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(54) **A VEHICLE AND A METHOD FOR A VEHICLE, WITH PRESENTATION OF MAXIMAL LOAD RANGE LIMITATION**

(57) A vehicle (2) for loading objects (20), comprising at least one sensing device (4) mounted on the vehicle (2) and being configured to capture measurement data to monitor the entire area, or a part of the area surrounding the vehicle, a processing unit (8) configured to receive said measurement data and to determine a real time overview image (10), e.g. a bird-view image, of the area surrounding the vehicle (2) based upon the measurement data, and further to generate a real time image signal (12) to be applied to a display unit (14) configured to show said real time overview image (10).

A loading arrangement (24) configured to load objects (20) to and from the vehicle, at least one supporting leg (30) configured to be extended outside the vehicle to support the vehicle during a loading procedure, wherein a supporting leg extension distance ranges from 0-100% of a maximal extension distance. The processing unit (8) is further configured to receive an object parameter comprising at least a weight of the object, and to determine a maximal load range limitation for said loading arrangement (24) for at least one of the entire range of support leg extension distances in dependence of the weight of the object, and to determine a load limitation image (34) of at least one of said determined maximal load range limitation. The load limitation image (34) is a graphical illustration (32) of said at least one maximal load range limitation in relation to the vehicle, and wherein said processing unit (8) is configured to superimpose said load limitation image (34) on said shown real time overview image (10).

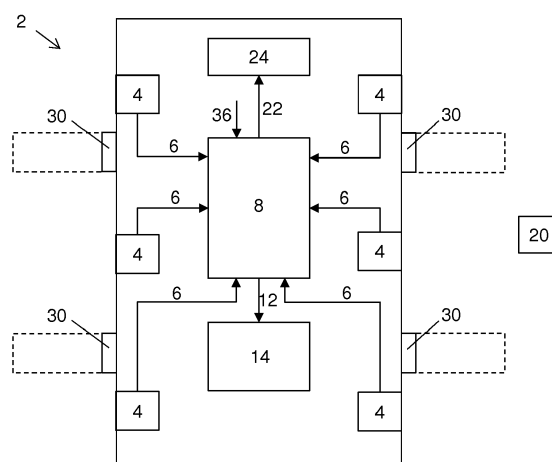


FIG. 1

DescriptionTechnical field

5 **[0001]** The present disclosure relates to a vehicle, and a method for a vehicle, providing a display unit presenting an overview image, e.g. a bird-view image, of the area surrounding the vehicle and including a superimposed image of at least one determined maximal load range limitation.

Background

10 **[0002]** For utility vehicles of various kinds, e.g. heavy vehicles, fire fighting vehicles, transport vehicles, but also for cars, visual assistance systems are known that comprise cameras for monitoring the ground area around the vehicle. For example, such camera systems are known for trucks to facilitate the manoeuvring of the vehicles, in particular in a backward driving situation. The driver may then watch the vehicle position on a display during driving operation.

15 In the following some prior art will be discussed illustrating various aspects of assistance systems.

[0003] In JP-2008074594 is disclosed a monitoring system for a vehicle provided with a crane and support legs. The crane comprises a rotatable base and a telescopic crane boom mounted to the base. Cameras are mounted to the crane and configured to monitor the area surrounding the vehicle. Images taken by the cameras are transformed into a bird view image by means of an image transformation unit and this bird view image is shown on a display in the driver's cabin of the vehicle. Markings lines illustrating the position of the support legs when extended by 50% and 100% are superposed on the bird view. Furthermore, a marking illustrating the area of rotation covered by the rotatable base is also superposed on the bird view. Hereby, it will be possible for the driver, when parking the vehicle, to check that there are no obstacles in the surroundings which will interfere with the support legs and the rotational base.

25 **[0004]** US-20150330146 discloses a monitoring system for a utility vehicle provided with an aerial apparatus, for instance in the form of a turnable ladder or a crane, and support legs. Cameras are mounted to the vehicle and configured to monitor the ground areas on which the support legs rest in the operating position. The ground areas monitored by the cameras are shown on a display in the driver's cabin of the vehicle. Markings illustrating the position of the support legs in the operating position are superposed on the image shown on the display. Furthermore, a marking illustrating the vertical turning axis of the aerial apparatus is also superposed on the image shown on the display. Hereby, it will be possible for the driver, when parking the vehicle, to check that there are no obstacles in the surroundings which will interfere with the support legs.

