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(54) Title: USER-MANAGED EVIDENTIARY RECORD OF DRIVING BEHAVIOR AND RISK RATING

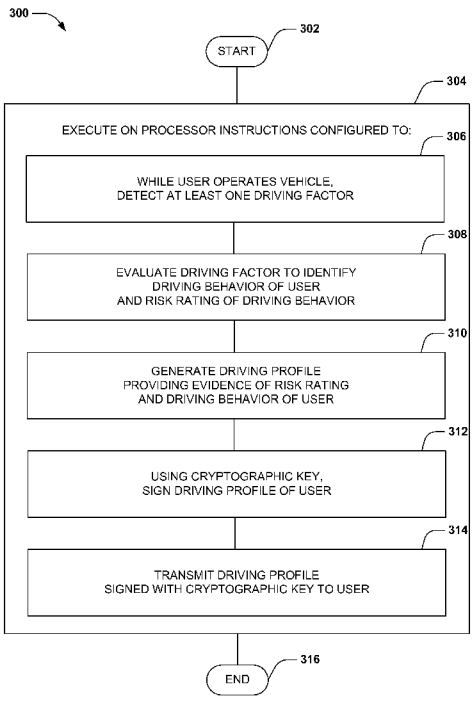


FIG. 3

(57) Abstract: A user driving a vehicle may be monitored by a device on behalf of a third party, such as employers and insurers. The device may generate an objective evidentiary record of the user's driving safety and/or proficiency for use by the third party. The user may wish to share the evidentiary record with other parties, but the third party that controls the record may not agree and/or release the record. A user-generated record of the user's driving behavior may be untrustworthy and/or unverifiable. Instead, a device of the user monitors the operation of the vehicle by the user, generates a driving profile of the user's driving behavior and risk rating, and cryptographically signs the driving profile. The cryptographically signed driving profile is transmitted to the user for sharing with third parties, e.g., potential employers and insurers, and the authenticity of the driving profile is verifiable using the cryptographic signature.

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# USER-MANAGED EVIDENTIARY RECORD OF DRIVING BEHAVIOR AND RISK RATING

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** The present application claims priority under 35 U.S.C. § 119(e) to U.S. Patent Application No. 61/946,962, filed on March 3, 2014, the entirety of which is incorporated by reference as if fully rewritten herein.

## BACKGROUND

**[0002]** Within the field of computing, many scenarios involve an evaluation of a driving behavior of user operating a vehicle. For example, a driver of an automobile may manipulate the gas, brake, gearshift, and steering wheel, and a device on board the automobile may monitor various driving factors of the vehicle. As a first such example, the device may evaluate the driving factors as a safety precaution; *e.g.*, upon detecting a firm application of the brakes resulting in a lockup condition, the vehicle may instead activate an antilock braking system that modifies the user's vehicle control input to provide a less firm braking pattern with greater stopping power. As a second such example, the device may warn the user if a dangerous condition arises (*e.g.*, a proximity detector of the vehicle may warn the user if sudden braking is detected ahead, or if the user allows the vehicle to enter the proximity of another vehicle on the road). These monitoring and user feedback techniques may assist the user in the moment-to-moment control of the vehicle.

**[0003]** In many such scenarios, the monitoring of the vehicle may be performed at the request of a third party, and may report to the third party the driving behavior of the user. As a first such example, a driver training service may install a device in the user's vehicle to evaluate the driving behavior of an inexperienced driver, and may award or withhold a driver's license to the user based on the driving behavior reported by the device. As a second such example, an employer of the user, such as an owner of a vehicle that the user operates in an employment context, may utilize a device in the vehicle to monitor compliance of driving safety policies by the user. As a third such

example, an insurer may install a monitoring device in the vehicle of the user to assess the user's driving proficiency, and may choose to offer the user a lower insurance rate if the monitoring of the device indicates a safe driving behavior. In this manner, third parties may utilize devices to detect, evaluate, and report on the user's driving behavior and proficiency.

## SUMMARY

**[0004]** This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key factors or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

**[0005]** Although third parties may request, apply, and utilize automated monitoring of a driving behavior of a user, the user may also wish to compile a record of his or her own driving behavior. For example, the user may wish to demonstrate evidence of driving safety, proficiency, and/or experience, such as a professional asset or as character evidence. The user may compile such a record utilizing a variety of devices, such as a vehicle-mounted camera, but the trustworthiness of such evidence may be diminished by the user's ability to edit and alter the contents of the record; *i.e.*, the dependability of the evidence compiled by the user about his or her own driving record may be only as reliable as the user's own trustworthiness, as well as the user's objectivity in self-assessment of his or her own driving behavior. Accordingly, a third party who does not have a trust relationship with the user may be unable to trust the evidentiary record of the user. Conversely, a driving behavior evidentiary record that is compiled by an objective third party, such as an insurer, may be reliable, but the insurer may be unwilling to share the evidentiary record with others. For example, the user may seek to compare the rates and/or coverage of the user's current insurer with that of another insurer, but the current insurer may be unwilling to release such an evidentiary record. The user may therefore find that the evidentiary record about the user's driving behavior is not portable or applicable to the user's other interests that are not consistent with those of the holder of the record.

**[0006]** Presented herein are techniques that enable a user to generate a verifiable, objective evidentiary record of the user's driving behavior. As a first example, a device having a cryptographic key may detect at least one driving factor while the user operates the vehicle, and evaluate the at least one driving factor to identify a driving behavior of the user, and a risk rating of the driving behavior. The device may then generate a driving profile providing evidence of the risk rating and the driving behavior of the user, and, using the cryptographic key, sign the driving profile of the user, and transmit the driving profile signed with the cryptographic key to the user. The driving profile signed by the cryptographic key of the device may attest to the authenticity of the evidentiary record of the device, and the user may provide the signed driving profile to third parties as an objective evidentiary record of the user's driving behavior.

**[0007]** As a second example, a server comprising a cryptographic key may feature a system that provides an evidentiary record of a driving behavior of a user. The system comprises a driving behavior evaluator, which receives at least one driving factor detected while the user operates the vehicle, and evaluates the at least one driving factor to identify a driving behavior of the user, and a risk rating of the driving behavior. The system further comprises a driving profile generator, which generates a driving profile providing evidence of the risk rating and the driving behavior of the user; using the cryptographic key, signs the driving profile of the user; and transmits the driving profile signed with the cryptographic key to the user.

**[0008]** As a third example, a vehicle device of a vehicle may feature a driving factor detector that, while the user operates the vehicle, detects at least one driving factor, and a system that provides an evidentiary record of a driving behavior of a user. The system comprises a driving behavior evaluator, which evaluates the at least one driving factor to identify a driving behavior of the user, and a risk rating of the driving behavior. The system further comprises a driving profile generator, which generates a driving profile providing evidence of the risk rating and the driving behavior of the user; using a cryptographic key, signs the driving profile of the user; and transmits the driving profile signed with the cryptographic key to the user. In this

manner, devices and services may provide to the user an objective, verifiably authentic evidentiary record of the driving behavior of the user in accordance with the techniques presented herein.

**[0009]** To the accomplishment of the foregoing and related ends, the following description and annexed drawings set forth certain illustrative aspects and implementations. These are indicative of but a few of the various ways in which one or more aspects may be employed. Other aspects, advantages, and novel features of the disclosure will become apparent from the following detailed description when considered in conjunction with the annexed drawings.

## DESCRIPTION OF THE DRAWINGS

**[0010]** Fig. 1 is an illustration of an example scenario featuring an evaluation of a driving behavior of a user operating a vehicle by a travel device.

**[0011]** Fig. 2 is an illustration of an example scenario featuring an evaluation of a driving behavior of a user operating a vehicle by a travel device and a generation of a driving profile of the user, in accordance with the techniques presented herein.

**[0012]** Fig. 3 is an illustration of an example method of generating a driving profile of a user in accordance with the techniques presented herein.

**[0013]** Fig. 4 is a component block diagram of an example profile service featuring an example system for generating a driving profile of a user in accordance with the techniques presented herein.

**[0014]** Fig. 5 is a component block diagram of an example vehicle device featuring an example system for generating a driving profile of a user in accordance with the techniques presented herein.

**[0015]** Fig. 6 is an illustration of an example computer-readable medium comprising processor-executable instructions configured to embody one or more of the provisions set forth herein.

**[0016]** Fig. 7 is an illustration of an example scenario featuring a second example method of collecting driving factors of a user operating a vehicle in accordance with the techniques presented herein.

**[0017]** Fig. 8 is an illustration of an example scenario featuring a statistical classification technique that may be utilized to identify a risk rating for a user in accordance with the techniques presented herein.

**[0018]** Fig. 9 is an illustration of an example scenario featuring techniques for connecting a user with an insurer using a driving profile in accordance with the techniques presented herein.

**[0019]** Fig. 10 illustrates an example computing environment wherein one or more of the provisions set forth herein may be implemented.

## DETAILED DESCRIPTION

**[0020]** The claimed subject matter is now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the claimed subject matter. It may be evident, however, that the claimed subject matter may be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to facilitate describing the claimed subject matter.

### [0021] A. Introduction

**[0022]** Fig. 1 illustrates an illustration of example scenarios in which a device monitors a driving behavior of a user 110 operating a vehicle 108 in a variety of circumstances. In a first example scenario 100 of Fig. 1, at a first time point 106 and in a particular driving context 104 (*e.g.*, sunny daytime weather), a user 110 of a second vehicle 108 may operate the vehicle 108 at a particular driving factor 114, such as a selected driving speed (*e.g.*, 45 kilometers per hour) while maintaining a particular braking distance with respect to a first, leading vehicle 108. At a second time point 106, the user 110 of the first vehicle 108 may activate brakes 116, resulting in a hard stop

and skidding, and the user 110 of the second vehicle 108 may also activate the brakes 116 to avoid a collision. The degree of braking 116 may ordinarily result in a lockup condition that extends the braking distance and results in a collision. Instead, the vehicle 108 may activate antilock brakes in order to shorten the achieved braking distance and to stop the second vehicle 108 with a braking margin 118 from the first vehicle 108 and to avoid a collision. The vehicle 108 may also present an antilock braking warning 120 to the user 110 to indicate the use of this braking system. Accordingly, the user 110 may correctly perceive that the braking distance from the first vehicle 108 was adequate for the driving context 104. However, in a similar second scenario 102, the user 110 may also operate the vehicle 108 with a braking distance from a first vehicle 108. However, a different driving context 104 of rainy weather may alter the road surface, and when the first vehicle 108 activates brakes 116, the same amount of braking, and even the activation of the antilock braking system, may be unable to mitigate the extended braking distance 116 and may result in a collision 122.

**[0023]** As further illustrate dint he example scenarios of Fig. 1, the driving behavior of the user 110 in various driving contexts 106 may be evaluated by a vehicle device 112 installed in the vehicle 108 on behalf of a third party. As a first such example, if the user 110 is an inexperienced driver, a driving training service may install such a vehicle device 112 to evaluate the user's driving behavior, and may award or withhold a driver's license based on the evaluation of the user's driving behavior by the vehicle device 112. As a second such example, an employer of the user 110, such as an owner of the vehicle 108, may install and monitor a vehicle device 112 to ensure compliance of the user 110 with the employer's safety policies, such as compliance with speed limits. As a third such example, an insurer may offer an opportunity to reduce a user's insurance rates if the user 110 agrees to be monitored by a vehicle device 112, and if the vehicle device 112 indicates that the user's driving behavior is typically safe, the insurer may lower the user's vehicle insurance rates as a reflection of the reduced risk entailed by the user's safe driving record. These and other scenarios may arise in which a

third party utilizes a vehicle device 112 on board the vehicle 108 to assess the driving behavior of the user 110.

**[0024]** However, in some circumstances, the user 110 may wish to use the driving record generated by such a vehicle device 112 for his or her own interests. As a first such example, the user 110 may wish to provide the driving record of the vehicle device 112 as evidence of driving capability, *e.g.*, as a professional asset for potential employers. As a second such example, the user 110 may wish to provide the driving record of the vehicle device 112 as evidence of safe driving while shopping for vehicle insurance, and may wish to provide the driving record to a range of candidate insurers. As a third such example, the user 110 may wish to provide the driving record as evidence of the driver's safe driving behavior, *e.g.*, in a legal proceeding involving a dispute over fault in a vehicle accident. In such circumstances, the user 110 may seek permission from a third party that controls the vehicle device 112 to share the driving record of the user 110 with others. However, the third party may not be agreeable to sharing the driving record, and may only wish to utilize the driving record for the interests of the third party; *e.g.*, the user 110 may wish to have the driving record shared with competing insurers to which the user 110 is considering transitioning. Alternatively or additionally, the third party may be concerned that sharing the driving record may be construed as an assertion by the third party of the user's safe driving behavior, which may incur liability to the third party if the user 110 is later deemed to be an unsafe driver. Accordingly, the third party may refuse to share the driving record generated by the vehicle device 112 with others on behalf of the user 110.

