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(71) Applicant: **TOYOTA MOTOR EUROPE** [BE/BE]; Avenue du Bourget 60, 1140 Brussels (BE).

(72) Inventor: **MORITA, Yasuaki**; c/o Toyota Motor Europe, European Technical Administration Division, Avenue du Bourget 60, 1140 Brussels (BE).

(74) Agent: **HEWEL, Christoph** et al.; CABINET BEAU DE LOMENIE, 158 Rue de l'Université, 75340 PARIS CEDEX 07 (FR).

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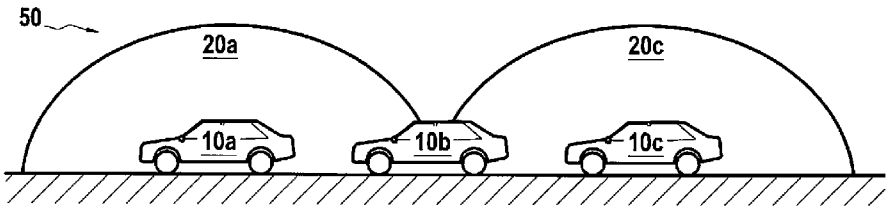


Fig. 2

(57) Abstract: The invention relates to system for inter vehicle management (50), comprising self-driving vehicles (10) which comprise each an automated driving system (30) and which are configured to communicate with each other, the system being configured to, in case a plurality of said self-driving vehicles drive in the same direction and are within a predetermined distance to each other: switch the automated driving system of at least one of the plurality of vehicles at least partially to an energy saving mode, and control automated driving of said vehicle at least partially by the others of said plurality of self-driving vehicles. The invention further relates to an electronic device (1) and to methods for inter vehicle management.

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System, electronic device and method for inter vehicle management

FIELD OF THE DISCLOSURE

[0001] The present disclosure is related to a system, electronic device and method for inter vehicle management, in particular comprising a plurality of self-driving vehicles which include each an automated driving system.

[0002] An automated driving system is a motor vehicle driving automation system that is capable of performing part or all of the dynamic driving task (DDT) on a sustained basis. An automated driving system may be mounted or is to be mounted in a vehicle (such as a car, a truck, an airplane).

[0003] In the case of road vehicles in particular, it may range in level from no driving automation (level 0) to full driving automation (level 5) according to SAE norm J3016.

[0004] In order to realize this function, an automated driving system normally comprises at least one sensor, an electronic control unit, and feedback devices which transmit information to the driver and/or act on control member(s) of the vehicle (for instance the steering shaft, the brake, the accelerator pedal or the like) instead of the driver to take some driving load off the driver.

[0005] An automated driving system is at least capable of assuming part of the driving task (for instance, to perform longitudinal control of the vehicle). In particular, many automated driving systems are designed to assist the driver and are therefore called Advanced Driver Assistance Systems (ADAS). Some automated driving systems are capable of assuming the whole driving task, at least during some periods. Such systems are classified at level 3, 4 or 5 according to SAE norm J3016.

[0006] The present disclosure concerns an automated driving system classified desirably at level 3 or more according to SAE norm J3016.

BACKGROUND OF THE DISCLOSURE

[0007] An automated driving system usually requires a plurality of sensors in order to determine the vehicle's position and relative movement with regard to non-moveable objects (e.g. the road or lane, stopped vehicles, trees or buildings) and moveable objects (e.g. other vehicles or pedestrians). The output of the sensors (in particular raw data) is usually processed by one,

regularly a plurality of control units, i.e. ECUs (electronic control units). Based on the processed data the automated driving system controls driving the system what also requires processing operations of one or several ECUs.

[0008] As a consequence, it has been found the automated driving systems have a relatively high energy consumption due to the high amount of generated sensor data which have to be processed.

[0009] It is known that self-driving vehicles may communicate with each other. For example, JP2018097556 (A) discloses that an automated driving control device prioritizes the traverse of a crossing vehicle to an own vehicle when a roadway which the own vehicle travels along is congested. The vehicle therefore includes an inter-vehicle communication part which receives from the crossing vehicle a signal indicating that the crossing vehicle wishes to traverse.