EP-2952467 discloses a monitoring system for a vehicle provided with a lifting device and support legs. Cameras are mounted to the vehicle and configured to monitor the area surrounding the vehicle. Images taken by the cameras are transformed into a bird view image and this bird view image is shown on a display in the driver's cabin of the vehicle. Markings illustrating the position of the support legs in different operating positions are superposed on the bird view. Hereby, it will be possible for the driver, when parking the vehicle, to check that there are no obstacles in the surroundings which will interfere with the support legs.

And finally, EP-2543622 discloses a monitoring system for an extensible boom of a mobile crane, wherein a camera is mounted near the outer end of the extensible boom in order to monitor a load suspended by the boom. The image taken by the camera is shown on a display. An image illustrating the extensible boom may be superposed on the image shown on the display. A limit performance line illustrating an area of maximum operation radius in which the extensible boom can move is superposed on the image shown on the display.

45 **[0005]** Thus, it is previously known to show, on a display in the driver's cabin of a vehicle, a bird view image of the vehicle and the area surrounding the vehicle, and that markings illustrating the position of support legs in different operating positions are superposed on the bird view.

[0006] Various extensions of the support legs may be applied dependent on the weight of the object to be loaded to, or unloaded from, a vehicle. In addition the environment surrounding the vehicle during loading/unloading may influence how much the support legs can be extended.

50 The object of the present invention is to achieve an improved vehicle and an improved method used in such a vehicle that provides a support tool for the operator of the vehicle to accurately and easily position the vehicle in relation to an object and indicate an applicable extension of the support legs in a specific situation.

Summary

55 **[0007]** The above-mentioned object is achieved by the present invention according to the independent claims. Preferred embodiments are set forth in the dependent claims.

[0008] According to a first aspect the invention relates to a vehicle, in particular a vehicle for loading objects, comprising at least one sensing device mounted on the vehicle and being configured to capture measurement data to monitor the

entire area, or a part of the area surrounding the vehicle. The at least one sensing device is configured to generate at least one measurement data signal including the captured measurement data, and a processing unit configured to receive the measurement data signal and to determine a real time overview image, e.g. a bird-view image, of the area surrounding the vehicle based upon the measurement data, and further to generate a real time image signal to be applied to a display unit configured to show the real time overview image. A loading arrangement is provided being configured to load objects to and from the vehicle, and being controlled by a loading control signal determined by the processing unit, and at least one supporting leg being arranged at the vehicle and being configured to be extended outside the vehicle to support the vehicle during a loading procedure, and that a supporting leg extension distance ranges from 0-100% of a maximal extension distance.

[0009] The processing unit is further configured to receive an object parameter comprising at least a weight of the object, and to determine a maximal load range limitation for the loading arrangement for at least one of the entire range of support leg extension distances in dependence of the weight of the object. Furthermore, the processing unit is configured to determine a load limitation image of at least one of the determined maximal load range limitation, wherein the load limitation image is a graphical illustration of the at least one maximal load range limitation in relation to the vehicle.

The processing unit is then configured to superimpose the load limitation image on the shown real time overview image. **[0010]** According to a second aspect the invention comprises a method to be applied in a vehicle, in particular a vehicle for loading objects. The method comprises:

- capturing measurement data by at least one sensing device mounted on the vehicle to monitor the entire area, or a part of the area surrounding the vehicle,
- generating at least one measurement data signal including the captured measurement data,
- receiving, in a processing unit, the measurement data signal,
- determining a real time overview image, e.g. a bird-view image, of the area surrounding the vehicle based upon said measurement data,
- generating a real time image signal and applying it to a display unit,
- showing said real time overview image in the display unit.

The method further comprises:

- receiving an object parameter comprising at least a weight of the object,
- determining a maximal load range limitation for said loading arrangement for at least one of the entire range of support leg extension distances in dependence of the weight of the object, and
- determining a load limitation image of at least one of said determined maximal load range limitation, wherein said load limitation image being a graphical illustration of said at least one maximal load range limitation in relation to the vehicle, and
- superimposing said load limitation image on said shown real time overview image.

[0011] Thus, according to the present invention a vehicle and a method is provided where a graphical illustration of the load range limitations for a loading arrangement of the vehicle is superposed on an overview image showing the vehicle and the area surrounding the vehicle. This is made in order to make it possible for the driver of the vehicle to place the vehicle optimally with respect to a load to be picked up, and more specifically, to get an indication and guidance of how far the support legs should be extended.

