(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 January 2017 (05.01.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/003341 A1

(51) International Patent Classification:
B60T 7/12 (2006.01) *B60W 30/09* (2012.01)
B60K 31/00 (2006.01) *G01S 13/93* (2006.01)

(21) International Application Number:
PCT/SE2016/050507

(22) International Filing Date:
31 May 2016 (31.05.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1550928-4 1 July 2015 (01.07.2015) SE

(71) Applicant: **SCANIA CV AB** [SE/SE]; 151 87 Södertälje (SE).

(72) Inventors: **ALAM, Assad**; Åsgärdevägen 8, 121 31 Enskededalen (SE). **BEMLER, Marie**; Odlingsvägen 13, 647 35 Mariefred (SE).

(74) Agent: **FRENDH, Eva**; Scania CV AB, 151 87 Södertälje (SE).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: METHOD AND SYSTEM FOR ALERTING A DRIVER IN A FOLLOWER VEHICLE

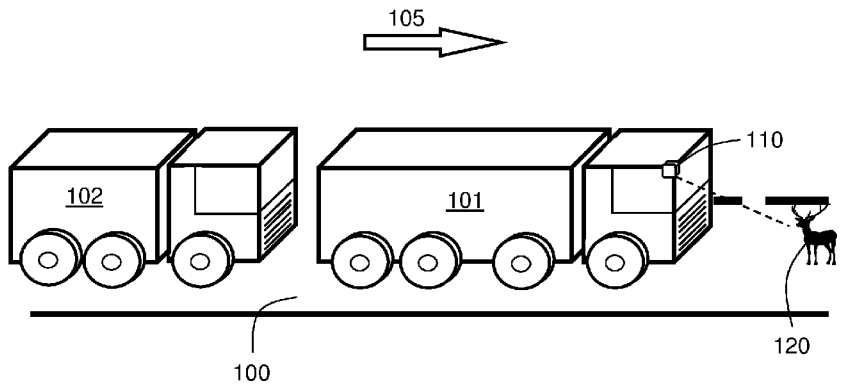


Fig. 1A

(57) Abstract: Method (400) and intervening driver assistant system (500), in a first vehicle (101), for alerting a driver in a follower vehicle (102) of an obstacle (120) in front of the first vehicle (101), detected by the intervening driver assistant system (500). The method (400) comprises detecting (401) the obstacle (120) in front of the first vehicle (101) by the intervening driver assistant system (500); and alerting (402) the driver in the follower vehicle (102), of the detected (401) obstacle (120) in front of the first vehicle (101), before the brakes of the first vehicle (101) are activated by the intervening driver assistant system (500).

WO 2017/003341 A1

METHOD AND SYSTEM FOR ALERTING A DRIVER IN A FOLLOWER VEHICLE

TECHNICAL FIELD

This document disclose a method and an intervening driver assistant system. More particularly, a method and an intervening driver assistant system in a first vehicle are described, for alerting a driver in a follower vehicle of an obstacle in front of the first vehicle.

BACKGROUND

Vehicles are sometimes equipped with an intervening driver assistant system such as e.g. an Automatic Emergency Brake (AEB) system. Such AEB system are mandated by legislation on all newly produced heavy vehicles, like trucks, busses etc. In short, the AEB helps the driver to avoid collisions by using radar and/ or camera sensors. The driver is first given a warning if the AEB system detects, through its sensors, that a collision is about to occur. Such warning may comprise an ignited lamp on the dash board, a waning on a display or similar. If the driver does not engage the brakes and the distance to the preceding vehicle (or other ahead obstacle) continues to decrease, a relatively mild brake is automatically applied to assist/ alert the driver. If the distance is further decreased and the driver has not stepped on the brake pedal, the braking is automatically applied in full.

Hence, safety is significantly improved and many lives are saved in the process with the AEB system. It may be noted that the above described functionality of the AEB system may be implemented under different trade names by different manufacturers.

However, for a vehicle driving behind an ahead vehicle, which may not be equipped with an AEB system, such sudden brake made by the vehicle in front may come as a complete surprise. In particular when driving behind a heavy vehicle at a close distance, as the driver of the follower vehicle may not be able to see what is occurring in front of the ahead vehicle.

Thus a sudden hard brake made by the ahead vehicle may come as a complete surprise to the driver in the follower vehicle, who may not be able to react and brake the vehicle fast enough to avoid an accident. Thus the AEB system unfortunately may have negative impact on the follower vehicles safety.

Another example of intervening driver assistant system is a turn assistant of a vehicle, which may alert unprotected road users when turning.

For avoiding such accidents, it would be desired to give the driver of the follower vehicle hint or warning of the upcoming situation, to give him/ her time to react on braking of the ahead vehicle.

Document US2013211687 and document US2006097570 describes different embodiments of warnings to the driver of a follower vehicle, in connection with automatic braking. The warning is emitted by braking lights, warning lights and/ or signal horn. The warning is however emitted later than the alert provided to the driver of the ahead vehicle.

Document US2014032094 describes a warning provided to the driver of a follower vehicle when the automatic brake system of the ahead vehicle is starting to brake the vehicle. However, no alert is provided to the driver in the follower vehicle, for preparing to brake. Further, no escalation in warnings is provided.

Document DE10218652 and document US2012283925 describes warning lights of a vehicle, able to emit light with different intensity or frequency to inform the follower vehicle about an emergency brake of the ahead vehicle. It is suggested that the ordinary brake light may flash or emit light with varying strength. However, the documents only discusses ordinary braking, not automated braking.

As these described scenarios, and similar variants of them, may lead to increased risks of accidents, it is desirable to find a solution.

SUMMARY

It is therefore an object of this invention to solve at least some of the above problems and provide a solution for enhanced traffic safety.

According to a first aspect of the invention, this objective is achieved by a method in a first vehicle having an intervening driver assistant system, for alerting a driver in a follower vehicle of an obstacle in front of the first vehicle. The method comprises detecting the obstacle in front of the first vehicle by the intervening driver assistant system. Further the method also comprises alerting the driver in the follower vehicle, of the detected obstacle in front of the first vehicle, before the brakes of the first vehicle are activated by the intervening driver assistant system.

According to a second aspect of the invention, this objective is achieved by an intervening driver assistant system in a first vehicle, for alerting a driver in a follower vehicle of an ob-

stacle in front of the first vehicle, detected by the automatic emergency brake system. The intervening driver assistant system comprises a detector, configured for detecting the obstacle in front of the first vehicle. Further, the intervening driver assistant system comprises an alerting device configured for alerting the driver in the follower vehicle, of the detected obstacle in front of the first vehicle, before the brakes of the first vehicle are activated by the intervening driver assistant system.