[0010] Furthermore, it is known to manage an onboard network with a plurality of ECUs (Electronic Control Unit). For example JP2016141200 (A) discloses a method of identifying an ECU which causes a failure such as a decrease in a remaining battery level, from among a plurality of ECUs constituting an onboard network.

SUMMARY OF THE DISCLOSURE

[0011] Currently, it remains desirable to provide a system, electronic device and method for inter vehicle management capable of controlling the automated driving systems of self-driving vehicles more efficiently, in particular with a reduced power consumption.

[0012] Therefore, according to the embodiments of the present disclosure, a system for inter vehicle management is disclosed. The system comprises (several) self-driving vehicles which comprise each an automated driving system. The self-driving vehicles are further configured to communicate with each other. The system is configured to: In case a plurality of said self-driving vehicles (might also be referred to as "a group of self-driving vehicles") drive in the same direction and are within a predetermined distance to each other (e.g. forming a convoy of vehicles), switch the automated driving system of at least one of the plurality of vehicles at least partially to an energy saving mode, and (remote) control automated driving of said vehicle at least partially by the others of said plurality of self-driving vehicles.

[0013] In other words, when a plurality of said self-driving vehicles drive in the same direction and are within a predetermined distance to each other, the automated driving system of at least one of the plurality of vehicles at least partially can be switched to an energy saving mode. Said vehicle is anyway still self-driving, as the automated driving of said vehicle is at least partially (remote) controlled by the others of said plurality of self-driving vehicles.

[0014] In still other words the vehicle in the energy saving mode may be controlled by receiving: sensor information (in this case the vehicle still steers itself and only uses the sensor information of other vehicles) and/or driving control information (in this case the vehicle also receives information of how to steer, which may be driving control recommendations, i.e. the vehicle can still decide on its own how to steer) and/or driving control instructions (in this case the vehicle is externally steered).

[0015] In short, the present disclosure allows a (at least partially) remote automated driving control of a vehicle by another vehicle.

[0016] Accordingly, since the automated driving system of a vehicle is witched at least partially to an energy saving mode, e.g. one or several ECUs and/or sensors of the automated driving system may be switched to a "sleeping mode" or even switched off, the energy consumption can be reduced. The "sleeping mode" may mean that the ECU is inactive except for a running "wake up function". Said "wake up function" may be configured such that another control unit (internal in the vehicle or external to it), e.g. a central ECU of the vehicle can still wake up the "sleeping" ECU.

[0017] More specifically, each automated driving system may comprise at least one electronic control unit and at least one sensor unit and may be configured to autonomously control driving the vehicle.

[0018] Switching an automated driving system at least partially to the energy saving mode may comprise switching its at least one electronic control unit and/or its at least one sensor unit to an energy saving mode.

[0019] When a vehicle is switched to sleeping mode (i.e. at least one of its ECUs is in the "sleeping mode"), it might anyway be reasonable to keep at least one sensor active for security reasons. For example, a LIDAR sensor may remain active, in order to track the "guiding" vehicle in front and hence to assure a predetermined distance to said guiding vehicle.

[0020] In case the plurality of vehicles drive in a convoy of two vehicles, the automated driving system of the first vehicle of said convoy may be in an active mode, and the automated driving system of the other vehicle of the convoy may be in the energy saving mode.

[0021] In case the plurality of vehicles drive in a convoy of more than two vehicles, the automated driving systems of at least the first and the last vehicle of said convoy may be in an active mode, and the automated driving system of at least one of the other vehicles of the convoy may be in the energy saving mode.

[0022] In particular, it may be desirable that all vehicles between the first and the last vehicle are in the energy saving mode. In this case the energy saving effect may be increased.

[0023] In another example, the automated driving system of each second vehicle of the plurality of vehicles may be in the energy saving mode, e.g. starting with the second vehicle of the convoy being in the energy saving mode. In this case the security requirements of the control of the convoy may be maintained at an optimum level, because in this case a vehicle in sleeping mode can still be provided with sensing information from its back and from its front by its active preceding and following vehicle.

