(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 120 218 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
04.12.2024 Bulletin 2024/49

(21) Application number: **21185811.3**

(22) Date of filing: **15.07.2021**

(51) International Patent Classification (IPC):
G08G 1/0962 *(2006.01)* ***G08G 1/16*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
G08G 1/0962; G08G 1/165; G08G 1/166; G08G 1/168

(54) SYSTEM AND METHOD FOR MONITORING AN AUTONOMOUS DRIVING OR PARKING OPERATION

SYSTEM UND VERFAHREN ZUR ÜBERWACHUNG EINES AUTONOMEN FAHR- ODER EINPARKVORGANGS

SYSTÈME ET PROCÉDÉ DE SURVEILLANCE D'OPÉRATION D'ENTRAÎNEMENT OU DE STATIONNEMENT AUTONOME

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(43) Date of publication of application:
18.01.2023 Bulletin 2023/03

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Description

[0001] The present invention first is directed to a system for monitoring an autonomous driving or parking operation of a vehicle. Secondly, the invention is directed to a method for monitoring an autonomous driving or parking operation of a vehicle with the presently disclosed system.

[0002] The invention relates to the field of known autonomous driver-assistance systems (ADAS) as used for autonomously driving a vehicle. Such advanced driver-assistance systems in vehicles may include Valet Parking Assistance (VaPA) to provide fully automated steering and manoeuvring when parking, for example within a car park or parking structure. Such systems use automated vehicle controls such as GPS (Global Positioning System) or on-board sensors along with camera, lidar, radar proximity and ultrasonic sensors, to navigate, identify valid parking slots, and park the vehicle ("drop-off" manoeuvre). The vehicle is also able to autonomously drive the parked vehicle from a parking slot to a specified pickup location ("summon" manoeuvre) upon request by the user. Within a summon manoeuvre the vehicle drives along a specified route or distance. Consequently, the summon manoeuvre is an operation during which the vehicle drives (driving operation). The aforementioned "drop-off" manoeuvre more relates to a parking operation. Thus, in the present document the term "driving operation" is used synonymously with the term "drop-off manoeuvre" and the term "parking operation" is used" synonymously for the term "summon manoeuvre".

[0003] Autonomous driver-assistance systems (ADAS) require information about the area where they are applied to be mapped for the vehicle to plan a route for the drop-off and summon manoeuvre. This digital map of the area, for example a car park or parking structure, could be very simple and consist only of a description of the drivable sections, or more complex such as high-definition maps with additional attributes such as signs, lane widths and the like. In most cases the ADAS or VaPA has to consider an actual traffic situation in the area of use, for example the car park or parking structure. Said digital map and said actual traffic situation might permanently be updated by using dedicated databases being connected with the ADAS or the vehicle. Alternatively, or additionally said digital map and said actual traffic situation might be updated by GPS data or the use of on-board sensors along with camera, lidar, radar proximity and ultrasonic sensors. Also, data relating to said digital map or said actual traffic situation which might be tracked and shared by other traffic participants might be used for such an update.

[0004] When using ADAS or VaPA for the first time, a user might not be familiar with the functions of the system. The user might want to learn or check how the system works. One way of doing this is to allow the user to stay inside the vehicle during an automated driving or parking operation (e.g. "drop-off" manoeuvre or "summon" manoeuvre). However, at a certain point in time the driving or parking operation will have to be performed without the user being inside the vehicle. For this purpose it would be beneficial if the user could monitor the driving or parking operation and the respective vehicle behaviour during the driving or parking operation from outside the vehicle, in particular from a position where the vehicle is out of sight of the user.

[0005] Relevant prior art may be identified in US 2021/023992 A1, WO2014/070276 A2 and US 2018/052457 A1.

[0006] Document US 2021/023992 A1 refers to an apparatus including a plurality of capture devices and a processor. The plurality of capture devices may each be configured to generate video frames corresponding to an area outside of a vehicle. The processor may be configured to receive the video frames from each of the plurality of capture devices, generate video data for a display in response to the video frames, store a view preference for the display corresponding to (i) a location and (ii) a vehicle status, determine a current location and a current status of the vehicle and generate an output signal to select a view for the display. The output signal may be generated in response to the current location matching the location and the current status matching the vehicle status. The view selected may be determined based on the view preference.

[0007] WO 2014/070276 A2 refers to a camera system installed on the front end of a vehicle, either on the left front, the right front, or both sides. The camera is linked via wired or wireless connection to an onboard computer and a navigation display that is located within the passenger compartment of the vehicle. The driver reviews a visual description on the display of any oncoming traffic in the form of motor vehicles, pedestrians, cyclists, animals and the like on the navigation display via a single screen, split screen or alternating screens. The camera system can include a speed sensor that detects when the vehicle reaches a threshold speed to activate or deactivate the camera. Alternatively, the computer can activate the system when a turn signal is activated, and deactivate the system when the turn signal is no longer activated. This camera system can be retrofitted into older vehicles.

[0008] US 2018/052457 A1 refers to a stereo camera-based autonomous driving method and apparatus, the method including estimating a driving situation of a vehicle, determining a parameter to control a stereo camera width of a stereo camera based on the estimated driving situation, controlling a capturer configured to control arrangement between two cameras of the stereo camera for a first direction based on the determined parameter, and measuring a depth of an object located in the first direction based on two images respectively captured by the two cameras with the controlled arrangement.

[0009] It is therefore an object of the invention to provide a user-friendly system and method that allows a user to monitor (and observe) an autonomous driving or park-

ing operation of a vehicle from outside the vehicle. It is a further object of the invention to overcome or at least mitigate shortcomings of the prior art, or at least to provide a user with a convenient alternative.

[0010] These objects are achieved by the system and method defined in the appended claims.

[0011] According to a first aspect of the invention, a system for monitoring an autonomous driving or parking operation of a vehicle is provided according to claim 1.

[0012] The portable electronic device may be a any portable computer, e.g. a laptop, notebook, tablet computer, telephone, smartphone or the like. In principle also a stationary computer could be employed instead of a portable electronic device as the basic idea of the present invention relates to remotely observing a driving or parking operation of the vehicle.

[0013] The system allows a user of a portable electronic device (the second communication unit of which is wirelessly connected to a first communication unit of the vehicle) to visually observe an autonomous driving or parking operation of the vehicle in a live-mode or live-video (during the autonomous driving or parking operation) from a position external to the vehicle. The cameras installed at different positions of the vehicle may be installed outside or inside the vehicle. Each camera may include one or more lenses. Also, each camera may be operated by a microcontroller, the microcontroller being connected with a main control unit of the vehicle. The mentioned expression of "capturing" videos may be understood in terms of "displaying" moving images (time-resolved image-sequences captured by a camera) to a user. Otherwise the term "capturing" may be understood in terms of recording (and storing) said moving images (time-resolved image-sequences captured by a camera). Data corresponding to said moving images may be stored temporarily or for longer terms. Said data may also be transmitted to an external server or database (e.g. a cloud). The signal connections of the cameras and the first communication unit may be based on cable(s) or may be a wireless signal connection. The first communication unit may be part of a main control unit of the vehicle. The wireless signal connection between the first and second communication unit may be based on digital signal (or data) transmission. Said wireless signal connection may exemplarily be based on Bluetooth, WLAN, ZigBee, NFC, Wibree, WiMAX, IrDA, FSO, LiFi. Said wireless signal connection may also be based on mobile internet connections of the first and second communication units, e.g. mobile internet connections based on 2G, 3G, 4G, 5G or any other known or future standard for mobile internet connections. The wireless connection between said first and second communication unit may be a direct connection (including a direct signal and data transfer) between both units, or may be an indirect connection including one or more intermediate transmission units or server. The first and second communication units can be understood as communication interfaces, each comprising dedicated means (e.g. antennas) for receiving and transmitting signals and data.

[0014] A suitable application software (abbrev.: App) may be installed on the portable electronic device to operate a visualization of the data transmitted to the portable electronic device via the wireless connection of the first and second communication unit. The App may be configured to overlay or display specific features/information directly in the video or next to the video.

