

DESCRIPTION

Title of Invention

VEHICLE

5 Technical Field

[0001] The present disclosure relates to a vehicle.

Background Art

[0002] Patent Document 1 discloses an in-vehicle image display device including: a camera installed in a vehicle to capture an image of the front
10 of the vehicle; a storage means including at least movie advertisement image data and still advertisement image data; an image replaying unit replaying the image data stored in the storage means and outputting an image signal; a vehicle state detection means detecting at least one information among a traveling state of the vehicle, a winker state, and an
15 opening/closing state of an entrance door; a monitor installed in the rear of the vehicle so as to be visible from the rear outside the vehicle; and a video signal switching unit switching an image signal from the camera and the image signal from the image replaying part based on detection information from the vehicle state detection means and sending them to
20 the monitor.

Citation List

Patent Literature

[0003] [Patent Document 1] Japanese Unexamined Patent Publication No. 2003-252153

25 Summary of Invention

Technical Problem

[0004] The present disclosure provides a vehicle capable of more effectively utilizing a monitor for transmitting information to the outside of the vehicle.

Solution to Problem

5 [0005] A vehicle according to one aspect of the present disclosure includes: a camera provided on a vehicle body so as to capture surroundings of the vehicle body; a monitor provided on a surface facing an opposite direction of a direction that the camera faces among outer surfaces of the vehicle body and configured to display, toward the opposite
10 direction, a real-time image captured by the camera; and an image adding device configured to cause the monitor to display an additional image changing in accordance with a position of the vehicle body based on contents stored, in association with position information, in a database, and a current position of the vehicle body.

15 [0006] According to this vehicle, by displaying an additional image corresponding to the current position of the vehicle on the monitor, it is possible to transmit, to a person who sees the image, information corresponding to the current position of the person. Thus, the monitor for transmitting information to the outside of the vehicle can be more
20 effectively utilized.

[0007] The image adding device may be configured to cause the monitor to display the additional image including an advertisement in accordance with the position of the vehicle body. In this case, the monitor can be effectively used for more effective advertisement.

25 [0008] The image adding device may be configured to: identify an in-field facility included in the real-time image based on a current position

and a travel direction of the vehicle and map information; and may cause the monitor to display the additional image including an advertisement of the in-field facility. In this case, it is possible to further improve the effect of advertisement by displaying the advertisement related to the image of the camera.

[0009] The image adding device may be configured to cause the monitor to display the additional image that associates the advertisement of the in-field facility with the in-field facility in the real-time image. In this case, the monitor can be more effectively utilized by a synergistic effect of information transmission by the image of the camera and information transmission by the additional image.

[0010] The camera may be provided on the vehicle body to capture a front of the vehicle body, and the monitor may be provided on a rear face of the vehicle body and configured to display the real-time image toward a rear of the vehicle body. In this case, the monitor can be effectively used to transmit information to a following vehicle.

[0011] The image adding device may be configured to cause the monitor to display the additional image including an indication of an expected exit position of the vehicle body from the road on which the vehicle body currently travels based on a route along which the vehicle body is scheduled to travel. In this case, it is possible to reduce the stress on the driver of the following vehicle and prevent unreasonable passing.

[0012] The camera may be provided on the vehicle body to capture a rear of the vehicle body, and the monitor may be provided on a front face of the vehicle body and configured to display the real-time image toward a front of the vehicle body. In this case, when the vehicle stops at an

intersection for waiting for a right turn (waiting for a left turn when the vehicle is traveling on the right side), the monitor can be effectively used to transmit information to a driver of an oncoming vehicle waiting for a right turn at the same intersection.

5 [0013] The camera may be provided on the vehicle body to capture a direction that a first side face of the vehicle body faces, and the monitor may be provided on a second side face of the vehicle body and configured to display the real-time image captured by the camera toward the direction that the second side face faces. In this case, the monitor can be effectively
10 used to transmit information to a pedestrian on a sidewalk, for example.