[0012] According to one embodiment the maximal load range limitations are determined for 2-5 different support leg extension distances, e.g. 50%, 75% and 100% of the maximal extension. Thereby the operator will have a clear indication of available options regarding how to position the vehicle in relation to the object,

[0013] According to another embodiment the processing unit is configured to receive an input signal including information of a chosen load range limitation. The input signal may e.g. be generated in response of an operator input via a touch screen of the display unit.

[0014] According to still another embodiment the processing unit is configured to determine a loading control signal in dependence of the chosen load range limitation, wherein the loading control signal comprises load instructions to control the loading arrangement to perform a loading procedure of an object within a loading area defined by the chosen load range limitation. This is advantageous in order to perform an accurate and fast loading of the object.

Brief description of the drawings

[0015]

Figure 1 is a block diagram schematically illustrating a vehicle according to the present invention.

Figures 2 and 3 are schematic illustrations of a screen of a display unit according to embodiments of the present invention.

Figure 4 is a flow diagram illustrating the method according to the present invention.

5 Detailed description

[0016] The vehicle and the method will now be described in detail with references to the appended figures. Throughout the figures the same, or similar, items have the same reference signs. Moreover, the items and the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

[0017] First with references to the schematic illustration in figure 1 the present invention relates to a vehicle 2, in particular a vehicle for loading objects 20, e.g. emptying a waste bin, loading a pile of forestry. The vehicle is provided with a load arrangement 24, e.g. a roof mounted crane (RMC), or a general articulated crane, capable of lifting loads from the ground to the load carrying part of the vehicle, and also for lifting loads from the vehicle to the ground.

The loading arrangement 24 is controlled by a loading control signal 22 determined by a processing unit 8.

The vehicle is further provided with at least one supporting leg 30, e.g. four supporting legs, configured to be extended outside the vehicle to support the vehicle during a loading procedure. The legs being extended often in a lateral and perpendicular direction in relation to the longitudinal axis of the vehicle. A supporting leg extension distance ranges from 0-100% of a maximal extension distance. In figure 1 the extended legs are denoted by dashed lines. By applying the supporting legs a stable support for the vehicle is achieved during a load lifting procedure. The distances that the support legs extend depend upon e.g. the weight of the load, and also of the position of the load in relation to the vehicle.

[0018] The object to be handled is not a part of the vehicle 2 and not physically connected to the vehicle but instead positioned outside the vehicle in an environment being accessible by the vehicle.

[0019] The vehicle comprises at least one sensing device 4 mounted on the vehicle 2 and being configured to capture measurement data to monitor the entire area surrounding the vehicle. The sensing device may be one or many of a camera, a radar, an infra-red sensor, a laser-scanner or any other type of sensing device. Various combinations of different types of sensing devices may be applied, e.g. one or many cameras and one or many laser-scanners.

[0020] The at least one sensing device 4 is configured to generate at least one measurement data signal 6 including the captured measurement data.

The processing unit 8 is configured to receive the measurement data signal 6 and to determine a real time overview image 10 of the entire area, substantially the entire area, or a part of the area surrounding the vehicle 2 based upon the measurement data. The part may be half of the area surrounding the vehicle, e.g. an area to the right of the vehicle.

The processing unit 8 is further configured to generate a real time image signal 12 to be applied to a display unit 14 configured to show the real time overview image 10 (see figure 2). The processor unit is provided with a necessary processing capability, and also computer memories, and is e.g. realized by a general computer unit normally available in the vehicle.

[0021] The number of sensing devices, e.g. cameras, is naturally related to the visual fields of the cameras that should be overlapping to cover the entire surroundings around the vehicle. In the figure six cameras are illustrated preferably arranged at elevated positions on the vehicle, but of course fewer or more sensing devices could be applied. The measurement data, e.g. the images, received from the sensing devices (the cameras) are then combined to a single overview image. In one embodiment the vehicle itself may be represented as a central rectangular marking in the centre of the image - see figures 2 and 3.

[0022] The measurement data received by the processing unit from the sensing devices represent the surroundings obtained at an angle that may range from 0 to 180 degrees in relation to the level of the ground. These images obtained by the sensing devices should then be transferred to an overview image, e.g. an image from above, i.e. a so-called bird-view image.

