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Srey et al.

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(45) **Date of Patent: Aug. 27, 2019**

(54) **ENCOURAGING SAFE DRIVING USING A REMOTE VEHICLE STARTER AND PERSONALIZED INSURANCE RATES**

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(51) **Int. Cl.**

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F02N 11/08	(2006.01)
G06Q 30/02	(2012.01)

(52) **U.S. Cl.**
CPC ***G06Q 40/08*** (2013.01); ***F02N 11/0807*** (2013.01); ***G06Q 30/0283*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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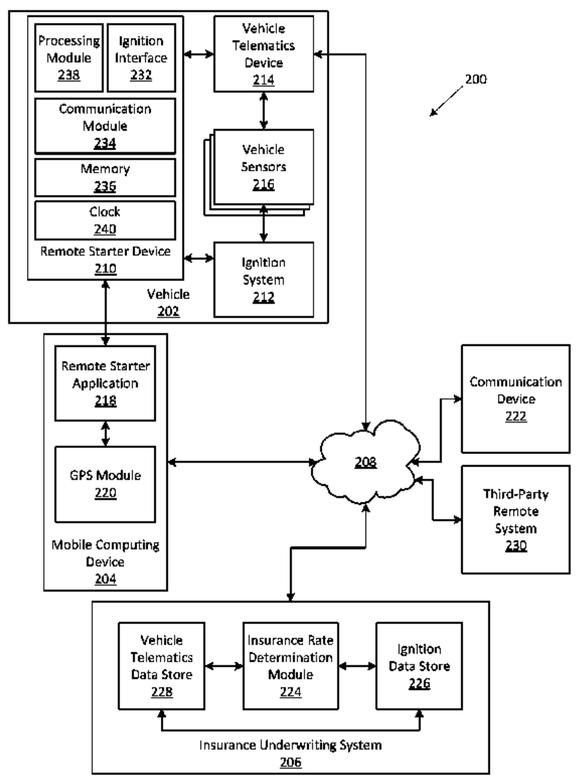
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(57) **ABSTRACT**

A method of encouraging safe driving of a vehicle using a remote starter device installed at a vehicle is provided. The remote starter device may determine whether it is in signal communication with a remote starter application operating at a mobile computing device separate from the remote starter device. When the remote starter device is in signal communication with the remote starter application, the remote starter device may permit ignition of the vehicle. When the remote starter device is not in signal communication with the remote starter application, the remote starter device may prevent ignition of the vehicle. The driver of the vehicle may be identified and a vehicle telematics device installed at the vehicle may provide vehicle telematics data to an insurance underwriting system. A personalized insurance rate for the driver may be determined based, at least in part, on the vehicle telematics data.

20 Claims, 11 Drawing Sheets



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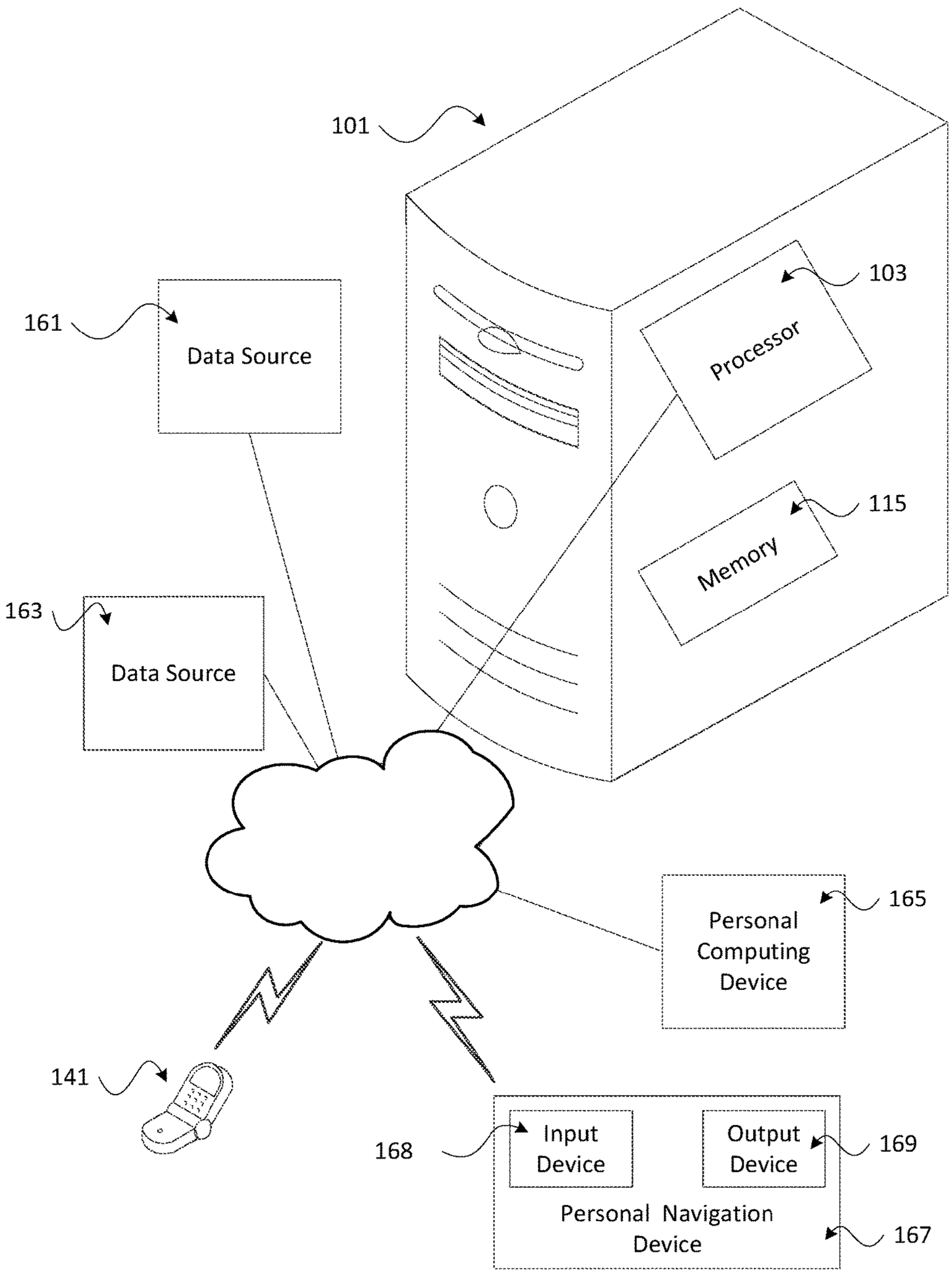

101
103
Processor
115
Memory
161
Data Source
163
Data Source
165
Personal Computing Device
141
168
Input Device
Output Device
169
Personal Navigation Device
167

FIG. 1A

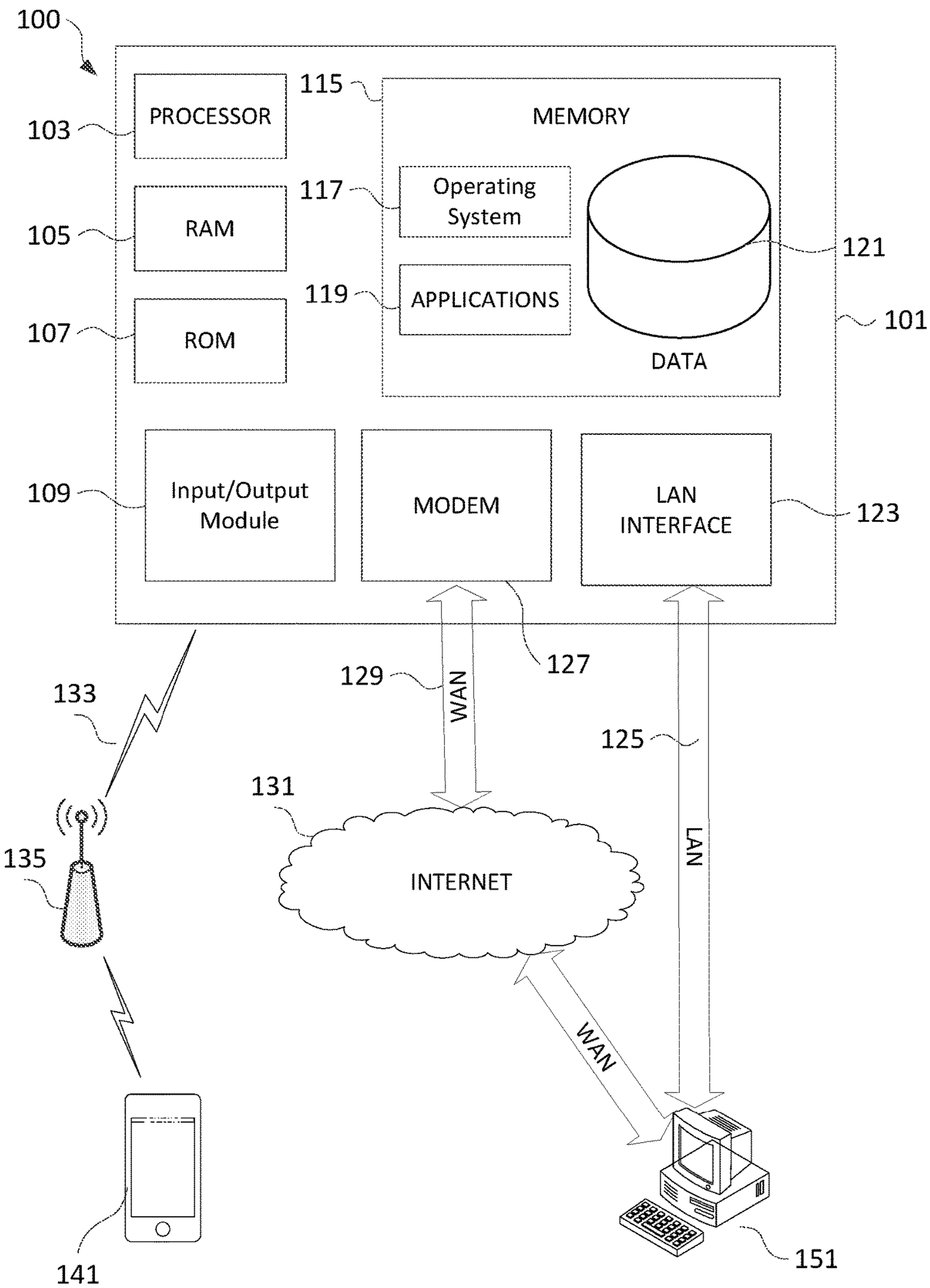

100
PROCESSOR
103
RAM
105
ROM
107
115
MEMORY
117
Operating System
119
APPLICATIONS
121
DATA
101
109
Input/Output Module
MODEM
LAN INTERFACE
123
127
129
WAN
125
LAN
133
131
INTERNET
135
WAN
141
151

FIG. 1B

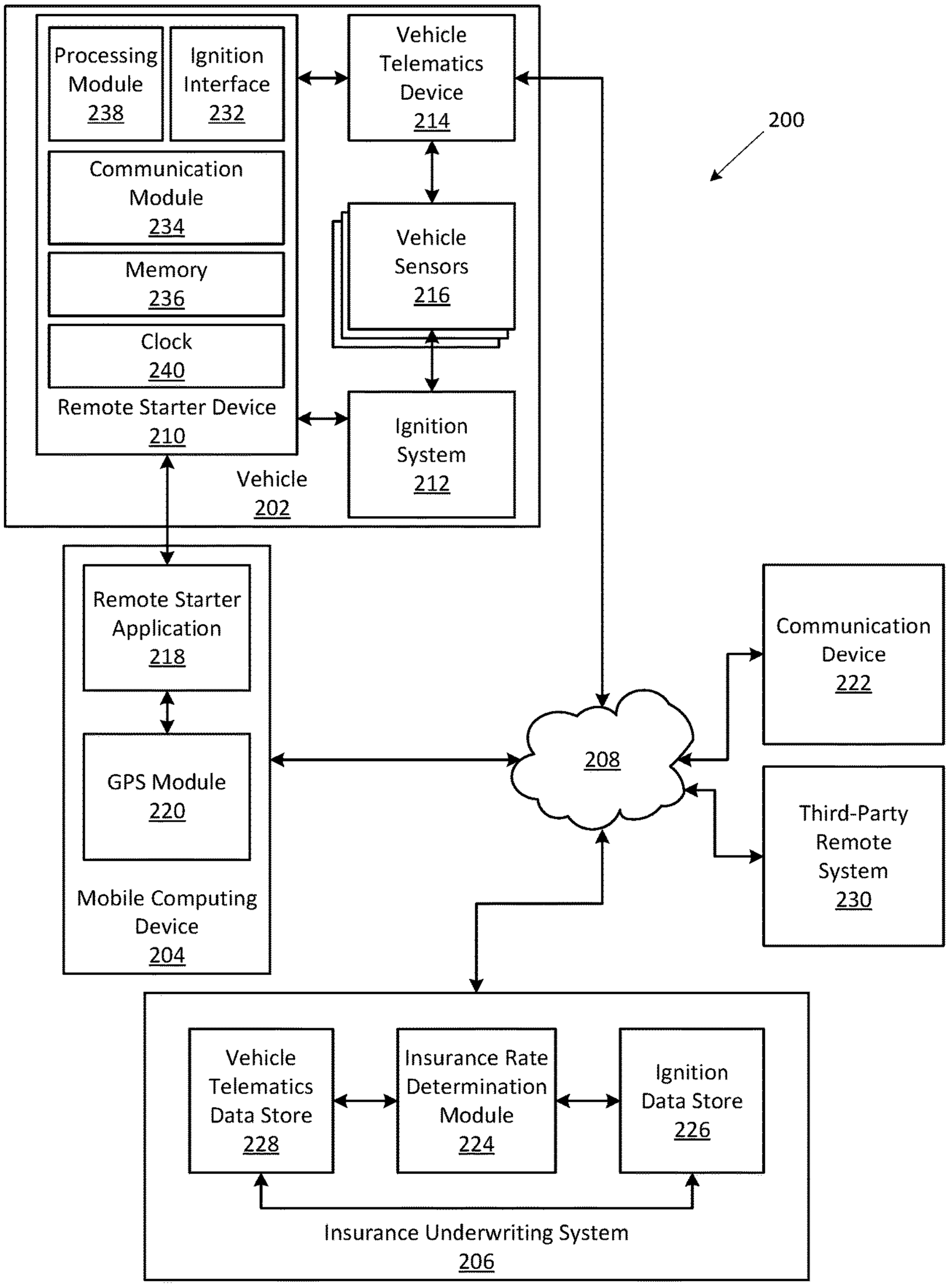

Processing Module 238
Ignition Interface 232
Communication Module 234
Memory 236
Clock 240
Remote Starter Device 210
Vehicle Telematics Device 214
Vehicle Sensors 216
Ignition System 212
Vehicle 202
200
Remote Starter Application 218
GPS Module 220
Mobile Computing Device 204
208
Communication Device 222
Third-Party Remote System 230
Vehicle Telematics Data Store 228
Insurance Rate Determination Module 224
Ignition Data Store 226
Insurance Underwriting System 206

FIG. 2

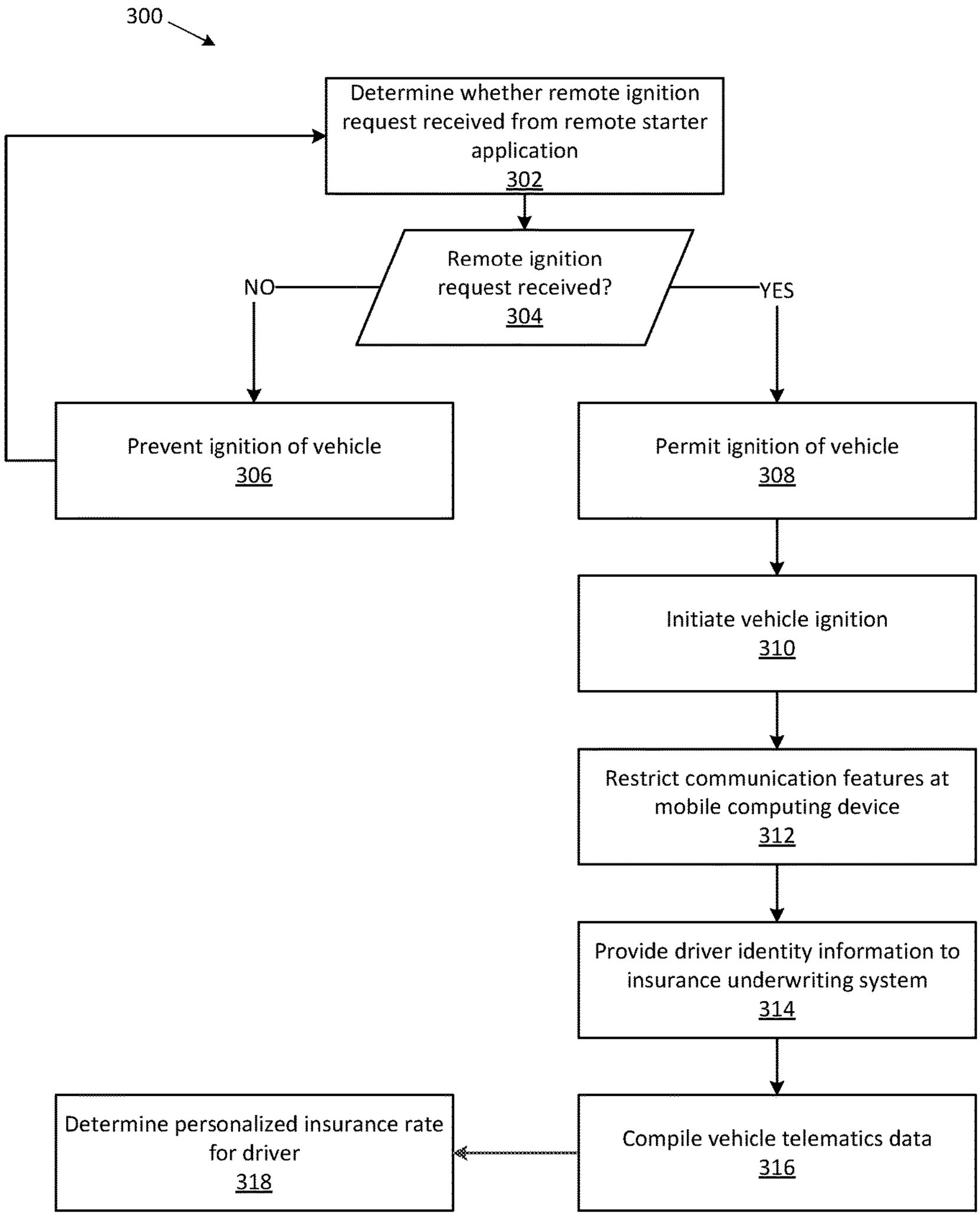

300
Determine whether remote ignition request received from remote starter application
302
Remote ignition request received?
304
NO
YES
Prevent ignition of vehicle
306
Permit ignition of vehicle
308
Initiate vehicle ignition
310
Restrict communication features at mobile computing device
312
Provide driver identity information to insurance underwriting system
314
Compile vehicle telematics data
316
Determine personalized insurance rate for driver
318