[0014] The vehicle may further include a second camera provided on the vehicle body so as to face between the direction that the camera faces and the opposite direction and configured to capture surroundings of the vehicle body, and the monitor may be configured to display the real-time
15 image and a second real-time image captured by the second camera. In this case, by widening the visual field range by using both the camera and the second camera, it is possible to increase the benefit of the image displayed on the monitor and improve the information transmission effect by the monitor.

20 [0015] The image adding device may be configured to reduce, compared to a first stop period in which the vehicle body stops in accordance with a road condition, a display size of the additional image in a second stop period in which the vehicle body stops for boarding or alighting of a person. In the second stop period, it is considered that the necessity of the
25 image of the camera increases compared to the first stop period. For example, in the second stop period, the person is more likely to cross the

road to board or alight from the vehicle, and thus the image of the front of the vehicle is more necessary in the following vehicle. Therefore, by making the display size of the additional image in the second stop period smaller than that in the first stop period, it is possible to transmit information that matches the needs more.

[0016] The image adding device may be configured to fade, compared to a first stop period in which the vehicle body stops in accordance with the road condition, a display of the additional image in a second stop period in which the vehicle body stops for boarding or alighting of a person. Also in this case, by fading the display of the additional image in the second stop period compared to that in the first stop period, it is possible to transmit information that matches the needs more.

[0017] The image adding device may be configured to cause the monitor to further display an attention calling image including an indication that a person is boarding or alighting from the vehicle body while the vehicle body stops. In this case, it is possible to improve the benefit of the image displayed on the monitor and improve the information transmission effect by the monitor.

[0018] The image adding device may be configured to cause the monitor to further display an emphasizing image that emphasizes an image of a moving object in the real-time image. In this case, it is possible to improve the benefit of the image displayed on the monitor and improve the information transmission effect by the monitor.

[0019] The image adding device may be configured to cause the monitor to further display an image received from another vehicle. In this case, it is possible to improve the benefit of the image displayed on the monitor

and improve the information transmission effect by the monitor.

[0020] A vehicle according to another aspect of the present disclosure includes: a camera provided on a vehicle body so as to capture a rear of the vehicle body; and a monitor provided on a front face of the vehicle body and configured to display a real-time image captured by the camera toward the front of the vehicle body.

[0021] For example, in a case where a vehicle stops at an intersection to wait for a right turn, the necessity of an image of the rear of the vehicle increases in an oncoming vehicle that waits for a right turn at the same intersection. Therefore, according to the present vehicle that provides the image of the rear of the vehicle to the other vehicle of the front, the monitor can be more effectively utilized.

Advantageous Effects of Invention

[0022] According to the present disclosure, it is possible to provide a vehicle capable of more effectively utilizing a monitor for transmitting information to the outside of the vehicle.

Brief Description of Drawings

[0023] FIG. 1 is a schematic diagram illustrating a schematic configuration of a vehicle.

FIG. 2 is a block diagram illustrating a functional configuration of an image adding device.

FIG. 3 is a schematic diagram illustrating a composite image of a real-time image and an additional image including advertisements.

FIG. 4 is a schematic diagram illustrating a composite image of a real-time image and an additional image including an exit announcement image.

FIG. 5 is a schematic diagram illustrating a composite image of a real-time

image and an attention calling image.

FIG. 6 is a schematic diagram illustrating a composite image of a real-time image and emphasizing images.

FIG. 7 is a schematic diagram illustrating a composite image of a real-time image and a remote image.

FIG. 8 is a schematic diagram illustrating a hardware configuration of the image adding device.

FIG. 9 is a schematic view illustrating a modification of the vehicle.

FIG. 10 is a schematic view illustrating another modification of the vehicle.

FIG. 11 is a flowchart illustrating an image display procedure.

Description of Embodiments

[0024] Hereinafter, an embodiment will be described in detail with reference to the drawings. In the description, the same elements or elements having the same functions are denoted by the same reference numerals, and redundant description will be omitted.

