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(54) Title: A DRIVER ASSISTANCE ARRANGEMENT FOR A VEHICLE, IN PARTICULAR A UTILITY VEHICLE, A VEHICLE, A DRIVER ASSISTANCE METHOD FOR A VEHICLE, AND A COMPUTER PROGRAM

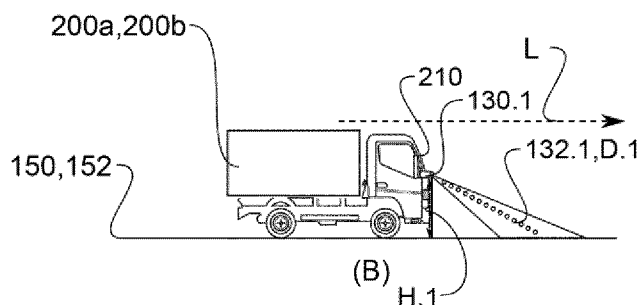


Fig. 2

(57) Abstract: A driver assistance arrangement (100) for a vehicle (200a), in particular a utility vehicle (200b), wherein the vehicle (200a), in particular utility vehicle (200b), is adapted to drive on a road surface (150), and the vehicle (200a), in particular utility vehicle (200b), comprises a principal locomotion direction (L), wherein the driver assistance arrangement (100) comprises a data processing device (110), an image sensor device (120) and a proximity sensor device (130), wherein the image sensor device (120) is adapted to acquire image data (121) in a surrounding (160) of the vehicle (200a), in particular utility vehicle (200b), in the principal locomotion direction (L), the proximity sensor device (130) is adapted to acquire proximity data (131) relating to a distance (D) between the proximity sensor device (130) and the road surface (150) in the principal locomotion direction (L), the data processing device (110) is adapted to obtain guiding information (111) from the image data (121) and to obtain slope information (112) from the proximity data (131), and wherein the data processing device (110) is adapted to obtain a vehicle control information (115) based on the combination of the guiding information (111) and the slope information (112).

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A driver assistance arrangement for a vehicle, in particular a utility vehicle, a vehicle, a driver assistance method for a vehicle, and a computer program

The present invention relates to a driver assistance arrangement for a vehicle, in particular a utility vehicle, wherein the vehicle, in particular utility vehicle, is adapted to drive on a road surface, and the vehicle, in particular utility vehicle, comprises a principal locomotion direction. The present invention further relates to a vehicle, in particular a utility vehicle, to a driver assistance method for a vehicle, in particular a utility vehicle, wherein the vehicle, in particular utility vehicle, is adapted to drive on a road surface and comprises a principal locomotion direction, and to a computer program.

Advanced driver assistance systems, ADAS, for vehicles, in particular utility vehicles are known from the prior art. Typically, such an ADAS evaluates sensor data of a vehicle sensor to perform an automated driving function and/or driving assistance.

An example of an ADAS according to the prior art is based on a radar system. Such a radar system is incapable of detecting lanes or traffic signs, of recognizing color and/or of detecting a slope. Such systems are typically cost-intensive and not retrofittable.

US 2010/114445 A1 discloses driving assistance method for a motor vehicle, wherein the method comprises the steps of detecting an obstacle located in proximity to the motor vehicle, calculating the slope of a road on which the motor vehicle is capable of travelling, determining, depending on the calculated slope of the road, a speed limit beyond which the motor vehicle will strike the obstacle, and if an obstacle is detected, automatically reducing the speed of the motor vehicle if this is greater than the speed limit. Therein, the obstacle is detected by means of ultrasonic detection sensors.

EP 3032458 A2 discloses a driver assistance apparatus with a stereo camera configured to acquire stereo images of a view ahead of a vehicle, and a processor configured to generate a depth map based on the acquired stereo images and to determine

whether a road segment that is within the view ahead of the vehicle is an uphill road segment or a downhill road segment based on the generated depth map.

Collision avoidance is a typical application of an ADAS. Therein, the ADAS outputs a driver warning and/or an override signal to avoid a collision. This is particularly demanding at a road curve in particular in combination with a slope, e.g., at a section of a road with a blind spot, at a steep gradient, at a single lane mountain road and/or at a ghat road. However, typically such a system cannot reliably recognize steep gradients, sharp turns, single lane mountain roads and/or ghat roads, at which the visibility is restricted. This may lead to an inability to perform an automated driving function to assist the driver.

It is an object of the present invention to provide driver assistance that may improve one or more of the aforementioned aspects and that is cost-effective, reliable and optionally retrofittable.

The object is solved by the subject-matter according to independent claim 1 and according to the remaining independent claims. Dependent claims relate to preferred embodiments.

