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(54) **APPARATUS AND METHOD FOR AUTOMATIC APPLICATION/DEAPPLICATION OF BRAKE LIGHTS**

(71) Applicant: **Deceleration Technologies, LLC**, Mountain, ND (US)

(72) Inventors: **Scott Thomas Ault**, Reynolds, ND (US); **Darren Roger Olafson**, Edinburg, ND (US); **Brad Driscoll**, East Grand Forks, MN (US)

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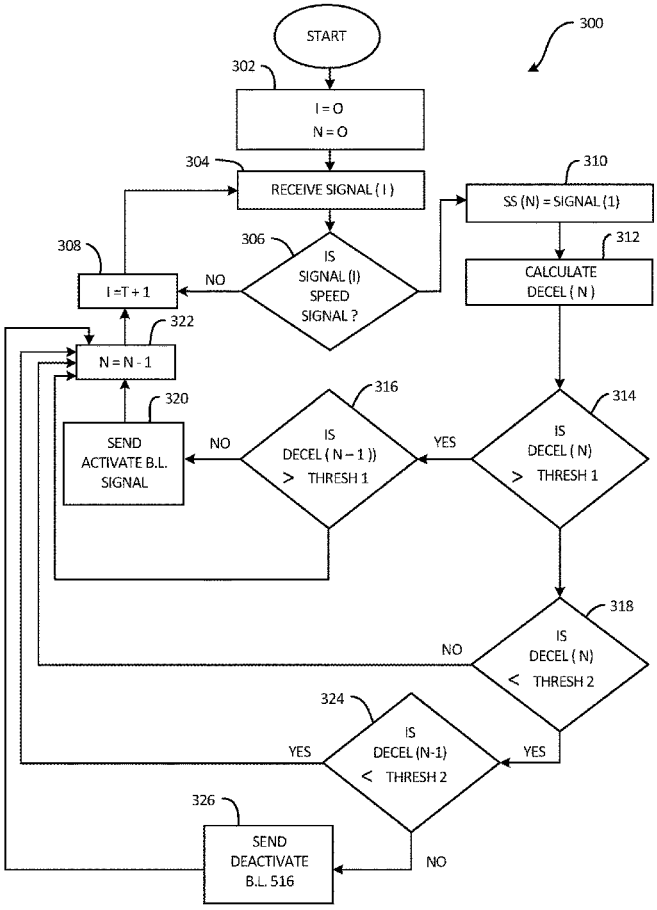
(52) **U.S. Cl.**

CPC ***B60Q 1/44*** (2013.01); *B60Q 1/0094* (2013.01); *G08G 1/164* (2013.01)

(57) **ABSTRACT**

Apparatus and associated methods include automatically activating and/or deactivating a vehicle's standard brake lights in response to signals indicative of the vehicle's speed. The signals indicative of a vehicle's speed are received from a vehicle communications bus. In some embodiments, a deceleration value is calculated based on a series of signals indicative of a vehicle's speed received from the vehicle communications bus. The calculated deceleration value is compared with a first predetermined deceleration threshold. If the calculated deceleration value is greater than the first predetermined deceleration threshold, a brake light activation signal is generated. When the vehicle no longer is decelerating or the computed deceleration value falls below a second predetermined deceleration threshold, a brake light deactivation signal is generated. The automatic activation/deactivation of a vehicle's standard brake light may advantageously provide improved safety to following vehicles and drivers.