FIG. 3

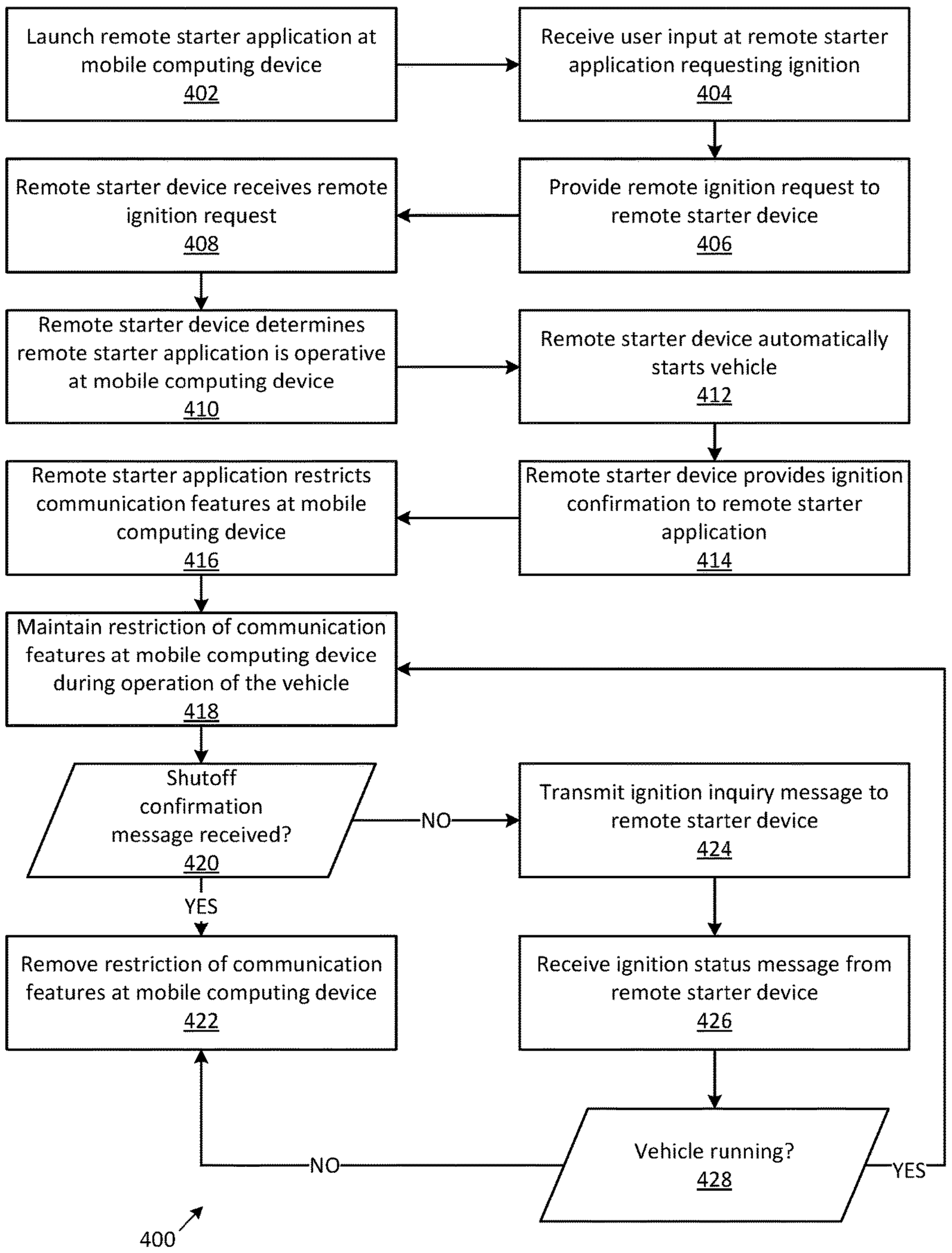

Launch remote starter application at mobile computing device
402
Receive user input at remote starter application requesting ignition
404
Provide remote ignition request to remote starter device
406
Remote starter device receives remote ignition request
408
Remote starter device determines remote starter application is operative at mobile computing device
410
Remote starter device automatically starts vehicle
412
Remote starter device provides ignition confirmation to remote starter application
414
Remote starter application restricts communication features at mobile computing device
416
Maintain restriction of communication features at mobile computing device during operation of the vehicle
418
Shutoff confirmation message received?
420
NO
YES
Transmit ignition inquiry message to remote starter device
424
Remove restriction of communication features at mobile computing device
422
Receive ignition status message from remote starter device
426
Vehicle running?
428
NO
YES
400

FIG. 4

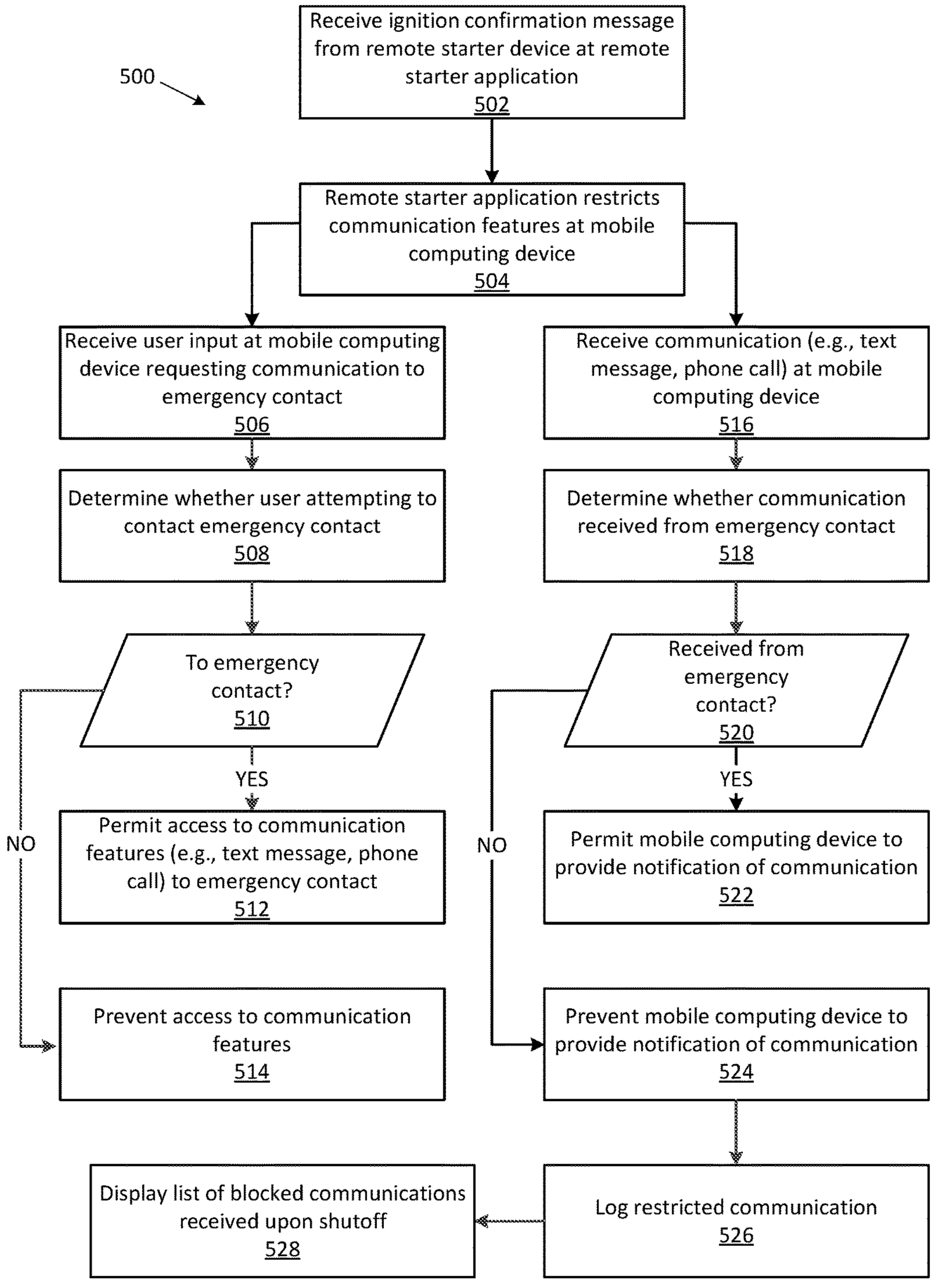

500
Receive ignition confirmation message from remote starter device at remote starter application
502
Remote starter application restricts communication features at mobile computing device
504
Receive user input at mobile computing device requesting communication to emergency contact
506
Determine whether user attempting to contact emergency contact
508
To emergency contact?
510
YES
Permit access to communication features (e.g., text message, phone call) to emergency contact
512
NO
Prevent access to communication features
514
Receive communication (e.g., text message, phone call) at mobile computing device
516
Determine whether communication received from emergency contact
518
Received from emergency contact?
520
YES
Permit mobile computing device to provide notification of communication
522
NO
Prevent mobile computing device to provide notification of communication
524
Log restricted communication
526
Display list of blocked communications received upon shutoff
528

FIG. 5

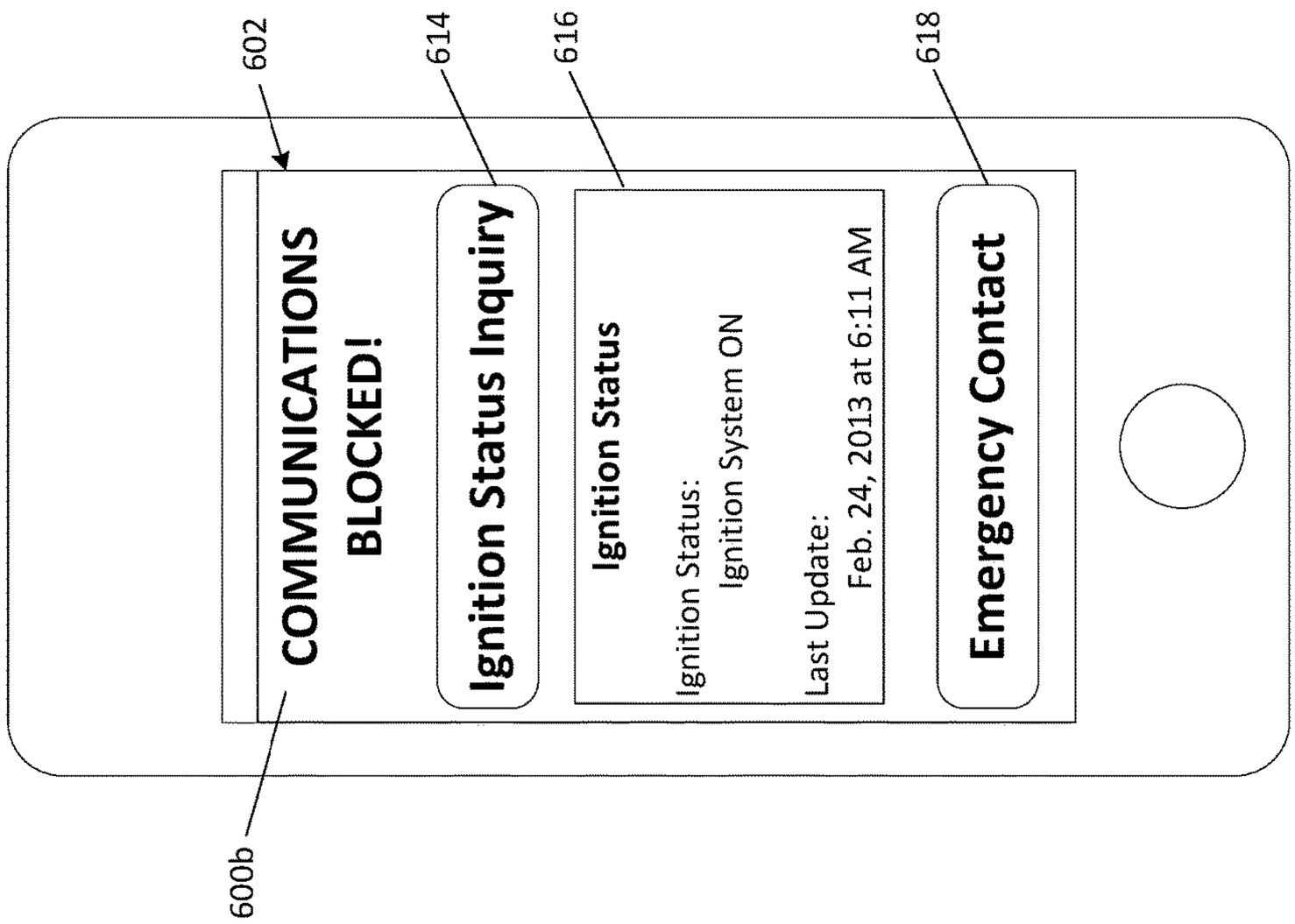

602
614
616
618
COMMUNICATIONS BLOCKED!
Ignition Status Inquiry
Ignition Status
Ignition Status:
Ignition System ON
Last Update:
Feb. 24, 2013 at 6:11 AM
Emergency Contact
600b

FIG. 6B

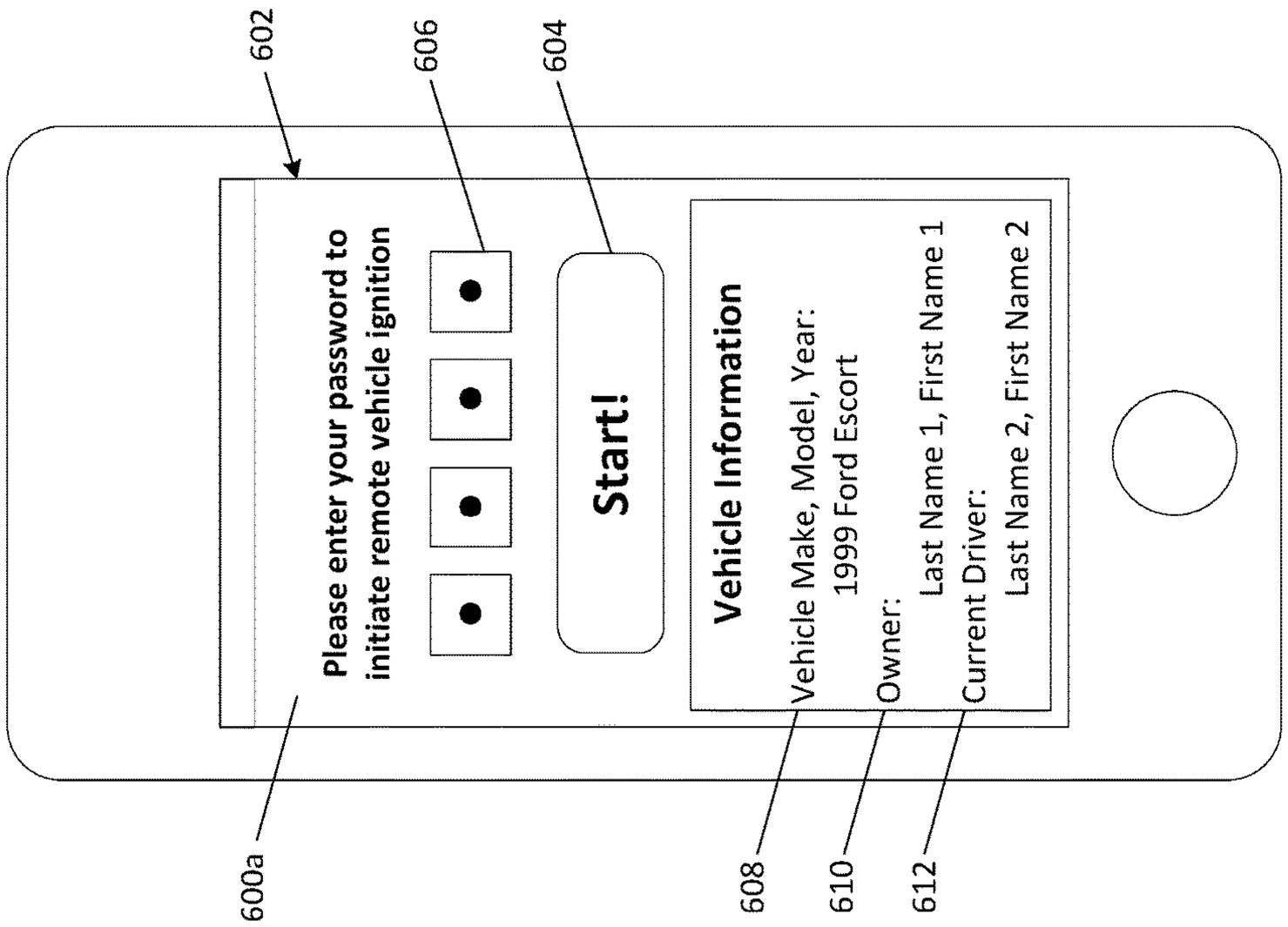

602
606
604
Please enter your password to initiate remote vehicle ignition
Start!
Vehicle Information
Vehicle Make, Model, Year:
1999 Ford Escort
Owner:
Last Name 1, First Name 1
Current Driver:
Last Name 2, First Name 2
600a
608
610
612

