoke the moving-collection collection to provide a user interface experience in the moving state and the non-moving-collection to provide a user interface experience in the non-moving state. (As will be described below, the mode functionality **434** can make other changes to produce an appropriate user interface experience.)

The two-collection example is merely illustrative; other applications can provide more than two classes of resource collections corresponding to different respective ways in which the vehicle **106** is being driven. For example, a developer can create a resource collection for use for a nighttime driving vehicle state and a resource collection for a daytime driving vehicle state (as well as a resource collection for a non-moving state).

In the above type of development environment, the developer can consult an appropriate software development kit (SDK) to assist him or her in creating the different sets of resources. The SDK describes various requirements and recommendations regarding the characteristics of resources to be used in different vehicle states. For example, the SDK can require or recommend that the developer use fonts no smaller than a certain size for certain vehicle states.

Advancing now to a description of the mode functionality **434**, this component is shown as comprising three submodules: an interface module **1306**, a state detection module **1308**, and an experience presentation module **1310**. To facilitate description, it will be assumed that all of the logic for implementing these three functions is indeed encapsulated in a unit being referred to as the mode functionality **434**. But as stated above, any aspect of the mode functionality **434** can be alternatively, or in addition, performed by the representative application **1302** and/or some other entity (such as the remote processing systems **118**).

The interface module **1306** receives various forms of inference-input information. A subset **1312** of the instances of inference-input information originates from input sources that are associated with the mobile device **104** itself Another subset **1314** of the instances of inference-input information originates from input sources that are external to the mobile device **104** (e.g., from the vehicle system **420**, the mount **302**, etc.).

For example, the subset **1312** of internal instances of inference-input information can originate from any of the movement-sensing devices **430** enumerated in FIG. **5**. The subset **1312** can also include image information received from one or more internal camera devices which capture a scene or scenes inside the vehicle **106** and/or outside the vehicle **106**. The subset **1312** can also include audio information captured by one or more microphone devices.

The subset **1314** of instances of external inference-input information can originate from any sensor devices which feed sensor information into any vehicle system **420**, e.g., as expressed by OBDII information or the like. The subset **1314** can also include image information received from one or more external camera devices which capture a scene or scenes inside the vehicle **106** and/or outside the vehicle **106**. For example, image information captured by an outward-pointing camera device can be used to reveal the presence of pedestrians and nearby vehicles, the presence of stop lights, and so on. The subset **1314** can also include audio information captured by one or more microphone devices.

This subset **1314** can also encompass any information that is extracted from a remote source (e.g., from any of the remote processing systems **118**). Such information can include map information, traffic information, road condition information, hazard information, weather information, region population information, point of interest information, legal information regarding driving-related rules pertinent to a particular jurisdiction, and so on. Moreover, the map information can provide information regarding a region in any level of granularity. For example, the map information can identify the location of traffic lights, complex intersections, school zones, etc. in a region.

The information maintained by the remote processing systems **118** can be collected in various ways. In one approach, the remote processing systems **118** can collect the information based on in-field sensing devices, such as roadway camera devices, aerial and satellite camera devices, temperature sensing devices, precipitation-sensing devices, and so forth. In addition, or alternatively, the remote processing systems **118** can collect the information from human observers who manually report the information. In addition, or alternatively, the remote processing systems **118** can collect the information by crowd-sourcing it from a plurality of mobile devices provided in respective vehicles.

The above-identified forms of inference-input information are cited by way of illustration, not limitation; other implementations can provide other forms of inference-input information, and/or can omit one or more forms of inference-input information described above.

