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(54) Title: METHOD FOR OPERATING A DRIVER ASSISTANCE SYSTEM OF A MOTOR VEHICLE WITH ELECTRONIC REARVIEW MIRROR, DRIVER ASSISTANCE SYSTEM AS WELL AS MOTOR VEHICLE

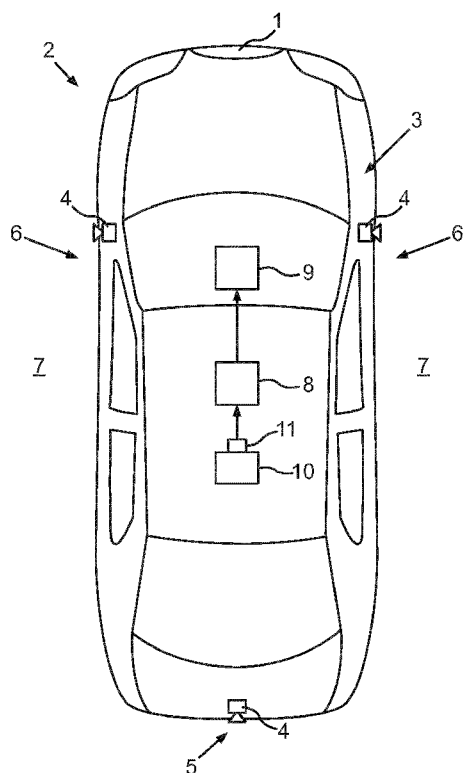


Fig. 1

(57) Abstract: The invention relates to a method for operating a driver assist-
ance system (2) of a motor vehicle (1), in which an electronic rearview mirror
(3) of the driver assistance system (2) is operated and herein an image sequence
of an environmental region (7) of the motor vehicle (1), which is laterally be-
sides the motor vehicle (1) and/or behind the motor vehicle (1), is captured by
means of at least one camera (4), and a display (12) is provided on a display
device (9) based on the captured image sequence, wherein the electronic rear-
view mirror (3) is operated in a battery mode with turned off drive engine of the
motor vehicle (1), in which the electronic rearview mirror (3) is supplied with
electrical energy from an electrical energy storage (10) and in which a state of
charge of the electrical energy storage (10) is detected.

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Method for operating a driver assistance system of a motor vehicle with electronic rearview mirror, driver assistance system as well as motor vehicle

The present invention relates to a method for operating a driver assistance system of a motor vehicle, in which an electronic rearview mirror of the driver assistance system is operated and herein an image sequence of an environmental region of the motor vehicle, which is located laterally besides the motor vehicle and/or behind the motor vehicle, is captured by means of at least one camera, and a display is provided on a display device based on the captured image sequence. In addition, the invention relates to a driver assistance system for a motor vehicle. Finally, the present invention relates to a motor vehicle.

Presently, the interest is in particular directed to driver assistance systems for motor vehicles. Such driver assistance systems serve for assisting the driver in driving the motor vehicle. Presently, in particular driver assistance systems are to be considered, which have a so-called electronic rearview mirror. Such an electronic rearview mirror can also be referred to as Camera Monitoring System (CMS) or as e-mirror. The electronic rearview mirror usually includes multiple cameras, which are disposed distributed on the motor vehicle and by which the environmental region of the motor vehicle can be captured in the form of an image sequence or in the form of video data. This video data can then be presented to the driver of the motor vehicle on a corresponding display device. In particular the regions, which otherwise can be seen with conventional rearview mirrors of the motor vehicle, can be captured by the cameras. The conventional rearview mirrors having a light reflecting surface can be replaced with an electronic rearview mirror.

It is the object of the present invention to demonstrate a solution, how a driver assistance system of the initially mentioned kind, which includes an electronic rearview mirror, can be more efficiently operated.

According to the invention, this object is solved by a method, by a driver assistance system as well by a motor vehicle having the features according to the respective independent claims. Advantageous implementations of the invention are the subject matter of the dependent claims, of the description and of the figures.