For many applications an image from above is most useful. However, also views from other directions may be applicable to provide an overview of the environment. These other directions range from essentially parallel to the ground to perpendicular to the ground. Below is a bird-view transformation technique described which also is generally applicable. Generally, a bird-eye view transformation technique is applied to generate a top view perspective of an image obtained by the sensing devices. One applied technique can be classified under digital image processing as a geometrical image modification. Basically the bird's eye view transform can be divided into three steps. First the image has to be represented in a shifted coordinate system, in a next step a rotation of the image is performed, and then the image is projected on a two dimensional plane.

[0023] The display unit is advantageously mounted in the cabin of the vehicle 2 such that images shown on the display are easily visible for the operator, e.g. the driver. Thus, the display is configured to show an overview illustration, e.g. a view from above, of the area surrounding the vehicle, and an object 20, if visible, to be picked up. The feature display should be interpreted broadly and should e.g. also comprise projected images, e.g. images projected at the windscreen, i.e. so-called heads-up systems.

[0024] With continuous references to figure 1, the processing unit 8 is further configured to receive an object parameter comprising at least a weight of the object, and to determine a maximal load range limitation for the loading arrangement 24 for at least one of the entire range of support leg extension distances in dependence of the weight of the object. The object parameter may be entered to the processing unit via the display unit, e.g. if the display unit is provided with a touchscreen. Thus, more in detail a maximal load range limitation for an input weight of an object is calculated by taking into account the lifting capacity of the loading arrangement for the entire range of support leg extension distances. For a particular weight W the maximal distance Dmax to the load should be determined for the entire range of support leg extension distances SLdist using the following formula:

$$D_{\max} = W \times f(\text{SLdist}), \text{ where } f \text{ is a function such that } D_{\max} \text{ is linearly } (D_{\max} = W \times (k \times \text{SLdist}), \text{ where } k \text{ is a constant } > 0), \text{ or non-linearly, dependent on the SLdist.}$$

where f is a function such that Dmax is linearly ($D_{\max} = W \times (k \times \text{SLdist})$, where k is a constant > 0), or non-linearly, dependent on the SLdist. If SLdist increases also Dmax increases.

[0025] The processing unit is then configured to determine a load limitation image 34 of at least one of the determined maximal load range limitation, and that the load limitation image 34 is a graphical illustration 32 of the at least one maximal load range limitation in relation to the vehicle and preferably around the vehicle. It may also be possible to determine the load range limitation for only one side of the vehicle. The thus determined load limitation image 34 is then superimposed on the shown real time overview image 10. The combined image is shown in figure 2 where four different load range limitations 32 are shown.

In accordance with one embodiment the processing unit 8 is configured to superimpose the load limitation image 34 in a fixed position in relation to a virtual image 28 of the vehicle, which is illustrated in figure 2. Preferably, the virtual image of the vehicle is centred in relation to the graphical illustration 32 of the load range limitation(s) of the load limitation image.

[0026] Preferably, the maximal load range limitations are determined for 2-5 different support leg extension distances, e.g. including 50% and 100% of a maximal extension distance.

[0027] The driver will then have a good overview of the different available options when arriving to an object to be loaded. If the environment around the object is such that the driver can position the vehicle close to the object it may be enough to extend applicable support legs only 25% of the maximal extension, which may be represented with the innermost dashed range limitation on the load limitation image 34. If, on the other hand, the environment is such that it is not possible to position the vehicle close to the object, due to e.g. trees, rocks or other obstacles, the full extension of the support legs may be required which will be represented by the utmost dashed range limitation presented on the display unit.

[0028] According to one embodiment the processing unit 8 is configured to receive an input signal 36 including information of a chosen load range limitation. The input signal 36 may be generated in response of an operator input via a touch screen at the display unit.

Preferably, the processing unit 8 is configured to determine a loading control signal 22 in dependence of the chosen load range limitation. The loading control signal comprises load instructions to control the loading arrangement 24 to perform a loading procedure of an object 20 within a loading area defined by the chosen load range limitation.

As a further alternative, the processing unit 8 may also be configured to control the extensions of the supporting legs to an extension that corresponds to the chosen load range limitation.

[0029] Figure 3 is schematic illustration of a real time overview image having a superimposed load limitation image 34 including a virtual image 28 of the vehicle provided with a loading arrangement 24. In figure 3 the graphical illustrations 32A, 32B, 32C of the load range limitation(s) designate, in this example, support load extensions of 50%, 75% and 100%, respectively.