[0024] The modes of the automated driving systems of the vehicles in the convoy may be selected based on the spatial sensing range of the sensor units of the automated driving systems, in particular selected such that the whole spatial range of the convoy is sensed.

[0025] Accordingly, it becomes possible to avoid any invisible (i.e. not sensed or "dead angle") zones in the area or the convoy.

[0026] As a further consequence, in case a vehicle with activated automated driving system, e.g. the first vehicle of the convoy is departing from the convoy, e.g. by accelerating or by taking an exit ramp from the currently driven road, or eventually by changing the road lane, its sensor units will not be able any more to cover the required spatial sensing range. In this case, the departing vehicle may inform the further vehicles which are in energy saving mode about its departure. In other words, the departing vehicle may "wake up" said vehicles, desirably before it departs from the convoy.

[0027] A vehicle having its automated driving system in the active mode may be configured to transmit sensor information and/or driving control information and/or driving control instructions to at least one other vehicle having its automated driving system in the energy saving mode and being within the spatial sensing range of said vehicle having its automated driving system in the active mode.

[0028] Adjacent (i.e. neighboring) vehicles in the convoy may be configured to: exchange sensor information, in order to determine the overlap of their spatial sensing ranges, and as a function of the determined overlap, decide to switch the automated driving system of at least one of the adjacent vehicles to the energy saving mode.

[0029] In other words, if the overlap exceeds a predetermined overlap threshold, one of the vehicles' ECUs, desirably of the second vehicle, may be switched to the sleeping mode. This scenario may become relevant, when a further vehicle joins the convoy, e.g. a following vehicle catching up with the convoy (i.e. driving faster that the convoy), the convoy catching up with a preceding vehicle, or a vehicle being integrated into the convoy by entering the road or lane by an access ramp or a lane change. In this case the energy saving mode configuration of the complete convoy may be respectively updated.

[0030] The vehicles in the convoy may be configured to determine a master vehicle according to a predetermined algorithm. The determined master vehicle may be configured to control the modes of the automated driving systems of the vehicles.

[0031] Accordingly, it is possible to decentrally control the system by selecting a master vehicle. In other words it may be first determined by the predetermined algorithm, which vehicle is selected as the master vehicle. The master vehicle has desirably the authorization to decide which of the other vehicles in the convoy is allowed to switch to the energy saving mode. The master vehicle itself desirably remains in the active mode. The master vehicle may further be authorized to wake up any of the vehicles in energy saving mode.

[0032] The predetermined algorithm may be configured e.g. such that always the first vehicle of convoy may be selected as being the master vehicle. Accordingly, the predetermined algorithm may initially select a

master vehicle when a convoy appears (i.e. starting from two vehicles within a predetermined distance to each other and driving in the same direction) and may update the master vehicle selection each time, the first vehicle of the convoy changes.

[0033] The present disclosure further relates to an electronic (control) device for inter vehicle management. The electronic device is configured to control the mode of an automated driving system of a self-driving vehicle. The electronic device comprises:

- a communications unit configured to communicate with at least one further vehicle driving in the same direction and being within a predetermined distance, and
- a control unit configured to select one of:
    - an active mode of the automated driving system, wherein an authorization to switch to an energy saving mode and/or sensor information and/or driving control information and/or driving control instructions of the automated driving system are transmitted to the further vehicle (i.e. it is transmitted at least one of: an authorization to switch to an energy saving mode, sensor information of the automated driving system, driving control information of the automated driving system, driving control instructions of the automated driving system), and
    - an energy saving mode of the automated driving system, wherein the electronic device is configured to receive an authorization to switch to an energy saving mode and/or sensor information and/or driving control information and/or driving control instructions from the further vehicle (i.e. it is received from the further vehicle at least one of: an authorization to switch to an energy saving mode, sensor information, driving control information, driving control instructions), and to control automated driving based on the received information.

[0034] Accordingly, the electronic device desirably controls only one single (ego) self-driving vehicle and not the whole system of vehicles. The device may therefore be integrated into the (ego) vehicle, e.g. be a part of the automated driving system.

[0035] The electronic device or its control unit may also be referred to as the « master ECU » of the vehicle.