**[0025]** Alternatively, the user 110 may seek to generate self-controlled evidence of his or her driving behavior, such as by installing cameras and monitoring equipment in the vehicle 108 to generate a driving record. However, the dependability of such information may be questionable, due to an inability to authenticate such evidence. For example, the user 110 may be able to alter the contents of the record to improve the appearance of safe driving, *e.g.*, altering vehicle telemetry recordings to reflect a lower recorded driving speed than the user's actual driving speed. As a second such

example, the user 110 may selectively include and/or exclude monitored periods, and may edit together a record that inaccurately portrays the user's driving record. The dependability of such evidence may therefore be limited to the dependability of the user 110, and a third party that has no evidence of the user's trustworthiness may not be able to attribute significant value to a self-compiled record of the user's driving behavior. The user 110 may therefore have no option for generating an objective, verifiable evidentiary record of the user's driving behavior that may be shared with third parties at the discretion and according to the interests of the user 110.

**[0026] B. Presented Techniques**

**[0027]** Fig. 2 presents an illustration of an example scenario 200 whereby a user 110 utilizes a vehicle device 202 to generate a driving profile 204 of the user's driving behavior 204 in accordance with the techniques presented herein.

**[0028]** In this example scenario 200, the while the user 110 operates the vehicle 108, a vehicle device 202 may monitor one or more driving factors 114, such as the speed, acceleration, braking, turning, gear shifting, and proximity with respect to other vehicles 108. The vehicle device 202 may store a cryptographic key 204, such as a public/private key pair generated and used according to an asymmetric encryption model. The vehicle device 202 may monitor driving factors 114 detected during operation of the vehicle 108 by the user 110, and may evaluate the driving factors 114 to identify a driving behavior 210 of the user 110, such as the user's tendency to drive a ta particular speed, accelerate at a particular rate, and/or maintain a braking distance with respect to another vehicle 108, in general and/or in particular driving contexts 104. The vehicle device 202 may also generate a risk rating 212 of the driving behavior 210 of the user 110, such as a comparative rating of the user's safety and/or proficiency as compared with other users 110. The device 202 may also generate 208 a driving profile 208 providing evidence of the risk rating 212 and the driving behavior 210 (*e.g.*, recordings of driving factors 114 that demonstrate the user's safe and/or unsafe driving behavior

210). Moreover, the device 202 may sign 214 the driving profile 208 with the cryptographic key 204 (*e.g.*, generating a hashcode of the contents of the driving profile 208; signing the hashcode with the cryptographic private key; and sharing the cryptographic public key in a publicly accessible location). The vehicle device 202 may then attach to the driving profile 208 a cryptographic signature 216 that may be used to verify the authenticity of the driving profile 208 (*e.g.*, that the user 110 has not altered the driving profile 208 originally generated by the vehicle device 202).

**[0029]** The cryptographically signed driving profile 208 may be transmitted by the vehicle device 202 to the user 110, who may share it with third parties. The third parties may evaluate the contents of the driving profile 208, and may confirm the authenticity of the driving profile 208 by verifying that the hashcode signed with the cryptographic signature 216 matches the hashcode of the contents of the driving profile 208. In this manner, the user 110 is provided with an objective, evidentiary record of his or her driving profile 208, in a manner that is verifiable as authentic and unaltered from the original driving profile 208 generated by the vehicle device 202, and may share the driving profile 208 with third parties at the discretion of the user 110 in accordance with the techniques presented herein.

**[0030]** **C. Technical Effects**

**[0031]** The techniques presented herein may provide a variety of technical effects.

**[0032]** As a first such example, the generation of a cryptographically signed driving profile 208 to the user 110 may enable the user 110 to share the driving profile 208 with third parties, who may verify the authenticity of the contents of the driving profile 208 by comparing the contents with the cryptographic signature 216. A verified driving profile 208 may indicate that the evidence provided therein was recorded by the vehicle device 202, and has not been altered by the user 110 or another party. The user 110 is also provided control over the driving profile 208, and may share or not share it according to the user's discretion and interests.

**[0033]** As a second such example, the generation of a verifiable evidentiary record of the user's driving behavior 210 may be used to provide a variety of services to the user 110 that may not be feasible in the absence of such a record. For example, the user 110 may be a candidate for an opportunity to control a vehicle 108 in a sensitive context, such as transporting an easily damaged piece of equipment on a long-distance trip in a vehicle 108, and the selection of the user 110 for the opportunity may depend on a verifiable record of the user's driving safety and/or proficiency. The generation of the driving profile 208 in accordance with the techniques presented herein may provide evidence of such skills, and may expedite the selection of the user 110 for the opportunity as compared with *ad-hoc* evaluation of the user's driving behavior 210. Moreover, a record of the user's driving behavior 210 while operating the vehicle 108 under ordinary circumstances may be more accurate than an evaluation of the user's driving behavior 210 in simulated conditions or an *ad-hoc* testing environment, in which the user 110 may exhibit a different driving behavior 210.

**[0034]** As a third such example, the preparation of a driving profile 208 based on evaluation by an independently managed vehicle device 202 may provide more accurate data about the user's driving behavior 210 and risk rating 212 than either the user's self-assessment or an evaluation performed by a self-interested third party. For example, a third party may be reluctant to release a driving profile 208 to the user 110 due to its perception that the third party is vouching for the safety of the user 110, because a vehicle accident involving the user 110 may cause the third party to incur liability. However, an evaluation performed only in an automated manner by a vehicle device 202 may assert a risk rating 212 in a disinterested manner and/or according to established criteria, such as compliance with speed limits and traffic restrictions. These and other technical advantages may be achieved by the development of a cryptographically signed driving profile 208 of the driving behavior 210 of the user 110 in accordance with the techniques presented herein.

**[0035]** **D. Example Embodiments**

**[0036]** Fig. 3 presents a first example embodiment of the techniques presented herein, illustrated as an example method 300 of providing an evidentiary record of a driving behavior 210 of a user 110 of a vehicle 108. The example method 300 involves a vehicle device 202 having a processor and a cryptographic key 204, such as a public/private cryptographic key pair generated according to an asymmetric encryption model. The example method 300 may be implemented, *e.g.*, as a set of instructions stored in a memory component of the vehicle device 202 (*e.g.*, a memory circuit, a platter of a hard disk drive, a solid-state memory component, or a magnetic or optical disc) that, when executed by the processor of the vehicle device 202, cause the vehicle device 202 to operate according to the techniques presented herein.

**[0037]** The example method 300 begins at 302 and involves executing 304 the instructions on the processor. Specifically, the instructions cause the vehicle device 202 to, while the user 110 operates the vehicle 108, detect 306 at least one driving factor 114. The instructions also cause the vehicle device 202 to evaluate 308 the at least one driving factor 114 to identify a driving behavior 210 of the user 110, and a risk rating 212 of the driving behavior 210. The instructions also cause the vehicle device 202 to generate 310 a driving profile 208 providing evidence of the risk rating 212 and the driving behavior 210 of the user 110. The instructions also cause the vehicle device 202 to, using the cryptographic key 204, sign 312 the driving profile 208 of the user 110. The instructions also cause the vehicle device 202 to transmit 314 the driving profile 208 signed with the cryptographic key 204 to the user 110. In this manner, the example method 300 causes the vehicle device 202 to generate a verifiable, evidentiary record of the driving behavior 210 of the user 110 in accordance with the techniques presented herein, and so ends at 316.

**[0038]** Fig. 4 presents an illustration of an example scenario 400 featuring a second example embodiment of the techniques presented herein, illustrated as an example server 402 featuring an example system 410 that provides an evidentiary record of a driving behavior 412 of a user 110. The example system 408 may be implemented, *e.g.*, on a server 402 having a processor

404, a vehicle communicator 406 that communicates with a vehicle device 202 of the vehicle 108 during operation by the user 110, and a cryptographic key 204, such as a public/private key pair generated according to an asymmetric encryption model. Respective components of the example system 410 may be implemented, *e.g.*, as a set of instructions stored in a memory 408 of the server 402 and executable on the processor 404 of the server 402, such that the interoperation of the components causes the server 402 to operate according to the techniques presented herein.

**[0039]** The example system 408 comprises a driving behavior evaluator 412, which receives, through the vehicle communicator 406, at least one driving factor 114 detected by the vehicle device 202 while the user 110 operates the vehicle 108. The driving factors 114 may include, *e.g.*, a speed of the vehicle 108; an acceleration and/or braking pattern of the vehicle 108; a proximity that the user 110 maintains with respect to other vehicles 108; and/or a driving context 104 in which the user 110 chooses to operate the vehicle 108 and exhibits the driving factors 114, such as the weather, the locations through which the user 110 navigates the vehicle 108, and the time of day. The driving behavior evaluator 412 further evaluates the at least one driving factor 114 (optionally in the context of a driving context 104) to identify a driving behavior 210 of the user 110, and a risk rating 212 of the driving behavior 210. The example system 408 also comprises a driving profile generator 414, which generates a driving profile 208 providing evidence of the risk rating 212 and the driving behavior 210 of the user 110 (*e.g.*, a record of the driving factors 114 supporting the determination of the driving behavior 210 and the risk rating 212), and, using the cryptographic key 204, signs the driving profile 208 of the user 110. The driving profile generator 414 then transmits the driving profile 208 signed with the cryptographic key 204 to the user 110. The interoperation of the components of the example system 410 in the example scenario 500 of Fig. 5 thereby delivers to the user 110 a driving profile 208 that evidences the driving behavior 210 and the risk rating 212 of the user in accordance with the techniques presented herein.

**[0040]** Fig. 5 presents an illustration of an example scenario 400 featuring a third example embodiment of the techniques presented herein, illustrated as

an example vehicle device 502 featuring an example system 510 that provides an evidentiary record of a driving behavior 412 of a user 110. The example system 508 may be implemented, *e.g.*, on a vehicle device 502 having a processor 504, a telemetric interface 506 through which the vehicle device 502 receives driving factors 14 about the operation of the vehicle 108 by the user 112, and a cryptographic key 204, such as a public/private key pair generated according to an asymmetric encryption model. Respective components of the example system 510 may be implemented, *e.g.*, as a set of instructions stored in a memory 508 of the vehicle device 502 and executable on the processor 504 of the vehicle device 502, such that the interoperation of the components causes the vehicle device 502 to operate according to the techniques presented herein.

**[0041]** The example system 508 comprises a driving behavior evaluator 512, which receives from the vehicle 108, through the telemetric interface 508, at least one driving factor 114 while the user 110 operates the vehicle 108. The driving factors 114 may include, *e.g.*, a speed of the vehicle 108; an acceleration and/or braking pattern of the vehicle 108; a proximity that the user 110 maintains with respect to other vehicles 108; and/or a driving context 104 in which the user 110 chooses to operate the vehicle 108 and exhibits the driving factors 114, such as the weather, the locations through which the user 110 navigates the vehicle 108, and the time of day. The driving behavior evaluator 512 further evaluates the at least one driving factor 114 (optionally in the context of a driving context 104) to identify a driving behavior 210 of the user 110, and a risk rating 212 of the driving behavior 210. The example system 508 also comprises a driving profile generator 514, which generates a driving profile 208 providing evidence of the risk rating 212 and the driving behavior 210 of the user 110 (*e.g.*, a record of the driving factors 114 supporting the determination of the driving behavior 210 and the risk rating 212), and, using the cryptographic key 204, signs the driving profile 208 of the user 110. The driving profile generator 514 then transmits the driving profile 208 signed with the cryptographic key 204 to the user 110. The interoperation of the components of the example system 510 in the example scenario 500 of Fig. 5 thereby delivers to the user 110 a driving profile 208 that evidences the

driving behavior 210 and the risk rating 212 of the user in accordance with the techniques presented herein.