[0025] Vehicle

A vehicle 1 illustrated in FIG. 1 is a bus used for public transportation. The vehicle 1 may be a route bus, a microbus, or a sightseeing bus. The vehicle 1 includes a vehicle body 10, a camera 20, a monitor 30, a GPS sensor 41, a vehicle speed sensor 42, and an image adding device 100.

[0026] The vehicle body 10 is configured so that a driver and passengers can board in the vehicle body 10. Although the vehicle body 10 having four wheels is illustrated in the drawing, the vehicle body 10 is not limited to four wheels and may have, for example, six wheels. An outer surface 11 of the vehicle body 10 includes a front face 12 facing the front D11, a

rear face 13 facing the rear D12, and a first side face 14 and a second side face 15 facing away from each other (see FIG. 10). As an example, the first side face 14 faces a left direction D21 of the vehicle body 10 (see FIG. 10) and the second side face 15 faces a right direction D22 (see FIG. 10). The second side face 15 may face the left direction D21 and the first side face 14 may face the right direction D22.

[0027] The camera 20 is provided in the vehicle body 10 to capture the surroundings of the vehicle body 10. For example, the camera 20 is provided at one position on the outer surface 11 of the vehicle body 10 and faces the direction that the outer surface 11 faces at the one position. The direction that the camera 20 faces is a direction from the placed position of the camera 20 toward the capturing target of the camera 20. Hereinafter, a direction in which the camera 20 faces is referred to as a “viewing direction” of the camera 20.

[0028] As an example, the camera 20 is provided in the vehicle body 10 so as to capture a front D11. For example, the camera 20 is provided on the front face 12 so as to face the front D11 (so that a viewing direction 21 coincides a front D11). Being provided on the front face 12 means being provided so as to be able to image an area that the front face 12 faces. In the drawing, the camera 20 is located outside of the front face 12, but the camera 20 may be located inside the vehicle body 10 as long as the camera 20 can image the area that the front face 12 faces. The same applies to a case where the camera 20 is provided on other surfaces. For example, the camera 20 may be provided in the vehicle body 10 so as to capture the front of the vehicle body 10 through a transparent panel (for example, windshield) constituting the front face 12. Specific examples of the

camera 20 include a camera including an imaging device such as a charge coupled device (CCD) image sensor or a complementary metal oxide semiconductor (CMOS) image sensor.

[0029] The monitor 30 is provided on a surface facing an opposite direction 22 of the viewing direction 21 of the camera 20 on the outer surface 11 of the vehicle body 10, and displays, toward the opposite direction 22, a real-time image captured by the camera 20. When the camera 20 faces the front D11 as described above, the monitor 30 is provided on the rear face 13 of the vehicle body 10 and displays the real-time image toward the rear D12 of the vehicle body 10. The wording “the monitor 30 is provided on the rear face 13” means that a person directly facing the rear face 13 can visually recognize the display content of the monitor 30 as a part of the rear face 13. In the drawing, the monitor 30 is provided outside the rear face 13, but the monitor 30 may be provided inside the vehicle body 10 as long as it can be visually recognized by a person directly facing the rear face 13.

[0030] The real-time image means an image displayed at substantially the same timing as the timing at which the image is captured by the camera 20. The real-time image changes in synchronization with a change in the current situation of the capturing target by the camera 20. In practice, a slight time lag occurs until the image captured by the camera 20 is displayed by the monitor 30 due to the influence of signal transfer, image processing, and the like. If this time lag is negligibly small, the image displayed by the monitor 30 is included in the real-time image.

[0031] The GPS sensor 41 receives satellite signals for GPS (Global Positioning System). The vehicle speed sensor 42 detects the running

speed of the vehicle body 10.