Thanks to the described aspects, the driver of the follower vehicle is given an alert before the first vehicle starts to brake. Thereby the attention of the follower vehicle driver is directed towards the impending braking of the first vehicle and he/ she is given time to react by placing the foot on the brake pedal and prepare for braking. Thus the risk of surprising the driver in a follower vehicle by a sudden braking of the ahead vehicle is reduced. Consequently also the risk of an accident is reduced, leading to enhanced traffic safety.

Other advantages and additional novel features will become apparent from the subsequent detailed description.

FIGURES

Embodiments of the invention will now be described in further detail with reference to the accompanying figures, in which:

Figure 1A illustrates a follower vehicle and a preceding vehicle according to an embodiment of the invention;

Figure 1B illustrates a follower vehicle and a preceding vehicle according to an embodiment of the invention;

Figure 2 illustrates a follower vehicle interior according to an embodiment;

Figure 3 illustrates a follower vehicle interior according to an embodiment;

Figure 4 is a flow chart illustrating an embodiment of the method;

Figure 5 is an illustration depicting a system according to an embodiment.

DETAILED DESCRIPTION

Embodiments of the invention described herein are defined as a method and an intervening driver assistant system, which may be put into practice in the embodiments described below. These embodiments may, however, be exemplified and realised in many different forms and are not to be limited to the examples set forth herein; rather, these illustrative

examples of embodiments are provided so that this disclosure will be thorough and complete.

Still other objects and features may become apparent from the following detailed description, considered in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are designed solely for purposes of illustration and not as a definition of the limits of the herein disclosed embodiments, for which reference is to be made to the appended claims. Further, the drawings are not necessarily drawn to scale and, unless otherwise indicated, they are merely intended to conceptually illustrate the structures and procedures described herein.

Figure 1A illustrates a scenario with a first vehicle **101** having an intervening driver assistant system such as e.g. an automatic emergency brake (AEB) system and a follower vehicle **102**. Both are driving in a driving direction **105** on a road **100**. The first vehicle 101 with the intervening driver assistant system, comprises a detector **110** configured for detecting the obstacle **120** in front of the first vehicle 101 in the driving direction 105.

The vehicles 101, 102 may comprise e.g. a truck, a bus, a car, a motorcycle or any similar vehicles or other means of conveyance. The vehicles 101, 102 may comprise vehicles of the same, or different types. Further, the first vehicle 101 may be driver controlled or driverless autonomously controlled vehicles in different embodiments. However, for enhanced clarity, the first vehicle 101 is subsequently described as having a driver.

The follower vehicle 102 and the preceding vehicle 101 may be organised in a platoon or vehicle convoy, wherein the vehicles 101, 102 are driving in coordination after each other with only a small distance between the vehicles 101, 102, such as some decimetres or some meters, e.g. 20-40 meters. However, the inter-vehicular distance or gap may be a variable time gap e.g. between 0.1-3 seconds, or any other appropriate time interval.

Further, the gap between the vehicles 101, 102 may vary with the speed of the vehicles 101, 102, as the time gap will create length distances of different length in different vehicle speeds (except when driving at very low speed, approaching a stationary condition, where a certain minimum distance in length may be desired).

However, the vehicles 101, 102 may be just coincidently driving one after another, without any particular coordination.

The detector 110 may comprise an on-board rangefinder sensor such as e.g. a laser rangefinder, a radar unit, a camera, a lidar, an ultrasonic sensor emitting an ultrasonic wave and detecting and analysing the reflections, or other similar devices.

The obstacle 120 detected in front of the first vehicle 101 may comprise e.g. an animal, a vehicle, a person, or basically any obstacle limiting or hindering the vehicle 101.

The problem with previously described solutions in the background section is that no preview information or alert is provided to the driver of the follower vehicle 102. Thereby, he/she may react too late to be able to brake, or steer away, in time. Thus, to alert the driver of the follower vehicle 102 that a collision avoidance action is about to occur, the intervening driver assistant system may issue a suitable indication is also issued to the follower vehicle, simultaneously with providing a collision warning in the instrument cluster to the driver of the first vehicle 101. This indication to the driver of the follower vehicle 102 may comprise e.g. that the brake lights of the first vehicle 101 are turned on as soon as a collision warning is issued by the intervening driver assistant system of the first vehicle 101. Another indication could be that the warning lights of the first vehicle 101 are initiated. Alternatively a sound could be used, for example by activating the horn of the first vehicle 101.

The indications may also be used with respect to what stage the collision avoidance is in. For example, if the collision avoidance is issued by the intervening driver assistant system of the first vehicle 101, the brake lights may be turned on with a low intensity. Further, the brake light intensity may become stronger when making the alert brake and then stronger when an automatic emergency braking, or automatic full braking is actuated.

Alternatively, in some embodiments, different lights or sounds of the first vehicle 101 can be combined. For example, when the collision warning is issued, the warning lights may be turned on. Then when the warning brakes are turned on, the brake lights may be activated. Finally, when the automatic emergency braking/ full braking is activated the vehicle horn may be activated in some embodiments.

By giving the driver of the follower vehicle 102 a hint in advance that the intervening driver assistant system of the ahead vehicle 101 has detected an obstacle 120 and will brake within soon, the driver is given a time period compensating for his/ her reaction time, which may be estimated to 1.6 seconds or there about (this is however somewhat different for different individuals depending on e.g. age). Thereby the attention of the follower driver is

increased and he/ she becomes aware of the possible collision avoidance situation in front of the first vehicle 101.

Thereby, an accident may be avoided and the life of the driver in the follower vehicle as well as the subject vehicle with the intervening driver assistant system may be saved, also when time period of the advance alert is very short, such as a second, or parts of a second.

Figure 1B illustrates a scenario similar to, or identical with the one already illustrated in Figure 1A, previously discussed.

In the illustrated example, the first vehicle 101 is igniting the braking lights 130 and/ or the warning lights 140 when the intervening driver assistant system of the first vehicle 101 is activated, i.e. generates a first (visual) alert to the driver in the first vehicle 101, and simultaneously, or substantially simultaneously ignites any or both of the braking lights 130 and/ or the warning lights 140.

In some embodiments, an escalation in alerting intensity may be made in order to reflect the escalation of the intervening driver assistant system of the first vehicle 101 (visual alert, warning brake and full brake, respectively). Such escalation may involve emitting light at different wavelength, i.e. in different colours; or intermittently emitted light at different frequencies, for example.

Figure 2 illustrates an interior view of how the driver of the follower vehicle 102 may perceive the situation described in Figure 1A/ Figure 1B, according to an embodiment.