[0030] The shape of the curves of the graphical illustrations of the load range limitations depends e.g. on the position of the loading arrangement at the vehicle, the angle between the loading arrangement and the longitudinal extension of the vehicle when in a loading position. This is clearly illustrated in figure 3 where a particular load range limitation depends on the angle between the crane and the vehicle. The present invention also relates to a method to be applied in a vehicle 2 for loading objects. The vehicle comprises a loading arrangement 24 configured to load objects 20 to and from the vehicle, and being controlled by a loading control signal 22 determined by a processing unit 8. The vehicle further comprises at least one supporting leg 30 configured to be extended outside the vehicle to support the vehicle during a loading procedure. A supporting leg extension distance ranges from 0-100% of a maximal extension distance.

The object 20 is not a part of the vehicle 2, but instead e.g. a waste bin or a pile of forestry, or any other object to be picked-up or handled by a loading arrangement of the vehicle.

[0031] The method will now be discussed in detail with references to the flow diagram shown in figure 4.

[0032] The method comprises capturing measurement data by at least one sensing device 4 mounted on the vehicle

2 to monitor the entire area, or a part of the area surrounding the vehicle, and generating at least one measurement data signal 6 including said captured measurement data. The method further comprises receiving, in a processing unit 8, the measurement data signal 6, determining a real time overview image 10 of the area surrounding the vehicle 2 based upon the measurement data, generating a real time image signal 12 and applying it to a display unit 14 where the real time overview image 10 is shown.

[0033] According to the invention the method further comprises receiving an object parameter comprising at least a weight of the object, and determining a maximal load range limitation for the loading arrangement 24 for at least one of the entire range of support leg extension distances in dependence of the weight of the object.

With regard to the detailed calculation of the load range limitation it is referred to the description above.

The method further comprises determining a load limitation image 34 of at least one of the determined maximal load range limitation, wherein the load limitation image is a graphical illustration of the at least one maximal load range limitation in relation to the vehicle, and superimposing the load limitation image on the shown real time overview image.

[0034] Preferably, the method comprises superimposing the load limitation image in a fixed position in relation to a virtual image 28 of the vehicle. The virtual image of the vehicle is preferably centred in relation to the graphical illustration 32 of the load range limitation(s) of the load limitation image.

[0035] The maximal load range limitations are advantageously determined for 2-5 different support leg extension distances, and the determined maximal load range limitations preferably includes 50% and 100% of a maximal extension distance.

[0036] According to one embodiment the method comprises receiving an input signal 36 including information of a chosen load range limitation. The input signal may be generated in response of an operator input via a touch screen of said display unit.

[0037] In still a further embodiment the method comprises determining a loading control signal 22 in dependence of the chosen load range limitation. The loading control signal comprises load instructions to control the loading arrangement 24 to perform a loading procedure of an object 20 within a loading area defined by the chosen load range limitation.

[0038] The present invention is not limited to the above-described preferred embodiments. Various alternatives, modifications and equivalents may be used. Therefore, the above embodiments should not be taken as limiting the scope of the invention, which is defined by the appending claims.

Claims

1. A vehicle (2) for loading objects (20), comprising:

- at least one sensing device (4) mounted on the vehicle (2) and being configured to capture measurement data to monitor the entire area, or a part of the area surrounding the vehicle, the at least one sensing device (4) is configured to generate at least one measurement data signal (6) including said captured measurement data,
- a processing unit (8) configured to receive said measurement data signal (6) and to determine a real time overview image (10) of the area surrounding the vehicle (2) based upon said measurement data, and further to generate a real time image signal (12) to be applied to a display unit (14) configured to show said real time overview image (10),
- a loading arrangement (24) configured to load objects (20) to and from the vehicle, and being controlled by a loading control signal (22) determined by said processing unit (8),
- at least one supporting leg (30) configured to be extended outside the vehicle to support the vehicle during a loading procedure, wherein a supporting leg extension distance ranges from 0-100% of a maximal extension distance, **characterized in that** the processing unit (8) is further configured to:

- receive an object parameter comprising at least a weight of the object,
- determine a maximal load range limitation for said loading arrangement (24) for at least one of the entire range of support leg extension distances in dependence of the weight of the object, and to
- determine a load limitation image (34) of at least one of said determined maximal load range limitation, wherein said load limitation image (34) being a graphical illustration (32) of said at least one maximal load range limitation in relation to the vehicle, and wherein said processing unit (8) is configured to superimpose said load limitation image (34) on said shown real time overview image (10).