[0036] The electronic device may send or receive information which is necessary to control automated driving. The range of possible information may include anything between raw sensor data and precise driving control instructions (e.g. steering and speed commands).

[0037] Furthermore an authorization to switch to an energy saving mode may be sent or received which allows the receiving vehicle to change to the sleeping mode. In this way it can be verified that the vehicle only changes to the sleeping mode, in case the other vehicle which remains active also gives its authorization, e.g. when it has verified to be able to provide the required information for (remote) automated driving control.

[0038] The present disclosure further relates to a self-driving vehicle comprising an automated driving system comprising at least one electronic control unit and at least one sensor unit and being configured to autonomously control driving the vehicle, and an electronic device for inter vehicle management as described above.

[0039] Moreover, the present disclosure relates to a method for inter vehicle management, wherein self-driving vehicles comprise each an automated driving system and communicate with each other. In case a plurality of said self-driving vehicles drive in the same direction and are within a predetermined distance to each other, the method comprising:

- switching the automated driving system of at least one of the plurality of vehicles at least partially to an energy saving mode, and
- controlling automated driving of said vehicle at least partially by the others of said plurality of self-driving vehicles.

[0040] Finally, the present disclosure relates to a method for inter vehicle management, comprising:

- controlling the mode of an automated driving system of a self-driving vehicle,
- communicating with at least one further vehicle driving in the same direction and being within a predetermined distance, and
- selecting one of:

an active mode of the automated driving system, wherein an authorization to switch to an energy saving mode and/or sensor information

and/or driving control information and/or driving control instructions of the automated driving system are transmitted to the further vehicle, and

an energy saving mode of the automated driving system, wherein an authorization to switch to an energy saving mode and/or sensor information and/or driving control information and/or driving control instructions are received from the further vehicle, and automated driving is controlled based on the received information.

[0041] The methods may comprise further method steps which correspond to the functions of the system and device, as described above.

[0042] It is intended that combinations of the above-described elements and those within the specification may be made, except where otherwise contradictory.

[0043] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the disclosure, as claimed.

[0044] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the disclosure and together with the description, and serve to explain the principles thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] Fig. 1 shows a block diagram of an automated driving system with an electronic control device according to embodiments of the present disclosure;

[0046] Fig. 2 shows a schematic representation of a system for inter vehicle management according to embodiments of the present disclosure; and

[0047] Fig. 3 shows a schematic flow chart illustrating an exemplary method of inter vehicle management according to embodiments of the present disclosure.

DESCRIPTION OF THE EMBODIMENTS

[0048] Reference will now be made in detail to exemplary embodiments of the disclosure, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0049] Fig. 1 shows a block diagram of an automated driving system 30 with an electronic control device 1 (i.e. an electronic device) according to embodiments of the present disclosure. The control device controls the mode of the automated driving system 30 of a self-driving vehicle 10.

[0050] The control device 1 may comprise an ECU 1a (electronic control units), i.e. a master ECU or in other words a control unit according to the present disclosure. The ECU 1a may additionally carry out further functions in the vehicle 10. For example, the ECU 1a may act as the general purpose ECU of the vehicle. In addition, the automated driving system comprises a plurality of further (auxiliary) ECUs 1b to 1d. The device 1 may also comprise more or less auxiliary ECUs 1b to 1d.

[0051] An ECU may comprise an electronic circuit, a processor (shared, dedicated, or group), a combinational logic circuit, a memory that executes one or more software programs, and/or other suitable components that provide the described functionality.

[0052] The control device 1 is further connected to sensor units 3a, 3b, in particular optical sensors, e.g. a digital camera and/or a LIDAR sensor. The sensor units are configured such that they sense the environment of the vehicle 10. There may be used also more or less sensors or, and also sensors of other type.

[0053] The output of the sensor units, in particular a recorded video stream or single images recorded at a predetermined sampling frequency (e.g. every second), is transmitted to the control device 1. Desirably, the output is transmitted instantaneously, i.e. in real time or in quasi real time, as raw data. The received data are then processed by one or several ECUs, e.g. 10b to 10d. Based on the processed data the automated driving of the vehicle is controlled. Due to the continuous sensing and generation and processing of sensor data, a relatively high energy consumption is caused.