In the illustrated example, the detector 110 of the intervening driver assistant system of the first vehicle 101 has detected an obstacle 120 in front of the first vehicle 101, in the driving direction 105. Thus an alert has been activated for alerting the driver of the first vehicle 101. Also, an additional alert has been activated for alerting the driver of the follower vehicle 102. Such alert may comprise activation of the braking lights 130 of the first vehicle 101.

However, in other embodiments, the alert may be provided by activation of the warning lights 140, activation of the horn of the first vehicle 101, activation of both the braking lights 130 and the warning lights 140 of the first vehicle 101 in some embodiments. In yet some embodiments, the braking lights 130, the warning lights 140 and the horn of the first vehicle 101 may all be activated simultaneously, for alerting the driver of the follower vehicle 102.

Figure 3 illustrates an interior view of how the driver of the follower vehicle 102 may perceive the situation described in Figure 1A/ Figure 1B, according to an embodiment.

In the illustrated embodiment, the driver of the follower vehicle 102 is alerted by various alerting devices on the first vehicle 101, like e.g. the braking lights 130, the warning lights 140 and/ or the horn of the first vehicle 101.

However, in addition the first vehicle 101 comprises a wireless transmitter **330**.The wireless transmitter 330 may transmit wireless signals to be received by a wireless receiver **310** in the follower vehicle 102.

The wireless communication may be made by e.g. Vehicle-to-Vehicle (V2V) signal, or any other wireless signal based on, or at least inspired by wireless communication technology such as Wi-Fi, Wireless Local Area Network (WLAN), Ultra Mobile Broadband (UMB), Bluetooth (BT), or infrared transmission to name but a few possible examples of wireless communications.

Upon receiving the wireless signal from the wireless transmitter 330 of the first vehicle 101, an alert may be presented to the driver of the follower vehicle 102, such as e.g. via a visual alert on a display **320**, a tactile/ haptic alert via vibrations in a device **340** in the follower vehicle 102, such as e.g. the steering wheel, and/ or an acoustic alert via a loudspeaker **350**. The acoustic alert may be a voice message, a sound, a melody or similar. The visual alert on the display 320 may comprise an image of the situation in front of the first vehicle 101, according to some embodiments.

In some embodiments, an escalation in alerting intensity may be made in order to reflect the escalation of the intervening driver assistant system of the first vehicle 101 (visual alert, warning brake and full brake, respectively). Such escalation may involve using different acoustic indications, or acoustic indications of increasing volume and/ or emitted light at different wavelength, i.e. in different colours; or intermittently emitted light at different frequencies, for example, on the display 320. Also, or alternatively, the vibrations of the tactile/ haptic alert in the device 340 may be emitted with different intensity.

By the made escalation in some embodiments, hazards resulting from an automatic braking process posed to the follower vehicle 102 behind the first vehicle 101 is reduced, as the

driver of the follower vehicle 102 becomes alerted and aware of the increasing danger, and thereby traffic safety is enhanced.

Figure 4 illustrates an example of a method **400** in a first vehicle 101 according to an embodiment. The flow chart in Figure 4 shows the method 400 in the first vehicle 101 having an intervening driver assistant system, for alerting a driver in a follower vehicle 102 of an obstacle 120 in front of the first vehicle 101. The first vehicle 101 is thus driving ahead of the follower vehicle 102, in the driving direction 105.

The vehicles 101, 102 may be any arbitrary kind of means for conveyance, such as a truck, a bus, a car or a motorcycle, or other similar vehicle.

The intervening driver assistant system may comprise an automatic emergency brake (AEB) system in some embodiments, or a right/ left turn assistance system, a system for electronic brakeforce distribution, a system for electronic brakeforce limitation, or other similar driver assist systems. The intervening driver assistant system may be configured for autonomously braking the vehicle 101, i.e. by automatically adjust the force applied to each of a vehicle's brakes, based on appearing obstacles 120, road conditions, speed, loading, etc.

In order to be able to correctly alert a driver in a follower vehicle 102, the method 400 may comprise a number of steps **401-404**. However, some of these steps 401-404 may be performed solely in some alternative embodiments, like e.g. step 403 and/ or 404. Further, the described steps 401-404 may be performed in a somewhat different chronological order than the numbering suggests. The method 400 may comprise the subsequent steps:

Step 401 comprises detecting the obstacle 120 in front of the first vehicle 101 by the intervening driver assistant system.

The obstacle 120 may be detected by a detector 110. The detector 110 may be based on an on-board rangefinder sensor such as e.g. a laser rangefinder, a radar unit, a camera, a lidar, an ultrasonic sensor emitting an ultrasonic wave and detecting and analysing the reflections, or other similar devices.

The detected obstacle 120 may comprise a human, an animal, a vehicle, a dropped piece of luggage or freight, or any other similar obstacle not appropriate on a road.

Step 402 comprises alerting the driver in the follower vehicle 102, of the detected 401 obstacle 120 in front of the first vehicle 101, before the brakes of the first vehicle 101 are activated by the intervening driver assistant system.

Thereby, the driver in the follower vehicle 102 is alerted together with an alert for the driver of the first vehicle 101, if this vehicle 101 has a driver. Such first vehicle alerting may be made by a visual indication on a display or a dashboard; by a sound or spoken message via a loudspeaker and/ or a tactile vibration via the steering wheel or car seat of the vehicle 101, in different embodiments. Such a display may also be a mobile phone, a computer display or the like and the display may be used both internal as well as external the vehicle.

The substantially simultaneous alert provided to the driver of the follower vehicle 102 may be made via the braking lights 130 of the first vehicle 101, the warning lights 140 of the first vehicle 101 and/ or the horn of the first vehicle 101 in different embodiments. The alert may comprise flashing with the lights 130, 140 in some embodiments; or alternatively emitting light continuously.

In some embodiments, the alert may be given about 1-3 seconds before the brake is activated in some embodiments.

Step 403 which may be performed only in some embodiments, may comprise indicating to the driver in the follower vehicle 102 that a warning brake is activated by the intervening driver assistant system of the first vehicle 101, in some embodiments.

The indication may be made via the braking lights 130 of the first vehicle 101, the warning lights 140 of the first vehicle 101 and/ or the horn of the first vehicle 101 in different embodiments.

Step 404 which may be performed only in some embodiments, may comprise warning the driver in the follower vehicle 102 that automatic emergency braking, or automatic full braking, is activated by the intervening driver assistant system of the first vehicle 101, in some alternative embodiments.

The indication may be made via the braking lights 130 of the first vehicle 101, the warning lights 140 of the first vehicle 101 and/ or the horn of the first vehicle 101 in different embodiments.

The alert 402, the indication 403, and/ or the warning 404 may be distinct according to some embodiments. Further, the alert 402, the indication 403, and/ or the warning 404 may be transmitted in an escalating manner, e.g. by increased intensity, by emitting light with different wave length, by emitting light with an increased frequency for example.