2. The vehicle (2) according to claim 1, wherein said processing unit (8) is configured to superimpose said load limitation image (34) in a fixed position in relation to a virtual image (28) of the vehicle.

3. The vehicle (2) according to claim 2, wherein the virtual image of the vehicle is centred in relation to the graphical

illustration (32) of the load range limitation(s) of the load limitation image.

4. The vehicle (2) according to any of claims 1-3, wherein maximal load range limitations are determined for 2-5 different support leg extension distances.

5. The vehicle (2) according to any of claims 1-4, wherein said processing unit (8) is configured to receive an input signal (36) including information of a chosen load range limitation.

6. The vehicle (2) according to claim 5, wherein said input signal (36) is generated in response of an operator input via a touch screen of said display unit.

7. The vehicle (2) according to any of claims 5 and 6, wherein said processing unit (8) is configured to determine a loading control signal (22) in dependence of the chosen load range limitation, and wherein said loading control signal comprises load instructions to control said loading arrangement (24) to perform a loading procedure of an object (20) within a loading area defined by said chosen load range limitation.

8. A method to be applied in a vehicle (2) for loading objects, the vehicle comprises a loading arrangement (24) configured to load objects (20) to and from the vehicle, and being controlled by a loading control signal (22) determined by a processing unit (8), and at least one supporting leg (30) configured to be extended outside the vehicle to support the vehicle during a loading procedure, wherein a supporting leg extension distance ranges from 0-100% of a maximal extension distance, the method comprises:

- capturing measurement data by at least one sensing device (4) mounted on the vehicle (2) to monitor the entire area, or a part of the area surrounding the vehicle,
- generating at least one measurement data signal (6) including said captured measurement data,
- receiving, in said processing unit (8), said measurement data signal (6),
- determining a real time overview image (10) of the area surrounding the vehicle (2) based upon said measurement data,
- generating a real time image signal (12) and applying it to a display unit (14),
- showing said real time overview image (10) in the display unit (14), **characterized in that** the method further comprises:

- receiving an object parameter comprising at least a weight of the object,
- determining a maximal load range limitation for said loading arrangement (24) for at least one of the entire range of support leg extension distances in dependence of the weight of the object, and
- determining a load limitation image (34) of at least one of said determined maximal load range limitation, wherein said load limitation image (34) being a graphical illustration (32) of said at least one maximal load range limitation in relation to the vehicle, and
- superimposing said load limitation image (34) on said shown real time overview image (10).

9. The method according to claim 8, wherein the method comprises superimposing said load limitation image (34) in a fixed position in relation to a virtual image (28) of the vehicle.

10. The method according to claim 9, wherein the virtual image of the vehicle is centred in relation to the graphical illustration (32) of the load range limitation(s) of the load limitation image.

11. The method according to any of claims 8-10, wherein maximal load range limitations are determined for 2-5 different support leg extension distances.

12. The method to any of claims 8-11, wherein the method comprises receiving an input signal (36) including information of a chosen load range limitation.

13. The method according to claim 12, wherein said input signal (36) is generated in response of an operator input via a touch screen of said display unit.

14. The method according to any of claims 12 and 13, wherein said method comprises determining a loading control signal (22) in dependence of the chosen load range limitation, and wherein said loading control signal comprises load instructions to control said loading arrangement (24) to perform a loading procedure of an object (20) within a

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loading area defined by said chosen load range limitation.