**[0042]** Still another embodiment involves a computer-readable medium comprising processor-executable instructions configured to apply the techniques presented herein. Such computer-readable media may include, *e.g.*, computer-readable storage media involving a tangible device, such as a memory semiconductor (*e.g.*, a semiconductor utilizing static random access memory (SRAM), dynamic random access memory (DRAM), and/or synchronous dynamic random access memory (SDRAM) technologies), a platter of a hard disk drive, a flash memory device, or a magnetic or optical disc (such as a CD-R, DVD-R, or floppy disc), encoding a set of computer-readable instructions that, when executed by a processor of a device, cause the device to implement the techniques presented herein. Such computer-readable media may also include (as a class of technologies that are distinct from computer-readable storage media) various types of communications media, such as a signal that may be propagated through various physical phenomena (*e.g.*, an electromagnetic signal, a sound wave signal, or an optical signal) and in various wired scenarios (*e.g.*, via an Ethernet or fiber optic cable) and/or wireless scenarios (*e.g.*, a wireless local area network (WLAN) such as WiFi, a personal area network (PAN) such as Bluetooth, or a cellular or radio network), and which encodes a set of computer-readable instructions that, when executed by a processor of a device, cause the device to implement the techniques presented herein.

**[0043]** An example computer-readable medium that may be devised in these ways is illustrated in Fig. 6, wherein the implementation 500 comprises a computer-readable medium 602 (e.g., a CD-R, DVD-R, or a platter of a hard disk drive), on which is encoded computer-readable data 604. This computer-readable data 604 in turn comprises a set of computer instructions 606 configured to operate according to the principles set forth herein. In a first such embodiment, the processor-executable instructions 606 may be configured to, when executed by a processor 612 of a device 610, cause the device 610 to generate an evidentiary record of a driving behavior of the user 110, such as the example method 300 of Fig. 3. In a second such

embodiment, the processor-executable instructions 606 may be configured to implement a server comprising a system for generate an evidentiary record of a driving behavior of the user 110, such as the example server 402 of Fig. 4. In a second such embodiment, the processor-executable instructions 606 may be configured to implement a vehicle device comprising a system for generate an evidentiary record of a driving behavior of the user 110, such as the example vehicle device 502 of Fig. 5. Some embodiments of this computer-readable medium may comprise a nontransitory computer-readable storage medium (*e.g.*, a hard disk drive, an optical disc, or a flash memory device) that is configured to store processor-executable instructions configured in this manner. Many such computer-readable media may be devised by those of ordinary skill in the art that are configured to operate in accordance with the techniques presented herein.

**[0044] E. Variable Aspects**

**[0045]** The techniques discussed herein may be devised with variations in many aspects, and some variations may present additional advantages and/or reduce disadvantages with respect to other variations of these and other techniques. Moreover, some variations may be implemented in combination, and some combinations may feature additional advantages and/or reduced disadvantages through synergistic cooperation. The variations may be incorporated in various embodiments (*e.g.*, the example method 300 of Fig. 3; the example system 408 of Fig. 4; the example computer-readable storage device 502 of Fig. 5; and the example method 608 of Fig. 6) to confer individual and/or synergistic advantages upon such embodiments.

**[0046] E1. Scenarios**

**[0047]** A first aspect that may vary among embodiments of these techniques relates to the scenarios wherein such techniques may be utilized.

**[0048]** As a first example of this first aspect, the techniques presented herein may be used with many types of vehicles 108, including automobiles, motorcycles, trucks, buses, watercraft, aircraft, and spacecraft.

**[0049]** As a second example of this first aspect, the techniques presented herein may be used to evaluate the driving behavior of the user 110 according to telemetry of a variety of controls utilized by the user 110 to operate the vehicle 108, such as an accelerator, or throttle, brake, gear selector, steering wheel, tiller, or yolk. The driving factors 114 provided as telemetry for an evaluation of the driving behavior of the usre 110 may also include vehicle accessories, including interior and exterior lighting; windshield wipers; cleaning, anti-fogging, and/or de-icing controls; climate controls; sound systems; and communication with other vehicles 108 and individuals. Additionally, the driving factors 114 may include indicators of the of user driving behavior 208 of the user 110, such as vehicle speed or vehicle acceleration; lane selection among at least two lanes of a causeway; vehicle turning rate (*e.g.*, the effects of turning too sharply or gradually at different speeds); vehicle gear selection; vehicle signaling input (*e.g.*, the use of turn signals); and vehicle climate control (*e.g.*, the use of a defogger or windshield wipers to clear weather-related obstructions).

**[0050]** As a third example of this first aspect, the techniques presented herein may be used to evaluate the driving behaviors 210 of the user 110 while operating the vehicle 108 in a variety of driving contexts 106, including the time of day; sunny, overcast, foggy, rainy, snowing, and/or freezing weather conditions; a vehicle causeway type context (*e.g.*, an unpaved local road, a residential side street, a main roadway, or a highway); a traffic congestion context (*e.g.*, the volume of traffic in the vicinity of the vehicle 108); a vehicle speed of at least one other vehicle 108 operating near the vehicle 108 (*e.g.*, if the vehicle 108 is passing, being passed by, or keeping pace with other vehicles 108); the route of the vehicle 108 (*e.g.*, a short local route, a longer cross-city route, or a long-distance route between cities); and a vehicle condition context (*e.g.*, the maintenance condition and/or cargo contents of the vehicle 108); and a vehicle passenger context (*e.g.*, the number and identities of other passengers aboard the vehicle 108). These and other variations may be included in various embodiments of the techniques presented herein.

**[0051] E2. Receiving Driving Factors**

**[0052]** A second aspect that may vary among embodiments of the techniques presented herein involves the driving factors 114 that may be received and utilized to determine the driving behavior 210 and/or risk rating 212 of the user 110. Such driving factors 114 may be utilized directly by the vehicle device 202, and/or may be transmitted to a server, such as a driving behavior evaluation and profiling service, to achieve an evaluation of the driving behavior 210 and risk rating 212 of the user 110 and the generation of a driving profile 208 of the user 110.

**[0053]** As a first variation of this second aspect, a vehicle device 202 may include, in the driving factors 114, at least one telemetric measurement received from the vehicle 108 during operation by the user 110. For example, the vehicle device 202 may communicate with the vehicle 108 through an On-Board Diagnostics (OBD-II) interface to receive information about the operation of the vehicle 202 by the user 110 and the performance of the vehicle 202 during such operation.

**[0054]** As a second variation of this second aspect, the vehicle device 202 may detect and utilize various sources of information about the driving context 104 in which the user 110 operates the vehicle. As a first such example, the vehicle device 202 may communicate with a weather service to detect a current weather condition in the area of the vehicle 202 that may represent a weather factor affecting the driving behavior 210 and/or risk rating of the user 110. The vehicle device 202 may also utilize sensors on board the vehicle 202, such as an ambient temperature sensor. As a second such example, the vehicle device 202 may evaluate the time of day, the day of the week, an instance of an event or holiday. As a third such example, the vehicle device 202 may monitor an interior condition of the vehicle 202, *e.g.*, to detect the interior temperature, occupancy, the use of seatbelts, the use of a radio or a communication device such as a mobile phone, and/or presence or absence of distractions, such as conversation among the occupants of the vehicle 108.

**[0055]** Fig. 7 presents an illustration of an example scenario 700 featuring a third variation of this second aspect, wherein the driving factors 114 include

information provided by a proximity sensor 702 of the vehicle 108 about the proximity of the vehicle 108 to other objects, such as other vehicles 108 traveling near the user 110. The proximity sensor 702 may detect proximity information using a variety of techniques, such as visual evaluation of camera data; ranging data gathered by sonar, radar, and/or lidar detection; and/or electronic communication with other vehicles 108 on the road. In this example scenario 700, the vehicle 108 is equipped with a proximity sensor 702 that detects a proximity of the vehicle 108 with respect to other vehicles 108 operating on the road, such as a distance 704 between the vehicle 108 and another vehicle 108 that is ahead of and/or behind the vehicle 108 of the user 110; the relative speeds of the vehicles 108 ahead of and/or behind the user 110; and/or the rates of acceleration, braking, turning, and/or swerving by the user 110 and the drivers of the other vehicles 108. The proximity sensor 702 may also detect information about vehicles 108 in other lanes of the road, such as the relative or absolute speeds of vehicles 108 in adjacent lanes, and/or whether or not such vehicles 108 are passing 706 and/or are being passed by the vehicle 108 of the user 110. The vehicle device 202 may utilize such proximity measurements to determine the driving behavior 210 and/or risk rating 212 of the user 110, and/or may transmit 708 the information detected by the proximity sensor 702 to a driving behavior evaluation service as a further driving factor 114. Many such sources of information may be received and utilized by a vehicle device 202 in order to provide a driving profile 208 of the user 110 in accordance with the techniques presented herein.

**[0056] E3. Evaluating Risk Ratings**

**[0057]** A third aspect that may vary among embodiments of the techniques presented herein involves the manner of evaluating the risk rating 212 of an user 110 according to the driving behaviors 210 and driving factors 114.

**[0058]** As a first variation of this third aspect, the risk rating 212 of the user 110 may be determined by comparing the driving factors 114 with standardized driving factors, such as comparing an average driving speed of

the user 110 with posted speed limits, or comparing an average braking rate of the user 110 with an established safe braking rate. Such comparisons may also be considered in general, *e.g.*, an average across all driving contexts 104 or in driving contexts 104 that are deemed to be ordinary, and/or in view of a specific driving context 104, *e.g.*, the average braking rate of the user 110 in rainy weather.

**[0059]** As a second variation of this third aspect, the risk rating 212 of the user 110 may be identified by comparing the driving behavior 210 of the user 110 with a second driving behavior of at least one other user 110, such as an average user who is a similar age and/or has a similar amount of driving experience as the user 110. For example, for a user 110 who is comparatively inexperienced, a comparison of the driving behavior 210 of the user 110 in comparison with drivers who have many years of experience may unfairly penalize the user 110, and may even prevent the user 110 from securing driving insurance in order to acquire more experience and to become a safer driver. Instead, the driving behavior 210 of the user 110 may be compared with other comparatively inexperienced drivers, and may therefore assign to the user 110 a risk rating 212 that is relative to other drivers of approximately the same level of experience.

**[0060]** As a third variation of this third aspect, the risk rating 212 of the user 110 may be identified by comparing the driving behavior with an earlier driving behavior 210 of the same user 110. Such comparison may indicate, *e.g.*, an improvement of the driving behavior 210 of the user 110 as compared with the earlier driving behavior 210 of the user 110, evidencing a commitment to improved driving capabilities. Conversely, if the user 110 exhibits worse driving behavior 210 as compared with an earlier driving behavior 210 of the user 110, a significant penalty in the risk rating 212 of the user 110 maybe applied, *e.g.*, in order to prompt an investigation of the reason for the reduction in driving skill. For example, the eyesight, reaction time, and/or cognitive capabilities of the user 110 may be deteriorating, and such changes may indicate a significantly greater risk not only from the physical changes, but from the need for the user 110 to adapt to such

changes; *e.g.*, the user 110 may refuse to acknowledge or accept a loss of driving proficiency and may overestimate his or her driving skill.

**[0061]** As a fourth variation of this third aspect, the selection of a risk rating 212 for a user 110 may also be based upon a user driving history of the user 110. As a first such example, even if the user driving behavior 210 indicates that the user 110 is typically a cautious driver, a user driving history indicating a significant number of accidents or speeding tickets may entail the assignment of a higher-risk rating 212. Conversely, even if the user driving behavior 210 indicates that the user 110 is typically an aggressive driver, a user driving history indicating an absence of accidents or speeding tickets over an extended duration may indicate that the user 110 may also be a focused driver, and therefore suggest the selection of a lower-risk rating 212. Other sources of information that may inform the selection of a risk rating 212 include, *e.g.*, actuarial tables indicating various risk factors that may or may not describe the user 110 and the risks of driving.

**[0062]** As a fifth variation of this third aspect, in addition to assigning a risk rating 212 to the user 110, a vehicle device 202 may reveal the risk rating 212 to the user 110. The vehicle device 202 may also explain to the use the basis for the risk rating 212, *e.g.*, the driving factors 114 that resulted in a conclusion of a particular driving behavior 210 for the user 110 (*e.g.*, an assessment that the user 110 is a safe driver, an aggressive driver, or an overcautious driver). Moreover, the vehicle device 202 may present to the user 110 at least one suggestion for an adjustment of the driving behavior 210 that is likely to improve the risk rating 212 of the driving behavior 210 of the user 110. For example, the vehicle device 202 may indicate to the user 110 that a 5% reduction in average speed, particularly in some driving contexts 104 such as rainy weather, may significantly reduce the risk rating 212 of the user 110.