The state detection module **1308** infers the state of the vehicle **106** based on any combination of the forms of inference-input information enumerated above (and/or other forms of inference-input information). The state detection module **1308** can perform this task in different ways. In one implementation, the state detection module **1308** can maintain a lookup table which maps different permutations of input conditions (defined by the inference-input information) to corresponding vehicle state information. That is, the state detection module **1308** can indicate that, if input conditions L, M, N, and P are present, the vehicle state is in state X. In another case, the state detection module **1308** can use a statistical model to map a feature vector associated with a set of input conditions into an identified vehicle state. That statistical model can be produced in a machine-learning process. In another case, the state detection module **1308** can use a rules-based engine of any type or a neural network to map the input conditions into an identified vehicle state, and so on. These implementations are cited by way of example, not limitation. Section B will describe the illustrative behavior of the state detection module **1308** in greater detail, in the context of representative scenarios.

In addition, the state detection module **1308** can consult a route prediction module to determine the route that the user **102** is likely to take to reach a specified or predicted destination. The route information helps the state detection module **1308** operate in a more proactive manner by predicting difficult driving conditions that the user **102** is likely to confront as the trip progresses, before those conditions are actually encountered. The state detection module **1308** can also mine any other user resources in order to generate the vehicle state, such as calendar information, purchase history information, prior travel route information, and so on.

The experience presentation module **1310** receives information regarding the inferred vehicle state from the state detection module **1308**. In response, the experience presentation module **1310** maps the vehicle state into a user interface experience. In general, as described above, the mode functionality **434** attempts to provide a user interface experience which consumes the attention of the user **102** in a way that is commensurate with the vehicle state. This means that that the user interface experience is such that it does not demand a level and type of attention from the user **102** that the user **102** cannot safely give in view of the vehicle state. This behavior, in turn, ultimately reduces the risk associated with the use of the mobile device **104** within the vehicle **106**. At the same time, the mode functionality **434** provides a user experience that is not unduly restrictive, e.g., by unnecessarily precluding certain interactions that do not pose a significant risk to the user **102**.

The experience presentation module **1310** can also consult functionality provided in the remote processing systems **118** (and its associated system store **122**) to choose the user interface experience that it presents to the user **102**. For example, the experience presentation module **1310** can determine the preferences and habits of the user **102**, and then use this information to influence the selection of the user interface experience. The preferences may indicate the configurations of the user interface experience which the user prefers to receive in different driving circumstances. The experience presentation module **1310** may attempt to satisfy a preference of the user for a particular driving circumstance, providing that such a choice is not contradicted by other considerations. The habits can indicate the manner in which the user has driven the vehicle **106** (on past occasions) when confronted with various driving circumstances in conjunction with different user interface experiences. If the user performed poorly for a particular combination of a driving circumstance and a user interface experience, the experience presentation module **1310** can negatively weight this combination to disfavor its use on a future occasion.

In addition to providing a user interface experience, the experience presentation module **1310** can present warnings to the user. For example, a warning may alert the user to the fact that he or she is approaching a school zone. The warning may encourage the driver to be watchful for the presence of children. In addition, or alternatively, the warning may alert the user that he or she is driving too fast for the circumstances.

FIG. **14** enumerates some of the different ways that the experience presentation module **1310** can produce a desired user interface experience. (Section B will describe yet more examples of the operation of the experience presentation module **1310**.) As one general category, the experience presentation module **1310** can adjust some aspect of the output functionality **432**. As another general category, the experience presentation module **1310** can adjust some aspect of the input functionality **410**. The experience presentation module **1310** can also modify any other aspect of the environment **100** shown in FIG. **1**.

First consider changes made to the output functionality **432**. As a first change, the experience presentation module **1310** can enable or disable certain output modes in response to the vehicle state (or at least partially enable or restrict one or more parts of certain output modes). To cite one example, the experience presentation module **1310** can disable a display output mode when the vehicle **106** is moving. In lieu of that manner of output, the experience presentation module **1310** can provide output information via the speech output mode, or produce no output information at all so long as the moving condition prevails.