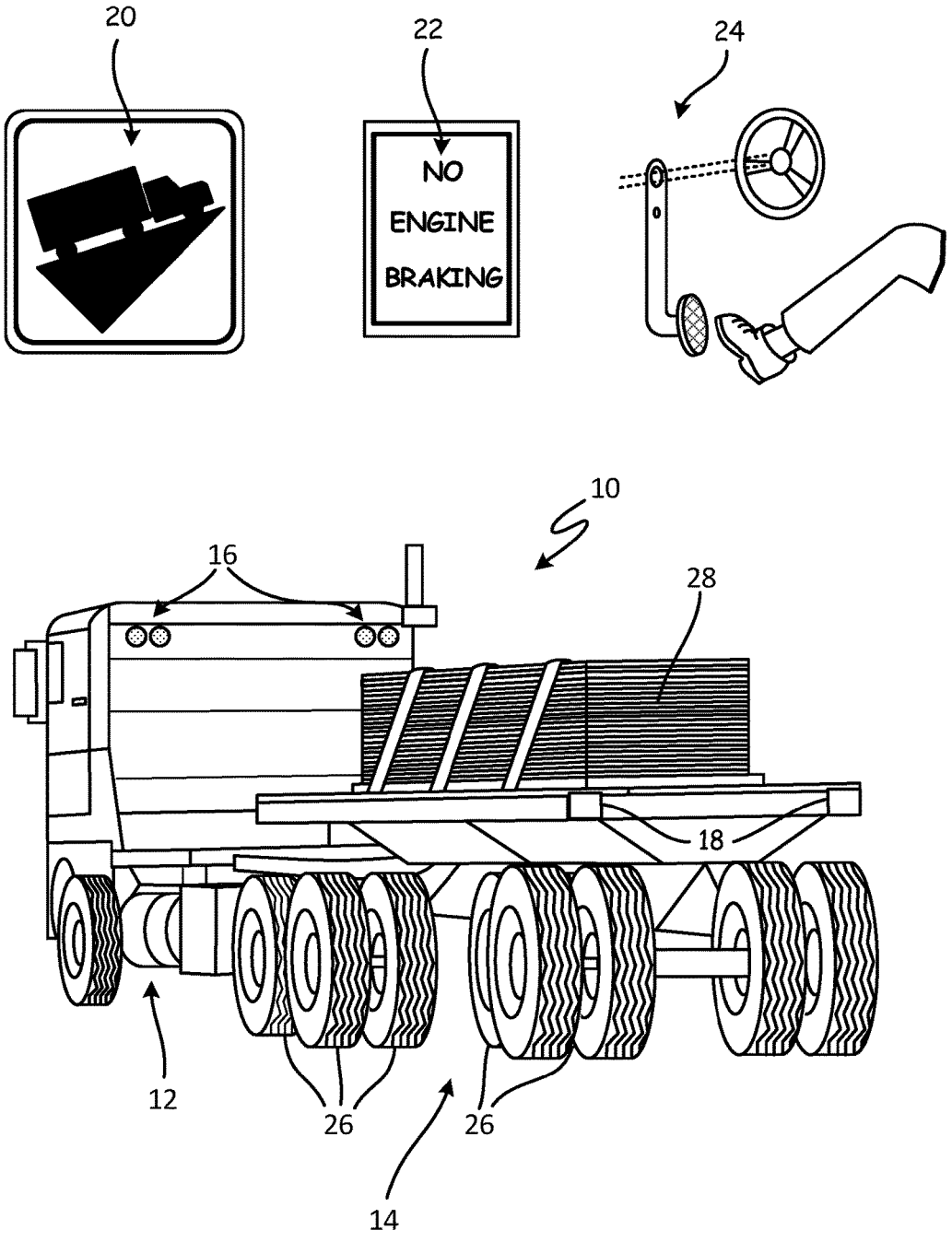


FIG. 1

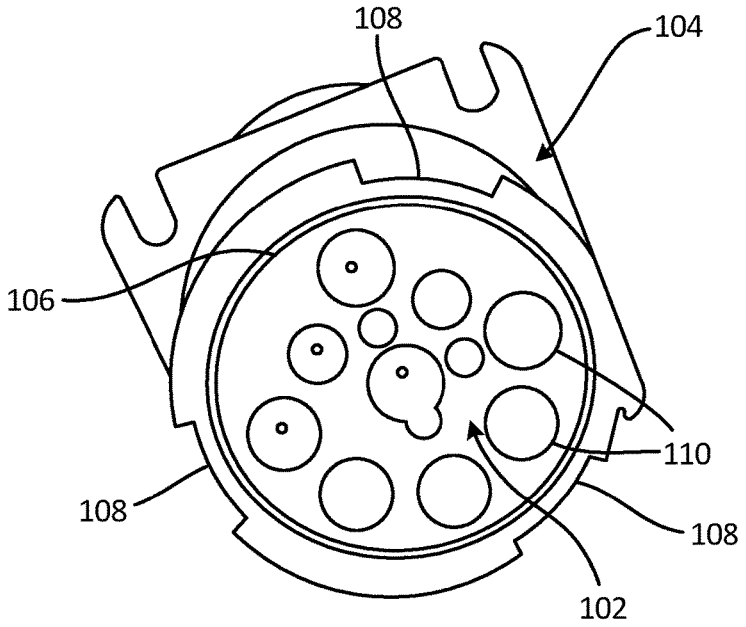

108
104
100
106
110
108
108
102

FIG. 2A

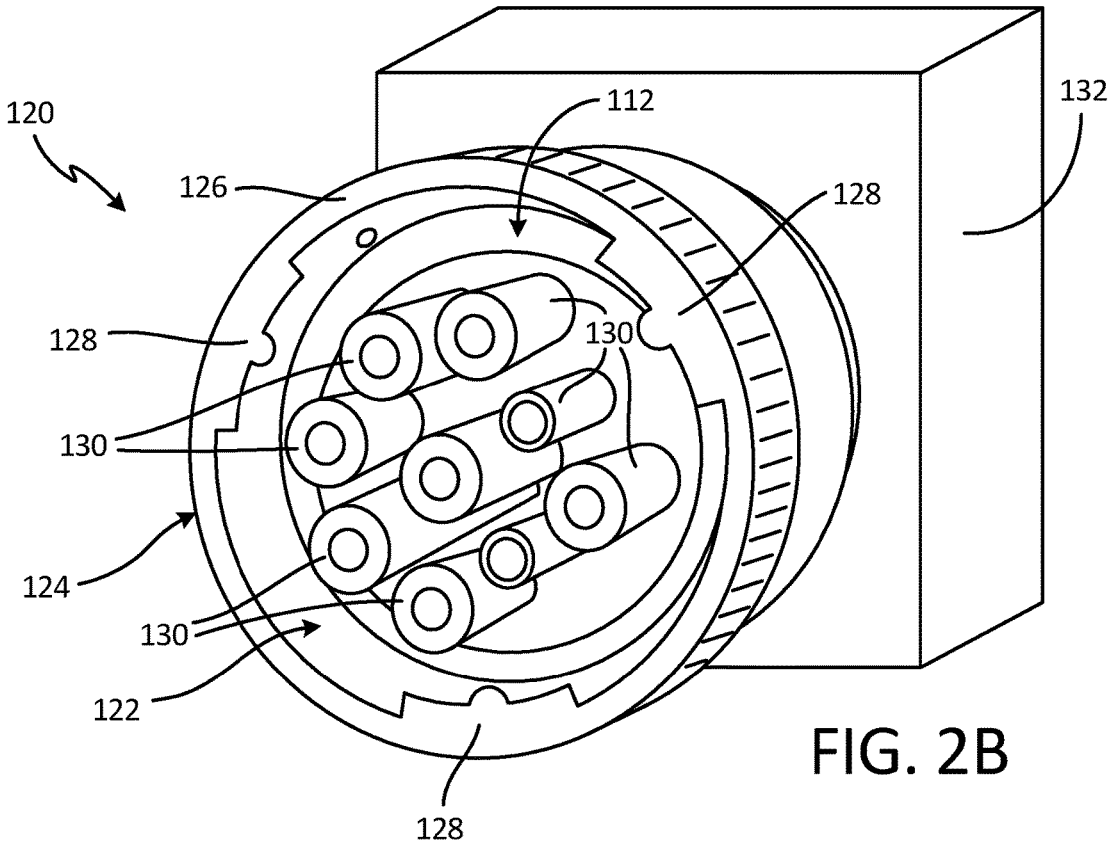

120
112
132
126
128
128
130
130
124
130
122
128

FIG. 2B

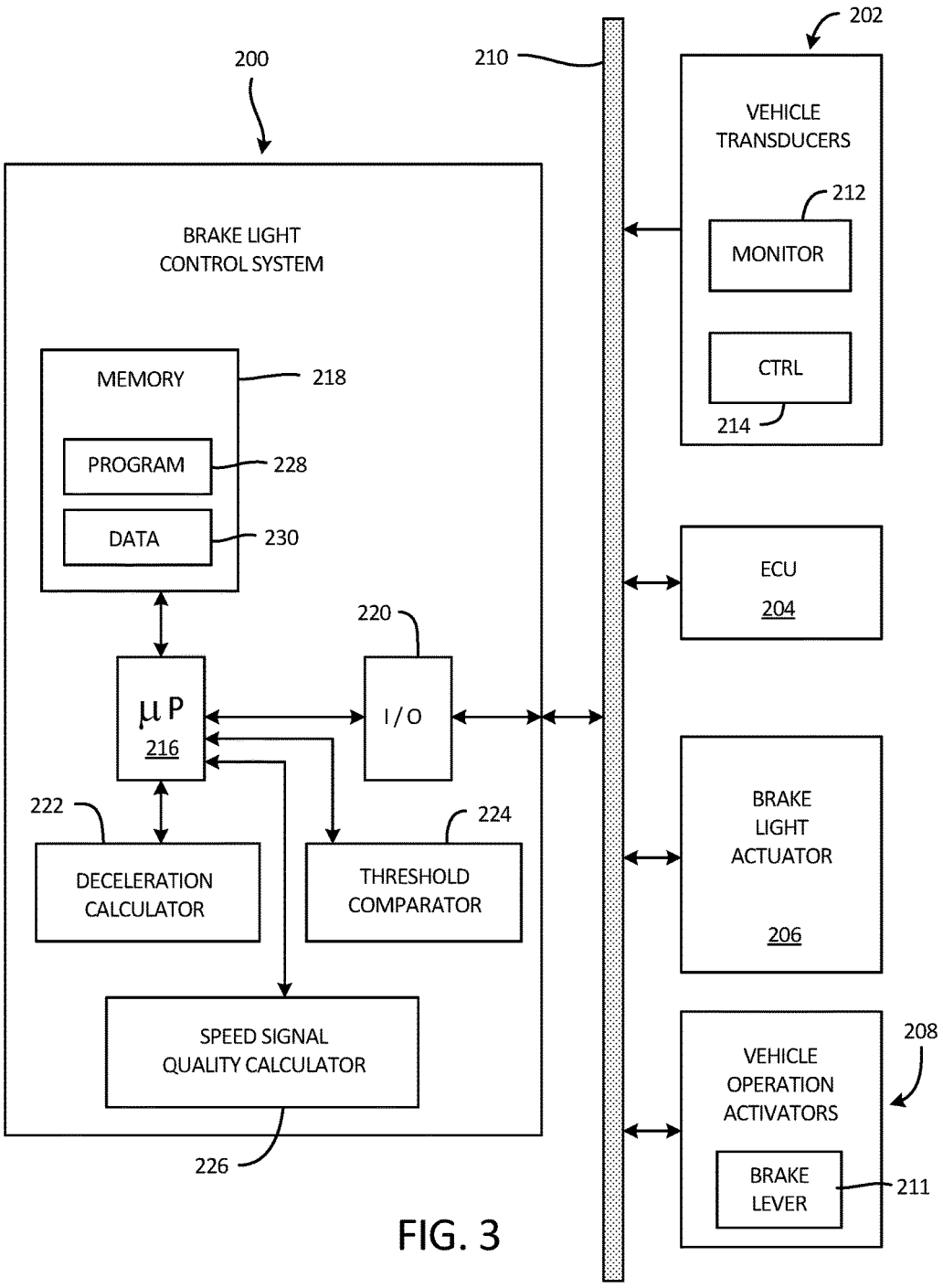

200
210
202
VEHICLE TRANSDUCERS
212
MONITOR
CTRL
214
BRAKE LIGHT CONTROL SYSTEM
MEMORY
218
PROGRAM
228
DATA
230
220
μP
216
I/O
ECU
204
222
224
DECELERATION CALCULATOR
THRESHOLD COMPARATOR
BRAKE LIGHT ACTUATOR
206
