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(54) **SYSTEMS AND METHODS FOR DETECTING SPEEDING VIOLATIONS**

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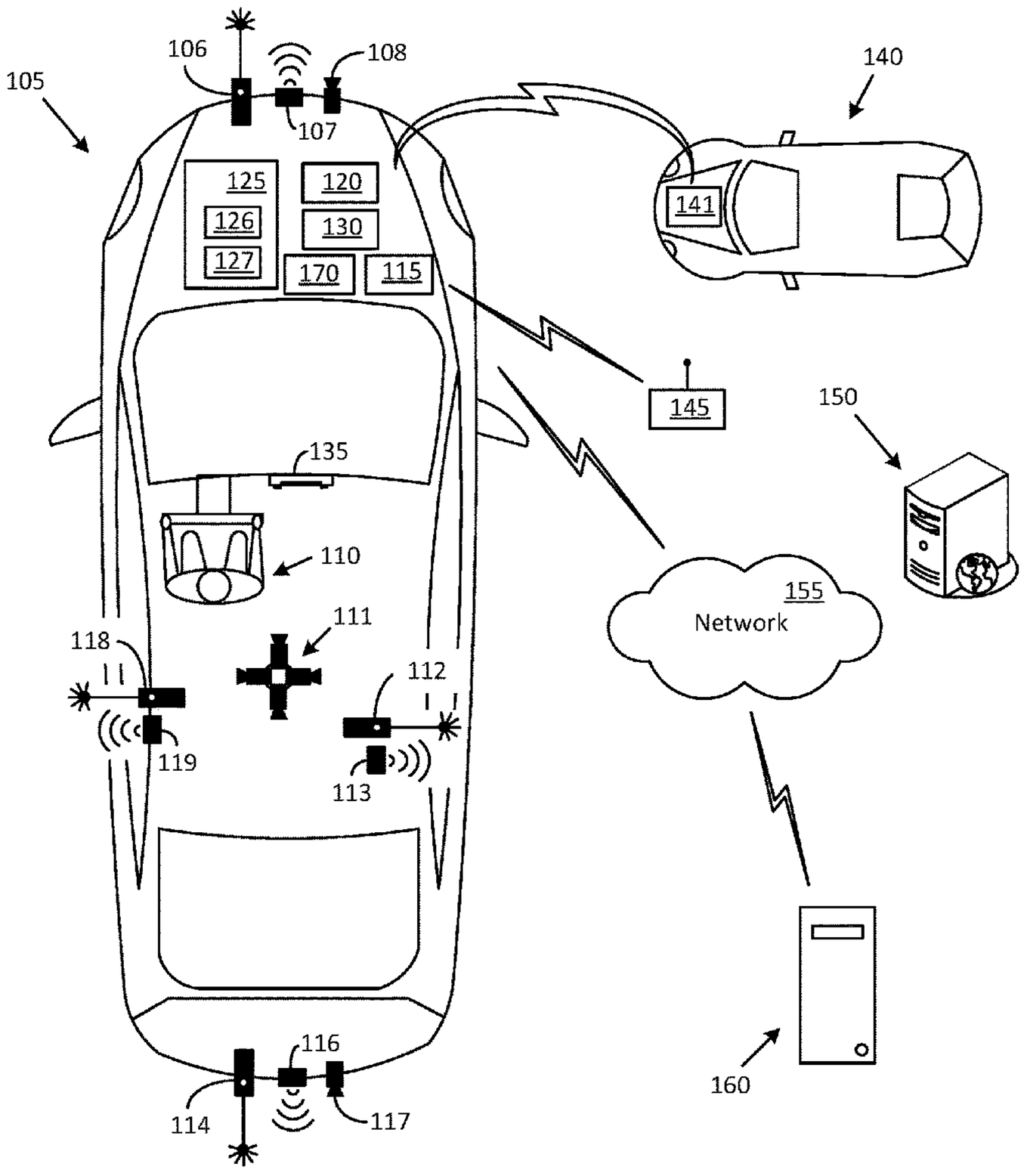
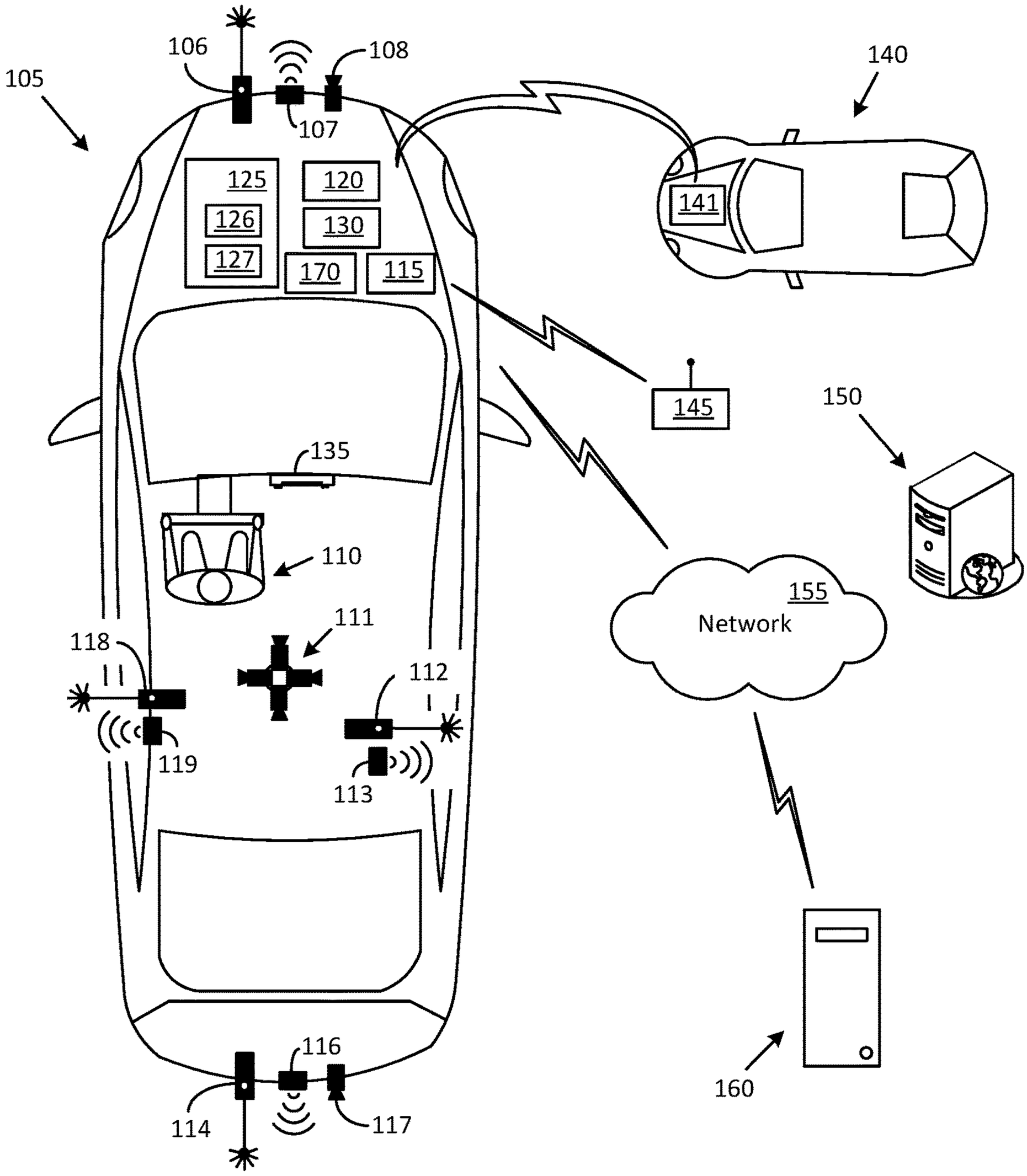
(57) **ABSTRACT**

The disclosure is generally directed to systems and methods for detecting and responding to speeding violations. An example method executed by a processor in a first vehicle (a law-enforcement vehicle, for example) can include receiving, from a vehicle speed detection system, a speed measurement associated with a second vehicle. The processor may determine that the speed of the second vehicle exceeds a threshold speed and may operate a camera to capture an image of the second vehicle. The image may be evaluated for determining at least one identifying feature of the second vehicle. A record may then be generated. The record can include the speed measurement, the image, and the first identifying feature. In some cases, the record may be transmitted to another law-enforcement vehicle for pursuing the second vehicle and/or to an Internet-of-Things (IoT) roadside unit for tracking the second vehicle.