[0015] As mentioned above, the portable electronic device is configured to show said live-videos to a user of the portable electronic device in a live mode during the driving or parking operation. This enables a user to observe an actual autonomous driving or parking operation via his smartphone, although the user may be located out of sight of the vehicle. The user may thus observe the vehicle behaviour and its vicinity in real time and on demand.

[0016] The view-management means may comprise hardware and software components, both being part of the portable electronic device or the vehicle. It is also possible, that hardware and software components of the vehicle and the portable electronic device define the view-management means and are configured to interact with each other. Hardware components may be understood as computing unit. Besides the possibility of automatically selecting a camera-view by the view-management means, the latter may be configured in that a user can manually switch between different camera-views. The view-management means may comprise an algorithm (the algorithm may be based on artificial intelligence) that may be operated in a dedicated software (environment), the software being installed on one or both of said computing units. The automated selection of the camera-view of which the corresponding live-video is shown to the user is performed by said algorithm.

[0017] When referring to said automated selection of the camera-view, the view-management means provide a situation-based view management system. Based on the situational context, a camera-view may be changed automatically to show the most interesting/relevant camera-view to the user. The algorithm may consider different criteria when calculating which camera-view (of which camera) is to be shown to the user. Said criteria may relate to the autonomous driving or parking operation as such, to the vicinity of the vehicle (e.g. the traffic situation, traffic participants) or to the needs of the user.

[0018] According to another aspect of the invention, the cameras are installed at positions of the vehicle to provide the following camera-views: a front view of the vehicle, a rear view of the vehicle, a left view of the vehicle and a right view of the vehicle. To provide each of said views (front view, rear view, left view, right view) a single camera or a number of cameras may be provided at the relevant positions of the vehicle (the front, the back, the left, the right of the vehicle). The cameras may be mounted on suitable vehicle components. It is to be noted that the system according to the invention may be implemented in newly fabricated vehicles or via retrofitting.

[0019] According to another aspect of the invention, a live-video referring to a bird's eye view of the vehicle can be obtained based on the live videos provided by the cameras installed at the vehicle and/or position data of the vehicle. A bird's eye view refers to a view of the vehicle from above, with a perspective as the observer were a bird. The live-video in bird's eye view may be calculated (extrapolated) based on video data provided from the front, rear, left, and/or right camera of the vehicle. Additionally, or alternatively one or more camera(s) may be installed on top of the roof of the vehicle. Said camera (being installed on the roof) may be a 360° camera. It could also be possible to install a drone at the vehicle. In case a bird's eye view would be needed, the drone could rise (fly) to a certain height above the vehicle and provide a bird's eye view.

[0020] According to another aspect of the invention, the view-management means are configured to select one- or more camera-views of which the corresponding live-video(s) is/are shown to the user on the portable electronic device. It is important to note that the view-management means are not only suitable to select a single camera view, but also to select multiple camera views to be shown to a user at the same time. In many driving or parking operations (as well as traffic situations) a parallel observation of several (different) views may be of interest. The live-videos may be shown to the user in a gallery format with multiple videos displayed to the user. The gallery format may include the videos as video-mosaics.

[0021] According to another aspect of the invention, the view-management means are configured to select a camera-view of which the corresponding live-video is shown to the user on the portable electronic device in a single camera-view or as highlighted camera-view besides other views. Sometimes it might be of advantage to only display a single camera-view to the user, e.g. in situations where the other accessible camera-views would not provide sufficient information referring to an actual driving or parking operation (or to an actual traffic situation). A single camera-view is means that only a single live-video (referring to a specific) camera-view is displayed to the user. A highlighted camera-view is to be understood as display mode where a live-video referring to a specific camera-view is prominently displayed to a user besides live-videos of other camera-views (which are not highlighted). The live video referring to the highlighted camera-view is shown enlarged with respect to live-videos of other camera-views shown to the user.

[0022] According to another aspect of the invention, the view-management means are configured to automatically select the single or highlighted camera-view as follows:

a. in case that the vehicle moves in a direction straight ahead or straight reverse: selecting a front-view or a rear-view as single or highlighted camera-view;

b. in case that the vehicle changes its direction of movement: selecting a camera-view directed in the changed direction of movement as single or highlighted camera-view;

c. in case that an object is monitored within a predefined first distance from the vehicle and the vehicle is moving toward the object: selecting a camera-view directed to the object as single or highlighted camera-view;

d. in case that an object is monitored within a predefined second distance from the vehicle and the object is moving toward the vehicle: selecting a camera-view directed to the object as single or highlighted camera-view.

[0023] The view-management means may be configured to evaluate (or weigh) which of the situations/aspects given under lit. a. - d is most relevant at a certain point in time. According to the evaluation (weighing) it is then decided which of the camera-views is selected as single or highlighted camera-view.

[0024] When referring to lit. a. it is to be mentioned, that a camera directed to the direction of movement (straight ahead, straight reverse) may be defined as the most relevant camera. When a change in the direction of movement occurs (lit. b), the camera-view may change to a camera-view of a camera directed in the changed direction of movement. A driving tube view may be overlaid on top of the selected camera view to indicate the direction of movement.

[0025] The case of lit c. is directed to a situation where an object is present within a predefined first distance (or range) around the vehicle. The object might be a pedestrian. The system may comprise means or determining the distance between the object and the vehicle. Also, the system may comprise means for determining if the vehicle is moving toward the object (e.g. the distance between object and vehicle decreases). Said means may be one of the cameras as such or additional means (distance measurement means) installed at the vehicle. If both criteria are met, a camera-view directed to the object is selected (shown as single camera-view or highlighted with respect to other camera-views). Said camera-view may be called "static object view". Said predefined first distance may automatically be determined or may be continuously adapted to a situational context (e.g. the traffic situation) of the vehicle.

[0026] In case d. where an object is monitored within a predefined second distance from the vehicle (the second predefined distance being larger than the first predefined distance) and a condition where the object moves toward the vehicle (distance between object and vehicle is reduced, which can be detected by the camera as such or dedicated distance measurement means), a camera-view is selected which is directed to the object as single or highlighted camera-view. Said predefined second distance may automatically be determined or may be continuously adapted to a situational context (e.g. the traffic situation) of the vehicle.

[0027] According to another aspect of the invention, in case d., the single or highlighted camera-view may be switched when the object leaves a field of view of a first camera and enters a field of view of a second camera. As the field of view of the cameras may be restricted, a moving object might enter different field of views of different cameras. To visually follow the movement of the object, it might be necessary to switch the selected camera according to the field of view in which the moving object is actually present. The live-video may be provided with a bounding box to indicate which moving (dynamic) object is actually tracked. The bounding box may be bound to the moving object and may be provided as overlay of the live-video.

[0028] According to another aspect of the invention, the view-management means are configured to consider an anticipated length of movement of the autonomous driving or parking operation for automatically selecting the single or highlighted camera-view shown to the user, wherein in case that an anticipated length of movement is below a given threshold length, the selected camera view(s) shown to the user are fixed. Said feature avoids flickering of camera-views due to fast changes of the direction of movement (e.g. within parking operations when the vehicle needs to undergo short moves). The length of movement may be anticipated based on path planning information (e.g. GPS data) or a tracked vehicle behaviour. In case of vehicle movements below a given threshold length, the camera-view should not be changed. The given threshold length may be automatically determined or manually defined by a manufacturer of the vehicle, a user of the vehicle or the like.

[0029] According to another aspect of the invention, the view-management means are configured to select the bird's view as single or highlighted camera-view in case that multiple movements of the vehicle with an anticipated length of movement below said given threshold value are expected. A bird's eye view does not require fast changes of camera-views, much more the autonomous driving or parking operation (including multiple changes in the direction of movement) may be observed from a position above the vehicle. To help the user to understand the vehicle behaviour (the short movements), an anticipated final position of the vehicle and the intended path (the driving or parking operation relies on) may be projected on top of the camera-view. Such a camera-view may be called "parking view". So one further aspect of the invention enables that an anticipated movement path or end position of the vehicle in the autonomous driving or parking operation is projected into the single or highlighted camera-view.