SPEED SIGNAL QUALITY CALCULATOR
208
VEHICLE OPERATION ACTIVATORS
BRAKE LEVER
211
226

FIG. 3

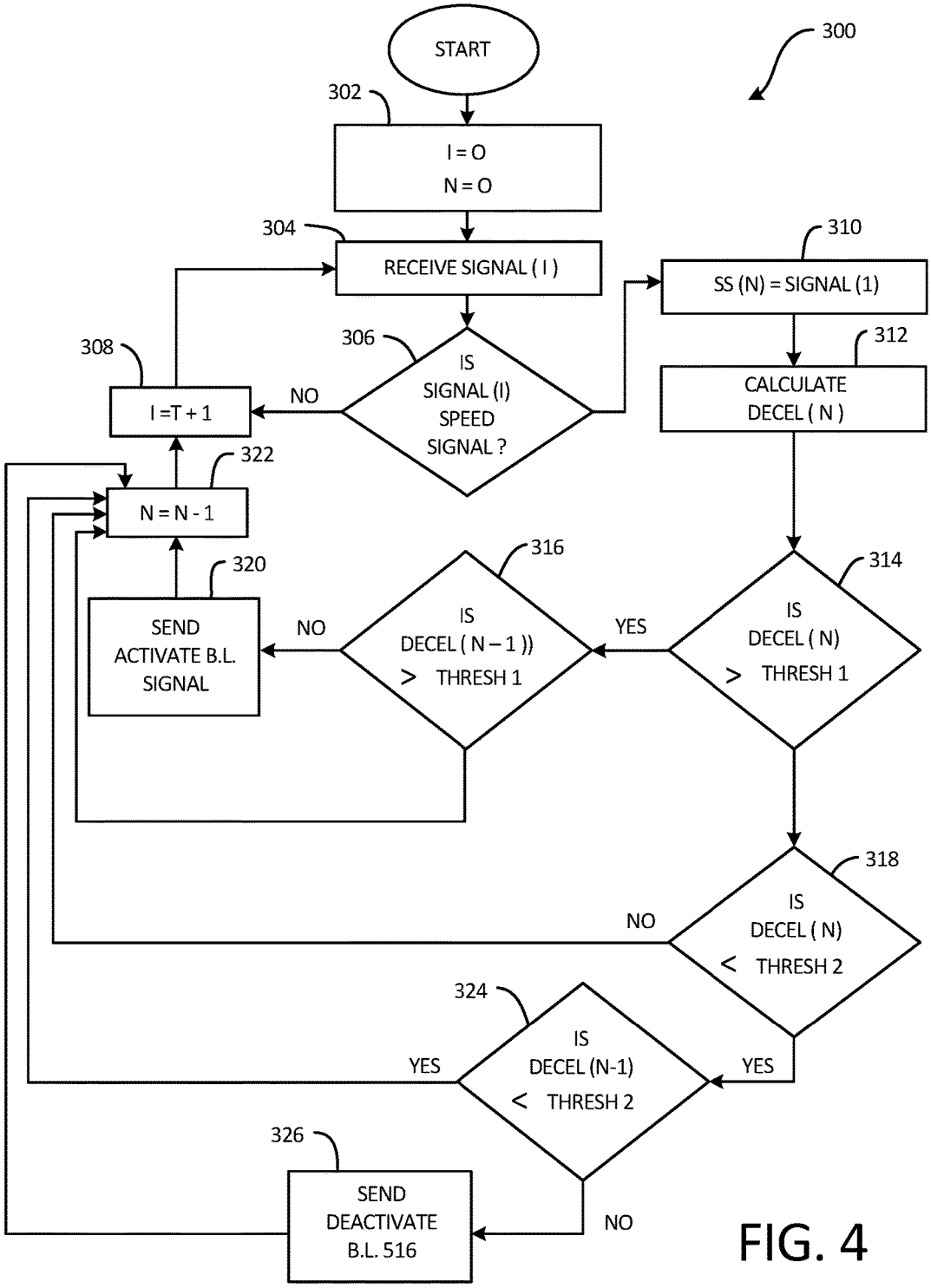

START
300
302
I = O
N = O
304
RECEIVE SIGNAL (I)
306
IS SIGNAL (I) SPEED SIGNAL ?
NO
308
I =T + 1
310
SS (N) = SIGNAL (1)
312
CALCULATE DECEL (N)
314
IS DECEL (N) > THRESH 1
YES
316
IS DECEL (N – 1)) > THRESH 1
NO
320
SEND ACTIVATE B.L. SIGNAL
322
N = N - 1
318
IS DECEL (N) < THRESH 2
NO
324
IS DECEL (N-1) < THRESH 2
YES
YES
326
SEND DEACTIVATE B.L. 516
NO