Alternatively, or in addition, the experience presentation module **1310** can change the content that it presents in response to the vehicle state. For example, as noted above, an application can include two or more collections of resources for use in providing an output presentation. The experience presentation module **1310** can present an output presentation using an appropriate collection of resources based on the vehicle state. For example, the experience presentation module **1310** can display large-sized icons when the speed of the vehicle **106** exceeds a prescribed threshold.

Alternatively, or in addition, the experience presentation module **1310** can change any property or properties of the output presentation itself in response to vehicle state. This type of change is similar to the one described immediately above. But here, instead of choosing an entirely new collection of resources, the experience presentation module **1310** can modify one or more variable attributes of the output presentation. This category encompasses a wide range of options. For example, for visual output presentations, the experience presentation module **1310** can adjust any of the size, contrast, color, transparency, etc. of the content that is displayed, the length of time that the content is displayed, the spatial organization between different parts of the content that is displayed, and so on. For audio output presentations, the experience presentation module **1310** can adjust the volume of the audio content that is presented, the rate of speaking provided by the audible content, and so on.

Alternatively, or in addition, the experience presentation module **1310** can send output information to different destinations based on the vehicle state. For example, for some vehicle states, the mobile device **104** may route the output information to an output device associated with the mobile device **104** itself. For other vehicle states, the mobile device **104** may route the output information to any vehicle system **420**, such as a media system associated with the vehicle **106**.

The experience presentation module **1310** can use yet other strategies for modifying any output presentation based on vehicle state.

Next consider the input functionality **410**. As a first change, the experience presentation module **1310** can enable or disable certain input modes (or at least partially enable or restrict one or more parts of certain input modes). To cite one example, the experience presentation module **1310** can disable the touch screen input mode and the keypad input mode when the vehicle **106** is moving at a high speed. In lieu of that manner of input, the experience presentation module **1310** can provide input via the voice-recognition input mode and/or the gesture-recognition input mode.

Alternatively, or in addition, the experience presentation module **1310** can change the type of user-input information that is obtained based on vehicle state. For example, the experience presentation module **1310** can accept a fewer number of voice commands while the vehicle **106** is traveling at high speeds, compared to when the vehicle **106** is moving at slower speeds. This change can help reduces the complexity of the voice-recognition input mode at higher speeds, and hence the distraction that this mode may impose on the user **102**.

Alternatively, or in addition, the experience presentation module **1310** can change the manner in which any input mode collects user-input information. For example, at certain junctures, an input mode may present a query to the user **102**, requiring a response; after a certain amount of time without receiving an answer, the input mode can deactivate the query. At higher speeds, the input mode can extend the length of time for which it solicits a response from the user **102**, as the user **102** may be distracted and unable to provide a quick answer.

The experience presentation module **1310** can use yet other strategies for modifying any input mode based on vehicle state.

FIG. **15** shows another environment **1500** in which the user **102** can operate his or her mobile device **104** within the vehicle **106**. In this context, the environment **1500** determines when the vehicle **106** appears to be in a distress condition. A distress condition corresponds to any traumatic event that befalls the vehicle **106**, and by extension, the user **102** who is driving the vehicle **106**. For example, a distress condition may correspond to an accident that has occurred that involves the vehicle **106**. When a distress condition has occurred, the environment **1500** solicits help from a diver assistance system **1502**. The driver assistance system **1502** can help the user **102** in various ways, such as by: (a) contacting the user **102** by telephone, text messaging, or other communication mechanism; (b) contacting an emergency response service (or services); (c) contacting the user's family members or other designated points of contact; (d) providing information regarding service stations and/or other assistance centers, and so on. Whenever the driver assistance system **1502** notifies a party of the occurrence of the distress condition, it can identify the location of the vehicle **106** and any qualifying circumstances surrounding the distress condition. The driver assistance system **1502** may be staffed by human agents who assist the user **102** in the event of a distress condition. In addition, or alternatively, the driver assistance system **1502** can include automated functionality for assisting the user **102**.

