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(54) **FALSE POSITIVE REQUEST DETECTION**

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(57)　　　　　　　　**ABSTRACT**

Systems, methods, and other embodiments described herein relate to detecting a false positive request to disengage a vehicle control system. In one embodiment, a method includes detecting a false positive request to disengage a vehicle control system based on a difference between a road wheel angle input and an angle of a road wheel controlled by the road wheel angle input and preventing the vehicle control system from disengaging based on detecting the false positive request.

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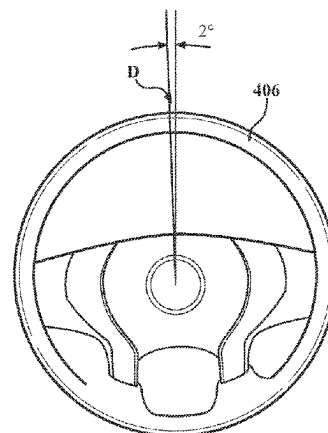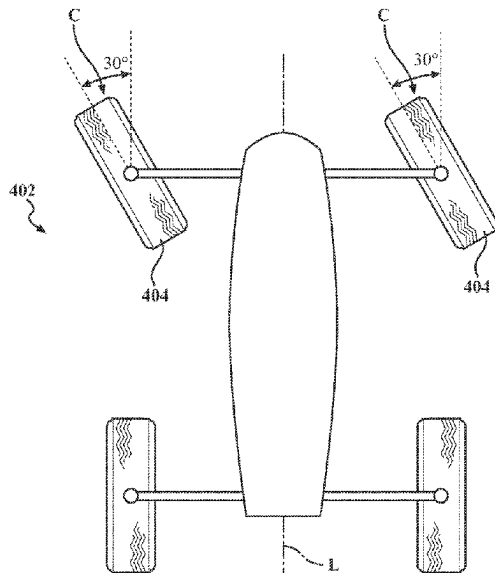
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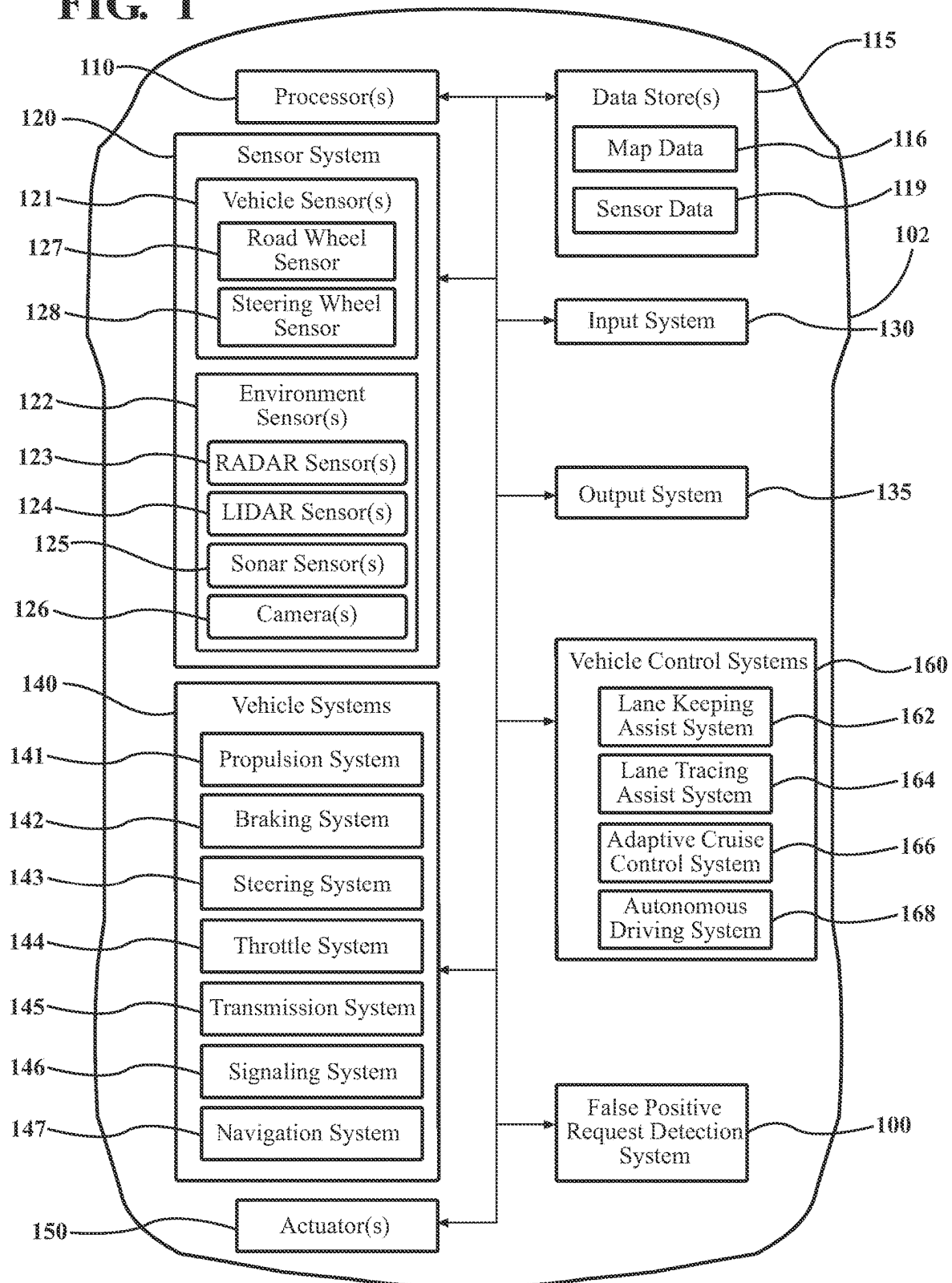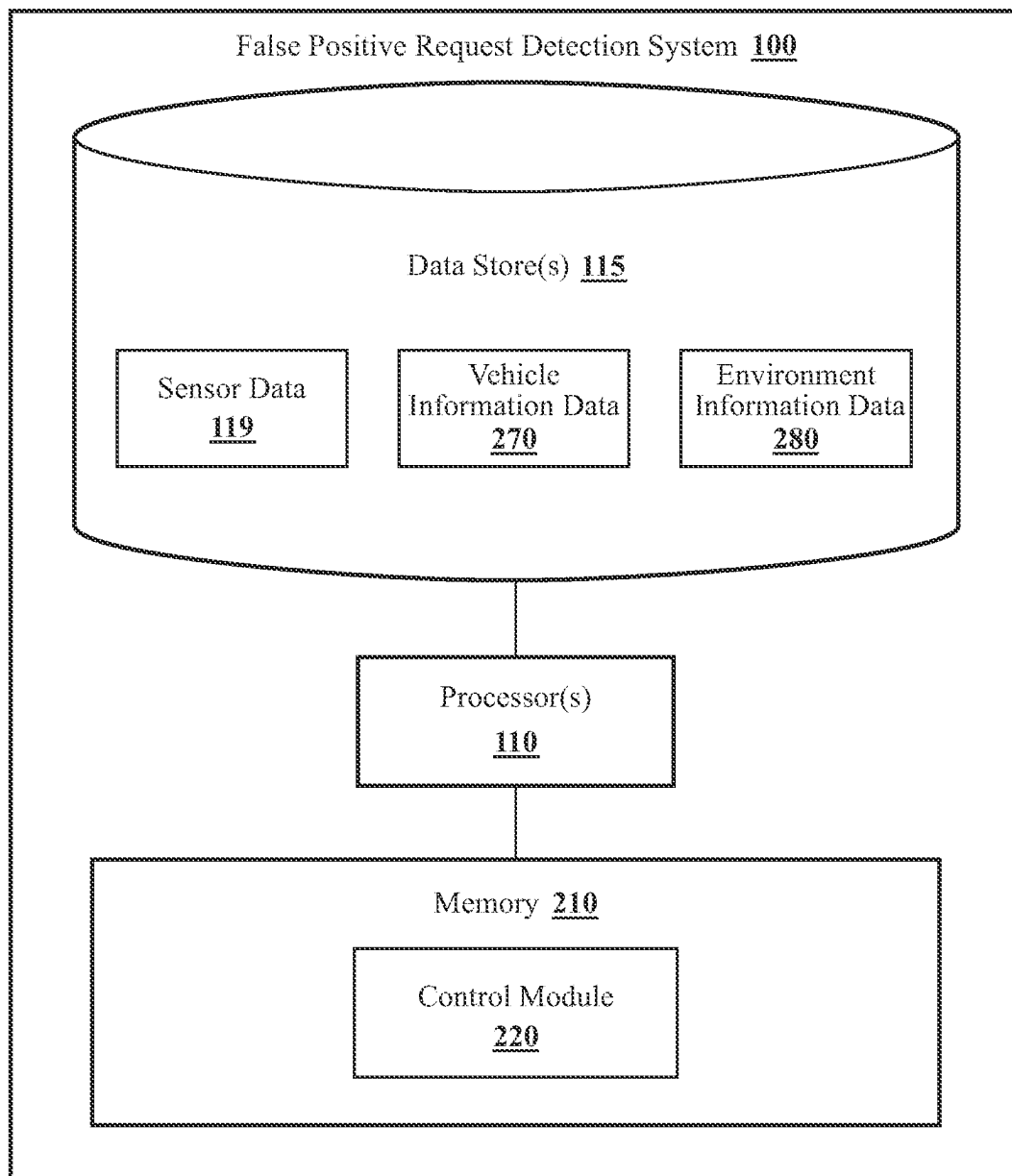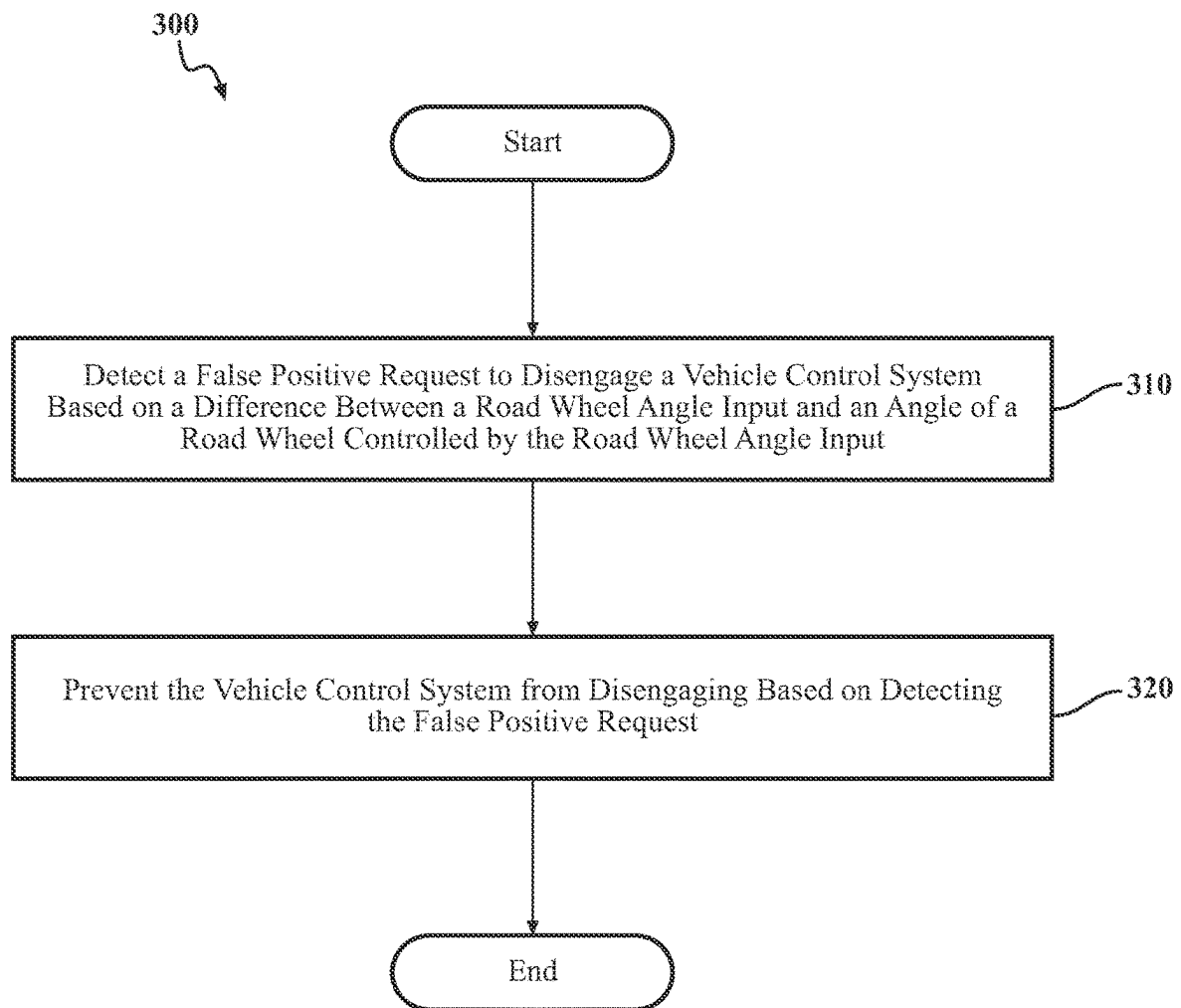
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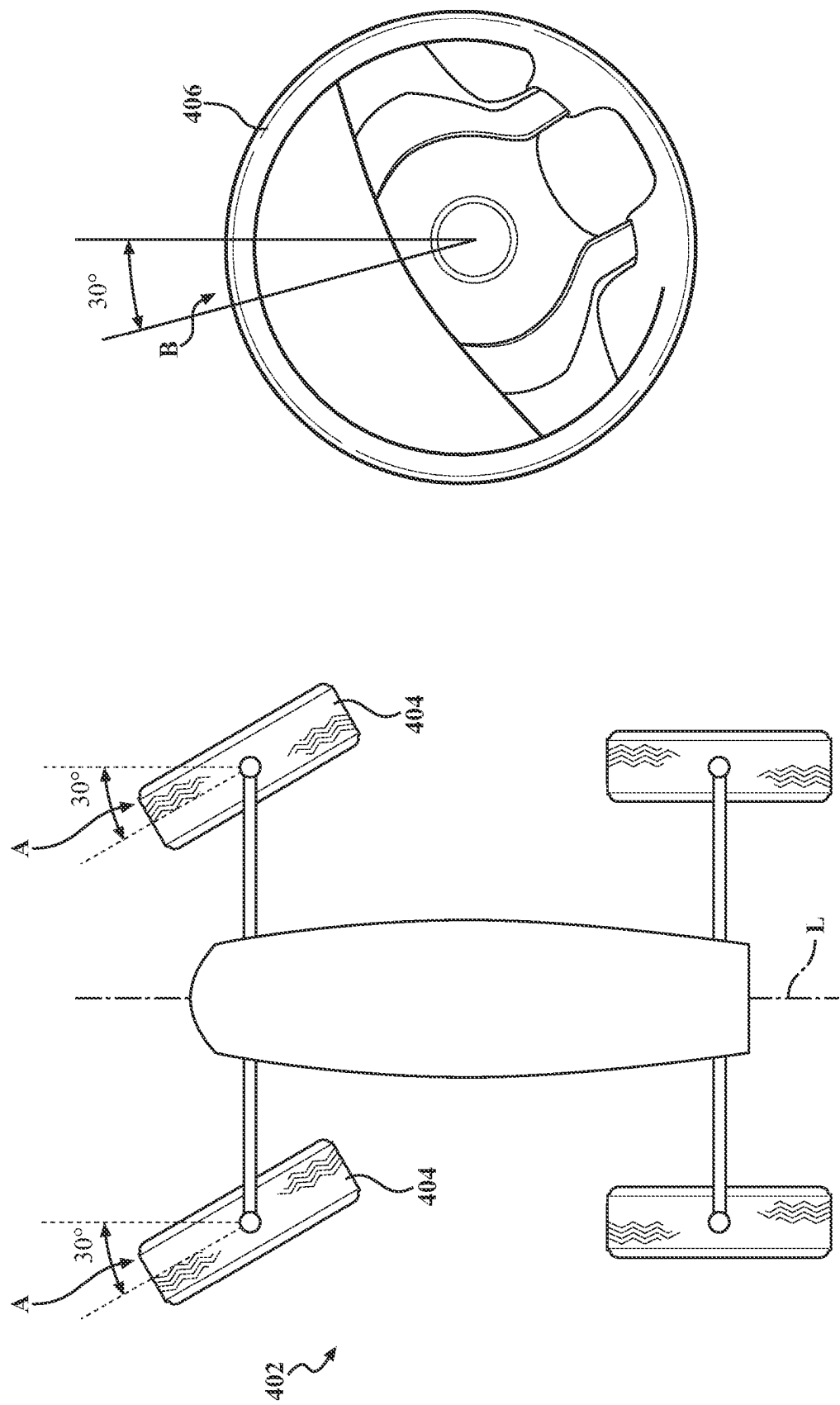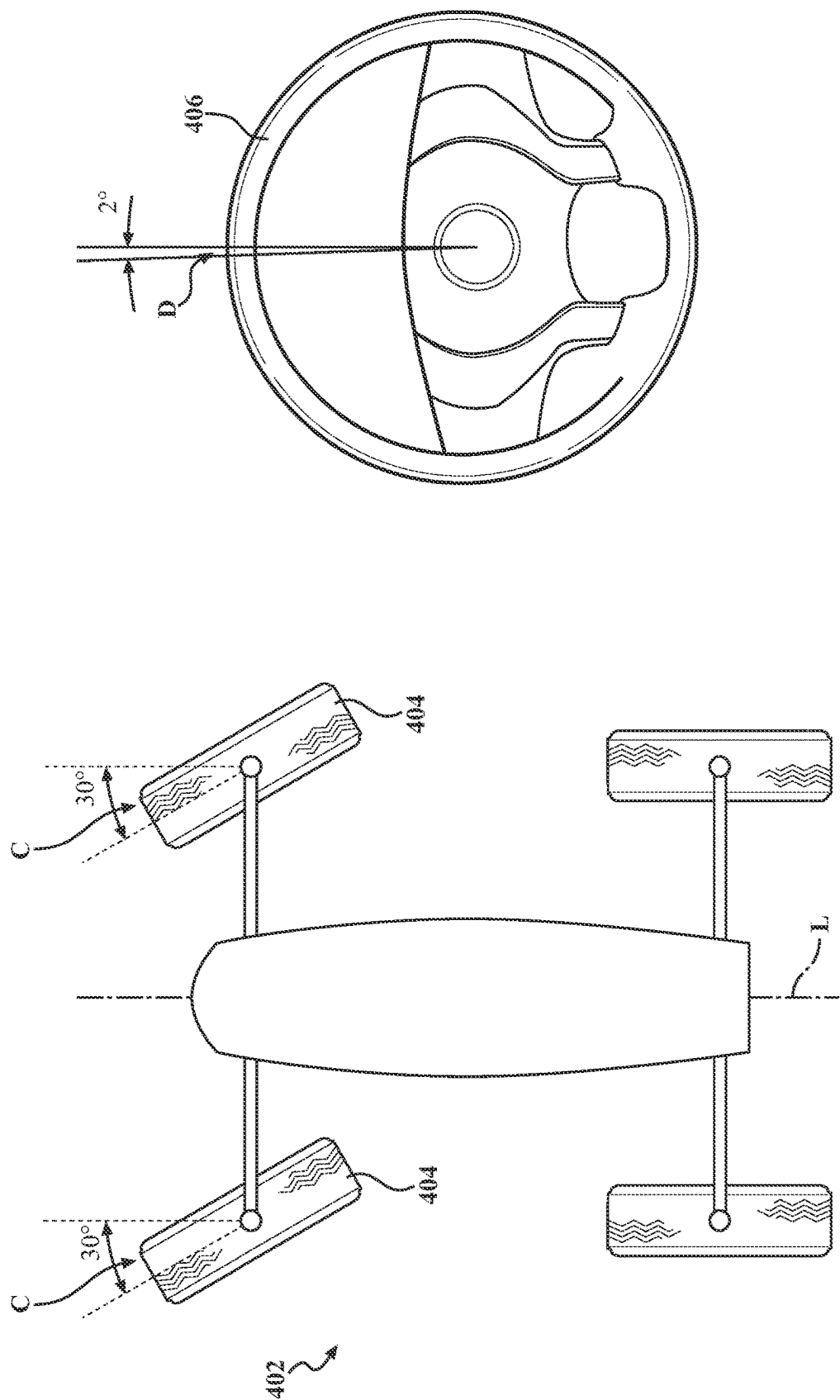
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FIG. 1