FIG. 4

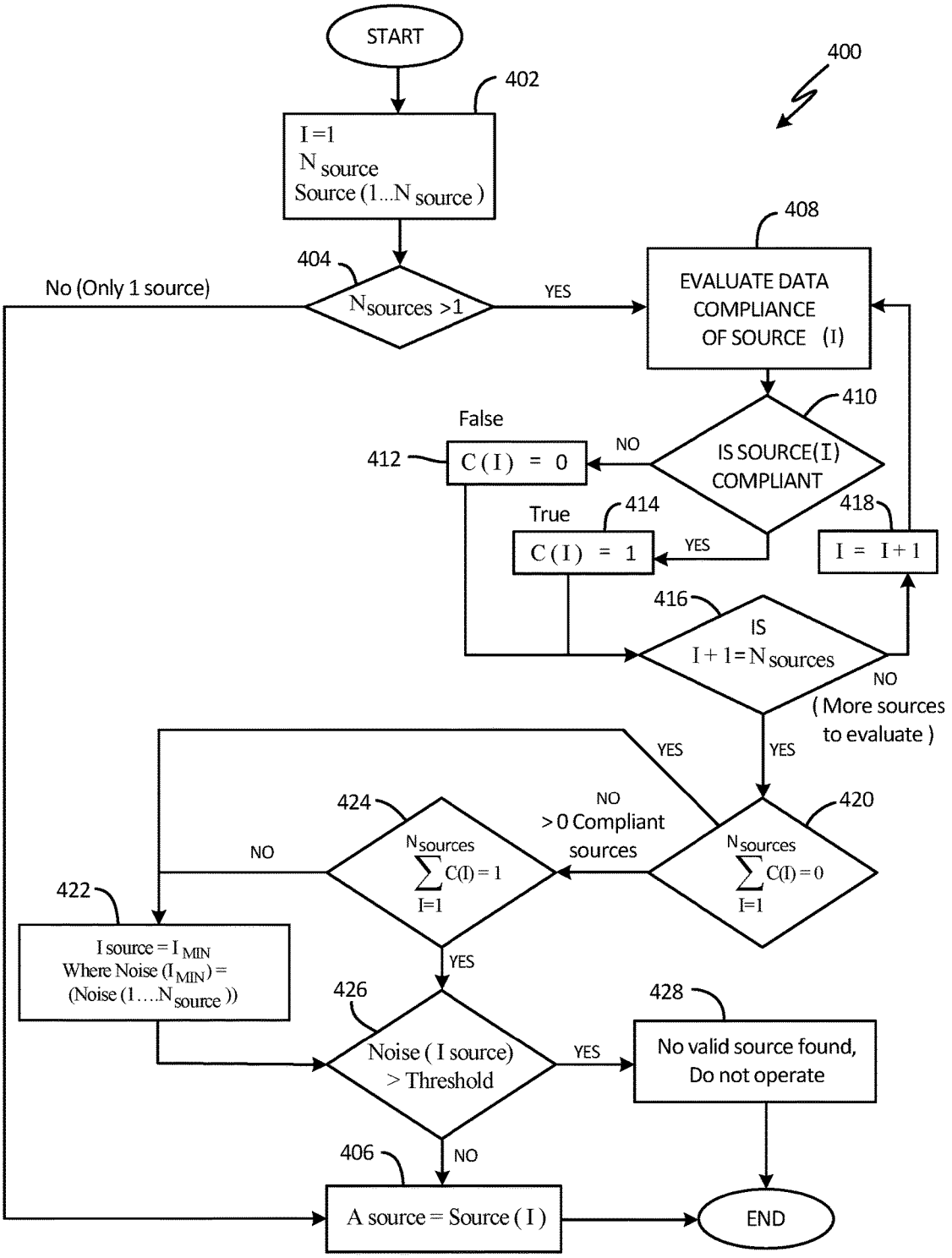

START
400
402
I=1
N source
Source (1...N source)
404
No (Only 1 source)
Nsources >1
YES
408
EVALUATE DATA COMPLIANCE OF SOURCE (I)
410
False
412
C(I) = 0
NO
IS SOURCE(I) COMPLIANT
True
414
C(I) = 1
YES
418
I = I+1
416
IS I+1=N sources
NO
(More sources to evaluate)
YES
YES
420
NO
>0 Compliant sources
424
NO
Nsources ∑ C(I)=1 I=1
Nsources ∑ C(I)=0 I=1
422
I source = I MIN
Where Noise (I MIN) =
(Noise (1....N source))
YES
426
Noise (I source) > Threshold
YES
428
No valid source found, Do not operate
NO
406
A source = Source (I)
END

FIG. 5

APPARATUS AND METHOD FOR AUTOMATIC APPLICATION/DEAPPLICATION OF BRAKE LIGHTS

BACKGROUND

[0001] Vehicular travel is ubiquitous in modern society. Our culture is built around transportation of people and goods. Many people travel upon roads to get to places of employment, to purchase goods that they want or need, to transport such purchased goods, to frequent service providers, to meet with friends, family, and fellow worshippers, and for myriad other purposes. Whether traffic is heavy or light, dangers abound on the roads and highways. Traffic accidents occur every day. Cars are damaged, and people are injured in some of these accidents.

[0002] Rear-end accidents are a common type of accident. Some rear-end accidents happen because a driver follows a vehicle too closely. Some rear-end accidents happen because a following driver is not paying attention to traffic ahead. Some rear-end accidents happen because a following driver may not know the speed and/or deceleration condition of the vehicle he/she is following. Ignorance of a speed and/or deceleration condition can also result in undesirable traffic patterns. Drivers may follow vehicles too closely because of such ignorance. Repetitive accordion-style traffic compressions and expansions can result from such ignorance.

SUMMARY

[0003] A brake light control system includes a control module configured to electrically connect to a vehicle communications port. The control module is physically supported by the vehicle communications port, when electrically connected. The brake light control system includes a signal detection module configured to receive a series of vehicle speed signals transmitted to the vehicle communications port. The brake light control system includes a deceleration calculation module configured to calculate deceleration based on the received series of vehicle speed signals. The brake light control system also includes a signal generation module configured to generate a brake light activation signal based on a comparison between the calculated deceleration and a predetermined threshold. The brake light activation signal is configured to cause a brake light activation system to activate a standard brake light of a vehicle.

[0004] A method for activating a vehicle's brake lights includes the step of electrically connecting a control module to the vehicle communications port. The method includes the step of receiving a series of vehicle speed signals transmitted to the vehicle communications port. The method includes the step of calculating a vehicle deceleration based on the received series of vehicle speed signals. The method includes the step of generating a brake light activation signal based on a comparison between the calculated deceleration and a predetermined threshold. The method also includes the step of outputting the generated brake light activation signal to the vehicle communications bus.

[0005] A vehicle brake light control system includes a control module having a non-transitory computer usable medium having a computer readable program code embodied therein. The computer readable program code is adapted to be executed to implement a method for activating a vehicle's brake lights. The method includes receiving a series of vehicle speed signals. The method includes calculating a vehicle deceleration based on the received series of vehicle speed signals. The method includes comparing the calculated vehicle deceleration with a predetermined threshold. The method includes generating a brake light activation signal if the comparing step indicates that the deceleration is greater than the predetermined threshold. The method also includes outputting the generated brake light activation signal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1** is a schematic view of various vehicle conditions in which a truck's brake lights are actuated using an exemplary brake light control system.

[0007] FIGS. **2**A-**2**B are perspective views of an exemplary vehicle communications port and a corresponding brake light control module, respectively.

[0008] FIG. **3** is a block diagram of an exemplary brake light control system.

[0009] FIG. **4** is a flow chart of an exemplary method for automatically actuating a vehicle's brake lights.

[0010] FIG. **5** is a flow chart of an exemplary method for selecting a speed signal from a plurality of sources that communicate a speed signal to the vehicle communications port.

DETAILED DESCRIPTION

[0011] Some vehicles today (e.g., on-highway trucks, off-highway equipment, agricultural equipment, construction equipment, etc.) are equipped with on-vehicle controller area networks to facilitate communications between various vehicle sensors, modules, and/or systems. Such sensors, modules, and systems may transmit electronic signals and control information among the other sensors, modules, and systems connected via an on-vehicle controller area network. Some sensors can detect various parameters within a vehicle (e.g., timing sensors, shaft speed sensors, temperature sensors, pressure sensors, etc.). These parameters may be used by the sensor, module, or system that detected them. Such sensors can be connected directly to one of various control modules or vehicle systems. Electrical signals indicative of the detected parameters can be transmitted to other controller-area-network connected devices.

