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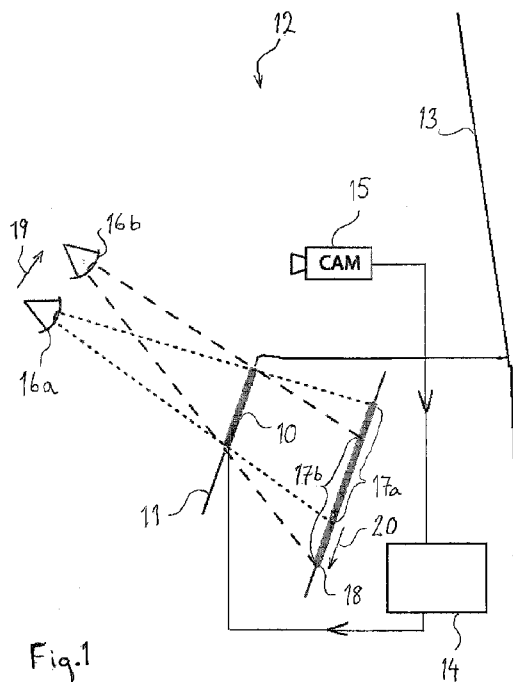
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(54) Title: A VEHICLE BASED DISPLAY SYSTEM AND A METHOD FOR OPERATING THE SAME



(57) Abstract: The invention relates to a vehicle based display system, comprising a driver head tracking system with a sensor (15) for monitoring the driver head position and/or gaze direction. The system also comprises a display (10) for displaying information to a driver of the vehicle, and a control unit (14) for controlling the display (10) to modify displayed information depending on the driver head position. The invention also relates to a method for operating the display system.

A vehicle based display system and a method for operating the same

Background of the invention

- 5 The invention relates to a vehicle based display system and a method for operating the same according to the preambles of the independent claims.

Motor vehicles are usually equipped with a set of information display devices that include, in general, an analogue or digital instrument panel on which various quantities are
10 displayed such as, for example, vehicle speed, engine speed, fuel level, etc., a number of optical indicators regarding the state of the vehicle indicating, for example, lights on, engine oil level, water coolant temperature, etc., and additional onboard display devices
... such as, for example, car radio, air-conditioner, navigator, etc.

- 15 Most of the analogue instruments comprise, for each quantity represented, a mechanical-type indicator needle representing the value of that quantity on an suitable graduated scale, generally consisting of a series of numeric characters of dimensions and style established during the instrument design phase, while the optical indicators generally comprise standard backlit graphical symbols, each indicating a respective state condition of the
20 motor vehicle.

Instead, most of the digital instruments form an instrument cluster where each quantity represented is composed of an LCD (Liquid Cristal Display) or a number of light emitting elements ("LED") that can be selectively illuminated to form numeric characters indicating
25 the value of that quantity in an associated unit of measurement, or sequentially illuminated to form a level indicator for that quantity on a graduated scale similar to that of an analogue instrument.

Both types of instruments are usually able to display messages to the driver, for example
30 warnings to indicate to an operator of the vehicle that a particular parameter reading, for example, the speedometer, tachometer, or temperature gage reading exceeds a desirable range. With so much information available to the operator of the vehicle, it is desirable to have interactive warning systems that allow the operator of the vehicle to confirm that a message has been detected.

According to prior art, specific buttons, for example on the steering wheel, can be used for navigation between different functions or different areas of the instrument cluster and for acknowledging messages. Alternatively, speech recognition systems can be used for voice control of various functions in a vehicle and also for acknowledging messages.

However, these prior art interactive systems can be complicated to use. Preferably, a system adapted for use in a commercial vehicle should be more user friendly to avoid distraction and to minimize driver workload.

EP 1658191 describes a system for controlling a dual-view display in a vehicle in which the view of the driver is monitored and when the driver directs his/her line of view to the display, data relevant to the operation of the vehicle will be visible on the display and data otherwise only viewable by a passenger will be invisible.

Summary of the invention

It is an object of the invention to provide a vehicle based display system and a method for operating the same which enables the operator to interact with the display clusters of a vehicle without the problems described above.

This object is achieved by the features of the independent claims. The other claims and the description disclose advantageous embodiments of the invention.

According to the invention, a vehicle based display system is proposed which is characterized by a driver head tracking system with a sensor for monitoring the driver head position, a display for displaying information to a driver of the vehicle, and a control unit for controlling the display to modify displayed information depending on the driver head position. The use of a driver head tracking system for interaction with the display system enables the driver to interface with the display in a user friendly manner.