[0032] The image adding device 100 causes the monitor 30 to display an additional image that changes in accordance with the position of the vehicle body 10 based on contents stored, in association with position information, in a database, and the current position of the vehicle body 10. For example, the image adding device 100 repeatedly performs a cycle of detecting the current position of the vehicle body 10 based on the satellite signal received by the GPS sensor 41, extracting contents corresponding to the detected current position from the database, and displaying an additional image indicating the extracted contents on the monitor 30. Hereinafter, this cycle is referred to as an “update cycle”. Since contents extracted from database by the image adding device 100 changes in accordance with the position of the vehicle body 10, the additional image displayed by the monitor 30 also changes in accordance with the position of the vehicle body 10. It should be noted that although the term “current position” is used for convenience, the term does not mean a strict current position, but means, for example, a position at one timing in the update cycle described above.

[0033] The image adding device 100 may display the additional image on the monitor 30 together with the real-time image, or may display the additional image on the monitor 30 at a timing different from the display timing of the real-time image. When the additional image is displayed on the monitor 30 together with the real-time image, the image adding device 100 may superimpose and display the additional image in the real-time image within a range that does not hinder the visual recognition of the object on the road (for example, a moving object such as an oncoming

vehicle or a pedestrian).

[0034] Specific examples of the contents include tourist information, advertisement, news, and the like regarding the current position. For example, the image adding device 100 may cause the monitor 30 to display an additional image including an advertisement corresponding to the position of the vehicle body 10. For example, the image adding device 100 identifies an in-field facility included in the real-time image based on the current position and travel direction of the vehicle 1 and map information, and displays an additional image including an advertisement of the in-field facility on the monitor 30. The image adding device 100 may cause the monitor 30 to display an additional image that associates the advertisement of the in-field facility with the in-field facility in the real-time image.

[0035] As an example, the image adding device 100 includes a position information acquisition unit 111, a real-time image acquisition unit 112, a map database 115, a contents database 114, an additional image generation unit 116, and an image synthesis unit 117 as functional components (hereinafter referred to as “functional block”), as illustrated in FIG. 2. The position information acquisition unit 111 acquires the current position information of the vehicle body 10 for every update cycle described above. For example, the position information acquisition unit 111 acquires satellite signals received by the GPS sensor 41 and detects the current position and travel direction of the vehicle body 10 based on the acquired satellite signals. The real-time image acquisition unit 112 acquires a real-time image captured by the camera 20 for every update cycle described above.

[0036] The map database 115 stores map data of an area including a driving route of the vehicle body 10. Specific examples of the map data include two-dimensional map data in which positions and shapes of facilities such as roads and buildings positioned in an area are represented by latitude, longitude, and the like. The map data may be three-dimensional map data representing the positions and the shapes of the facilities by latitude, longitude, and altitude.

[0037] The contents database 114 stores a plurality of contents in association with positions. For example, the contents database 114 stores a plurality of advertisement data sets in association with positions. For example, the contents database 114 stores each of a plurality of advertisement data sets in association with a position in the map data.

[0038] The additional image generation unit 116 extracts contents corresponding to the current position acquired by the position information acquisition unit 111 from the contents database 114 for each update cycle described above, and generates an additional image indicating the extracted contents. For example, the additional image generation unit 116 generates an additional image including an advertisement corresponding to the position of the vehicle body 10.

[0039] For example, the additional image generation unit 116 identifies the in-field facility included in the real-time image (real-time image acquired by the real-time image acquisition unit 112.) based on the current position and travel direction of the vehicle body 10 detected by the position information acquisition unit 111 and map data stored in the map database 115. For example, the additional image generation unit 116 calculates an in-field region included in the visual field of the camera

in the map data based on the current position and travel direction of the vehicle body 10 and the angle of view and resolution performance of the camera 20, and identifies an in-field facility included in the in-field region. The additional image generation unit 116 extracts the advertisement data set of the identified in-field facility from the contents database 114, and generates an additional image including the extracted advertisement data set of the in-field facility.

[0040] The image synthesis unit 117 synthesizes the real-time image acquired by the real-time image acquisition unit 112 and the additional image generated by the additional image generation unit 116 and displays the synthesized image in the monitor 30 for every update cycle described above. Thus, the additional image is displayed on the monitor 30 together with the real-time image.