[0012] Such controller-area-network connected systems include an Engine Control Module (ECM) or Engine Control Unit (ECU), a Transmission Control Module (TCM), and a Chassis Control Module (CCM). An ECM, for example, can receive various signals indicative of information pertaining to the vehicle (e.g., coolant temp, RPM, fault codes, etc.). These signals indicative of vehicle information may have been placed on the controller area network by other sensors, modules, and/or systems. Also, the ECM may be able to transmit control signals and/or signals indicative of vehicle information to other sensors, modules, and/or systems (e.g., a display module, dashboard indicators, a diagnostic tool, etc.).

[0013] The TCM, for example, may be hardwired directly to a shaft speed sensors, gear indicators, etc., and may calculate a vehicle speed based on signals from these hardwired devices. The TCM may then output this information to the controller area network to be received and/or used by other modules connected thereto. This information may

be used by these other modules, for example, to govern engine speed, display ground speed, actuate control members, and/or for use in calculating other vehicle metrics.

[0014] The Chassis Control Module may monitor and processing vehicle control members operated by a driver (e.g., steering wheels, foot pedals, turn signal levers, dashboard buttons, etc.), monitor and/or control cab temperature, monitor and/or actuate various vehicle lights.

[0015] The various sensors, modules and systems may function as a distributed electronic computing system that operates on various subsystems within a vehicle. Each control module is directly connected to various sensors. The microprocessors in the control modules turn raw data provided by various sensors into standard messages that are then shared with other control modules via the on-vehicle controller area network. The control modules can be strategically placed throughout the vehicle to minimize the amount of wiring required, and/or to be localized proximate transducers or sensors related to their functional purposes.

[0016] Various types, protocols and standards of on-vehicle controller area networks may be used. In an exemplary embodiment, a J1939 CANbus may be utilized to facilitate intra-vehicular communications. In some embodiments, Bluetooth communications can be used. In some embodiments, RS485 and/or RS232 protocols and standards may be used. In some embodiments various combinations of these and other on-vehicle controller area networks having various protocols and standards may be used. These on-vehicle controller area networks and the signals carried thereon can be used to augment the number of conditions that brake lights are activated. Such an augmentation of brake light activation can provide a more comprehensive set of visual communications to trailing vehicles.

[0017] FIG. **1** is a schematic view of various vehicle conditions in which a truck's brake lights are actuated using an exemplary brake light control system. In FIG. **1**, tractor-trailer **10** has tractor **12** and trailer **14**, which have brake lights **16** and **18**, respectively. Current vehicles are with a system for activating brake lights **16**, **18** in response to physical depression a brake lever. Tractor **12** is further equipped with a system for automatically controlling brake lights **16**, **18** in response to a computed vehicle deceleration that is greater than a predetermined threshold. The system for automatically controlling brake lights **16**, **18** calculates deceleration of tractor-trailer **10**. The system for automatically controlling brake lights **16**, **18** may be configured to actuate the brake lights under certain deceleration conditions. For example, the system for automatically controlling brake lights **16**, **18** may control brake lights **16**, **18** such that when tractor-trailer **10** is decelerating at greater than a first deceleration threshold, brake lights **16**, **18** will illuminate. The system for automatically controlling brake lights **16**, **18** may control brake lights **16**, **18** such that when tractor-trailer **10** is no longer decelerating, or is decelerating at less than a second deceleration threshold, brake lights **16**, **18** will not illuminate.

[0018] Various vehicle and road conditions symbolized by icons **20**, **22**, **24** may contribute to deceleration of tractor-trailer **10**. For example, steep grade road condition, symbolized by icon **20**, can contribute to a deceleration of tractor-trailer **10**, even if a driver of tractor-trailer **10** is controlling a throttle position that causes an engine of tractor-trailer **10** to power drive wheels **26** of tractor **12**. Steep grade road condition, symbolized by icon **20**, can help cause tractor-trailer **10** to decelerate, especially if tractor-trailer **10** is carrying load **28** that is very heavy. Another condition that may contribute to deceleration of tractor-trailer **10** is engine braking, symbolized by icon **22**. Engine braking, symbolized by icon **22**, can cause tractor-trailer **10** to decelerate, if tractor-trailer **10** is equipped with engine braking capabilities, such as, for example, Jake braking or exhaust braking. Engine braking, symbolized by icon **22**, traditionally does not cause brake lights **16**, **18** to activate. But should engine braking, symbolized by icon **22**, result in deceleration of tractor-trailer **10** that exceeds the first predetermined threshold, the system for automatically controlling brake lights **16**, **18** may cause brake lights **16**, **18** to illuminate, none-the-less. Another condition that may contribute to deceleration is depressing a brake pad, symbolized by icon **24**. This traditional method of braking can result in deceleration detection by use of the first deceleration threshold. Such detection can be used instead of or in addition to a traditional brake-pedal position sensor.

[0019] Automatically controlling brake lights **16**, **18** may provide more comprehensive brake light illumination than traditional methods. Automatically controlling brake lights **16**, **18** may result in brake-light illumination that is better correlated to a vehicle's actual deceleration than traditional methods. Such comprehensive brake-light illumination may indicate to drivers in following vehicles that tractor-trailer **10** is decelerating, even when the driver of tractor-trailer **10** is not depressing brake pedal, symbolized by icon **24**. Systems for automatically controlling brake lights may provide customizable brake light illumination. For example, a user may select conditions and/or condition parameters that will result in illumination of brake lights **16**, **18**. Such conditions may augment the traditional illumination resulting from brake pedal depression. Such conditions may include vehicle speed and/or deceleration conditions, throttle position conditions, timing conditions, etc.

[0020] FIGS. **2**A-**2**B are perspective views of an exemplary vehicle communications port and a corresponding brake light control module, respectively. In FIG. **2**A, vehicle communications port **100** includes electrical interface **102** and mechanical interface **104**. Vehicle communications port **100** may be mounted, for example underneath a dashboard of a vehicle. In some embodiments, vehicle communications port **100** may be mounted in a glove compartment of a vehicle. Mechanical interface **104** has cylindrical body **106** with outwardly facing tabs **108** configured to engage a complementary connector. Electrical interface **102** has nine pin-receiving cavities **110**. Each of pin receiving cavities **110** is configured to mechanically receive a complementary connecting pin. Various embodiments have various configurations of mechanical interface **104** and electrical interface **102**. Vehicle communications port **100** is in electrical communication with an on-board controller area network of a vehicle.

[0021] In FIG. **2**B, exemplary brake light control module **120** includes electrical interface **122** and mechanical interface **124**. Brake light control module **120** is configured to mechanically connect to vehicle communications port **100**. When connected to vehicle communications port **100**, brake light control module **120** is physically supported by vehicle communications port **100**. Mechanical interface **124** has cylindrical wall **126** with inwardly facing tabs **128**. Cylin-

drical wall **126** defines a cylindrical cavity **112** configured to receive cylindrical body **106** of vehicle communications port **100**.