A method according to the invention serves for operating a driver assistance system of a motor vehicle. Herein, an electronic rearview mirror of the driver assistance system is

operated and herein an image sequence of an environmental region of the motor vehicle, which is laterally besides the motor vehicle and/or behind the motor vehicle, is captured by means of at least one camera. In addition, a display is provided on a display device based on the captured image sequence. The electronic rearview mirror is operated in a battery mode with turned off drive engine of the motor vehicle, in which the electronic rearview mirror is supplied with electrical energy from an electrical energy storage and in which a state of charge of the electrical energy storage is detected.

In the method, an electronic rearview mirror of the driver assistance system is in particular activated. The electronic rearview mirror can be activated if the motor vehicle is moved and the drive engine of the motor vehicle is activated or is operated. In addition, the electronic rearview mirror can be activated if the drive engine of the motor vehicle is turned off and the motor vehicle is stationary. The electronic rearview mirror includes at least one camera, by which at least a part of the environmental region of the motor vehicle can be captured. Presently, the environmental region laterally besides the motor vehicle and/or behind the motor vehicle is captured by the at least one camera. Thus, an image sequence or video data is provided by the at least one camera, which describes the environmental region besides the motor vehicle and/or behind the motor vehicle. The electronic rearview mirror, which can also be referred to as Camera Monitoring System (CMS), can for example include three cameras. One of the cameras can be disposed in a rear area of the motor vehicle. Further, the two other cameras can be disposed laterally on the motor vehicle. The image sequences or video data provided by the cameras can correspondingly be combined and presented on the display device of the motor vehicle. The display device can for example include one or more screens.

If the drive engine of the motor vehicle is turned off, the electronic rearview mirror is operated in a so-called battery mode. In the battery mode, the electronic rearview mirror is supplied with electrical energy from an electrical energy storage. The electrical energy storage can in particular be a battery or an accumulator of the motor vehicle. If the drive engine of the motor vehicle is deactivated and/or the motor vehicle is not moved, electrical energy is not generated, with which the electrical energy storage can be charged. Thus, there is the risk that the electrical energy storage is discharged if the electronic rearview mirror is operated with turned off drive engine. In the worst case, this can result in the electrical energy storage being discharged as far as a further operation of the motor vehicle is not possible. In order to avoid this, the state of charge of the electrical energy storage is detected during the mode of the electronic rearview mirror. Hereto, the driver assistance system can include a corresponding sensor device, by which the state of

charge of the electrical energy storage can be detected. Thus, the state of charge of the electrical energy storage can be monitored during the battery mode of the electronic rearview mirror. In particular, it can be examined if the state of charge of the electrical energy storage or of the battery reaches a critical value. Thus, the electronic rearview mirror can be particularly reliably operated.

Preferably, in the battery mode, a status symbol is displayed by the display device, which describes the detected state of charge of the electrical energy storage. The status symbol can overlay the display, which has been provided depending on the captured image sequences of the camera. The status symbol can describe the electrical energy storage or the battery. The current state of charge of the electrical energy storage can for example be indicated as a percentage value. In addition, it can be provided that the status symbol is presented in different colors. The color can then describe the state of charge. By the display of the status symbol, the driver or the vehicle occupant can be made aware of the fact that the electronic rearview mirror is operated in the battery mode. In addition, he can be fast informed about the current state of charge of the electrical energy storage.

In an embodiment, at least one threshold value for the state of charge of the electrical energy storage is preset and an operating state of the electronic rearview mirror is adapted if the detected state of charge exceeds the at least one threshold value. With respect to the state of charge of the electrical energy storage, one or more threshold values can be preset. By presetting multiple threshold values with respect to the state of charge, then, different operating states can be preset for the electronic rearview mirror operated in the battery mode. Thus, the electronic rearview mirror can be adequately operated depending on the current state of charge of the electrical energy storage or the battery.

Furthermore, it is advantageous if the at least one threshold value and/or the operating state, in which the electronic rearview mirror is operated, if the detected state of charge falls below the at least one threshold value, are adapted by an operating input. In other words, the at least one threshold value and the operating mode associated with it can be adapted. For example the number of the threshold values, which are preset, can be adapted. In addition, it can be preset how the electronic rearview mirror is to be operated if it is fallen below the at least one threshold value. Thus, the electronic rearview mirror can be individually adapted to the respective user.