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Network
160

FIG. 1

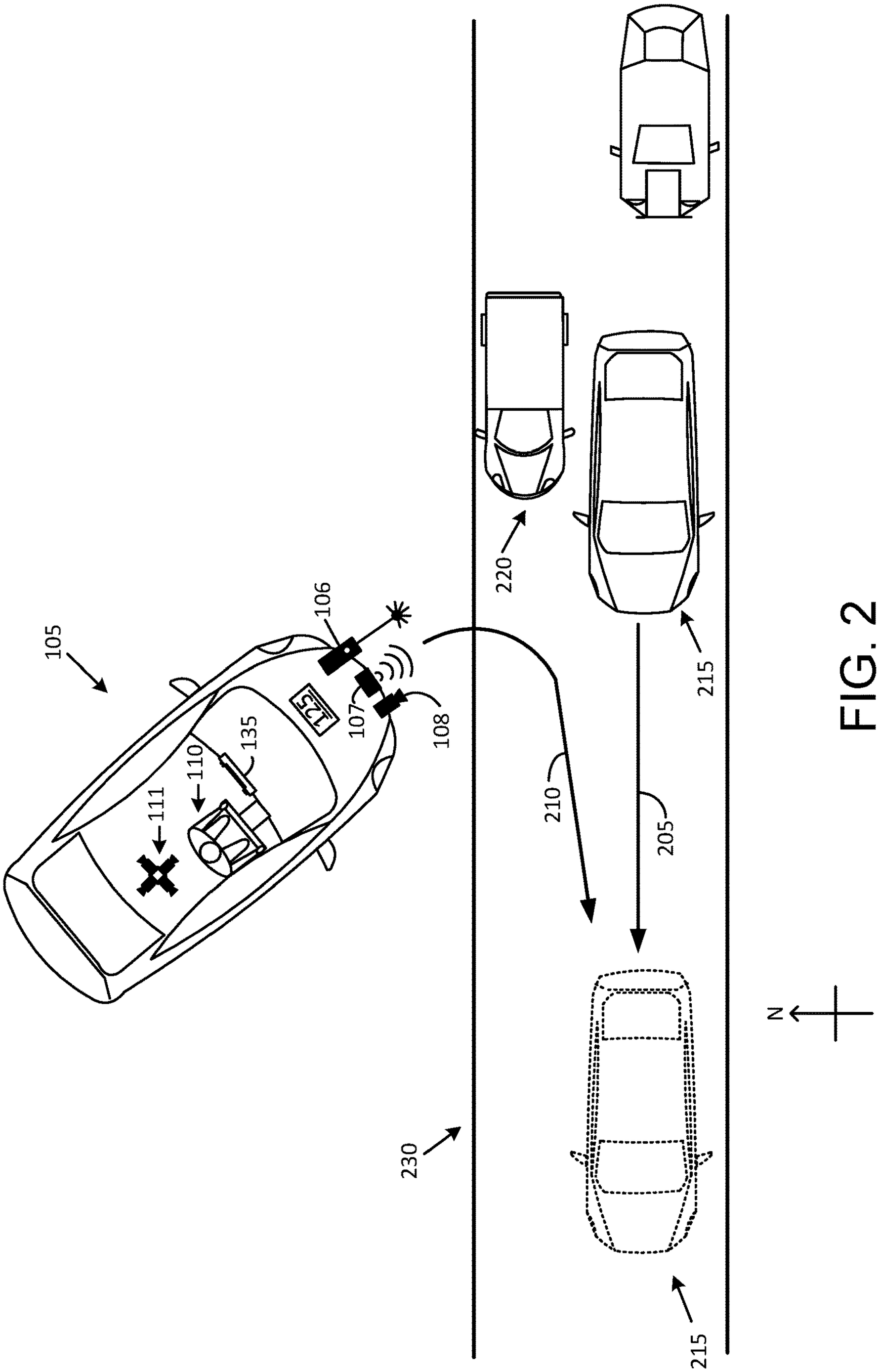


FIG. 2

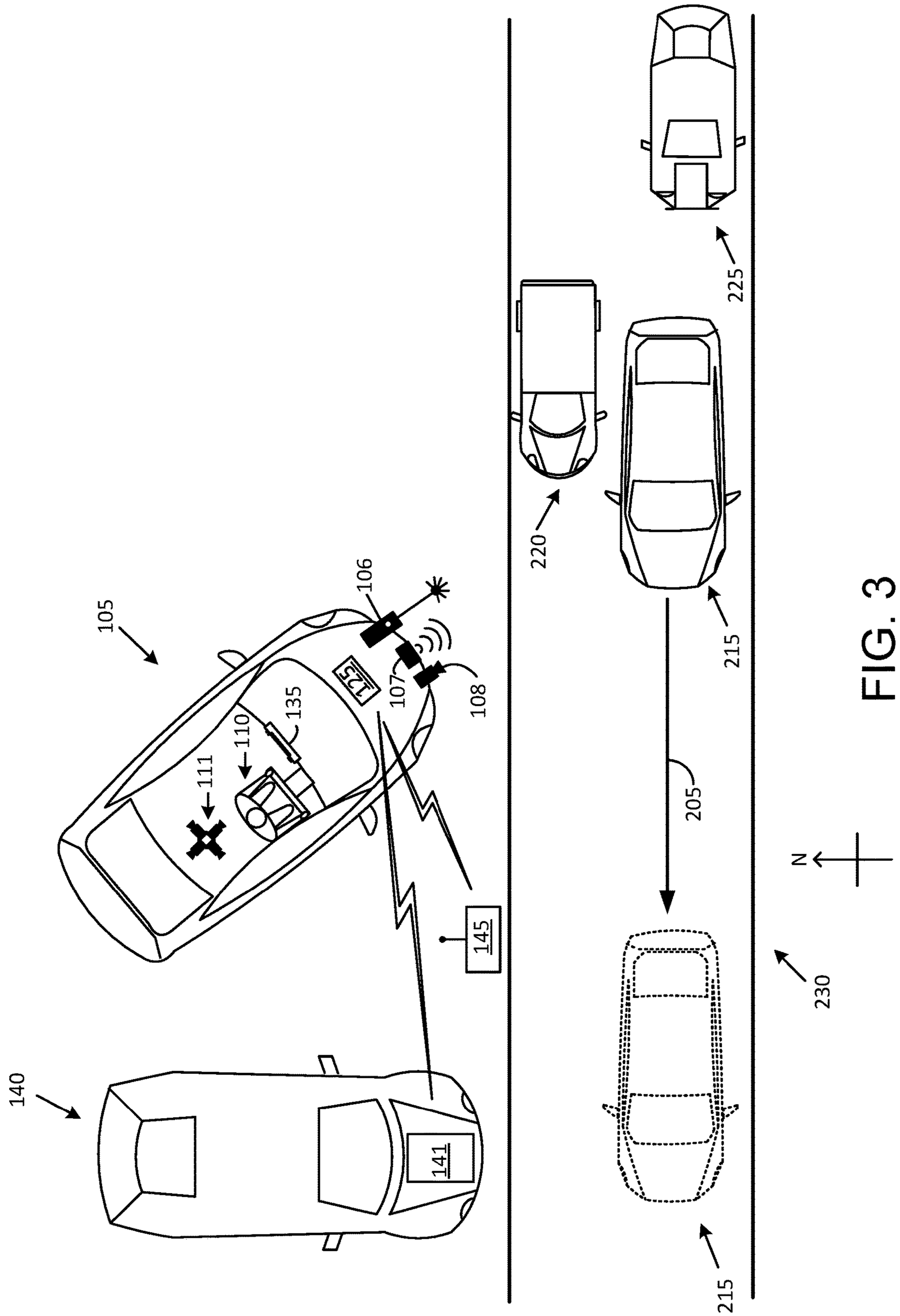
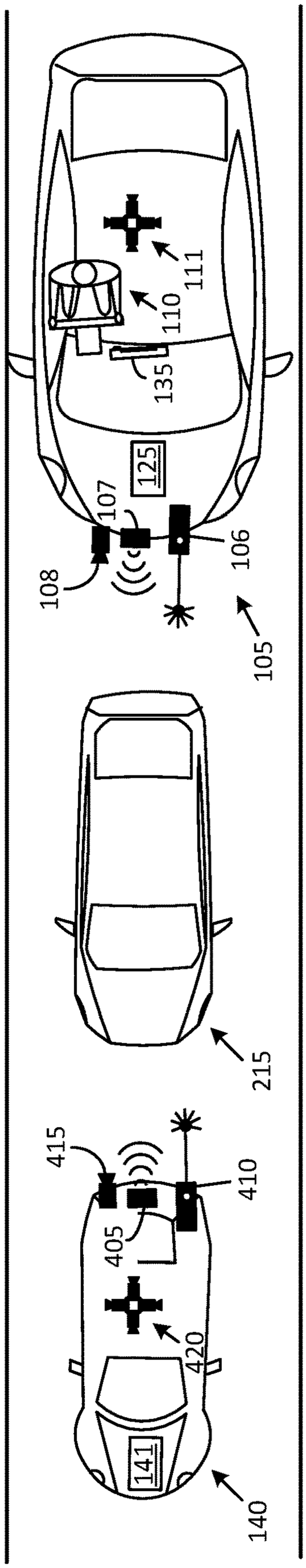


FIG. 3


111
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230

FIG. 4

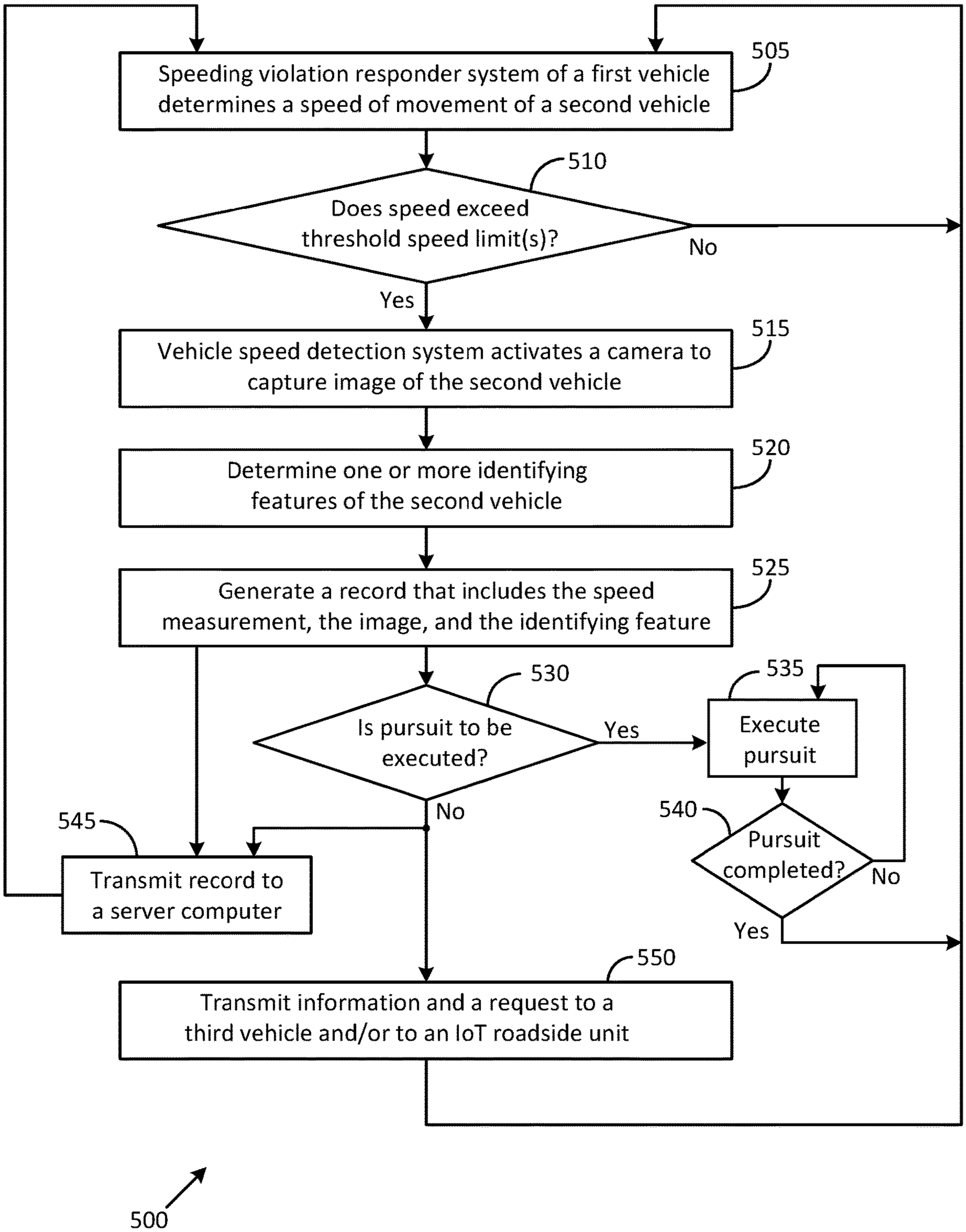
505
Speeding violation responder system of a first vehicle determines a speed of movement of a second vehicle
510
Does speed exceed threshold speed limit(s)?
No
Yes
515
Vehicle speed detection system activates a camera to capture image of the second vehicle
520
Determine one or more identifying features of the second vehicle
525
Generate a record that includes the speed measurement, the image, and the identifying feature
530
Is pursuit to be executed?
Yes
No
535
Execute pursuit
540
Pursuit completed?
No
Yes
545
Transmit record to a server computer
550
Transmit information and a request to a third vehicle and/or to an IoT roadside unit
500