Thereby the driver of the follower vehicle 102 may distinguish the alert 402, the indication 403, and/ or the warning 404 from each other and correctly interpret the respective alert 402, indication 403, and/ or warning 404.

Furthermore, according to some embodiments, the method 400 may comprise generating and transmitting wireless control signals for activating the brakes also of the follower vehicle 102, substantially simultaneously with the braking of the first vehicle 101. Alternatively, the method 400 may comprise generating and transmitting wireless control signals for presenting a recommendation to the driver of the follower vehicle 102 to brake, or handle the situation based on the logic of the follower vehicle 102. Further, in some embodiments, a description such as an image of an obstacle 120 in front of the first vehicle 101 may be wirelessly transmitted to the follower vehicle 102, for being presented to the driver therein.

Figure 5 illustrates an embodiment of a system **500** in a first vehicle 101. The system 500 may be an intervening driver assistant system, such as e.g. an emergency alert brake system, or a turn assistance system in different embodiments. The intervening driver assistant system 500 in the first vehicle 101 may be configured for alerting a driver in a follower vehicle 102 of an obstacle 120 in front of the first vehicle 101, detected by the intervening driver assistant system 500. Thus the intervening driver assistant system 500 is configured for performing at least some of the previously described steps 401-404 according to the method 400 described above and illustrated in Figure 4.

The intervening driver assistant system 500 comprises a detector 110, configured for detecting the obstacle 120 in front of the first vehicle 101, in the driving direction 105. Further the intervening driver assistant system 500 comprises an alerting device 130, 140, **540** configured for alerting the driver in the follower vehicle 102, of the detected obstacle 120 in front of the first vehicle 101, before the brakes of the first vehicle 101 are activated by the intervening driver assistant system 500.

The detector 110 may comprise e.g. a radar, lidar, camera or similar situated in the front part of the first vehicle 101.

The alerting device 130, 140, 540 may comprise e.g. braking lights, warning lights and/ or horn of the first vehicle 101 or other alerting device 130, 140, 540 in the first vehicle 101, detectable for the driver in the follower vehicle 102.

The alerting device 130, 140, 540 may be configured for emitting an incrementing alert to be perceived by the driver in the follower vehicle 102, via the alerting device 130, 140, 540. It is thereby possible for the follower vehicle driver to distinguish between an alert, an indication and/ or a warning.

Furthermore, the intervening driver assistant system 500 may comprise a transmitter 330 configured to wirelessly transmit information concerning the detected obstacle 120 in front of the first vehicle 101, for alerting the driver in the follower vehicle 102 of the detected obstacle 120 via a local alerting device 320, 340, 350 in the follower vehicle 102.

The intervening driver assistant system 500 may in some embodiments also be configured for generating and transmitting control signals, via the transmitter 330, for controlling the brakes of the follower vehicle 102, simultaneously with braking the first vehicle 101. Thereby accidents may be avoided also in case the follower vehicle driver is inattentive.

Furthermore, the intervening driver assistant system 500 may comprise a control unit **510**, configured for controlling the actions performed by the intervening driver assistant system 500. The control unit 510 may comprise a receiving circuit **515**, configured for receiving signals from the detector 110 via a wired or wireless interface.

The control unit 510 may comprise a processor **520** configured for performing computations for alerting a driver in a follower vehicle 102 of an obstacle 120 in front of the first vehicle 101. Thus the processor 520 may be configured for performing the method 400 according to at least some of the previously described steps 401-404 of the method 400.

Such processor 520 may comprise one or more instances of a processing circuit, i.e. a Central Processing Unit (CPU), a processing unit, a processing circuit, a processor, an Application Specific Integrated Circuit (ASIC), a microprocessor, or other processing logic that may interpret and execute instructions. The herein utilised expression “processor” may thus represent a processing circuitry comprising a plurality of processing circuits, such as, e.g., any, some or all of the ones enumerated above.

Furthermore, the control unit 510 may comprise a memory **525** in some embodiments. The optional memory 525 may comprise a tangible, physical device utilised to store data or programs, i.e., sequences of instructions, on a temporary or permanent basis. According to some embodiments, the memory 525 may comprise integrated circuits comprising silicon-based transistors. The memory 525 may comprise e.g. a memory card, a flash memory, a USB memory, a hard disc, or another similar volatile or non-volatile storage unit for storing data such as e.g. ROM (Read-Only Memory), PROM (Programmable Read-Only Memory), EPROM (Erasable PROM), EEPROM (Electrically Erasable PROM), etc. in different embodiments.

Further, the control unit 510 may comprise a signal transmitter **530**. The signal transmitter 530 may be configured for transmitting a control signal over a wired or wireless interface in some embodiments, for an alerting device 130, 140, 540 in the first vehicle 101, or a wireless transmitter 330.

The previously described steps 401-404 to be performed by the intervening driver assistant system 500 may be implemented through the one or more processors 520 within the control unit 510, together with computer program product for performing at least some of the functions of the steps 401-404. Thus a computer program product, comprising instructions for performing the steps 401-404 in the control unit 510 may perform the method 400 comprising at least some of the steps 401-404 for alerting a driver in a follower vehicle 102 of an obstacle 120 in front of the first vehicle 101, when the computer program is loaded into the one or more processors 520 of the control unit 510.

The computer program product mentioned above may be provided for instance in the form of a tangible data carrier carrying computer program code for performing at least some of the step 401-404 according to some embodiments when being loaded into the one or more processors 520 of the control unit 510. The data carrier may be, e.g., a hard disk, a CD ROM disc, a memory stick, an optical storage device, a magnetic storage device or any other appropriate medium such as a disk or tape that may hold machine readable data in a non-transitory manner. The computer program product may furthermore be provided as computer program code on a server and downloaded to the control unit 510 remotely, e.g., over an Internet or an intranet connection.

Further, some embodiments may comprise a first vehicle 101, comprising the intervening driver assistant system 500, such as e.g. an automatic emergency brake system, config-

ured for alerting a driver in a follower vehicle 102 of an obstacle 120 in front of the first vehicle 101.

Furthermore, some embodiments may comprise a vehicle 102, such as a follower vehicle 102, comprising a receiver 310 configured for wirelessly receiving information concerning a detected obstacle 120 in front of another ahead vehicle 101, from the other vehicle 101. The vehicle 102 further comprises a local alerting device 320, 340, 350 configured for alerting the driver in the vehicle 102 of the detected obstacle 120 in front of the other vehicle 101, before the brakes of the other vehicle 101 are activated by an intervening driver assistant system 500 of the other vehicle 101. The local alerting device 320, 340, 350 may comprise e.g. a display in the vehicle 102, a tactile device in the steering wheel or car seat of the vehicle 102, a loudspeaker or horn of the follower vehicle 102, or any similar device.