Processor(s) 110	Data Store(s) 115
	Map Data 116
	Sensor Data 119

Sensor System 120

Vehicle Sensor(s) 121
- Road Wheel Sensor 127
- Steering Wheel Sensor 128

Environment Sensor(s) 122
- RADAR Sensor(s) 123
- LIDAR Sensor(s) 124
- Sonar Sensor(s) 125
- Camera(s) 126

Input System 130 (102)

Output System 135

Vehicle Systems 140
- Propulsion System 141
- Braking System 142
- Steering System 143
- Throttle System 144
- Transmission System 145
- Signaling System 146
- Navigation System 147

Vehicle Control Systems 160
- Lane Keeping Assist System 162
- Lane Tracing Assist System 164
- Adaptive Cruise Control System 166
- Autonomous Driving System 168

False Positive Request Detection System 100

Actuator(s) 150

False Positive Request Detection System **100**

Data Store(s) **115**

| Sensor Data **119** | Vehicle Information Data **270** | Environment Information Data **280** |

Processor(s) **110**

Memory **210**

Control Module **220**

FIG. 2

300

Start

Detect a False Positive Request to Disengage a Vehicle Control System Based on a Difference Between a Road Wheel Angle Input and an Angle of a Road Wheel Controlled by the Road Wheel Angle Input — 310

Prevent the Vehicle Control System from Disengaging Based on Detecting the False Positive Request — 320

End

FIG. 3

FIG. 4A

FIG. 4B

FALSE POSITIVE REQUEST DETECTION

TECHNICAL FIELD

The subject matter described herein relates, in general, to systems and methods for detecting a false positive request to disengage a vehicle control system.

BACKGROUND

The background description provided is to present the context of the disclosure generally. Work of the inventor, to the extent it may be described in this background section, and aspects of the description that may not otherwise qualify as prior art at the time of filing, are neither expressly nor impliedly admitted as prior art against the present technology.

Some vehicles are equipped with one or more vehicle control systems such as a lane keeping assist system and an adaptive cruise control system. These vehicle control systems can be activated or deactivated using vehicle systems. As an example, the vehicle control systems can be deactivated using a braking system, a throttle system, or a steering system.

SUMMARY

This section generally summarizes the disclosure and is not a comprehensive explanation of its full scope or all its features.

In one embodiment, a method for detecting a false positive request to disengage a vehicle control system is disclosed. The method includes detecting a false positive request to disengage a vehicle control system based on a difference between a road wheel angle input and an angle of a road wheel controlled by the road wheel angle input and preventing the vehicle control system from disengaging based on detecting the false positive request.

In another embodiment, a system for detecting a false positive request to disengage a vehicle control system is disclosed. The system includes a processor and a memory in communication with the processor. The memory stores machine-readable instructions that, when executed by the processor, cause the processor to detect a false positive request to disengage a vehicle control system based on a difference between a road wheel angle input and an angle of a road wheel controlled by the road wheel angle input and prevent the vehicle control system from disengaging based on detecting the false positive request.

In another embodiment, a non-transitory computer-readable medium for detecting a false positive request to disengage a vehicle control system and including instructions that, when executed by a processor, cause the processor to perform one or more functions, is disclosed. The instructions include instructions to detect a false positive request to disengage a vehicle control system based on a difference between a road wheel angle input and an angle of a road wheel controlled by the road wheel angle input and prevent the vehicle control system from disengaging based on detecting the false positive request.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate various systems, methods, and other embodiments of the disclosure. It will be appreciated that the illustrated element boundaries

(e.g., boxes, groups of boxes, or other shapes) in the figures represent one embodiment of the boundaries. In some embodiments, one element may be designed as multiple elements or multiple elements may be designed as one element. In some embodiments, an element shown as an internal component of another element may be implemented as an external component and vice versa. Furthermore, elements may not be drawn to scale.

FIG. **1** illustrates a block diagram of a vehicle incorporating a false positive request detection system.

FIG. **2** is a more detailed block diagram of the false positive request detection system of FIG. **1**.

FIG. **3** is an example of a method for detecting a false positive request to disengage a vehicle control system.

FIGS. **4A-4B** are an example of a false positive request detection scenario.

DETAILED DESCRIPTION

Systems, methods, and other embodiments associated with detecting a false positive request to disengage a vehicle control system, are disclosed. A vehicle can be controlled using various vehicle control systems such as a lane keeping assist system, a lane tracing assist system, an autonomous vehicle control system, an autopilot system, and/or an adaptive cruise control system. Vehicle control systems can be activated or deactivated using vehicle systems such as a braking system, a throttle system, or a steering system.

Vehicle control systems that can be deactivated or disengaged using the steering system may be inadvertently disengaged when, as an example, a road wheel of the vehicle turns sharply in response to a bump in the road. An unplanned disengagement of a vehicle control system may result in the control of the vehicle being handed over to an unaware and unprepared operator, which can be dangerous. As such, the road wheel turning may trigger a false positive request to disengage the vehicle control system(s). In a case where not explicitly disclosed, the road wheel turning, the angle of the road wheel, and the rate of change of the angle of the road wheel in this disclosure are relative to the longitudinal axis of the vehicle.

Current methods are unable to detect a false positive request. As such, current methods, in response to the road wheel turning, may require user confirmation before disengagement. In other cases, the current methods may issue an alarm such as an audio alarm or visual alarm indicating that the road wheel turned and triggered the disengagement of the vehicle control system(s). Current methods may utilize torque to detect intervention which is not reliable and result in a high false positive rate.

Accordingly, in one embodiment, the disclosed approach is a system that detects a false positive request to disengage a vehicle control system and prevents the vehicle control system from disengaging based on detecting the false positive request. As an example, the system includes a road wheel sensor that monitors the angle of the road wheel and the rate of change of the angle of the road wheel relative to the longitudinal axis of the vehicle. The system includes a steering wheel sensor that monitors the angle of the steering wheel and the rate of change of the angle of the steering wheel. The system continually monitors the road wheel and the steering wheel by requesting sensor data relating to the angle of the road wheel, the rate of change of the angle of the road wheel, the angle of the steering wheel, and the rate of change of the angle of the steering wheel. In response to the road wheel turning, the system may first determine whether the rate of the change of the angle exceeds a

predetermined threshold value. In other words, the system determines whether the road wheel made a sharp turn that may trigger a request to disengage the vehicle control system. The system may then compare the difference between the angle of the road wheel and the angle of the steering wheel with a second predetermined threshold value. In the case that the difference does not exceed the second predetermined threshold value (i.e., the difference is between the predetermined threshold value and the second predetermined threshold value), the system may conclude that the road wheel turned due to a bump or a pothole in the road and not due to the rotation of the steering wheel. The system may then determine that the turning of the road wheel was not a disengagement request. In the case that the difference exceeds the second predetermined threshold, the system may conclude that the road wheel turned in response to the rotation of the steering wheel and as such, the turning of the road wheel was a disengagement request.