[0030] According to another aspect of the invention, the view-management means are configured to automatically select the single or highlighted camera-view in predefined situations of an autonomous driving or parking operation according to predefined selection criteria, wherein the predefined situations and predefined selection criteria are as follows:

a. Selecting a bird's eye view in case that a parking slot to carry out the parking operation of the vehicle has been identified;

b. Selecting a number of camera-views and switching through the number of camera-views at the beginning or end of the autonomous driving or parking operation.

[0031] When referring to case a., a parking operation might often be better observed from a bird's eye view. When referring to case b., an automated switching through accessible or predefined camera-views (e.g. front, rear, left, right) at the beginning (or before) or at the end of an autonomous driving or parking operation enables a user to observe or check the vicinity of the vehicle for possible objects that could hinder the driving or parking operation.

[0032] To select the camera-view according to the above given criteria a. and b., the system may consider path planning data (e.g. based on GPS data) or data referring to the local environment of the vehicle. Path planning data may also refer to a local map. Such data may be provided from an external server to the vehicle or the portable electronic device, so that the view-management means may consider said data.

[0033] Optionally, a section of the live-video (of a certain camera-view) where the vehicle is assumed to get very close to a certain object during the driving or parking operation may be marked (e.g. with a bounding box).

[0034] As mentioned before, the view-management means are configured to automatically select the camera-view shown to the user based on a routine, optionally a routine based on artificial intelligence.

[0035] According to another aspect of the invention, the view management means are configured to show additional information to a user by displaying said information in the live-video corresponding to a selected camera-view shown to the user on the portable electronic device, wherein said information is/are preferably displayed as video-overlay(s). Said additional information may also be displayed by boxes or illustrative means affixed to objects or positions present in the live-video. The information may relate to anticipated movement paths, vehicle data, data referring to the environment (e.g. an outdoor temperature), traffic signs etc.

[0036] Additional situations where an overlay of the live-video would help the user to better understand the situational context and the behaviour of the vehicle include (but are not limited to):

- a bounding box on a stopping position at the end of a pick-up manoeuvre;
- a stop sign to illustrate an intention of the vehicle to stop at an intersection;
- driving speed;
- remaining driving distance in case of a pick-up manoeuvre;
- distance to close objects;

- moving direction of close dynamic (moving) objects;
- text about issue and intention of the vehicle in case of exceptional situations (component failure, no parking slot found etc.);
- slot polygon overlay during a parking operation;
- local path planner visualization overlay during a parking operation.

[0037] The system may be configured to include said overlays to the live-video(s) displayed to a user on a screen of the portable electronic device.

[0038] Additionally, a function may be implemented in the system where the user may choose to shut off the automated view-selection and to select a camera-view manually. This feature may be implemented in the App operated on the portable electronic device. The user may also choose a hybrid mode where some camera-views may be fixed (as selected by the user) and other views change automatically according to the situational context.

[0039] According to yet another aspect of the invention, there is provided a method according to claim 12 for monitoring an autonomous driving or parking operation of a vehicle with a previously described system.

[0040] One or more camera-views of which the corresponding live-video is/are shown to a user on the portable electronic device in a single camera-view or as highlighted camera-view besides other views is/are automatically selected by view-management means. The selection may refer to a selection (and display) of a single camera-view or to a selection of a highlighted camera-view (a selected camera-view is displayed enlarged with respect to other camera-views). The automated selection may be based on the same criteria or situations as described before.

[0041] It is to be emphasized, that the system may comprise dedicated units or means for performing any of the method steps described above.

[0042] The invention will now be described in more detail with reference to the appended figures. In the figures:

Fig. 1 shows a basic illustration of a vehicle to be used in a system and method according to the invention,

Fig. 2 shows a basic illustration of a system according to the invention,

Fig. 3 shows a way of displaying a live-video in a single camera-view to a user on a display of a portable electronic device,

Fig. 4 shows a way of displaying a live-video in a highlighted camera-view to a user on a display of a portable electronic device,

Fig. 5a-d shows different selection modes for selecting a camera-view to be displayed to a user on a portable electronic device.

[0043] Turning to Figure 1, a vehicle to be used in a system according to the invention is shown in a schematic illustration. The system is suitable for monitoring an autonomous driving or parking operation of the vehicle 1. The vehicle 1 (e.g. a car) has a front F, a back B as well as a left side L and right side R. A number of cameras 2L, 2R, 2F, 2B are installed at different positions of the vehicle. A camera 2L is installed at the left side L of the vehicle 1, a camera 2R is installed at the right side R of the vehicle 1, a camera 2F is installed at the front F of the vehicle 1, and a camera 2B is installed at the back side B of the vehicle 1. The back B may synonymously be expressed as "rear" side of the vehicle 1. The positions of the cameras 2L, 2R, 2F, 2B were only chosen for illustrative purposes. Each of the cameras 2L, 2R, 2F, 2B is configured to capture live-videos of the driving or parking operation from a camera-view corresponding to the position of the camera 2L, 2R, 2F, 2B. The corresponding camera-views are indicated with field-of-views 21, 22, 24 and 24, wherein the field-of-view 21 refers to camera 2L, field-of-view 22 refers to camera 2R, field-of-view 23 refers to camera 2F and field-of-view 24 refers to camera 2B. The vehicle comprises a first communication unit 11 which may be part of a board computer of the vehicle 1. The cameras 2L, 2R, 2F, 2B are in signal connection with the first communication unit 11.

[0044] As shown in figure 2, the system according to the invention comprises a number of cameras 2L, 2R, 2F, 2B installed at different positions of the vehicle 1, each of the cameras 2L, 2R, 2F, 2B configured to capture live-videos of the driving or parking operation from a camera-view corresponding to the position of the camera 2L, 2R, 2F, 2B, wherein the cameras 2L, 2R, 2F, 2B are in signal connection (not shown) with a first communication unit 11 being installed in the vehicle 1.

[0045] The system further comprises a portable electronic device 30 comprising a second communication unit 12. The portable electronic device 30 comprises a display 13. The portable electronic device 30 is used by user 5, wherein the user 5 is located external to the vehicle 1.

[0046] The first communication unit 11 is configured to transmit the captured live-videos to the second communication unit 12 via a wireless signal connection 15, wherein the second communication unit 12 is configured to receive the transmitted live-videos, and wherein the portable electronic device 30 is configured to show the live-videos to the user 5 of the portable electronic device 30 in a live mode during the driving or parking operation. The system further comprises view-management means (not shown) configured to automatically select a camera-view of which the corresponding live-video is shown to the user 5 on the portable electronic device 30. The view-management means may comprise hardware and software components, both being part of the portable electronic device 30 or the vehicle 1. It is also possible, that hardware and software components of the vehicle 1 and

the portable electronic device 30 together provide the view-management means and are configured to interact with each other. Hardware components may be understood as computing unit. Besides the possibility of automatically selecting a camera-view by the view-management means, the latter may be configured in that a user 5 can manually switch between different camera-views. The view-management means may comprise an algorithm (the algorithm may be based on artificial intelligence) that may be operated in a dedicated software (environment), the software being installed on one or both of said computing units. The automated selection of the camera-view of which the corresponding live-video is shown to the user 5 is performed by said algorithm.

[0047] As shown in figures 3 and 4, the view-management means are configured to select a camera-view of which the corresponding live-video is shown to the user 5 on the portable electronic device 30 in a single camera-view 100 or as highlighted camera-view 101 besides other views 102. In a single camera-view 100 only a single live-video is displayed on the display 13 of the portable electronic device 30. In a highlighted camera-view 101 a live-video of a certain camera view is displayed enlarged when compare to the live-videos of other views 101 (shown smaller).

[0048] Figures 5a - d illustrate different buttons (provided in an App operated on the portable electronic device 30) which a user 5 of the portable electronic device 30 may activate/deactivate, wherein the buttons are related to different selection options referring to the selection of a camera-view of which a live-video is shown to the user 5. The buttons may be shown in a touch sensitive manner on the display 13 of the portable electronic device 30. From the right to the left of the buttons illustrated in figs. 5a - d the buttons refer to a right view, a left view, a rear view, a front view and a bird's eye view of the vehicle 1. Said buttons may also be displayed in an on-board display of the vehicle 1, so that the user 5 of the vehicle may pre-select a certain selection procedure before leaving the vehicle 1.