[0041] The additional image generation unit 116 may generate an additional image to associate the advertisement of the in-field facility with the in-field facility in the real-time image. Associating an advertisement with an in-field facility means visually indicating to which in-field facility the advertisement corresponds by a leader line, an arrow, or the like. For example, the additional image generation unit 116 calculates the display position of the in-field facility in the in-field region based on the current position and travel direction of the vehicle body 10 and the angle of view of the camera 20, and specifies the position to be indicated by a leader line, an arrow, or the like based on the calculated display position.

[0042] FIG. 3 is a schematic diagram illustrating an example additional image that associates an advertisement of an in-field facility with the in-field facility in a real-time image. In this figure, a plurality of facility

images 211 corresponding to the in-field facility in the real-time image are associated with a plurality of advertisement images 212 by arrows. Although only the name of the advertisement target is included in the advertisement image 212 in the drawing, various other information can be included in the advertisement image 212.

[0043] The image adding device 100 may be configured to acquire the map data and the contents data from a server through network communication and update the stored contents of the map database 115 and the contents database 114 with the acquired map data and contents data, respectively. For example, the image adding device 100 calculates an acquisition target area of a predetermined size based on the current position of the vehicle body 10, and acquires map data and contents data of the acquisition target area from a server. The image adding device 100 updates the storage contents of the map database 115 with the acquired map data, and updates the storage contents of the contents database 114 with the acquired contents data.

[0044] The image adding device 100 may update the storage contents of the map database 115 and the contents database 114 in each update cycle described above or in each of a plurality of update cycles. After updating the storage contents of the map database 115 and the contents database 114, the image adding device 100 may update the storage contents of the map database 115 and the contents database 114 when the variation amount of the current position in the vehicle body 10 exceeds a predetermined amount.

[0045] The image adding device 100 may be configured to cause the monitor 30 to display an additional image that includes an indication of an

expected exit position of the vehicle body 10 from the road on which the vehicle body 10 is currently traveling based on the route that the vehicle body 10 is scheduled to travel. Exiting from a road includes a left turn or a right turn to another road that crosses the road. For example, as shown in FIG. 2, the image adding device 100 further includes a driving route storage unit 121 that stores a route along which the vehicle body 10 is going to drive.

[0046] The additional image generation unit 116 specifies the expected exit position based on the route stored by the driving route storage unit 121 and the current position acquired by the position information acquisition unit 111 for each update cycle. For example, the additional image generation unit 116 calculates the display position of the expected exit position in the in-field region based on the current position and travel direction of the vehicle body 10 and the angle of view of the camera 20, and includes the exit announcement image indicating the expected exit direction in the additional image in the calculated display position.

[0047] FIG. 4 is a schematic diagram illustrating an additional image including an exit announcement image. In this figure, an exit announcement image 213 is displayed in accordance with the display position of the expected exit position in the real-time image.

[0048] The image adding device 100 may be configured to reduce, compared to a first stop period in which the vehicle body 10 stops in accordance with a road condition, the display size of the additional image in a second stop period in which the vehicle body 10 stops for boarding or alighting of a person. Reducing the display size of the additional image includes erasing the display of the additional image (setting the display

size of the additional image to zero). The image adding device 100 may be configured to fade the display of additional image in the second stop period compared to the first stop period. Fading means making the display of the additional image transparent and displaying the transparent image of the real-time image even in the display position of the additional image.

[0049] For example, the image adding device 100 may further include a driving state monitoring unit 122, as illustrated in FIG. 2. The driving state monitoring unit 122 recognizes the first stop period and the second stop period based on at least a vehicle speed detected by the vehicle speed sensor 42 and an opening/closing state of an entrance door of the vehicle body 10. The additional image generation unit 116 sets the display size of the additional image based on the confirmation result by the driving state monitoring unit 122 for each update cycle described above.