In some embodiments, the follower vehicle 102 may comprise a set of brakes configured for braking the vehicle 102 when receiving an instruction via a wireless interface from the intervening driver assistant system 500 of the first vehicle 101. Thus the braking of the follower vehicle 102 may be coordinated with the braking of the first vehicle 101 and an accident may be avoided, also when the driver of the follower vehicle 102 is inattentive; or in case there is no driver in the follower vehicle 102; i.e. when the follower vehicle 102 is autonomously driven.

Furthermore, in some embodiments, the follower vehicle 102 may propagate the alert/ indication/ warning to a further following vehicle. Thereby, accidents with other further follower vehicles may be avoided.

The terminology used in the description of the embodiments as illustrated in the accompanying drawings is not intended to be limiting of the described method 400; the intervening driver assistant system 500, the computer program, the first vehicle 101 and/ or the follower vehicle 102. Various changes, substitutions or alterations may be made, without departing from invention embodiments as defined by the appended claims.

As used herein, the term "and/ or" comprises any and all combinations of one or more of the associated listed items. The term “or” as used herein, is to be interpreted as a mathematical OR, i.e., as an inclusive disjunction; not as a mathematical exclusive OR (XOR), unless expressly stated otherwise. In addition, the singular forms "a", "an" and "the" are to be interpreted as “at least one”, thus also possibly comprising a plurality of entities of the same kind, unless expressly stated otherwise. It will be further understood that the terms

"includes", "comprises", "including" or "comprising", specifies the presence of stated features, actions, integers, steps, operations, elements, or components, but do not preclude the presence or addition of one or more other features, actions, integers, steps, operations, elements, components, or groups thereof. A single unit such as e.g. a processor may fulfil the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. A computer program may be stored/ distributed on a suitable medium, such as an optical storage medium or a solid-state medium supplied together with or as part of other hardware, but may also be distributed in other forms such as via Internet or other wired or wireless communication system.

PATENT CLAIMS

1. A method (400) in a first vehicle (101) having an intervening driver assistant system (500), for alerting a driver in a follower vehicle (102) of an obstacle (120) in front of the first vehicle (101); which method (400) comprises:

detecting (401) the obstacle (120) in front of the first vehicle (101) by the intervening driver assistant system (500); and

alerting (402) the driver in the follower vehicle (102), of the detected (401) obstacle (120) in front of the first vehicle (101), before the brakes of the first vehicle (101) are activated by the intervening driver assistant system (500).

2. The method (400) according to claim 1, further comprising

indicating (403) to the driver in the follower vehicle (102) that a warning brake is activated by the intervening driver assistant system (500) of the first vehicle (101).

3. The method (400) according to any of claim 1 or claim 2, further comprising

warning (404) the driver in the follower vehicle (102) that automatic full braking is activated by the intervening driver assistant system (500) of the first vehicle (101).

4. An intervening driver assistant system (500) in a first vehicle (101), for alerting a driver in a follower vehicle (102) of an obstacle (120) in front of the first vehicle (101), detected by the driver assistant system (500); wherein the intervening driver assistant system (500) comprises:

a detector (110), configured for detecting the obstacle (120) in front of the first vehicle (101); and

an alerting device (130, 140, 540) configured for alerting the driver in the follower vehicle (102), of the detected obstacle (120) in front of the first vehicle (101), before the brakes of the first vehicle (101) are activated by the intervening driver assistant system (500).

5. The intervening driver assistant system (500) according to claim 4, wherein the alerting device (130, 140, 540) comprises braking light (130) of the first vehicle (101), warning lights (140) of the first vehicle (101), horn (540) of the first vehicle (101), or other alerting device (130, 140, 540) in the first vehicle (101), detectable for the driver in the follower vehicle (102).

6. The intervening driver assistant system (500) according to any of claim 4 or claim 5, wherein the alerting device (130, 140, 540) is configured for emitting an incrementing alert to be perceived by the driver in the follower vehicle (102).

7. The intervening driver assistant system (500) according to any of claims 4-6, further comprising:

a transmitter (330) configured to wirelessly transmit information concerning the detected obstacle (120) in front of the first vehicle (101), for alerting the driver in the follower vehicle (102) of the detected obstacle (120) via a local alerting device (320, 340, 350) in the follower vehicle (102).

8. The intervening driver assistant system (500) according to claim 7, wherein the transmitter (330) is further configured to transmit wireless signals for activating the brakes of the follower vehicle (102).

9. A computer program comprising program code for performing a method (400) according to any of claims 1-3 when the computer program is executed in a computer in the first vehicle (101).

10. A first vehicle (101) comprising the intervening driver assistant system (500) according to any of claims 4-8.

11. A vehicle (102), comprising

a receiver (310) configured for wirelessly receiving information concerning a detected obstacle (120) in front of another vehicle (101), from the other vehicle (101); and

a local alerting device (320, 340, 350) configured for alerting the driver in the vehicle (102) of the detected obstacle (120) in front of the other vehicle (101), before the brakes of the other vehicle (101) are activated by an intervening driver assistant system (500) of the other vehicle (101).

12. The vehicle (102) according to claim 11, further comprising

a set of brakes configured for braking the vehicle (102) when receiving an instruction via a wireless interface from the intervening driver assistant system (500) of the first vehicle (101).