FIG. 5

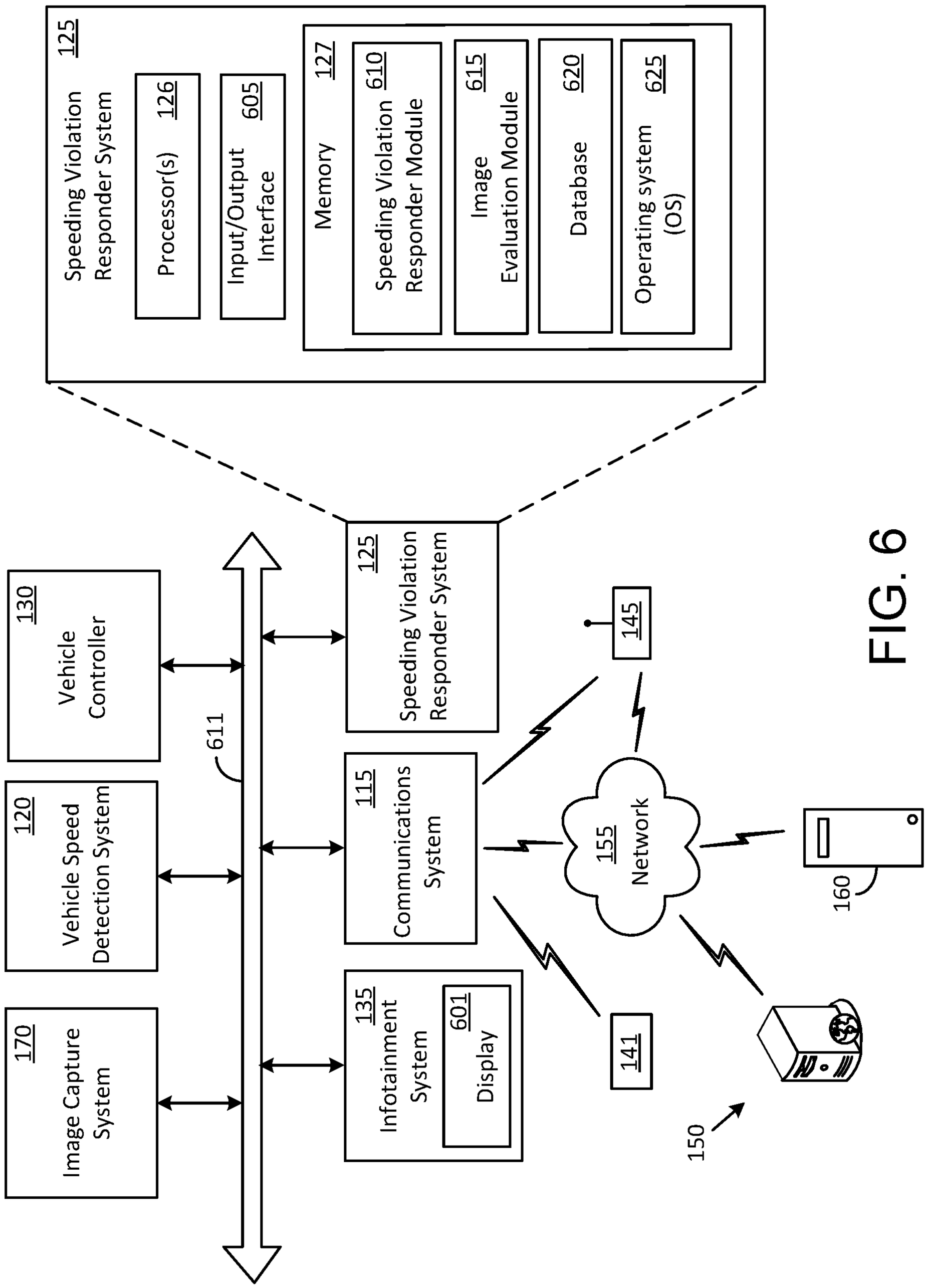
Speeding Violation Responder System 125
Processor(s) 126
Input/Output Interface 605
Memory 127
Speeding Violation Responder Module 610
Image Evaluation Module 615
Database 620
Operating system (OS) 625
Vehicle Controller 130
Vehicle Speed Detection System 120
Image Capture System 170
611
Speeding Violation Responder System 125
Communications System 115
Infotainment System 135
Display 601
145
141
155 Network
160
150

FIG. 6

SYSTEMS AND METHODS FOR DETECTING SPEEDING VIOLATIONS

BACKGROUND

[0001] Traffic police typically face various types of challenges when dealing with speeding violations. Among these challenges is a need to quickly and accurately identify a speeding vehicle and take responsive action. It is desirable to provide systems and methods that assist traffic police and/or other law enforcement officers perform such tasks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] A detailed description is set forth below with reference to the accompanying drawings. The use of the same reference numerals may indicate similar or identical items. Various embodiments may utilize elements and/or components other than those illustrated in the drawings, and some elements and/or components may not be present in various embodiments. Elements and/or components in the figures are not necessarily drawn to scale. Throughout this disclosure, depending on the context, singular and plural terminology may be used interchangeably.

[0003] FIG. **1** shows an example vehicle that includes a speeding violation responder system in accordance with an embodiment of the disclosure.

[0004] FIG. **2** shows a first example scenario where a speeding violation responder system may be used in accordance with an embodiment of the disclosure.

[0005] FIG. **3** shows a second example scenario where a speeding violation responder system may be used in accordance with an embodiment of the disclosure.

[0006] FIG. **4** shows a third example scenario where two records associated with a speeding violation are generated in accordance with an embodiment of the disclosure.

[0007] FIG. **5** shows a flowchart of a method to implement a speeding violation detection and response procedure in accordance with an embodiment of the disclosure.

[0008] FIG. **6** shows some functional components that may be included in a vehicle that includes a speeding violation responder system in accordance with an embodiment of the disclosure.

DETAILED DESCRIPTION

Overview

[0009] In terms of a general overview, embodiments described in this disclosure are generally directed to systems and methods for detecting and responding to speeding violations. An example method executed by a processor of a speeding violation responder system in a first vehicle such as, for example, a law-enforcement vehicle, can include receiving, from a vehicle speed detection system of the first vehicle, a speed measurement associated with a second vehicle. The processor may determine that a speed of the second vehicle exceeds a posted speed limit. The processor may then activate and receive from an image capture system of the first vehicle, an image that includes the second vehicle. At least one identifying feature of the second vehicle may be determined based on evaluating the image and a record may be generated. Identifying features can include, for example, a registration plate, a paint color, a damage (dent, missing part, etc.), a sticker, and an accessory (ski rack, bicycle rack, spoiler etc.). The record can include the speed measurement, the image, and the first identifying feature of the second vehicle. In an example scenario, the record may be transmitted to another law-enforcement vehicle for taking action upon the second vehicle. In another example scenario, the record may be transmitted to an Internet-of-Things (IoT) roadside unit for tracking the second vehicle.

Illustrative Embodiments

[0010] The disclosure will be described more fully hereinafter with reference to the accompanying drawings, in which example embodiments of the disclosure are shown. This disclosure may however, be embodied in many different forms and should not be construed as limited to the example embodiments set forth herein. It will be apparent to persons skilled in the relevant art that various changes in form and detail can be made to various embodiments without departing from the spirit and scope of the present disclosure. Thus, the breadth and scope of the present disclosure should not be limited by any of the above-described example embodiments but should be defined only in accordance with the following claims and their equivalents. The description below has been presented for the purposes of illustration and is not intended to be exhaustive or to be limited to the precise form disclosed. It should be understood that alternate implementations may be used in any combination desired to form additional hybrid implementations of the present disclosure. For example, any of the functionality described with respect to a particular device or component may be performed by another device or component. Furthermore, while specific device characteristics have been described, embodiments of the disclosure may relate to numerous other device characteristics. Further, although embodiments have been described in language specific to structural features and/or methodological acts, it is to be understood that the disclosure is not necessarily limited to the specific features or acts described. Rather, the specific features and acts are disclosed as illustrative forms of implementing the embodiments.

[0011] Certain words and phrases are used herein solely for convenience and such words and terms should be interpreted as referring to various objects and actions that are generally understood in various forms and equivalencies by persons of ordinary skill in the art. For example, it must be understood that the word "object" as used herein with respect to images encompasses various inanimate objects outside a vehicle (vehicles, traffic lights, traffic signs, etc.) and animate objects (pedestrians, drivers, passengers, etc.). Words such as "image" and "photograph" may be used herein in an interchangeable manner. More particularly, the word "image" as used herein is merely one example of "data" or "information" in accordance with the disclosure. Other forms of data may include sensor signals captured by use of various types of sensors provided in a vehicle (infrared sensors, motion detectors, sonar, radar, images, etc.). The images/photographs referred to herein in accordance with the disclosure may be obtained by use of various types of image capture devices (still camera, digital camera, video camera, smartphone, etc.). The various forms of images/photographs can include still photographs, video clips, real-time video, movies, still frames etc. A still frame is a single static image that may be obtained from a video clip or a video stream. A video clip is generally composed of a set of images that are captured sequentially over a

period of time. Thus, a description below with respect to a single image is equally applicable to a video clip for example. The word "vehicle" as used in this disclosure can pertain to any one of various types of vehicles such as, for example, cars, vans, sports utility vehicles, trucks, electric vehicles, gasoline vehicles, and hybrid vehicles. Furthermore, the description provided herein is applicable to various vehicles incorporating various kinds of driving automation such as, for example, the six levels of driving automation that is defined by the Society of Automotive Engineers (SAE) as ranging from Level 0 (fully manual) to Level 5 (fully autonomous).