In an embodiment, an amount of the electrical energy, with which the electronic rearview mirror is supplied from the electrical energy storage, is reduced by adapting the operating state. In other words, the electronic rearview mirror is operated such that it has a lower energy consumption if the state of charge falls below the threshold value. If the state of charge exceeds the threshold value, the electronic rearview mirror can have a first energy consumption, and if it is fallen below the threshold value, the electronic rearview mirror can have a second energy consumption, wherein the second energy consumption is lower than the first energy consumption. Thus, it can be achieved in simple manner that the energy consumption of the electronic rearview mirror and thus the electrical energy drawn from the electrical energy storage is reduced with a relatively low state of charge.

In a further configuration, a frame rate, with which the at least one camera captures the image sequence, is reduced by adapting the operating state. For example, it can also be provided that the at least one camera is deactivated for predetermined time intervals. If the electronic rearview mirror includes multiple cameras, it can also be provided that individual of these cameras are turned off. Thus, the operation of the at least one camera can be adapted such that it has a reduced energy consumption with relatively low state of charge.

In a further embodiment, it is provided that a brightness of the display, which is provided by the display device, is reduced by adapting the operating state. For example, the background illumination of the display device can be reduced. It can also be provided that an image refresh rate, with which the display is provided on the display device, is reduced. Thus, the energy consumption of the display device can be reduced with relatively low state of charge of the electrical energy storage.

Furthermore, it is advantageous if a warning symbol is presented on the display device if the state of charge of the electrical energy storage falls below the at least one threshold value. For example, it can be provided that the electronic rearview mirror is operated in a lower energy consumption upon falling below a first threshold value for the state of charge. If the state of charge of the electrical energy storage falls below a second predetermined threshold value, a corresponding warning symbol can be presented on the display device. By the warning symbol, the driver or the vehicle occupant can be made aware of the fact that the state of charge of the electrical energy storage has reached a critical value. Further, it can be provided that the driver or the vehicle occupant is made aware of the fact that he is to deactivate the electronic rearview mirror, by the warning symbol. In this manner, discharge of the electrical energy storage can be prevented.

In a further embodiment, it is provided that the electronic rearview mirror is deactivated if the state of charge of the electrical energy storage falls below the at least one threshold value. For example, it can be provided that the electronic rearview mirror is deactivated if it is fallen below the second threshold value for the state of charge. Thus, the battery of the motor vehicle can be prevented from being discharged. Thus, it can be further guaranteed that the motor vehicle or the drive engine of the motor vehicle can be started.

A driver assistance system according to the invention for a motor vehicle is adapted to perform a method according to the invention. The driver assistance system preferably includes an electronic rearview mirror and a sensor device for detecting a state of charge of an electrical energy storage. The electronic rearview mirror can include at least one camera, a display device and a control device. In particular, the electronic rearview mirror can include multiple cameras, which are disposed distributed on the motor vehicle. For example, the electronic rearview mirror can include two lateral cameras and a rear camera. The control device can for example be constituted by an electronic control unit of the motor vehicle. By the at least one sensor device, an electrical voltage applied to the terminals of the electrical energy storage can for example be detected. The current state of charge of the electrical energy storage can be determined from it.

A motor vehicle according to the invention includes a driver assistance system according to the invention. The motor vehicle is in particular formed as a passenger car.

Preferably, the motor vehicle is formed devoid of exterior mirrors. The motor vehicle can also be formed devoid of reflecting mirrors. In other words, the motor vehicle does not include exterior mirrors or wing mirrors. The motor vehicle can also be formed without rearview mirrors. In particular, the motor vehicle does not include mirrors or mirror surfaces reflecting light. Preferably, the conventional rearview mirrors are replaced with the electronic rearview mirror.

The preferred embodiments presented with respect to the method according to the invention and the advantages thereof correspondingly apply to the driver assistance system according to the invention as well as to the motor vehicle according to the invention.

Further features of the invention are apparent from the claims, the figures and the description of figures. The features and feature combinations mentioned above in the

description as well as the features and feature combinations mentioned below in the description of figures and/or shown in the figures alone are usable not only in the respectively specified combination, but also in other combinations or alone, without departing from the scope of the invention. Thus, implementations are also to be considered as encompassed and disclosed by the invention, which are not explicitly shown in the figures and explained, but arise from and can be generated by separated feature combinations from the explained implementations. Implementations and feature combinations are also to be considered as disclosed, which thus do not have all of the features of an originally formulated independent claim.