FIG. **16** provides additional information regarding a distress management module **1602** that can detect and respond to a distress condition within the environment **1500** of FIG. **15**. In one case, the mobile device **104** implements the distress management module **1602**. Alternatively, or in addition, the remote processing systems **118** and/or mount **302** can implement at least part of the distress management module **1602**.

The distress management module **1602** includes an interface module **1604** that receives a subset **1606** of instances of inference-input information from one or more internal input sources and/or a subset **1608** of instances of inference-input information from one or more external input sources. In other words, the interface module **1604** functions in the same manner as the interface module **1306** of FIG. **13**.

A distress condition detection module **1610** analyzes the input information to determine whether a distress condition has occurred. Different environments can make this judgment in different ways. Generally, the distress condition detection module **1610** forms a signature from the various instances of inference-input information that have been received, and then determines whether this signature matches the telltale signature of a distress condition. In one case, the distress condition detection module **1610** determines that a distress condition has occurred if: (1) the mobile device **104** is present in the vehicle **106**; and (2) the vehicle **106** came to an abrupt stop or otherwise abruptly decelerated (or accelerated); and/or (3) the mobile device **104** became dislodged from the mount **302** at about the same time as the occurrence of the abrupt deceleration (or acceleration). Informally, this means that an accident may have occurred which jolted the mobile device **104** out of its cradle **308**. Or the mobile device **104** may otherwise experience a dramatic (e.g., a jarring) deceleration or acceleration without necessarily becoming dislodged from the cradle **308**. A jolting deceleration may indicate that the moving vehicle **106** has collided with an object in its path. A jolting acceleration may indicate that the vehicle **106** has been hit by another moving object, including while the vehicle **106** is originally at rest.

The distress condition detection module **1610** can presume that the mobile device **104** is located in the vehicle **106** if, just prior to the abrupt deceleration, the attachment-sensing mechanism **316** indicates that the mobile device **104** is inserted in the cradle **308** of the mount **302**. Likewise, the distress condition detection module **1610** can determine that the mobile device **104** has broken free of the mount **302** based on the output of the attachment-sensing mechanism **316**. The distress condition detection module **1610** can determine that the mobile device **104** has come to an abrupt stop or otherwise abruptly decelerated (or accelerated) based on the output of the accelerometer device **502**, for example.

In other cases, the distress condition detection module **1610** can indicate the occurrence of a distress condition without the occurrence of events (2) and/or (3). For example, the distress condition detection module **1610** take into consideration any of the following events in assessing the occurrence of a distress condition: (a) a dramatic application of the breaks; (b) erratic steering; (c) traversal of significantly uneven surfaces (as when the vehicle **106** veers off a roadway); (d) the vehicle **106** turning on its side or completely overturning, etc. In addition, or alternatively, the distress condition detection module **1610** can base its analysis on image information captured by one or more camera devices and/or audio information captured by one or more microphone devices. These events are cited by way of illustration, not limitation.

An action module **1612** can notify the driver assistance system **1502** when the distress condition detection module **1610** informs it that a distress condition has occurred. An assistance center interaction module **1614** allows the user **102** to subsequently communicate with the driver assistance system **1502** to receive manual and/or automated help from that entity.

As a closing point, the above-described explanation has set forth the use of the mode functionality **434** within vehicles. But the user **102** can use the mode functionality **434** to interact with the mobile device **104** in any environment. Generally stated, the mode functionality **434** provides a particularly useful service in those environments in which the user **102** may interact with the mobile device **104** in different use scenarios, and further where the user **102** has different respective capabilities of interacting with the mobile device **104** in these different scenarios. To cite merely one example, the mobile device **104** can determine whether the user **102** is interacting with the mobile device **104** while walking or running; if so, the mobile device **104** can present a user interface experience to the user **102** which takes into consideration various constraints to which the user **102** may be subject while walking or running (as opposed to interacting with the mobile device **104** while at a single location).