[0050] For example, when it is determined that the current time is the first stop period, the additional image generation unit 116 sets the display size of the additional image to the first size. If the driving state monitoring unit 122 determines that the current time is the second stop period, the additional image generation unit 116 sets the display size of the additional image to a second size smaller than the first size. The image synthesis unit 117 combines the additional image with the real-time image at the display size set by the additional image generation unit 116, and displays it on the monitor 30.

[0051] The image adding device 100 may be configured to further cause the monitor 30 to display an attention calling image including an indication that a person is boarding or alighting from the vehicle body 10 while the vehicle body 10 is stopped. For example, when it is determined

that the vehicle body 10 is stopped by the driving state monitoring unit 122, the additional image generation unit 116 generates an attention calling image 214 including a character string indicating that a person is boarding or alighting from the vehicle body 10. The image synthesis unit 117 combines the attention calling image 214 generated by the additional image generation unit 116 into a real-time image and displays it in the monitor 30 (see FIG. 5).

[0052] The image adding device 100 may be configured to cause the monitor 30 to further display an emphasizing image that emphasizes the image of a moving object in the real-time image. For example, the additional image generation unit 116 extracts a moving object such as an oncoming vehicle or a pedestrian from the real-time image, and generates an emphasizing image 216 that emphasizes a moving object image 215 corresponding to the extracted moving object. The image synthesis unit 117 combines the emphasizing image 216 generated by the additional image generation unit 116 into a real-time image and displays it in the monitor 30 (see FIG. 6).

[0053] In FIG. 6, the emphasizing image 216 in which the moving object image 215 is emphasized by being surrounded by a frame is illustrated, but a method of emphasizing the moving object image 215 is not limited thereto. The additional image generation unit 116 may cause the monitor 30 to display the emphasizing image 216 in which the moving object image 215 is filled with a predetermined highlight color.

[0054] The image adding device 100 may be configured to cause the monitor 30 to further display an image received from another vehicle. For example, the image adding device 100 may further include a remote image

acquisition unit 123, as illustrated in FIG. 2. The remote image acquisition unit 123 acquires an image data from another vehicle by wireless network communication. The additional image generation unit 116 generates a remote image 217 based on the image data acquired by the remote image acquisition unit 123. The image synthesis unit 117 combines the remote image 217 generated by the additional image generation unit 116 into a real-time image and displays it in the monitor 30 (see FIG. 7).

[0055] Although FIG. 7 illustrates a case in which a real-time image received from another vehicle is displayed as the remote image 217, the additional image generation unit 116 may generate the remote image 217 further including an additional image received from another vehicle. In addition, the additional image generation unit 116 may generate the remote image 217 including only an additional image received from another vehicle.

[0056] FIG. 8 is a block diagram illustrating the hardware configuration of the image adding device 100. As illustrated in FIG. 8, the image adding device 100 includes circuitry 190. The circuitry 190 includes at least one processor 191, a memory 192, storage 193, a communication port 194, camera control circuitry 195, monitor control circuitry 196, and an input/output port 197.

[0057] The storage 193 stores a program for causing the image adding device 100 to cause the monitor 30 to display an additional image changing in accordance with the position of the vehicle body 10 based on the contents stored in the database in association with the position information and the current position of the vehicle body 10. For example, the image adding device 100 stores a program for configuring each

functional block described above in the image adding device 100.

[0058] The memory 192 temporarily stores the program loaded from the storage 193. The processor 191 causes the image adding device 100 to function as each of the functional blocks described above by executing the program loaded into the memory 192. The result of the intermediate calculation by the processor 191 is stored in the memory 192 as appropriate.

[0059] The camera control circuitry 195 controls the camera 20 in accordance with instructions from the processor 191. Controlling the camera 20 includes causing the camera 20 to acquire an image, causing the camera 20 to transmit the acquired image, and receiving the transmitted image from the camera 20. The monitor control circuitry 196 controls the monitor 30 in accordance with instructions from the processor 191. Controlling the monitor 30 includes transmitting an image data to the monitor 30 and causing the monitor 30 to display an image corresponding to the transmitted image data. The input/output port 197 inputs and outputs information between the GPS sensor 41 and the vehicle speed sensor 42 in accordance with instructions from the processor 191.