Now, the invention is explained in more detail based on preferred embodiments as well as with reference to the attached drawings.

There show:

- Fig. 1 a motor vehicle according to an embodiment of the present invention, which includes a driver assistance system with an electronic rearview mirror;
- Fig. 2 a display device of the electronic rearview mirror, wherein the electronic rearview mirror is operated in a battery mode; and
- Fig. 3 a control device of the driver assistance system in a schematic illustration.

In the figures, identical and functionally identical elements are provided with the same reference characters.

Fig. 1 shows a motor vehicle 1 according to an embodiment of the present invention in a plan view. In the present case, the motor vehicle 1 is formed as a passenger car. The motor vehicle 1 includes a driver assistance system 2. The driver assistance system 2 in turn includes an electronic rearview mirror 3. The electronic rearview mirror 3 includes at least one camera 4. In the present embodiment, the electronic rearview mirror 3 includes three cameras 4. Therein, one of the cameras 4 is disposed in a rear area 5 of the motor vehicle 1. The remaining two cameras 4 are disposed in respective lateral areas 6 of the motor vehicle 1. By the cameras 4, an environmental region 7 can be captured, which is laterally besides the motor vehicle 1 and/or behind the motor vehicle 1.

The electronic rearview mirror 3 further includes a control device 8. The control device 8 can for example be constituted by an electronic control unit of the motor vehicle 1. An image sequence or video data is provided by the cameras 4, which depicts the environmental region 7. This image sequences or video data can be transmitted from the cameras 4 to the control device 8 via a corresponding data line not illustrated here. In addition, the electronic rearview mirror 3 includes a display device 9. A display on the display device 9 can be controlled by means of the control device 8. Thus, the image sequences or video data provided by the cameras 4 can for example be displayed on the display device 9. In the present embodiment, the motor vehicle 1 does not include conventional rearview mirrors. In particular, the region or the environmental region 7 is presented on the display device 9 to the driver or the occupant of the motor vehicle 1, which he otherwise can see with the aid of the rearview mirror.

The driver assistance system 2 or the motor vehicle 1 further includes an electrical energy storage 10. The electrical energy storage 10 can for example be a battery. Moreover, the driver assistance system 2 includes a sensor device 11, by which the state of charge of the electrical energy storage 10 can be detected. Hereto, the sensor device 11 can for example measure an electrical voltage at the terminals of the electrical energy storage 10. The current state of charge of the electrical energy storage 10 detected by the sensor device 11 can be transmitted to the control device 8 via an electrical data line.

During the operation of the motor vehicle 1, in which the drive engine of the motor vehicle 1 is activated, the electronic rearview mirror 3 is also activated or operated. In addition, the electronic rearview mirror 3 is to be operated if the drive engine of the motor vehicle 1 is turned off. With the turned off drive engine, the electronic rearview mirror 3 is operated in a battery mode. Herein, the electronic rearview mirror 3 is supplied with electrical energy from the electrical energy storage 10. The electrical energy storage 10 can for example be a part of an on-board network of the motor vehicle 1. Moreover, the current state of charge of the electrical energy storage 10 is detected by means of the sensor device 11 and transmitted to the control device 8 during the battery mode. Presently, the display presented on the display device 9 is adapted during the battery mode of the electronic rearview mirror 3.

Fig. 2 shows a schematic illustration of the display device 9 in the battery mode of the electronic rearview mirror 3. By the display device 9, a corresponding display 12 is presented, which is determined based on the image sequences captured by the cameras

4. Thus, the display 12 describes the environmental region 7 of the motor vehicle 1. During the battery mode, in addition, a status symbol 13 is presented on the display device 9. The status symbol 13 shows the electrical energy storage 10 or the battery in a schematic representation. In addition, the status symbol 13 shows the current state of charge of the electrical energy storage 10 in the manner of a bargraph. In addition, the current state of charge of the electrical energy storage 10 is indicated as a numerical value or percentage value. In the present embodiment, in addition, a warning symbol 14 is presented on the display device 9. With the aid of the warning symbol 14, the driver or the occupant of the motor vehicle 1 can be made aware of the fact that the current state of charge of the electrical energy storage 10 reaches a critical value.