In one embodiment, the system may compare the difference between the rate of change of the angle of the road wheel and the rate of change of the angle of the steering wheel with a third predetermined threshold value. As such, the system may determine whether the road wheel turned faster and perhaps before the steering wheel rotated. In a case where the difference exceeds the third predetermined threshold value, the system may conclude that the road wheel turned due to a bump or a pothole in the road and not due to the rotation of the steering wheel. The system may then determine that the turning of the road wheel was not a disengagement request. In the case that the difference does not exceed the third predetermined threshold, the system may conclude that the road wheel turned in response to the rotation of the steering wheel and as such, the turning of the road wheel was a disengagement request.

The system may detect a false positive request using the angle of the road wheel and the angle of the steering wheel. Additionally and/or alternatively, the system may detect a false positive request using the rate of change of the angle of the road wheel and the rate of change of the angle of the steering wheel.

The embodiments disclosed herein present various advantages over the current methods. First, the embodiments detect false positive requests with higher accuracy than the current methods. Second, the embodiments reduce unexpected disengagement of a vehicle control system. Third, the embodiments utilize sensors and do not require extensive hardware or computing resources.

Detailed embodiments are disclosed herein; however, it is to be understood that the disclosed embodiments are intended only as examples. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the aspects herein in virtually any appropriately detailed structure. Further, the terms and phrases used herein are not intended to be limiting but rather to provide an understandable description of possible implementations. Various embodiments are shown in the figures, but the embodiments are not limited to the illustrated structure or application.

It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the

art that the embodiments described herein can be practiced without these specific details.

Referring to FIG. 1, a block diagram of a vehicle 102 incorporating a false positive request detection system 100 is illustrated. The vehicle 102 includes various elements. It will be understood that in various embodiments, it may not be necessary for the vehicle 102 to have all of the elements shown in FIG. 1. The vehicle 102 can have any combination of the various elements shown in FIG. 1. Further, the vehicle 102 can have additional elements to those shown in FIG. 1. In some arrangements, the vehicle 102 may be implemented without one or more of the elements shown in FIG. 1. While the various elements are shown as being located within the vehicle 102 in FIG. 1, it will be understood that one or more of these elements can be located external to the vehicle 102. Further, the elements shown may be physically separated by large distances. For example, as discussed, one or more components of the disclosed system can be implemented within a vehicle while further components of the system can be implemented within a cloud-computing environment.

Some of the possible elements of the vehicle 102 are shown in FIG. 1 and will be described along with subsequent figures. However, a description of many of the elements in FIG. 1 will be provided after the discussion of FIGS. 2-4 for purposes of brevity of this description. Additionally, it will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. In addition, the discussion outlines numerous specific details to provide a thorough understanding of the embodiments described herein. Those of skill in the art, however, will understand that the embodiments described herein may be practiced using various combinations of these elements. In any case, as illustrated in the embodiment of FIG. 1, the vehicle 102 includes a false positive request detection system 100 that is implemented to perform methods and other functions as disclosed herein relating to detecting a false positive request to disengage a vehicle control system. As an example, the false positive request detection system 100, in various embodiments, may be implemented partially within the vehicle 102 and may further exchange communications with additional aspects of the false positive request detection system 100 that are remote from the vehicle 102 in support of the disclosed functions. Thus, while FIG. 2 generally illustrates the false positive request detection system 100 as being self-contained, in various embodiments, the false positive request detection system 100 may be implemented within multiple separate devices some of which may be remote from the vehicle 102.

The vehicle 102 can include one or more vehicle control systems 160. The vehicle control system 160 can include one or more devices, applications, and/or combinations thereof, now known or later developed, configured to control the movement, speed, maneuvering, heading, direction, etc. of the vehicle 102. The vehicle control systems 160 can include one or more driver assistance systems such as a lane keeping assist system 162, a lane tracing assist system 164, an adaptive cruise control system 166, an autonomous driving system 168, a lane centering system, a collision avoidance system, and/or a driver monitoring system. As an example, a vehicle control system 160 can control the steering of the vehicle 102 by generating a road wheel angle input and sending the road wheel angle input to the wheel(s) of the vehicle 102. The vehicle control system 160 may generate and send the road wheel angle input using an electronic control unit (ECU). Additionally and/or alterna-

tively, the vehicle control system **160** may take control of the steering wheel in the vehicle **102** and control the rotation of the steering wheel to steer the vehicle **102**. The vehicle control systems **160** may be disengaged by turning the steering wheel such that the road wheels of the vehicle **102** rotate along the longitudinal axis of the vehicle **102**.

The vehicle **102** can include a sensor system **120**. The sensor system **120** can include one or more vehicle sensors **121**. The vehicle sensor(s) **121** can detect, determine, and/or sense information about the vehicle **102** itself. In one or more arrangements, the vehicle sensor(s) **121** can be configured to detect, and/or sense position and orientation changes of the vehicle **102**, such as, for example, based on inertial acceleration. In one or more arrangements, the vehicle sensor(s) **121** can include one or more accelerometers, one or more gyroscopes, an inertial measurement unit (IMU), a dead-reckoning system, a global navigation satellite system (GNSS), a global positioning system (GPS), and/or other suitable sensors. The vehicle sensor(s) **121** can be configured to detect, and/or sense one or more characteristics of the vehicle **102**. In one or more arrangements, the vehicle sensor(s) **121** can include a road wheel sensor **127** for detecting an angle and/or a rate of change of the angle of a road wheel of the vehicle **102** relative to the longitudinal axis of the vehicle **102**. In one or more arrangements, the vehicle sensor(s) **121** can include a steering wheel sensor **128** for detecting an angle and/or a rate of change of the angle of a steering wheel of the vehicle **102** relative to the longitudinal axis of the vehicle **102**.

With reference to FIG. 2, a more detailed block diagram of the false positive request detection system **100** is shown. The false positive request detection system **100** may include a processor(s) **110**. Accordingly, the processor(s) **110** may be a part of the false positive request detection system **100**, or the false positive request detection system **100** may access the processor(s) **110** through a data bus or another communication pathway. In one or more embodiments, the processor(s) **110** is an application-specific integrated circuit that may be configured to implement functions associated with a control module **220**. More generally, in one or more aspects, the processor(s) **110** is an electronic processor, such as a microprocessor that can perform various functions as described herein when loading the control module and executing encoded functions associated therewith.

The false positive request detection system **100** may include a memory **210** that stores the control module **220**. The memory **210** may be a random-access memory (RAM), read-only memory (ROM), a hard disk drive, a flash memory, or other suitable memory for storing the control module **220**. The control module **220** includes, for example, computer-readable instructions that, when executed by the processor(s) **110**, cause the processor(s) **110** to perform the various functions disclosed herein. While, in one or more embodiments, the control module **220** is a set of instructions embodied in the memory **210**, in further aspects, the control module **220** includes hardware, such as processing components (e.g., controllers), circuits, etc. for independently performing one or more of the noted functions.

The false positive request detection system **100** may include a data store(s) **115** for storing one or more types of data. Accordingly, the data store(s) **115** may be a part of the false positive request detection system **100**, or the false positive request detection system **100** may access the data store(s) **115** through a data bus or another communication pathway. The data store(s) **115** is, in one embodiment, an electronically based data structure for storing information. In at least one approach, the data store **115** is a database that

is stored in the memory **210** or another suitable medium, and that is configured with routines that can be executed by the processor(s) **110** for analyzing stored data, providing stored data, organizing stored data, and so on. In either case, in one embodiment, the data store **115** stores data used by the control module **220** in executing various functions. In one embodiment, the data store **115** may be able to store sensor data **119** and/or other information that is used by the control module **220**.

The data store(s) **115** may include volatile and/or non-volatile memory. Examples of suitable data stores **115** include RAM (Random Access Memory), flash memory, ROM (Read Only Memory), PROM (Programmable Read-Only Memory), EPROM (Erasable Programmable Read-Only Memory), EEPROM (Electrically Erasable Programmable Read-Only Memory), registers, magnetic disks, optical disks, hard drives, or any other suitable storage medium, or any combination thereof. The data store(s) **115** may be a component of the processor(s) **110**, or the data store(s) **115** may be operatively connected to the processor(s) **110** for use thereby. The term "operatively connected" or "in communication with" as used throughout this description, can include direct or indirect connections, including connections without direct physical contact.

In one or more arrangements, the data store(s) **115** can include sensor data **119**. The sensor data **119** can originate from the sensor system **120** of the vehicle **102**. The sensor data **119** can include data from visual sensors, audio sensors, road wheel sensors **127**, steering wheel sensors **128**, and/or any other suitable sensors in the vehicle **102**. The sensor data **119** can include the angle(s) of one or more road wheels of the vehicle **102**. The sensor data **119** can include the rate of change of the angle(s) of the one or more road wheels. The sensor data **119** can include the angle of the steering wheel of the vehicle **102**. The sensor data **119** can include the rate of change of the angle(s) of the steering wheel.