[0049] Fig. 5a refers to an activated button (the left button is activated) referring to an automated (auto) camera selection. The automated camera selection may be selected as default. Figure 5b refers to a hybrid mode of camera selection (second button from the left is activated). However, by selecting the hybrid mode only without selecting a further camera vie, the system undergoes an automated camera selection as shown in fig. 5a. Figure 5c again refers to an activated hybrid of camera selection, but the right view is also activated. In such a case the activated view (the right view in this case) is displayed as single or highlighted view 100, 101 to the user 5 on the portable electronic device 30 until the view management means decide that there is a more relevant (or critical) view that should be displayed to the user (e.g. a certain traffic situation or movement). When the situation ends, the view returns to the selected view (the right view in this case). Figure 5d refers to a selection of the left view without the buttons of the automated selection or hybrid selection being activated. In such a case only the selected view is displayed to the user 5 on the portable electronic device.

Claims

1. System for monitoring an autonomous driving or parking operation of a vehicle (1), the system comprising

- a number of cameras (2L, 2R, 2F, 2B) configured to be installed at different positions of the vehicle (1), each of the cameras (2L, 2R, 2F, 2B) configured to capture live-videos of the driving or parking operation from a camera-view corresponding to the position of the camera (2L, 2R, 2F, 2B), wherein the cameras (2L, 2R, 2F, 2B) are in signal connection with a first communication unit (11) configured to be installed in the vehicle (1);
- a portable electronic device (30) comprising a second communication unit (12);

wherein the first communication unit (11) is configured to transmit the captured live-videos to the second communication unit (12) via a wireless signal connection (15), wherein the second communication unit (12) is configured to receive the transmitted live-videos, and wherein the portable electronic device (30) is configured to show the live-videos to a user (5)of the portable electronic device (30) in a live mode during the driving or parking operation,

wherein the system comprises view-management means configured to automatically select a camera-view of which the corresponding live-video is shown to the user (5) on the portable electronic device (30) in a single camera-view (100) or as highlighted camera-view (101) besides other views (102), wherein in a highlighted camera-view (101) a live-video of the selected camera-view is displayed enlarged as compared to the live-videos of other camera-views,

wherein the cameras (2L, 2R, 2F, 2B) are configured to be installed at positions of the vehicle (1) to provide the following camera-views: a front view of the vehicle (1), a rear view of the vehicle (1), a left view of the vehicle (1) and a right view of the vehicle (1),

wherein the view-management means are configured to select a bird's eye view as the single (100) or highlighted (101) camera-view in case that multiple movements of the vehicle (1) with an anticipated length of each of said multiple movements below a given threshold value are expected,

said multiple movements including multiple

changes in the direction of movement.

2. System according to claim 1, wherein a live-video referring to the bird's eye view of the vehicle (1) is obtained based on the live videos provided by the cameras (2L, 2R, 2F, 2B) installed at the vehicle (1) and/or position data of the vehicle (1).

3. System according to claim 1 or 2, wherein the view-management means are configured to select one or more camera-views of which the corresponding live-video(s) is/are shown to the user (5) on the portable electronic device (30).

4. System according to claim 1, wherein the view-management means are configured to automatically select the single or highlighted camera-view (100, 101) as follows:

a. in case that the vehicle (1) moves in a direction straight ahead or straight reverse: selecting a front-view or a rear-view as single (100) or highlighted (101) camera-view;
b. in case that the vehicle (1) changes its direction of movement: selecting a camera-view directed in the changed direction of movement as single (100) or highlighted (101) camera-view;
c. in case that an object is monitored within a predefined first distance from the vehicle (1) and the vehicle (1) is moving toward the object: selecting a camera-view directed to the object as single (100) or highlighted (101) camera-view;
d. in case that an object is monitored within a predefined second distance from the vehicle (1) and the object is moving toward the vehicle (1): selecting a camera-view directed to the object as single (100) or highlighted (101) camera-view.

5. System according to claim 4, wherein the second predefined distance is larger than the first predefined distance.

6. System according to claim 4, wherein in case d. the single (100) or highlighted (101) camera-view is switched when the object moves leaves a field of view (21, 22, 23, 24) of a first camera (2L, 2R, 2F, 2B) and enters a field of view (21, 22, 23, 24) of a second camera (2L, 2R, 2F, 2B).

7. System according to claim 1, wherein the view-management means are configured to consider an anticipated length of movement of the autonomous driving or parking operation for automatically selecting the single (100) or highlighted (101) camera-view shown to the user (5), wherein in case that an anticipated length of movement is below said given threshold length, the selected camera view(s) shown to the user (5) are fixed.

8. System according to claim 1, wherein an anticipated movement path or end position of the vehicle (1) in the autonomous driving or parking operation is projected into the single (100) or highlighted (101) camera-view.

9. System according to claim 1, wherein the view-management means are configured to automatically select the single (100) or highlighted (101) camera-view in predefined situations of an autonomous driving or parking operation according to predefined selection criteria, wherein the predefined situations and predefined selection criteria are as follows:

a. Selecting a bird's eye view in case that a parking slot to carry out the parking operation of the vehicle (1) has been identified;
b. Selecting a number of camera-views and switching through the number of camera-views at the beginning or end of the autonomous driving or parking operation.

10. System according to one of the preceding claims, wherein the view-management means are configured to automatically select the camera-view shown to the user (5) based on a routine, optionally a routine based on artificial intelligence.

11. System according to one of the preceding claims, wherein the view management means are configured to show additional information to a user (5) by displaying said information in the live-video corresponding to a selected camera-view shown to the user (5) on the portable electronic device (30), wherein said information is preferably displayed as video-overlay.

12. Method for monitoring an autonomous driving or parking operation of a vehicle with a system according to any of the claims 1 - 11, comprising the steps:

- capturing a live-video of the driving or parking operation;
- transmitting the captured live-video to the portable electronic device (30) of the system;
- showing the live-video to a user (5) of the portable electronic device (30) in a live mode during the driving or parking operation,
wherein a camera-view of which the corresponding live-video is shown to a user (5) on the portable electronic device (30) is automatically selected by the view-management means of the system,
wherein the view-management means automatically select a camera-view of which the corresponding live-video is shown to the user (5) on

the portable electronic device (30) in a single camera-view (100) or as highlighted camera-view (101) besides other views (102), wherein in a highlighted camera-view (101) a live-video of the selected camera-view is displayed enlarged as compared to the live-videos of other camera-views, wherein the view-management means select the bird's eye view as the single (100) or highlighted (101) camera-view in case that multiple movements of the vehicle (1) with an anticipated length of each of said multiple movements below a given threshold value are expected, said multiple movements including multiple changes in the direction of movement.