[0012] It must be further understood that the description herein refers to detecting speeding violations, which is merely one example of a traffic violation. Accordingly, the systems and methods described herein are equally applicable to any of various other types of traffic violations including for example, improper lane changes, rash driving, driving with an expired license, driving with no registration, driving under the influence, etc. Thus, in an example scenario, a speeding violation responder system may capture an image in accordance with the disclosure upon detecting a vehicle that is weaving haphazardly (even if traveling below a speed limit). The motion of the vehicle may be indicative of the vehicle being driven by a driver who is under the influence of alcohol.

[0013] It must also be understood that words such as "implementation," "application," "scenario," "case," and "situation" as used herein are an abbreviated version of the phrase "In an example ("implementation," "application," "scenario," "case," "approach," and "situation") in accordance with the disclosure." It must also be understood that the word "example" as used herein is intended to be non-exclusionary and non-limiting in nature.

[0014] FIG. **1** shows a vehicle **105** that includes a speeding violation responder system **125** in accordance with an embodiment of the disclosure. In an example scenario, the vehicle **105** is a law-enforcement vehicle such as, for example, a police sedan. However, in other scenarios, the vehicle **105** can be any of various types of vehicles operated by various types of agencies. Henceforth, the label "vehicle **105**" and "law-enforcement vehicle **105**" may be used in an interchangeable manner. The speeding violation responder system **125** can include a processor **126** that is configured to execute computer-executable instructions stored in a memory **127** for performing various operations in accordance with the disclosure. The vehicle **105** may further include components such as, for example, a vehicle controller **130**, a communications system **115**, an infotainment system **135**, a vehicle speed detection system **120**, and an image capture system **170**.

[0015] The vehicle controller **130** may be operated to execute various operations related to the vehicle **105**, such as, for example, controlling engine operations (fuel injection, speed control, emissions control, braking, etc.), managing climate controls (air conditioning, heating etc.), activating airbags, and issuing alerts (check engine light, bulb issues, low tire pressure, etc.), and also for executing various operations in accordance with disclosure.

[0016] In the illustrated example scenario, the vehicle **105** is a driver-operated vehicle and the driver of the vehicle **105** can be, for example, a law-enforcement officer **110**. In other scenarios, the vehicle **105** can be driven by various other types of individuals, such as, for example, an emergency services responder or a private security officer. The vehicle controller **130** responds to actions performed by the law-enforcement officer **110** (such as, for example, reducing the speed of the vehicle **105** when the law-enforcement officer **110** executes a braking operation, moving the vehicle **105** at a cruising speed when the law-enforcement officer **110** applies cruise control, and selecting an appropriate gear when the law-enforcement officer **110** steps on the accelerator).

[0017] In another example scenario, the vehicle **105** is an autonomous vehicle and the vehicle controller **130** performs some or all of various operations that may replicate those performed by the law-enforcement officer **110**. More particularly, the vehicle controller **130** of the autonomous vehicle can be configured to autonomously perform various operations associated with detecting speeding violations in accordance with the disclosure. Detecting speeding violations can include operations such as, for example, operating the vehicle speed detection system **120** for determining a speed of one or more other vehicles by, operating the image capture system **170** for capturing one or more images of one or more vehicles that may be involved in speeding violations, and generating a record of the speeding violation.

[0018] The infotainment system **135** may include a combination of various entertainment items (such as a radio, streaming audio solutions, etc., and USB access ports for digital audio devices). The infotainment system **135** may also include other types of items, such as, for example, a navigation system and a graphical user interface (GUI) that is displayed on a display screen. The law-enforcement officer **110** may use the GUI for interacting with the speeding violation responder system **125** and for executing various operations in accordance with the disclosure. Some example operations can include transmitting a request to another law-enforcement officer in another vehicle, for performing one or more actions with respect to a vehicle that may be involved in a speeding violation.

[0019] The vehicle speed detection system **120** can include various types of speed detectors that are configured to obtain speed measurements of various vehicles that may be traveling on a highway, for example. More particularly, in accordance with an embodiment of the disclosure, the vehicle speed detection system **120** can include a radar device and a light detection and ranging (LIDAR) device. The radar device may be operated to detect a group of vehicles in which one or more vehicles are traveling over a posted speed limit. The speeding violation responder system **125** may use information such as, for example, speed measurements provided by the radar device, to obtain a "coarse" indication that at least a first vehicle in the group of vehicles is traveling over the posted speed limit. The LIDAR device, which uses a light beam for obtaining a speed measurement may then be operated in order to establish a "narrow" aim upon the first vehicle for determining the speed of the first vehicle. The measurement provided by the LIDAR device may thus allow the speeding violation responder system **125** to distinguish between the first vehicle that is traveling over the posted speed limit and a second vehicle that is traveling close to the first vehicle and may or may not, be traveling over the posted speed limit.

[0020] The various devices of the vehicle speed detection system **120** may be located at various places upon the vehicle **105** and communicatively coupled to the speeding violation responder system **125** by use of wireless and/or

wired connections. For example, a radar device **107** may be mounted upon a front portion of the vehicle **105** (for example, on a front bumper, behind a grille, on the front windshield, etc.) and configured for capturing vehicle speed data of vehicles moving in front of the vehicle **105**. A LIDAR device **106** may be mounted beside the radar device **107** and configured for capturing vehicle speed data of the vehicles moving in front of the vehicle **105**.

[0021] A radar device **116** may be mounted upon a rear portion of the vehicle **105** (for example, on a rear bumper, on a trunk, on a license plate etc.) and configured for capturing vehicle speed data of vehicles moving behind the vehicle **105**. A LIDAR device **114** may be mounted beside the radar device **116** and configured for capturing vehicle speed data of the vehicles moving behind of the vehicle **105**.

[0022] A radar device **119** may be mounted upon a roof of the vehicle **105** and configured for capturing vehicle speed data of vehicles that may be moving on a driver side of the vehicle **105** along a generally parallel path or an angular (<90 degrees) path with respect to a longitudinal axis of the vehicle **105**. A LIDAR device **118** may be mounted beside the radar device **113** and configured for capturing vehicle speed data of the vehicles moving on the driver side of the vehicle **105**.

[0023] A radar device **113** may be mounted upon the roof of the vehicle **105** and configured for capturing vehicle speed data of vehicles that may be moving on a passenger side of the vehicle **105** along a generally parallel path or an angular (<90 degrees) path with respect to the longitudinal axis of the vehicle **105**. A LIDAR device **112** may be mounted beside the radar device **113** and configured for capturing vehicle speed data of the vehicles moving on the passenger side of the vehicle **105**.

[0024] Other vehicle speed detection devices (not shown) that are operable by the speeding violation responder system **125** can include sensors and detectors such as, for example, infrared detectors, motion detectors, distance sensors, proximity sensors, and audio sensors. The information obtained by operating the various vehicle speed detection devices can be used by the speeding violation responder system **125** and/or by other computing devices that are communicatively coupled to the speeding violation responder system **125** for various purposes in accordance with the disclosure.

[0025] The image capture system **170** can include one or more cameras. The cameras can be any of various types of image capture devices such as, for example, a digital camera that captures a still image, a video camera that captures a video clip, a video camera that captures real-time video, and/or an infrared camera. Each of the cameras may be mounted at any of various locations on the vehicle **105**. In the illustrated implementation, each of the camera **111**, the camera **108**, and the camera **117** is mounted upon a body portion of the vehicle **105** in a manner that allows the cameras to be operated for capturing images of objects located outside the vehicle **105**.

[0026] More particularly, in the illustrated example, the camera **111** is an image capture device that is mounted upon the roof the vehicle **105**. The camera **111** is configured to provide a 360-degree field of view for capturing images of objects located around the outside of the vehicle **105**. The images are conveyed to the speeding violation responder system **125** for executing various operations in accordance with the disclosure.

[0027] The camera **108** may be mounted upon a front portion of the vehicle **105** (for example, on a front bumper, behind a grille, on the front windshield, etc.) and configured for capturing images of objects located in front of the vehicle **105**. The camera **117** may be mounted upon a rear portion of the vehicle **105** (for example, on a rear bumper, on a trunk, on a license plate etc.) and configured for capturing images of objects located behind the vehicle **105**. Images captured by the camera **108** and the camera **117** may be conveyed to the speeding violation responder system **125** for performing various actions in accordance with the disclosure such as, for example, to determine one or more identifying features of a vehicle. Some example identifying features can be a registration plate of the vehicle, a paint color of the vehicle, a damaged part of the vehicle (dent, missing part, etc.) and an accessory (ski rack, bicycle rack, spoiler etc.).

[0028] When the vehicle **105** is an autonomous vehicle, images captured by the camera **111**, the camera **108** and/or the camera **117** may be conveyed to the vehicle controller **130** to enable the vehicle controller **130** to autonomously control the movement of the vehicle **105** (navigation, object avoidance, etc.).

[0029] In an example implementation of the disclosure, one or more of the cameras can be controlled by the law-enforcement officer **110** for capturing images that are conveyed by the cameras to the speeding violation responder system **125** for various purposes in accordance with the disclosure. In another example implementation, one or more of the cameras can be controlled by the speeding violation responder system **125** either in cooperation with the law-enforcement officer **110** (when present) or independently such as, for example, when the vehicle **105** is an autonomous vehicle or when the image capture process is automated. The captured images can be used for various purposes in accordance with the disclosure.

[0030] The communication system **115** of the vehicle **105** is configured to wirelessly communicate with various devices such as, for example, a computer **160**, a cloud computer **150**, an Internet-of-Things (IoT) roadside unit **145**, and a speeding violation responder system **141** provided in a vehicle **140**. In an example scenario, the vehicle **140** is another law-enforcement vehicle.

[0031] The wireless communications may be carried out via device-to-device communications and/or via a network **155**. The device-to-device communications may involve, for example, vehicle-to-vehicle (V2V) communications that may be used by the communication system **115** of the vehicle **105** to communicate with the communication system **141** of the vehicle **140**, and vehicle-to-infrastructure (V2I) communications that may be used by the communication system **115** of the vehicle **105** to communicate with the IoT roadside unit **145**.

[0032] The network **155** may include any one, or a combination of networks, such as, for example, a local area network (LAN), a wide area network (WAN), a telephone network, a cellular network, a cable network, a wireless network, and/or private/public networks such as the Internet. At least one portion of the network **155** includes a wireless communication link such as, for example, a cellular communication link, a WiFi communications link, an ultra-wideband (UWB) communication link, and a Bluetooth® communication link.