**[0063]** Fig. 8 is an illustration of an example scenario 800 featuring a sixth variation of this third aspect, wherein the risk rating 212 of the user 110 is assigned using an artificial neural network 806 that has been trained to identify a risk rating 212 based upon a number of sources of information. In this example scenario 800, the artificial neural network 806 may have been

trained, *e.g.*, by providing to the artificial neural network 806 an extensive list of information about a prototypical set of individuals and an appropriate risk rating 212 to be assigned to each such individual. Once trained to assign such risk ratings 212 within an acceptable margin of error, the artificial neural network 806 may then be applied to assign a risk rating 212 to the user 110 based on a set of varied information, such as the driving behaviors 210 of the user 110; the driving contexts 104 in which the user 110 chooses to operate the vehicle; a user driving history 802 of the user 110; and actuarial tables 804 that indicate the significance of various individual personality traits, such as health history, to the risk rating 212 of the user 110. The artificial neural network 806 may accurately assign a risk rating 212 to the user 110 that reflects the significance of each source of information about the user 110 and the relative significance of such traits. Other classification techniques that may be suitable for such assignment include, *e.g.*, genetic algorithms and statistical classifiers, such as Bayesian classification systems. Many ways may be devised to select a risk rating 212 for the user 110 based on the driving behavior 210 and other sources of information in accordance with the techniques presented herein.

**[0064] E4. Uses of Driving Profile**

**[0065]** A fourth aspect that may vary among embodiments of the techniques presented herein involves the uses of the driving profile 208 of the user 110.

**[0066]** As a first variation of this fourth aspect, the driving profile 208 may be presented to the user 110 as a reflection or independent assessment of the driving behavior 210 and risk rating 212 of the user 110. For example, the user 110 may not be aware of a perception of the user's driving behavior 210 as compared with other drivers or a driving standard (*e.g.*, the user 110 may not be aware that others may perceive the user 110 as an aggressive or overcautious driver), and may appreciate an objective assessment of the driving behavior 210. Moreover the user 110 may appreciate an identification of driving behaviors 210 that may be particularly risky or unusual, such as a

tendency to brake unnecessarily hard, and may wish to learn about such driving behaviors 210 in order to ameliorate them and reduce the risk rating 212 of the user 110.

**[0067]** As a second variation of this fourth aspect, the driving profile 208 may be used to adapt the operating properties of a vehicle 108 of the user 110. As a first such example, the user 110 may exhibit a slow response time to braking of vehicles ahead of the user 110, and the braking systems and alert mechanisms of the vehicle 108 may be adjusted to provide greater sensitivity to detecting and warning the user 110 of such circumstances and/or automatically engaging the brakes when such circumstances arise. As a second such example, the user 110 may utilize a driving feature of the vehicle 108, such as cruise control, that may be personalized to reflect the driving behavior 210 of the user 110 (*e.g.*, setting the cruise control to a faster or slower speed based upon whether the user 110 exhibits a preference for fast or slow driving).

**[0068]** Fig. 9 presents a set of examples of a third variation of this fourth aspect, wherein the driving profile 208 may be utilized to connect the user 110 with an insurer 904 who may provide vehicle insurance for the user 110 and the vehicle 108. In this example scenario 900, the user 110 may utilize a profile service 902 to generate the driving profile 208, such as a cloud-based service that remotely monitors the driving factors 114 and identifies driving behaviors 210 of the user 110 and a risk rating 212 based thereupon. In addition, the profile service 902 may interact with a variety of insurers 904 to select an insurance plan that is compatible with the driving behavior 210 and risk rating 212 of the user 110.

**[0069]** As a first such example 922, the user 110 may request a recommendation of an insurer 904, and may provide a driving profile 208 for the user 110 and/or utilize the profile service 902 to generate a driving profile 208 for the user 110. The profile service 902 may compare at least two insurance plans 906 respectively offered by a candidate insurer 904, *e.g.*, by comparing the contents of the driving profile 208 of the user 110 with the candidate insurers 904 to identify a cost-effective and appropriate vehicle insurance plan 906. Such comparison may involve, *e.g.*, a comparison of the

insurance rates of the respective insurance plans 906 to identify a selected insurer 904 that is offering an insurance rate that is lower than the insurance rate of at least one other candidate insurer 904. Such comparison may also involve, *e.g.*, a comparison of user ratings of the at least two candidate insurers 904 (*e.g.*, information such as user satisfaction rates, customer service surveys, customer retention rates, and/or a volume of customer complaints) to identify a selected insurer 904 that achieves a higher user rating than at least one other candidate insurer 904. Such comparison may also involve, *e.g.*, a comparison of insurance coverage of the at least two candidate insurers 904 to identify a selected insurer 904 that is offering broader insurance coverage than at least one other candidate insurer 904. Upon evaluating such candidate insurers 904, the profile service 902 may identify a selected insurer 904 and present a recommendation 908 of the selected insurer 904 to the user 110. A similar process may be utilized to compare multiple insurance plans 906 offered by the same insurer 904 (*e.g.*, comparing the cost-effectiveness of a maximum coverage insurance plan, a typical coverage insurance plan, and a minimum coverage insurance plan offered by the same insurer 904), optionally in view of preferences of the user 110 such as cost sensitivity and/or risk aversion, to identify and recommend to the user 110 a selected insurance plan that is suitable for the risk rating 212 of the user 110.

**[0070]** As a second such example 924, the profile service 902 may share portions of the driving profile 208 of the user 110 with one or more insurers 904, under circumstances for which the user 110 is fully informed, consents to such sharing while declining an option to refuse such sharing, and derives an advantage from such sharing. For example, the profile service 902 may initiate a bidding process on behalf of the user 110 among a set of candidate insurers 904, based on a desirably low risk rating 212 and/or clean driving history of the user 110. In doing so, the profile service 902 may first inform the user 110 of this process, and await consent 914 from the user 110 before transmitting a portion of the driving profile 208 to the candidate insurers 904. In this context, the profile service 902 may first anonymize the driving profile 208, *e.g.*, by invoking an anonymizer that, before delivering the driving profile

to an insurer, removes any and all personal identifying information from the driving profile 208. An anonymized driving profile 910 may then be shared with the candidate insurers 904 to solicit bids for insurance plans 906 to be compared and presented to the user 110. The anonymized driving profile 910 may attest to the user's risk rating 212 and driving history, in a manner that allows candidate insurers 904 to evaluate their interest in providing a competitive insurance plan 906 to the user 110, without revealing personal identifying information. Additionally, upon receiving from an insurer 904 a notification that the user 110 has contracted with the insurer 904 (*e.g.*, an acceptance by the user 110 of an offer for an insurance plan 906), the profile service 902 may again contact the user 110 to request the release of the full driving profile 918 of the user 110 to the insurer 904, and, upon receiving such consent 914 from the user 110, may transmit the full driving profile 918 to the insurer 904 with whom the user 110 has formulated a contract for insurance coverage.

**[0071]** As a third such example 926, the profile service 902 may enable an interaction between the user 110 and the insurer 904 to improve the user's risk rating 212. For example, the profile service 902 may determine that a particular driving behavior 210 of the user 110 is significantly reducing the risk rating 212 of the user 110 and prompting higher insurance rates. The profile service 902 may secure from the insurer 904 an offer to reduce the user's insurance rates if the user 110 ameliorates the risk-inducing driving behavior 210, *e.g.*, an agreement to reduce the user's insurance rates by a specified amount if the user 110 demonstrates a marginal reduction in average driving speed. The profile service 902 may invoke a driving behavior suggester that presents to the user 110 a suggested adjustment of the driving behavior 210 that reduces the risk rating 212 of the user 110, and a projected insurance rate savings through the insurer 904 that arises from user adoption of the suggested adjustment of the driving behavior 210. Moreover, the profile service 902 may communicate with the vehicle device 202 of the vehicle 108, and upon detecting an adoption of the suggested adjustment by the user 110, may transmit a notification 920 to the insurer 904 of the adoption of the suggested adjustment, thereby prompting the insurer 904 to fulfill the offer for

an insurance rate reduction for the user 110. In this manner, the profile service 902 may facilitate a positive engagement between the insurer 904 and the user 110. Many such uses of the driving profile 208 may be devised in accordance with the techniques presented herein.

**[0072] F. Computing Environment**

**[0073]** Fig. 10 and the following discussion provide a brief, general description of a suitable computing environment to implement embodiments of one or more of the provisions set forth herein. The operating environment of Fig. 10 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 operating environment. Example computing devices include, but are not limited to, personal computers, server computers, hand-held or laptop devices, mobile devices (such as mobile phones, Personal Digital Assistants (PDAs), media players, and the like), multiprocessor systems, consumer electronics, mini computers, mainframe computers, distributed computing environments that include any of the above systems or devices, and the like.

**[0074]** Although not required, embodiments are described in the general context of "computer readable instructions" being executed by one or more computing devices. Computer readable instructions may be distributed via computer readable media (discussed below). Computer readable instructions may be implemented as program modules, such as functions, objects, Application Programming Interfaces (APIs), data structures, and the like, that perform particular tasks or implement particular abstract data types. Typically, the functionality of the computer readable instructions may be combined or distributed as desired in various environments.

**[0075]** Fig. 10 illustrates an example of a system 1000 comprising a computing device 1002 configured to implement one or more embodiments provided herein. In one configuration, computing device 1002 includes at least one processing unit 1006 and memory 1008. Depending on the exact configuration and type of computing device, memory 1008 may be volatile (such as RAM, for example), non-volatile (such as ROM, flash memory, etc.,

for example) or some combination of the two. This configuration is illustrated in Fig. 10 by dashed line 1004.

**[0076]** In other embodiments, device 1002 may include additional features and/or functionality. For example, device 1002 may also include additional storage (e.g., removable and/or non-removable) including, but not limited to, magnetic storage, optical storage, and the like. Such additional storage is illustrated in Fig. 10 by storage 1010. In one embodiment, computer readable instructions to implement one or more embodiments provided herein may be in storage 1010. Storage 1010 may also store other computer readable instructions to implement an operating system, an application program, and the like. Computer readable instructions may be loaded in memory 1008 for execution by processing unit 1006, for example.

**[0077]** The term "computer readable media" as used herein includes computer storage media. Computer storage media includes volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information such as computer readable instructions or other data. Memory 1008 and storage 1010 are examples of computer storage media. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, Digital Versatile Disks (DVDs) or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by device 1002. Any such computer storage media may be part of device 1002.

**[0078]** Device 1002 may also include communication connection(s) 1016 that allows device 1002 to communicate with other devices. Communication connection(s) 1016 may include, but is not limited to, a modem, a Network Interface Card (NIC), an integrated network interface, a radio frequency transmitter/receiver, an infrared port, a USB connection, or other interfaces for connecting computing device 1002 to other computing devices. Communication connection(s) 1016 may include a wired connection or a wireless connection. Communication connection(s) 1016 may transmit and/or receive communication media.

**[0079]** The term "computer readable media" may include communication media. Communication media typically embodies computer readable instructions or other data in a "modulated data signal" such as a carrier wave or other transport mechanism and includes any information delivery media. The term "modulated data signal" may include a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal.

**[0080]** Device 1002 may include input device(s) 1014 such as keyboard, mouse, pen, voice input device, touch input device, infrared cameras, video input devices, and/or any other input device. Output device(s) 1012 such as one or more displays, speakers, printers, and/or any other output device may also be included in device 1002. Input device(s) 1014 and output device(s) 1012 may be connected to device 1002 via a wired connection, wireless connection, or any combination thereof. In one embodiment, an input device or an output device from another computing device may be used as input device(s) 1014 or output device(s) 1012 for computing device 1002.

**[0081]** Components of computing device 1002 may be connected by various interconnects, such as a bus. Such interconnects may include a Peripheral Component Interconnect (PCI), such as PCI Express, a Universal Serial Bus (USB), firewire (IEEE 1394), an optical bus structure, and the like. In another embodiment, components of computing device 1002 may be interconnected by a network. For example, memory 1008 may be comprised of multiple physical memory units located in different physical locations interconnected by a network.

**[0082]** Those skilled in the art will realize that storage devices utilized to store computer readable instructions may be distributed across a network. For example, a computing device 1020 accessible via network 1018 may store computer readable instructions to implement one or more embodiments provided herein. Computing device 1002 may access computing device 1020 and download a part or all of the computer readable instructions for execution. Alternatively, computing device 1002 may download pieces of the computer readable instructions, as needed, or some instructions may be executed at computing device 1002 and some at computing device 1020.

**[0083] G. Usage of Terms**

**[0084]** Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

**[0085]** As used in this application, the terms "component," "module," "system", "interface", and the like are generally intended to refer to a computer-related entity, either hardware, a combination of hardware and software, software, or software in execution. For example, a component may be, but is not limited to being, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration, both an application running on a controller and the controller can be a component. One or more components may reside within a process and/or thread of execution and a component may be localized on one computer and/or distributed between two or more computers.