According to an aspect of the invention, a driver assistance arrangement for a vehicle, in particular a utility vehicle, is provided. Therein, the vehicle, in particular utility vehicle, is adapted to drive on a road surface, and the vehicle, in particular utility vehicle, comprises a principal locomotion direction. The driver assistance arrangement comprises a data processing device, an image sensor device and a proximity sensor device, wherein the image sensor device is adapted to acquire image data in a surrounding of the vehicle, in particular utility vehicle, in the principal locomotion direction, the proximity sensor device is adapted to acquire proximity data relating to a distance between the proximity sensor device and the road surface in the principal locomotion direction, the data processing device is adapted to obtain guiding information from the image data and to obtain slope information from the proximity data, and wherein the data processing device is adapted to obtain a vehicle control information based on the combination of the guiding information and the slope information.

In the following, the vehicle, in particular utility vehicle, is referred to as vehicle. The vehicle comprises the principal locomotion direction which is a forward direction and/or longitudinal direction of the vehicle. The vehicle is adapted to drive on a road, wherein the road comprises the road surface. The road surface and the vehicle contact each other, and the contact between the road surface and the vehicle enables the vehicle to change a travel direction, to accelerate and/or to decelerate. The road and thus the road surface may comprise a curve. Additionally or alternatively, the road and the road surface may comprise a slope, i.e., an inclination that might be considered as an ascent and/or a descent in the principal locomotion direction. The slope of the road may change and/or may differ locally.

Each of the image sensor device and the proximity sensor device is arranged to acquire data of the surrounding of the vehicle in the principal locomotion direction, i.e., in front of the vehicle. By image data processing, the data processing device obtains guiding information from the image data. The guiding information may be used to assist the driver in the lateral control of the vehicle, e.g., to guide the vehicle in a curve of the road and/or to control the vehicle to drive along the curve.

The proximity sensor device is used for slope detection. The proximity sensor device measures the distance between the proximity sensor device and the road surface, i.e., the proximity sensor device may comprise a measuring axis which may be tilted towards the road with respect to a horizontal. The data processing device evaluates the proximity data, e.g., by comparing different distances between the proximity sensor device and the road surface, to obtain the slope information.

The data processing device is adapted to receive the image data and the proximity data and to obtain the guiding information and the slope information therefrom, respectively. The data processing device is further adapted to obtain the vehicle control information. The vehicle control information may assist the driver. To obtain the vehicle control information, the data processing device evaluates the guiding information being obtained from the image data and the slope information being obtained from the proximity information in a combined manner. I.e., to obtain the vehicle control information, the data processing device combines guiding information and slope information. This enables the data processing device to obtain vehicle control information

so that a kinematically feasible path for the vehicle may be determined and a respective automatic driving function may be performed.

The combination of the proximity sensor device and the image sensor device is cost-effective, reliable and retrofittable. The driver assistance arrangement may warn a driver of the vehicle regarding a sharp turn, a road curve, an obstruction, an oncoming vehicle, etc. so that the driver may be made aware of potentially unsafe situations, and/or to perform an automated driver assistance function, e.g., to take corrective maneuvers.

By the combination of the sensor data, the driver assistance system may identify a steep cut road surface, a fill slope and/or a road pit in a foggy or cloudy area, e.g., where the visibility of the lane is restricted and/or during lane change. The driver assistance system may reduce the workload of the driver even under difficult weather and/or visibility conditions. This may enable vehicle operation with enhanced reliability when traversing rough terrain.

Preferably, the guiding information comprises lane information and the lane information comprises a curvature information relating to the curvature of a road in the principal locomotion direction. The road comprises the road surface to which the distance to the proximity sensor device is measured. The image sensor device may be used for lane detection and/or warning sign detection which may indicate a curve. Thus, by image processing, the lane information and/or the curvature information may be detected by lane detection and/or traffic sign detection. Lane detection may enable a precise estimation of the road curvature. Traffic sign detection may enable an efficient estimation of a direction and/or sharpness of a curve. The image data may be used for a lateral control function of the driving assistance system to guide the vehicle at an intended lane.

Preferably, the vehicle control information comprises an operating speed profile, wherein the operating speed profile comprises a target vehicle speed in dependence on the combination of the guiding information and the slope information. The slope information and guiding information combination data makes it possible to predict reliably an optionally continuous operating speed profile at each point along a curved

and/or an inclined road. The target vehicle speed is a kinematically feasible limit vehicle velocity. The target vehicle speed depends on an optionally spatially resolved combination of the slope information and the guiding information for the curved and/or inclined road.

Preferably, the image sensor device is adapted to acquire infra-red image data. The acquisition of infra-red image data may achieve a reliable image data acquisition during night and daytime and/or under difficult visibility conditions, such as fog and/or snow. The driver assistance arrangement may comprise an infra-red light sensing device to acquire infra-red image data. Optionally, the driver assistance arrangement may comprise an infra-red light source to further enhance the acquisition of infra-red image data.