[0033] The computer **160** can be any of various types of computers such as, for example, a server computer, a client

device, a personal computer, and/or a distributed computer (multiple computers operating in cooperation with each other as a single computing entity). In an example implementation, the computer **160** is a server computer configured to store traffic-related information of various vehicles including records related to traffic violations. Records related to traffic violations can include, for example, moving violations (speeding tickets, reckless driving, improper lane changing, driving without lights, etc.) and other violations (damaged tail lights, expired vehicle registration, driving license suspension, etc.).

[0034] The cloud computer **150** may be used either independently or together with the computer **160** to store records related to traffic violations.

[0035] The IoT roadside unit **145** can be configured to execute various functions such as, for example, to provide tracking functions and/or to relay communications transmitted by the speeding violation responder system **125** to devices such as another IoT roadside unit (not shown) or the computer **160**. An example tracking function may involve the operation of a camera (not shown) of the IoT roadside unit **145** to capture an image (or real-time video) of a vehicle and to track a movement of the vehicle. Identifying a vehicle for purposes of carrying out a tracking function may be based on a record of the vehicle that may be transmitted by the speeding violation responder system **125** to the IoT roadside unit **145**.

[0036] The speeding violation responder system **141** provided in the vehicle **140** may be substantially identical to the speeding violation responder system **125** provided in the vehicle **105** and may be configured to perform functions that are substantially identical to functions performed by the speeding violation responder system **125**.

[0037] FIG. **2** shows a first example scenario where the speeding violation responder system **125** may be used in accordance with an embodiment of the disclosure. In this example scenario, the vehicle **105** is parked at an angle with respect to a road **230**. A front portion of the vehicle **105** faces the road **230** and some devices of the vehicle speed detection system **120** (such as, for example, the radar device **107** and the LIDAR device **106**) and of the image capture system **170** (such as, for example, the camera **108** and/or the camera **111**) may be found suitable for monitoring speeding violations. In other scenarios, where the vehicle **105** is parked with a different orientation, various other devices of the vehicle speed detection system **120** and the image capture system **170** may be used for monitoring speeding violations.

[0038] In the illustrated example scenario, a group of vehicles is traveling west on the road **230**. One or more of the vehicles in the group of vehicles may be traveling over a posted speed limit.

[0039] The radar device **107** may be first activated by the speeding violation responder system **125** for monitoring the group of vehicles to detect one or more vehicles that may be traveling over a first threshold speed. The first threshold speed may be equal to, or different than, the posted speed limit. In an example implementation, the first threshold speed may be selected by the law-enforcement officer **110** and entered into the speeding violation responder system **125** (via the GUI of the infotainment system **135**, for example). The law-enforcement officer **110** may for example, decide to select the first threshold speed based on a margin value above the posted speed limit applicable to the road **230**.

[0040] In an example scenario, the law-enforcement officer **110** may for example, decide to select the first threshold speed to be a percentage value over the posted speed limit (20% over the posted speed limit, for example) or an absolute value above the posted speed limit (10 mph over the posted speed limit, for example).

[0041] The first threshold speed may be used to alert the law-enforcement officer **110** of a speeding condition on the road **230**. The law-enforcement officer **110** may use the alert to perform any of various actions such as, for example, to issue a visual alert (turning on a red-white-blue light on the roof the vehicle **105**, for example) and/or an audible alert (activate a siren, for example) to alert the vehicles traveling on the road **230** to slow down. The law-enforcement officer **110** may or may not, at this time, opt to pursue any of the vehicles traveling on the road **230**.

[0042] In an example situation, the radar device **107** may provide a trigger signal to alert the law-enforcement officer **110** of a speeding condition on the road **230**. The trigger signal may fail to provide adequate information for the speeding violation responder system **125** to unambiguously identify a specific vehicle among the group of vehicles that may be exceeding the posted speed limit by a large margin (for example, 40% over the posted speed limit). For example, the trigger signal may indicate an average speed of movement of two or more vehicles such as, for example, an average speed of movement of a vehicle **215** and a vehicle **220** that is moving beside the vehicle **215**. The radar device **107** may emit a radar signal having a broad radiation pattern that may reflect off a front portion of the vehicle **215** and at least a portion of the vehicle **220**. The speeding violation responder system **125** may be unable to identify based on the speed measurement provided by the radar device **107** whether only one, or both, of the vehicle **215** and the vehicle **220** are exceeding the posted speed limit by a large margin.

[0043] Accordingly, in accordance with an embodiment of the disclosure, the speeding violation responder system **125** may prompt the law-enforcement officer **110** to provide a visual identification of a specific vehicle that appears to be exceeding the posted speed limit. The prompt may be provided in the form of a notification displayed on the GUI of the infotainment system **135** and/or as an audio signal (a beep through a speaker of the infotainment system **135**, for example). The law-enforcement officer **110** may respond to the prompt by providing an indication to the speeding violation responder system **125** that the vehicle **215** is a target vehicle that appears to be exceeding the posted speed limit based on a visual examination of the group of vehicles.

[0044] Based on the input provided by the law-enforcement officer **110**, the speeding violation responder system **125** may activate the LIDAR device **106** and configure the LIDAR device **106** to target, and to measure, a speed of movement of the vehicle **215**. The speeding violation responder system **125** may compare a speed measurement obtained from the LIDAR device **106** against a second threshold speed. In one implementation, the second threshold speed may be set equal to the first threshold speed. In another implementation, the second threshold speed may be set different than the first threshold speed such as, for example, above the first threshold speed (for example, 40% over a posted speed limit). The speeding violation responder system **125** may display (via the GUI of the infotainment system **135**, for example) a result of comparing the speed measurement obtained from the LIDAR device **106** against

the second threshold speed and/or a speed measurement associated with the vehicle **215**.

[0045] The law-enforcement officer **110** may evaluate the displayed information and decide whether to take responsive action. In one case, the law-enforcement officer **110** may provide an indication to the speeding violation responder system **125** of a decision to pursue the vehicle **215** for purposes of issuing a citation or a warning. In this case, the speeding violation responder system **125** may automatically transmit a warning to the vehicle computer (not shown) and/or a speeding violation responder system (not shown) of the vehicle **220** to slow down and allow the vehicle **105** to enter the road **230** for pursuing the vehicle **215** along a movement path **210**. The warning may be conveyed via V2V communications, for example. The vehicle **215** may have continued to travel along a movement path **205**.

[0046] In accordance with another embodiment of the disclosure, the speeding violation responder system **125** may transmit a signal to activate the camera **108** for capturing an image that includes at least a front portion of the vehicle **215** and at least a portion of the vehicle **220**. The captured image may be evaluated by the speeding violation responder system **125** (together with the speed measurement provided by the radar device **107**) for determining that at least two vehicles (the vehicle **215** and the vehicle **220**) appear to be exceeding the posted speed limit by a large margin. In some cases, techniques such as artificial intelligence and/or machine learning may be employed for evaluating the captured image. If both vehicles are determined to be exceeding the posted speed limit, the speeding violation responder system **125** may activate the LIDAR device **106** to identify which of the two vehicles is moving faster. In this case, the speeding violation responder system **125** may configure the LIDAR device **106** to obtain a speed measurement of the vehicle **215** exclusively and further configure the LIDAR device **106** to obtain a speed measurement of the vehicle **220** exclusively.

[0047] In an example scenario, the speeding violation responder system **125** may determine that the vehicle **215** is traveling over the posted speed limit by a large margin and/or is traveling faster than the vehicle **220**. The speeding violation responder system **125** may display upon the GUI of the infotainment system **135** one or both the speed measurements of the vehicle **215** and/or the vehicle **220**.

[0048] The law-enforcement officer **110** may evaluate the displayed information and decide whether to take responsive action in the form of a pursuit. In one case, the law-enforcement officer **110** may provide an indication to the speeding violation responder system **125** of a decision to pursue the vehicle **215** for purposes of issuing a citation or a warning. In this case, the speeding violation responder system **125** may automatically transmit a warning to the vehicle controller (not shown) and/or a speeding violation responder system (not shown) of the vehicle **220** to slow down and allow the vehicle **105** to enter the road **230** for pursuing the vehicle **215** along a movement path **210**. The warning may be conveyed via V2V communications, for example. The vehicle **215** may have traveled along a movement path **205** ahead of the vehicle **105**.

[0049] FIG. **3** shows a second example scenario where the speeding violation responder system **125** may be used in accordance with an embodiment of the disclosure. The description provided above with reference to the first example scenario (shown in FIG. **2**) is applicable up to the point where the speeding violation responder system **125** displays upon the GUI of the infotainment system **135**, one or both the speed measurements of the vehicle **215** and/or the vehicle **220**. In the first example scenario described above, the law-enforcement officer **110** evaluates the displayed information and decides to engage in a pursuit of the vehicle **215**.

[0050] In the second example scenario, the law-enforcement officer **110** may evaluate the displayed information and decide not to pursue the vehicle **215** for one or more reasons such as, for example, due to high traffic congestion on the road **230**, a high speed of travel of the vehicle **215**. In this second scenario, the law-enforcement officer **110** may provide an indication to the speeding violation responder system **125** of a decision not to pursue the vehicle **215** and may further make a request to the speeding violation responder system **125** to take action in the matter.

[0051] In this case, the speeding violation responder system **125** may automatically transmit a signal to activate the camera **108** for capturing an image that includes at least a portion of the vehicle **215** that is in a field of view of the camera **108** at a first instant in time and/or an entirety of the vehicle **215** that is in a field of view of the camera **108** at a second instant in time when the vehicle **215** has traveled further down the road **230**. The speeding violation responder system **125** may evaluate the captured image to determine one or more identifying features of the vehicle **215** that may be unique to the vehicle **215** and/or may be used for identifying the vehicle **215** when the vehicle **215** is moving along with a number of vehicles. Identifying features of the vehicle **215** can include, for example, a make, a model, a year of manufacture, a registration plate, a paint color, a damage (dent, missing part, etc.), a sticker, and an accessory (ski rack, bicycle rack, spoiler etc.). In an example implementation, the speeding violation responder system **125** may display the image on a display screen of the infotainment system **135** and seek the assistance of the law-enforcement officer **110** to determine one or more identifying features of the vehicle **215**.