[0054] For this reason the control device further comprises or is connected to a (wireless) communications unit 2 configured to communicate with at least one further vehicle driving in the same direction and being within a predetermined distance.

[0055] The ECU 1a is configured to select an energy saving mode of the automated driving system 30, in which the electronic device is configured to receive from the at least one further vehicle (desirably already processed)

sensor information and/or driving control information and/or driving control instructions from the further vehicle, and to control automated driving based on the received information. In this way the energy consumption in the automated driving system 30 can significantly be reduced, as the own automated driving system can be switched to an energy saving mode, i.e. at least some of the ECUs 1b to 1d (desirably all) and at least some of the sensor units can be switched to a sleep mode.

[0056] Eventually the ECU 1a also awaits an authorization of the other vehicle to switch the own automated driving system 30 to an energy saving mode. In this way the further vehicle can get the status of a master vehicle which at least can prohibit an energy saving mode of other vehicles by refusing the authorization. In this way the further vehicle can block or stop an energy saving mode, in case it cannot assure to reliably and safely control the driving of the vehicle 10.

[0057] Driving control information may comprise e.g. a corridor to be driven and a speed range, wherein the ECU1a still steers the vehicle based on said received information. In comparison, driving control instructions may comprise explicit instructions how the vehicle 10 is to be steered, e.g. acceleration/breaking instructions and a steering angle etc.

[0058] Furthermore the ECU 1a may also be configured to select an active mode of the automated driving system and to send an authorization to switch to an energy saving mode and/or sensor information and/or driving control information and/or driving control instructions of the automated driving system to the further vehicle which may then switch its automated driving system to an energy saving mode.

[0059] Fig. 2 shows a schematic representation of a system 50 for inter vehicle management according to embodiments of the present disclosure. In the shown exemplary scenario the system comprises 3 self-driving vehicles 10a, 10b, 10c driving as a convoy, but it may also comprise more or less vehicles. The first vehicle 10a is in the active mode, the second following vehicle 10b (i.e. its automated driving system 30) is in the energy saving mode. Further, the third vehicle 10c may also be in the active mode, what is advantageously, as it defines the last vehicle of the convoy. Furthermore, in this case the sensing areas 20a and 20c of the respective first and third vehicles 10a and 10c

can cover the whole area of the convoy, including the area where the vehicle 10b is located.

[0060] The first and desirably also the third vehicle 10a and 10c transmit sensor information and/or driving control information to the middle vehicle 10b.

[0061] Desirably the first vehicle 10a of the convoy may be designated to be the master vehicle. Accordingly, the first vehicle 10a may send an authorization to the second vehicle 10b to switch to an energy saving mode. It may also send explicit driving control instructions to the second vehicle 10b (in this case the third vehicle 10c desirably does not send any sensor information and/or driving control information to the second vehicle 10b).

[0062] Fig. 3 shows a schematic flow chart illustrating an exemplary method of inter vehicle management according to embodiments of the present disclosure. The method addresses the exemplary scenario (cf. step S1) that during driving a first (i.e. preceding) vehicle 10a (e.g. in fig. 2 vehicle 10a) is relatively approached by a second (i.e. following or subsequent) vehicle 10b (e.g. in fig. 2 vehicle 10b). In other words, in this example the vehicles are driving on the same road or lane in the same direction, wherein the first vehicle is slightly slower than the second following vehicle.

[0063] The reduced distance between the vehicles may be determined by their sensor units, wherein when reaching a predetermined proximity, the vehicles may automatically start to set up a communication procedure via their communications units.

[0064] Accordingly, in step S2 the first vehicle sends sensor information to the second following vehicle. Based on said sensor information the second vehicle, in particular its (master) ECU 1a may determine whether it sufficiently overlaps with its own sensor information. If the overlap exceeds a predetermined overlapping threshold the ECU1a of the second vehicle, the ECU 1a determines to switch its automated driving system at least partly to an energy saving mode.