[0060] The hardware configuration of the image adding device 100 illustrated above is merely an example and may be modified as appropriate. For example, a part of the above-described functional blocks may be configured by a dedicated device such as an application specific integrated circuit (ASIC).

[0061] Although the configuration in which the camera 20 is provided on the vehicle body 10 so as to capture the front D11 of the vehicle body 10 and the monitor 30 is provided on the rear face 13 of the vehicle body 10

is described above, the arrangement of the camera 20 and the monitor 30 is not limited thereto. For example, the camera 20 may be provided on the vehicle body 10 to capture the rear D12 of the vehicle body 10 and the monitor 30 may be provided on the front face 12 of the vehicle body 10 and display a real-time image toward the front D11 of the vehicle body 10. Further, as illustrated in FIG. 9, the vehicle 1 may include: both a set of a camera 20A and a monitor 30A that displays the real-time image of the front D11 of the vehicle body 10 toward the rear D12 of the vehicle body 10; and a set of a camera 20B and a monitor 30B that displays the real-time image of the rear D12 of the vehicle body 10 toward the front D11 of the vehicle body 10. In this case, the image adding device 100 may be configured to display the additional image on both the monitor 30A and the monitor 30B.

[0062] Further, the camera 20 may be provided on the vehicle body 10 so as to capture the direction that the first side face 14 of the vehicle body 10 faces (for example, the left direction D21), and the monitor 30 may be provided on the second side face 15 of the vehicle body 10 and display the real-time image captured by the camera 20 toward the direction that the second side face 15 faces (for example, the right direction D22). Further, the camera 20 may be provided on the vehicle body 10 so as to capture the direction that the second side face 15 of the vehicle body 10 faces, the monitor 30 may be provided on the first side face 14 of the vehicle body 10 and display the real-time image captured by the camera 20 may be displayed toward the direction that the first side face 14 faces. Further, as illustrated in FIG. 10, the vehicle 1 may include both a set of a camera 20C and a monitor 30C that displays a real-time image of the left direction

D21 of the vehicle body 10 towards the right direction D22 of the vehicle body 10 and a set of a camera 20D and a monitor 30D that displays a real-time image of the right direction D22 of the vehicle body 10 towards the left direction D21 of the vehicle body 10.

5 [0063] The vehicle 1 may further include a second camera provided on the vehicle body 10 so as to face between the viewing direction 21 of the camera 20 and the opposite direction 22 and capture surroundings of the vehicle body 10, and the monitor 30 may display the real-time image and a second real-time image captured by the second camera. For example, the
10 vehicle 1 may include the camera 20C (second camera) capturing the left direction D21 and the camera 20D (second camera) capturing the right direction D22 in addition to the camera 20 capturing a front D11, and the monitor 30 may display, toward a rear D12, combination of a real-time image captured by the camera 20 and a second real-time image captured
15 by the camera 20C and the camera 20D.

[0064] Image Displaying Procedure

Next, an example displaying procedure of the additional image executed by the image adding device 100 will be described. As illustrated in FIG. 11, the image adding device 100 executes steps S01 and S02. In step S01,
20 the position information acquisition unit 111 acquires current position information of the vehicle body 10. In step S02, the real-time image acquisition unit 112 acquires a real-time image captured by the camera 20.

[0065] Next, the image adding device 100 executes steps S03, S04, and S05. In step S03, the additional image generation unit 116 calculates an
25 in-field region included in the visual field of the camera 20 in the map data based on the current position and travel direction of the vehicle body 10

and the angle of view and resolution performance of the camera 20. In step S04, the additional image generation unit 116 identifies the in-field facility included in the in-field data and extracts the advertisement region set of the in-field facility from the contents database 114. In step S05, the additional image generation unit 116 generates an additional image including the extracted advertisement data set of the in-field facility.