[0052] In an example embodiment, the speeding violation responder system **125** may generate a record that can include a speed measurement associated with the vehicle **215**, the image of the vehicle **215** that was captured by the camera **108**, and one or more identifying features of the vehicle **215** determined by the speeding violation responder system **125**. In some cases, the record may include input provided by the law-enforcement officer **110** via the GUI of the infotainment system **135** such as, for example, one or more identifying features of the vehicle **215**. The record may further include a first timestamp when the speed measurement was captured by the LIDAR device **106**, a second timestamp when the image of the vehicle **215** was captured by the camera **108**, and/or location information where the speeding violation occurred and data associated with the vehicle **215** (speed, image, etc.) was obtained.

[0053] The record may be transmitted, for example, to the computer **160** which can be a server computer configured to store traffic-related information of various vehicles and records related to traffic violations. The information stored in the computer **160** may be used by a law-enforcement agency as court documents, if judicial action is taken in court against a driver of the vehicle **215**.

[0054] In an example scenario, the speeding violation responder system **125** may wirelessly transmit at least some

of the record (such as, for example, the speed measurement of the vehicle **215**, the image of the vehicle **215**, and identifying information of the vehicle **215**) to the speeding violation responder system of another law-enforcement vehicle (such as, for example, to the speeding violation responder system **141** of the vehicle **140**). In an example scenario, real-time information associated with the vehicle **215** may be transmitted to the speeding violation responder system **141** of the vehicle **140**. The real-time information may be obtained via a video capture operation executed by the camera **108** under control of the speeding violation responder system **125**.

[0055] The speeding violation responder system **125** may further transmit a request via the speeding violation responder system **141** of the law-enforcement vehicle **140** to a law-enforcement officer in the law-enforcement vehicle **140** for taking action with respect to the vehicle **215** as it travels down the road and away from the vehicle **105**. Some example actions that may be taken against the vehicle **215** can include, for example, a pursuit of the vehicle **215** by the law-enforcement vehicle **140**, a stopping of the vehicle **215** by the law-enforcement officer in the law-enforcement vehicle **140**, and/or issuance of a speeding ticket to a driver of the vehicle **215** by the law-enforcement officer.

[0056] In another example scenario, the speeding violation responder system **125** may wirelessly transmit (via V2I communications, for example) at least some of the record (such as, for example, the speed measurement of the vehicle **215**, the image of the vehicle **215**, and identifying information of the vehicle **215**) to the IoT roadside unit **145** together with a request to track a movement of the vehicle **215** as the vehicle **215** moves down the road **230** and away from the vehicle **105**. The IoT roadside unit **145** may initiate a tracking procedure that may include image capture of the vehicle **215** by an image capture system of the IoT roadside unit **145**. The image capture may include capturing a real-time video of the vehicle **215**. In some cases, the tracking procedure may include the use of real time video and/or a video clip provided to the IoT roadside unit **145** by the speeding violation responder system **125** of the vehicle **105**. The tracking procedure can include a hand-off procedure where the IoT roadside unit **145** communicates with another IoT roadside unit further down the road **230**, a base station, and/or the computer **160**. Communications with the computer **160** can include transmission of a record generated by the IoT roadside unit **145** in connection with the tracking procedure of the vehicle **215**.

[0057] FIG. **4** shows a third example scenario where two records associated with a speeding violation are generated in accordance with an embodiment of the disclosure. The third example scenario can be an operation that takes place after the law-enforcement vehicle **105** engages in a pursuit operation of the vehicle **215** as described above with reference to FIG. **2**. In this case, the law-enforcement vehicle **105** communicates with the law-enforcement vehicle **140** that may be stationed further west, to engage in a tandem pursuit arrangement. More particularly, the speeding violation responder system **125** of the law-enforcement vehicle **105** may wirelessly transmit to the speeding violation responder system **141** of the vehicle **140**, at least some of the record that is associated with the vehicle **215** (such as, for example, the speed measurement of the vehicle **215**, the image of the vehicle **215**, and identifying information of the vehicle **215**). In an example scenario, real-time information associated with a pursuit of the vehicle **215** by the law-enforcement vehicle **105** may be transmitted to the speeding violation responder system **141** of the vehicle **140**. The real-time information may be obtained via a video capture operation executed by the camera **108** under control of the speeding violation responder system **125**.

[0058] The speeding violation responder system **141** of the vehicle **140** may provide directions to a law-enforcement officer in the law-enforcement vehicle **140** (for example, via a GUI of an infotainment system of the law-enforcement vehicle **140**). The instructions may enable the law-enforcement officer in the law-enforcement vehicle **140** to move into position ahead of the vehicle **215** as a part of the tandem pursuit arrangement whereby the vehicle **215** is sandwiched between the law-enforcement vehicle **140** and the law-enforcement vehicle **105**.

[0059] The tandem pursuit arrangement allows the law-enforcement vehicle **140** and the law-enforcement vehicle **105** to cooperate with each other for performing various operations. One example operation may involve compelling a driver of the vehicle **215** to slow down and to pull over to the side of the road **230**. Another example operation may involve obtaining two distinct records of a speeding violation associated with the vehicle **215**. The two distinct records can include a first record that the speeding violation responder system **125** of the vehicle **105** may generate and a second record that the speeding violation responder system **141** of the vehicle **140** may generate. The first record may be generated by the speeding violation responder system **125** by use of information obtained from one or more speed detection devices (such as, for example, the radar device **107** and/or the LIDAR device **106**) and one or more image capture devices (such as, for example, the camera **108** and/or the camera **111**).

[0060] The second record may be generated by the speeding violation responder system **141** by use of information obtained from one or more speed detection devices (such as, for example, a radar device **405** and/or a LIDAR device **410** mounted upon a rear portion of the law-enforcement vehicle **140**) and images captured by one or more image capture devices (such as, for example, a camera **415** mounted upon a rear portion of the law-enforcement vehicle **140** and/or a camera **420** mounted upon a roof of the law-enforcement vehicle **140**).

[0061] In an example implementation, the first record generated by the speeding violation responder system **125** and/or the second record generated by the speeding violation responder system **141**, can include an image of one or more objects such as, for example, a posted sign that indicates a speed limit applicable to the road **230** at the site of the speeding violation, and/or an object that provides an indication of the location of the vehicle **215** at the time of the speeding violation (a mile marker, a street sign, a distinct building, etc.). The second record may further include one or more timestamps that provide an indication of a time at which the speeding violation occurred.

[0062] In an example implementation, the first record generated by the speeding violation responder system **125** and the second record generated by the speeding violation responder system **141** may be wirelessly transmitted to the computer **160** for use by a law-enforcement agency as court documents, if judicial action is taken in court against the driver of the vehicle **215**. In an example scenario, the second

record may be used to complement, supplement, support, or confirm evidence derived from the first record, and vice-versa.

[0063] The tandem pursuit arrangement described above involves both the law-enforcement vehicle **140** and the law-enforcement vehicle **105** traveling in the same direction (westwards) as the vehicle **215**. In one case, the tandem pursuit arrangement may support a hand-over arrangement wherein the law-enforcement vehicle **105** may discontinue pursuit of the vehicle **215** such as, for example, upon reaching a boundary line (county line, state line, etc.). The second record generated by the speeding violation responder system **141** of the law-enforcement vehicle **140** may be used in court cases to complement evidence derived from the first record.

[0064] In another example scenario in accordance with the disclosure, the law-enforcement vehicle **140** and the law-enforcement vehicle **105** may engage in an opposing arrangement for generating two independent records and/or for pursuing the vehicle **215** that is speeding. More particularly, in this example scenario, the law-enforcement vehicle **140** may be stationed further west of the law-enforcement vehicle **105**, alongside a road that runs parallel to the road **230**. The road **230** may be designated for one-way traffic moving westwards and the road that runs parallel to the road **230** may be designated for one-way traffic moving eastwards.

[0065] The second record generated by the law-enforcement vehicle **140** that is stationed (or moving) on the parallel road in the opposing arrangement, may be generated by the speeding violation responder system of the law-enforcement vehicle **140** by use of information obtained from one or more speed detection devices provided upon a front portion of the law-enforcement vehicle **140** and images captured by one or more image capture devices that may be mounted upon a front portion of the law-enforcement vehicle **140** (and/or a roof of the law-enforcement vehicle **140**). In this case, the second record is generated with respect to the vehicle **215** that is traveling on the road **230**. In another case, a third record in accordance with the disclosure can be generated with respect to a vehicle that is speeding eastwards on the road that runs parallel to the road **230**. In this configuration, the law-enforcement vehicle **140** can detect and take action not only on vehicles moving eastwards but also assist in generating a record of a vehicle moving westwards and/or pursue the vehicle moving westwards.

[0066] In yet another example scenario the road **230** can be a multi-lane highway. In accordance with an embodiment of the disclosure, the law-enforcement vehicle **140** and the law-enforcement vehicle **105** may engage in a side-by-side pursuit arrangement by traveling on either side of the vehicle **215**, such as, for example, on adjacent lanes of the multi-lane highway. The law-enforcement vehicle **105** can generate a first record and the law-enforcement vehicle **105** can generate a second record that may be used in court cases to complement evidence derived from the first record.

[0067] In at least some of the scenarios described above, a traffic ticket may be issued and/or a fine levied upon the driver **110** of the vehicle **105** based on detection of a speeding violation. In some cases, the traffic ticket and/or fine may be handed over to the driver **110** when the vehicle **105** reaches a toll-booth (when the road **230** is a toll road).

[0068] FIG. **5** shows a flowchart **500** of a method to detect a speeding violation in accordance with the disclosure. The flowchart **500** illustrates a sequence of operations that can be implemented in hardware, software, or a combination thereof. In the context of software, the operations represent computer-executable instructions stored on one or more non-transitory computer-readable media such as the memory **127**, that, when executed by one or more processors such as the processor **126**, perform the recited operations. Generally, computer-executable instructions include routines, programs, objects, components, data structures, and the like that perform particular functions or implement particular abstract data types. The order in which the operations are described is not intended to be construed as a limitation, and any number of the described operations may be carried out in a different order, omitted, combined in any order, and/or carried out in parallel. The description below may make reference to certain components and objects shown in FIGS. **1** through **4**, but it should be understood that this is done for purposes of explaining certain aspects of the disclosure and that the description is equally applicable to many other embodiments.