FIG. 6A

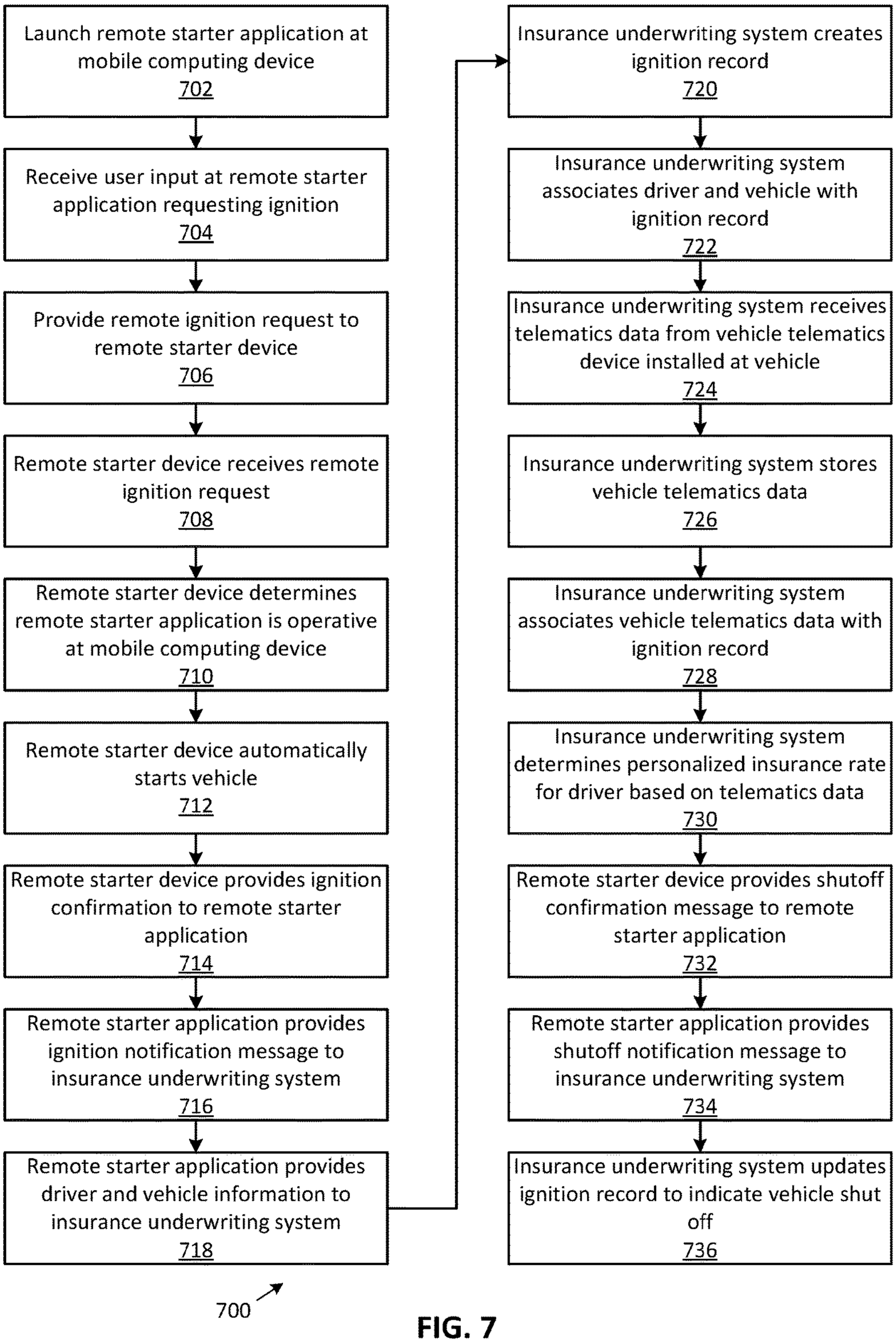

Launch remote starter application at mobile computing device 702
Receive user input at remote starter application requesting ignition 704
Provide remote ignition request to remote starter device 706
Remote starter device receives remote ignition request 708
Remote starter device determines remote starter application is operative at mobile computing device 710
Remote starter device automatically starts vehicle 712
Remote starter device provides ignition confirmation to remote starter application 714
Remote starter application provides ignition notification message to insurance underwriting system 716
Remote starter application provides driver and vehicle information to insurance underwriting system 718
Insurance underwriting system creates ignition record 720
Insurance underwriting system associates driver and vehicle with ignition record 722
Insurance underwriting system receives telematics data from vehicle telematics device installed at vehicle 724
Insurance underwriting system stores vehicle telematics data 726
Insurance underwriting system associates vehicle telematics data with ignition record 728
Insurance underwriting system determines personalized insurance rate for driver based on telematics data 730
Remote starter device provides shutoff confirmation message to remote starter application 732
Remote starter application provides shutoff notification message to insurance underwriting system 734
Insurance underwriting system updates ignition record to indicate vehicle shut off 736
700

FIG. 7

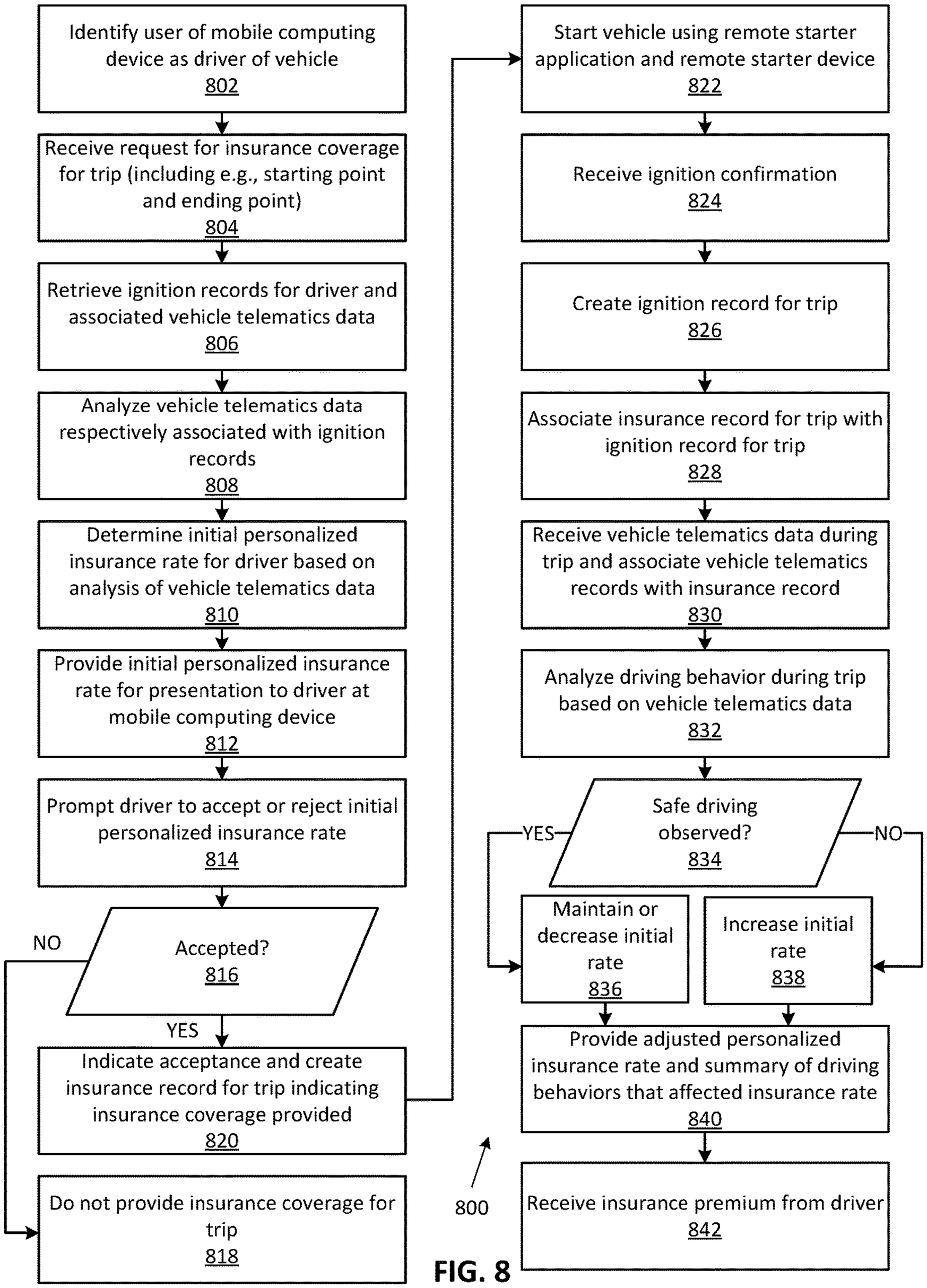

Identify user of mobile computing device as driver of vehicle
802
Receive request for insurance coverage for trip (including e.g., starting point and ending point)
804
Retrieve ignition records for driver and associated vehicle telematics data
806
Analyze vehicle telematics data respectively associated with ignition records
808
Determine initial personalized insurance rate for driver based on analysis of vehicle telematics data
810
Provide initial personalized insurance rate for presentation to driver at mobile computing device
812
Prompt driver to accept or reject initial personalized insurance rate
814
Accepted?
816
NO
YES
Indicate acceptance and create insurance record for trip indicating insurance coverage provided
820
Do not provide insurance coverage for trip
818
Start vehicle using remote starter application and remote starter device
822
Receive ignition confirmation
824
Create ignition record for trip
826
Associate insurance record for trip with ignition record for trip
828
Receive vehicle telematics data during trip and associate vehicle telematics records with insurance record
830
Analyze driving behavior during trip based on vehicle telematics data
832
Safe driving observed?
834
YES
NO
Maintain or decrease initial rate
836
Increase initial rate
838
Provide adjusted personalized insurance rate and summary of driving behaviors that affected insurance rate
840
Receive insurance premium from driver
842
800

FIG. 8

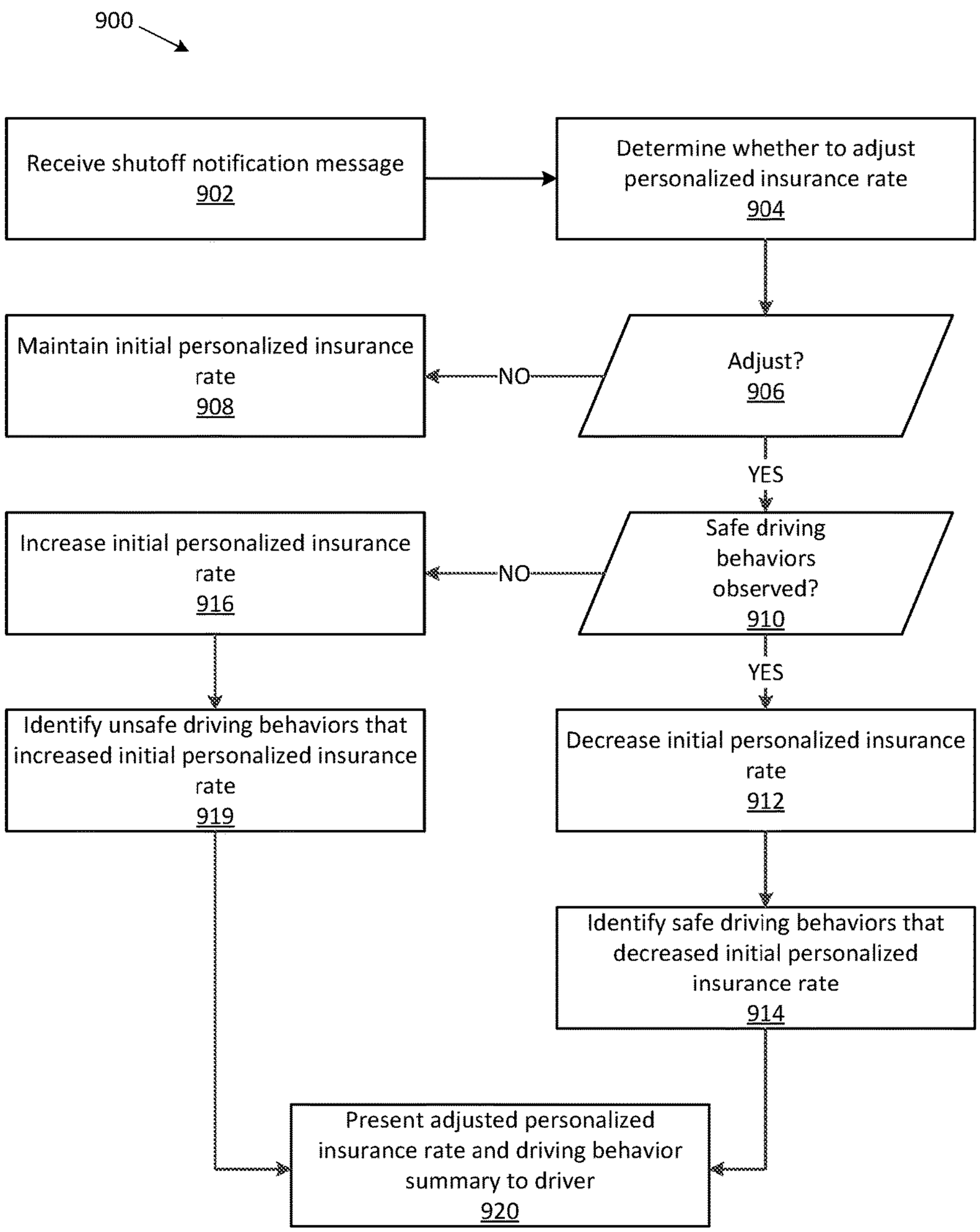

900
Receive shutoff notification message
902
Determine whether to adjust personalized insurance rate
904
Adjust?
906
NO
Maintain initial personalized insurance rate
908
YES
Safe driving behaviors observed?
910
NO
Increase initial personalized insurance rate
916
YES
Decrease initial personalized insurance rate
912
Identify unsafe driving behaviors that increased initial personalized insurance rate
919
Identify safe driving behaviors that decreased initial personalized insurance rate
914
Present adjusted personalized insurance rate and driving behavior summary to driver
920