In one or more arrangements, the data store(s) **115** can include vehicle information data **270**. The vehicle information data **270** may include information about the vehicle **102**. The vehicle information data **270** may include vehicle control input(s) such as road wheel angle input and/or a speed input. The vehicle information data **270** may be from the vehicle control system(s) **160**, the ECU, or any suitable control or monitoring system.

In one or more arrangements, the data store(s) **115** can include environment information data **280**. The environment information data **280** may include information about the environment surrounding the vehicle **102** such as the location and condition of the path that the vehicle **102** is travelling on. The location of the path(s) may include geographic coordinates of the path. The condition of the path may include information about the physical condition of the path such as the presence of potholes, road debris, and vegetation.

The sensor data **119**, the vehicle information data **270**, and the environment information data **280** may be digital data that describe information used by the false positive request detection system **100** to control a vehicle control system **160**.

In one embodiment, the control module **220** may include instructions that, when executed by the processor(s) **110**, cause the processor(s) **110** to detect a false positive request to disengage a vehicle control system **160** based on a difference between a road wheel angle input and an angle of a road wheel controlled by the road wheel angle input and prevent the vehicle control system from disengaging based on detecting the false positive request. The vehicle control

system **160** is capable of being disengaged based on the road wheel angle input. In such a case, in response to the road wheel angle input changing by a certain angle value, the presently engaged vehicle control system **160** disengages. As explained further below, the road wheel angle input may be based on a steering wheel input. Additionally and/or alternatively, the road wheel angle input may be based on the ECU.

In one embodiment, the control module **220** continuously monitors one or more road wheels of the vehicle **102**. As such, the control module **220** may continuously request and receive sensor data **119** from the road wheel sensor **127**. As an example, the sensor data **119** may include an indication that the road wheel has rotated by an angle relative to the longitudinal axis of the vehicle **102**. The sensor data **119** may also include the angle of the road wheel relative to the longitudinal axis of the vehicle **102**. The sensor data **119** may also include a rate of change of the angle of the road wheel relative to the longitudinal axis of the vehicle **102**. In other words, the sensor data **119** may include a rate of rotation of the road wheel relative to the longitudinal axis of the vehicle **102**. The sensor data **119** may also include how long the road wheel remained rotated to the angle.

In one embodiment, the control module **220** continuously monitors the road wheel control input. The road wheel is controlled by the road wheel control input. The road wheel control input may control the angle of the road wheel relative to the longitudinal axis of the vehicle **102** and/or the rate of rotation of the road wheel relative to the longitudinal axis of the vehicle **102**. Thus, a vehicle system **140** or a vehicle control system **160** may control the steering of the vehicle **102** by controlling the angle of the road wheel relative to the longitudinal axis of the vehicle **102** and/or the rate of rotation of the road wheel relative to the longitudinal axis of the vehicle **102**. The road wheel control input may also determine the rate of rotation of the road wheel about an axis perpendicular to the road wheel and through the center mass of the road wheel. Thus, the vehicle system **140** or the vehicle control system **160** may control the speed at which the vehicle **102** is travelling by controlling the rate of rotation of the road wheel about an axis perpendicular to the road wheel and through the center mass of the road wheel.

As an example, a vehicle control system **160** may control the steering of the vehicle **102** by controlling the angle of the road wheel and the rate of change of the angle of the road wheel relative to the longitudinal axis of the vehicle **102** using the road wheel angle input. The vehicle control system **160** may generate a road wheel angle input based on and using any suitable methods. The vehicle control system **160** may then transmit the road wheel angle input to the road wheel. As an example, the vehicle control system **160** may transmit the road wheel angle input to the road wheel through the steering wheel. In such an example, the vehicle control system **160** may control and rotate the steering wheel based on the road wheel angle input and, in response, the road wheel moves according to the road wheel angle input. In another example, the vehicle control system **160** may send the road wheel angle input to the ECU or any other suitable control unit that is capable of controlling the road wheel. In such an example, the ECU or any other suitable control unit may then control the road wheel according to the road wheel angle input.

The control module **220** may request and receive sensor data **119** from the steering wheel sensor **128** and/or cameras monitoring the steering wheel. The sensor data **119** may include the road wheel angle input and/or the rate of change of the road wheel angle input. The control module **220** may

request and receive the road wheel angle input and/or the rate of change of the road wheel angle input from the ECU or any suitable control unit capable of controlling the road wheel.

In one or more arrangements where a vehicle control system **160** is presently engaged and can be disengaged by the road wheel angle input, the control module **220** continually receives information indicating whether the road wheel has rotated by an angle relative to the longitudinal axis of the vehicle **102**, the angle of the road wheel, the road wheel angle input, and/or the length of time that the wheel remained rotated to the angle. The control module **220** then determines whether the rotation of the road wheel is a positive request to disengage the vehicle control system **160** based on the previously mentioned information.

As an example, the control module **220** determines a first threshold value and a second threshold value which become the predetermined threshold value and the second predetermined threshold value respectively. The control module **220** may determine the first threshold value based on the characteristics of the road that the vehicle **102** is travelling on. As an example, the control module **220** may receive sensor data **119** from cameras on the vehicle **102** indicating that the road is bumpy and has several potholes. The control module **220** may then generate the first threshold value to be an angle that the road wheel may rotate to without triggering the request to disengage the vehicle control system **160**. As an example, the control module **220** may generate a first threshold value that is a relatively higher value so as not to capture the road wheel rotating and/or the road wheel and the road wheel angle input being out of alignment due to the bumpy road or a pothole. The control module **220** may generate a first threshold value that is relatively lower value when the vehicle **102** is travelling on a smooth road without any bumps or potholes. As another example, the control module **220** may determine the first threshold value based on the characteristics of the vehicle **102** such the alignment of the road wheel and the road wheel angle input or the suspension system of the vehicle **102**. As another example, the control module **220** may determine the first threshold value based on a predetermined setting or a factory setting of the vehicle **102**.

The control module **220** determines the second threshold value based on the characteristics of the vehicle **102**. As an example, the control module **220** determines the second threshold value based on the factory settings of the vehicle **102**. As another example, the control module **220** may determine the second threshold value based on the precision of the vehicle **102**. In such an example, the control module **220** may generate a second threshold value that is a lower value for a vehicle **102** that has been calibrated such that there is a relatively high alignment between the angle of the road wheel and the road wheel angle input. In such an example, the angle of the road wheel and the road wheel angle input tend to be the same value during normal vehicle operation. As another example, the control module **220** may generate a second threshold value that is a higher value for a vehicle **102** that has been calibrated such that there is a relatively low alignment between the angle of the road wheel and the road wheel angle input. In such an example, the angle of the road wheel may be slightly higher or slightly lower than the road wheel angle input during normal vehicle operation. As such, the second threshold value may be higher for the vehicle **102** with less alignment between the angle of the road wheel and the road wheel angle input than for the vehicle **102** with more alignment between the angle of the road wheel and the road wheel angle input so as not

to capture normal vehicle operation cases. The control module **220** may generate the second threshold value based on any suitable characteristics of the vehicle **102** such as the responsiveness of the vehicle **102**, the size of the vehicle **102**, and/or the accuracy of the vehicle systems **140**.

As previously mentioned, the control module **220** continually receives information indicating whether the road wheel has rotated by an angle relative to the longitudinal axis of the vehicle **102**, the angle of the road wheel, and the road wheel angle input. The control module **220** then compares the angle of the road wheel to the first threshold value. In a case where the control module **220** determines that the angle of the road wheel does not exceed the first threshold value, the control module **220** does not disengage the presently engaged vehicle control system **160**. In a case where the control module **220** determines that the angle of the road wheel exceeds the first threshold value, the control module **220** proceeds to compare the angle of the road wheel to the road wheel angle input.

The control module **220** receives the angle of the road wheel and the road wheel angle input as previously disclosed. The control module **220** then determines a difference between the angle of the road wheel and the road wheel angle input and compares the difference to the second threshold value. In a case where the control module **220** determines that the difference exceeds the second threshold value, the control module **220** determines that a positive request to disengage the presently engaged vehicle control system **160** has been inputted. In response, the control module **220** disengages the presently engaged vehicle control system **160**. In a case where the control module **220** determines that the difference does not exceed the second threshold value, the control module **220** determines that a false positive request has been received and the control module **220** does not respond to the false positive request. As such, the control module **220** does not disengage the presently engaged vehicle control system **160**. In other words, the control module **220** prevents the vehicle control system **160** from disengaging based on the false positive request.

In one or more arrangements, the control module **220** continually receives information indicating whether the road wheel has rotated by an angle relative to the longitudinal axis of the vehicle **102**, the rate of change of the angle of the road wheel, and the rate of change of the road wheel angle input. The control module **220** then compares the angle of the road wheel to the first threshold value. In a case where the control module **220** determines that the angle of the road wheel does not exceed the first threshold value, the control module **220** does not disengage the presently engaged vehicle control system **160**. In a case where the control module **220** determines that the angle of the road wheel exceeds the first threshold value, the control module proceeds to comparing the rate of change of the angle of the road wheel to the rate of change of the road wheel angle input.