[0069] At block **505**, a speeding violation responder system of a first vehicle, such as, for example, the speeding violation responder system **125** of the law-enforcement vehicle **105**, may determine a speed of movement of a second vehicle such as, for example, the vehicle **215**. The speed of the second vehicle may be determined by use of various types of detection devices provided in the first vehicle. In an example implementation, the speed of the second vehicle may be determined by operating one of a radar device or a LIDAR device such as, for example, the radar device **107** or the LIDAR device **106** of the law-enforcement vehicle **105**. In another example implementation, the speed of the second vehicle may be determined by operating a radar device followed by operating a LIDAR device, such as, for example, operating the radar device **107** followed by operating the LIDAR device **106** of the law-enforcement vehicle **105**. Determining the speed of the second vehicle by operating a radar device followed by operating a LIDAR device allows identification of the second vehicle committing the speeding violation when the second vehicle is moving among a group of vehicles and/or when a radar beam measurement is adversely affected by an intervening vehicle that may be located between the radar device and the second vehicle. Additional details pertaining to determining a speed of a vehicle by operating a radar device followed by a LIDAR device are provided above with reference to FIG. **2** wherein a vehicle **220** may adversely affect a speed measurement performed by the radar device **107** for determining a speed of movement of the vehicle **215**.

[0070] At block **510**, a determination is made whether the speed of the second vehicle exceeds one or more threshold speeds. In an example implementation a first speed measurement obtained by operating a radar device may be compared to a first threshold speed. The first threshold speed, which may be settable by a law-enforcement officer may for example, be equal to, or different than, a posted speed limit. In one case, the first threshold speed may be used to alert the law-enforcement officer of a speeding condition on a road being monitored by a speeding violation responder system of a law-enforcement vehicle in which the law-enforcement officer is seated. A LIDAR device may then be used to measure a speed of movement of the second vehicle and compare the speed of movement of the second

vehicle against a second threshold speed. In one case, the second threshold speed may be set equal to the first threshold speed. In another case, the second threshold speed may be set to be different than the first threshold speed.

[0071] If the second vehicle is traveling below the threshold speed (below the second threshold speed, for example), the actions indicated in block **505** and block **510** are carried out.

[0072] If the second vehicle is traveling above the threshold speed (above the second threshold speed, for example), at block **515**, an image capture device such as, for example, a camera of the image capture system **170** may be activated to capture an image that includes at least a portion of the second vehicle.

[0073] At block **520**, one or more identifying features of the second vehicle may be determined by the speeding violation responder system (and/or the law-enforcement officer) based on evaluating one or more images captured by the image capture device. Some example identifying features can be a registration plate, a paint color, a damage (dent, missing part, etc.) and an accessory (ski rack, bicycle rack, spoiler etc.). In an example implementation, the speeding violation responder system may display one or more images of the second vehicle on a display screen of an infotainment system in the first vehicle and may seek the assistance of the law-enforcement officer to determine one or more identifying features of the second vehicle.

[0074] At block **525**, the speeding violation responder system may generate a record that is associated with the second vehicle. In an example scenario, the record can include a speed measurement associated with the second vehicle, an image of the second vehicle, and one or more identifying features of the second vehicle. In some cases, the record may further include a first timestamp when a speed measurement of the second vehicle was captured, a second timestamp when the image of the vehicle was captured, and/or location information where the speeding violation occurred.

[0075] At block **530** a determination is made whether a pursuit operation is to be executed. If a pursuit operation is to be executed, at block **535** a pursuit of the second vehicle by the first vehicle is executed. In an example scenario, the pursuit is carried out by the first vehicle in an independent manner. In another example scenario, the pursuit is carried out in cooperation with a third vehicle (another law-enforcement vehicle, for example) using, for example, a tandem pursuit arrangement or an opposing arrangement. The tandem pursuit arrangement and the opposing arrangement are described above.

[0076] At block **540** a determination is made whether the pursuit has been completed. If the pursuit has been completed or has been discontinued, the actions indicated in block **505** and subsequent blocks may be carried out. If the pursuit has not been completed, execution of the pursuit (indicated at block **535**) is continued.

[0077] If at block **530**, a determination is made not to proceed with a pursuit operation, at block **550**, information (such as, for example, a record associated with the second vehicle) may be transmitted by the speeding violation responder system of the first vehicle to a speeding violation responder system of a third vehicle and/or an IoT roadside unit. Some details pertaining to this operation are described above with respect to FIG. **3**.

[0078] In at least some scenarios, at block **545**, a record that is generated at block **525** may be transmitted to a server computer (such as, for example, the computer **160** described above). In some other scenarios, the record that is generated at block **525** may be transmitted to the server computer after a determination is made that a pursuit is not to be executed (block **530**).

[0079] FIG. **6** shows some functional components that may be included in the example vehicle **105** in accordance with an embodiment of the disclosure. The example components can include the image capture system **170**, the speed detection system **120**, the vehicle controller **130**, the infotainment system **135**, the communications system **115**, and the speeding violation responder system **125**. The various components are communicatively coupled to each other via one or more buses such as an example bus **611**. The bus **611** may be implemented using various wired and/or wireless technologies. For example, the bus **611** can be a vehicle bus that uses a controller area network (CAN) bus protocol, a Media Oriented Systems Transport (MOST) bus protocol, and/or a CAN flexible data (CAN-FD) bus protocol. Some or all portions of the bus **611** may also be implemented using wireless technologies such as Bluetooth®, Ultra-Wideband, Wi-Fi, Zigbee®, or near-field-communications (NFC). In an example implementation, a Matter protocol, which is a unifying, IP-based connectivity protocol may be used. The Matter protocol provides interoperability among various devices including artificial intelligence robots, drones, and Internet-of-Things (IoT) platforms.

[0080] The image capture system **170** can include various types of cameras such as, for example, the camera **108**, the camera **117**, and the camera **111** that are shown in FIG. **1**.

[0081] The speed detection system **120** can include various types of speed detection devices such as, for example, the radar device **107**, the radar device **113**, the radar device **116**, the LIDAR device **106**, the LIDAR device **112**, and the LIDAR device **114** that are shown in FIG. **1**.

[0082] The vehicle controller **130** can be operated to execute various operations related to the vehicle **105**, such as, for example, controlling engine operations (fuel injection, speed control, emissions control, braking, etc.), managing climate controls (air conditioning, heating etc.), activating airbags, and issuing alerts (check engine light, bulb issues, low tire pressure, etc.), and also for executing various operations in accordance with disclosure.

[0083] The infotainment system **135** can include a display system **601** having a GUI for carrying out various operations. The GUI may be used, for example, by the law-enforcement officer **110** to interact with the speeding violation responder system **125** and to execute actions associated with detecting speeding violations.

[0084] The communications system **115** can include various components such as, for example, a wireless transmitter, a wireless receiver, and/or a wireless transceiver, that are configured to allow the speeding violation responder system **125** to communicate with devices such as, for example, the computer **160**, the cloud computer **150**, the IoT roadside unit **145**, and the example speeding violation responder system **141** (of the example vehicle **140**), that are shown in FIG. **1**). The communications may be carried out via wireless signals either directly or via the network **155** by use of any of various communication formats such as, for example, WiFi,

cellular, TCP/IP, Bluetooth®, Ultra-Wideband, Wi-Fi, Ultra-Wideband (UBW), Zigbee®, and near-field-communications (NFC).

[0085] In one implementation, the speeding violation responder system **125** can be an independent device (enclosed in an enclosure, for example). In another implementation, some or all components of the speeding violation responder system **125** can be housed, merged, or can share functionality, with the vehicle controller **130**. For example, an integrated unit that combines the functionality of the speeding violation responder system **125** with that of the vehicle controller **130** can be operated by a single processor and a single memory device. In the illustrated example configuration, the speeding violation responder system **125** includes the processor **126**, an input/output interface **605**, and the memory **127**.

[0086] The input/output interface **605** is configured to provide communications between the speeding violation responder system **125** and other components such as the image capture system **170** (for obtaining captured images) and the speed detection system **120** (for obtaining speed measurements).

[0087] The memory **127**, which is one example of a non-transitory computer-readable medium, may be used to store an operating system (OS) **625**, a database **620**, and various code modules such as a speeding violation responder module **610** and an image evaluation module **615**. The code modules are provided in the form of computer-executable instructions that can be executed by the processor **126** for performing various operations in accordance with the disclosure.

[0088] The database **620** may be used to store information such as, for example, images captured by use of the cameras of the image capture system **170** and records of various traffic violations by one or more vehicles.

[0089] The speeding violation responder module **610** may be executed by the processor **126** for performing various operations in accordance with the disclosure, including, execution of some operations of the example flow chart **500** described above.

[0090] In the above disclosure, reference has been made to the accompanying drawings, which form a part hereof, which illustrate specific implementations in which the present disclosure may be practiced. It is understood that other implementations may be utilized, and structural changes may be made without departing from the scope of the present disclosure. References in the specification to "one embodiment," "an embodiment," "an example embodiment," "an example embodiment," etc., indicate that the embodiment described may include a particular feature, structure, or characteristic, but every embodiment may not necessarily include the particular feature, structure, or characteristic. Moreover, such phrases are not necessarily referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, one skilled in the art will recognize such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

[0091] Implementations of the systems, apparatuses, devices, and methods disclosed herein may comprise or utilize one or more devices that include hardware, such as, for example, one or more processors and system memory, as discussed herein. More particularly, it must be understood that various operations described above with respect to the speeding violation responder system **125** of the vehicle **105** can be executed by various other devices such as, for example, the computer **160** (and vice-versa). The computer **160** may execute these operations either independently, or in cooperation with the speeding violation responder system **125**.

[0092] An implementation of the devices, systems, and methods disclosed herein may communicate over a computer network. A "network" is defined as one or more data links that enable the transport of electronic data between computer systems and/or modules and/or other electronic devices. When information is transferred or provided over a network or another communications connection (either hardwired, wireless, or any combination of hardwired or wireless) to a computer, the computer properly views the connection as a transmission medium. Transmission media can include a network and/or data links, which can be used to carry desired program code means in the form of computer-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer. Combinations of the above should also be included within the scope of non-transitory computer-readable media.

[0093] Computer-executable instructions comprise, for example, instructions and data which, when executed at a processor, cause the processor to perform a certain function or group of functions. The computer-executable instructions may be, for example, binaries, intermediate format instructions, such as assembly language, or even source code. 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 described features or acts described above. Rather, the described features and acts are disclosed as example forms of implementing the claims.