[0065] In particular, ECU 1a may create in step S3 a list of ECUs and/or applications running on ECUs and/or sensors which may be switched to an energy saving (i.e. sleeping) mode or may be entirely deactivated during the energy saving mode of the automated driving system. Hence, the ECU 1a may send in steps S4 to S6 respective orders to further ECUs, e.g. ECUs 1b to 1d, to switch to the energy saving mode.

[0066] It is however also possible, as shown in the alternative embodiment of step S7, that one of the ECUs receiving said order, in this example ECU 1b, re-transmits it to a further ECU, in this example ECU 1d, or the two ECUs coordinate their energy saving modes (e.g. such that only one of the two ECUs will switch to the sleeping mode meanwhile the other one remains active).

[0067] As a further (additional or alternative) embodiment, shown in step S8, it is possible that only any application(s) running in ECUs is (are) switched to an energy saving mode or is (are) stopped. In particular, these may be any applications which process the sensor data.

[0068] Throughout the description, including the claims, the term "vehicle" is desirably implying a "self-driving vehicle".

[0069] Throughout the description, including the claims, the term "comprising a" should be understood as being synonymous with "comprising at least one" unless otherwise stated. In addition, any range set forth in the description, including the claims should be understood as including its end value(s) unless otherwise stated. Specific values for described elements should be understood to be within accepted manufacturing or industry tolerances known to one of skill in the art, and any use of the terms "substantially" and/or "approximately" and/or "generally" should be understood to mean falling within such accepted tolerances.

[0070] Although the present disclosure herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present disclosure.

[0071] It is intended that the specification and examples be considered as exemplary only, with a true scope of the disclosure being indicated by the following claims.

CLAIMS

1. A system (50) for inter vehicle management,
comprising self-driving vehicles (10) which comprise each an automated driving system (30) and which are configured to communicate with each other,
the system being configured to, in case a plurality of said self-driving vehicles drive in the same direction and are within a predetermined distance to each other:
switch the automated driving system of at least one of the plurality of vehicles at least partially to an energy saving mode, and
control automated driving of said vehicle at least partially by the others of said plurality of self-driving vehicles.

2. The system according to claim 1, wherein
each automated driving system comprises at least one electronic control unit (1a – 1d) and at least one sensor (3a, 3b) unit and is configured to autonomously control driving the vehicle, wherein
switching an automated driving system at least partially to the energy saving mode comprises switching its at least one electronic control unit and/or its at least one sensor unit to an energy saving mode.

3. The system according to claim 1 or 2, wherein
in case the plurality of vehicles drive in a convoy of two vehicles (10a, 10b), the automated driving system of the first vehicle of said convoy is in an active mode, and the automated driving system of the other vehicle of the convoy is in the energy saving mode, and
in case the plurality of vehicles drive in a convoy of more than two vehicles (10a, 10b, 10c), the automated driving systems of at least the first and the last vehicle of said convoy are in an active mode, and the automated driving system of at least one of the other vehicles of the convoy is in the energy saving mode.

4. The system according to the preceding claim, wherein
the automated driving system of each second vehicle of the plurality of vehicles is in the energy saving mode starting with the second vehicle of the convoy.

5. The system according to any of the preceding claims 3 or 4, wherein the modes of the automated driving systems of the vehicles in the convoy are selected based on the spatial sensing range of the sensor units of the automated driving systems, in particular selected such that the whole spatial range of the convoy is sensed.

6. The system according to any of the preceding claims, wherein a vehicle having its automated driving system in the active mode is configured to transmit sensor information and/or driving control information and/or driving control instructions to at least one other vehicle having its automated driving system in the energy saving mode and being within the spatial sensing range of said vehicle having its automated driving system in the active mode.

7. The system according to any of the preceding claims, wherein adjacent vehicles in the convoy are configured to:
exchange sensor information, in order to determine the overlap of their spatial sensing ranges, and
as a function of the determined overlap, decide to switch the automated driving system of at least one of the adjacent vehicles to the energy saving mode.

8. The system according to any of the preceding claims, wherein the vehicles in the convoy are configured to determine a master vehicle according to a predetermined algorithm, and
the determined master vehicle is configured to control the modes of the automated driving systems of the vehicles.