B. Illustrative Processes

FIGS. **17-22** show procedures that explain one manner of operation of the environment **100** of FIG. **1**. Since the principles underlying the operation of the environment **100** have already been described in Section A, certain operations will be addressed in summary fashion in this section.

Starting with FIG. **17**, this figure shows an illustrative procedure **1700** that sets forth one manner of operation of the environment **100** of FIG. **1**, from the perspective of the user **102**. In block **1702**, the user **102** may use his or her mobile device **104** in a conventional mode of operation, e.g., by using his or her hands to interact with the mobile device **104** using the touch input device **424**. In block **1704**, the user **102** enters the vehicle **106** and places the mobile device **104** in any type of mount, such as the mount **302**. In block **1706**, the user **102** instructs the mobile device **104** to operate in the vehicle mode. In block **1708**, the user **102** begins navigation using the vehicle **106**. In block **1708**, the user **102** receives a user interface experience that is tailored to a current vehicle state. The vehicle state, in turn, is based on input information supplied by various input sources. In block **1712**, after completion of the user's trip, the user **102** may remove the mobile device **104** from the mount **302**. The user **102** may then resume using the mobile device **104** in a normal handheld mode of operation.

FIG. **18** shows an illustrative procedure **1800** which explains one manner of operation of the mode functionality **434**, from the perspective of the mode functionality **434**. In block **1802**, the mode functionality **434** receives inference-input information from one or more input sources, including one or more internal input sources (e.g., corresponding to the movement-sensing devices **430**), and/or one or more external input sources (e.g., corresponding to sensor information provided by a vehicle system **420**). In block **1804**, the mode functionality **434** infers the vehicle state based on the inference-input information. In block **1806**, the mode functionality **434** presents a user interface experience based on the inferred driving state.

FIGS. **19-21** show three instantiations of the procedure **1700** of FIG. **17**. For example, FIG. **19** presents a scenario that hinges on whether the vehicle **106** is moving or not. In block **1902**, the mode functionality **434** receives inference-input information. In block **1904**, the mode functionality **434** determines whether the vehicle **106** is moving or not. In block **1906**, the mode functionality **434** can make any combination of the changes summarized in FIG. **8**.

For example, in one scenario, the mode functionality **434** can use the inference-input information provided by any of the movement-sensing devices **430** and/or external sensor devices to determine that the vehicle **106** is in motion. In response, the mode functionality **434** can terminate the use of the display input mode, or use the display input mode to present simplified content (compared to the content it would present if the vehicle **106** was stationary). In lieu of the display input mode, the mode functionality **434** can optionally interact with the user **102** using the voice-recognition mode and/or the gesture-recognition input mode. Alternatively, the mode functionality **434** can preclude the presentation of certain types of content, such as video content, while the vehicle **106** is in motion.

FIG. **20** presents a scenario that depends on the manner in which the user **102** is driving the vehicle **106**. In block **2002**, the mode functionality **434** receives inference-input information. In block **2004**, the mode functionality **434** classifies the manner in which the mobile device **104** is moving based on the inference-input information. In block **2006**, the mode functionality **434** can make any combination of the changes summarized in FIG. **8**.

For example, the mode functionality **434** can use any combination of inference-input information to compile a movement signature that characterizes the manner in which the device is moving. The mode functionality **434** can then compare this movement signature to telltale movement signatures associated with different classes of movement; a matching telltale signature indicates the type of movement that the vehicle **106** is currently undergoing. Such classes of movement can include (but are not limited to): (a) traveling at speeds over a prescribed threshold; (b) traveling at dramatically varying speeds; (c) traveling over a winding roadway; (d) traveling over a roadway with marked elevation changes; (e) traveling over an uneven surface; (f) making frequent lane changes while traveling; (g) frequently applying the breaks of the vehicle **106** while traveling; (h) frequently shifting gears while traveling (i) drifting over the roadway while traveling or traveling in an otherwise erratic manner, and so on. The mode functionality **434** can then apply a user interface experience which correlates to the matching telltale movement signature. As a general principle, if the collected evidence indicates that the task of driving is (or should be) an arduous or complex task at the current time, then the mode functionality **434** will seek to reduce the attention-related demands that it imposes on the user **102**. Alternatively, or in addition, if the collected evidence indicates that the user **102** is already distracted (as evidenced by poor driving), then the mode functionality **434** will seek to lessen the attention-related burden on the user **102**.