Preferably, the driver assistance arrangement comprises a gyroscope adapted to detect vehicle inclination information. The gyroscope is a device for measuring an orientation and/or angular velocity of the vehicle. This may enable the driver assistance arrangement to further enhance the detection of a slope and/or to differentiate between a slope change, i.e., a local slope difference, and an overall slope, i.e., the slope of the road with respect to a specific run and/or slope length being optionally larger than a vehicle length. Therein, the data processing device is adapted to obtain the vehicle control information in dependence on the vehicle inclination information. This may provide a more reliable vehicle control information at a sloped road. Therein, the drivability of the road may be limited by the slope change, since the slope change needs to be smaller than an angle of approach, which is the largest angle that the vehicle may climb from the road surface without interference.

Preferably, the data processing device is adapted to obtain a stability control signal based on the slope information. The slope may limit and/or require an application of a specific torque between the wheels of the vehicle and the road surface. The stability of the vehicle may be improved by applying a torque within a specific torque range. The stability control signal may inform the driver regarding the torque being in or outside the range and/or assist the driver to control the vehicle accordingly.

Preferably, the vehicle control information comprises a warning signal. This embodiment is particularly effective to retrofit, i.e., to install the driver assistance arrangement in and/or at an existing vehicle to improve the driving assistance capability of the vehicle. The warning signal may comprise a visual and/or an acoustic signal. Alternatively or additionally, the vehicle control information comprises an override signal to override a driver input signal. This embodiment may directly assist the driver in controlling the vehicle.

According to another aspect of the invention, a vehicle, in particular a utility vehicle is provided. The vehicle, in particular utility vehicle, comprises the driver assistance arrangement described herein. Preferably, the driver assistance arrangement comprises a preferred and/or optional feature as described herein to achieve a technical effect associated therewith.

According to another aspect of the invention, a driver assistance method for a vehicle, in particular a utility vehicle, is provided. Therein, the vehicle, in particular utility vehicle, is adapted to drive on a road surface, and the vehicle, in particular utility vehicle, comprises a principal locomotion direction. The method comprises the steps: acquiring image data in a surrounding of the vehicle, in particular utility vehicle, in the principal locomotion direction; acquiring proximity data relating to a distance between a proximity sensor device of the vehicle, in particular utility vehicle, and the road surface in the principal locomotion direction; obtaining guiding information from the image data; obtaining slope information from the proximity data; and obtaining a vehicle control information based on the combination of the guiding information and the slope information. Preferably, the driver assistance method comprises a preferred and/or optional method step analogous to the feature as described herein to achieve a technical effect associated therewith.

According to another aspect of the invention, a computer program is provided. The computer program comprises instructions which, when the program is executed by a controller, causes the controller to carry out the method according to the invention. Preferably, the computer program comprises instructions, when the program is executed by a controller, causes the controller to carry out a preferred and/or optional methods step as described herein to achieve technical effects associated therewith.

Further advantages and technical features and their technical effects are disclosed in the figures and the description thereof.

The figures show preferred embodiments as follows:

Fig. 1 a schematic of a vehicle, in particular a utility vehicle, comprising a driver assistance arrangement according to an embodiment of the invention;

Fig. 2 a schematic of a vehicle, in particular a utility vehicle, according to an embodiment of the invention;

Fig. 3 a schematic of a driver assistance arrangement according to an embodiment of the invention; and

Fig. 4 a schematic of a driver assistance method according to an embodiment of the invention.

Figure 1 shows a schematic of a vehicle 200a, in particular a utility vehicle 200b, comprising a driver assistance arrangement 100 according to an embodiment of the invention. The vehicle 200a, in particular utility vehicle 200b, will be referred to as vehicle 200a, 200b. The driver assistance arrangement 100 is an arrangement for a vehicle 200a, 200b as is further explained with reference to Figures 2 and 3.

As shown in Figure 1, the vehicle 200a, 200b, comprises a principal locomotion direction L, i.e., a forward direction. The vehicle 200a, 200b, is adapted to drive on a road surface 150 of a road 152. The road 152 comprises a first slope 153 and a second slope 154, each of which is indicated by a triangle with a dashed line. The first slope 153 is different from the second slope 154. The road 152 comprises a slope change 155 between the first slope 153 and the second slope 154. The road 152 comprises a curve (not indicated) with a curvature 151 (indicated schematically only).

The driver assistance arrangement 100 comprises a data processing device 110, an image sensor device 120, a proximity sensor device 130 and a gyroscope 140.

The image sensor device 120 is adapted to acquire image data 121 in a surrounding 160 of the vehicle 200a, 200b, in the principal locomotion direction L. The image

sensor device 120 is adapted to acquire infra-red image data 121a. The image sensor device 120 and the data processing device 110 are connected to each other so that the data processing device 110 may receive the image data 121, 121a to further process the image data 121, 121a for obtaining guiding information 111.

The proximity sensor device 130 is adapted to acquire proximity data 131 relating to a distance D between the proximity sensor device 130 and the road surface 150 in the principal locomotion direction L . The proximity sensor device 130 and the data processing device 110 are connected to each other so that the data processing device may receive the proximity data 131 to further process the proximity data 131 for obtaining slope information 112. The slope information 112 may relate to the first slope 153, to the second slope 154, to the difference between the first slope 153 and the second slope 154 and/or to the slope change 155.