Patentansprüche

1. System zum Überwachen eines autonomen Fahr- oder Parkvorgangs eines Fahrzeugs (1), das System umfassend

- eine Anzahl von Kameras (2L, 2R, 2F, 2B), die konfiguriert sind, um an verschiedenen Positionen des Fahrzeugs (1) installiert zu sein, wobei jede der Kameras (2L, 2R, 2F, 2B) konfiguriert ist, Live-Videos des Fahr- oder Parkvorgangs von einer Kameraansicht korrespondierend mit der Position der Kamera (2L, 2R, 2F, 2B) zu erfassen, wobei die Kameras (2L, 2R, 2F, 2B) in Signalverbindung mit einer ersten Kommunikationseinheit (11) sind, die konfiguriert ist, um in dem Fahrzeug (1) installiert zu sein;
- eine tragbare elektronische Vorrichtung (30), umfassend eine zweite Kommunikationseinheit (12);
wobei die erste Kommunikationseinheit (11) konfiguriert ist, die erfassten Live-Videos an die zweite Kommunikationseinheit (12) über eine drahtlose Signalverbindung (15) zu übertragen, wobei die zweite Kommunikationseinheit (12) konfiguriert ist, die übertragenen Live-Videos zu empfangen, und wobei die tragbare elektronische Vorrichtung (30) konfiguriert ist, einem Benutzer (5) der tragbaren elektronischen Vorrichtung (30) die Live-Videos in einem Live-Modus während des Fahr- oder Parkvorgangs zu zeigen,
wobei das System Ansichtsverwaltungsmittel umfasst, die konfiguriert sind zum automatischen Auswählen einer Kameraansicht, dessen korrespondierendes Live-Video dem Benutzer (5) auf der tragbaren elektronischen Vorrichtung (30) in einer einzelnen Kameraansicht (100) oder als hervorgehobene Kameraansicht (101) neben anderen Ansichten (102) gezeigt wird, wobei in einer hervorgehobenen Kameraansicht (101) ein Live-Video der ausgewählten Kameraansicht im Vergleich mit den Live-Videos von anderen Kameraansichten vergrößert angezeigt wird,
wobei die Kameras (2L, 2R, 2F, 2B) konfiguriert sind, an Positionen des Fahrzeugs (1) installiert zu sein, um die folgenden Kameraansichten bereitzustellen: eine Vorderansicht des Fahrzeugs (1), eine Rückansicht des Fahrzeugs (1), eine linke Ansicht des Fahrzeugs (1) und eine rechte Ansicht des Fahrzeugs (1),
wobei die Ansichtsverwaltungsmittel konfiguriert sind zum Auswählen einer Ansicht aus der Vogelperspektive als die einzelne (100) oder hervorgehobene (101) Kameraansicht im Fall, dass mehrere Bewegungen des Fahrzeugs (1) mit einer antizipierten Länge jeder der mehreren Bewegungen unter einem gegebenen Schwellenwert erwartet werden,
wobei die mehreren Bewegungen mehrere Änderungen der Bewegungsrichtung enthalten.

2. System nach Anspruch 1, wobei ein Live-Video in Bezug auf die Ansicht aus der Vogelperspektive des Fahrzeugs (1) basierend auf den durch die an dem Fahrzeug (1) installierten Kameras (2L, 2R, 2F, 2B) bereitgestellten Live-Videos und/oder Positionsdaten des Fahrzeugs (1) erlangt wird.

3. System nach Anspruch 1 oder 2, wobei die Ansichtsverwaltungsmittel konfiguriert sind zum Auswählen einer oder mehrerer Kameraansichten, dessen korrespondierende(s) Live-Video(s) dem Benutzer (5) auf der tragbaren elektronischen Vorrichtung (30) gezeigt wird/werden.

4. System nach Anspruch 1,
wobei die Ansichtsverwaltungsmittel konfiguriert sind zum automatischen Auswählen der einzelnen oder hervorgehobenen Kameraansicht (100, 101) wie folgt:

a. im Fall, dass das Fahrzeug (1) sich in eine Richtung gerade voraus oder gerade zurück bewegt: Auswählen einer Vorderansicht oder einer Rückansicht als einzelne (100) oder hervorgehobene (101) Kameraansicht;
b. im Fall, dass die Fahrzeug (1) seine Bewegungsrichtung ändert: Auswählen einer Kameraansicht, die in die geänderte Bewegungsrichtung weist, als einzelne (100) oder hervorgehobene (101) Kameraansicht;
c. im Fall, dass ein Objekt innerhalb einer im Voraus definierten ersten Distanz von dem Fahrzeug (1) überwacht wird und das Fahrzeug (1) sich hin zu dem Objekt bewegt: Auswählen einer Kameraansicht, die zu dem Objekt weist, als einzelne (100) oder hervorgehobene (101) Kameraansicht;

d. im Fall, dass ein Objekt innerhalb einer im Voraus definierten zweiten Distanz von dem Fahrzeug (1) überwacht wird und das Objekt sich hin zu dem Fahrzeug (1) bewegt: Auswählen einer Kameraansicht, die zu dem Objekt weist, als einzelne (100) oder hervorgehobene (101) Kameraansicht.

5. System nach Anspruch 4, wobei die zweite im Voraus definierte Distanz größer als die erste im Voraus definierte Distanz ist.

6. System nach Anspruch 4, wobei in Fall d. die einzelne (100) oder hervorgehobene (101) Kameraansicht gewechselt wird, wenn das Objekt, das sich bewegt, ein Sichtfeld (21, 22, 23, 24) einer ersten Kamera (2L, 2R, 2F, 2B) verlässt und in ein Sichtfeld (21, 22, 23, 24) einer zweiten Kamera (2L, 2R, 2F, 2B) eintritt.

7. System nach Anspruch 1, wobei die Ansichtsverwaltungsmittel konfiguriert sind zum Berücksichtigen einer antizipierten Bewegungslänge des autonomen Fahr- oder Parkvorgangs zum automatischen Auswählen der einzelnen (100) oder hervorgehobenen (101) Kameraansicht, die dem Benutzer (5) gezeigt wird, wobei im Fall, dass eine antizipierte Bewegungslänge unter der gegebenen Schwellenwertlänge ist, die ausgewählte(n) Kameraansicht(en), die dem Benutzer (5) gezeigt wird/werden, fest ist/sind.

8. System nach Anspruch 1,
wobei ein antizipierter Bewegungsweg oder eine Endposition des Fahrzeugs (1) in dem autonomen Fahr- oder Parkvorgang in die einzelne (100) oder hervorgehobene (101) Kameraansicht projiziert wird.

9. System nach Anspruch 1,
wobei die Ansichtsverwaltungsmittel konfiguriert sind zum automatischen Auswählen der einzelnen (100) oder hervorgehobenen (101) Kameraansicht in im Voraus definierten Situationen eines autonomen Fahr- oder Parkvorgangs gemäß im Voraus definierten Auswahlkriterien, wobei die im Voraus definierten Situationen und im Voraus definierten Auswahlkriterien wie folgt sind:

a. Auswählen einer Ansicht aus der Vogelperspektive im Fall, dass eine Parklücke zum Ausführen des Parkvorgangs des Fahrzeugs (1) identifiziert wurde;
b. Auswählen einer Anzahl von Kameraansichten und Wechseln durch die Anzahl von Kameraansichten am Anfang oder Ende des autonomen Fahr- oder Parkvorgangs.

10. System nach einem der vorhergehenden Ansprüche, wobei die Ansichtsverwaltungsmittel konfiguriert sind zum automatischen Auswählen der Kameraansicht, die dem Benutzer (5) gezeigt wird, basierend auf einer Routine, wahlweise einer auf künstlicher Intelligenz basierenden Routine.

11. System nach einem der vorhergehenden Ansprüche, wobei die Ansichtsverwaltungsmittel konfiguriert sind, einem Benutzer (5) zusätzliche Informationen zu zeigen, durch Anzeigen der Informationen in dem Live-Video korrespondierend mit einer ausgewählten Kameraansicht, die dem Benutzer (5) auf der tragbaren elektronischen Vorrichtung (30) gezeigt wird, wobei die Informationen vorzugsweise als Videoüberlagerung angezeigt werden.

12. Verfahren zum Überwachen eines autonomen Fahr- oder Parkvorgangs eines Fahrzeugs mit einem System nach einem der Ansprüche 1-11, die folgenden Schritte umfassend:

- Erfassen eines Live-Videos des Fahr- oder Parkvorgangs;
- Übertragen des erfassten Live-Videos an die tragbare elektronische Vorrichtung (30) des Systems;
- Zeigen des Live-Videos einem Benutzer (5) der tragbaren elektronischen Vorrichtung (30) in einem Live-Modus während des Fahr- oder Parkvorgangs,

wobei eine Kameraansicht, dessen korrespondierendes Live-Video einem Benutzer (5) auf der tragbaren elektronischen Vorrichtung (30) gezeigt wird, durch die Ansichtsverwaltungsmittel des Systems automatisch ausgewählt wird,
wobei die Ansichtsverwaltungsmittel eine Kameraansicht, dessen korrespondierendes Live-Video dem Benutzer (5) auf der tragbaren elektronischen Vorrichtung (30) in einer einzelnen Kameraansicht (100) oder als hervorgehobene Kameraansicht (101) neben anderen Ansichten (102) gezeigt wird, automatisch auswählen, wobei in einer hervorgehobenen Kameraansicht (101) ein Live-Video der ausgewählten Kameraansicht im Vergleich mit den Live-Videos von anderen Kameraansichten vergrößert angezeigt wird,
wobei die Ansichtsverwaltungsmittel die Ansicht aus der Vogelperspektive als die einzelne (100) oder hervorgehobene (101) Kameraansicht im Fall, dass mehrere Bewegungen des Fahrzeugs (1) mit einer antizipierten Länge jeder der mehreren Bewegungen unter einem gegebenen Schwellenwert erwartet werden, auswählen, wobei die mehreren Bewegungen mehrere Änderungen der Bewegungsrichtung enthalten.