FIG. **21** presents a scenario that depends on an assessed location of the vehicle **106**. In block **2102**, the mode functionality **434** receives inference-input information. The inference-input information can include any evidence pertaining to the location of the vehicle **106**. Such evidence can include position information, such as GPS information, WiFi or cell tower triangulation information, dead reckoning information, and so on. In addition, or alternatively, the mode functionality **434** can directly monitor the environment in which the user **102** is traveling based on image information captured by one or more camera devices and/or audio information captured by one or more microphone devices.

In block **2104**, the mode functionality **434** identifies the region in which the vehicle **106** is located based on the inference-input information. This can comprise position-related analysis of position information received by any position-determining device. For example, this operation may involve determining a street location of the vehicle **106** by consulting map information that is provided by the mobile device **104** and/or the remote processing systems **118**. The determination of the region can also involve analysis of image information received from camera devices and/or analysis of audio information received from microphone devices. For example, the mode functionality **434** can rely on image analysis to determine that the roadway on which the user **102** is traveling is congested with pedestrians and/or other vehicles.

As another part of this block **2104**, the mode functionality **434** can ascertain the driving-related implications of the region in which the vehicle **106** is located. In one implementation, the mode functionality **434** can make this assessment by consulting the remote processing systems **118** (and the associated system store **122**). The remote processing systems **118** can determine whether there are any attention-related considerations that have a bearing on the amount and type of attention that a user **102** is expected to maintain while in the identified region. Based on this information, in block **2106**, the mode functionality **434** can make any combination of the changes summarized in FIG. **8**.

For example, the mode functionality **434** can ascertain whether the user **102** is within any one or the following representative regions to which a particular attention profile may apply: (a) a school zone; (b) a construction zone; (c) an area in proximity to emergency services; (d) a hazard zone, and so on. More generally, the mode functionality can also use any position-related evidence to determine the driving rules which are applicable to the vehicle **106** at a particular point in time. The mode functionality **434** can then apply a user interface experience which it appropriate for the identified region.

Alternatively, the mode functionality **434** can make its determination of the vehicle state based on the manner in which the user **102** is driving his or her vehicle **106** (as ascertained in scenario A or scenario B), combined with insight regard the present location of the vehicle **106** (as ascertained in scenario C). For example, the mode functionality **434** can selectively disable a display input mode output presentation when the user **102** is driving more than 20 MPH on a street that borders a park.

FIG. **22** shows a procedure **2200** which summarizes one manner of operation of the distress management module **1602** shown in FIG. **16**. In block **2202**, the distress management module **1602** receives inference-input information. In block **2204**, the distress management module **1602** determines whether the vehicle **106** is in a distress condition at the present time, based on the inference-input information. In block **2206**, the distress management module **1602** presents assistance to the user **102** (presuming that the vehicle **106** is in a distress condition). This assistance can include contacting the remote driver assistance system **1502**.

C. Representative Computing functionality

FIG. **23** sets forth illustrative computing functionality **2300** that can be used to implement any aspect of the functions described above. For example, the computing functionality **2300** can be used to implement any aspect of the mobile device **104**. In addition, the type of computing functionality **2300** shown in FIG. **23** can be used to implement any aspect of the remote processing systems **118**. In one case, the computing functionality **2300** may correspond to any type of computing device that includes one or more processing devices. In all cases, the computing functionality **2300** represents one or more physical and tangible processing mechanisms.