The gyroscope 140 is adapted to detect vehicle inclination information 141. The gyroscope 140 and the data processing device 110 are connected to each other so that the data processing device 110 may receive the vehicle inclination information 141 to further process the vehicle inclination information 141. The vehicle inclination information 141 may relate to the inclination of the vehicle 200a, 200b with respect to a horizontal. Thus, the vehicle inclination information 141 may relate to the first slope 153 and/or the second slope 154.

The data processing device 110 is adapted to obtain a vehicle control information 115 based on the combination of the guiding information 111, the slope information 112, and the vehicle inclination information 141 as explained with reference to Figure 3.

The data processing device 110 may be a dedicated device for the driver assistance arrangement 100 so that the driver assistance arrangement 100 may be retrofittable. Alternatively or additionally, the data processing device 110 may be an electronic control unit, ECU, of the vehicle 200a, 200b.

Optionally, the data processing device 110 may be coupleable, e.g., via a wireless communication protocol, to a user terminal device and/or to a navigation device (not

shown). Further alternatively, the data processing device 110 may include a navigation device. The data processing device 110 may receive from the user terminal device and/or the navigation device, map data. The map data may comprise information relating to the road 152 and/or the road surface 150. The data processing device 110 may obtain guiding information 111 and/or lane information 113 from the map data. The map data may comprise slope information 112, e.g., the map data may comprise a topographic map and/or contour lines. The map data may be used to obtain the vehicle control information 115, e.g., by using the map data for a plausibility assessment regarding the guiding information 111 as being obtained from the image data 121 and the slope information 112 as being obtained from the proximity data 131, or vice versa. The map data may complement guiding information 111 and/or slope information 112 if the guiding information 111 and/or the slope information 112 may not be acquirable by the driver assistance arrangement 100. However, receiving and evaluating map data is optional and might be dispensed with.

Figure 2 shows a schematic of a vehicle 200a, 200b. The vehicle 200a, 200b comprises the driver assistance arrangement 100 as described with reference to Figures 1 and 3. Therein, Figure 2 shows three different views of the vehicle 200a, 200b (Figures 2 (A), 2 (B) and 2 (C)).

In Figure 2 (A), the vehicle 200a, 200b is shown in a front view. Thus, the principal locomotion direction L (not indicated) is oriented perpendicular to and out of the drawing plane. Figure 2 (A) indicates the arrangement of the image sensor device 120 and the proximity sensor device 130.1, 130.2.

Specifically, the image sensor device 120 is arranged at and orientated to a front of the vehicle 200a, 200b and below a windshield 210 of the vehicle 200a, 200b. Thus, a field of view of a driver may overlap with a sensing field of the image sensor device 120.

The proximity sensor device 130 comprises two distinct proximity sensor device members 130.1, 130.2. The proximity sensor device members 130.1, 130.2 are arranged at and orientated to a front of the vehicle 200a, 200b. The proximity sensor

device members 130.1, 130.2 are arranged at different heights as further explained with reference to Figures 2 (B) and 2 (C).

As shown in Figure 2 (B), the proximity device member 130.1 is arranged below the windshield 210 at a first height H.1. The proximity device member 130.1 comprises a first measuring axis 132.1 as indicated by the dotted line. The first measuring axis 132.1 is tilted with respect to a horizontal and/or to the principal locomotion direction L towards the road surface 150. The proximity device member 130.1 measures a first distance D.1 between the proximity device member 130.1 and the road surface 150.

As shown in Figure 2 (C), the proximity device member 130.2 is arranged above the windshield 210 at a second height H.2. The proximity device member 130.2 comprises a second measuring axis 132.2 as indicated by the dotted line. The second measuring axis 132.2 is tilted with respect to a horizontal and/or to the principal locomotion direction L towards the road surface 150. The proximity device member 130.2 measures a second distance D.2 between the proximity device member 130.2 and the road surface 150.

The data processing device 110 may receive the proximity data 131 from each of the proximity device members 130.1, 130.2 and compare the proximity data 131 of each of the proximity device members 130.1, 130.2 with each other to obtain the slope information 112.

Figure 3 shows a schematic of a driver assistance arrangement 100. The driver assistance arrangement 100 is the driver assistance arrangement 100 as described with reference to Figures 1 and 2.

As illustrated in Figure 3, the image sensor device 120 is connected to the data processing device 110 to transmit image data 121 from the image sensor device 120 to the processing device 110. The image sensor device 120 is adapted to obtain raw image data. The raw image data which is obtained by the image sensor device 120 is processed by a lane detector 123 and an edge detector 124 to obtain lane information 113 and curvature information 114 relating to the curvature 151 of the road 152 in the principal locomotion direction L. Therein, the lane detector 123 and the

edge detector 124 may be comprised by a dedicated processing member of the image sensor device 120 and/or by the data processing device 110 (not shown).

As explained with reference to Figures 1 and 2, the proximity sensor device 130 is adapted to acquire proximity data 131 and the gyroscope 140 is adapted to detect vehicle inclination information 141. Each of the proximity data 131 and the vehicle inclination information 141 is transmitted to the data processing device 110.