FIG. 9

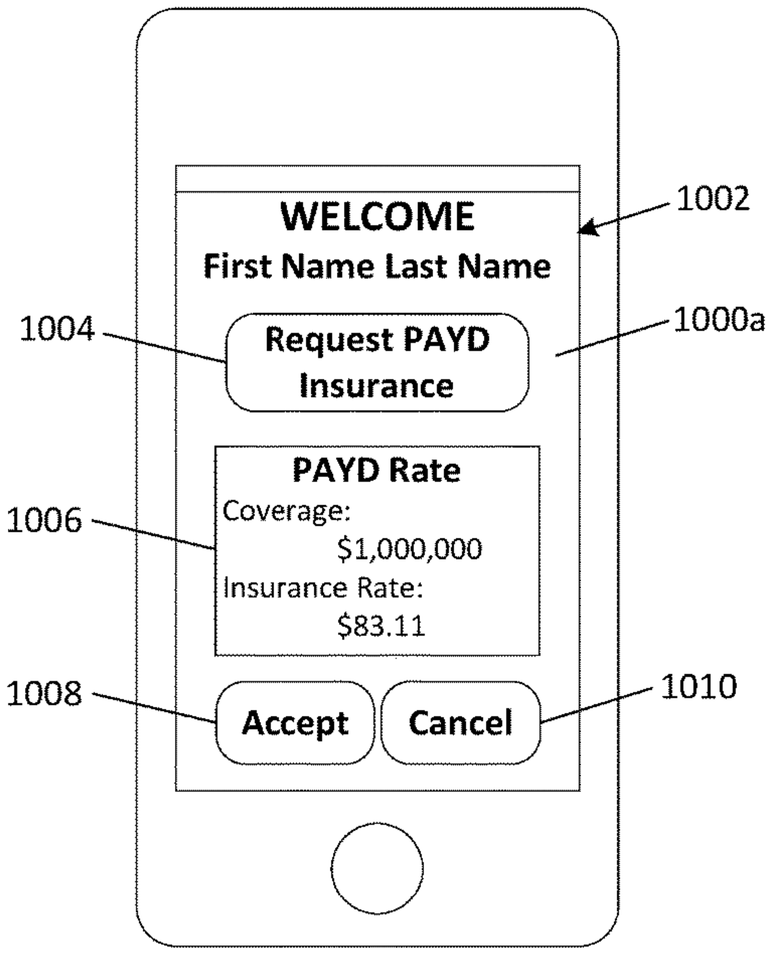


FIG. 10A

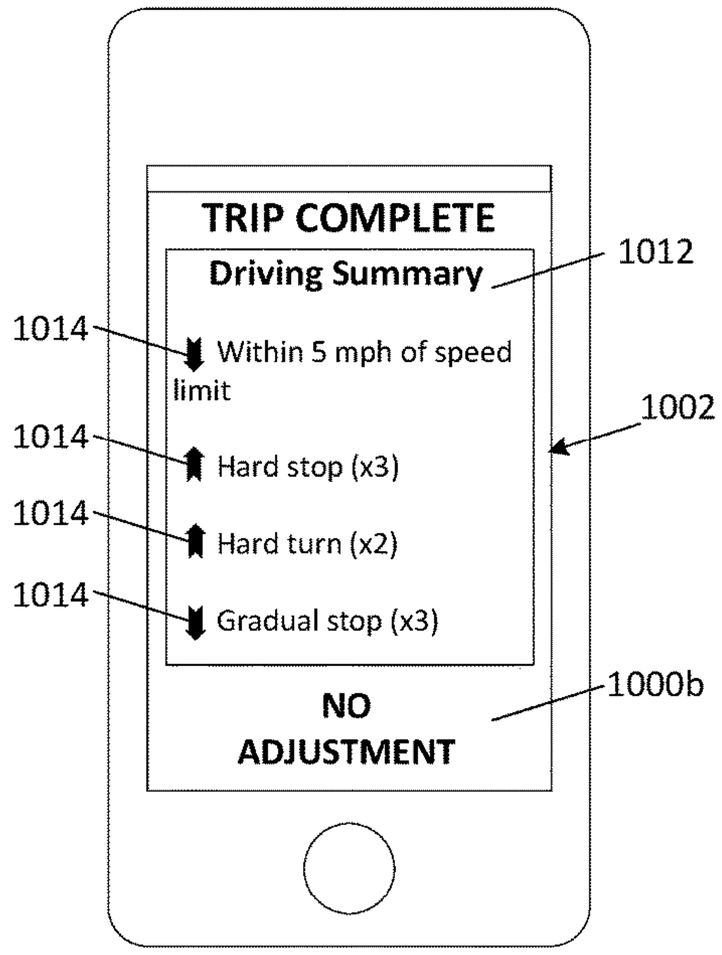


FIG. 10B

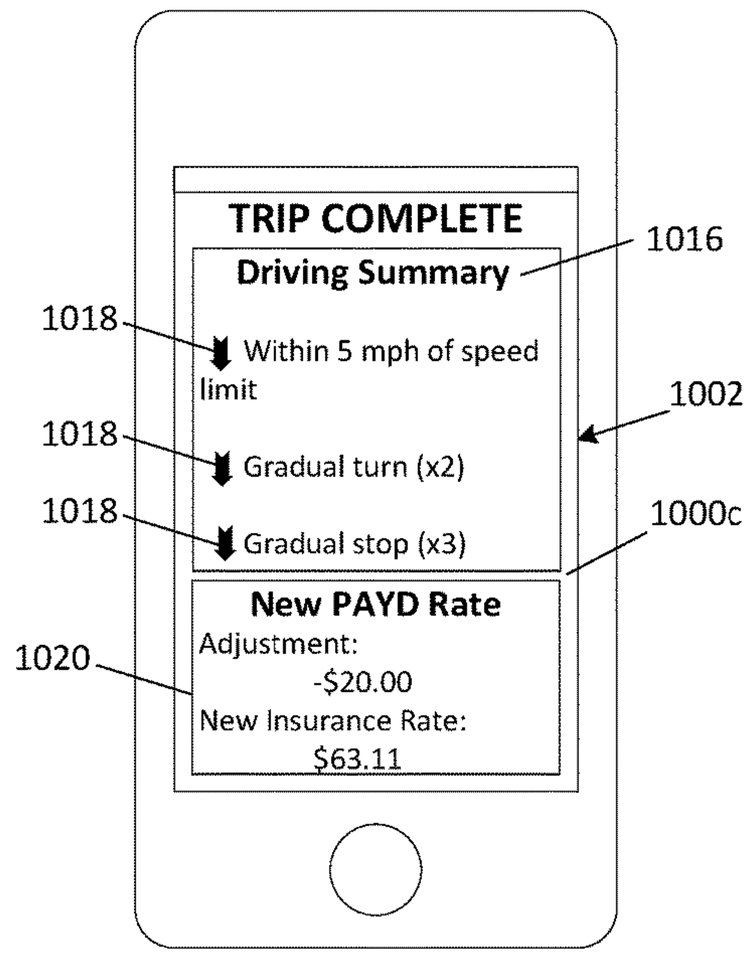


FIG. 10C

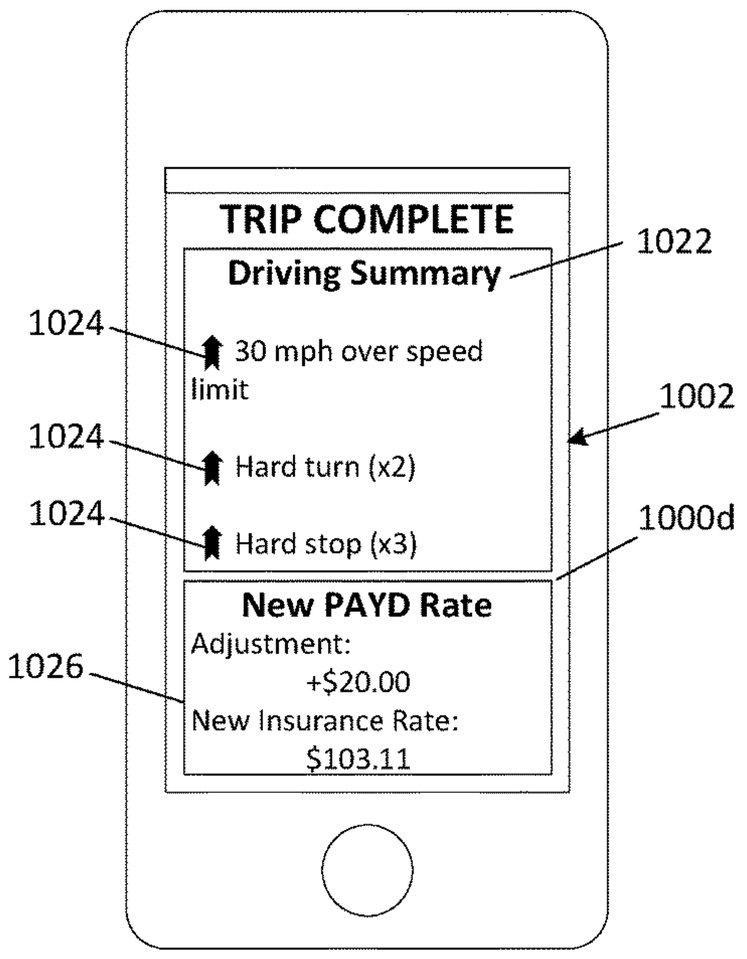


FIG. 10D

ENCOURAGING SAFE DRIVING USING A REMOTE VEHICLE STARTER AND PERSONALIZED INSURANCE RATES

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. patent application Ser. No. 13/791,287, U.S. Pat. No. 9,454,786, entitled "Encouraging Safe Driving Using a Remote Vehicle Starter and Personalized Insurance Rates" and filed on Mar. 8, 2013, which is incorporated by reference herein.

TECHNICAL FIELD

Aspects of the disclosure relate generally to encouraging safe driving behaviors and more particularly to approaches to encouraging safe driving behaviors through the use of a remote vehicle starter and a remote starter application configured to operate at a mobile computing device.

BACKGROUND

Insurance providers have an incentive to encourage their customers to engage in safe driving behaviors. By engaging in safe driving behaviors, customers are less likely to be involved in an accident. Unsafe driving behaviors may include exceeding the speed limit, taking hard and fast turns, making hard stops, and operating a mobile phone while driving.

Software applications for blocking text messages at a mobile computing device are known but have drawbacks. For example, some text blocking applications may require a driver to voluntarily launch the application before driving. If the driver fails or chooses not to launch the text blocking application, the driver may have access to the text messaging features of the mobile computing device while driving. Therefore, a need exists for an approach to restricting communications at a mobile computing device during operation of the vehicle.

Additionally, in conventional practice, insurance providers may provide insurance coverage for a vehicle rather than for a driver of the vehicle. This may be due, in part, to challenges in determining the individual presently driving the vehicle. If an insurance provider could accurately identify the driver of a vehicle, alternative approaches to providing vehicle insurance based on the driver rather than the vehicle are possible.

SUMMARY

The following presents a simplified summary in order to provide a basic understanding of some aspects of the disclosure. The summary is not an extensive overview of the disclosure and is not intended to identify key or critical elements or to delineate the scope of protection sought. The following summary merely presents some concepts of the disclosure in a simplified form as an introduction to the more detailed description provided below.

A method of encouraging safe driving of a vehicle using a remote starter device installed at a vehicle is provided. The remote starter device may determine whether it is in signal communication with a remote starter application operating at a mobile computing device separate from the remote starter device. When the remote starter device is in signal communication with the remote starter application, the remote starter device may permit ignition of the vehicle.

When the remote starter device is not in signal communication with the remote starter application, the remote starter device may prevent ignition of the vehicle. The driver of the vehicle may be identified and a vehicle telematics device installed at the vehicle may provide vehicle telematics data to an insurance underwriting system. A personalized insurance rate for the driver may be determined based, at least in part, on the vehicle telematics data.

The remote starter device may provide an ignition confirmation message upon ignition of the vehicle and a shutoff message upon shutoff of the vehicle. The insurance underwriting system may create an ignition record in response to ignition at the vehicle and update the ignition record in response to shutoff of the vehicle. The ignition record may be associated with the vehicle telematics data. Additionally, the ignition record may be configured to indicate when and where the vehicle achieved ignition as well as when and where the vehicle shut off.

A remote starter device configured to encourage safe driving of a vehicle is also provided. The remote starter device may include an ignition interface configured for connection to an ignition system of the vehicle. The remote starter device may also be configured to automatically initiate vehicle ignition via the ignition interface. The remote starter device may include a communication module configured to exchange communications with a remote starter application operating at a mobile device. The remote starter device may further include a processing module connected to the ignition interface and the communication module.

A memory module of the remote starter device may include instructions executable by a processor of the processing module. When executed, the instructions may cause the remote starter device to determine whether a connection has been established with the remote starter application, permit or prevent vehicle ignition based on whether the connection has been established, and provide an ignition confirmation message upon ignition of the vehicle. Receipt of the ignition confirmation message may trigger identification of the driver to the insurance underwriting system. The insurance underwriting system may determine a personalized insurance rate for a driver of the vehicle. The personalized insurance rate may be adjusted based on driving behaviors of the driver during a trip in the vehicle. In response to receipt of a shutoff confirmation message, a driving behavior summary may be presented to the driver as well as an adjusted personalized insurance rate.

A non-transitory computer-readable medium having computer-executable instructions stored thereon that carry out one or more of the steps described above is further provided.

The details of these and other embodiments of the disclosure are set forth in the accompanying drawings and description below. Other features and advantages of aspects of the disclosure will be apparent from the description and drawings.

DESCRIPTION OF THE DRAWINGS

Aspects of the disclosure may be implemented in certain parts, steps, and embodiments that will be described in detail in the following description and illustrated in the accompanying drawings in which like reference numerals indicate similar elements. It will be appreciated with the benefit of this disclosure that the steps illustrated in the accompanying figures may be performed in other than the recited order and that one or more of the steps disclosed may be optional. It will also be appreciated that one or more components illustrated in the accompanying figures may be positioned in

other than the disclosed arrangement and that one or more of the components illustrated may be optional.

FIG. **1**A is an example of an implementation of a suitable operating environment in which various aspects of the disclosure may be implemented.

FIG. **1**B is a block diagram of a system that may be used according to one or more example embodiments of the disclosure.

FIG. **2** is a block diagram of an example of an implementation of system for encouraging safe driving behavior using a remote starter device installed at a vehicle.

FIG. **3** is a flowchart of example method steps for encouraging safe driving behaviors using a remote starter device installed at a vehicle.

FIG. **4** is a flowchart of example method steps for restricting communications at a mobile computing device using a remote starter device installed at a vehicle.

FIG. **5** is another flowchart of example method steps for restricting communications at a mobile computing device using a remote starter device installed at a vehicle.

FIG. **6**A is an example of an implementation of a display interface for a remote starter application configured to operate at a mobile computing device.

FIG. **6**B is another example of an implementation of a display interface for a remote starter application configured to operate at a mobile computing device.

FIG. **7** is a flowchart of example method steps for identifying a driver of a vehicle and maintaining a driving history for the driver.

FIG. **8** is a flowchart of example method steps for providing personalized insurance rates.

FIG. **9** is a flowchart of example method steps for adjusting the initial personalized insurance rate.

FIG. **10**A is an example of an implementation of a display interface of the remote starter application for requesting pay-as-you-drive insurance.

FIG. **10**B is an example of an implementation of a display interface of the remote starter application that includes a driving behavior summary.

FIG. **10**C is another example of an implementation of a display interface of the remote starter application that includes a driving behavior summary.

FIG. **10**D is a further example of an implementation of a display interface of the remote starter application that includes a driving behavior summary.

DETAILED DESCRIPTION

In accordance with aspects of the present disclosure, systems and methods are disclosed that encourage good driving behavior through the use of a remote vehicle starter device and a remote starter application configured to operate at a mobile computing device. As discussed in further detail below, a remote starter device and a remote starter application may be employed to encourage safe driving behaviors by restricting communications at the mobile computing device during operation of the vehicle. The remote starter device and remote starter application may additionally encourage safe driving behaviors by identifying a driver of the vehicle so as to determine a personalized insurance rate for the driver based on a driving history associated with the driver and observed driving behaviors during operation of the vehicle.

The remote starter application is configured to remotely initiate vehicle ignition by transmitting a signal to the remote starter device via the mobile computing device. The remote starter application is also configured to restrict communications received at or transmitted from the mobile computing device during operation of the vehicle. The remote starter application may be further configured to identify the driver of the vehicle to an insurance underwriting system that determines a personalized insurance rate for the driver. In order to ensure activation of the remote starter application, the remote starter device is configured to prevent ignition of the vehicle when the remote starter application is not operative at the mobile computing device and permit ignition of the vehicle when the remote starter application is operative at the mobile computing device. The remote starter device thus ensures activation of the remote starter application and, as a result, ensures restriction of communications of the mobile computing device during operation of the vehicle.

Because the remote starter device ensures activation of the remote starter application at the mobile computing device, an individual associated with the mobile computing device may be identified as the driver of the vehicle. The identity of the driver (or information that can be used to identify the driver) may be provided to an insurance underwriting system. The insurance underwriting system may thus determine a personalized insurance rate for the driver rather than the conventional approach of determining a general insurance rate for the vehicle. The insurance underwriting system may base the personalized insurance rate on a driving history associated with the driver as well as on observed driving behaviors during an ongoing trip in the vehicle. Personalized insurance rates thus encourage drivers to engage in safe driving behavior in order to obtain better (e.g., relatively less expensive) insurance rates. By identifying the driver of the vehicle, the insurance underwriting system may also be able to provide personalized insurance rates for insurance coverage during individual trips in the vehicle. Insurance coverage provided in this fashion may be described as "pay-as-you-drive" insurance coverage, in which a driver purchases insurance coverage for a single trip. These and other aspects of the disclosure will be discussed in further detail below.

Referring to FIG. **1**A, an example of an implementation of a suitable operating environment in which various aspects of the disclosure may be implemented is shown. The operating environment is only one example of a suitable operating environment and is not intended to suggest any limitation as to the scope of use or functionality of the disclosure. The operating environment may be comprised of one or more data sources **161**, **163** in communication with a computing device **101**. The computing device **101** may use information communicated from the data sources **161**, **163** to generate values that may be stored in a database format. In one embodiment, the computing device **101** may be a high-end server computer with one or more processors **103** and one or more memories **115** for storing and maintaining the values generated. The memories **115** storing and maintaining the values generated need not be physically located in the computing device **101**. Rather, the memories (e.g., ROM **107**, RAM **105**, flash memory, hard drive memory, RAID memory, and the like) may be located in a remote data store (e.g., memory storage area **227**) physically located outside the computing device **101**, but in communication with the computing device **101**.

A personal computing device **165** (e.g., a personal computer, tablet PC, handheld computing device, personal digital assistant, mobile device, etc.) may communicate with the computing device **101**. Similarly, a geographic positioning device **167** (e.g., a global positioning system (GPS), geographic information system (GIS), satellite navigation sys-

tem, mobile device, other location tracking device, and the like) may communicate with the computing device **101**. The communication between the computing device **101** and the other devices **165**, **167** may be through wired or wireless communication networks or direct links. One or more networks may be in the form of a local area network (LAN) that has one or more of the well-known LAN topologies and may use a variety of different protocols, such as Ethernet. One or more of the networks may be in the form of a wide area network (WAN), such as the Internet. The computing device **101** and other devices (e.g., devices **165**, **167**) may be connected to one or more of the networks via twisted pair wires, coaxial cable, fiber optics, radio waves or other media. The term "network" as used herein and depicted in the drawings should be broadly interpreted to include not only systems in which devices or data sources are coupled together via one or more communication paths, but also stand-alone devices that may be coupled, from time to time, to such systems that have storage capability.