The computing functionality **2300** can include volatile and non-volatile memory, such as RAM **2302** and ROM **2304**, as well as one or more processing devices **2306** (e.g., one or more CPUs, and/or one or more GPUs, etc.). The computing functionality **2300** also optionally includes various media devices **2308**, such as a hard disk module, an optical disk module, and so forth. The computing functionality **2300** can perform various operations identified above when the processing device(s) **2306** executes instructions that are maintained by memory (e.g., RAM **2302**, ROM **2304**, or elsewhere).

More generally, instructions and other information can be stored on any computer readable medium **2310**, including, but not limited to, static memory storage devices, magnetic storage devices, optical storage devices, and so on. The term computer readable medium also encompasses plural storage devices. In all cases, the computer readable medium **2310** represents some form of physical and tangible entity.

The computing functionality **2300** also includes an input/output module **2312** for receiving various inputs (via input modules **2314**), and for providing various outputs (via output modules). One particular output mechanism may include a presentation module **2316** and an associated graphical user interface (GUI) **2318**. The computing functionality **2300** can also include one or more network interfaces **2320** for exchanging data with other devices via one or more communication conduits **2322**. One or more communication buses **2324** communicatively couple the above-described components together.

The communication conduit(s) **2322** can be implemented in any manner, e.g., by a local area network, a wide area network (e.g., the Internet), etc., or any combination thereof. The communication conduit(s) **2322** can include any combination of hardwired links, wireless links, routers, gateway functionality, name servers, etc., governed by any protocol or combination of protocols.

Alternatively, or in addition, any of the functions described in Sections A and B can be performed, at least in part, by one or more hardware logic components. For example, without limitation, illustrative types of hardware logic components that can be used include Field-programmable Gate Arrays (FPGAs), Application-specific Integrated Circuits (ASICs), Application-specific Standard Products (ASSPs), System-on-a-chip systems (SOCs), Complex Programmable Logic Devices (CPLDs), etc.

In closing, functionality described herein can employ various mechanisms to ensure the privacy of user data maintained by the functionality. For example, the functionality can allow a user to expressly opt in to (and then expressly opt out of) the provisions of the functionality. The functionality can also provide suitable security mechanisms to ensure the privacy of the user data (such as data-sanitizing mechanisms, encryption mechanisms, password-protection mechanisms, etc.).

Further, the description may have described various concepts in the context of illustrative challenges or problems. This manner of explanation does not constitute an admission that others have appreciated and/or articulated the challenges or problems in the manner specified herein.

Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

What is claimed is:

1. A computer implemented method, comprising:
determining that a mobile device is in a vehicle based upon at least one of mobile device-provided input information provided by the mobile device or vehicle-provided input information provided by the vehicle;
automatically switching the mobile device from a hand-held mode to a vehicle mode based upon the at least one of the mobile device-provided input information or the vehicle-provided input information;
evaluating the at least one of the mobile device-provided input information or the vehicle-provided input information to select a current vehicle state of the vehicle having a corresponding level of driving complexity, the current vehicle state being selected from a plurality of predetermined vehicle states associated with different levels of driving complexity; and,
generating a user interface experience for a user who is operating the vehicle based at least in part on the corresponding level of driving complexity of the current vehicle state, wherein the user interface experience imposes attention-related demands on the user and wherein the user interface experience replaces at least some input commands with other input commands that are associated with the corresponding level of driving complexity of the current vehicle state.

2. The method of claim **1**, further comprising:
obtaining the mobile device-provided input information from one or more of:
an accelerometer device of the mobile device;
a gyro device of the mobile device;
a vision device of the mobile device;
a magnetometer device of the mobile device;
or a position-determining device of the mobile device,
wherein the mobile device-provided input information is evaluated to select the current vehicle state.