The driver assistance arrangement 100 comprises and/or the data processing device 110 is connected to an output device 215. The output device 215 may comprise a dedicated output device 215 of the driver assistance arrangement 100 and/or an output device 215 of the vehicle 200a, 200b. The output device 215 comprises an acoustic output device 216, such as a horn, and a visual output device 217, such as a display.

The data processing device 110 is connected to a CAN bus 220 of the vehicle 200a, 200b. The CAN bus 220 is connected to a pedal 221 of the vehicle 200a, 200b for transmitting pedal information 222 to the data processing device 110, to a transmission 223 of the vehicle 200a, 200b for transmitting transmission information 224, e.g., relating to a gear, to the data processing device 110, to a steering device 225, e.g., a steering wheel, of the vehicle 200a, 200b for transmitting steering information 226, e.g., relating to a steering angle of the vehicle 200a, 200b, to the data processing device 110 and to a speedometer 227 of the vehicle 200a, 200b for transmitting speed information 228 relating to the current speed of the vehicle 200a, 200b to the data processing device 110. The pedal information 222, the transmission information 224 and the steering information 226 are driver input signals 119b.

The data processing device 110 is adapted to obtain guiding information 111 from the image data 121 and to obtain slope information 112 from the proximity data 131. The guiding information 111 and the slope information 112 may be output via the output device 215. Further, the data processing device 110 is adapted to obtain the vehicle control information 115 in dependence on the vehicle inclination information 141 and based on the combination of the guiding information 111 and the slope information 112. The vehicle control information 115 may be output via the output device

215 and/or transmitted via the CAN bus 220 to perform driver assistance. Therein, the vehicle control information 115 comprises an operating speed profile 116, wherein the operating speed profile 116 comprises a target vehicle speed 117 in dependence on the combination of the guiding information 111 and the slope information 112.

The data processing device 110 is adapted to obtain a stability control signal 118 based on the slope information 112. The stability control signal 118 may be output via the output device 215 and/or transmitted via the CAN bus 220 to perform driver assistance.

The vehicle control information 115 comprises a warning signal 119 which is output via the output device 215. The vehicle control information 115 comprises an override signal 119a to override the driver input signal 119b, wherein the override signal 119a is transmitted via the CAN bus 220 to perform driver assistance.

Figure 4 shows a schematic of a driver assistance method 300 according to an embodiment of the invention. The driver assistance method 300 is described with regard to the description of Figures 1 to 3.

The driver assistance method 300 comprises acquiring 310 image data 121 in the surrounding 160 of the vehicle 200a, 200b, in the principal locomotion direction L.

The driver assistance method 300 comprises acquiring 320 proximity data 131 relating to the distance D between the proximity sensor device 130, and the road surface 150 in the principal locomotion direction L.

The driver assistance method 300 comprises obtaining 330 guiding information 111 from the image data 121 and obtaining 340 slope information 112 from the proximity data 131.

The driver assistance method 300 comprises obtaining 350 a vehicle control information 115 based on the combination of the guiding information 111 and the slope information 112.

The skilled person realizes that the steps of the driver assistance method 300 may be performed in an order other than illustrated in Figure 4. Steps of the driver assistance method 300 may be performed simultaneously and/or continuously, i.e., during performing other steps of the driver assistance method 300. E.g., the steps of acquiring 310 image data 121 and proximity data 131 may be performed in another order, simultaneously and/or continuously. The steps of obtaining 330 guiding information 111 and of obtaining 340 slope information 112 may be performed in another order, simultaneously and/or continuously.

List of Reference Signs (part of the description):

100	driver assistance arrangement
110	data processing device
111	guiding information
112	slope information
113	lane information
114	curvature information
115	vehicle control information
116	operating speed profile
117	target vehicle speed
118	stability control signal
119	warning signal
119a	override signal
119b	driver input signal
120	image sensor device
121	image data
121	infra-red image data
123	lane detector
124	edge detector
130	proximity sensor device
130.1	proximity sensor device member
130.2	proximity sensor device member
131	proximity data
132.1	measuring axis
132.2	measuring axis
140	gyroscope
141	vehicle inclination information
150	road surface
151	curvature
152	road
153	first slope
154	second slope
155	slope change

160	surrounding
200a	vehicle
200b	utility vehicle
210	windshield
215	output device
216	acoustic output device
217	visual output device
220	CAN bus
221	pedal
222	pedal information
223	transmission
224	transmission information
225	steering device
226	steering information
227	speedometer
228	speed information
300	driver assistance method
310	acquiring image data
320	acquiring proximity data
330	obtaining guiding information
340	obtaining slope information
350	obtaining vehicle control information
D	distance
D.1	first distance
D.2	second distance
H.1	first height
H.2	second height
L	principal locomotion direction

Claims:

1. A driver assistance arrangement (100) for a vehicle (200a), in particular a utility vehicle (200b), wherein the vehicle (200a), in particular utility vehicle (200b), is adapted to drive on a road surface (150), and the vehicle (200a), in particular utility vehicle (200b), comprises a principal locomotion direction (L), wherein
 - the driver assistance arrangement (100) comprises a data processing device (110), an image sensor device (120) and a proximity sensor device (130), wherein
 - the image sensor device (120) is adapted to acquire image data (121) in a surrounding (160) of the vehicle (200a), in particular utility vehicle (200b), in the principal locomotion direction (L),
 - the proximity sensor device (130) is adapted to acquire proximity data (131) relating to a distance (D) between the proximity sensor device (130) and the road surface (150) in the principal locomotion direction (L),
 - the data processing device (110) is adapted to obtain guiding information (111) from the image data (121) and to obtain slope information (112) from the proximity data (131), and wherein
 - the data processing device (110) is adapted to obtain a vehicle control information (115) based on the combination of the guiding information (111) and the slope information (112).
2. The driver assistance arrangement as claimed in claim 1, wherein the guiding information (111) comprises lane information (113), and the lane information (113) comprises a curvature information (114) relating to the curvature (151) of a road (152) in the principal locomotion direction (L).
3. The driver assistance arrangement as claimed in any one of the preceding claims, wherein the vehicle control information (115) comprises an operating speed profile (116), wherein the operating speed profile (116) comprises a target vehicle speed (117) in dependence on the combination of the guiding information (111) and the slope information (112).
4. The driver assistance arrangement as claimed in any one of the preceding claims, wherein the image sensor device (120) is adapted to acquire infra-red image data (121a).

5. The driver assistance arrangement as claimed in any one of the preceding claims, wherein the driver assistance arrangement (100) comprises a gyroscope (140) adapted to detect vehicle inclination information (141), and the data processing device (110) is adapted to obtain the vehicle control information (115) in dependence on the vehicle inclination information (141).

6. The driver assistance arrangement as claimed in any one of the preceding claims, wherein the data processing device (110) is adapted to obtain a stability control signal (118) based on the slope information (112).

7. The driver assistance arrangement as claimed in any one of the preceding claims, wherein the vehicle control information (115) comprises a warning signal (119) and/or an override signal (119a) to override a driver input signal (119b).

8. A vehicle (200a), in particular a utility vehicle (200b), comprising the driver assistance arrangement (100) as claimed in any one of the preceding claims.

9. A driver assistance method (300) for a vehicle (200a), in particular a utility vehicle (200b), wherein the vehicle (200a), in particular utility vehicle (200b), is adapted to drive on a road surface (150), and the vehicle (200a), in particular utility vehicle (200b), comprises a principal locomotion direction (L), wherein the method (300) comprises the steps:

- acquiring (310) image data (121) in a surrounding (160) of the vehicle (200a), in particular utility vehicle (200b), in the principal locomotion direction (L);
- acquiring (320) proximity data (131) relating to a distance (D) between a proximity sensor device (130) of the vehicle (200a), in particular utility vehicle (200b), and the road surface (150) in the principal locomotion direction (L);
- obtaining (330) guiding information (111) from the image data (121);
- obtaining (340) slope information (112) from the proximity data (131); and
- obtaining (350) a vehicle control information (115) based on the combination of the guiding information (111) and the slope information (112).

10. A computer program, comprising instructions which, when the program is executed by a processor, causes the processor to carry out the method (300) as claimed in claim 9.