In another embodiment in accordance with aspects of the disclosure, a personal navigation device **167** may operate in a stand-alone manner by locally storing some of the database of values stored in the memories **115** of the computing device **101**. For example, a personal navigation device **167** (e.g., a GPS in an automobile) may be comprised of a processor, memory, input devices **168**, and output devices **169** (e.g., keypad, display screen, speaker, and the like). The memory may be comprised of a non-volatile memory that stores a database of values. Therefore, the personal navigation device **167** need not communicate, in one example, with a computing device **101** located at a remote location. Rather, the personal navigation device **167** may behave in a stand-alone manner and use its processor to perform particular steps disclosed herein. If desired, the personal navigation device **167** may be refreshed with an updated database of values after a period of time.

In yet another embodiment in accordance with aspects of the disclosure, a personal computing device **165** may operate in a stand-alone manner by locally storing some of the database of values stored in the memory of the computing device. For example, a personal computing device **165** may be comprised of a processor, memory, input device (e.g., keypad, CD-ROM drive, DVD drive, etc.), and output device (e.g., display screen, printer, speaker, etc.). The memory may be comprised of CD-ROM media. Therefore, the personal computing device **165** may use the input device to read the contents of the CD-ROM media. Rather, the personal computing device **165** may behave in a stand-alone manner and use its processor to perform particular steps disclosed herein. If desired, the personal computing device may be provided with an updated database of values (e.g., in the form of updated CD-ROM media) after a period of time.

The data sources **161**, **163** may provide information to the computing device **101**. In one embodiment in accordance with aspects of the disclosure, a data source may be a computer which contains memory storing data and is configured to provide information to the computing device **101**. Some examples of providers of data sources in accordance with aspects of the disclosure include, but are not limited to, insurance companies, third-party insurance data providers, government entities, state highway patrol departments, local law enforcement agencies, state departments of transportation, federal transportation agencies, traffic information services, road hazard information sources, construction information sources, weather information services, geographic information services, vehicle manufacturers, vehicle safety organizations, and environmental information services. For privacy protection reasons, in some embodiments of the disclosure, access to the information in the data sources **161**, **163** may be restricted to only authorized computing devices **101** and for only permissible purposes. For example, access to the data sources may be restricted to only those persons or entities that have signed an agreement (e.g., an electronic agreement) acknowledging their responsibilities with regard to the use and security to be accorded this information.

The computing device **101** may use the information from the data sources **161**, **163** to generate values that may be used to determine personalized insurance rates for drivers. Some examples of the information that the data sources may provide to the computing device **101** include, but are not limited to, accident information, geographic information, and other types of information useful to determine insurance rates.

FIG. **1**B illustrates a block diagram of a computing device (or system) **101** in the communication system **100** that may be used according to one or more illustrative embodiments of the disclosure. The device **101** may have a processor **103** for controlling overall operation of the device **101** and its associated components, including RAM **105**, ROM **107**, input/output (I/O) module **109**, and memory **115**. The computing device **101**, along with one or more additional devices (e.g., terminals **141**, **151**) may correspond to any of multiple systems or devices, such as an insurance underwriting system (FIG. **2**), configured as described herein for determining personalized insurance rates.

I/O module **109** may include a microphone, keypad, touch screen, and/or stylus through which a user of the computing device **101** may provide input, and may also include one or more of a speaker for providing audio output and a video display device for providing textual, audiovisual or graphical output. Software may be stored within memory **115** or storage to provide instructions to processor **103** for enabling device **101** to perform various functions. For example, memory **115** may store software used by the device **101**, such as an operating system **117**, application programs **119**, and an associated internal database **121**. Processor **103** and its associated components may allow the insurance underwriting system to execute a series of computer-readable instructions to, e.g., identify a driver of a vehicle, receive driving information from the vehicle, and determine a personalized insurance rate.

The insurance underwriting system may operate in a networked environment supporting connections to one or more remote computers, such as terminals **141** and **151**. The terminals **141** and **151** may be personal computers, servers (e.g., web servers, database servers), or mobile communication devices (e.g., vehicle telematics devices, on-board vehicle computers, mobile phones, portable computing devices, and the like), and may include some or all of the elements described above with respect to the driving analysis system **101**. The network connections may include a local area network (LAN) **125** and a wide area network (WAN) **129**, and a wireless telecommunications network **133**, but may also include other networks. When used in a LAN networking environment, the insurance underwriting system may be connected to the LAN **125** through a network interface or adapter **123**. When used in a WAN networking environment, the system **101** may include a modem **127** or other means for establishing communications over the WAN **129**, such as network **131** (e.g., the Internet). When used in a wireless telecommunications network **133**, the system **101** may include one or more transceivers, digital signal processors, and additional circuitry and software for communicating with wireless computing devices **141** (e.g., mobile

phones, vehicle telematics devices) via one or more network devices **135** (e.g., base transceiver stations) in the wireless network **133**.

It will be appreciated that the network connections shown are illustrative and other means of establishing a communications link between the computers may be used. The existence of any of various network protocols such as TCP/IP, Ethernet, FTP, HTTP and the like, and of various wireless communication technologies such as GSM, CDMA, WiFi, and WiMAX, is presumed, and the various computing devices and driving analysis system components described herein may be configured to communicate using any of these network protocols or technologies.

Additionally, one or more application programs **119** used by the insurance underwriting system may include computer executable instructions (e.g., driving analysis programs) for receiving and storing vehicle driving data, analyzing the driving data to assess driving behaviors, determining a personalized insurance rate for a driver, and performing other related functions as described herein.

System Overview

FIG. **2** is a block diagram of an example of an implementation of system **200** for encouraging safe driving behavior. One or more of the components shown in FIG. **2** may be implemented in hardware, software, or a combination of hardware and software. Additionally, one or more of the components of the system **200** may include a computing device or system having some or all of the structural components described above for computing device **101**.

As seen in FIG. **2**, various components of a vehicle **202**, mobile computing device **204**, and insurance underwriting system **206** may be in signal communication with each other via a network **208**. The vehicle **202** may include a remote starter device **210** configured for connection to an ignition system **212** and a vehicle telematics device **214** configured for connection to one or more vehicle sensors **216**. The mobile computing device **204** may include a remote starter application **218** and a GPS module **220** connected to the remote starter application. The remote starter application **218**, when operative at the mobile computing device **204**, may restrict communications received at or transmitted from the mobile computing device during operation of the vehicle **202**. The remote starter application **218** may also facilitate identification of the driver of the vehicle **202**. The mobile computing device **204** may be configured to exchange communications with a communication device **222** (e.g., another mobile telephone) via the network **208**. The insurance underwriting system **206** may include an insurance rate determination module **224**, an ignition data store **226**, and a vehicle telematics data store **228**. The insurance underwriting system **206** may also be configured to exchange communications with a remote third-party system **230** via the network **208**. An insurance provider may operate the insurance underwriting system **206** and may provide (or otherwise make accessible) the remote starter device **210** and remote starter application **218** to insurance customers.

The remote starter device **210** may be a device configured to initiate ignition of the vehicle **202** without a standard ignition key. The remote starter device **210**, in this example, includes an ignition interface **232** configured for connection to the ignition system **212** of the vehicle **202**, a communication module **234** for receiving remote ignition requests, a memory module **236** for storing computer-executable instructions related to remote vehicle ignition, and a processing module **238** connected to the ignition interface **232**, communication module **234**, and memory module **236**. The ignition interface **232** may, for example, connect to an ignition switch, ignition wire, power wire, starter wire, brake wire, tachometer wire, and brake wire of the ignition system **212** in order initiate vehicle ignition. The processing module **238** may include one or more processors that control operation of the ignition interface **232** and communication module **234** based on the instructions retrieved from the memory module **236**. The remote starter device **210** may also include a timing device **240**, e.g., a clock for providing date and time information.

The communication module **234** is configured to receive ignition requests, e.g., an ignition request signal, from a remote device. For example, the communication module **234** may receive an ignition request from the remote starter application **218** via the mobile computing device **204**. The communication module **234** may forward the ignition request to the processing module **238**, and in response, the processing module **238** may retrieve and execute the computer-executable instructions stored at the memory module **236** to initiate vehicle ignition. The communication module **234** may also be configured to transmit communications from the remote starter device **210**, e.g., ignition confirmation messages indicating that vehicle ignition was successfully achieved as well as ignition status messages indicating whether the vehicle **202** is presently running or presently shut off. The remote starter device **210** may also be in signal communication with the vehicle telematics device **214** to assess the present status of the vehicle **202**. The communication module **234** may receive and transmit communications via a wired or wireless signals over a WAN such as the Internet or directly via a personal area network (PAN) using various communication technologies (e.g., Bluetooth, USB, and the like).

The remote starter device **210** is configured such that vehicle ignition may be achieved via the remote starter application **218**. In this regard, the remote starter application **218** may be viewed as a replacement for a standard ignition key. If the remote starter device **210** is not in signal communication with the remote starter application **218**, then the remote starter device may determine the remote starter application is not operating at the mobile computing device **204** and prevent ignition of the vehicle **202**, e.g., by blocking or failing to provide one or more signals to the ignition system **212**. If the remote starter device **210** is in signal communication with the remote starter application **218**, then the remote starter device may determine that the remote starter application is operating at the mobile computing device **204** and permit ignition of the vehicle **202**, e.g., in response to a remote ignition request. In this way the remote starter device **210** ensures that the driver launches the remote starter application **218** before operating the vehicle **202**.

The remote starter device **210** may also be configured to establish communications with the remote starter application **218**. The remote starter device **210** may establish a communication channel with the remote starter application **218** via conventional handshaking techniques. In some example embodiments, the remote starter device **210** and remote starter application **218** may maintain the connection during operation of the vehicle **202** by exchanging periodic communications. In other example embodiments, the remote starter device **210** and remote starter application **218** may only communicate in response to events occurring at the vehicle **202** or at the mobile computing device **204**, e.g., in

response to receipt of an ignition request provided by the remote starter application **218** or in response to a shutdown of the vehicle.

The vehicle **202** may also include a vehicle telematics device **214** that monitors the status of the vehicle during operation of the vehicle. The vehicle telematics device **214** may be in signal communication with the insurance underwriting system **206** to provide driving information to the insurance underwriting system. The vehicle telematics device **214** may provide the driving information in the form of vehicle telematics data. The vehicle telematics device **214** may be a type of on-board data recording device (e.g., an on-board diagnostic device operating according to the OBDII standard) that is configured to communicate with one or more vehicle sensors **216**. The vehicle telematics device **214** may also include a communication module **234** (not shown) configured to communicate with the insurance underwriting system **206** via the network **208**.

The vehicle sensors **216** may be capable of detecting and recording various conditions at the vehicle **202** and operational parameters of the vehicle. Vehicle sensors **216** may, for example, detect and store data corresponding to the speed, distance driven, rate of acceleration or deceleration (e.g., braking), and geographic location of the vehicle **202**. Vehicle sensors **216** may also, for example, detect and store data corresponding to specific instances of sudden acceleration, deceleration, and swerving of the vehicle **202**. Vehicle sensors **216** may further detect and store data received from the internal systems of the vehicle **202** such as, for example, impact to the body of the vehicle, air bag deployment, headlight usage, brake light operation, door opening and closing, door locking and unlocking, cruise control usage, hazard light usage, windshield wiper usage, horn usage, turn signal usage, seat belt usage, radio usage within the vehicle, maintenance performed on the vehicle, and other data collected by the vehicle systems.

Additional vehicle sensors **216** may detect and store the external driving conditions such as, for example, external temperature, rain (e.g., using a rain sensor on a windshield), light levels, and sun position for driver visibility. The vehicle sensors **216** may additionally detect and store data relating to moving violations and the observance of traffic signals and traffic signs near the vehicle **202**. Furthermore, internal cameras in the vehicle sensors **216** may detect conditions such as the number of the passengers in the vehicle and potential sources of driver distraction within the vehicle **202** (e.g., pets, phone usage, unsecured objects, and the like). Vehicle sensors **216** may also include external cameras or proximity sensors that detect other nearby vehicles, traffic levels, road conditions, traffic obstructions, animals, cyclists, pedestrians, and other conditions that may factor into a driving analysis. Vehicle sensors **216** may also detect and store data relating to the maintenance of the vehicle **202**, such as the engine status, oil level, engine coolant temperature, odometer reading, the fuel level, engine revolutions per minute (RPMs), or tire pressure. It will be recognized that a variety of other vehicle sensors **216** may be additionally or alternatively employed in accordance with various aspects of this disclosure.

The vehicle telematics device **214** may be in signal communication with systems located remotely relative to the vehicle telematics device (e.g., a remote third-party system **230**) and capable of determining additional conditions inside or outside of the vehicle **202**. In this regard, a remote third-party system **230** may act as a vehicle sensor in accordance with aspects of this disclosure. As an example, one of the remote-third party systems may be a weather information system. A vehicle sensor **216** may be communicatively coupled with the weather information system to receive weather information that the vehicle sensor **216** may use to determine the weather conditions in which the vehicle **202** is being operated (e.g., rain, snow, sleet, hail, temperature, wind, road conditions, visibility, etc.) The vehicle telematics device **214** may also include, for example, a GPS module **220** that provides the location (e.g., GPS coordinates) of the vehicle **202** to the remote third-party computer system, and the weather information system may retrieve weather information from a database or other data store based on the geographic location of the vehicle. The weather information system may thus use the geographic location information of the vehicle **202** to determine the weather conditions (e.g., snow characteristic, hail characteristic, etc.) where the vehicle is presently located. In some examples, the remote third-party system **230** may immediately transmit the information to the vehicle telematics device **214**. In other example implementations, the remote third-party system **230** may transmit the information only if the information has changed within a predetermined time period following a previous request. It will be appreciates with the benefit of this disclosure that, although the preceding example discusses weather characteristics, various other types of characteristics may use a similar arrangement to monitor driving conditions and driving behavior (e.g., location characteristics, road rules characteristics, and the like).

The vehicle sensors **216** may store data within the vehicle **202** (e.g., at the vehicle telematics device **214**) or, additionally or alternatively, may transmit the data to one or more external computer systems, e.g., an insurance underwriting system **206**. As shown in FIG. **2**, the vehicle sensors **216** may be configured to transmit data to one or more external computer systems via a vehicle telematics device **214**. In other examples, one or more of the vehicle sensors **216** may be configured to transmit data directly without using a vehicle telematics device **214**. The vehicle telematics device **214** may, for example, be configured to receive and transmit data from some of the vehicle sensors **216**, while other vehicle sensors may be configured to directly transmit data to one or more external computer systems without using the vehicle telematics device **214**. Thus, the vehicle telematics device **214** may be optional in certain embodiments where one or more vehicle sensors **216** are configured to independently capture, store, and transmit vehicle operation and driving data.

The vehicle telematics device **214** may be a computing device containing many or all of the hardware or software components as the computing device **101** (FIG. **1**A). As discussed above, the vehicle telematics device **214** may receive vehicle operation and driving data from one or more vehicle sensors **216** and may transmit the data to one or more external computer systems via the network **208**. The vehicle telematics device **214** may also be configured to detect or determine additional types of data relating to real-time driving and the condition of the vehicle **202**. In certain embodiments, the vehicle telematics device **214** may contain or may be integral with one or more of the vehicle sensors **216** discussed herein.

Additionally, the vehicle telematics device **214** may utilize the vehicle sensors **216** to collect data regarding the number of passengers and the types of passengers (e.g. adults, children, teenagers, pets, and the like) in the vehicle **202**. The telematics device may also be configured to collect data regarding movement of the driver or the condition of the driver. The vehicle telematics device **214** may, for example, include or communicate with vehicle sensors **216**

that monitor driver movements, such as the eye position, head position, and other positions of the driver. Additionally, the vehicle telematics device **214** may collect data regarding the physical or mental state of the driver, such as fatigue or intoxication. The condition of the driver may be determined through the movements of the driver or through vehicle sensors **216**, for example, sensors that detect the content of alcohol in the air or blood alcohol content of the driver, such as a breathalyzer with an ethanol vapor (EtOH) sensor.

The vehicle telematics device **214** may also utilize the vehicle sensors **216** to collect information regarding route choice, whether the driver follows a given route, and to classify the type of trip (e.g. commute, errand, new route, and the like). In certain embodiments, the vehicle telematics device **214** may be configured to communicate with the vehicle sensors **216** to determine when and how often the vehicle **202** stays in a single lane or strays into other lanes. To determine the chosen route, lane position, and other data, the vehicle telematics device **214** may include or may receive data from a mobile telephone, a GPS device, locational sensors positioned inside the vehicle **202**, or locational sensors or devices located remotely relative to the vehicle.

The vehicle telematics device **214** may also store the vehicle information that identifies the vehicle type, e.g., the make, model, trim (or sub-model), year, or engine specifications. The vehicle type may be programmed into the vehicle telematics device **214** by a user or customer, determined by accessing a remote computer system, such as an insurance company or financial institution system, or may be determined from the vehicle **202** itself, e.g., by accessing the computer systems of the vehicle.