**[0086]** Furthermore, the claimed subject matter may be implemented as a method, apparatus, or article of manufacture using standard programming and/or engineering techniques to produce software, firmware, hardware, or any combination thereof to control a computer to implement the disclosed subject matter. The term "article of manufacture" as used herein is intended to encompass a computer program accessible from any computer-readable device, carrier, or media. Of course, those skilled in the art will recognize many modifications may be made to this configuration without departing from the scope or spirit of the claimed subject matter.

**[0087]** Various operations of embodiments are provided herein. In one embodiment, one or more of the operations described may constitute computer readable instructions stored on one or more computer readable media, which if executed by a computing device, will cause the computing device to perform the operations described. The order in which some or all of the operations are described should not be construed as to imply that these

operations are necessarily order dependent. Alternative ordering will be appreciated by one skilled in the art having the benefit of this description. Further, it will be understood that not all operations are necessarily present in each embodiment provided herein.

**[0088]** Moreover, the word "example" is used herein to mean serving as an example, instance, or illustration. Any aspect or design described herein as "example" is not necessarily to be construed as advantageous over other aspects or designs. Rather, use of the word example is intended to present concepts in a concrete fashion. As used in this application, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or". That is, unless specified otherwise, or clear from context, "X employs A or B" is intended to mean any of the natural inclusive permutations. That is, if X employs A; X employs B; or X employs both A and B, then "X employs A or B" is satisfied under any of the foregoing instances. In addition, the articles "a" and "an" as used in this application and the appended claims may generally be construed to mean "one or more" unless specified otherwise or clear from context to be directed to a singular form.

**[0089]** Also, although the disclosure has been shown and described with respect to one or more implementations, equivalent alterations and modifications will occur to others skilled in the art based upon a reading and understanding of this specification and the annexed drawings. The disclosure includes all such modifications and alterations and is limited only by the scope of the following claims. In particular regard to the various functions performed by the above described components (e.g., elements, resources, etc.), the terms used to describe such components are intended to correspond, unless otherwise indicated, to any component which performs the specified function of the described component (*e.g.*, that is functionally equivalent), even though not structurally equivalent to the disclosed structure which performs the function in the herein illustrated example implementations of the disclosure. In addition, while a particular feature of the disclosure may have been disclosed with respect to only one of several implementations, such feature may be combined with one or more other features of the other implementations as may be desired and advantageous for any given or particular application.

Furthermore, to the extent that the terms "includes", "having", "has", "with", or variants thereof are used in either the detailed description or the claims, such terms are intended to be inclusive in a manner similar to the term "comprising."

What is claimed is:

1. A method of providing an evidentiary record of a driving behavior of a user of a vehicle, the method involving a device having a processor and a cryptographic key and comprising:

executing, by the processor, instructions that cause the device to:

while the user operates the vehicle, detect at least one driving factor;

evaluate the at least one driving factor to identify:

a driving behavior of the user, and

a risk rating of the driving behavior;

generate a driving profile providing evidence of the risk rating and the driving behavior of the user;

using the cryptographic key, sign the driving profile of the user; and

transmit the driving profile signed with the cryptographic key to the user.

2. The method of claim 1, wherein detecting the at least one driving factor further comprises: receiving, from the vehicle, at least one telemetric measurement of the vehicle during operation by the user.

3. The method of claim 1, wherein:

the vehicle comprise a proximity sensor; and

detecting the at least one driving factor further comprises: receiving, from the vehicle, a proximity measurement of a proximity of the vehicle to a second vehicle during operation by the user.

4. The method of claim 1, wherein detecting the at least one driving factor further comprises: identifying, for an area of the vehicle, a weather factor that affects operation of the vehicle by the user.

5. The method of claim 1, wherein executing the instructions further causes the device to present to the user at least one suggestion for an adjustment of the driving behavior that improves the risk rating of the driving behavior of the user.

6. A server that provides an evidentiary record of a driving behavior of a user, the server comprising:

a processor;

a cryptographic key; and

a memory storing instructions that, when executed by the processor, provide a system comprising:

a driving behavior evaluator that:

receives at least one driving factor detected while the user operates the vehicle; and

evaluates the at least one driving factor to identify:

a driving behavior of the user, and

a risk rating of the driving behavior; and

a driving profile generator that:

generates a driving profile providing evidence of the risk rating and the driving behavior of the user;

using the cryptographic key, signs the driving profile of the user; and

transmits the driving profile signed with the cryptographic key to the user.

7. The server of claim 6, wherein the system further comprises: an insurer connector that connects the user with an insurer providing vehicle insurance that is compatible with the risk rating of the user.

8. The server of claim 7, wherein the insurer connector connects the user with the insurer by:

among at least two candidate insurers, comparing an insurance rate of the at least two candidate insurers; and

connecting the user with a selected insurer offering an insurance rate that is lower than the insurance rate of at least one other candidate insurer.

9. The server of claim 7, wherein the insurer connector connects the user with the insurer by:

among at least two candidate insurers, comparing user ratings of the at least two candidate insurers; and

connecting the user with a selected insurer that is associated with a user rating that is higher than the user rating of at least one other candidate insurer.

10. The server of claim 7, wherein the insurer connector connects the user with the insurer by:

among at least two candidate insurers, comparing an insurance coverage of the at least two candidate insurers; and

connecting the user with a selected insurer offering insurance coverage that is broader than the insurance coverage of at least one other candidate insurer.

11. The server of claim 7, wherein:

the insurer offers at least two insurance plans; and

wherein the insurer connector connects the user with the insurer by:

comparing the at least two insurance plans offered by the insurer to identify a selected insurance plan that is suitable for the risk rating of the user; and

recommending the selected insurance plan to the user.

12. The server of claim 7, wherein the system further comprises: a driving behavior suggester that presents to the user:

a suggested adjustment of the driving behavior that reduces the risk rating of the user; and

a projected insurance rate savings through the insurer arising from the suggested adjustment of the driving behavior.

13. The server of claim 7, wherein the insurer connector, upon detecting an adoption of the suggested adjustment of the driving behavior by the user, notifies the insurer of the adoption of the suggested adjustment.

14. The server of claim 15, wherein the insurer connector further comprises: a user profile transmitter that, upon receiving consent from the user to transmit the driving profile to the insurer, transmits the driving profile to the insurer.

15. The server of claim 14, wherein the user profile transmitter further comprises: an anonymizer that, before delivering the driving profile to an insurer, removes personal identifying information from the driving profile.

16. The server of claim 15, wherein the anonymizer further discloses the personal identifying information to the insurer only upon receiving a notification that the user has contracted with the insurer.

17. A vehicle device of a vehicle that provides an evidentiary record of a driving behavior of a user, the device comprising:

a processor;

a cryptographic key;

a telemetric interface that, while the user operates the vehicle, receivers at least one driving factor from the vehicle; and

a memory storing instructions that, when executed by the processor, provide a system comprising:

a driving behavior evaluator that evaluates the at least one driving factor to identify:

a driving behavior of the user, and

a risk rating of the driving behavior; and

a driving profile generator that:

generates a driving profile providing evidence of the risk rating and the driving behavior of the user;

using the cryptographic key, signs the driving profile of the user; and

transmits the driving profile signed with the cryptographic key to the user.

18. The vehicle device of claim 17, wherein the driving behavior evaluator identifies the driving behavior and the risk rating by: evaluating a driving context in which the user operates the vehicle that relates to the driving behavior and the risk rating of the user.

19. The vehicle device of claim 17, wherein the driving behavior evaluator identifies the driving behavior and the risk rating by:

comparing the driving behavior of the user with a second driving behavior of at least one other user; and

identifying the driving behavior of the user relative to the second driving behavior of the at least one other user.

20. The vehicle device of claim 17, wherein the driving behavior evaluator identifies the driving behavior and the risk rating by:

comparing the driving behavior of the user with an earlier driving behavior of the user; and

identifying an improvement of the driving behavior of the user as compared with the earlier driving behavior of the user.

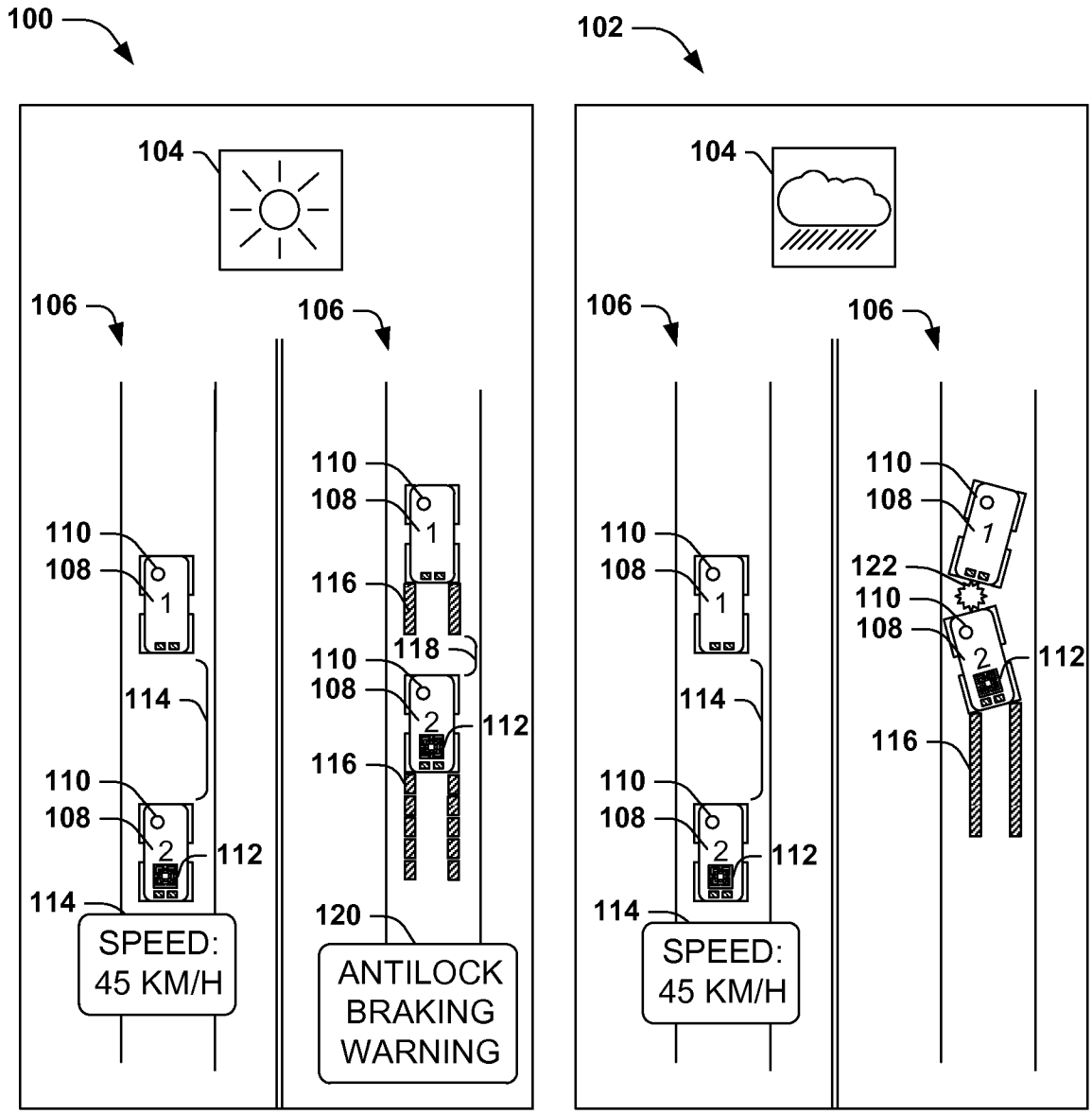
100
102
104
104
106
106
106
106
110
108
1
110
108
1
114
110
108
2
112
114
SPEED:
45 KM/H
110
108
1
116
118
110
108
2
112
116
120
ANTILOCK
BRAKING
WARNING
110
108
1
122
110
108
2
112
116
110
108
1
114
110
108
2
112
114
SPEED:
45 KM/H