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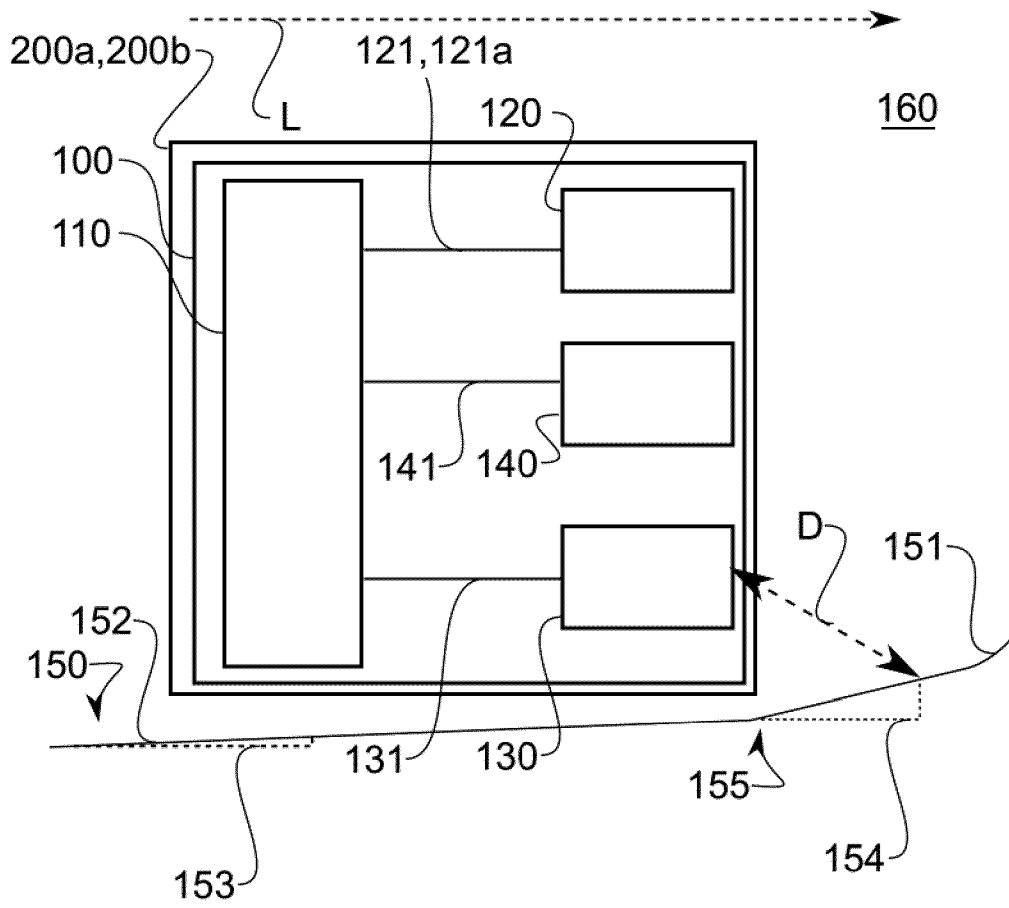
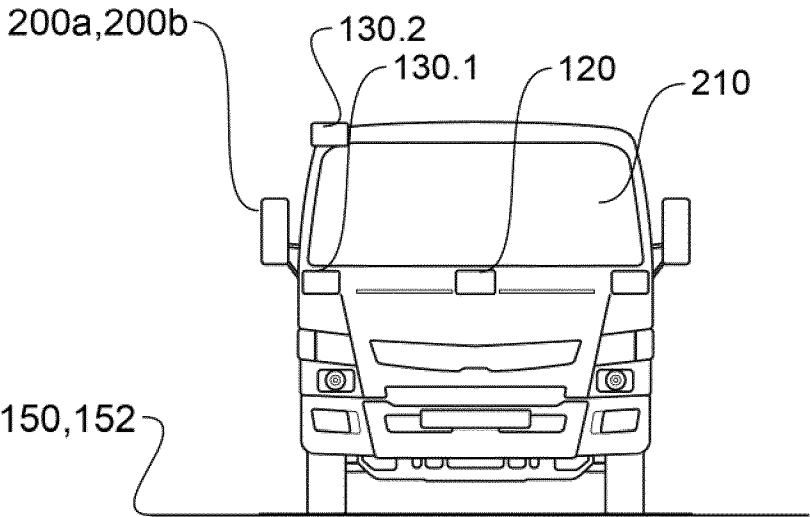
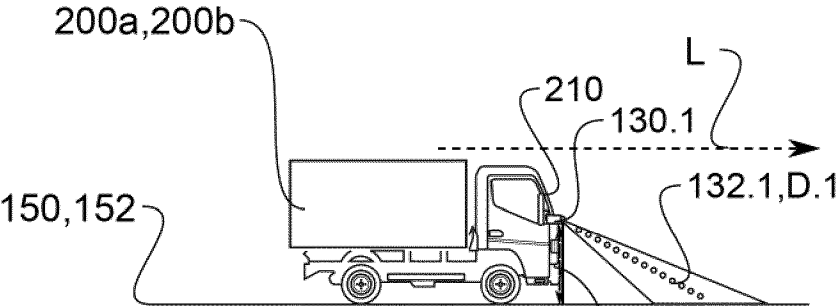


Fig. 1

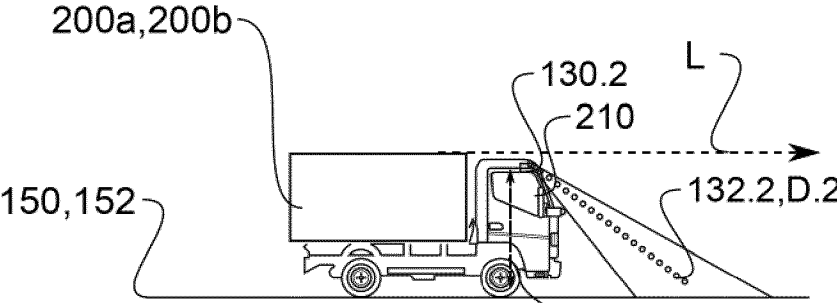
2/3



(A)



(B)



(C)