[0094] A memory device, such as the memory **127**, can include any one memory element or a combination of volatile memory elements (e.g., random access memory (RAM, such as DRAM, SRAM, SDRAM, etc.)) and non-volatile memory elements (e.g., ROM, hard drive, tape, CDROM, etc.). Moreover, the memory device may incorporate electronic, magnetic, optical, and/or other types of storage media. In the context of this document, a "non-transitory computer-readable medium" can be, for example but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device. More specific examples (a non-exhaustive list) of the computer-readable medium would include the following: a portable computer diskette (magnetic), a random-access memory (RAM) (electronic), a read-only memory (ROM) (electronic), an erasable programmable read-only memory (EPROM, EEPROM, or Flash memory) (electronic), and a portable compact disc read-only memory (CD ROM) (optical). Note that the computer-readable medium could even be paper or another suitable medium upon which the program is printed, since the program can be electronically captured, for instance, via optical scanning of the paper or other medium, then compiled, interpreted or otherwise processed in a suitable manner if necessary, and then stored in a computer memory.

[0095] Those skilled in the art will appreciate that the present disclosure may be practiced in network computing environments with many types of computer system configu-

rations, including in-dash vehicle computers, personal computers, desktop computers, laptop computers, message processors, handheld devices, multi-processor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, mobile telephones, PDAs, tablets, pagers, routers, switches, various storage devices, and the like. The disclosure may also be practiced in distributed system environments where local and remote computer systems, which are linked (either by hardwired data links, wireless data links, or by any combination of hardwired and wireless data links) through a network, both perform tasks. In a distributed system environment, program modules may be located in both the local and remote memory storage devices.

[0096] Further, where appropriate, the functions described herein can be performed in one or more of hardware, software, firmware, digital components, or analog components. For example, one or more application specific integrated circuits (ASICs) can be programmed to carry out one or more of the systems and procedures described herein. Certain terms are used throughout the description, and claims refer to particular system components. As one skilled in the art will appreciate, components may be referred to by different names. This document does not intend to distinguish between components that differ in name, but not function.

[0097] It should be noted that the sensor embodiments discussed above may comprise computer hardware, software, firmware, or any combination thereof to perform at least a portion of their functions. For example, a sensor may include computer code configured to be executed in one or more processors and may include hardware logic/electrical circuitry controlled by the computer code. These example devices are provided herein for purposes of illustration and are not intended to be limiting. Embodiments of the present disclosure may be implemented in further types of devices, as would be known to persons skilled in the relevant art(s).

[0098] At least some embodiments of the present disclosure have been directed to computer program products comprising such logic (e.g., in the form of software) stored on any computer-usable medium. Such software, when executed in one or more data processing devices, causes a device to operate as described herein.

[0099] While various embodiments of the present disclosure have been described above, it should be understood that they have been presented by way of example only, and not limitation. It will be apparent to persons skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the present disclosure. Thus, the breadth and scope of the present disclosure should not be limited by any of the above-described example embodiments but should be defined only in accordance with the following claims and their equivalents. The foregoing description has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the present disclosure to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. Further, it should be noted that any or all of the aforementioned alternate implementations may be used in any combination desired to form additional hybrid implementations of the present disclosure. For example, any of the functionality described with respect to a particular device or component may be performed by another device or component. Further, while specific device characteristics have been described, embodiments of the disclosure may relate to numerous other device characteristics. Further, although embodiments have been described in language specific to structural features and/or methodological acts, it is to be understood that the disclosure is not necessarily limited to the specific features or acts described. Rather, the specific features and acts are disclosed as illustrative forms of implementing the embodiments. Conditional language, such as, among others, "can," "could," "might," or "may" unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain embodiments could include, while other embodiments may not include, certain features, elements, and/or steps. Thus, such conditional language is not generally intended to imply that features, elements, and/or steps are in any way required for one or more embodiments.

That which is claimed is:

1. A method comprising:

receiving, by a processor in a first vehicle, from a first vehicle speed detection system of the first vehicle, a speed measurement associated with a second vehicle;

determining, by the processor, based on evaluating the speed measurement, that a speed of the second vehicle exceeds a first threshold speed;

receiving, by the processor, from an image capture system of the first vehicle, an image comprising the second vehicle;

determining, by the processor, based on evaluating the image, at least a first identifying feature of the second vehicle; and

generating, by the processor, a record comprising the speed measurement, the image comprising the second vehicle, and the first identifying feature of the second vehicle.

2. The method of claim **1**, wherein the first vehicle is a first law-enforcement vehicle and wherein the method further comprises:

transmitting, by the processor, at least a portion of the record to at least one of a server computer that is configured to store information associated with traffic violations, a second law-enforcement vehicle, or an internet-of-things (IoT) roadside unit that is configured to provide tracking of the second vehicle.

3. The method of claim **1**, wherein the first vehicle is a first law-enforcement vehicle and wherein the method further comprises:

transmitting, by the processor, at least a portion of the record, to a second vehicle speed detection system of a second law-enforcement vehicle; and

transmitting, by the processor, a request to execute a pursuit operation of the second vehicle by the second law-enforcement vehicle based on the at least the portion of the record.

4. The method of claim **1**, wherein the first vehicle is a first law-enforcement vehicle and wherein the method further comprises:

displaying, by the processor, on a display screen of an infotainment system of the first vehicle, a notification that includes at least one of the speed measurement associated with the second vehicle, the image comprising the second vehicle, or the first identifying feature of the second vehicle.

5. The method of claim **1**, wherein the first threshold speed is equal to a posted speed limit, and wherein the method further comprises:

activating, by the processor, a radar device of the first vehicle speed detection system;

receiving, by the processor, from the radar device, a trigger signal indicating that at least one vehicle among a group of vehicles is traveling over a second threshold speed;

activating, by the processor, a light detection and ranging device of the first vehicle speed detection system; and

identifying, based on evaluating one or more speed measurements obtained from the light detection and ranging device, the second vehicle that is exceeding the second threshold speed.

6. The method of claim **5**, wherein the second threshold speed is settable to be different than the posted speed limit.

7. The method of claim **5**, wherein the first vehicle is a first law-enforcement vehicle and wherein the method further comprises:

generating, by the processor, an alert based on determining that the speed of the second vehicle exceeds the posted speed limit.

8. A method comprising:

determining, by a processor in a first vehicle, based on evaluating a speed measurement obtained from a first vehicle speed detection system of the first vehicle, that a second vehicle is traveling over a posted speed limit;

activating, by the processor, an image capture system of the first vehicle, to capture an image comprising the second vehicle; and

displaying, by the processor, on a display screen of an infotainment system of the first vehicle, a notification that includes at least one of the speed measurement associated with the second vehicle or the image comprising the second vehicle.

9. The method of claim **8**, wherein the first vehicle is a first law-enforcement vehicle and wherein the method further comprises:

activating, by the processor, a radar device of the first vehicle speed detection system;

receiving, by the processor, from the radar device, a trigger signal indicating that at least one vehicle among a group of vehicles is traveling over a threshold speed;

activating, by the processor, a light detection and ranging device of the first vehicle speed detection system; and

identifying, based on evaluating one or more speed measurements obtained from the light detection and ranging device, the second vehicle that is exceeding the posted speed limit.

10. The method of claim **9**, wherein the threshold speed is settable to be different than the posted speed limit.

11. The method of claim **8**, wherein the first vehicle is a first law-enforcement vehicle and wherein the method further comprises:

determining, by the processor, based on evaluating the image, at least a first identifying feature of the second vehicle;

generating, by the processor, a record comprising the speed measurement, the image comprising the second vehicle, and the first identifying feature of the second vehicle; and

transmitting, by the processor, at least a portion of the record to at least one of a server computer that is configured to store information associated with traffic violations or an internet-of-things (IoT) roadside unit that is configured to provide tracking of the second vehicle.

12. The method of claim **8**, wherein the first vehicle is a first law-enforcement vehicle and wherein the method further comprises:

transmitting, by the processor, to at least a computer of a third vehicle, an alert that the first law-enforcement vehicle is executing a pursuit operation.

13. The method of claim **8**, wherein the first vehicle is a first law-enforcement vehicle and wherein the method further comprises:

identifying, by the processor, a traffic condition around the second vehicle, based one evaluating the image; and

displaying, by the processor, on the display screen of the infotainment system of the first vehicle, an advisory to one of pursue the second vehicle or desist from pursuing the second vehicle, based on the traffic condition.

14. The method of claim **13**, further comprising:

transmitting, by the processor, to a second vehicle speed detection system of a second law-enforcement vehicle; the image comprising the second vehicle and the speed measurement; and

transmitting, by the processor, a request to execute a pursuit operation of the second vehicle by the second law-enforcement vehicle.

15. A vehicle comprising:

a vehicle speed detection system;

an image capture system; and

a speeding violation responder system comprising:

a memory that stores computer-executable instructions; and

a processor configured to access the memory and execute the computer-executable instructions to perform operations comprising:

receiving, from the vehicle speed detection system, a speed measurement associated with a second vehicle;

determining, based on evaluating the speed measurement, that a speed of the second vehicle exceeds a posted speed limit;

receiving, from the image capture system, an image that includes the second vehicle;

determining, based on evaluating the image, at least a first identifying feature of the second vehicle; and

generating, a record comprising the speed measurement, the image comprising the second vehicle, and the first identifying feature of the second vehicle.

16. The vehicle of claim **15**, wherein the vehicle is a first law-enforcement vehicle, and wherein the processor is further configured to access the memory and execute the computer-executable instructions to perform operations comprising:

transmitting at least a portion of the record to at least one of a server computer that is configured to store information associated with traffic violations, a second law-enforcement vehicle, or an internet-of-things (IoT) roadside unit that is configured to provide tracking of the second vehicle.

17. The vehicle of claim **15**, wherein the vehicle speed detection system comprises a radar device and a light detection and ranging device, and wherein the processor is further configured to access the memory and execute the computer-executable instructions to perform operations comprising:

activating the radar device;

receiving, from the radar device, a trigger signal indicating that at least one vehicle among a group of vehicles is traveling over a threshold speed;

activating the light detection and ranging device; and

identifying, based on evaluating one or more speed measurements obtained from the light detection and ranging device, the second vehicle that is exceeding the posted speed limit.

18. The vehicle of claim **17**, wherein the threshold speed is settable to be different than the posted speed limit.

19. The vehicle of claim **15**, further comprising an infotainment system comprising a display screen, and wherein the processor is further configured to access the memory and execute the computer-executable instructions to perform operations comprising:

displaying, on the display screen, a notification that includes at least one of the speed measurement associated with the second vehicle, the image comprising the second vehicle, or the first identifying feature of the second vehicle.

20. The vehicle of claim **15**, further comprising an infotainment system comprising a display screen, and wherein the processor is further configured to access the memory and execute the computer-executable instructions to perform operations comprising:

generating an alert based on determining that the speed of the second vehicle exceeds the posted speed limit; and

displaying the alert on the display screen.

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