The mobile computing device **204** may also be referred to as a mobile device and may include some or all of the components described above for computing device **101**. The mobile computing device **204** may be configured to transmit and receive wireless communications such that a user may wirelessly communicate with other communication devices directly or via one or more networks. Mobile computing devices may include, for example, laptop computers, tablet computers, handheld/palmtop computers, handheld game consoles, personal navigation devices, mobile telephones, and other devices configured for mobile wireless communication. A data store of the mobile computing device **204** may store a remote starter application **218** configured to operate at the mobile computing device. The remote starter application **218** may include computer-executable instructions that, when executed by a processor of the mobile device **204**, cause the processor to perform one or more of the steps described in further detail below. Such steps may include, for example, communicating with a remote starter device **210** installed at a vehicle **202** to remotely initiate vehicle ignition and activating restrictions on communication features at the mobile computing device **204** during operation of the vehicle.

As noted above, the remote starter application **218** may reside at a data store of the mobile computing device **204** and include instructions executable by a processor of the mobile computing device. The remote starter application **218** may be configured to perform a variety of tasks at the mobile computing device **204**. Such tasks may include, for example: remotely initiating vehicle ignition via a remote starter device **210** installed at the vehicle **202**; restricting communication features at the mobile computing device **204** during operation of the vehicle; communicating with the remote starter device **210** during operation of the vehicle; communication with an insurance underwriting system **206** during operation of the vehicle; facilitating insurance coverage transactions; and providing driving behavior summaries based on observed driving behaviors during operation of the vehicle. These tasks will be discussed in further detail below.

The insurance underwriting system **206** may be a computing device separate from the vehicle **202**, containing some or all of the hardware or software components as the computing device **101** (FIG. **1**B). The insurance underwriting system **206** may include an insurance rate determination module **224** configured to determine insurance rates, e.g., personalized insurance rates for drivers. The insurance rate determination module **224** may be configured to determine personalized insurance rates based, at least in part, on a driving history associated with a driver (e.g., past driving behaviors) as well as driving behaviors observed during present operation of the vehicle **202** (e.g., current/real-time driving behaviors). Accordingly, the insurance underwriting system **206** may also include a vehicle telematics data store **228** that stores vehicle telematics data received from a vehicle telematics device **214** installed at the vehicle **202** as well as an ignition data store **226** that stores information corresponding to instances when a driver operates the vehicle.

The insurance underwriting system **206** may be implemented as a single system (e.g., a single computer server) or may be separate systems (e.g. multiple computer servers). In some examples, the insurance underwriting system **206** may be a central server configured to receive vehicle telematics data from a plurality of remotely located mobile devices **204** and vehicle telematics devices **214**. Additionally, the insurance rate determination module **224** may be implemented in hardware, software, or a combination of hardware and software that is configured to perform a set of specific functions within the insurance underwriting system **206**, e.g., receive and store vehicle telematics information, receive and store remote ignition information, and determine personalized insurance rates for drivers. These functions may be executed by one or more software applications running on generic or specialized hardware within the insurance underwriting system **206**. The insurance rate determination module **224** may utilize the vehicle telematics data received from the vehicle telematics device **214** as well as information from other systems (e.g., a remote third-party system **230**) to perform driving analyses when determining a personalized insurance rate for the driver.

The vehicle telematics data store **228** may be, for example, a vehicle telematics database configured to store the vehicle telematics data received from the vehicle telematics device **214** installed at the vehicle. A vehicle telematics database may implement a vehicle telematics data model as a set of database tables and columns relating to vehicle telematics information. The vehicle telematics data model may define various entities, attributes, and relationships corresponding to vehicle telematics data received from the vehicle **202**. A database management system (DBMS) may manage the tasks of creating, modifying, and retrieving vehicle telematics records from the vehicle telematics database. The vehicle telematics database may also relate vehicle telematics data driver information associated with vehicle drivers.

The ignition data store **226** may be, for example, an ignition database configured to store information relating to ignition of the vehicle **202**. As discussed further below, an ignition record database may implement an ignition record data model as a set of database tables and columns relating to vehicle ignition using the remote starter application **218**

and remote starter device **210**. The ignition record data model may define various entities, attributes, and relationships corresponding to vehicle ignition information. A DBMS may also manage the tasks of creating, modifying, and retrieving ignition records from the ignition database. The ignition records in the ignition data store **226** may be respectively associated with vehicle telematics records in the vehicle telematics data store **228**. In this way, past and present driving behaviors may be associated with instances of remote vehicle ignition, e.g., individual trips in the vehicle **202**.

The insurance rate determination module **224** may be configured to determine or otherwise calculate an insurance rate, e.g., a personalized insurance rate for a driver of the vehicle **202**. An insurance rate calculated for the driver rather than for the vehicle **202** may be referred to as a personalized insurance rate. The insurance rate determination module **224** may determine the personalized insurance rate based, at least in part, on past or present vehicle telematics data associated with the driver. Past vehicle telematics data associated with the driver may have been collected during previous trips taken by the driver in one or more vehicles and therefore represent a driving history for the driver. Present vehicle telematics data associated with the driver may be collected in real-time (or near real-time) as the driver operates the vehicle **202**.

It will be appreciated that underwriting insurance policies may be an actuarial endeavor for which many techniques and approaches are presently known. The insurance rate determination module **224**, in this example, may be configured to employ these known techniques and approaches when determining personalized insurance rates.

The insurance rate determination module **224**, in this example, may analyze the vehicle telematics data to determine the personalized insurance rate. Based on the vehicle telematics data (e.g., speed, acceleration/deceleration, turning, and so forth), the insurance rate determination module **224** may identify various "safe" or "unsafe" driving behaviors the driver has engaged in during present or past operation of the vehicle **202**. Driving behaviors may correspond to various driving characteristics the insurance underwriting system **206** may employ when determining a personalized insurance rate for a driver. Generally, a characteristic may be anything that can be detected and measured in the tangible world, sometimes with the use of sensory circuitry (e.g., sensors **212**, **214**). It will be appreciated that various characteristics are contemplated herein and will become apparent to a person having ordinary skill in the art with the benefit of this disclosure.

Driving characteristics may include information relating to braking, acceleration, speed, steering, lane changes, lateral movement, distance traveled, duration of travel, tailgating, and other characteristics. Information relating to braking, acceleration, steering, lateral movement, and other characteristics may be measured in units of force (or magnitude of force). In some examples, braking and acceleration information may be conflated into a single characteristic in which a negative value indicates braking and a positive value indicates acceleration. Information relating to speed and other characteristics may be measured in units of distance over time, such as miles per hour. Information relating to the distance traveled may be measured in units of distance, such as miles. Information relating to duration of travel may be measured in units of time, such as minutes, e.g., a measurement of the total number of minutes a driver has operated the vehicle **202**, from the moment the engine started until it is shutdown (e.g., the engine ignition is switched off). Information relating to lane changes, tailgating, and other characteristics may be measured as Boolean values and/or numerical values. For example, information relating to a lane change may measure the riskiness of the lane change, taking into account the speed of the vehicle **202**, the severity of the braking of the vehicle, and the severity of the steering of the vehicle. Information relating to tailgating may measure the proximity of the vehicle **202** to another vehicle, taking into account the speed of the vehicle. In one example, a tailgate measurement may be a Boolean value, set to true if a predetermined threshold is exceeded with respect to a safe following distance while the vehicle **202** is moving above a particular speed. Generally, many of the driving characteristics corresponding to driving behavior may be detected and measured with the use of the vehicle telematics device **214** or comparable devices. For example, values for driving characteristics may be retrieved via an on-board diagnostics (OBDII) interface (not shown) in the vehicle **202**. In another example values for driving characteristics may be retrieved with the use of an accelerometer, gyroscope, proximity sensors, and/or digital compass in a device installed in or on the vehicle **202**. The insurance underwriting system **206** may thus identify various driving behaviors as safe or unsafe.

The insurance underwriting system **206** may employ other driving characteristics when determining a personalized insurance rate for the driver. In this regard, the personalized insurance rate for the driver may be based on a combination of past or present driving behaviors as well as other characteristics. Other characteristics may include, for example, vehicle characteristics, driver characteristics, location characteristics, time characteristics, weather characteristics, traffic characteristics, road rules characteristics, and other characteristics. Vehicle characteristics may include, for example, engine temperature, tire pressure, environmental features, and other characteristics. Engine temperature may be measured in units of degree, such as Fahrenheit. Tire pressure may be measured in units of force per area, such as Pascal. Environmental features may be measured as a numerical value indicating the degree to which the operation is environmentally friendly (e.g., driving within particular speed ranges may be more conducive to maximum gas mileage and earn a higher environmental rating). Vehicle characteristics may relate to the run-time, dynamic condition of the vehicle and may be detected and measured with the use of sensory circuitry installed in the vehicle **202** or in a vehicle telematics device **214**, through an OBDII interface, or through an external server.

Driver characteristics may include, for example, fatigue, intoxication, seat belt usage, information relating to passengers in the vehicle **202**, music or noise, and other characteristics. Fatigue may be measured with the use of a sensor that measures the blink rate of the driver, and may be provided as a numerical value. Intoxication may be measured using an EtOH sensor (or other device that measures ethanol vapor or blood ethanol levels) and may be provided as a numerical value. Seat belt usage may be measured as a Boolean, e.g., TRUE if the driver seat belt is engaged and FALSE if the driver seat belt is unbuckled. Information relating to passengers in the vehicle **202** may be a measure of the number of passengers, and may be measured using infrared or laser technology (e.g., the Kinect™ system), or another technology. Music or noise may be a measure of the amount of sound in the vehicle **202**, and may be measured in decibels using a microphone, e.g., a microphone installed in a smartphone or the vehicle itself. Driver characteristics may be detected and measured with the use of sensors

located within the vehicle **202** and may relate to the capacity of the driver to safely operate the vehicle.

Weather characteristics may include, for example, rain, snow, or hail information; visibility information (e.g., sunny, cloudy, foggy); wind speed, temperature, and other weather characteristics. The insurance underwriting module may query a third-party remote system via a network **208** for information relating to such weather characteristics (e.g., a weather information server). Time characteristics may include, for example, the time of day, the day of the week, the day of the month, daylight, nighttime, or other time characteristics. Time characteristics may be provided by, e.g., the remote starter application **218**, the mobile computing device **204**, the vehicle telematics device **214**, the insurance rate determination module **224**, the insurance underwriting system **206**, or other sources. Traffic characteristics may include, for example, traffic congestion, vehicle type, and other traffic characteristics. Road rules characteristics may include, for example, speed limit information, traffic signal information (e.g., stop signs, traffic lights), and other road rules characteristics. These characteristics may be measured or determined using sensors **214**, or additionally or alternatively, using sensors **212**.

Location characteristics may include, for example, geographic location (e.g., GPS coordinates), road surface information (e.g., parking lot, alley, highway, off-road, surface street), zip code, region (e.g., city, suburb, rural), or other location characteristics. Other examples of location characteristics may include characteristics relating to areas under construction, topography (e.g., flat, rolling hills, steep hills, curves), road type (e.g., residential, interstate, separated highway, city street, country road), road feature (e.g., intersection, gentle curve, blind curve, bridge, tunnel), intersections, roundabouts, railroad crossings, passing zones, merge point, the number of lanes, the width of the road or lanes, population density within a predetermined vicinity (e.g., within a radius, within a zip code), condition of the road (e.g., new, worn, severely damaged with sink-holes, severely damaged with erosion, gravel, dirt, paved), wildlife area, state, county, or municipality. The aforementioned characteristics may be measured/determined using sensor units **214**, or alternatively, in some scenarios, using sensor units **212**. The insurance underwriting system **206** may, for example, query one or more third-party remote systems via the network **208** to obtain information relating to these or other location characteristics.

The insurance underwriting system **206** may be part of a backend system of an insurance provider (e.g., a vehicle insurance provider). The insurance rate determination module **224** may analyze the collected driving information and other information to determine a personalized insurance rate for the driver. The insurance rate determination module **224** may use machine learning or other techniques, such as artificial intelligence, statistical or predictive modeling, or other methods, to analyze the data. In one example, the insurance rate determination module **224** may limit the analysis to the past and present vehicle telematics data associated with the driver. In such an example, the insurance rate determination module **224** may access the vehicle telematics database storing the collected vehicle telematics data associated with the driver. The insurance rate determination module **224** may analyze some or all of the vehicle telematics data associated with the driver to determine a predictive model that identifies an insurance risk for the driver. In this regard, the insurance rate determination module **224** identifies driving behaviors that contribute to a lower or higher personalized insurance rate. As noted above, the insurance rate determination module **224** may analyze other types of characteristics to identify an insurance risk for the driver and determine a corresponding personalized insurance rate.

It will further be appreciated that the insurance risk and personalized insurance rate for the driver may be further based on such characteristics associated with other drivers, e.g., the historical driving behaviors of other drivers within the vicinity of the area in which the driver will operate the vehicle **202**. For example, the insurance rate determination module **224** may query a remote third-party system **230** via the network **208** (e.g., accident report databases, crime report databases) when determining the risk profile of other drivers within the vicinity of the driver. For example, statistical data may indicate that certain locations are more dangerous or less dangerous at certain times throughout the day. A hypothetical location may be located, for example, on a steep cliff-side with no street lights, such that once the sun begins to set in the evening. Accordingly, the statistical data may show that the riskiness of driving through this hypothetical location may increase until the sun has set. As a result, the insurance rate determination module **224** may include time of day characteristics location characteristics identifying the hypothetical location (e.g., via a zip code). If the vehicle telematics data indicates that the driver typically travels or is travelling through this hypothetical location during these risky periods, then the insurance rate determination module **224** may determine a relatively higher personalized rate for the driver.

For example, the insurance rate determination module **224** may query a remote third-party system **230** via the network **208** (e.g., accident report databases, crime report databases) when determining the risk profile of other drivers within the vicinity of the driver. For example, statistical data may indicate that certain locations are more dangerous or less dangerous at certain times throughout the day. A hypothetical location may be located, for example, on a steep cliff-side with no street lights, such that once the sun begins to set in the evening. Accordingly, the statistical data may show that the riskiness of driving through this hypothetical location may increase until the sun has set. As a result, the insurance rate determination module **224** may include time of day characteristics location characteristics identifying the hypothetical location (e.g., via a zip code). If the vehicle telematics data indicates that the driver typically travels or is travelling through this hypothetical location during these risky periods, then the insurance rate determination module **224** may determine a relatively higher personalized rate for the driver. As another example, the historical vehicle telematics data for the driver may indicate that the driver typically travels through heavily-congested metropolitan areas in a downtown area of a city. Accordingly, the insurance rate determination module **224** may determine a relatively higher personalized insurance rate for the driver based partly on the risk profile for this location.

The insurance rate determination module **224** may consider these characteristics when determining the personalized insurance rate for the driver. As an example, the insurance rate determination module **224** may assign a risk profile to the driver based on these characteristics, and determine the personalized insurance rate based on the risk profile associated with the driver. Approaches to determining an insurance rate may be described in U.S. Pat. Nos. 7,937,278 and 8,280,752 to Cripe et al. as well as U.S. Pat.

Nos. 8,065,169 and 8,249,968 to Oldham et al. each assigned to Allstate Insurance Company of Northbrook, Ill.

Process Overview

Referring now to FIG. **3**, a flowchart **300** of example method steps for encouraging safe driving behaviors using a remote starter device installed at a vehicle is shown. As noted above, the remote starter device determines whether the remote starter application is operating at the mobile device. In order to determine whether the remote starter application is operating at the mobile device, the remote starter device may determine whether a remote ignition request has been received from the remote starter application (block **302**). The remote starter application may be configured to provide the remote ignition request in response to receipt of user input at the remote starter application (e.g., when a user selects a button to generate the remote ignition request). The remote starter application may additionally or alternatively be configured to automatically transmit a remote ignition request at periodic intervals. In this way, the remote starter device may automatically initiate vehicle ignition when the user comes within the vicinity of the vehicle with the mobile device.

If a remote ignition request has not been received at the remote starter device (block **304**), then the remote starter device may prevent ignition of the vehicle (block **306**). As noted above, the remote starter device may prevent ignition of the vehicle by not providing or blocking signals to the ignition system of the vehicle used to achieve vehicle ignition. If a remote ignition request has been received at the remote starter device (block **304**), then the remote starter device may permit ignition of the vehicle (block **308**). As also noted above, the remote starter device may permit vehicle ignition by providing or not blocking the signals to the ignition system used to achieve vehicle ignition.

Having received the remote ignition request from the remote starter application, the remote starter device may initiate vehicle ignition at the vehicle via the ignition interface (block **310**). Upon vehicle ignition, the remote starter application may restrict communication features at the mobile device (block **312**). The remote starter application may also be configured to restrict communications at the mobile device as soon as the remote starter application is launched. Restricting communications upon vehicle ignition will be discussed in further detail below.

The identity of the driver may also be provided to the insurance underwriting system, e.g., also upon ignition (block **314**). Various approaches may be employed to identify the driver of the vehicle. In one example approach, the remote starter application may transmit information identifying the user of the mobile application to the insurance underwriting system. The insurance underwriting system may thus determine that the user operating the mobile device is the driver of the vehicle. The remote starter application may require a password or personal identification number (PIN) from the user in order to generate the remote ignition request. Having identified the driver of the vehicle, the insurance underwriting system may collect vehicle telematics data as discussed above (block **316**) and determine a personalized insurance rate for the driver (block **318**). Determining a personalized insurance rate for the driver will also be discussed in further detail below.