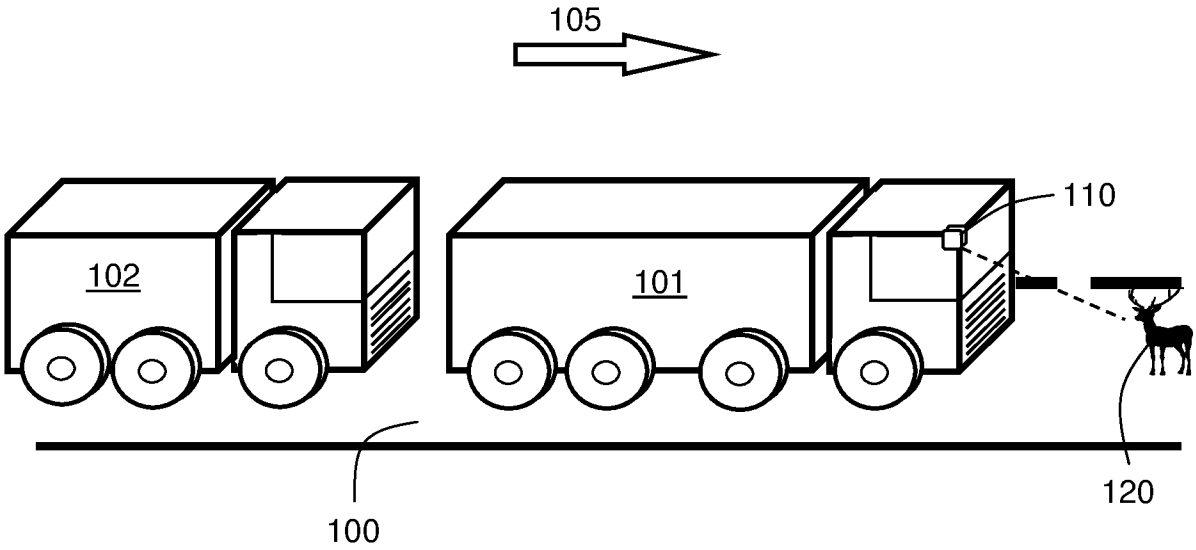


Fig. 1A

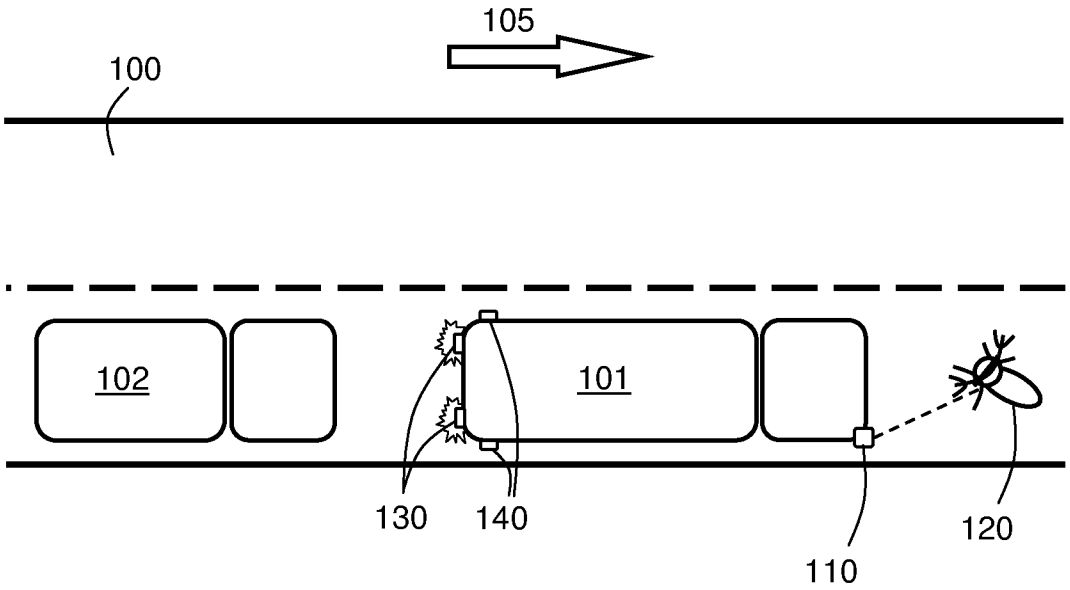


Fig. 1B

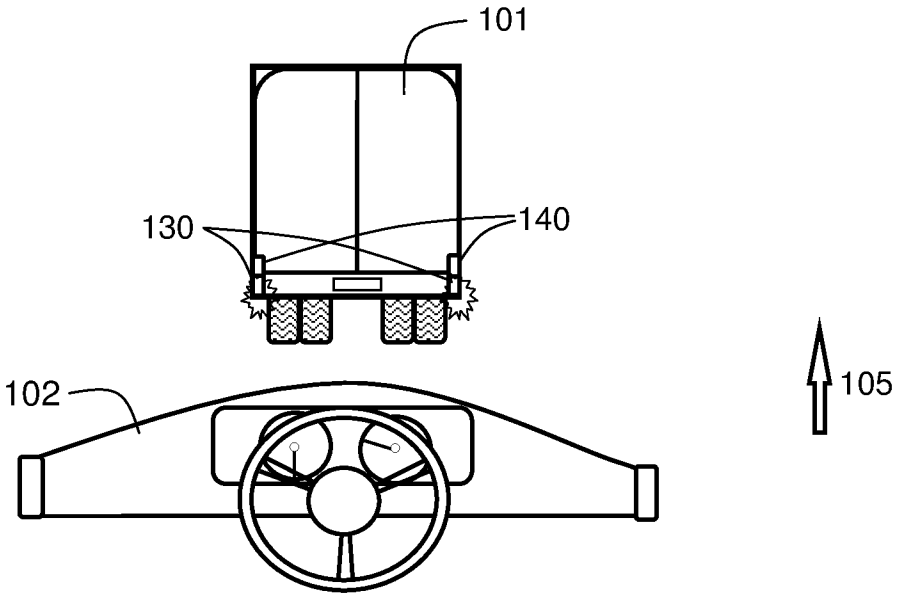


Fig. 2

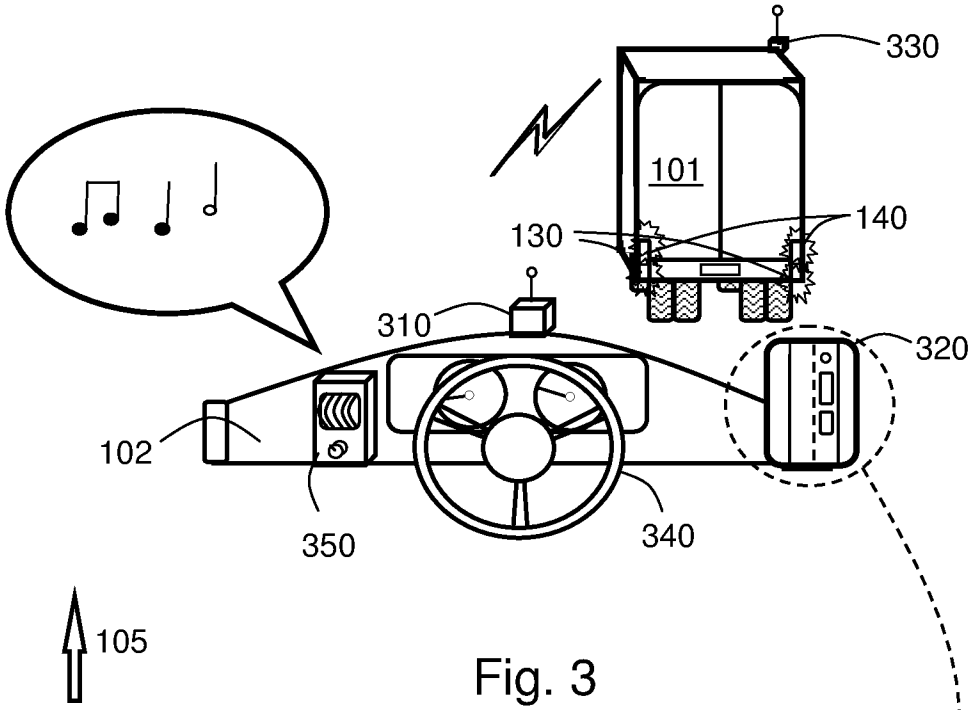
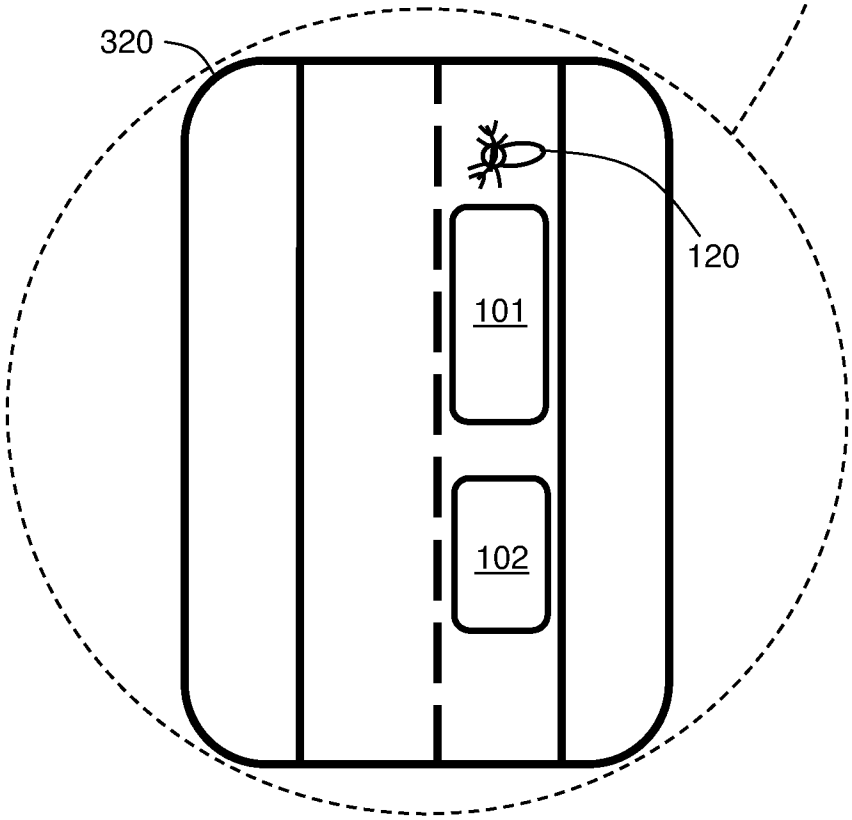


Fig. 3



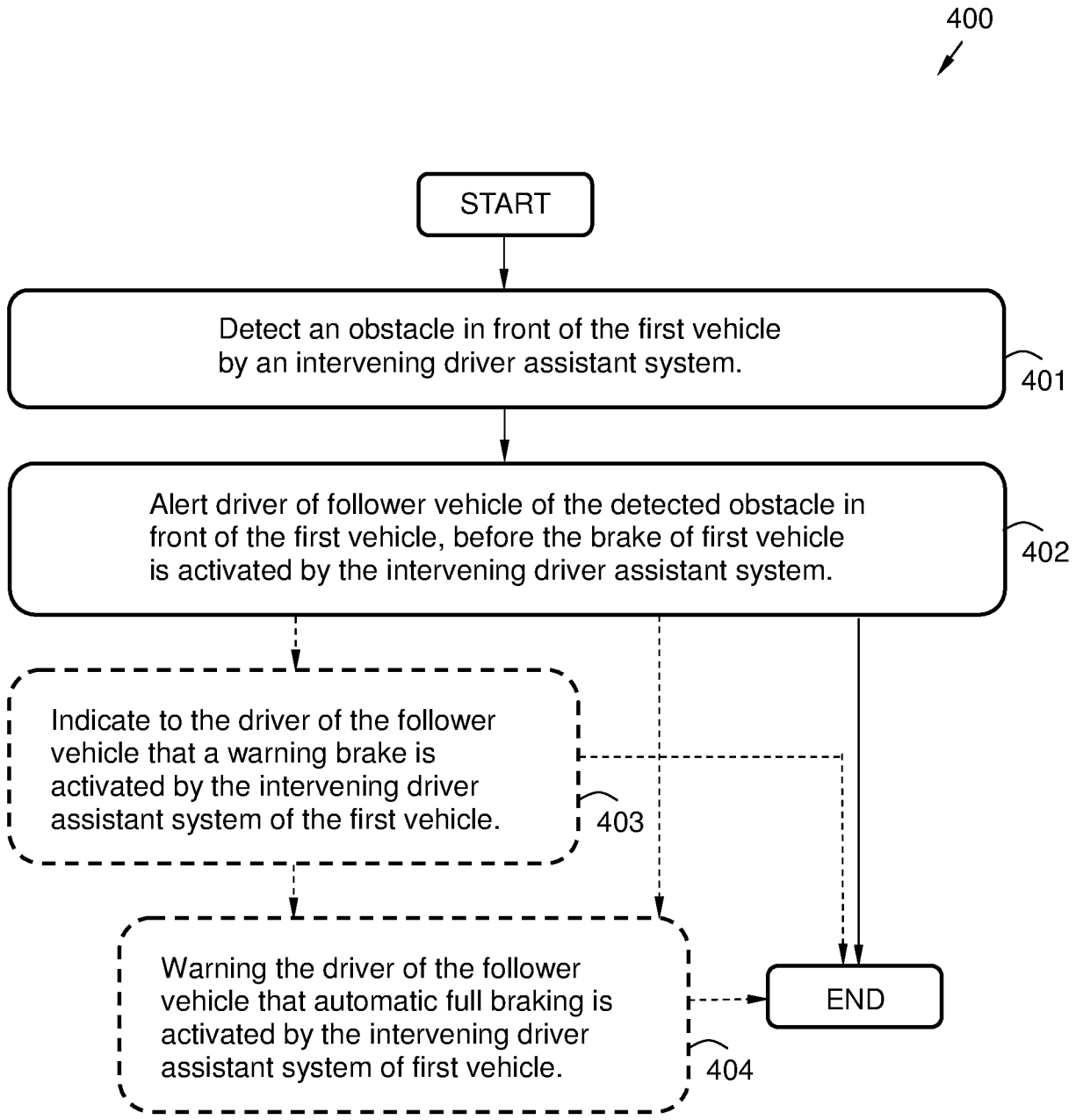

400
START
Detect an obstacle in front of the first vehicle by an intervening driver assistant system.
401
Alert driver of follower vehicle of the detected obstacle in front of the first vehicle, before the brake of first vehicle is activated by the intervening driver assistant system.
402
Indicate to the driver of the follower vehicle that a warning brake is activated by the intervening driver assistant system of the first vehicle.
403
Warning the driver of the follower vehicle that automatic full braking is activated by the intervening driver assistant system of first vehicle.
404
END