9. An electronic device (1) for inter vehicle management,
the electronic device being configured to control the mode of an automated driving system (30) of a self-driving vehicle (10),
the electronic device comprising:
a communications unit (2) configured to communicate with at least one further vehicle driving in the same direction and being within a predetermined distance, and
a control unit (1a) configured to select one of:

an active mode of the automated driving system, wherein an authorization to switch to an energy saving mode and/or sensor information and/or driving control information and/or driving control instructions of the automated driving system are transmitted to the further vehicle, and

an energy saving mode of the automated driving system, wherein the electronic device is configured to receive an authorization to switch to an energy saving mode and/or sensor information and/or driving control information and/or driving control instructions from the further vehicle, and to control automated driving based on the received information.

10. A self-driving vehicle comprising:

an automated driving system comprising at least one electronic control unit and at least one sensor unit and being configured to autonomously control driving the vehicle, and

an electronic device for inter vehicle management according to claim 9.

11. A method for inter vehicle management, wherein self-driving vehicles comprise each an automated driving system and communicate with each other, and

in case a plurality of said self-driving vehicles drive in the same direction and are within a predetermined distance to each other, the method comprising:

switching the automated driving system of at least one of the plurality of vehicles at least partially to an energy saving mode, and

controlling automated driving of said vehicle at least partially by the others of said plurality of self-driving vehicles.

12. A method for inter vehicle management, comprising:

controlling the mode of an automated driving system of a self-driving vehicle,

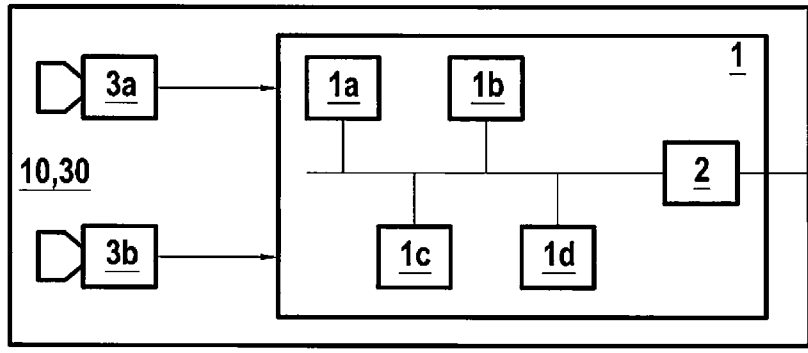
communicating with at least one further vehicle driving in the same direction and being within a predetermined distance, and

selecting one of:

an active mode of the automated driving system, wherein an authorization to switch to an energy saving mode and/or sensor information and/or driving control information and/or driving control instructions of the automated driving system are transmitted to the further vehicle, and

an energy saving mode of the automated driving system, wherein an authorization to switch to an energy saving mode and/or sensor information and/or driving control information and/or driving control instructions are received from the further vehicle, and automated driving is controlled based on the received information.