Revendications

1. Système de surveillance d'une opération de conduite ou de stationnement autonome d'un véhicule (1), le système comprenant

- un certain nombre de caméras (2L, 2R, 2F, 2B) configurées pour être installées à différentes positions du véhicule (1), chacune des caméras (2L, 2R, 2F, 2B) étant configurée pour capturer des vidéos en direct de l'opération de conduite ou de stationnement à partir d'une vue de la caméra correspondant à la position de la caméra (2L, 2R, 2F, 2B), les caméras (2L, 2R, 2F, 2B) étant en connexion de signal avec une première unité de communication (11) configurée pour être installée dans le véhicule (1) ;
- un dispositif électronique portable (30) comprenant une deuxième unité de communication (12) ;

la première unité de communication (11) étant configurée pour transmettre les vidéos en direct capturées à la deuxième unité de communication (12) via une connexion de signal sans fil (15), la deuxième unité de communication (12) étant configurée pour recevoir les vidéos en direct transmises, et le dispositif électronique portable (30) étant configuré pour montrer les vidéos en direct à un utilisateur (5) du dispositif électronique portable (30) en mode direct pendant l'opération de conduite ou de stationnement,

le système comprenant des moyens de gestion de vue configurés pour sélectionner automatiquement une vue de caméra dont la vidéo en direct correspondante est montrée à l'utilisateur (5) sur le dispositif électronique portable (30) dans une vue de caméra unique (100) ou en tant que vue de caméra mise en évidence (101) par rapport à d'autres vues (102), où, dans une vue de caméra mise en évidence (101), une vidéo en direct de la vue de caméra sélectionnée est affichée agrandie par rapport aux vidéos en direct d'autres vues de caméra,

les caméras (2L, 2R, 2F, 2B) étant configurées pour être installées à certaines positions du véhicule (1) pour fournir les vues de caméras suivantes : une vue avant du véhicule (1), une vue arrière du véhicule (1), une vue de gauche du véhicule (1) et une vue de droite du véhicule (1),

les moyens de gestion de vue étant configurés pour sélectionner une vue aérienne en tant que vue de caméra unique (100) ou mise en évidence (101) dans un cas où de multiples déplacements du véhicule (1) avec une longueur anticipée de chacun desdits multiples déplacements inférieure à une valeur seuil donnée sont atteindus,

lesdits multiples déplacements incluant de multiples changements de direction de déplacement.

2. Système selon la revendication 1, dans lequel une vidéo en direct relative à une vue aérienne du véhicule (1) est obtenue sur la base des vidéos en direct fournies par les caméras (2L, 2R, 2F, 2B) installées au niveau du véhicule (1) et/ou des données de position du véhicule (1) .

3. Système selon la revendication 1 ou 2, dans lequel les moyens de gestion de vue sont configurés pour sélectionner une ou plusieurs vues de caméra dont la ou les vidéos en direct correspondante(s) est/sont montrées à l'utilisateur (5) sur le dispositif électronique portable (30).

4. Système selon la revendication 1,
dans lequel les moyens de gestion de vue sont configurés pour sélectionner automatiquement la vue de caméra unique ou mise en évidence (100, 101) de la manière suivante :

a. dans le cas où le véhicule (1) se déplace tout droit vers l'avant ou tout droit vers l'arrière : sélection d'une vue avant ou d'une vue arrière en tant que vue de caméra unique (100) ou mise en évidence (101) ;
b. dans le cas où le véhicule (1) change sa direction de déplacement : sélection d'une vue de caméra dirigée dans la direction de déplacement modifiée en tant que vue de caméra unique (100) ou mise en évidence (101) ;
c. dans le cas où un objet est surveillé à une première distance prédéfinie du véhicule (1) et où le véhicule (1) se déplace vers l'objet : sélection d'une vue de caméra dirigée vers l'objet en tant que vue de caméra unique (100) ou mise en évidence (101) ;
d. dans le cas où un objet est surveillé à une deuxième distance prédéfinie du véhicule (1) et où l'objet se déplace vers le véhicule (1) : sélection d'une vue de caméra dirigée vers l'objet en tant que vue de caméra unique (100) ou mise en évidence (101).

5. Système selon la revendication 4, dans lequel la deuxième distance prédéfinie est plus grande que la première distance prédéfinie.

6. Système selon la revendication 4, dans lequel, dans le cas d., la vue de caméra unique (100) ou mise en évidence (101) est permutée lorsque l'objet quitte un champ de vision (21, 22, 23, 24) d'une première caméra (2L, 2R, 2F, 2B) et entre dans un champs de vision (21, 22, 23, 24) d'une deuxième caméra

(2L, 2R, 2F, 2B).

7. Système selon la revendication 1, dans lequel les moyens de gestion de vue sont configurés pour considérer une longueur de déplacement anticipée de l'opération de conduite ou de stationnement autonome pour la sélection automatique de la vue de caméra unique (100) ou mise en évidence (101) montrée à l'utilisateur (5), où, dans le cas où une longueur de déplacement anticipée est inférieure à ladite longueur seuil donnée, la ou les vues de caméra sélectionnées montrées à l'utilisateur (5) sont fixes.

8. Système selon la revendication 1, dans lequel un chemin de déplacement ou une position finale anticipé(e) du véhicule (1) dans l'opération de conduite ou de stationnement autonome est projeté(e) dans la vue de caméra unique (100) ou mise en évidence (101).

9. Système selon la revendication 1, dans lequel les moyens de gestion de vue sont configurés pour sélectionner automatiquement la vue de caméra unique (100) ou mise en évidence (101) dans des situations prédéfinies d'une opération de conduite ou de stationnement autonome selon des critères de sélection prédéfinis, les situations prédéfinies et les critères de sélection prédéfinis étant les suivants :

a. sélection d'une vue aérienne dans le cas où une place de parking a été identifiée pour l'exécution de l'opération de stationnement du véhicule (1) ;
b. sélection d'un certain nombre de vues de caméra et permutation entre les différentes vues de caméra au début ou à la fin de l'opération de conduite ou de stationnement autonome.

10. Système selon l'une quelconque des revendications précédentes, dans lequel les moyens de gestion de vue sont configurés pour sélectionner automatiquement la vue de caméra montrée à l'utilisateur (5) selon une routine, éventuellement une routine basée sur de l'intelligence artificielle.

11. Système selon l'une quelconque des revendications précédentes, dans lequel les moyens de gestion de vue sont configurés pour montrer des informations additionnelles à un utilisateur (5) en affichant lesdites informations dans la vidéo en direct correspondant à une vue de caméra sélectionnée montrée à l'utilisateur (5) sur le dispositif électronique portable (30), lesdites informations étant de préférence affichées sous forme de superposition vidéo.