[0022] An electronic brake light controller (not depicted) can reside in an electronics bay with housing **132**. The electronic brake light controller, when connected to the vehicle communications port, receives and transmits electrical signals from and to an on-vehicle controller area network via vehicle communications port **100**, respectively. Thus, when brake light control module **120** is connected to vehicle communications port **100**, the electronic brake light control system is in electrical communication with various engine and/or vehicle transducers, vehicle operation actuators, and engine and/or vehicle control units, via electrical interfaces **102**, **122**. The electronic brake light control system receives and sends signals from and to these listed and other engine and/or vehicle components, respectively.

[0023] Mechanical interface **124** and electrical interface **122** are coordinated so that when brake light control module **120** is mechanically connected to vehicle communications port **100**, electrical interface **122** provides electrical communication between brake light control module **120** and vehicle communications port **100**. In the depicted embodiment, electrical interface **122** includes pins **130** configured to engage receiving cavities **110** when brake light control module **120** is mechanically connected to vehicle communications port **100**. Electrical interface **122** is located on a side of brake light control module **120** facing vehicle communications port **100**, when connected thereto.

[0024] In some embodiments, brake light control module **120** has a second electrical interface on a side facing away from vehicle communications port **100**, when connected thereto. Such embodiments may present an electrical interface substantially the same as electrical interface **102** so that additional components can be in electrical communication with vehicle communications port **100**. An additional component can be connected to brake light control module **120** via the second electrical interface, while brake light control module **120** is connected to vehicle communications port **100**. In such embodiments, brake light control module **120** may also have a second mechanical interface on the side facing away from vehicle communications port **100**, when connected thereto. Such embodiments may present a mechanical interface substantially the same as mechanical interface **104**.

[0025] In some embodiments, either or both of complementary electrical interfaces **102**, **122** and complementary mechanical interfaces **104**, **124** may be of a different form. In some embodiments, brake light control module includes electronics and/or software that perform automatic control of a vehicle's standard brake lights, as will be detailed below. In some embodiments, a vehicle's engine control unit may be adapted to automatically control a vehicle's standard brake lights. In such embodiments, the engine and/or chassis control unit may be electronically configured and/or programmed to perform automatic control of the vehicle's standard brake lights. In such embodiments, connection of a physical module to vehicle communications port may not be required for automatic control of a vehicle's standard brake lights.

[0026] FIG. **3** is a block diagram of an exemplary brake light control system. In FIG. **3**, brake light control system **200** is in electrical communication with vehicle transducers **202**, engine control unit **204**, brake light actuator **206**, and vehicle operation actuators **208** via vehicle communications bus **210**. In some embodiments, brake light control system **200** is part of brake light control module **120**, depicted in FIG. **2**B. Vehicle transducers **202** include vehicle sensors and/or monitors **212** and vehicle control transducers **214**. Various vehicle sensors and/or monitors **212** may provide electrical signals indicative of various monitored and/or measured vehicle parameters to vehicle communications bus **210**. Some vehicle sensors and/or monitors may provide signals indicative of a vehicle's speed. For example, an anti-lock brake sensor and/or a transmission shaft speed sensor may provide a signal indicative of a vehicle's speed. vehicle transducers **202**, engine control unit **204**, brake light actuator **206**, and vehicle operation actuators **208** can usually be found in various within a vehicle. Such vehicle components share communications bus **210** for sending and/or receiving electrical signals indicative of various vehicle parameters.

[0027] Engine control unit **204** may receive various signals provided to vehicle communications bus. The signals received by engine control unit **204** may then be processed by engine control unit **204**, which then may provide control signals to vehicle control transducers **214** via vehicle communications bus **210**. Engine control unit **204** may also generate a vehicle speed signal and provide it to vehicle communications bus **210**. In some embodiments engine control unit **204** can provide automatic control of a vehicle's standard brake lights. In such embodiments, engine control unit **204** may provide brake light activation and/or deactivation signals to vehicle communications bus **210**. Brake light actuator **206** may receive the brake light activation and/or deactivation signals from vehicle communications bus **210**. In response to receiving activation and/or deactivation signals from vehicle communications bus **210**, brake light actuator **206** may then control operating power to a vehicle's standard brake lights.

[0028] Vehicle operation actuators **208** may also provide signals to vehicle communications bus **210**. Vehicle operation actuators **208** can include driver operated actuators, such as, for example, throttle position, and brake lever position **211**. A brake lever position sensor may provide a signal indicative of a brake lever position to vehicle communications bus **210**, for example. A throttle position sensor may provide a signal indicative of a throttle position to vehicle communications bus **210**, for example.

[0029] Brake light control system **200** may receive various signals provided to vehicle communications bus **210**. Brake light control system **200** may then process the signals received from vehicle communications bus **210** to generate brake light control signals. Brake light control system **200** includes microprocessor **216**, memory **218**, input/output buffer **220**, deceleration calculator **222**, threshold comparator **224**, and speed signal quality calculator **226**. Memory **216** includes program memory **228** and data memory **230**.

[0030] Microprocessor **216** can be programmed to control a vehicle's brake lights using a variety of methods, some of which will be detailed below. For example, microprocessor **216** may retrieve program instructions from program memory **228**. Microprocessor **216** may then receive signals indicative of a vehicle's speed from communications bus **210** via input/output buffer **220**. In some embodiments, microprocessor **216** may receive signals indicative of a vehicle's speed from one source, or from more than one source. In some embodiments, microprocessor **216** sends the

signals indicative of a vehicle's speed received from multiple sources to speed signal quality calculator **226**. Speed signal quality calculator **226** may select one of the sources from the multiple sources of signals indicative of the vehicle's speed to be used by deceleration calculator **222** for calculating a deceleration of the vehicle.

[0031] The speed signal quality calculator **226** may send a signal indicative of the selected one of the multiple sources to microprocessor **216**. Microprocessor **216** may then send the received signal from the selected one of the multiple sources to deceleration calculator **222**. Deceleration calculator **222** then processes the signal indicative of the vehicle's speed sent from the selected source and calculates a deceleration of the vehicle. Deceleration calculator **222** then sends a signal indicative of the vehicle's deceleration to microprocessor **216**. Microprocessor **216** may then retrieve one or more predetermined thresholds from data memory **230**. Then, microprocessor **216** may send the signal indicative of the vehicle's deceleration, along with the one or more predetermined thresholds to threshold comparator **224**. Threshold comparator **224** compares the signal indicative of the vehicle's deceleration with the one or more predetermined thresholds. Threshold comparator **224** sends signals indicative of the results of these comparisons to microprocessor **216**.

[0032] Based on these signals indicative of the comparison results, microprocessor **216** generates signals to control the vehicle's brake lights. Microprocessor **216** may then send the generated signals to vehicle communications bus **210** via input/output buffer **220**. These generated signals may include an address indicative of intended recipient brake light actuator **206**, for example. Brake light actuator **206** activates and/or deactivates the vehicle's standard brake lights in response the received signals generated by microprocessor **216**.

[0033] In some embodiments, brake light control system **200** may be embodied in brake light control module **120**. In such embodiments, electrical communication between brake light control system **200** and vehicle communications bus **210** may be enabled by connecting brake light control module **120** to vehicle communications port **100**. In some embodiments, one or more of the functions performed by deceleration calculator **222**, threshold comparator **224**, and speed signal quality calculator **226** may be performed by microprocessor **216**. In some embodiments, automatic control of a vehicle's standard brake lights may be performed by engine control unit **204**.