Fig. 1



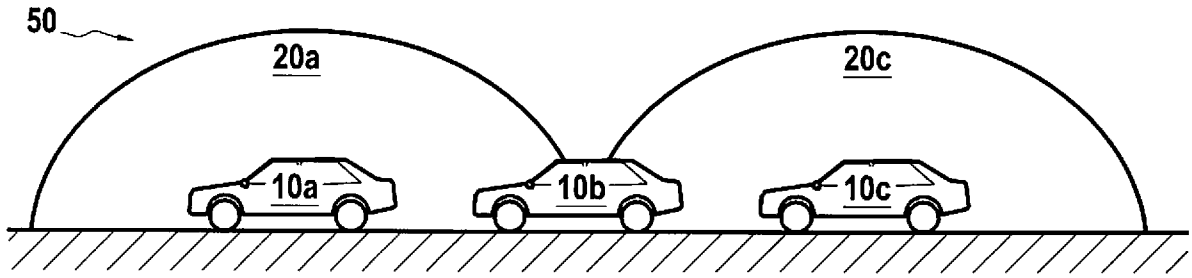


Fig. 2

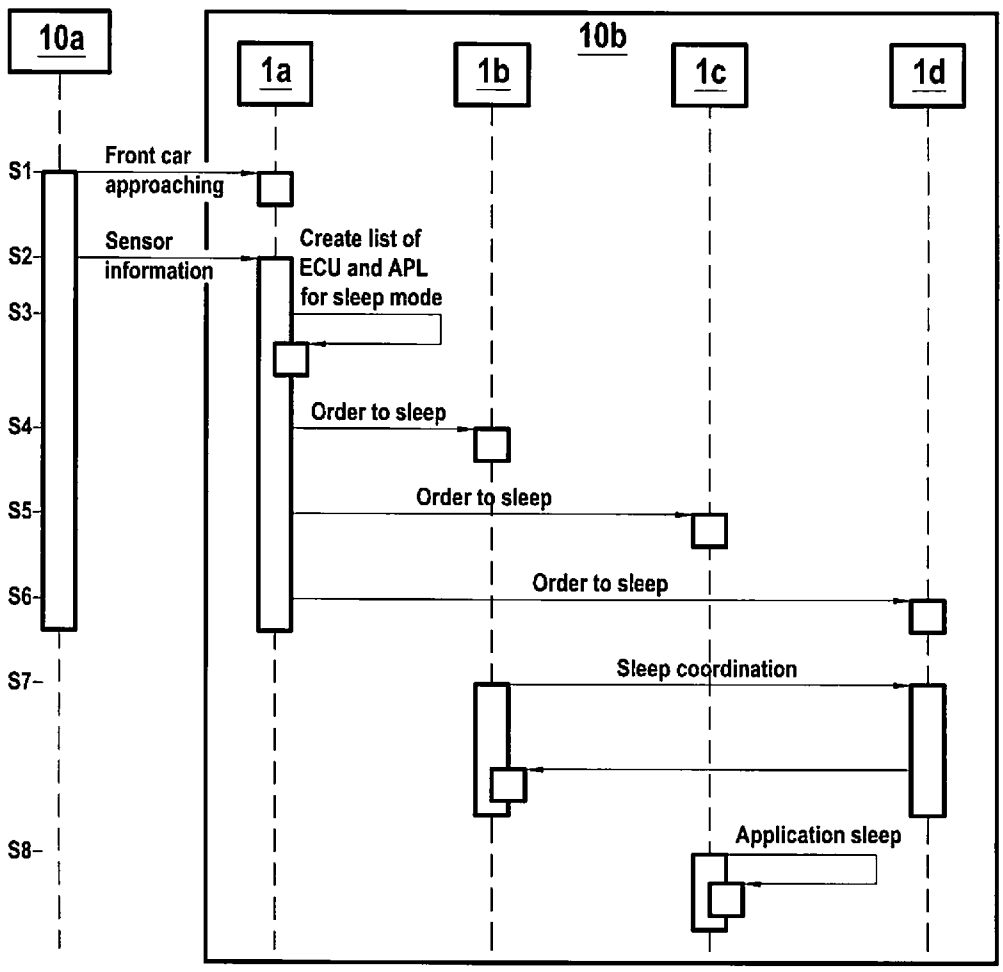


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/085344

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60W30/182 G08G1/00 G05D1/02
ADD. B60W50/00

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 G08G G05D

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.
X	US 2018/113448 A1 (NAGDA YASH [US] ET AL) 26 April 2018 (2018-04-26) paragraphs [0001], [0008] - [0030] figures 1-6	1-12
X	US 2018/239352 A1 (WANG YIZHOU [US] ET AL) 23 August 2018 (2018-08-23) paragraph [0032]	1,11
A	DE 10 2014 200804 A1 (BOSCH GMBH ROBERT [DE]) 23 July 2015 (2015-07-23) paragraphs [0004], [0007], [0045]	1-12
A	US 2010/256835 A1 (MUDALIGE UPALI PRIYANTHA [US]) 7 October 2010 (2010-10-07) paragraphs [0080] - [0081], [0105], [0124] - [0133]	1-12

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"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

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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

Date of the actual completion of the international search	Date of mailing of the international search report
10 September 2019	18/09/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Laiou, M

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2018/085344

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