Fig. 3 shows the control device 8 of the electronic rearview mirror 3 or of the driver assistance system 2 in a schematic illustration. The control device 8 is connected to a vehicle data bus 15. The vehicle data bus can be a CAN bus or an Ethernet connection. The control device 8 can receive the data from the sensor device 11 and thus the current state of charge of the electrical energy storage 10 via the vehicle data bus 15. In a first block 16 of the control device 8, the current state of charge of the electrical energy storage 10 is monitored. The state of charge of the electrical energy storage 10 can for example be compared to at least one threshold value. If it is fallen below a first threshold value for the state of charge, the electronic rearview mirror 3 can be operated in a corresponding operating mode, in which it has a lower energy consumption compared to a normal operating mode. Hereto, a brightness of the display device 9 can for example be reduced. Alternatively or additionally, it can be provided that a frame rate, with which the cameras 4 capture the image sequence, is reduced. If it is fallen below a further threshold value, the warning symbol 14 can be presented on the display device 9. It can also be provided that the electronic rearview mirror 3 is activated or turned off upon falling below the further threshold value. In the block 14, the display 12 on the display device 9 is adapted in the battery mode of the electronic rearview mirror. Thus, the display 12 can be overlaid by the status symbol 13 and/or the warning symbol 14.

Claims

1. Method for operating a driver assistance system (2) of a motor vehicle (1), in which an electronic rearview mirror (3) of the driver assistance system (2) is operated and herein an image sequence of an environmental region (7) of the motor vehicle (1), which is laterally besides the motor vehicle (1) and/or behind the motor vehicle (1), is captured by means of at least one camera (4), and a display (12) is provided on a display device (9) based on the captured image sequence, characterized in that
the electronic rearview mirror (3) is operated in a battery mode with turned off drive engine of the motor vehicle (1), in which the electronic rearview mirror (3) is supplied with electrical energy from an electrical energy storage (10) and in which a state of charge of the electrical energy storage (10) is detected.
2. Method according to claim 1, characterized in that
in the battery mode, a status symbol (13) is displayed by the display device (9), which describes the detected state of charge of the electrical energy storage (10).
3. Method according to claim 1 or 2, characterized in that
at least one threshold value is preset for the state of charge of the electrical energy storage (10) and an operating state of the electronic rearview mirror (3) is adapted if the detected state of charge falls below the at least one threshold value.
4. Method according to claim 3, characterized in that
the at least one threshold value and/or the operating state, in which the electronic rearview mirror (3) is operated, if the detected state of charge falls below the at least one threshold value, are adapted by an operating input.
5. Method according to claim 3 or 4, characterized in that
an amount of the electrical energy, with which the electronic rearview mirror (3) is

supplied from the electrical energy storage (3), is reduced by adapting the operating state

6. Method according to any one of claims 3 to 5, characterized in that a frame rate, with which the at least one camera (4) captures the image sequence, is reduced by adapting the operating state.
7. Method according to any one of claims 3 to 6, characterized in that a brightness of the display (12), which is provided by the display device (9), is reduced by adapting the operating state.
8. Method according to any one of the preceding claims, characterized in that a warning symbol (14) is presented on the display device (9) if the state of charge of the electrical energy storage (10) falls below the at least one threshold value.
9. Method according to any one of the preceding claims, characterized in that the electronic rearview mirror (3) is deactivated if the state of charge of the electrical energy storage (10) falls below the at least one threshold value.
10. Driver assistance system (2) for a motor vehicle (1), which is adapted to perform a method according to any one of the preceding claims.
11. Driver assistance system (2) according to claim 10, characterized in that the driver assistance system (2) includes an electronic rearview mirror (3) and a sensor device (11) for detecting a state of charge of the electrical energy storage (10).
12. Motor vehicle (1) with a driver assistance system (2) according to claim 10 or 11.

13. Motor vehicle (1) according to claim 12,
characterized in that
the motor vehicle (1) is formed devoid of exterior mirrors.