Fig. 4

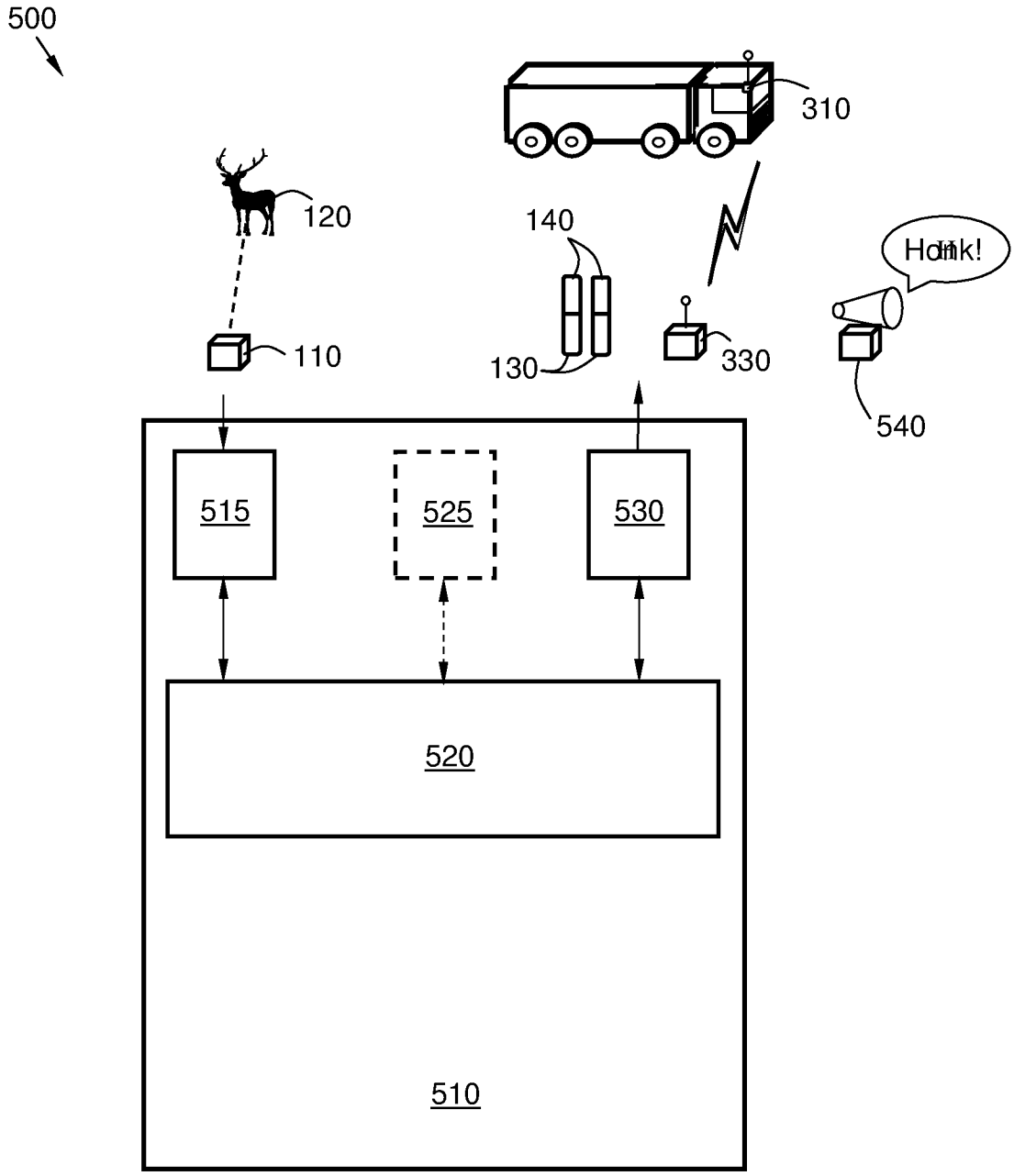


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/050507

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60K, B60T, B60W, G01S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 20080312834 A1 (NODA KAZUHIRO ET AL), 18 December 2008 (2008-12-18); paragraphs [0030], [0054]-[0060]	1-12
	--	
X	US 6624747 B1 (FRIEDERICH MICHAEL ET AL), 23 September 2003 (2003-09-23); column 2, lines 37-65; column 4, line 49 - column 5, line 50	1-12
	--	
A	DE 102011112985 A1 (DAIMLER AG), 14 March 2013 (2013-03-14); figures 3-5; paragraphs [0034], [0040]-[0048]	1-12
	--	

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31-08-2016	01-09-2016

Name and mailing address of the ISA/SE
Patent- och registreringsverket
Box 5055
S-102 42 STOCKHOLM
Facsimile No. + 46 8 666 02 86

Authorized officer
Johan Kjellgren
Telephone No. + 46 8 782 28 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/050507

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6278360 B1 (YANAGI EIJI), 21 August 2001 (2001-08-21); column 1, line 59 - column 2, line 33 --	1-12
A	WO 2014145918 A1 (PELOTON TECHNOLOGY INC ET AL), 18 September 2014 (2014-09-18); abstract --	1-12
A	US 5680097 A1 (UEMURA HIROKI ET AL), 21 October 1997 (1997-10-21); column 9, line 64 - column 10, line 29 --	1-12

International application No.
PCT/SE2016/050507

Continuation of: second sheet

International Patent Classification (IPC)

B60T 7/12 (2006.01)
B60K 31/00 (2006.01)
B60W 30/09 (2012.01)
G01S 13/93 (2006.01)

US	20080312834	A1	18/12/2008	DE	102008027744	A1	18/12/2008
				JP	2008307999	A	25/12/2008
				JP	4412356	B2	10/02/2010
				US	8260538	B2	04/09/2012
US	6624747	B1	23/09/2003	DE	19806687	A1	26/08/1999
				EP	1057159	B1	08/05/2002
				ES	2178392	T3	16/12/2002
				JP	2002504452	A	12/02/2002
				WO	9942973	A1	26/08/1999
DE	102011112985	A1	14/03/2013	NONE			
US	6278360	B1	21/08/2001	DE	20007584	U1	31/08/2000
				DE	10020524	A1	02/11/2000
				JP	2001014596	A	19/01/2001
WO	2014145918	A1	18/09/2014	CA	2907452	A1	18/09/2014
				US	20160054735	A1	25/02/2016
US	5680097	A1	21/10/1997	DE	4342257	B4	01/03/2007