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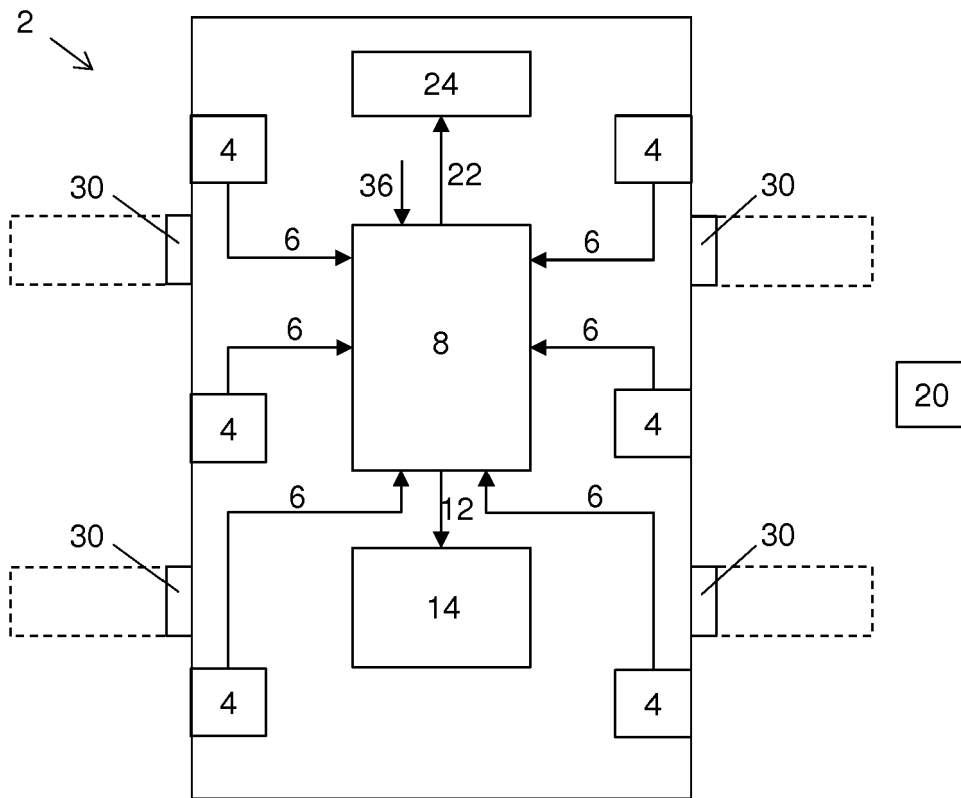