[0034] FIG. **4** is a flow chart of an exemplary method for automatically actuating a vehicle's brake lights. In FIG. **4**, method **300** for automatically actuating a vehicle's standard brake lights is detailed from the vantage point of microprocessor **216** of FIG. **3**. Method **300** begins at step **302**, in which step indices I and N are initialized to zero. Then, at step **304**, microprocessor receives signal(I) from vehicle communications bus **210**. Then, at step **306**, microprocessor **216** evaluates whether signal(I) is a speed signal. In some embodiments, signal(I) contains a tag indicative of a type of signal.

[0035] In some embodiments, vehicle communications bus **210** may be implemented as a J1939 Controller Area Network (CAN) bus. On some trucks, vehicle communications buses **210** and/or vehicle communications ports **100** operate using J1939 protocols and/or using CAN bus protocols. Messages on the CAN bus may contain a CAN identification (ID). CAN IDs may have a Parameter Group Number (PGN) defining a data type and/or a CAN bus device source address. The J1939 protocol, for example, may identify the vehicle speed using a PGN of 0xFEF1. Multiple sources, each having a unique source address may send communications having a PGN value of 0xFEF1, if each of these communications includes signals indicative of the vehicle's speed. In such embodiments the PGN value can serve as the tag indicative of the type of signal received by microprocessor **216**.

[0036] Then, at step **306**, microprocessor **216** compares the tag indicative of the type of signal with a predetermined value indicative of a speed signal. If, at step **306**, signal(I) does not have a tag indicative of a speed signal, the method proceeds to step **308**. At step **308**, microprocessor **216** increments index I and then method **300** returns to step **304** and awaits the next signal(I). If, however, at step **306**, signal(I) has a tag indicative of a speed signal, the method proceeds to step **310**. At step **310**, Speed Signal SS(N) is equated to signal(I). Then, at step **312**, microprocessor **216** calculates the vehicle's deceleration DECEL(N) based on a series of speed signals SS(M . . . N). At step **314**, microprocessor **216** compares the calculated DECEL(N) with a first predetermined threshold THRESH**1**. If, at step **314**, the calculated DECEL(N) is greater than THRESH**1**, method **300** proceeds to step **316**. If, however, at step **314**, the calculated DECEL(N) is not greater than THRESH**1**, method **300** proceeds to step **318**.

[0037] At step **316**, microprocessor **216** compares the immediately preceding calculated DECEL(N−1) with THRESH**1**. If, at step **316**, immediately preceding calculated DECEL(N−1) is not greater than THRESH**1**, method **300** proceeds to step **320**. At step **320**, microprocessor **216** sends a signal to activate the vehicle's brake lights to vehicle communications bus **210**. If, however, at step **318**, immediately preceding calculated DECEL(N−1) is greater than THRESH**1**, there is no need to send a signal to activate the vehicle's brake lights, as a preceding step has presumably already done so. Method **300** proceeds to step **322** after step **318** if preceding calculated DECEL(N−1) is greater than THRESH**1**, and after step **320**. At step **322**, microprocessor increments index N. After step **322**, method **300** returns to step **308** and increments index I.

[0038] If at step **314**, the calculated DECEL(N) was not greater than THRESH**1**, method **300** proceeds to step **318**. At step **318**, microprocessor **216** compares the calculated DECEL(N) with a second predetermined threshold THRESH**2**. THRESH**2** is typically less than THRESH**1** so that hysteresis is employed when activating/deactivating a vehicle's brake lights. If, at step **318**, DECEL(N) is not less than THRESH **2**, then method **300** returns to step **322** and increments index N.

[0039] If, however, at step **318**, DECEL(N) is less than THRESH **2**, then method **300** proceeds to step **324**. At step **324**, microprocessor **216** compares the immediately preceding calculated DECEL(N−1) with THRESH**2**. If, at step **324**, immediately preceding calculated DECEL(N−1) is not less than THRESH**2**, method **300** proceeds to step **326**. At step **326**, microprocessor **216** sends a signal to deactivate the vehicle's brake lights to vehicle communications bus **210**. If, however, at step **324**, immediately preceding calculated DECEL(N−1) is less than THRESH**2**, there is no need to send a signal to deactivate the vehicle's brake lights, as a preceding step has presumably already done so. Method **300**

returns to step **322** after step **324** if preceding calculated DECEL(N−1) is less than THRESH**2**, and after step **326**.

[0040] FIG. **5** is a flow chart of an exemplary method for selecting a speed signal from a plurality of sources that communicate a speed signal to the vehicle communications port. In FIG. **5**, method **400** for selecting a speed signal from a plurality of sources is detailed from the vantage point of microprocessor **216** of FIG. **3**. Method **400** begins at step **402**, in which step: i) index I is initialized to zero; ii) microprocessor **216** retrieves the number of sources $N_{SOURCES}$ from data memory **230**; and iii) microprocessor **216** retrieves a list of source addresses SOURCE(**1** . . . $N_{SOURCES}$) from data memory **230**. Then, at step **404**, microprocessor **216** compares $N_{SOURCES}$ with 1. If, at step **404**, the number of sources not greater than one, method **400** proceeds to step **406**. At step **406**, microprocessor **216** sets the source address A_{SOURCE} equal to the single source in the source list—SOURCE(**1**), and method **400** ends. A_{SOURCE} will be the address identifying the speed signals to be used for calculating the vehicle's deceleration. If, however, at step **404**, the number of sources is greater than one, method **400** proceeds to step **408**. At step **408**, microprocessor **216** tests signals from SOURCE(I) for compliance with J1939 standards. Then at step **410**, microprocessor compares the results of the compliance test at step **408** with compliance standards. If, at step **410**, signals from SOURCE(I) are found to be not in compliance with compliance standards, method **410** proceeds to step **412**, at which step Compliance C(I) is set to false. If, however, at step **410**, signals from SOURCE(I) are found to be in compliance with compliance standards, method **410** proceeds to step **414**, at which step Compliance C(I) is set to true.

[0041] Regardless of whether signals from SOURCE(I) are found to be in compliance, after both steps **412** and **414**, method **400** proceeds to step **416**. At step **416**, microprocessor compares I+1 with $N_{SOURCES}$. If, at step **416**, I+1 is not equal to $N_{SOURCES}$, then method **400** proceeds to step **418** where index I is incremented. Method **400** proceeds from step **418** back to step **408** where tests signals from next SOURCE(I) for compliance with J1939 standards. If, however, at step **416**, I+1 is equal to $N_{SOURCES}$, then method **400** proceeds to step **420**. At step **420**, microprocessor compares the sum of all C(**0** . . . $N_{SOURCES}$−1) with zero. If at step **420**, the sum is equal to zero, method **400** proceeds to step **422**. At step **422**, microprocessor **216** determines the best source for use in calculating deceleration from the plurality of sources, all of which in this case are found not to be compliant with J1939 standards. In some embodiments, microprocessor **216** will determine a noise metric corresponding to signals from each of SOURCES (**0** . . . $N_{SOURCES}$−1). Microprocessor **216** may, for example, use the source corresponding to a minimum noise metric value of all of the computed noise metrics. Microprocessor **216** sets the source address A_{SOURCE} equal to the source selected using such a method, and the method ends.