12. Procédé de surveillance d'une opération de conduite ou stationnement autonome d'un véhicule au moyen d'un système selon l'une quelconque des revendications 1 à 11, comprenant les étapes de :

- capture d'une vidéo en direct de l'opération de conduite ou de stationnement ;
- transmission de la vidéo en direct capturée au dispositif électronique portable (30) du système ;
- présentation de la vidéo en direct à un utilisateur (5) du dispositif électronique portable (30) dans un mode direct pendant l'opération de conduite ou de stationnement,

une vue de caméra dont la vidéo en direct correspondante est montrée à un utilisateur (5) sur le dispositif électronique portable (30) étant sélectionnée automatiquement par les moyens de gestion de vue du système,
les moyens de gestion de vue sélectionnant automatiquement une vue de caméra dont la vidéo en direct correspondante est montrée à l'utilisateur (5) sur le dispositif électronique portable (30) dans une vue de caméra unique (100) ou sous la forme d'une vue de caméra mise en évidence (101) à côté d'autres vues (102), où, dans une vue de caméra mise en évidence (101), une vidéo en direct de la vue de caméra sélectionnée est affichée agrandie par rapport aux vidéos en direct d'autres vues de caméra, les moyens de gestion de vue sélectionnant la vue aérienne en tant que vue de caméra unique (100) ou mise en évidence (101) dans un cas où de multiples déplacements du véhicule (1) avec une longueur anticipée de chacun desdits multiples déplacements inférieure à une valeur seuil donnée sont attendus, lesdits multiples déplacements incluant de multiples changements de direction de déplacement.