3. The method of claim **2**, wherein the mobile device-provided input information is obtained from the position-determining device and the position-determining device comprises a GPS device.

4. The method of claim **1**, further comprising:
obtaining the vehicle-provided input information, wherein the vehicle- provided input information indicates whether passengers are present in the vehicle and the vehicle-provided input information is evaluated to select the current vehicle state.

5. The method of claim **1**, further comprising: obtaining and evaluating both the vehicle-provided input information and the mobile device-provided input information to select the current vehicle state.

6. The method of claim **1**, wherein the evaluating comprises:
compiling a movement signature from the at least one of the mobile device-provided input information or the vehicle-provided input information.

7. The method of claim **6**, wherein the evaluating comprises comparing the movement signature to a plurality of different movement signatures associated with different classes of movement to determine the current vehicle state.

8. The method of claim **7**, wherein the different classes of movement correspond to different variations in speed of the vehicle and the current vehicle state characterizes an extent to which the speed of the vehicle varies.

9. The method of claim **7**, wherein the different classes of movement correspond to different amounts of braking of the vehicle and the current vehicle state characterizes an extent to which the brakes of the vehicle are being applied.

10. The method of claim **1**, wherein, in the vehicle mode, the generating comprises sending the generated user interface experience to the vehicle for presentation by the vehicle.

11. The method of claim **1**, wherein the at least some input commands that are replaced are touch input commands and the other input commands are voice-based or gesture-based commands.

12. The method of claim **1**, wherein the generating comprises presenting the user interface experience on the mobile device.

13. A mobile device, comprising:
a display;
a processor; and

a computer-readable medium storing computer readable instructions which, when executed by the processor, cause the processor to:

allow a user to specify that the mobile device operate in either a handheld mode or a vehicle mode; in the vehicle mode:

obtain sensor information from one or more sensors, and

use the sensor information to predict a route that a vehicle is likely to take to reach a specified or predicted destination; based at least on the predicted route, determine a predicted future vehicle state of the vehicle, the predicted future vehicle state having an attention profile that characterizes a level of attention and a type of attention which is appropriate for the user to maintain while operating the vehicle; and

configure a user interface of the mobile device to comply with the attention profile for the predicted future vehicle state.

14. The mobile device of claim **13**, wherein:

an application with which the mobile device interacts includes a plurality of resources, the plurality of resources including at least a first group of resources adapted for application in a first vehicle state, and a second group of resources adapted for application in a second vehicle state, and

the computer readable instructions, when executed by the processor, cause the processor to use either the first group of resources or the second group of resources based at least on the predicted future vehicle state.

15. The mobile device of claim **13**, further comprising the one or more sensors.

16. The mobile device of claim **15**, wherein:

the one or more sensors indicate a location of the mobile device, and

the computer readable instructions, when executed by the processor, cause the processor to consult prior routes traveled by the mobile device to predict the route.

17. The mobile device of claim **13**, wherein the computer readable instructions, when executed by the processor, cause the processor to:

determine predicted driving conditions associated with the predicted route; and

determine the predicted future vehicle state based at least on the predicted driving conditions.

18. The mobile device of claim **13**, wherein:

the one or more sensors are provided by the vehicle, and the computer readable instructions, when executed by the processor,

cause the processor to obtain the sensor information from the vehicle.

19. A method comprising:

operating a mobile device having a handheld mode and a vehicle mode in the vehicle mode;

while in the vehicle mode:

obtaining sensor information from one or more sensors, and

using the sensor information to predict a route that a vehicle is likely to take to reach a specified or predicted destination;

based at least on the predicted route, determining a predicted future vehicle state of the vehicle, the predicted future vehicle state having an attention profile that characterizes a level of attention and a type of attention which is appropriate for a user to maintain while operating the vehicle; and

configuring a user interface of the mobile device in accordance with the attention profile for the predicted future vehicle state.

20. The method of claim **19**, performed entirely by the mobile device.

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