[0042] If, however, at step **420**, the sum of sources in compliance with J1939 standards is not equal to zero, method **400** proceeds to step **424**. At step **424**, microprocessor tests to see if a single source is determined to be in compliance with J1939 standards. If, at step **424**, only one source is found to be in compliance, method **400** proceeds to step **426**. At step **426**, microprocessor **216** sets the source address A_{SOURCE} equal to the single source in compliance—SOURCE($I_{compliance}$), and method **400** ends. If, however, at step **426**, more than one source is found to be in compliance, method **400** proceeds to step **422**. At step **422**, microprocessor **216** determines the best source for use in calculating deceleration from the plurality of sources that are found to be in compliance with J1939 standards. After step **422**, method **400** ends.

[0043] In some embodiments, conditions for illumination of brake lights may be user configurable. For example, even if a vehicle is decelerating at a rate above a first predetermined threshold, if the vehicle throttle position is greater than a second predetermined threshold, the user may choose not to illuminate the vehicle's brake lights. Such a scenario could happen as a heavy truck is going up a steep hill, for example. In some circumstances, a user may choose not to illuminate the brake lights of the decelerating vehicle because the driver may not want a following user to think the driver is braking while driving up a hill, when in fact the driver is attempting to accelerate up the hill.

[0044] In an exemplary embodiment, a driver may configure an amount of hysteresis in activating/deactivating a brake light. A user, for example, may set both a first predetermined threshold of deceleration for activation and a second predetermined threshold of deceleration for deactivation. In some embodiments, a brake light timer may ensure that brake light activation has a duration that is always greater than a predetermined threshold. Such a system may prevent short duration illuminations of brake lights. In an illustrative embodiment, brake lights may be activated when the vehicle speed is below a predetermined threshold. Such a system will illuminate brake lights whenever a vehicle is stopped or moving at a low speed.

[0045] Various embodiments may have various advantages. For example, in some embodiments, a brake light control module may be retrofittable to a vehicle via the vehicle's vehicle communications port. In such embodiments, connecting the brake light control module to the vehicle's vehicle communications port augments the number or conditions that result in brake light illumination. For example, brake lights may be illuminated for vehicle conditions even without a driver activating a brake lever.

[0046] In some embodiments, automatic activation of brake lights may prevent rear-end accidents of vehicles so equipped. In some embodiments, vehicles that are stopped for whatever reason (e.g., accident, stall, traffic, etc.) will safely notify following vehicles of its stopped condition. In an exemplary embodiment, traffic patterns may improve as a result of improved communication of vehicular conditions on the road. For example, accordion-style traffic speed patterns may be reduced as following vehicles have early communication of vehicular speed and/or deceleration conditions. Traffic capacity of roads may increase as a consequence of such improved traffic patterns.

[0047] While the invention has been described with reference to an exemplary embodiment(s), it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular

embodiment(s) disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

1. A brake light control system comprising:

a control module configured to electrically connect to a vehicle communications port, the control module being physically supported by the vehicle communications port, when electrically connected, the control module including:

a microprocessor configured to receive a series of vehicle speed signals transmitted to the vehicle communications port;

a deceleration calculator configured to calculate deceleration based on the received series of vehicle speed signals; and

a threshold comparator configured to compare the calculated deceleration with a predetermined threshold,

wherein the microprocessor is further configured to generate a signal a brake light activation signal if the calculated deceleration is greater than the predetermined threshold,

wherein the generated brake light activation signal is configured to cause an illumination of a standard brake light of a vehicle.

2. The brake light control system of claim **1**, wherein the microprocessor is further configured to receive a plurality of series of vehicle speed signals transmitted to the vehicle communications port, each of the plurality of series of vehicle speed signals having an identification tag corresponding to a generating source of the series.

3. The brake light control system of claim **2**, wherein the microprocessor is further configured to select one of the received plurality of series of vehicle speed signals, the selected one being used by the deceleration calculator for calculating the deceleration.

4. The brake light control system of claim **3**, further comprising a speed signal quality calculator configured to calculate a noise metric corresponding to each of the received plurality of series of speed signals.

5. The brake light control system of claim **4**, wherein the selected one of the plurality of series of speed signals corresponds to a lowest one of the calculated noise metrics.

6. The brake light control system of claim **1**, wherein the predetermined threshold is a first predetermined threshold, and the threshold comparator if further configured to compare the calculated deceleration with a second predetermined threshold that is less than the first predetermined threshold, wherein the microprocessor is further configured to generate a brake light deactivation signal if the calculated deceleration is less than the second predetermined threshold.

6. The brake light control system of claim **1**, wherein operating power for the brake light control system is provided by the vehicle communications port.

7. The brake light control system of claim **1**, wherein the microprocessor is further configured to output the generated brake light activation signal to the vehicle communications port.

8. The brake light control system of claim **5**, wherein the microprocessor is further configured to output the deactivation signal at or after a predetermined time following output of a preceding activation signal.

9. A method for activating a vehicle's brake lights comprising:

electrically connecting a control module to a vehicle communications bus;

receiving a series of vehicle speed signals transmitted to the vehicle communications bus;

calculating a vehicle deceleration based on the received series of vehicle speed signals;

generating a brake light activation signal based on a comparison between the calculated deceleration and a predetermined threshold; and

outputting the generated brake light activation signal to the vehicle communications bus.

10. The method of claim **9** further comprising:

physically supporting the control module by a vehicle communications port.

11. The method of claim **9**, further comprising:

selecting a series of vehicle speed signals from a plurality of series of speed signals received by the signal detection module, the selected series to be used by the calculating step.

12. The method of claim **11**, wherein selecting a series of vehicle speed signals from a plurality of series of speed signals includes calculating a noise metric corresponding to each of the plurality of series of speed signals received by the signal detection module.

13. The method of claim **12**, wherein selecting a series of vehicle speed signals from a plurality of series of speed signals involves selecting the series of speed signals corresponding to the lowest of the calculated noise metrics.

14. The method of claim **9**, wherein the predetermined threshold is a first predetermined threshold, the method further comprising generating a brake light deactivation signal based on the comparison between the calculated deceleration and a second predetermined threshold, the second predetermined threshold indicative of a deceleration that is less than a deceleration indicated by the first predetermined threshold.

15. The method of claim **14**, further comprising outputting the generated deactivation signal at or after a predetermined time following a preceding activation signal was output.

16. The method of claim **9**, further comprising:

receiving operating power for the control module from the vehicle communications bus.

17. A vehicle brake light control system comprising:

a control module having a non-transitory computer usable medium having a computer readable program code embodied therein, said computer readable program code adapted to be executed to implement a method for activating a vehicle's brake lights, the method comprising:

receiving a series of vehicle speed signals;

calculating a vehicle deceleration based on the received series of vehicle speed signals;

comparing the calculated vehicle deceleration with a predetermined threshold;

generating a brake light activation signal if the deceleration is greater than the predetermined threshold; and

outputting the generated brake light activation signal.

18. The brake light control system of claim **17**, wherein the control module is physically supported by a vehicle communications port.

19. The brake light control system of claim **17**, wherein the control module is electrically connected to a vehicle communications bus.

20. The brake light control system of claim **17**, wherein the predetermined threshold is a first predetermined threshold, wherein the method further comprises:

generating a brake light deactivation signal based on the comparison between the calculated deceleration and a second predetermined threshold, the second predetermined threshold indicative of a deceleration that is less the a deceleration indicated by the first predetermined threshold.

21. The brake light control system of claim **20**, wherein the method further comprises:

outputting the brake light deactivation signal at or after a predetermined time following a preceding outputting of a brake light activation signal.

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