The control module **220** receives the rate of change of the angle of the road wheel and the rate of change of the road wheel angle input as previously disclosed. The control module **220** then determines a difference between the rate of change of the angle of the road wheel and the rate of change of the road wheel angle input and compares the difference to a third threshold value. The control module **220** may determine the third threshold value using any suitable methods, and the third threshold value becomes the third predetermined threshold value. Similar to the second threshold value, the control module **220** may determine the third

threshold value based on the characteristics of the vehicle **102**. In a case where the control module **220** determines that the difference does not exceed the third threshold value, the control module **220** determines that a positive request to disengage the presently engaged vehicle control system **160** has been inputted. In response, the control module **220** disengages the presently engaged vehicle control system **160**. In a case where the control module **220** determines that the difference exceeds the third threshold value, the control module **220** determines that a false positive request has been received and the control module **220** does not respond to the false positive request. As such, the control module **220** does not disengage the presently engaged vehicle control system **160**. In other words, the control module **220** prevents the vehicle control system **160** from disengaging based on the false positive request.

FIG. **3** illustrates a method **300** for detecting a false positive request to disengage a vehicle control system **160**. The method **300** will be described from the viewpoint of the vehicle **102** of FIG. **1** and the false positive request detection system **100** of FIGS. **1** and **2**. However, the method **300** may be adapted to be executed in any one of several different situations and not necessarily by the vehicle **102** of FIG. **1** and/or the false positive request detection system **100** of FIGS. **1** and **2**.

At step **310**, the control module **220** may cause the processor(s) **110** to detect a false positive request to disengage a vehicle control system **160** based on a difference between a road wheel angle input and an angle of a road wheel controlled by the road wheel angle input. The vehicle control system **160** is capable of disengaging in response to a road wheel angle input. In one embodiment, the road wheel angle input may be based on a steering wheel input. In another embodiment, the road wheel angle input may be based on an ECU.

As previously mentioned, and as an example, the false positive request detection system **100** or more specifically, the control module **220** may receive the road wheel angle input from a steering wheel sensor **128** and the angle of the road wheel controlled by the road wheel input from a road wheel sensor **127**. The control module **220** may determine a difference between the road wheel angle input and the angle of the road wheel and determine whether the difference exceeds a predetermined threshold value. The predetermined threshold may be based on characteristics of the vehicle **102** and/or characteristics of the road the vehicle **102** is travelling on.

As another example, the control module **220** may receive the rate of change of the road wheel angle input from the steering wheel sensor **128** and the rate of change of the angle of the road wheel controlled by the road wheel input from the road wheel sensor **127**. The control module **220** may determine a difference between the rate of change of the road wheel angle input and the rate of change of the angle of the road wheel and determine whether the difference exceeds the predetermined threshold value. As disclosed above, the predetermined threshold may be based on characteristics of the vehicle **102** and/or characteristics of the road the vehicle **102** is travelling on.

At step **320**, the control module **220** may cause the processor(s) **110** to prevent the vehicle control system **160** from disengaging based on detecting the false positive request. As an example, the control module **220** may determine that the difference between the road wheel angle input and the angle of the road wheel exceeds the predetermined threshold value and, in response, may prevent the vehicle control system **160** from disengaging. As another example,

the control module **220** may determine that the difference between the rate of change of the road wheel angle input and the rate of change of the angle of the road wheel exceeds the predetermined threshold value and, in response, may prevent the vehicle control system **160** from disengaging.

As another example, the control module **220** may determine that the difference between the road wheel angle input and the angle of the road wheel is between the predetermined threshold value and a second predetermined threshold value, where the second predetermined threshold value is larger than the predetermined threshold value. In such an example, the control module **220** may determine the rotation of the road wheel to be a false positive and thus, prevent the vehicle control system **160** from disengaging. As another example, the control module **220** may determine that the difference between the road wheel angle input and the angle of the road wheel exceeds the second predetermined threshold value. In such an example, the control module **220** may determine the rotation of the road wheel to be a true positive and thus, disengage the vehicle control system **160**.

A non-limiting example of the operation of the false positive request detection system **100** and/or one or more of the methods will now be described in relation to FIGS. **4A-4B**. FIGS. **4A-4B** show an example of a false positive request detection scenario.

FIGS. **4A-4B** show a vehicle **402** that includes a vehicle control system **160**, the lane keeping assist system **162**, which is presently activated and engaged in controlling the vehicle **402**. The vehicle **402** includes the false positive request detection system **100** and is similar to the vehicle **102** described above.

As shown in FIG. **4A**, the vehicle **402** is traveling along and the two front road wheels **404** turn at an angle A relative to the longitudinal axis L of the vehicle **402**. The false positive request detection system **100** or more specifically, the control module **220** receives the angle A of the road wheels **404** from the road wheel sensor **127** and the angle B of the steering wheel **406**, which is the road wheel angle input, from the steering wheel sensor **128**. The control module **220** determines a difference between the angle A of the road wheel **404**, which is 30 degrees and the angle B of the steering wheel **406**, which is also 30 degrees. The control module **220** then compares the difference of zero to a predetermined threshold value of 20 degrees. In this example, the control module **220** determines that the difference does not exceed the predetermined threshold value and permits the vehicle control system **160** to disengage. As such, the vehicle control system **160** becomes disengaged and no longer active.

As shown in FIG. **4B**, the vehicle **402** is traveling along and the two front road wheels **404** turn at an angle C relative to the longitudinal axis L of the vehicle **402**. The false positive request detection system **100** or more specifically, the control module **220** receives the angle C of the road wheel **404** from the road wheel sensor **127** and the angle D of the steering wheel **406**, which is the road wheel angle input, from the steering wheel sensor **128**. The control module **220** determines a difference between the angle C of the road wheel **404**, which is 30 degrees and the angle D of the steering wheel **406**, which is 2 degrees. The control module then compares the difference of 28 degrees to a predetermined threshold value of 20 degrees. In this example, the control module **220** determines that the difference exceeds the predetermined threshold value and prevents the vehicle control system **160** from disengaging. As such, the vehicle control system **160** remains engaged and active.

FIG. **1** will now be discussed in full detail as an example environment within which the system and methods disclosed herein may operate. In some instances, the vehicle **102** is configured to switch selectively between an autonomous mode, one or more semi-autonomous operational modes, and/or a manual mode. Such switching can be implemented in a suitable manner, now known, or later developed. "Manual mode" means that all of or a majority of the navigation and/or maneuvering of the vehicle is performed according to inputs received from a user (e.g., human driver). In one or more arrangements, the vehicle **102** can be a conventional vehicle that is configured to operate in only a manual mode.

In one or more embodiments, the vehicle **102** is an autonomous vehicle. As used herein, "autonomous vehicle" refers to a vehicle that operates in an autonomous mode. "Autonomous mode" refers to navigating and/or maneuvering the vehicle **102** along a travel route using one or more computing systems to control the vehicle **102** with minimal or no input from a human driver. In one or more embodiments, the vehicle **102** is highly automated or completely automated. In one embodiment, the vehicle **102** is configured with one or more semi-autonomous operational modes in which one or more computing systems perform a portion of the navigation and/or maneuvering of the vehicle along a travel route, and a vehicle operator (i.e., driver) provides inputs to the vehicle to perform a portion of the navigation and/or maneuvering of the vehicle **102** along a travel route.

The vehicle **102** can include one or more processors **110**. In one or more arrangements, the processor(s) **110** can be a main processor of the vehicle **102**. For instance, the processor(s) **110** can be an electronic control unit (ECU). The vehicle **102** can include one or more data stores **115** for storing one or more types of data. The data store **115** can include volatile and/or non-volatile memory. Examples of suitable data stores **115** include RAM (Random Access Memory), flash memory, ROM (Read Only Memory), PROM (Programmable Read-Only Memory), EPROM (Erasable Programmable Read-Only Memory), EEPROM (Electrically Erasable Programmable Read-Only Memory), registers, magnetic disks, optical disks, hard drives, or any other suitable storage medium, or any combination thereof. The data store **115** can be a component of the processor(s) **110**, or the data store **115** can be operatively connected to the processor(s) **110** for use thereby. The term "operatively connected," as used throughout this description, can include direct or indirect connections, including connections without direct physical contact.

In one or more arrangements, the one or more data stores **115** can include map data **116**. The map data **116** can include maps of one or more geographic areas. In some instances, the map data **116** can include information or data on roads, traffic control devices, road markings, structures, features, and/or landmarks in the one or more geographic areas. The map data **116** can be in any suitable form. In some instances, the map data **116** can include aerial views of an area. In some instances, the map data **116** can include ground views of an area, including 360-degree ground views. The map data **116** can include measurements, dimensions, distances, and/or information for one or more items included in the map data **116** and/or relative to other items included in the map data **116**. The map data **116** can include a digital map with information about road geometry. The map data **116** can be high quality and/or highly detailed.