FIG. 1

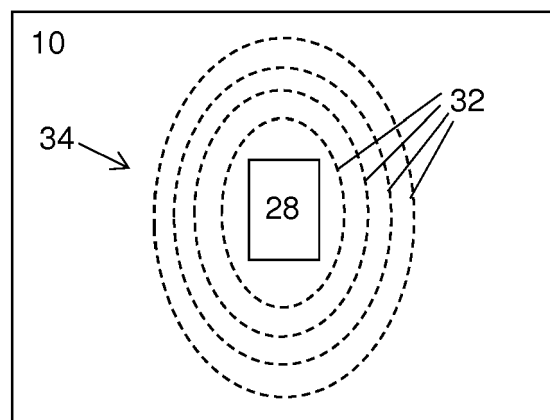


FIG. 2

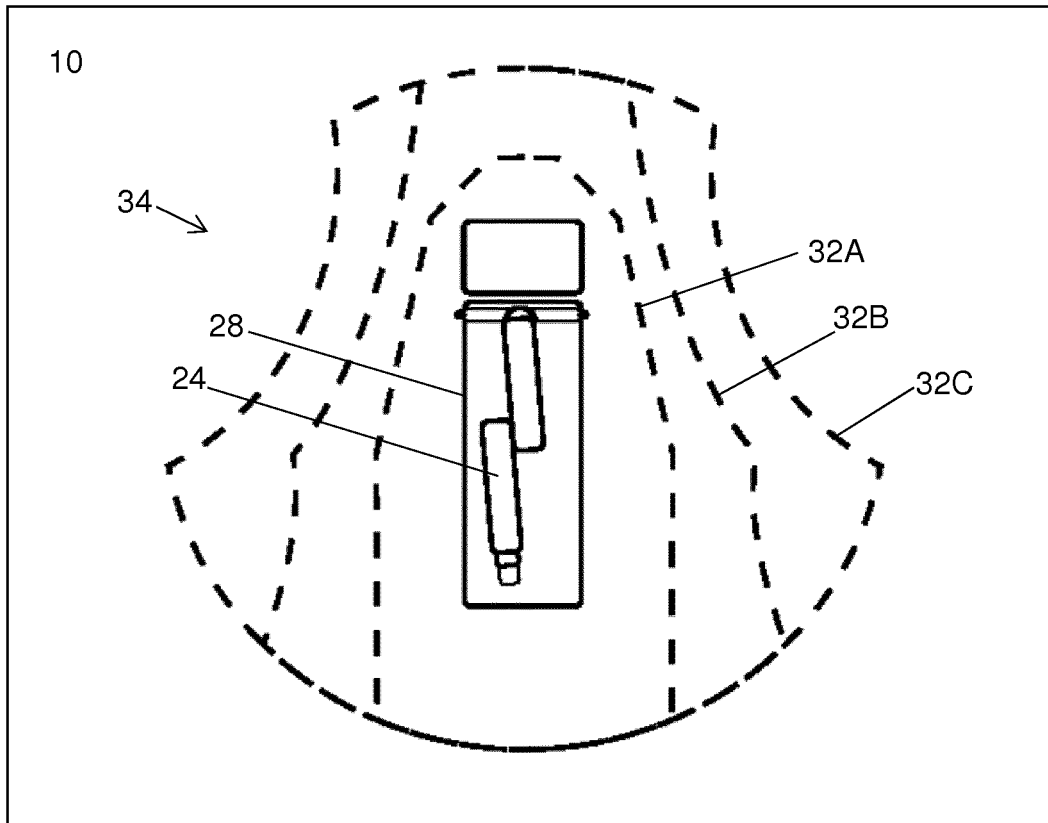


FIG. 3

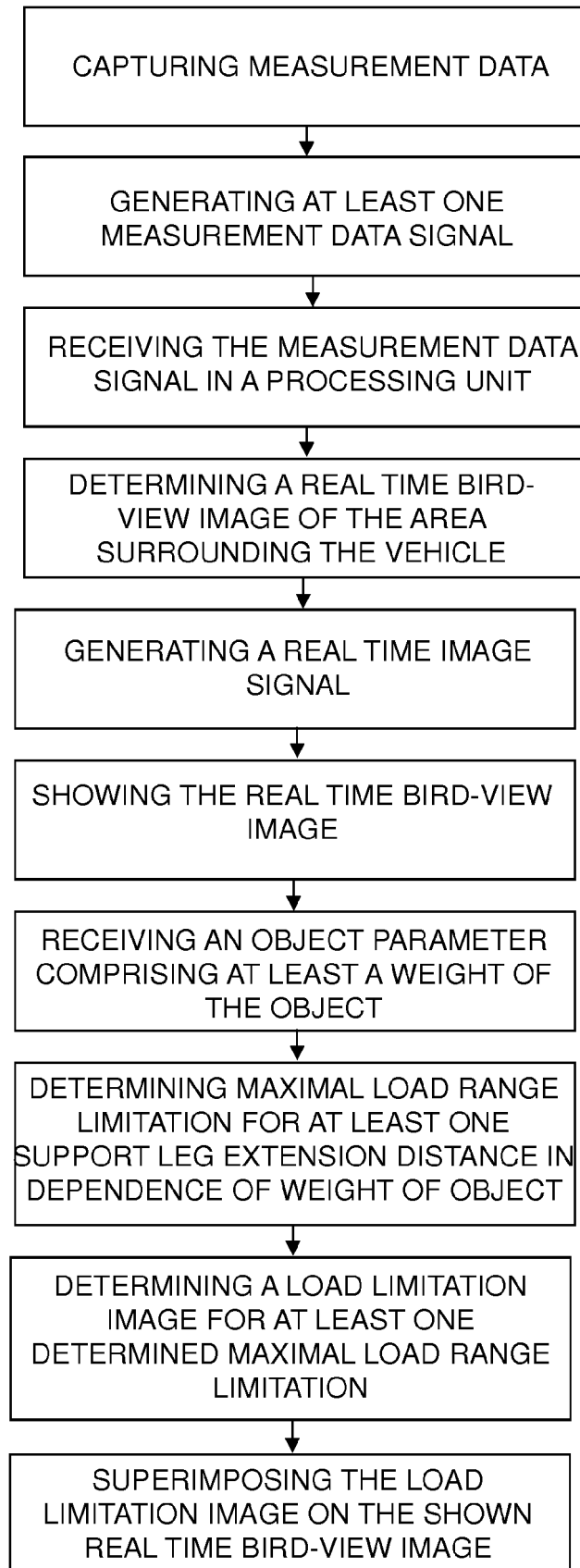


FIG. 4



EUROPEAN SEARCH REPORT

Application Number
EP 16 20 2749

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D A	EP 2 543 622 A1 (TADANO LTD [JP]) 9 January 2013 (2013-01-09) * the whole document *	1-5, 7-12,14 6,13	INV. B66C23/80 B66C23/90
X	EP 3 000 761 A1 (TADANO LTD [JP]) 30 March 2016 (2016-03-30) * paragraph [0120] - paragraph [0152]; figures 17-22 *	1,2,5-9, 12-14	
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 7 June 2017	Examiner Rupcic, Zoran
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 16 20 2749

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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