According to one embodiment of the invention, the display is connected to a camera which is provided with means for changing the camera image viewpoint. This enables the driver to use a display, for example, as a rear-view mirror. For example, the display viewpoint image can be modified when a side movement of the head in the transversal direction of

the vehicle is detected. Also, the zoom distance of the display image can be modified when a movement of the head in the longitudinal direction of the vehicle is detected.

According to another embodiment of the invention, the head tracking system includes means for monitoring driver gaze direction. An even more refined interactive system can be achieved by monitoring eye movement. Thus, detection of gaze direction can be used for modification of displayed information, for example can certain information on a display be highlighted when an eye movement away from the display is detected. Alternatively or additionally, an eye movement to a certain field of the display may confirm that a message displayed in said field has been viewed by the driver.

Preferably, the display is adapted for displaying information related to vehicle status.

Brief description of the drawings

Fig. 1 is a schematic side view illustration of a display system according to one embodiment of the invention arranged inside a vehicle; and
Fig. 2-4 shows in front view the display cluster of Fig. 1 in three different modes of use.

Detailed description of the invention

In the drawings, equal or similar elements are referred to by equal reference numerals. The drawings are merely schematic representations, not intended to portray specific parameters of the invention. Moreover, the drawings are intended to depict only typical embodiments of the invention and therefore should not be considered as limiting the scope of the invention.

For explaining the invention, an embodiment of a display system is depicted in Fig. 1, comprising a instrument cluster 10 installed in the dashboard 11 of a vehicle 12 having a windscreen 13. The instrument cluster is connected to a control unit 14 which receives imaging input from a digital image sensor camera 15. The instrument cluster 10 preferably comprises a digital graphics screen, for example an LCD or plasma screen. The camera 15 is adapted to register the position of the driver's head or eye 16a, 16b. The control unit 14 receives image data from the camera 15, analyzes the collected image information and adapts the video signal sent to the digital graphics screen.

In Fig. 1, the eye 16a illustrates a first normal position of the driver's head and a corresponding display view 17a on a virtual instrument cluster 18. The camera 15 detects the head or eye position and a virtual view corresponding to the head position is graphically transmitted by the control unit 14 to the non-virtual instrument cluster 10. Fig. 2 shows an instrument cluster view corresponding to the head position 16a. In this view the instrument cluster provides information regarding vehicle speed and engine speed at the centre of the cluster. Information regarding engine temperature and fuel level is provided at the left side of the cluster. Service information is provided at the right side of the cluster.

In Fig. 1, the eye 16b illustrates a movement of the driver's head towards the instrument cluster 10 in accordance with the arrow 19. In this second position of the driver's head the display view 17b on the virtual instrument cluster 18 is moved correspondingly in accordance with the arrow 20. The camera 15 detects the altered head or eye position and this new different virtual view is graphically transmitted by the control unit 14 to the non-virtual instrument cluster 10. Preferably, the control unit 14 moves the viewpoint of the digital image downwards as illustrated by the arrow 20 allowing information to be added at the bottom of the cluster screen. Fig. 3 shows the instrument cluster view corresponding to the head position 16b. In this view the information described above has been moved slightly upwards to allow additional information regarding radio station selection and vehicle navigation information to be displayed at the bottom of the instrument display, see arrow 21.

Thus, the illusion perceived by the driver looking at the display screen and moving the head in the direction of the arrow 19, is that he or she is able to look past the bottom edge into an opening with a larger display screen at the bottom. Hence, the vehicle driver can use the display system according to the invention to control the amount of displayed information on the instrument cluster 10 by head movement.

If the driver head tracking system is provided with means for detecting driver gaze direction, it is possible to add further functionality. For example, if the head tracking system detects that driver gaze direction is aimed at the road ahead, certain information on the instrument cluster can be highlighted. This is illustrated in Fig. 4, where information regarding vehicle speed, engine speed and an important service message (see arrow 22)

regarding ABS system function are highlighted. Instead of highlighting information, a detailed image can be modified to be more suited for peripheral view.

5 Additionally, a series of detected shifts of gaze direction by the driver towards the service message, within a certain time-frame, can for example be used as a confirmation that the driver has realized the message. Thus, the display system according to the invention can be utilized by the driver to control different functionalities. Hence, an enhanced interactive driver environment can be obtained by using the invention.

10 Another possible application of the invention is in the field of mirrors. A heavy commercial vehicle, for example a trailer tractor, is usually equipped with a set of adjustable external mirrors allowing the driver to view traffic in neighbouring lanes at the sides and towards the rear of the vehicle. Other mirrors may be arranged at the front and sides of the tractor cab to view the road immediately in front of the vehicle and near its
15 front wheels. All these external mirrors need frequent cleaning to remove contamination. The mirror installations reduce the aerodynamic efficiency of the vehicle.