FIG. 1

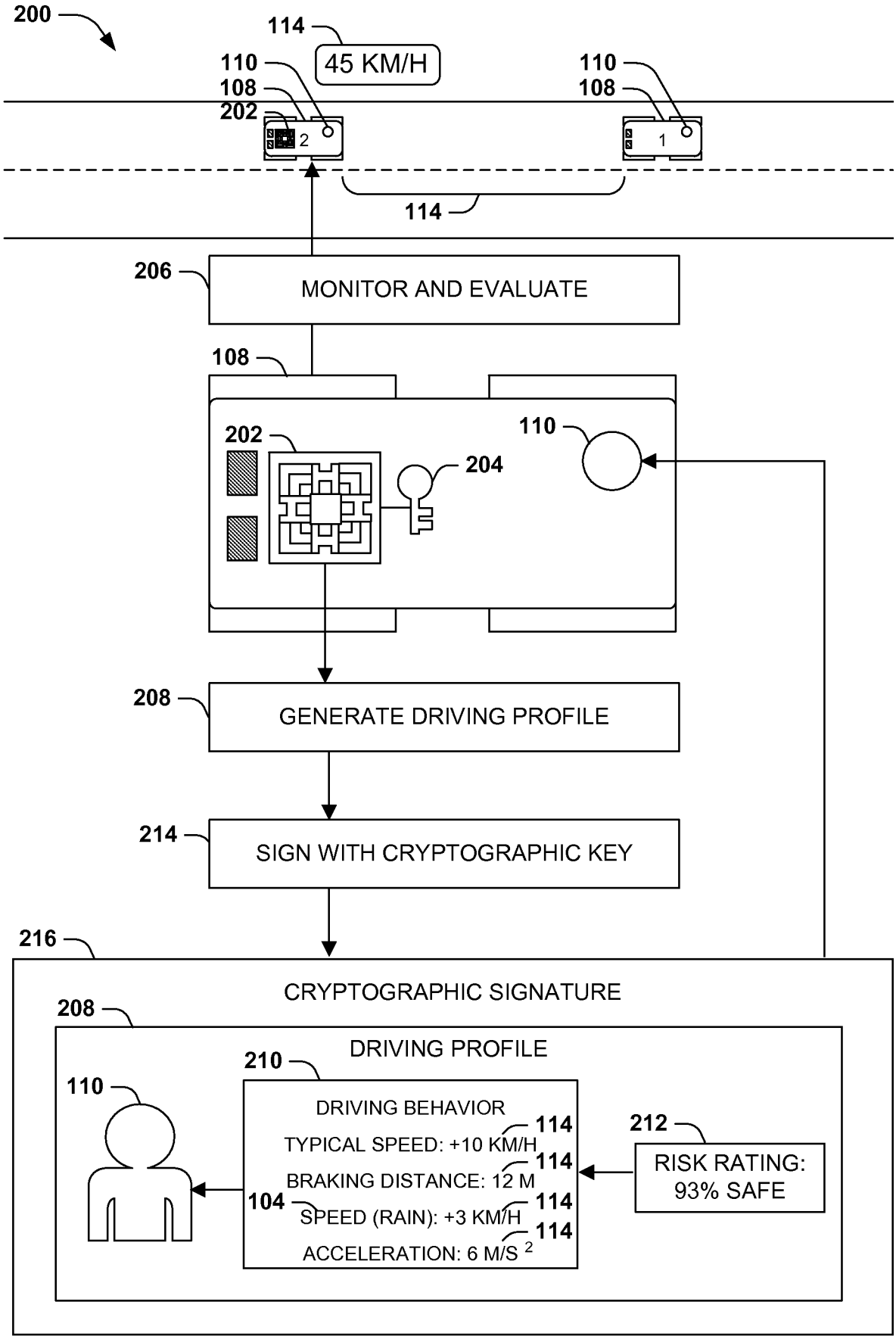
200
114
45 KM/H
110
108
202
2
110
108
1
114
206
MONITOR AND EVALUATE
108
202
204
110
208
GENERATE DRIVING PROFILE
214
SIGN WITH CRYPTOGRAPHIC KEY
216
CRYPTOGRAPHIC SIGNATURE
208
DRIVING PROFILE
210
110
DRIVING BEHAVIOR
TYPICAL SPEED: +10 KM/H
114
BRAKING DISTANCE: 12 M
114
104
SPEED (RAIN): +3 KM/H
114
ACCELERATION: 6 M/S 2
114
212
RISK RATING:
93% SAFE

FIG. 2

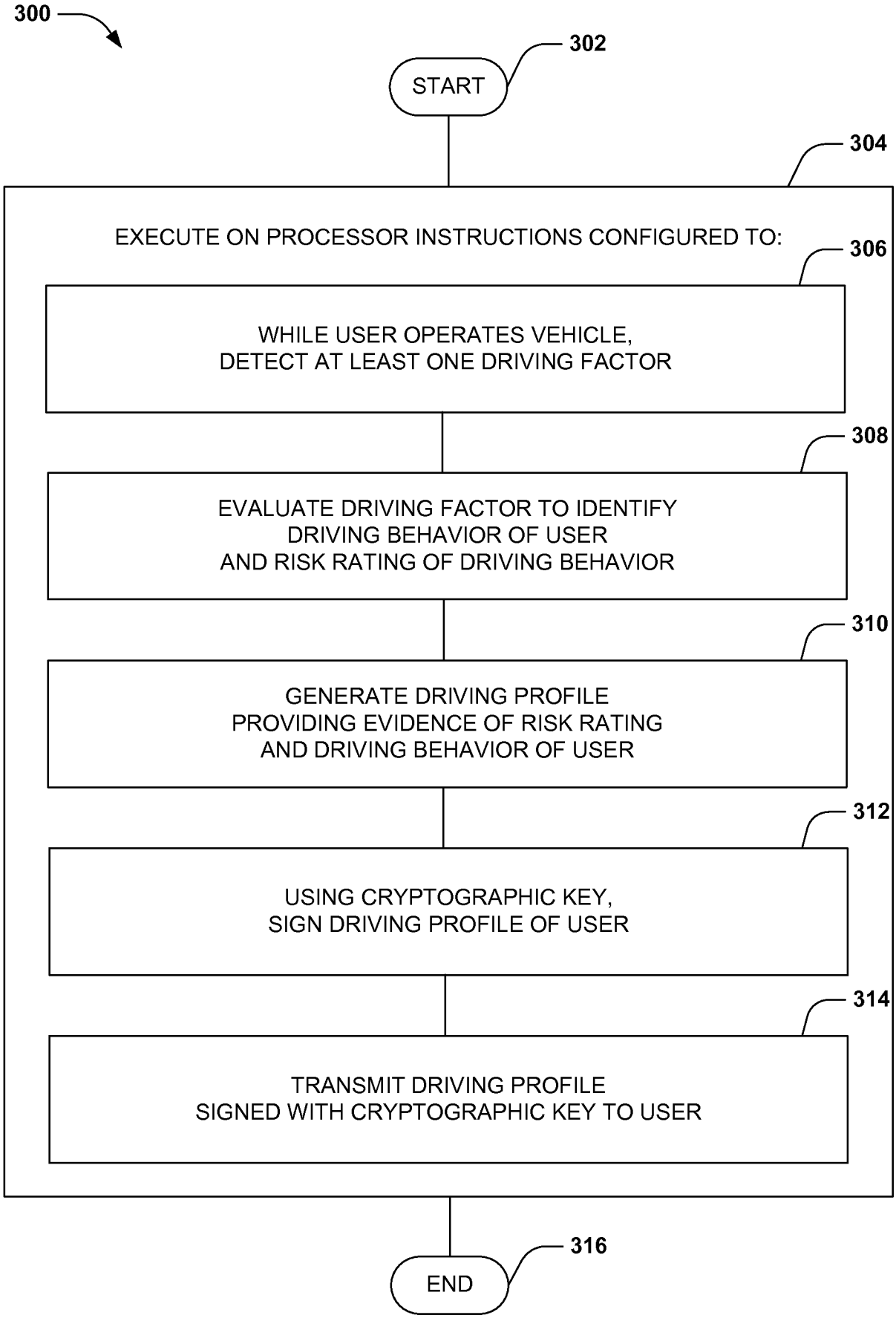
300
302
START
304
EXECUTE ON PROCESSOR INSTRUCTIONS CONFIGURED TO:
306
WHILE USER OPERATES VEHICLE,
DETECT AT LEAST ONE DRIVING FACTOR
308
EVALUATE DRIVING FACTOR TO IDENTIFY
DRIVING BEHAVIOR OF USER
AND RISK RATING OF DRIVING BEHAVIOR
310
GENERATE DRIVING PROFILE
PROVIDING EVIDENCE OF RISK RATING
AND DRIVING BEHAVIOR OF USER
312
USING CRYPTOGRAPHIC KEY,
SIGN DRIVING PROFILE OF USER
314
TRANSMIT DRIVING PROFILE
SIGNED WITH CRYPTOGRAPHIC KEY TO USER
316
END

FIG. 3

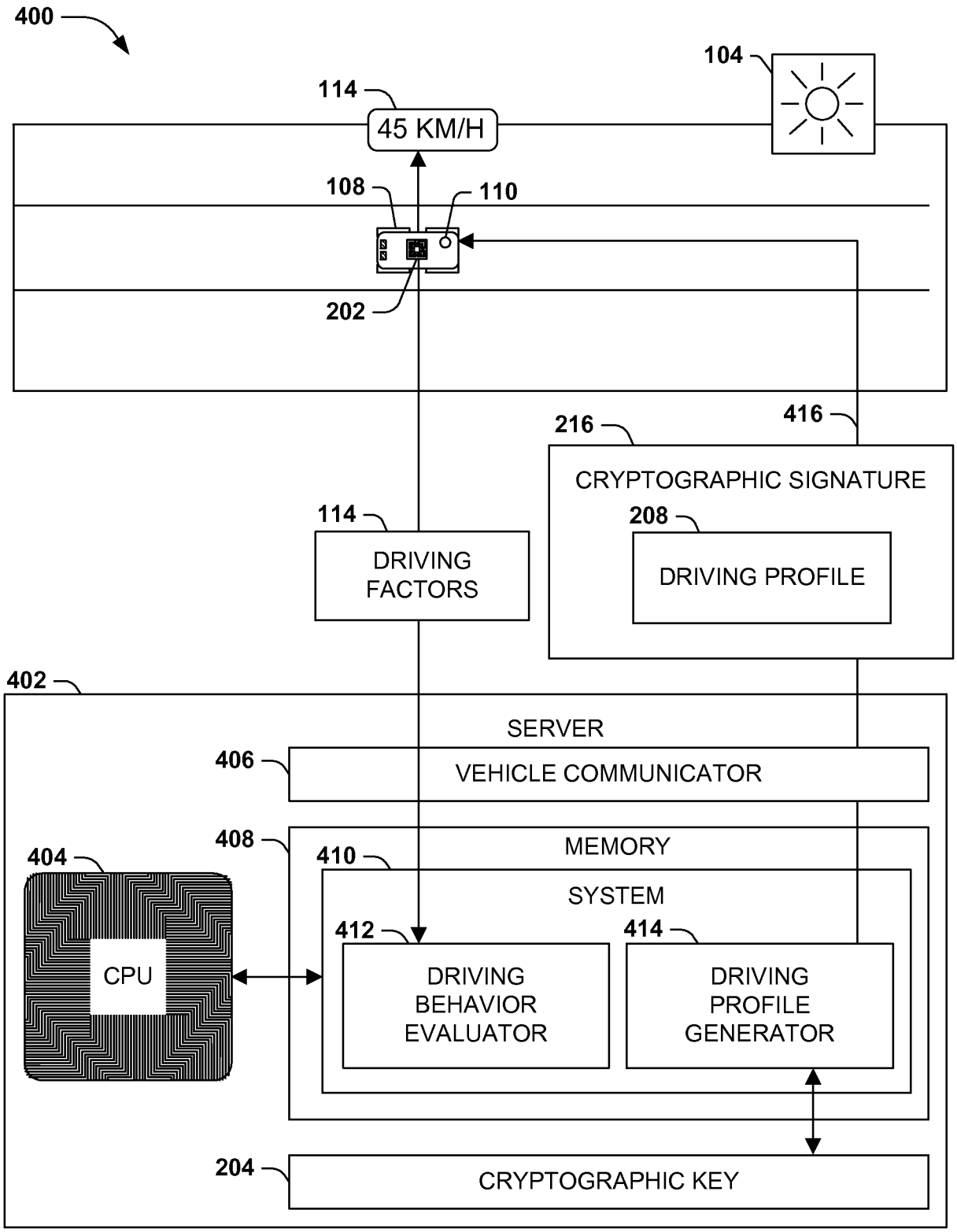
400
104
114
45 KM/H
108
110
202
216
416
CRYPTOGRAPHIC SIGNATURE
208
DRIVING PROFILE
114
DRIVING FACTORS
402
SERVER
406
VEHICLE COMMUNICATOR
408
MEMORY
410
SYSTEM
404
CPU
412
DRIVING BEHAVIOR EVALUATOR
414
DRIVING PROFILE GENERATOR
204
CRYPTOGRAPHIC KEY