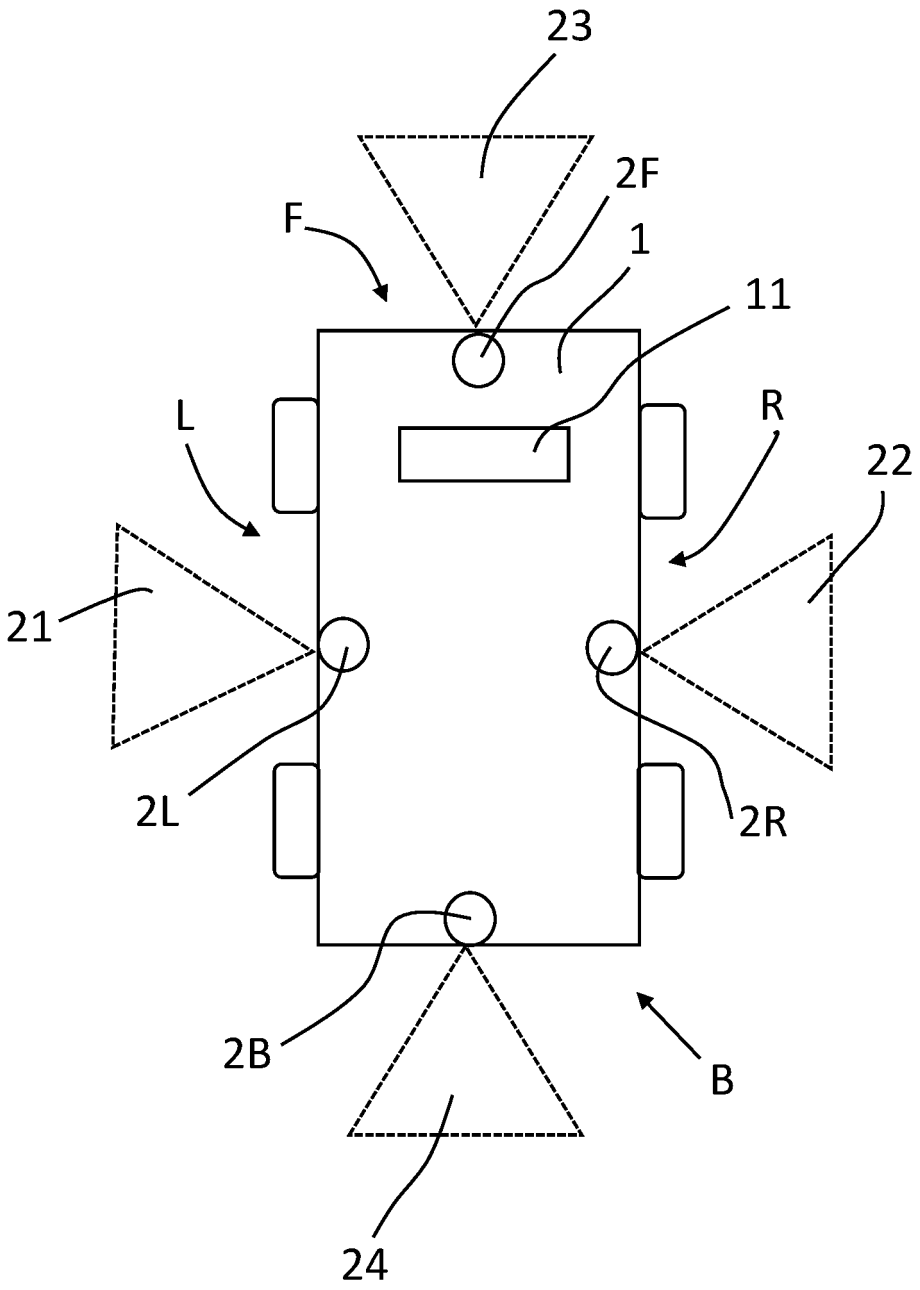

Fig. 1

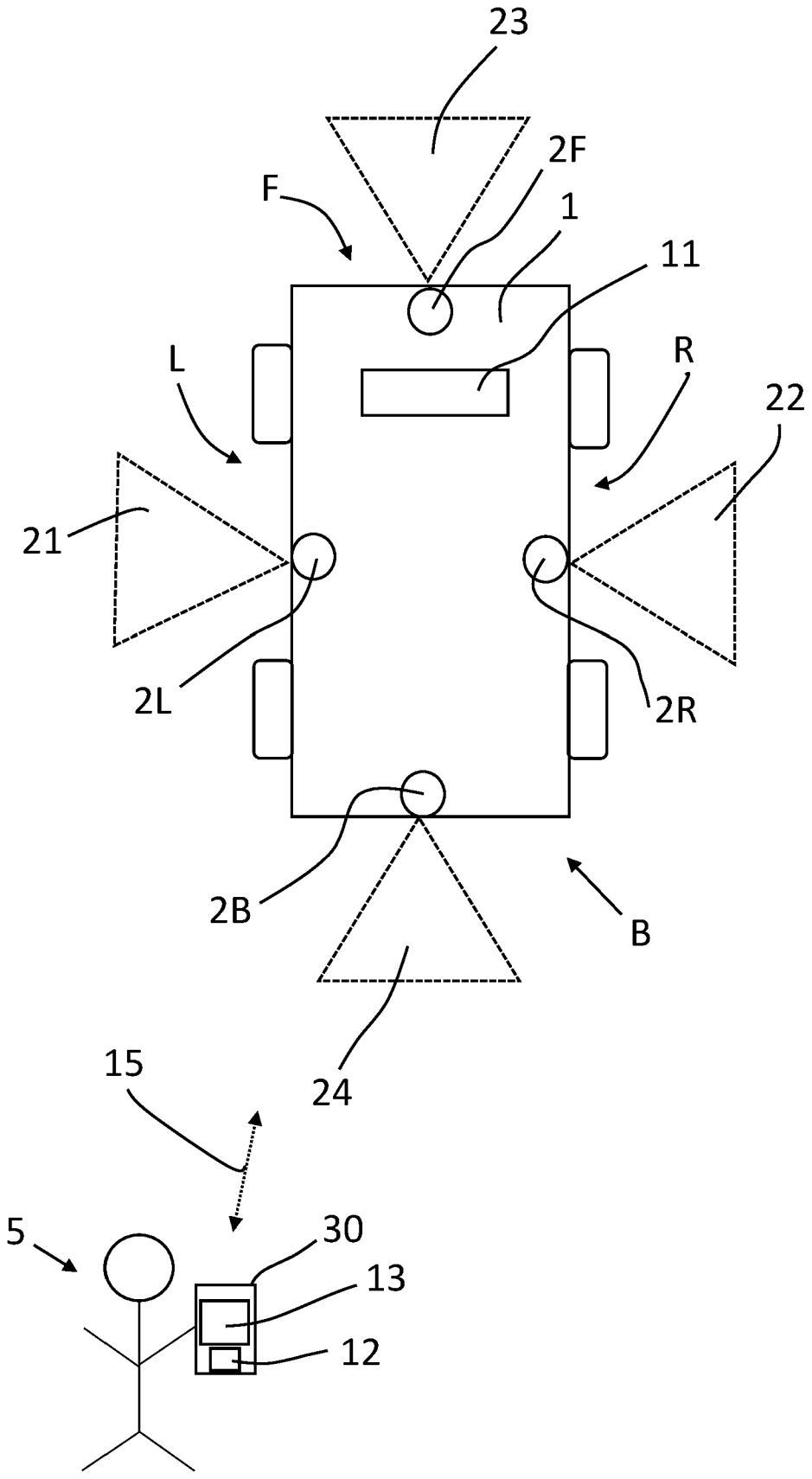

Fig. 2

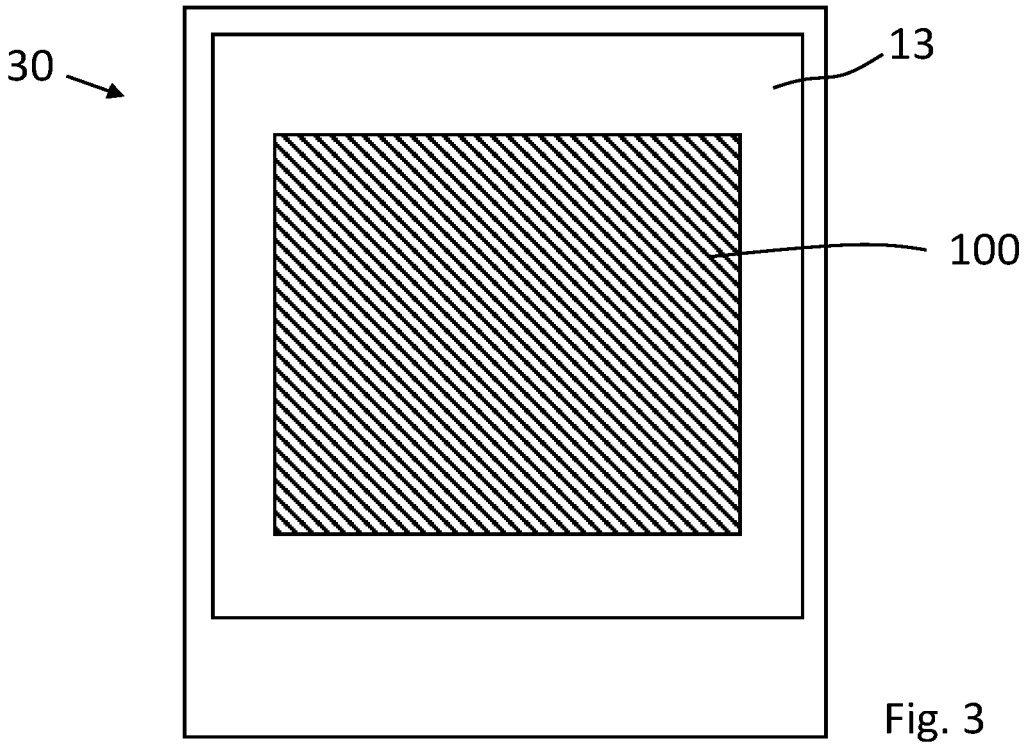

Fig. 3

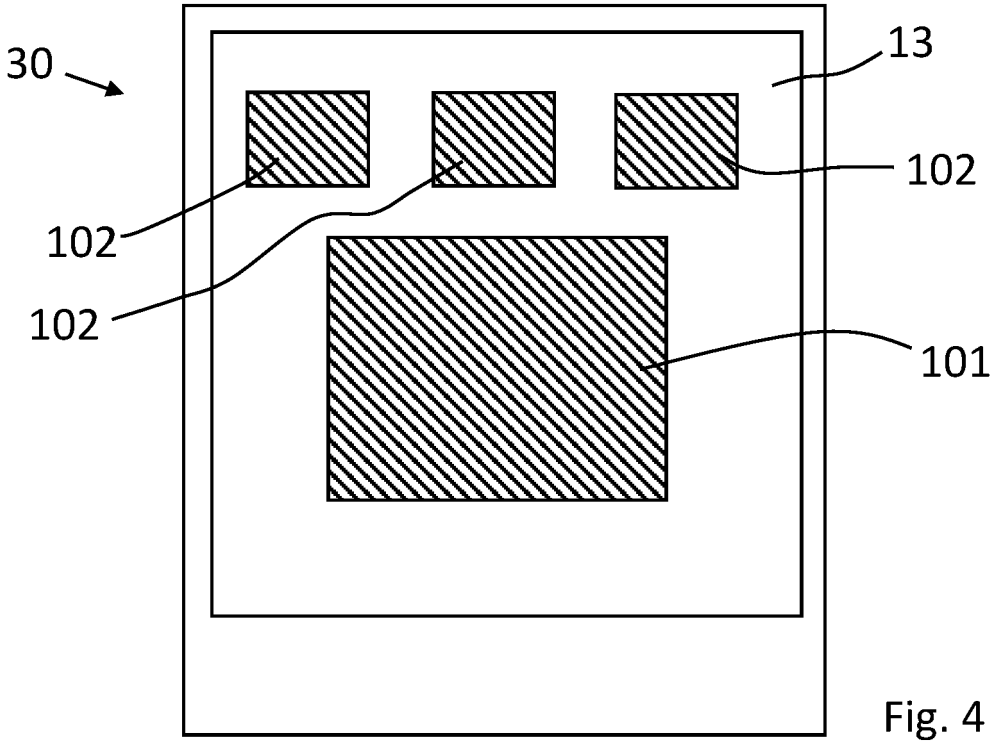

Fig. 4

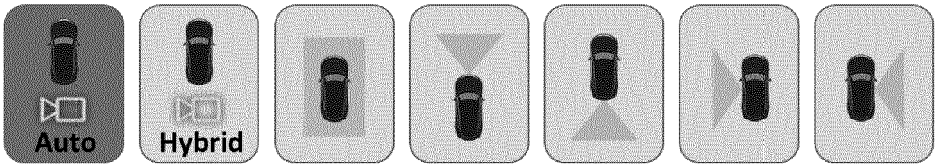

Fig. 5a

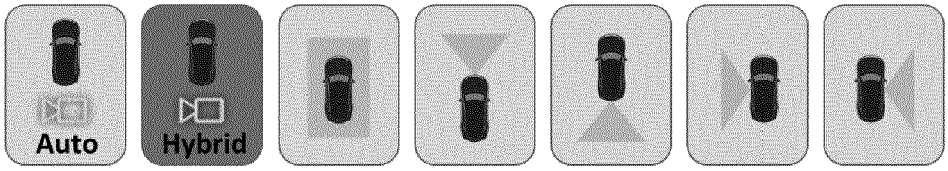

Fig. 5b

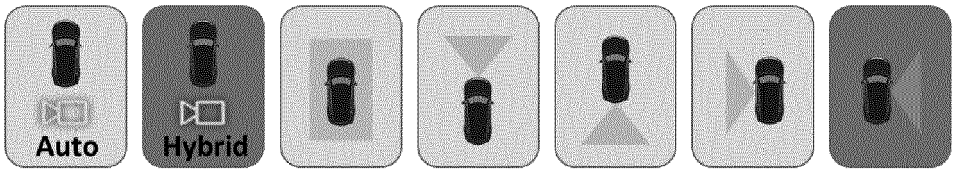

Fig. 5c

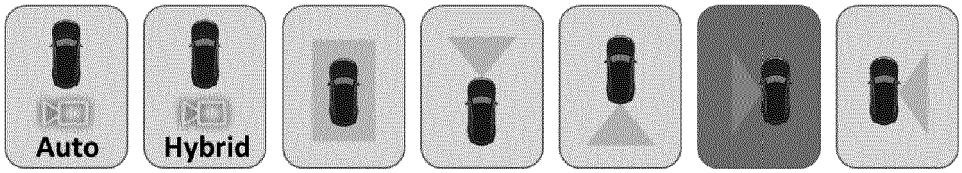

Fig. 5d

REFERENCES CITED IN THE DESCRIPTION

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