Fig.2

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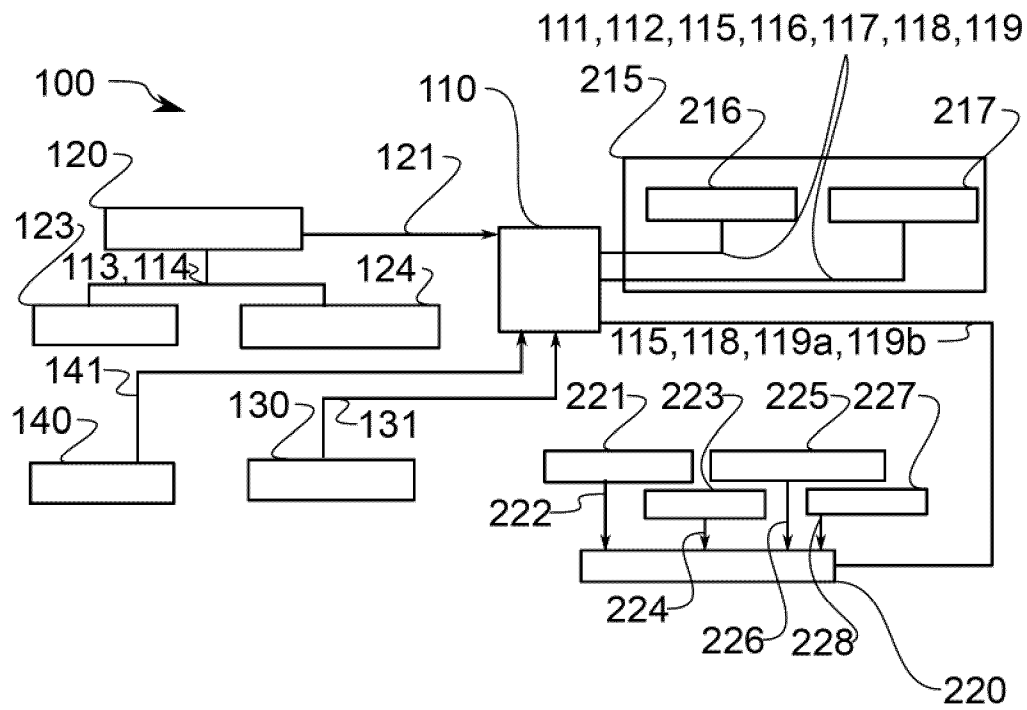


Fig.3

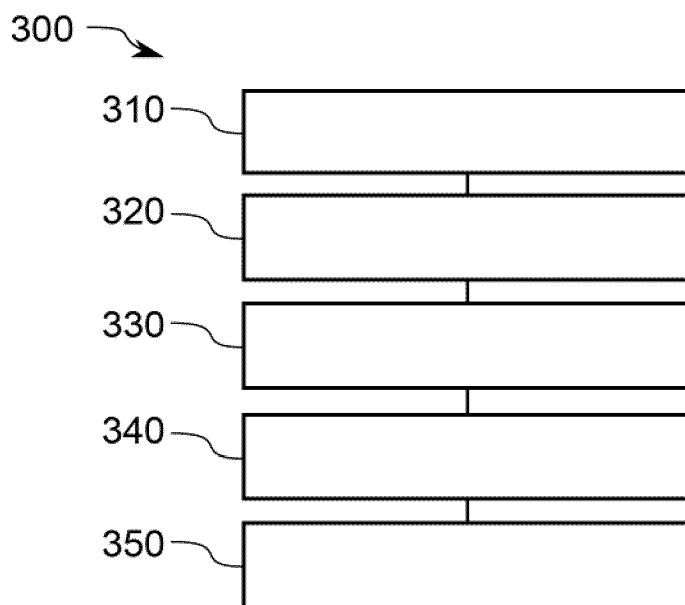


Fig.4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/062779

A. CLASSIFICATION OF SUBJECT MATTER INV. B60W40/06 B60W30/14 B60W40/076 B60W50/14 ADD.		
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) B60W		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2016/121888 A1 (CHOI JAE SEOB [KR]) 5 May 2016 (2016-05-05) paragraphs [0013] - [0014], [0021], [0036], [0039] - [0044], [0047] - [0051] paragraphs [0058] - [0059], [0063] - [0065] claims 1, 3, 5, 9, 11 figures 1-6 -----	1, 2, 4-10
Y	US 2007/081349 A1 (HAYASHI KENJI [JP]) 12 April 2007 (2007-04-12) paragraphs [0031] - [0033] claims 1, 3, 5 figure 3 -----	1, 8-10
Y	CN 109 387 841 A (UNIV ZHEJIANG) 26 February 2019 (2019-02-26) the whole document -----	1, 8-10
-/-		
☒ 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 5 September 2023		Date of mailing of the international search report 12/09/2023
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Laiou, M

INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	US 2021/171043 A1 (ALTMAN SHLOMO [US] ET AL) 10 June 2021 (2021-06-10) figures 1, 2, 4 paragraphs [0030], [0042], [0045], [0047], [0059], [0065] - [0066], [0071] claim 1 -----	1, 3, 4, 6-10
Y	JP 6 956165 B2 (HONDA MOTOR CO LTD) 27 October 2021 (2021-10-27) paragraph [0017] -----	1, 5, 8-10

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