FIG. 4

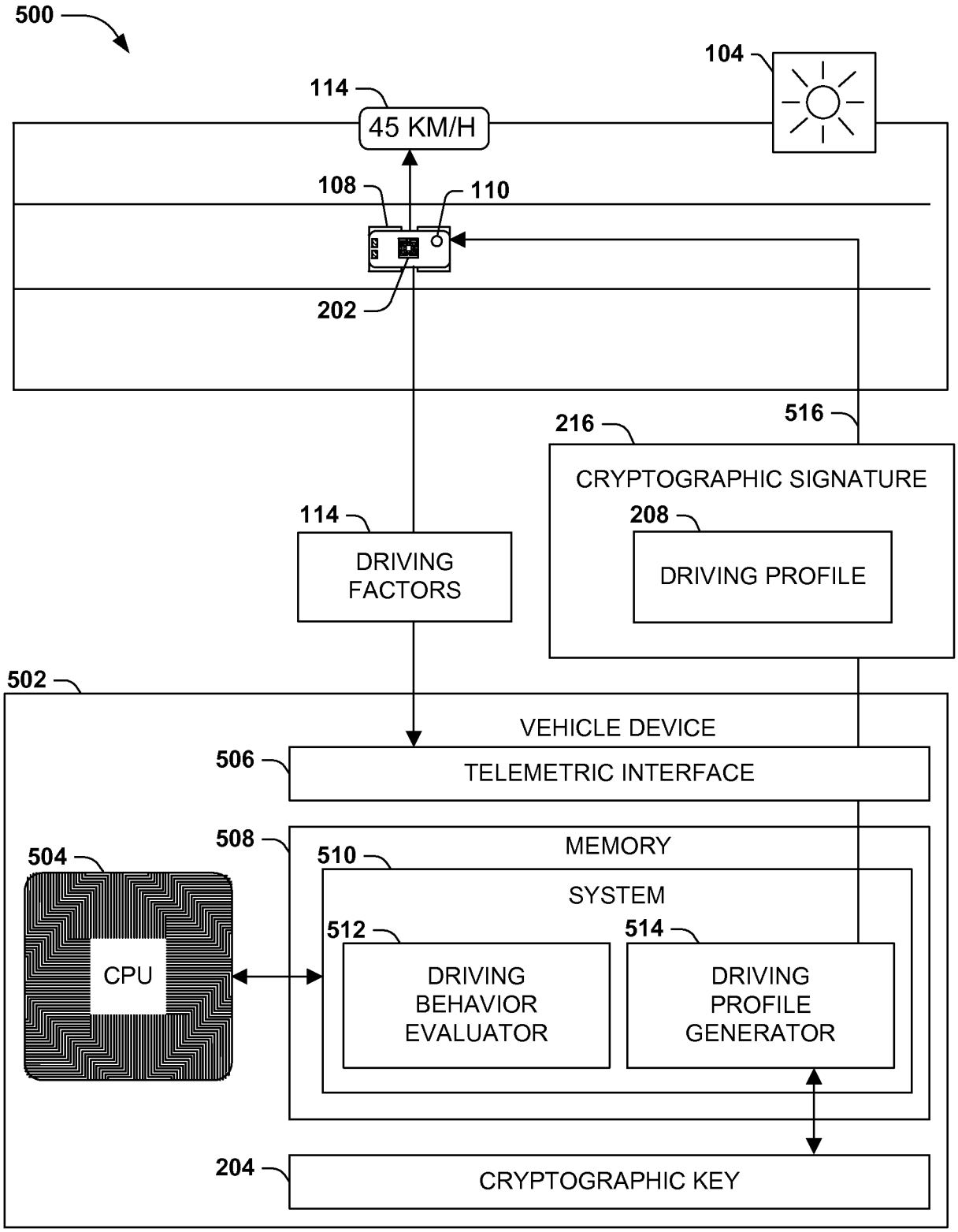
500
104
114
45 KM/H
108
110
202
216
516
CRYPTOGRAPHIC SIGNATURE
208
DRIVING PROFILE
114
DRIVING FACTORS
502
VEHICLE DEVICE
506
TELEMETRIC INTERFACE
508
MEMORY
504
510
SYSTEM
512
514
CPU
DRIVING BEHAVIOR EVALUATOR
DRIVING PROFILE GENERATOR
204
CRYPTOGRAPHIC KEY

FIG. 5

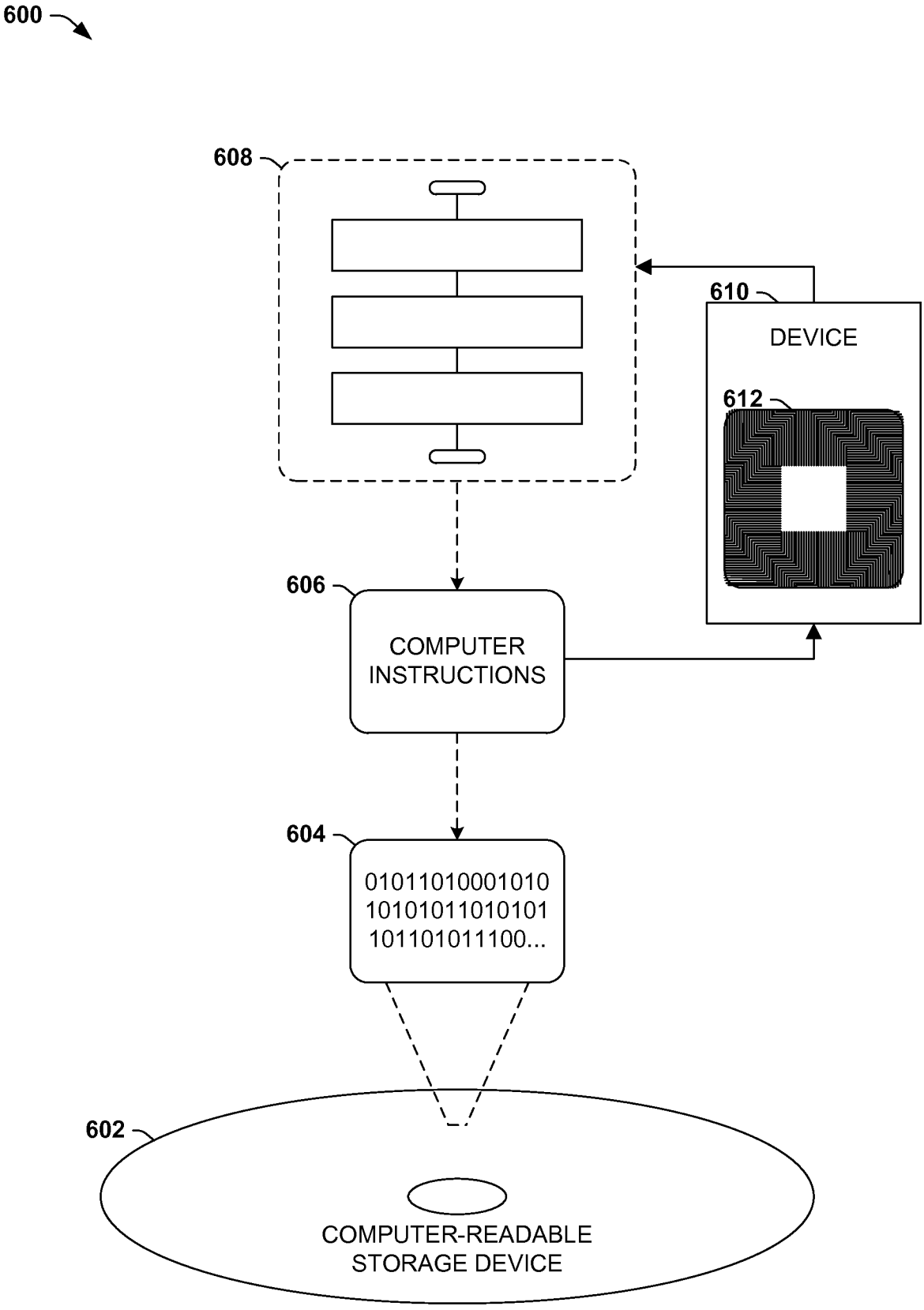
600
608
610
DEVICE
612
606
COMPUTER INSTRUCTIONS
604
01011010001010
10101011010101
101101011100...
602
COMPUTER-READABLE STORAGE DEVICE

FIG. 6

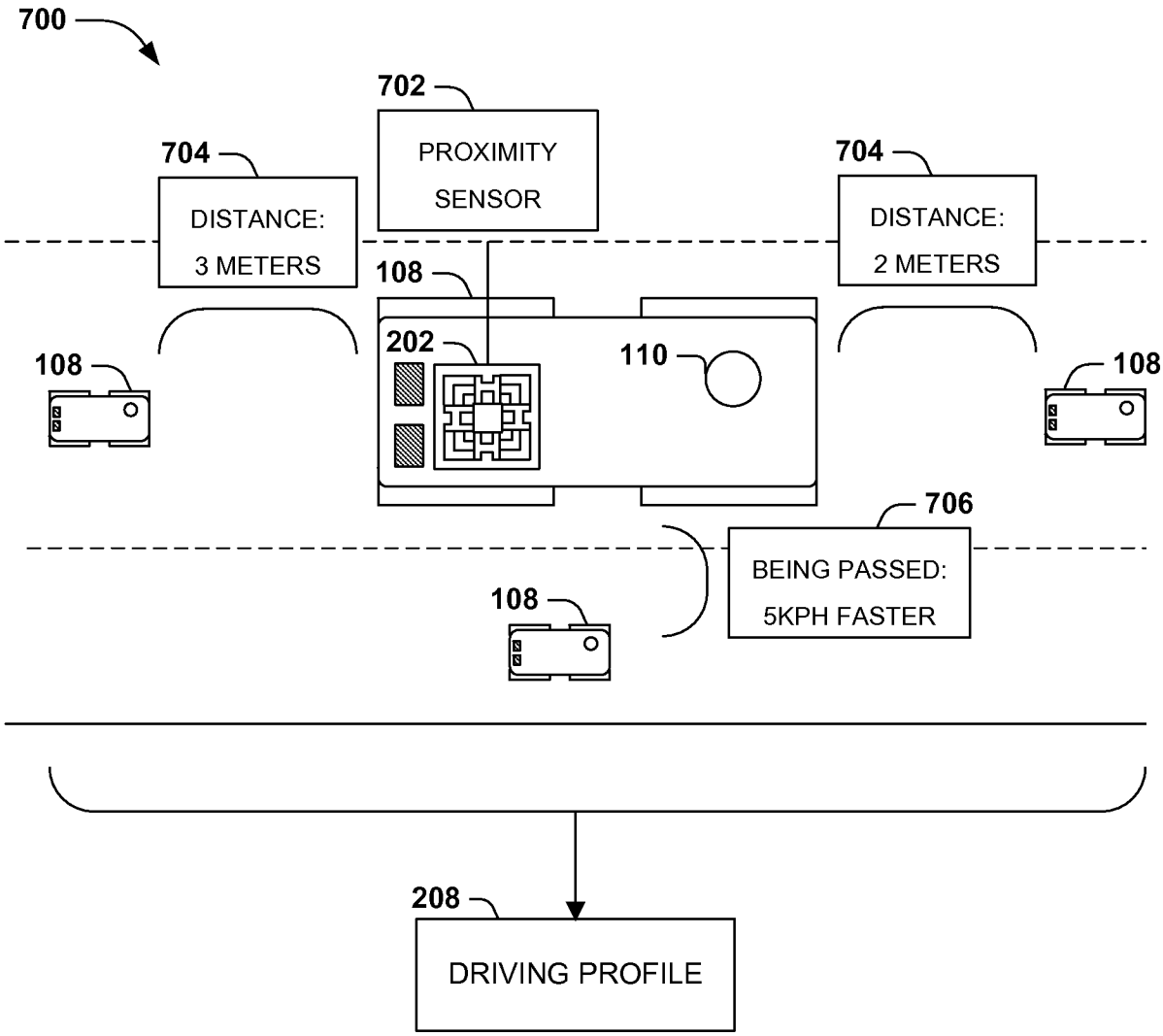
700
702
PROXIMITY SENSOR
704
DISTANCE: 3 METERS
704
DISTANCE: 2 METERS
108
202
110
108
108
706
BEING PASSED: 5KPH FASTER
108
208
DRIVING PROFILE