In some example embodiments, the identity of the driver may be provided to the insurance underwriting system (block **314**) before vehicle ignition is initiated (block **310**). In this example, the insurance underwriting system may verify that the individual is authorized to operate the vehicle. As a result, the insurance underwriting system may control which individuals may remotely initiate vehicle ignition via the remote starter application. For example, the remote starter application may be configured such that it does not transmit a remote ignition request until it receives confirmation from the insurance underwriting system. The remote underwriting system may be configured to determine whether an individual is authorized to operate the vehicle based, for example, on an authorized driver list maintained at the insurance underwriting system and associated with the vehicle. Accordingly, the insurance underwriting system may be configured to send a confirmation to the remote starter application when the individual is included in the authorized driver list and to not send a confirmation to the remote starter application when the individual is not included in the authorized driver list. The insurance underwriting system may additionally or alternatively be configured to determine whether the individual is authorized to drive in general, for example, whether the individual has a valid license to drive (e.g., when the individual is underage or when the individual has a suspend or revoked license to drive). Accordingly, the insurance underwriting system may be configured to access one or more remote third-party systems (e.g., a system maintained by a Department of Motor Vehicles) in order to determine whether the individual is authorized to operate the vehicle.

Restricting Communications

Referring now to FIG. **4**, a flowchart **400** of example method steps for restricting communications at a mobile device using a remote starter device is shown. A user may launch the remote starter application at the mobile device (block **402**). The remote starter application may receive user input requesting remote ignition of the vehicle (block **404**), e.g., via selection of a button at a user interface display. In response to receipt of the user input requesting remote ignition of the vehicle, the remote starter application may generate a remote ignition request and transmit the remote ignition request to the remote starter device via the mobile device (block **406**). The communication module of the remote starter device may receive the remote ignition request and forward the remote ignition request to the processing module of the remote starter device for processing (block **408**). Having received the remote ignition request, the remote starter device may determine that the remote starter application is operative at the mobile device and permit ignition of the vehicle (block **410**). The ignition interface of the remote starter device may then initiate vehicle ignition by providing the necessary signals to the ignition system of the vehicle (block **412**). In some example embodiments, the remote starter device may provide an ignition confirmation message back to the remote starter application upon successful vehicle ignition (block **414**). In these example embodiments, the remote starter application may restrict communication features at the mobile device upon receipt of the ignition confirmation message from the remote starter device (block **416**). In other example embodiments, the remote starter application may restrict communication features at the mobile device upon receipt of the user input requesting remote vehicle ignition (block **404**) or when the remote starter application is launched (block **402**).

Communication features may include, for example, text messaging, multimedia messaging, phone calling, video chatting, Internet access, email access, short-range wireless communication (e.g., infrared, Bluetooth), and the like.

Restricting communication features may include preventing the mobile communication device from transmitting some or all communications via one or more of the communication features. Restricting communication features may also include preventing the mobile communication device from indicating that a communication has been received at the mobile device via one or more of the communication features. As an example, the remote starter application may prevent a driver from accessing a text messaging feature and a phone calling feature at the mobile device upon vehicle ignition. The remote starter application may prevent the user from accessing communication features by, for example, locking a display screen or, additionally or alternatively, ignoring user input associated with attempts to access the communication features. As another example, the remote starter application may prevent the mobile device from indicating that a text message or phone call has been received at the mobile device. The remote starter application may prevent the mobile device from indicating a text message or phone call was received by suppressing any visual notifications, audible notifications, haptic notifications (e.g., vibrations), or other types of notifications the mobile device may employ to indicate receipt of a new communication. Restricting communication features may also include preventing some types of communication features while permitting other types of communication features, e.g., preventing text messaging but permitting short-range messaging over Bluetooth. Restricting communication features may also include preventing some communications while permitting other communications, e.g., permitting communications to or from a contact that is designated as an emergency contact but preventing communications to or from contacts that are not designated as an emergency contact.

The remote starter application may maintain the restriction on communication features at the mobile device during operation of the vehicle (block **418**). In some example embodiments, the remote starter application may maintain the restriction on the communication features at the mobile device until a shutoff confirmation message is received from the remote starter device. If a shutoff confirmation message is received at the remote starter application from the remote starter device (block **420**), then the remote starter application may remove the restriction on the communication features at the mobile device (block **422**). In some example embodiments, the remote starter application may be configured to query the remote starter device for the status of the vehicle. In this way, the remote starter application includes a way to remove the restriction on the communication features in case a shutoff confirmation message is not received at the remote starter application. Accordingly, if the remote starter application does not receive a shutoff confirmation message from the remote starter device (block **420**), the remote starter application may transmit an ignition inquiry message to the remote starter device (block **424**) in order to determine whether the vehicle is still running. The remote starter application may be configured to transmit the ignition inquiry message to the remote starter device in response to receipt of user input from the user or, additionally or alternatively, at periodic intervals. In response to receipt of the ignition inquiry message, the remote starter device may determine the current status of the vehicle, e.g., whether the vehicle is running. The remote starter device may determine whether the vehicle is running via the ignition interface connected to the ignition system of the vehicle or, additionally or alternatively, via the vehicle telematics device. The remote starter device may then provide an ignition status message to the remote starter application indicating whether the vehicle is still running or has been shut off (block **426**). If the ignition status message indicates the vehicle is still running (block **428**), then the remote starter application may maintain the restriction on the communication features at the mobile device (block **418**). If the ignition status message indicates that the vehicle is not running (block **428**), e.g., that the vehicle has been shut off, then the remote starter application may remove the restriction on the communication features at the mobile communication device (block **420**). As used in this description, the remote starter device is referred to as providing confirmation and status messages and the remote starter application is referred to as providing notification messages simply for the purpose of clarity. Confirmation messages, status messages, and notification messages may, in general, refer to messages that indicate whether the vehicle achieved ignition, is presently running, or shut off. Accordingly, the terms confirmation message, status message, and notification message may be used interchangeably.

As noted above, restricting communication features at the mobile device may include permitting some communications at the mobile device (e.g., communications to and from emergency contacts) while preventing other communications. In FIG. **5**, another flowchart **500** of example method steps for restricting communications at a mobile device using a remote starter device is shown. Upon receipt of an ignition confirmation message at the remote starter application from the remote starter device (block **502**), the remote starter application may restrict communication features at the mobile device (block **504**) as noted above.

If the user attempts to initiate a communication with a contact while the restriction is in place (block **506**), the remote starter application may determine whether the user is attempting to communicate with a contact designated as an emergency contact (block **508**). If the user is attempting to contact an emergency contact (block **510**), then the remote starter application may permit the user to access one or more communication features to initiate a communication with the emergency contact (block **512**). If the user is attempting to initiate a communication with a contact that is not designated as an emergency contact (block **510**), then the remote starter application may prevent the user from accessing communication features at the mobile device (block **514**).

If a communication is received at the mobile device while the restriction is in place (block **516**), then the remote starter application may determine whether the communication was received from a contact designated as an emergency contact (block **518**). If the remote starter application determines the mobile device received the communication from an emergency contact (block **520**), then the remote starter application may permit the mobile device to provide notification (e.g., visual, audible, haptic notification, or a combination of such) that the communication was received (block **522**). If the remote starter application determines the mobile device received the communication from a contact that is not designated as an emergency contact (block **520**), then the remote starter application may prevent the mobile device from providing notification that the mobile device received the communication (block **524**). When the remote starter application prevents notification of a communication received at the mobile computing device, the remote starter application may log the communication in a list of blocked communications (block **526**). Once the remote starter application removes the restriction on the communication features, the remote starter application may present a list of

communications received at the mobile device while the restriction was in place (block **528**).

As also noted above, the remote starter device prevents ignition of the vehicle unless a remote starter application is operating at a mobile device. As a result, an insurance underwriting system may identify the driver of the vehicle based on the mobile device at which the remote starter application is operative. Being able to identify the driver of the vehicle introduces the possibility of providing vehicle insurance associated with the driver of the vehicle rather than the vehicle itself. The insurance underwriting system may maintain a driving history for the driver and determine a personalized insurance rate for the driver based on the driving behaviors and habits of the driver. The insurance underwriting system may determine a risk profile for the driver and an appropriate personalized insurance rate for the risk profile.

Additionally, drivers may be able to affect their personalized insurance rate by engaging in safe or unsafe driving habits. As an example, where a driving history shows that a driver tends to engage in relatively unsafe driving habits, the insurance rate determination module of an insurance underwriting system may assess the driver to be a relatively high insurance risk and determine a relatively high personalized insurance rate for the driver. In contrast, where the driving history for the driver shows that the driver tends to engage in relatively safe driving habits, the insurance rate determination module of the insurance underwriting system may assess the driver to be a relatively low insurance risk and determine a relatively low personalized insurance rate for the driver. As a result, the driver is encouraged to engage in safe driving habits where driving behaviors affect the personalized insurance rate for the driver. The insurance underwriting system may be configured to determine a personalized insurance rate for the driver upon request (e.g., from the driver, from the insurance provider, or both) as well as at periodic intervals (e.g., once a year during a policy renewal period or more frequently such as once a month). Additionally, the personalized insurance rate may correspond to insurance coverage for a traditional policy term (e.g., one year) or for a single trip in the vehicle (e.g., a PAYD personalized insurance rate). Personalized insurance rates will be discussed in further detail below.

In FIGS. **6**A-B, example implementations of respective display interfaces **600***a* and **600***b* of the remote starter application **602** are shown. In FIG. **6**A, an example of an implementation of a display interface **600***a* for a remote starter application **602** is shown. The display interface in FIG. **6**A may include a button **604** to remotely initiate vehicle ignition. The display interface **600***a* may also include password element **606** at which a user may provide a password to have access to the remote ignition feature. As seen in FIG. **6**A, the remote starter application **602** may provide vehicle information **608**, e.g., vehicle make, model, year, and the name of the vehicle owner **610**. The remote starter application **602** may also identify the driver **612** of the vehicle as the user of the mobile device on which the remote starter application is operating. It will be appreciated that the driver of the vehicle may or may not be the vehicle owner. As discussed above, selecting the button to remotely initiate vehicle ignition may activate restrictions on communication features at the mobile device.

In FIG. **6**B, another example of an implementation of a display interface **600***b* for a remote starter application **602** is shown. The interface **600***b* in FIG. **6**B may be presented to the driver, once the driver has remotely initiated vehicle ignition using the remote starter application **602**. As seen in FIG. **6**B, the remote starter application restricts communication features (e.g., text message, phone calls) at the mobile computing device. The interface may include a button **614** for submitting an ignition status inquiry to the remote starter device installed at the vehicle. In this way, the remote starter application **602** may determine whether the vehicle is still running or has been shut off in the event that the remote starter application fails to receive a shutoff confirmation message from the remote starter device. The display interface **600***b*, in this example, also includes ignition status information **616** indicating, for example, whether the vehicle is running and the last time the vehicle status information was updated. The display interface **600***b*, in this example, also includes a button **618** to initiate a communication (e.g., text message, phone call) with a contact designated as an emergency contact. It will be appreciated with the benefit of this disclosure that the remote starter application may provide additional or alternative display interfaces relating to restricting communications at the mobile device that include additional or alternative information as well as additional or alternative interface elements.

Personalized Insurance Rates

Referring to FIG. **7**, a flowchart **700** of example method steps for identifying a driver of a vehicle and maintaining a driving history for the driver is shown. As mentioned above, a user may launch the remote starter application at the mobile device (block **702**), and provide user input requesting remote ignition of the vehicle via the remote starter device (block **704**). The remote starter application may provide the remote ignition request via the mobile device (block **706**) and the remote starter device installed at the vehicle may receive the ignition request (block **708**). Upon receipt of the remote ignition request from the remote starter application, the remote starter device may determine that the remote starter application is operative at the mobile device (block **710**), and initiate vehicle ignition (block **712**). The remote starter device may provide an ignition confirmation message to the remote starter application upon ignition of the vehicle (block **714**). A timing device (e.g., a clock) at the remote starter may provide date and time information that the remote starter device may include in the ignition confirmation message.

In response to receipt of the ignition confirmation message, the remote starter application may transmit an ignition notification message to the insurance underwriting system (block **716**). The remote starter application may include in the ignition notification message the date and time information from the ignition confirmation message. Alternatively, a timing device at the mobile device may provide date and time information that the remote starter application may include in the ignition notification message. The ignition notification message may also include geographic location information (e.g., GPS coordinates) indicating a geographic location where the vehicle achieved ignition. The geographic location information may be provided by a GPS module installed at the mobile device as shown by way of example in FIG. **2**. In other example embodiments, the remote starter device may include a GPS module, and the remote starter device may include geographic location information from its GPS module in the ignition confirmation message. In further example embodiments, the vehicle telematics device may include a GPS module, and the remote starter device may query the vehicle telematics device for geographic location information to include in the ignition confirmation message.

The remote starter application may also provide driver information and vehicle information to the insurance underwriting system (block **718**). The driver information may directly identify the driver (e.g., by first and last name), or may indirectly identify the driver by a unique identifier that can be used to determine the identity of the driver (e.g., a customer number or mobile phone number). The insurance underwriting system may be configured to determine the identity of the user based on the unique identifier by, for example, querying a customer database using the customer number or querying a remote third-party system using the mobile phone number. The vehicle information may include, for example, the make, model, year, vehicle identification number (VIN), and the like. In some example embodiments, the remote starter application may include the driver information, the vehicle information, or a combination of such in the ignition notification message sent to the insurance underwriting system. In other example embodiments, the remote starter application may provide the driver information or vehicle information in separate messages to the insurance underwriting system.

The driver information and vehicle information may be stored at a respective memory of the mobile device, the remote starter device, or the vehicle telematics device. Accordingly, the remote starter device may, in some example embodiments, include the driver information or vehicle information in the ignition confirmation message provided to the remote starter application. Furthermore, it will be recognized that, in some example embodiments, the remote starter device or the vehicle telematics device may be configured to provide the ignition confirmation message, the driver information, and the vehicle information directly to the insurance underwriting system rather than providing the ignition confirmation message to the remote starter application that, in turn, provides an ignition notification message to the insurance underwriting system. In general, it will be appreciated with the benefit of this disclosure that various approaches may be employed with respect to notifying the insurance underwriting system that the vehicle has achieved ignition and providing ignition information, driver information, and vehicle information to the insurance underwriting system.

In response to receipt of an ignition notification message from the remote starter application (or an ignition confirmation message from the remote vehicle starter or vehicle telematics device), the insurance underwriting system may create a new ignition record in the ignition record database (block **720**). The insurance underwriting system may associate the ignition record with the individual determined to be the driver of the vehicle (block **722**). The insurance underwriting system may associate the driver and the newly created ignition record by, for example, establishing a relationship (or otherwise associating) the newly created ignition record with a customer record in a customer database. Likewise, the insurance underwriting system may associate the ignition record with the vehicle by, for example, establishing a relationship between (or otherwise associating) the ignition record and a vehicle record in a vehicle database. The insurance underwriting system may configure the ignition record to include (or otherwise be associated with) the driver information and vehicle information. The insurance underwriting system may also configure the ignition record to include (or otherwise be associated with) ignition timestamp information indicating the date and time at which the vehicle achieved ignition as well as ignition location information indicating a geographic location at which the vehicle achieved ignition.

As discussed above, the insurance underwriting system may also receive vehicle telematics data from the vehicle telematics device during operation of the vehicle (block **724**). The insurance underwriting system may store the vehicle telematics data in one or more records of a vehicle telematics database (block **726**) and associate the vehicle telematics records with the ignition record created upon vehicle ignition (block **728**). In this way the insurance underwriting system may be able to analyze driving behaviors of the driver for a particular trip in the vehicle. Subsequent ignition records for subsequent trips may be associated with subsequent vehicle telematics records created for vehicle telematics data collected during those subsequent trips.

Based on the vehicle telematics data collected from the vehicle, the insurance rate determination module at the insurance underwriting system may determine a personalized insurance rate for the driver (block **730**). The personalized insurance rate may be based, at least in part, on vehicle telematics data obtained for a presently ongoing trip in the vehicle, on vehicle telematics data obtained for previous trips by the driver, or on a combination of presently obtained and previously obtained vehicle telematics data associated with the driver.

The insurance underwriting system may collect and store vehicle telematics data provided by the vehicle telematics device until the vehicle is shut off. When the driver shuts off the vehicle, the remote starter device may provide a shut off confirmation message to the remote starter application at the mobile device (block **732**). In response to receipt of the shutoff confirmation message from the remote starter device, the remote starter application may provide a shutoff notification message to the insurance underwriting system (block **734**). Similar to the ignition notification message, the shutoff notification message may indicate the date and time at which the vehicle shut off as well as location information (e.g., GPS coordinates) that indicates a geographic location where the vehicle shut off. A timing device (e.g., a clock) at the mobile device, remote starter device, or vehicle telematics device may provide the shutoff timing information. Likewise, a GPS module at the mobile device, remote starter device, or vehicle telematics device may provide the shutoff location information. It will also likewise be appreciated that the insurance underwriting system may receive a shutoff notification message from the remote starter device or the vehicle telematics device directly. In response to receipt of the shutoff notification message, the insurance underwriting system may update the ignition record to indicate that the vehicle shut off (block **736**). The insurance underwriting system may configure the ignition record to include (or otherwise be associated with) the shutoff timestamp information indicating the date and time at which the vehicle shut off as well as the location information indicating the geographic location at which the vehicle shut off.