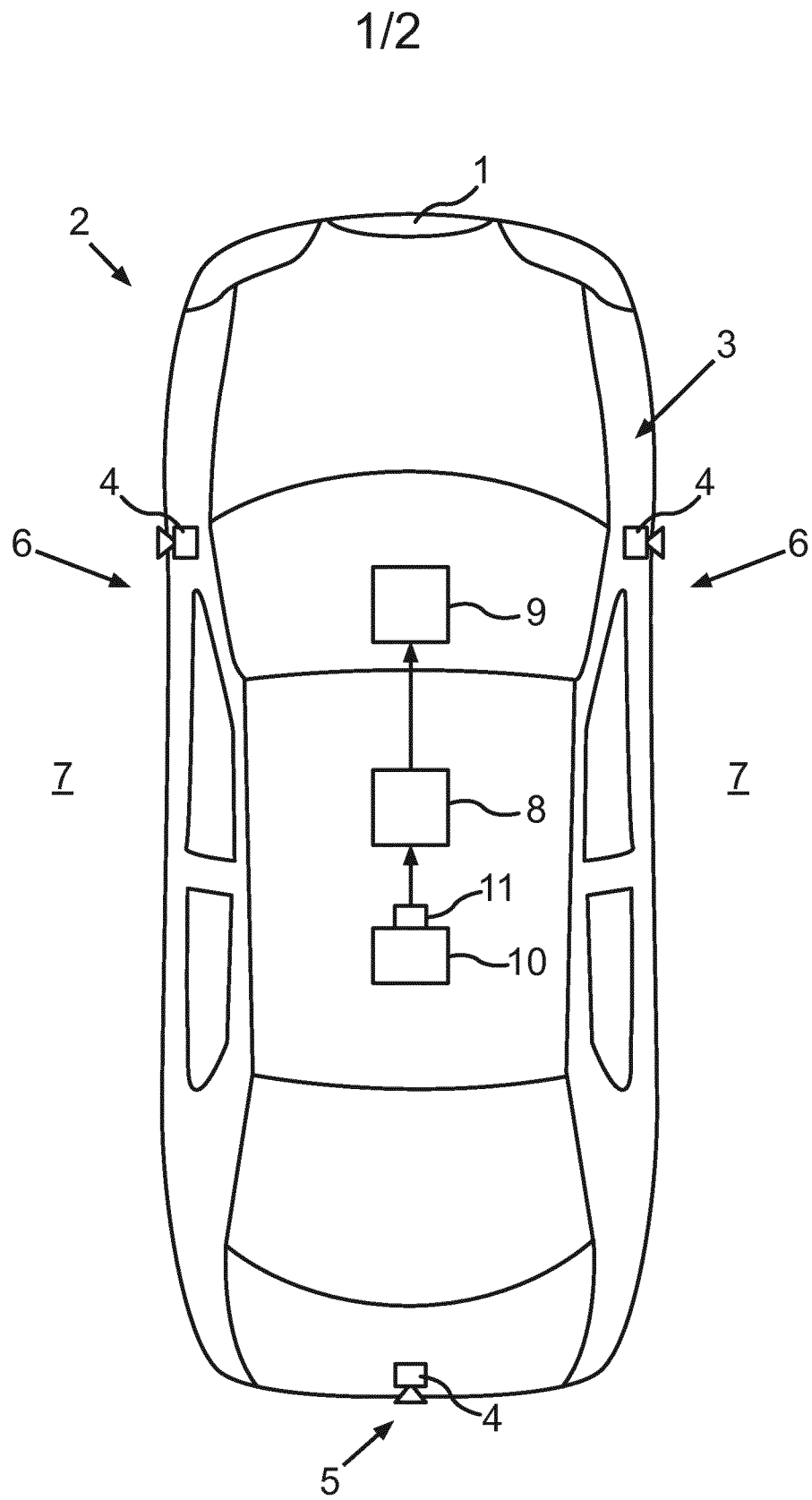
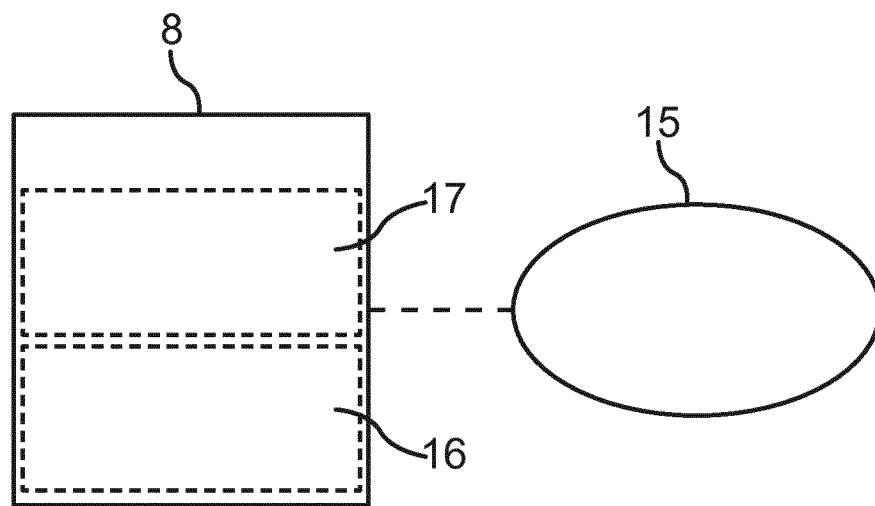
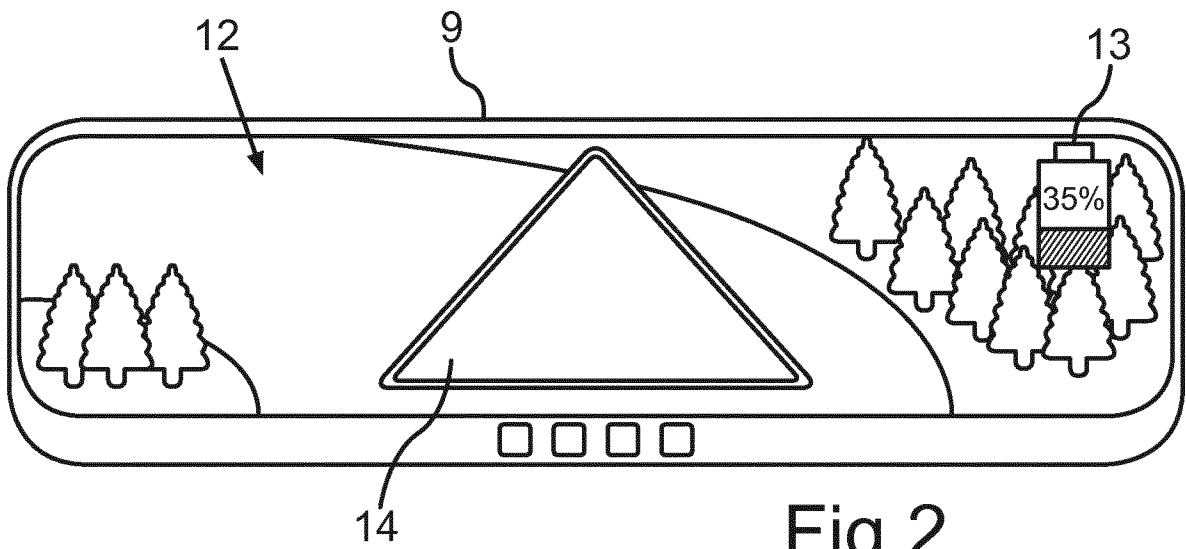


Fig.1

2/2



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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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)
B60R G07C

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

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Y	claim 1; figures 5,7,8	2-9,11, 13
Y	----- WO 2009/094367 A1 (HONDA MOTOR CO LTD [JP]; OWENS C RICHARD JR [US]; SCHEUFLER NICK [US];) 30 July 2009 (2009-07-30) claim 43; figure 2	2-9,11, 13
A	----- JP 2005 115853 A (DENSO CORP) 28 April 2005 (2005-04-28) abstract	1-13
	----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"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

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Kyriakides, Leonidas

INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 006 486 A2 (TUNER CORP [JP]) 7 June 2000 (2000-06-07) paragraph [0068] -----	1-13
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Information on patent family members

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