The one or more data stores **115** can include sensor data **119**. In this context, "sensor data" means any information about the sensors that the vehicle **102** is equipped with,

including the capabilities and other information about such sensors. As will be explained below, the vehicle 102 can include the sensor system 120. The sensor data 119 can relate to one or more sensors of the sensor system 120. As an example, in one or more arrangements, the sensor data 119 can include information on one or more vehicle sensors 121 and/or environment sensors 122 of the sensor system 120.

In some instances, at least a portion of the map data 116 and/or the sensor data 119 can be located in one or more data stores 115 located onboard the vehicle 102. Alternatively, or in addition, at least a portion of the map data 116 and/or the sensor data 119 can be located in one or more data stores 115 that are located remotely from the vehicle 102.

As noted above, the vehicle 102 can include the sensor system 120. The sensor system 120 can include one or more sensors. "Sensor" means any device, component and/or system that can detect, and/or sense something. The one or more sensors can be configured to detect, and/or sense in real-time. As used herein, the term "real-time" means a level of processing responsiveness that a user or system senses as sufficiently immediate for a particular process or determination to be made, or that enables the processor to keep up with some external process.

In arrangements in which the sensor system 120 includes a plurality of sensors, the sensors can work independently from each other. Alternatively, two or more of the sensors can work in combination with each other. In such a case, the two or more sensors can form a sensor network. The sensor system 120 and/or the one or more sensors can be operatively connected to the processor(s) 110, the data store(s) 115, and/or another element of the vehicle 102 (including any of the elements shown in FIG. 1). The sensor system 120 can acquire data of at least a portion of the internal environment as well as the external environment of the vehicle 102 (e.g., nearby vehicles).

The sensor system 120 can include any suitable type of sensor. Various examples of different types of sensors will be described herein. However, it will be understood that the embodiments are not limited to the particular sensors described. The sensor system 120 can include one or more vehicle sensors 121. The vehicle sensor(s) 121 can detect, determine, and/or sense information about the vehicle 102 itself. In one or more arrangements, the vehicle sensor(s) 121 can be configured to detect, and/or sense position and orientation changes of the vehicle 102, such as, for example, based on inertial acceleration. In one or more arrangements, the vehicle sensor(s) 121 can include one or more accelerometers, one or more gyroscopes, an inertial measurement unit (IMU), a dead-reckoning system, a global navigation satellite system (GNSS), a global positioning system (GPS), and/or other suitable sensors. The vehicle sensor(s) 121 can be configured to detect, and/or sense one or more characteristics of the vehicle 102. In one or more arrangements, the vehicle sensor(s) 121 can include a road wheel sensor 127 that detects the angle of the road wheel and/or the rate of change of the angle of the road wheel. The vehicle sensor(s) 121 can include a steering wheel sensor 128 that detects the angle of the steering wheel and/or the rate of change of the angle of the steering wheel.

Alternatively, or in addition, the sensor system 120 can include one or more environment sensors 122 configured to acquire, and/or sense data inside the vehicle as well as around the vehicle. Sensor data inside the vehicle can include information about one or more users in the vehicle cabin and any other objects of interest. Sensor data around

the vehicle can include information about the external environment in which the vehicle is located or one or more portions thereof.

As an example, the one or more environment sensors 122 can be configured to detect, quantify and/or sense objects in at least a portion of the internal and/or the external environment of the vehicle 102 and/or information/data about such objects.

In the internal environment of the vehicle 102, the one or more environment sensors 122 can be configured to detect, measure, quantify, and/or sense human users inside the vehicle 102 and the facial expressions of the users. In the external environment, the one or more environment sensors 122 can be configured to detect, measure, quantify, and/or sense objects in the external environment of the vehicle 102, such as, for example, lane markers, signs, traffic lights, traffic signs, lane lines, crosswalks, curbs proximate the vehicle 102, off-road objects, electronic roadside devices, etc.

Various examples of sensors of the sensor system 120 will be described herein. The example sensors may be part of the one or more environment sensors 122 and/or the one or more vehicle sensors 121. However, it will be understood that the embodiments are not limited to the particular sensors described.

As an example, in one or more arrangements, the sensor system 120 can include one or more radar sensors 123, one or more LIDAR sensors 124, one or more sonar sensors 125, and/or one or more cameras 126. In one or more arrangements, the one or more cameras 126 can be high dynamic range (HDR) cameras or infrared (IR) cameras.

The vehicle 102 can include an input system 130. An "input system" includes any device, component, system, element or arrangement or groups thereof that enable information/data to be entered into a machine. The input system 130 can receive an input from a user (e.g., a driver or a passenger). The vehicle 102 can include an output system 135. An "output system" includes any device, component, or arrangement or groups thereof that enable information/data to be presented to a user (e.g., a person, a vehicle passenger, etc.) such as a display interface.

The vehicle 102 can include one or more vehicle systems 140. Various examples of the one or more vehicle systems 140 are shown in FIG. 1. However, the vehicle 102 can include more, fewer, or different vehicle systems 140. It should be appreciated that although particular vehicle systems are separately defined, each or any of the systems or portions thereof may be otherwise combined or segregated via hardware and/or software within the vehicle 102. The vehicle 102 can include a propulsion system 141, a braking system 142, a steering system 143, throttle system 144, a transmission system 145, a signaling system 146, and/or a navigation system 147. Each of these systems can include one or more devices, components, and/or a combination thereof, now known or later developed.

The navigation system 147 can include one or more devices, applications, and/or combinations thereof, now known or later developed, configured to determine the geographic location of the vehicle 102 and/or to determine a travel route for the vehicle 102. The navigation system 147 can include one or more mapping applications to determine a travel route for the vehicle 102. The navigation system 147 can include a global positioning system, a local positioning system or a geolocation system.

As previously mentioned, the vehicle 102 can include one or more vehicle control systems 160. The vehicle control system(s) 160 can be configured to receive data from the

sensor system **120** and/or any other type of system capable of capturing information relating to the vehicle **102** and/or the external environment of the vehicle **102**. In one or more arrangements, the vehicle control system(s) **160** can use such data to generate one or more driving scene models. The vehicle control system(s) **160** can determine position and velocity of the vehicle **102**. The vehicle control system(s) **160** can determine the location of obstacles, obstacles, or other environmental features including traffic signs, trees, shrubs, neighboring vehicles, pedestrians, etc.

The vehicle control system(s) **160** can be configured to receive, and/or determine location information for obstacles within the external environment of the vehicle **102** for use by the processor(s) **110**, and/or one or more of the modules described herein to estimate position and orientation of the vehicle **102**, vehicle position in global coordinates based on signals from a plurality of satellites, or any other data and/or signals that could be used to determine the current state of the vehicle **102** or determine the position of the vehicle **102** with respect to its environment for use in either creating a map or determining the position of the vehicle **102** in respect to map data.

The vehicle control system(s) **160** can be configured to determine travel path(s), current autonomous driving maneuvers for the vehicle **102**, future autonomous driving maneuvers and/or modifications to current autonomous driving maneuvers based on data acquired by the sensor system **120**, driving scene models, and/or data from any other suitable source such as determinations from the sensor data **119**. "Driving maneuver" means one or more actions that affect the movement of a vehicle. Examples of driving maneuvers include accelerating, decelerating, braking, turning, moving in a lateral direction of the vehicle **102**, changing travel lanes, merging into a travel lane, and/or reversing, just to name a few possibilities. The vehicle control system(s) **160** can be configured to implement determined driving maneuvers. The vehicle control system(s) **160** can cause, directly or indirectly, such autonomous driving maneuvers to be implemented. As used herein, "cause" or "causing" means to make, command, instruct, and/or enable an event or action to occur or at least be in a state where such event or action may occur, either in a direct or indirect manner. The vehicle control system(s) **160** can be configured to execute various vehicle functions and/or to transmit data to, receive data from, interact with, and/or control the vehicle **102** or one or more systems thereof (e.g., one or more of vehicle systems **140**).

The processor(s) **110**, the false positive request detection system **100**, and/or the vehicle control system(s) **160** can be operatively connected to communicate with the various vehicle systems **140** and/or individual components thereof. For example, returning to FIG. **1**, the processor(s) **110**, the false positive request detection system **100**, and/or the vehicle control system(s) **160** can be in communication to send and/or receive information from the various vehicle systems **140** to control the movement, speed, maneuvering, heading, direction, etc. of the vehicle **102**. The processor(s) **110**, the false positive request detection system **100**, and/or the vehicle control system(s) **160** may control some or all of these vehicle systems **140** and, thus, may be partially or fully autonomous.

The processor(s) **110**, the false positive request detection system **100**, and/or the vehicle control system(s) **160** may be operable to control the navigation and/or maneuvering of the vehicle **102** by controlling one or more of the vehicle systems **140** and/or components thereof. As an example, when operating in an autonomous mode, the processor(s)

110, the false positive request detection system **100**, and/or the vehicle control system(s) **160** can control the direction and/or speed of the vehicle **102**. As another example, the processor(s) **110**, the false positive request detection system **100**, and/or the vehicle control system(s) **160** can activate, deactivate, and/or adjust the parameters (or settings) of the one or more driver assistance systems. The processor(s) **110**, the false positive request detection system **100**, and/or the vehicle control system(s) **160** can cause the vehicle **102** to accelerate (e.g., by increasing the supply of fuel provided to the engine), decelerate (e.g., by decreasing the supply of fuel to the engine and/or by applying brakes) and/or change direction (e.g., by turning the front two wheels). As used herein, "cause" or "causing" means to make, force, compel, direct, command, instruct, and/or enable an event or action to occur or at least be in a state where such event or action may occur, either in a direct or indirect manner.