According to the invention, each external mirror element is replaced by a corresponding display inside the cab. An external camera is connected to the display via a control unit.

20 The external camera is controlled via the head tracking system so that the camera viewpoint is changed simulating natural physical viewpoint changes offered when moving the head relative to a conventional fixed mirror surface. Preferably, a detected side movement of the driver head in the transversal direction of the vehicle modifies the viewpoint angle of the camera and the displayed viewpoint on the display. In the same
25 manner can a detected movement of the driver head in the longitudinal direction of the vehicle modifies the zoom distance of the display image. The head tracking system may also be used for controlling a camera view of the area behind the vehicle when travelling backwards.

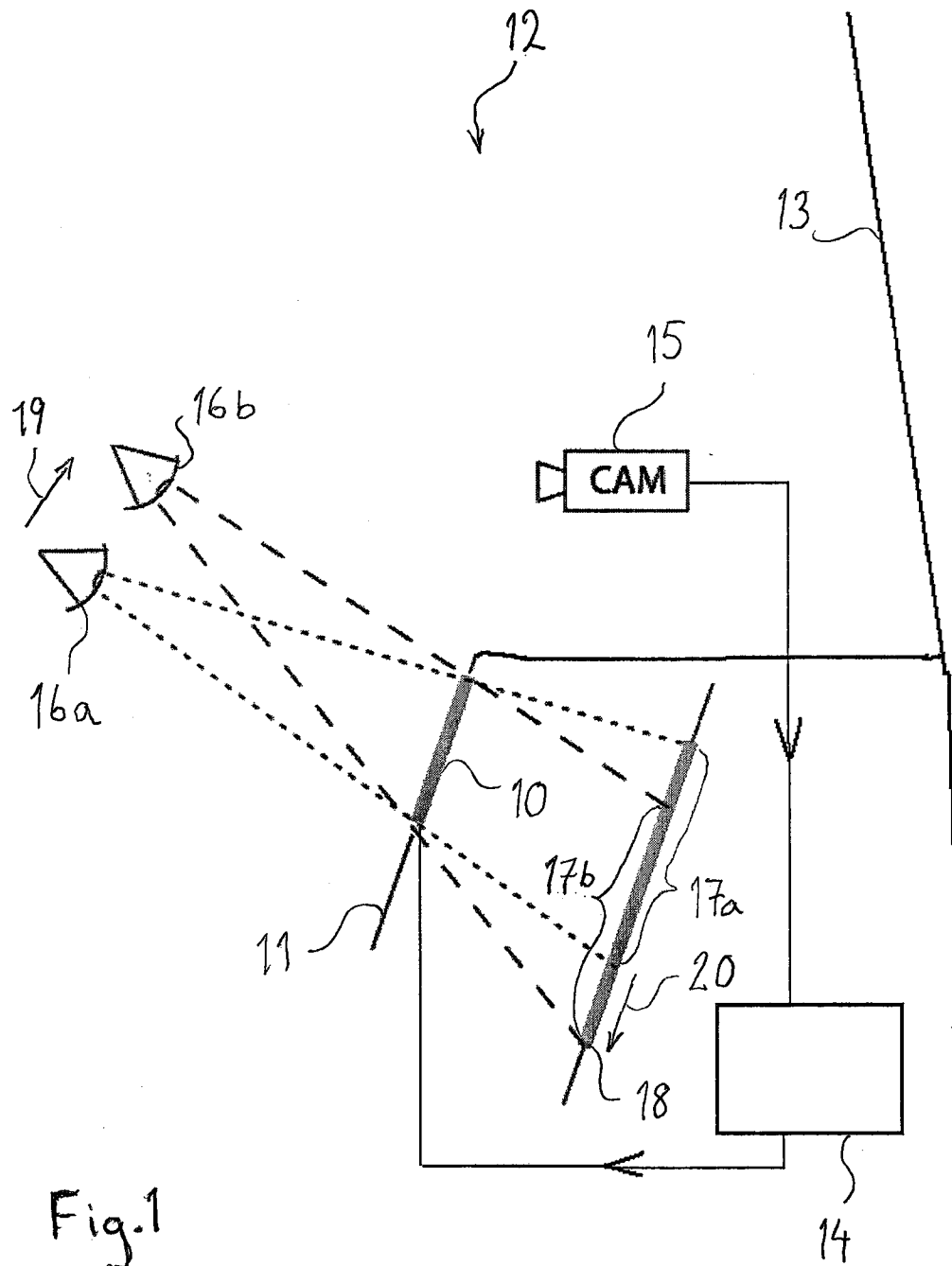
30 The arrangement and method according to the invention reduces driver workload and increases traffic safety. The invention is not to be regarded as being limited to the embodiments described above, a number of additional variants and modifications being possible within the framework of the following patent claims. The system and the method

can, for example, also be used for confirming messages displayed by other means than a digital display screen.