It will be appreciated that, by collecting ignition records and associated vehicle telematics records, the insurance underwriting system may build a personal driving history for the driver on which the personalized insurance rate for the driver may be, at least in part, determined. The insurance underwriting system described in this disclosure thus introduces alternative approaches to providing insurance coverage for operating a vehicle. One such approach includes providing insurance coverage for individual trips taken by the driver. The approach to providing insurance coverage for individual trips may be referred to as pay-as-you-drive (PAYD) insurance. For PAYD insurance, a driver may pay a one-time insurance premium for insurance coverage during

a single trip in the vehicle. Accordingly, in some situations, the driver may pay the one-time insurance premium each time the driver desires to take a trip in a vehicle. As discussed further below, an insurance rate for the driver may be based, at least in part, on a driving history of the driver and observed driving behaviors during the trip.

Referring to FIG. **8**, a flowchart **800** of example method steps for providing personalized insurance rates is shown. The insurance underwriting system may first identify the driver of the vehicle (block **802**), e.g., in accordance with the approach set forth above where the user of the mobile device that remotely initiates vehicle ignition is identified as the driver of the vehicle. The driver may submit a request for PAYD insurance coverage via the remote starter application operating at the mobile device (block **804**). Upon receipt of the request for PAYD insurance coverage, the insurance underwriting system may retrieve the driving history for the driver, e.g., the ignition records and vehicle telematics records associated with the driver (block **806**). The insurance underwriting system may analyze the ignition records and the vehicle telematics records (block **808**) in order to determine a risk profile and corresponding personalized insurance rate for the driver (block **810**). As noted above, the insurance underwriting system may employ conventional approaches to determining a risk profile and corresponding insurance rate for the driver based on the driving history and driving behaviors of the driver.

In some example implementations, the remote starter application may include input elements (not shown) for specifying a starting and ending location for the trip. The request for insurance coverage may include the starting and ending points. The insurance rate determination module of the insurance underwriting system may thus factor the starting and ending points into the determination of the personalized insurance rate for the driver. For example, if statistical data indicates that the driver will be traveling an area of relatively high risk or relatively low risk, the insurance rate determination module may determine a relatively high or relatively low personalized insurance rate for the driver respectively. In some example embodiments, the insurance rate determination module may be configured to determine one or more routes from the starting point to the ending point specified in the request. The insurance rate determination module may then determine which route is least risky, recommend the least risky route to the driver with a corresponding personalized insurance rate. The insurance underwriting system may then monitor the progress of the vehicle as it travels from the starting point to the ending point along the route and determine whether the driver maintains or deviates from the route. If the driver deviates from the route, then the insurance underwriting system may adjust the personalized insurance rate for the driver or assess a penalty against the driver. In other example embodiments, the insurance rate determination module may identify multiple routes from the starting point to the ending point and determine a respective personalized insurance rate for each possible route. The insurance underwriting system may provide the list of possible routes and respective insurance rates to the remote starter application for display to the user. The user may then select one of the routes and receive insurance coverage at the personalized insurance rate associated with the selected route.

The insurance underwriting system may provide an initial personalized insurance rate to the driver (block **812**). The insurance underwriting system may provide the initial personalized insurance rate to the remote starter application operating at the mobile device, and the remote starter application may display the initial personalized insurance rate to the driver. The remote starter application may prompt the driver to either accept or reject the initial personalized insurance rate offered (block **814**). If the driver does not accept the initial personalized insurance rate offered (block **816**), then an insurance provider may not provide insurance coverage for the driver during the trip (block **818**). Additionally or alternatively, the insurance underwriting system may determine and offer a second personalized insurance rate if the driver rejects the first personalized insurance rate offered. If the driver does accept the initial personalized insurance rate offered (block **816**), then the remote starter application may provide an acceptance message to the insurance underwriting system that creates an insurance record for the driver indicating that an insurance provider will provide insurance coverage for the driver during the trip (block **820**).

The driver may then proceed to remotely start the vehicle using the remote starter application (block **822**) and begin the trip. As discussed above, the insurance underwriting system may receive an ignition confirmation message (block **824**) and create an ignition record for the vehicle (block **826**). The insurance underwriting system may associate the insurance record with the ignition record (block **828**). During the trip, the insurance underwriting system may collect vehicle telematics data and associate the vehicle telematics records with the insurance record for the driver (block **830**). In this way, the insurance underwriting system may monitor and analyze the driving behaviors of the driver during the trip (block **832**).

The insurance underwriting system may encourage safe driving during the trip by adjusting the initial personalized insurance rate based on the driving behaviors observed during the trip. If the insurance underwriting system observes relatively safe driving behaviors during the trip (block **834**), then the insurance underwriting system may maintain the initial personalized insurance rate or reduce the initial personalized insurance rate for the driver (block **836**). If the insurance underwriting system observes relatively unsafe driving behaviors during the trip (block **838**), then the insurance underwriting system may increase the initial personalized insurance rate for the driver (block **838**).

The insurance underwriting system may assess whether a driving behavior is a safe or unsafe driving behavior based on the vehicle telematics data collected and the various characteristics discussed above. The insurance underwriting system may, for example, define exceeding the speed limit more than an average of five miles per hour during the trip as an unsafe driving behavior and define maintaining the speed limit during the trip as a safe driving behavior. As another example, the insurance underwriting system may define turning the vehicle at or above a predetermined speed as an unsafe driving behavior and define turning the vehicle at or below a predetermined speed as a safe driving behavior. A further example may define gradual stops (e.g., stopping the vehicle at or below a predetermined deceleration rate) as a safe driving behavior and define hard stops (e.g., stopping the vehicle at or above a predetermine deceleration rate) as an unsafe driving behavior. Such driving behaviors may be defined bases on the various characteristics set forth above and indicated by the vehicle telematics data provided by the vehicle telematics device. It will be appreciated with the benefit of this disclosure that the insurance underwriting system may define many more safe and unsafe driving behaviors that can affect the personalized insurance rate for the driver.

The insurance premium paid by the driver may thus be based on an adjusted insurance rate. The insurance underwriting system may generate a summary of driving behaviors during the trip that contributed to the determination of whether to adjust the initial personalized insurance rate and provide the driving behavior summary to the remote starter application for display to the driver (block **840**). The driving behavior summary may identify specific driving behaviors that resulted in a relatively higher or lower adjusted personalized insurance rate. the insurance underwriting system may associate driving behaviors with respective amounts by which the initial personalized insurance rate may be adjusted, e.g., by adding the amount to or subtracting the amount from the initial personalized insurance rate. The driver may thus pay the insurance provider an insurance premium corresponding to the final personalized insurance rate that may be the same as the initial personalized insurance rate or may be an adjusted personalized insurance rate (block **842**). It will be appreciated that alternative approaches to adjusting the personalized insurance rate may be employed. As one example, the driver may pay an insurance premium corresponding to the initial personalized insurance rate before the trip begins, and the insurance provider may provide a refund to the driver or assess penalties against the driver at the conclusion of the trip based on the driving behaviors observed during the trip.

Referring to FIG. **9**, a flowchart **900** of example method steps for adjusting the initial personalized insurance rate at the conclusion of a trip is shown. The insurance underwriting system may receive a shutoff notification message (block **902**), which may indicate that the trip has concluded. The insurance underwriting system may then determine whether or not or adjust the initial personalized insurance rate for the driver (block **904**). The insurance underwriting system may determine not to adjust the initial personalized insurance rate (block **906**) where, for example, the insurance underwriting system observes both safe driving behaviors and unsafe driving behaviors during the trip such that the unsafe driving behaviors cancel out the safe driving behaviors. For example, the insurance underwriting system may assign positive ratings to safe driving behaviors and negative ratings to unsafe driving behaviors. The insurance underwriting system may then determine an overall driving behavior rating that corresponds to the sum total of the ratings for the safe and unsafe driving behaviors observed during the trip. Accordingly, the positive ratings for the safe driving behaviors will tend to raise the overall driving behavior rating while the negative ratings will tend to lower the overall driving behavior rating. The insurance underwriting system may maintain a reward threshold such that the insurance underwriting decreases the initial personalized insurance rate where the overall driving behavior rating is greater than or equal to the reward threshold. The insurance underwriting system may also maintain a penalty threshold such that the insurance underwriting system increases the initial personalized insurance rate where the overall driving behavior rating is less than or equal to the penalty threshold. In this example, the insurance underwriting system may maintain the initial personalize insurance rate (block **908**) where the overall driving behavior rating does not cross either the reward threshold or the penalty threshold.

If the overall driving behavior rating crosses either the reward threshold or the penalty threshold, the insurance underwriting system may determine to adjust the initial personalized insurance rate (block **906**). If safe driving behaviors are observed (block **910**), e.g., if the overall driving behavior rating is greater than or equal to the reward threshold, then the insurance underwriting system may determine an adjusted personalized insurance rating by decreasing the initial personalized insurance rate (block **912**). As noted above, the insurance underwriting system may also identify safe driving behaviors that contributed to the decrease of the initial personalized insurance rate (block **914**). If unsafe driving behaviors are observed (block **910**), e.g., if the overall driving behavior rating is less than or equal to a penalty threshold, then the insurance underwriting system may determine an adjusted personalized insurance rating by increasing the initial personalized insurance rate (block **916**). The insurance underwriting system may similarly identify unsafe driving behaviors that contributed to the increase of the initial personalized insurance rate (block **918**). The insurance underwriting system may provide a driving behavior summary to the remote starter application for presentation to the driver at the conclusion of the trip (block **920**). The driving behavior summary may indicate the final personalized insurance rate (e.g., the initial or adjusted personalized insurance rate) as well as a list of driving behaviors that may have contributed to the determination of whether to adjust the initial insurance rate and driving behaviors that may have contributed to an adjustment of the initial insurance rate.

Referring to FIGS. **10**A-D, example implementations of respective user interfaces **1000***a-d* of a remote starter application **1002** are shown. In FIG. **10**A, an example of a display interface **1000***a* of the remote starter application **1002** is shown. In FIG. **10**A, the display interface **1000***a* includes a button **1004** to request PAYD insurance coverage from an insurance provider. When the user selects the button **1004**, the remote starter application **1002** may transmit a request for a PAYD insurance quote to an insurance underwriting system via the mobile device. The remote starter application **1002** may also be configured to prompt the user for information regarding the type or amount of insurance coverage desired and includes this information in the request. As discussed above, the insurance underwriting system may determine an initial personalized insurance rate for the user and provide the initial personalized insurance rate to the remote starter application for presentation to the user. As seen in FIG. **10**A, the PAYD insurance quote **1006** may identify the personalized insurance rate along with, e.g., the amount of coverage offered for the trip. The display interface may include buttons **1008** and **1010** allowing the user to accept or reject the PAYD insurance quote at the initial personalized insurance rate.

Referring to FIG. **10**B, an example of an implementation of a display interface **1000***b* of the remote starter application **1002** displaying a driving behavior summary **1012** is shown. The remote starter application **1002** may display the driving behavior summary **1012** at the conclusion of a trip and indicate one or more driving behaviors **1014** of the driver during the trip. In this example, the list of driving behaviors **1014** includes both relatively safe and unsafe driving behaviors. Accordingly, the insurance underwriting system determined not to adjust the initial personalized insurance rate in this example.

In FIG. **10**C, an example of an implementation of a display interface **1000***c* of the remote starter application **1002** where safe driving behaviors result in a decrease in the initial personalized insurance rate is shown. As seen in FIG. **10**C, the driving summary **1016** indicates safe driving behaviors **1018** during the trip thereby resulting in a lower adjusted personalized insurance rate **1020**. In FIG. **10**D, an example of an implementation of a display interface **1000***d* of the remote starter application **1002** where unsafe driving

behaviors result in an increase in the initial personalized insurance rate is shown. As seen in FIG. **10**D, the driving summary **1022** indicates unsafe driving behaviors **1024** during the trip thereby resulting in a higher adjusted personalized insurance rate **1026**. By basing driver insurance rates, at least in part, on driving behavior, safe driving behavior is thereby encouraged.

While the disclosure has been described with respect to specific examples including presently illustrative modes of carrying out the disclosure, a person having ordinary skill in the art, after review of the entirety disclosed herein, will appreciate that there are numerous variations and permutations of the above-described systems and techniques that fall within the spirit and scope of the disclosure. For example, the vehicle telematics device (rather than the insurance underwriting system) may monitor and analyze the driving behaviors during a trip and transmit a driving analysis to the insurance underwriting system such that the insurance underwriting system determines whether and how much to adjust a personalized insurance rate based on the driving analysis provided by the vehicle telematics device (rather than vehicle telematics data provided by the vehicle telematics device).

What is claimed is:

1. A non-transitory computer-readable medium having instructions stored thereon that, when executed by a processor of a mobile computing device, cause the mobile computing device to:

transmit, to a remote starter device connected to an ignition system of a vehicle, a request to initiate ignition of the vehicle, where receipt of the request causes the remote starter device to initiate ignition of the vehicle;

receive, from the remote starter device upon ignition of the vehicle, an ignition confirmation message;

determine, responsive to receipt of the ignition confirmation message, that a user of the mobile computing device is a driver of the vehicle; and

transmit, to an insurance underwriting system in response to the receipt of the ignition confirmation message, an ignition notification message comprising data identifying the driver, where receipt of the ignition notification message by the insurance underwriting system causes the insurance underwriting system to create an ignition record;

wherein the insurance underwriting system determines a personalized insurance rate for the driver based, at least in part, on vehicle telematics data collected by the insurance underwriting system during operation of the vehicle after the ignition of the vehicle, where the vehicle telematics data characterizes the operation of the vehicle by the driver.

2. The non-transitory computer-readable medium of claim **1**, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

receive, from the insurance underwriting system, the personalized insurance rate; and

present, at a display device of the mobile computing device, the personalized insurance rate.

3. The non-transitory computer-readable medium of claim **2**, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

receive, at a user interface of the mobile computing device, input from the user requesting insurance coverage; and

transmit, to the insurance underwriting system, a request for insurance coverage, where receipt of the request for insurance coverage causes the insurance underwriting system to transmit, to the mobile computing device, the personalized insurance rate, where receipt of the personalized insurance rate by the mobile computing device causes presentation of the personalized insurance rate at the display device of the mobile computing device.

4. The non-transitory computer-readable medium of claim **3**, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

prompt the user to accept or reject the insurance coverage at the personalized insurance rate;

receive, at the user interface of the mobile computing device, input from the user representing acceptance or rejection of the insurance coverage; and

transmit, to the insurance underwriting system, a message indicating whether the user has accepted or rejected the insurance coverage.

5. The non-transitory computer-readable medium of claim **2**, wherein:

the personalized insurance rate is based on vehicle telematics data collected by the insurance underwriting system during a plurality of trips taken by the driver.

6. The non-transitory computer-readable medium of claim **2**, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

receive, from the insurance underwriting system, an adjusted personalized insurance rate that is either higher or lower than the personalized insurance rate, where the adjusted personalized insurance rate determined by the insurance underwriting system is based on at least one driving behavior identified by the insurance underwriting system from the vehicle telematics data collected by the insurance underwriting system during operation of the vehicle; and

present, at the display device of the mobile computing device, the adjusted personalized insurance rate.

7. The non-transitory computer-readable medium of claim **6**, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

present, at the display device of the mobile computing device, a driving behavior summary comprising information indicating the at least one driving behavior on which the adjusted personalized insurance rate is based.

8. The non-transitory computer-readable medium of claim **7**, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

present, in the driving behavior summary, information indicating whether the at least one driving behavior caused the adjusted personalized insurance rate to be higher or lower than the personalized insurance rate.

9. The non-transitory computer-readable medium of claim **6**, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

present, at the display device of the mobile computing device, an amount by which the personalized insurance rate was adjusted.

10. The non-transitory computer-readable medium of claim 1, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

prevent receipt of user input requesting transmission of the request to initiate ignition of the vehicle until the user provides, at a user interface of the mobile computing device, user input representing one of a password or a unique identifier.

11. The non-transitory computer-readable medium of claim 1, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

transmit, to the remote starter device, an ignition inquiry request; and

receive, from the remote starter device in response to receipt of the ignition inquiry request, an ignition status message indicating whether the vehicle is running or shut off.

12. The non-transitory computer-readable medium of claim 11, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

automatically transmit the ignition inquiry request at a periodic interval.

13. The non-transitory computer-readable medium of claim 11, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

transmit the ignition inquiry request in response to receipt, at a user interface of the mobile computing device, of user input requesting an ignition status of the vehicle.

14. The non-transitory computer-readable medium of claim 1, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

receive, from the remote starter device upon shutoff of the vehicle, a shutoff confirmation message; and

transmit, to the insurance underwriting system, a shutoff notification message, where receipt of the shutoff notification message by the insurance underwriting system causes the insurance underwriting system to update the ignition record.

15. The non-transitory computer-readable medium of claim 14, wherein: the shutoff notification message comprises a date and a time.

16. The non-transitory computer-readable medium of claim 14, wherein:

the shutoff notification message comprises data identifying a geographic location of the vehicle.

17. The non-transitory computer-readable medium of claim 14, wherein:

each of the ignition notification message and the shutoff notification message comprises data identifying the vehicle.

18. The non-transitory computer-readable medium of claim 1, wherein:

the ignition notification message comprises a date and a time.

19. The non-transitory computer-readable medium of claim 1, wherein:

the ignition notification message comprises data identifying a geographic location of the vehicle.

20. The non-transitory computer-readable medium of claim 1, wherein the instructions, when executed by the processor of the mobile computing device, further cause the mobile computing device to:

perform a handshaking process with the remote starter device in order to establish a connection between the mobile computing device and the remote starter device.

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