The vehicle **102** can include one or more actuators **150**. The actuators **150** can be any element or combination of elements operable to modify, adjust and/or alter one or more of the vehicle systems **140** or components thereof. Any suitable actuator can be used. For instance, the one or more actuators **150** can include motors, pneumatic actuators, hydraulic pistons, relays, solenoids, and/or piezoelectric actuators, just to name a few possibilities.

The vehicle **102** can include one or more modules, at least some of which are described herein. The modules can be implemented as computer-readable program code that, when executed by a processor **110**, implement one or more of the various processes described herein. One or more of the modules can be a component of the processor(s) **110**, or one or more of the modules can be executed on and/or distributed among other processing systems to which the processor(s) **110** is operatively connected. The modules can include instructions (e.g., program logic) executable by one or more processor(s) **110**. Alternatively, or in addition, one or more data store **115** may contain such instructions.

In one or more arrangements, one or more of the modules described herein can include artificial or computational intelligence elements, e.g., neural network, fuzzy logic, or other machine learning algorithms. Further, in one or more arrangements, one or more of the modules can be distributed among a plurality of the modules described herein. In one or more arrangements, two or more of the modules described herein can be combined into a single module.

Detailed embodiments are disclosed herein. However, it is to be understood that the disclosed embodiments are intended only as examples. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the aspects herein in virtually any appropriately detailed structure. Further, the terms and phrases used herein are not intended to be limiting but rather to provide an understandable description of possible implementations. Various embodiments are shown in the figures, but the embodiments are not limited to the illustrated structure or application.

The flowcharts and block diagrams in the figures illustrate the architecture, functionality, and operation of possible implementations of systems, methods, and computer program products according to various embodiments. In this regard, each block in the flowcharts or block diagrams may represent a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It should also be noted that, in some alternative implementations, the func-

tions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved.

The systems, components and/or processes described above can be realized in hardware or a combination of hardware and software and can be realized in a centralized fashion in one processing system or in a distributed fashion where different elements are spread across several interconnected processing systems. Any kind of processing system or another apparatus adapted for carrying out the methods described herein is suited. A typical combination of hardware and software can be a processing system with computer-usable program code that, when being loaded and executed, controls the processing system such that it carries out the methods described herein. The systems, components and/or processes also can be embedded in a computer-readable storage, such as a computer program product or other data programs storage device, readable by a machine, tangibly embodying a program of instructions executable by the machine to perform methods and processes described herein. These elements also can be embedded in an application product which comprises all the features enabling the implementation of the methods described herein and which when loaded in a processing system, is able to carry out these methods.

Furthermore, arrangements described herein may take the form of a computer program product embodied in one or more computer-readable media having computer-readable program code embodied, e.g., stored, thereon. Any combination of one or more computer-readable media may be utilized. The computer-readable medium may be a computer-readable signal medium or a computer-readable storage medium. The phrase "computer-readable storage medium" means a non-transitory storage medium. A computer-readable storage medium may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific examples (a non-exhaustive list) of the computer-readable storage medium would include the following: a portable computer diskette, a hard disk drive (HDD), a solid-state drive (SSD), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a portable compact disc read-only memory (CD-ROM), a digital versatile disc (DVD), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing. In the context of this document, a computer-readable storage medium may be any tangible medium that can contain or store a program for use by or in connection with an instruction execution system, apparatus, or device.

Generally, modules, as used herein, include routines, programs, objects, components, data structures, and so on that perform particular tasks or implement particular data types. In further aspects, a memory generally stores the noted modules. The memory associated with a module may be a buffer or cache embedded within a processor, a RAM, a ROM, a flash memory, or another suitable electronic storage medium. In still further aspects, a module as envisioned by the present disclosure is implemented as an application-specific integrated circuit (ASIC), a hardware component of a system on a chip (SoC), as a programmable logic array (PLA), or as another suitable hardware component that is embedded with a defined configuration set (e.g., instructions) for performing the disclosed functions.

Program code embodied on a computer-readable medium may be transmitted using any appropriate medium, including but not limited to wireless, wireline, optical fiber, cable, RF, etc., or any suitable combination of the foregoing. Computer program code for carrying out operations for aspects of the present arrangements may be written in any combination of one or more programming languages, including an object-oriented programming language such as Java™, Smalltalk, C++, or the like and conventional procedural programming languages, such as the "C" programming language or similar programming languages. The program code may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer, or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider).

The terms "a" and "an," as used herein, are defined as one or more than one. The term "plurality," as used herein, is defined as two or more than two. The term "another," as used herein, is defined as at least a second or more. The terms "including" and/or "having," as used herein, are defined as comprising (i.e., open language). The phrase "at least one of . . . and . . . " as used herein refers to and encompasses any and all possible combinations of one or more of the associated listed items. As an example, the phrase "at least one of A, B, and C" includes A only, B only, C only, or any combination thereof (e.g., AB, AC, BC, or ABC).

Aspects herein can be embodied in other forms without departing from the spirit or essential attributes thereof. Accordingly, reference should be made to the following claims, rather than to the foregoing specification, as indicating the scope hereof.

What is claimed is:

1. A method comprising:
   detecting a false positive request to disengage a vehicle control system based on whether:
   a rate of change of angle of a road wheel exceeds a predetermined threshold value, the road wheel being controlled by a road wheel angle input; and
   a difference between the road wheel angle input and an angle of the road wheel exceeds a second predetermined threshold value; and
   preventing the vehicle control system from disengaging based on detecting the false positive request.

2. The method of claim **1**, wherein the vehicle control system is capable of being disengaged based on the road wheel angle input.

3. The method of claim **1**, wherein the difference is based on a position of the road wheel angle input and a position of the angle of the road wheel.

4. The method of claim **1**, wherein the difference is based on a rate of change of the road wheel angle input and a rate of change of the angle of the road wheel.

5. The method of claim **1**, further comprising:
   detecting the false positive request based on at least one of: a characteristic of a vehicle and a characteristic of a road, wherein the vehicle includes the vehicle control system, and wherein the vehicle is travelling on the road.

6. The method of claim **1**, wherein the road wheel angle input is based on a steering wheel input.

7. The method of claim **1**, wherein the road wheel angle input is based on an electronic control unit (ECU).

8. A system comprising:

a processor; and

a memory storing machine-readable instructions that, when executed by the processor, cause the processor to:

    detect a false positive request to disengage a vehicle control system based on whether:

        a rate of change of angle of a road wheel exceeds a predetermined threshold value, the road wheel being controlled by a road wheel angle input; and

        a difference between the road wheel angle input and an angle of the road wheel exceeds a second predetermined threshold value; and

    prevent the vehicle control system from disengaging based on detecting the false positive request.

9. The system of claim **8**, wherein the vehicle control system is capable of being disengaged based on the road wheel angle input.

10. The system of claim **8**, wherein the difference is based on a position of the road wheel angle input and a position of the angle of the road wheel.

11. The system of claim **8**, wherein the difference is based on a rate of change of the road wheel angle input and a rate of change of the angle of the road wheel.

12. The system of claim **8**, wherein the machine-readable instructions further include instructions that when executed by the processor cause the processor to:

    detect the false positive request based on at least one of:

        a characteristic of a vehicle and a characteristic of a road, wherein the vehicle includes the vehicle control system, and wherein the vehicle is travelling on the road.

13. The system of claim **8**, wherein the road wheel angle input is based on a steering wheel input.

14. The system of claim **8**, wherein the road wheel angle input is based on an electronic control unit (ECU).

15. A non-transitory computer-readable medium including instructions that when executed by a processor cause the processor to:

    detect a false positive request to disengage a vehicle control system based on whether:

        a rate of change of angle of a road wheel exceeds a predetermined threshold value, the road wheel being controlled by a road wheel angle input; and

        a difference between the road wheel angle input and an angle of the road wheel exceeds a second predetermined threshold value; and

    prevent the vehicle control system from disengaging based on detecting the false positive request.

16. The non-transitory computer-readable medium of claim **15**, wherein the vehicle control system is capable of being disengaged based on the road wheel angle input.

17. The non-transitory computer-readable medium of claim **15**, wherein the difference is based on a position of the road wheel angle input and a position of the angle of the road wheel.

18. The non-transitory computer-readable medium of claim **15**, wherein the difference is based on a rate of change of the road wheel angle input and a rate of change of the angle of the road wheel.

19. The non-transitory computer-readable medium of claim **15**, wherein the instructions further include instructions that when executed by the processor cause the processor to:

    detect the false positive request based on at least one of:

        a characteristic of a vehicle and a characteristic of a road, wherein the vehicle includes the vehicle control system, and wherein the vehicle is travelling on the road.

20. The non-transitory computer-readable medium of claim **15**, wherein the road wheel angle input is based on a steering wheel input.

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