CLAIMS

1. A vehicle based display system, characterized by
 - a driver head tracking system with a sensor (15) for monitoring the driver head position,
 - a display (10) for displaying information to a driver of the vehicle, and
 - a control unit (14) for controlling the display (10) to modify displayed information depending on the driver head position.
2. The display system according to claim 1, wherein the display (10) is connected to a vehicle exterior view camera provided with means for changing the camera image viewpoint.
3. The display system according to claim 1, wherein the head tracking system includes means for monitoring driver gaze direction.
4. The display system according to claim 3, wherein the control unit (14) for controlling the display (10) is adapted to modify the displayed information when a certain eye movement is detected.
5. The display system according to claim 4, wherein the control unit (14) is adapted to regard an eye movement to a certain field of the display (10) as a confirmation that information in said field has been viewed by the driver.
6. A method for operating a vehicle based display system (10) according to one of the preceding claims, characterized by
 - detecting a movement of the vehicle driver head position or gaze direction, and
 - controlling a display for displaying information to a driver of the vehicle to modify the displayed information when a certain head movement is detected.
7. The method according to claim 6, wherein the display (10) is adapted for displaying information related to vehicle status.

8. The method according to claim 7, wherein a detected forward movement of the driver head in the longitudinal direction of the vehicle adds information to the display.
- 5
9. The method according to claim 8, wherein the information is added at the bottom field of the display (10).
10. The method according to claim 6, wherein the display is adapted for displaying a vehicle exterior view image.
- 10
11. The method according to claim 10, wherein a detected side movement of the driver head in the transversal direction of the vehicle modifies the viewpoint angle of the camera and the displayed viewpoint on the display .
- 15
12. The method according to claim 10 or 11, wherein a detected movement of the driver head in the longitudinal direction of the vehicle modifies the zoom distance of the display image.
- 20
13. The method according to claim 6, further characterized by monitoring driver eye (16a, 16b) movement and modifying the displayed information when a certain eye movement is detected.
- 25
14. The method according to claim 13, wherein information on the display (10) is highlighted when an eye movement away from the display is detected.
15. The method according to claims 13 or 14, wherein an eye movement to a certain field of the display (10) confirms that a message displayed in said field has been viewed by the driver.