FIG. 7

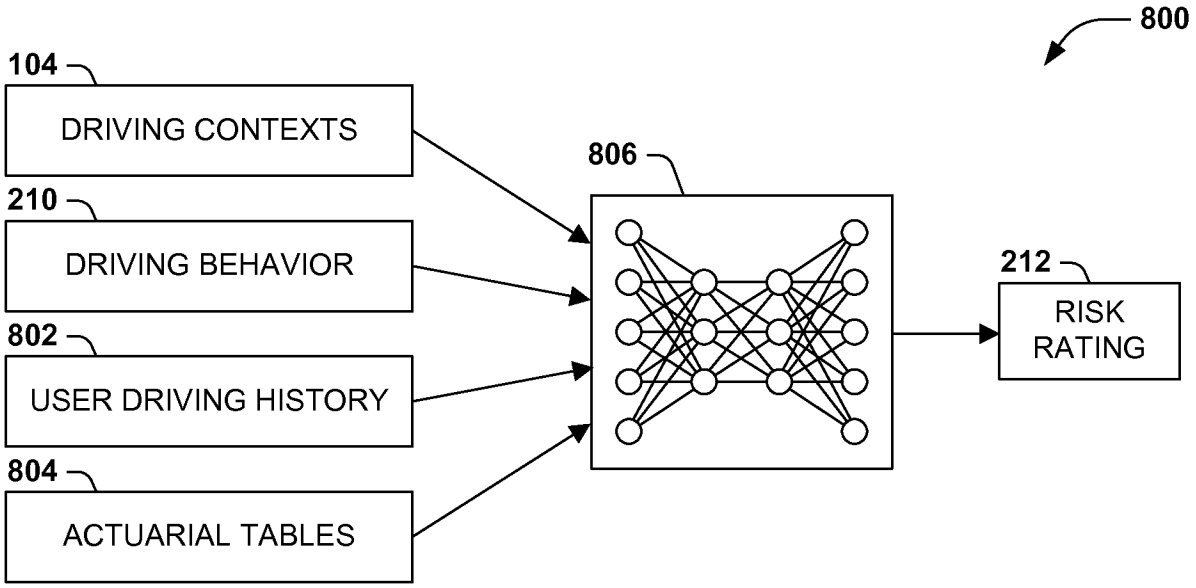
800
104
DRIVING CONTEXTS
210
DRIVING BEHAVIOR
802
USER DRIVING HISTORY
804
ACTUARIAL TABLES
806
212
RISK RATING

FIG. 8

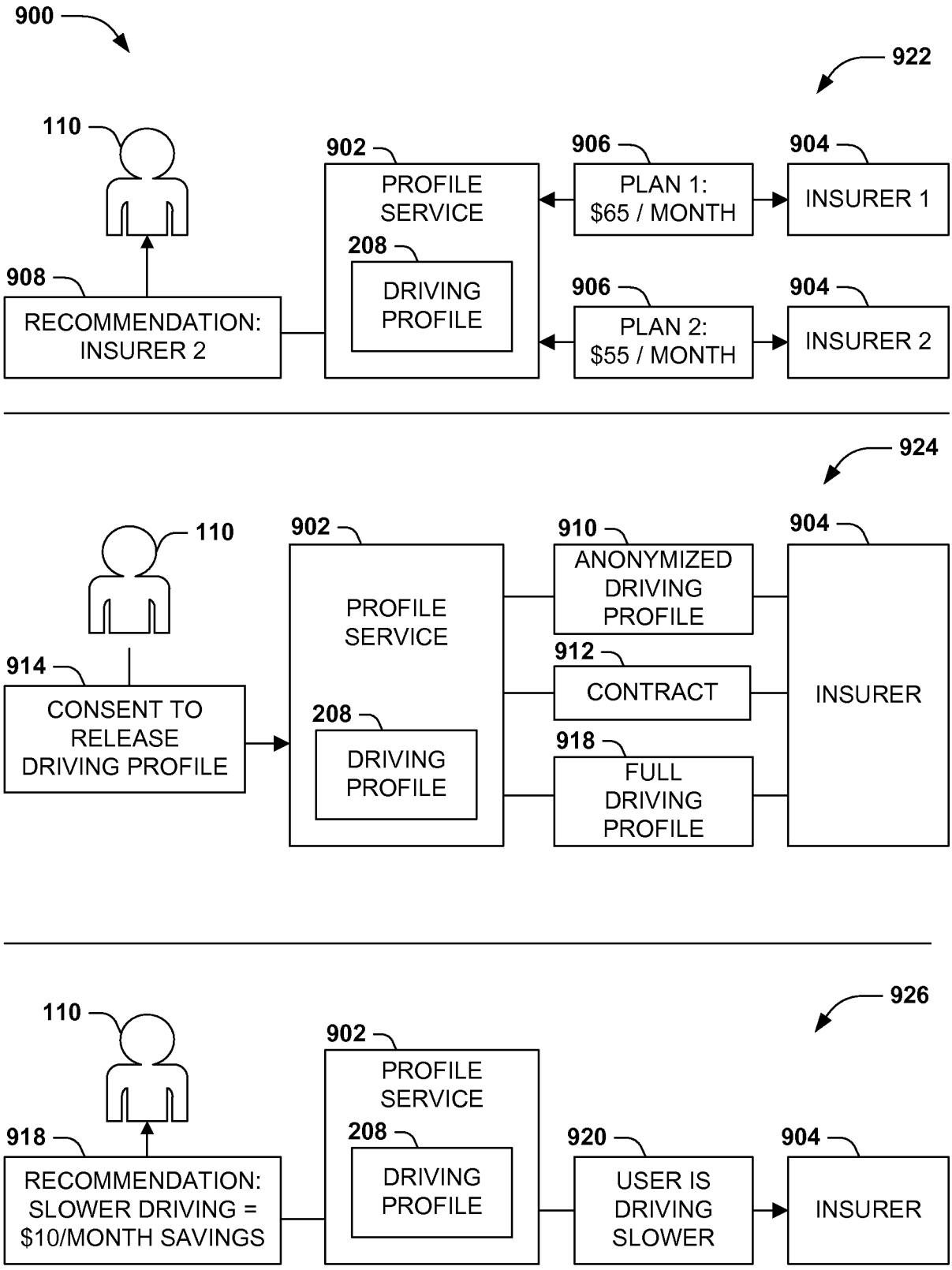
900
922
110
902
PROFILE SERVICE
208
DRIVING PROFILE
906
PLAN 1: $65 / MONTH
904
INSURER 1
908
RECOMMENDATION: INSURER 2
906
PLAN 2: $55 / MONTH
904
INSURER 2
924
110
902
PROFILE SERVICE
208
DRIVING PROFILE
910
ANONYMIZED DRIVING PROFILE
912
CONTRACT
918
FULL DRIVING PROFILE
904
INSURER
914
CONSENT TO RELEASE DRIVING PROFILE
926
110
902
PROFILE SERVICE
208
DRIVING PROFILE
920
USER IS DRIVING SLOWER
904
INSURER
918
RECOMMENDATION: SLOWER DRIVING = $10/MONTH SAVINGS

FIG. 9

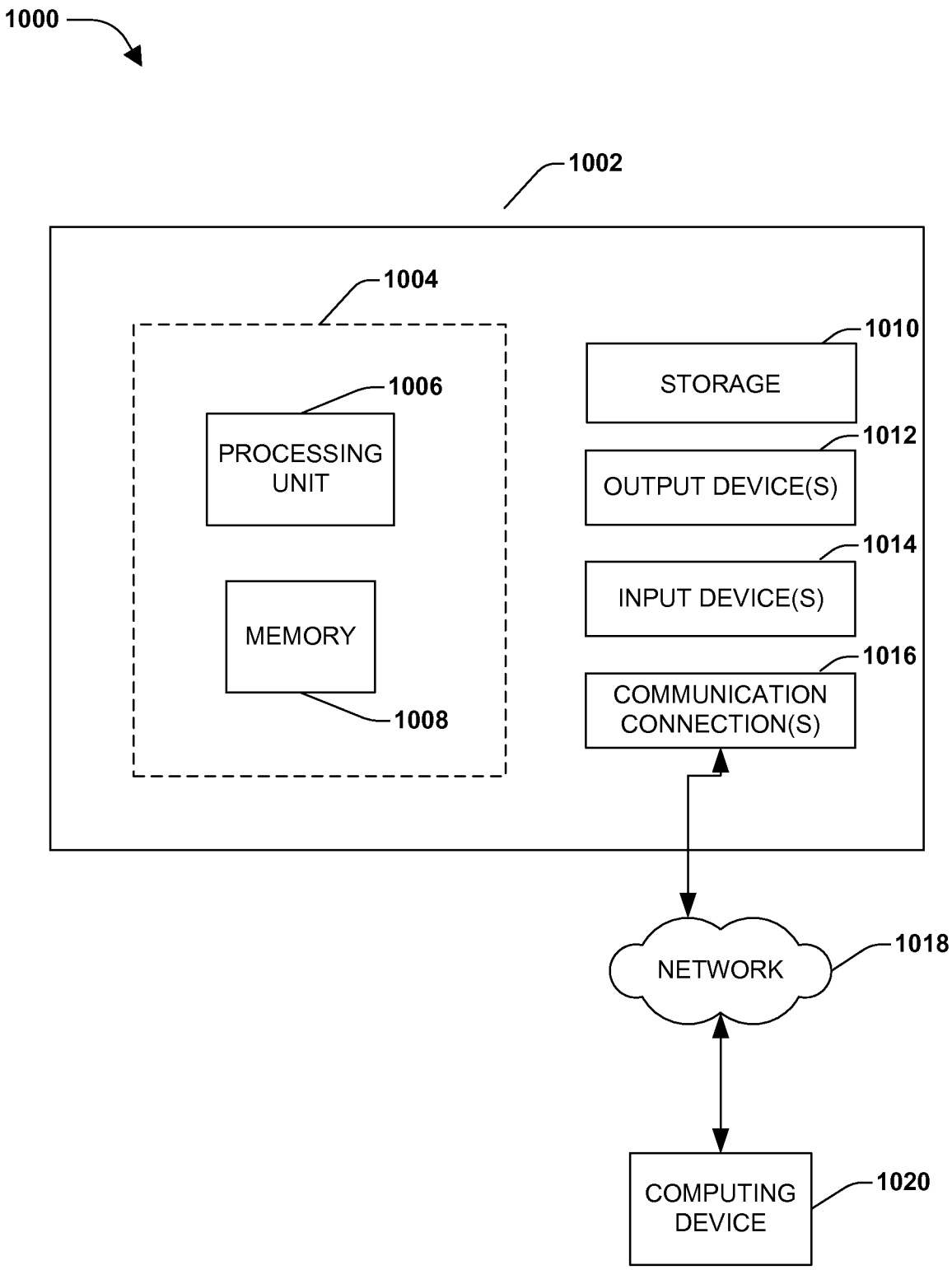
1000
1002
1004
1006
PROCESSING UNIT
MEMORY
1008
1010
STORAGE
1012
OUTPUT DEVICE(S)
1014
INPUT DEVICE(S)
1016
COMMUNICATION CONNECTION(S)
NETWORK
1018
COMPUTING DEVICE
1020

FIG. 10

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/018394

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06Q 40/00 (2015.01)
CPC - G06Q 40/08 (2015.04)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - B60W 40/09, G06F 7/00, 17/00, 19/00, G06Q 40/00 (2015.01)
USPC - 705/33, 51, 400, 705/1, 5

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - B60W 10/06, F16H 61/061, 61/0213, G06Q 40/00, 40/08, 50/22 (2015.04) (keyword delimited)

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

Orbit, Google Patents, Google
Search terms used: insurance, cryptographic, key, consent, signature, vehicle, driving

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US 2013/0317736 A1 (FERNANDES et al) 28 November 2013 (28.11.2013) entire document | 1-20 |
| Y | US 2013/0218604 A1 (HAGELSTEIN et al) 22 August 2013 (22.08.2013) entire document | 1-20 |
| Y | US 7,483,840 B2 (WEITERMANN et al) 27 January 2009 (27.01.2009) entire document | 8-11 |
| Y | US 2012/0221357 A1 (KRAUSE et al) 30 August 2012 (30.08.2012) entire document | 9 |

☐ Further documents are listed in the continuation of Box C. ☐

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

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 04 May 2015 | 03 JUN 2015 |

| Name and mailing address of the ISA/US | Authorized officer: |
|---|---|
| Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-8300 | Blaine R. Copenheaver<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

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