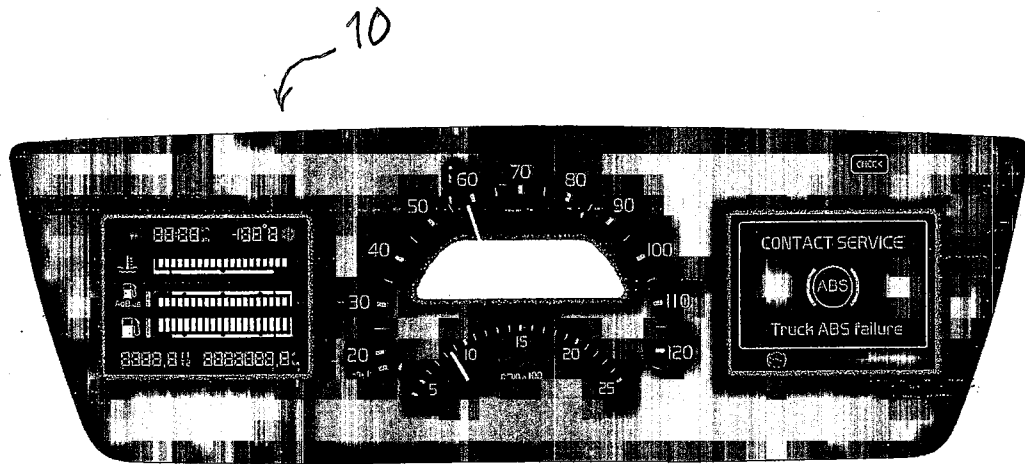


Fig. 2

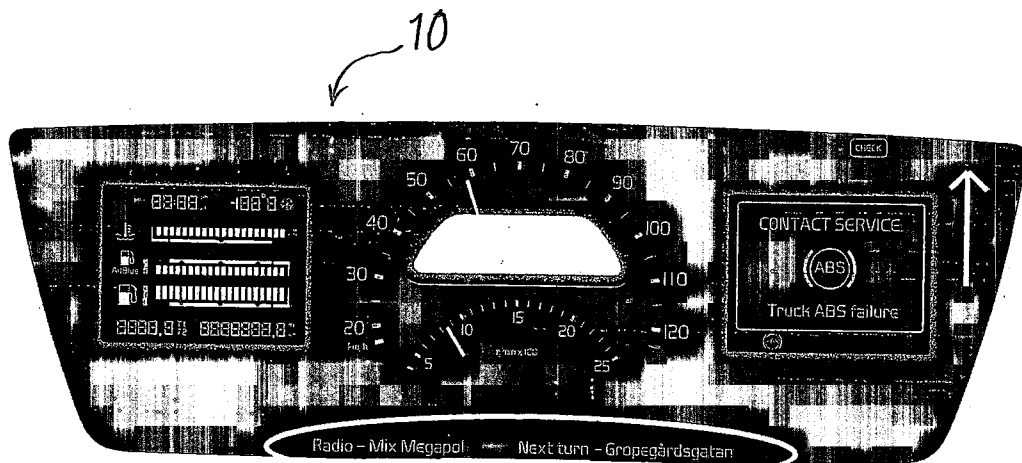


Fig. 3

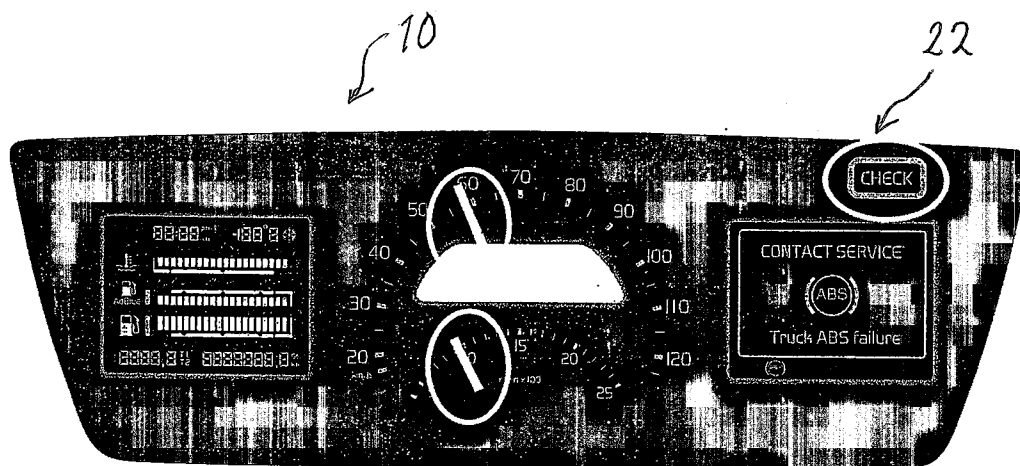


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2010/000164

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: A61B, G02B, G06F

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, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 20090040196 A1 (DUCKSTEIN, BERND), 12 February 2009 (12.02.2009), claim 1, paragraph [0020]	1,3,6,7,13
Y		4,5,8,9,14, 15
A	--	2,10-12
Y	JP 2008141574 A (-), 19 June 2008 (19.06.2008), page 17, line 1 - line 22, figure 11	2,10-12
Y	WO 9956274 A1 (DELUCA, MICHAEL, J.), 4 November 1999 (04.11.1999), figures 13-16, abstract	4,5,8,9,14, 15
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

8 February 2011

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2010/000164

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 7538744 B1 (LIU, JIN ET AL), 26 May 2009 (26.05.2009), column 1, line 34 - line 40; column 2, line 61 - column 3, line 6; column 4, line 53 - line 63 --	1-15
A	US 20020041259 A1 (LEWIS, JOHN R. ET AL), 11 April 2002 (11.04.2002), abstract, paragraphs [0007], [0013] --	1-15
A	US 5689619 A (SMYTH, CHRISTOPHER C.), 18 November 1997 (18.11.1997), column 3, line 56 - column 4, line 34, figure 3 --	1-15
A	US 5367315 A (PAN, SHAUGAN), 22 November 1994 (22.11.1994), the whole document --	1-15
A	US 6009210 A (KANG, SING BING), 28 December 1999 (28.12.1999), column 2, line 43 - line 64 -- -----	1-15

International patent classification (IPC)**G06F 3/01** (2006.01)**A61B 3/113** (2006.01)**G02B 27/00** (2006.01)**B60R 1/02** (2006.01)**G06F 3/00** (2006.01)**Download your patent documents at www.prv.se**

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2010/000164

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US	5367315	A	22/11/1994	NONE			

US	6009210	A	28/12/1999	NONE			