[0066] Next, the image adding device 100 executes steps S06 and S07. In step S06, the additional image generation unit 116 specifies the expected exit position based on route stored by the driving route storage unit 121 and current position acquired by the position information acquisition unit 111. In step S07, the additional image generation unit 116 checks whether the distances from the current position to the expected exit position are smaller than a predetermined threshold.

[0067] If it is determined in step S07 that the range from the current position to the expected exit position is less than the predetermined threshold, the image adding device 100 performs step S08. In step S08, the additional image generation unit 116 calculates the display position of the expected exit position in the in-field region based on the current position and travel direction of the vehicle body 10 and the angle of view in the camera 20, generates an exit announcement image indicating the expected exit direction in the calculated display position, and includes the exit announcement image in the additional image.

[0068] Next, the image adding device 100 executes step S09. If it is determined in step S07 that the range from the current position to the expected exit position is greater than the predetermined threshold, the image adding device 100 performs step S09 without performing step S08.

In step S09, the additional image generation unit 116 extracts a moving body such as an oncoming vehicle or a pedestrian from the real-time image, and generates the emphasizing image 216 in which the moving object image 215 corresponding to the extracted moving body is emphasized.

[0069] Next, the image adding device 100 executes step S11. In step S11, the additional image generation unit 116 checks whether the remote image acquisition unit 123 has acquired an image data from another vehicle.

[0070] If it is determined in step S11 that an image data has been acquired from another vehicle, the image adding device 100 executes step S12. In step S12, the additional image generation unit 116 generates the remote image 217 based on the image data acquired by the remote image acquisition unit 123.

[0071] Next, the image adding device 100 executes step S13. If it is determined in step S11 that an image data has not been acquired from another vehicle, the image adding device 100 executes step S13 without executing step S12. In step S13, the driving state monitoring unit 122 checks whether the vehicle body 10 is stopped for boarding or alighting of a person based on the vehicle speed or the like detected by the vehicle speed sensor 42.

[0072] If it is determined in step S13 that the vehicle body 10 is not stopped or is stopped in accordance with the road condition but not for boarding or alighting of a person, the image adding device 100 executes step S14. In step S14, the additional image generation unit 116 sets the display size of the additional image to the first size. The image synthesis unit 117 combines an additional image into the real-time image with a

display size set by the additional image generation unit 116. Further, the image synthesis unit 117 combines the emphasizing image 216 generated in step S09 and the remote image 217 generated in step S12 into the real-time image.

5 [0073] If it is determined in step S13 that the vehicle body 10 is stopped, the image adding device 100 executes steps S15 and S16. In step S15, the additional image generation unit 116 generates the attention calling image 214 including a character string indicating that person is getting off from the vehicle body 10. In step S16, the additional image generation unit 116
10 sets the display size of the additional image to a second size smaller than the first size. The image synthesis unit 117 combines the additional image into the real-time image with the display size set by the additional image generation unit 116. Further, the image synthesis unit 117 synthesizes the emphasizing image 216 generated in step S09, the remote image 217
15 generated in step S12, and the attention calling image 214 generated in step S15 into the real-time image.

[0074] Next, the image adding device 100 executes step S17. In step S17, the image synthesis unit 117 causes the monitor 30 to display an image obtained by combining the real-time image with the additional image, the
20 emphasizing image 216, and the remote image 217. Thus, the update cycle is completed, and the image adding device 100 returns the process to step S01. Thereafter, the update cycle is repeatedly executed.

[0075] Effects of Embodiment

As described above, the vehicle 1 includes: the camera 20 provided on the
25 vehicle body 10 so as to capture the surroundings of the vehicle body 10; the monitor 30 provided on a surface facing an opposite direction 22 of a

direction that the camera 20 faces among outer surfaces of the vehicle body 10 and configured to display, toward the opposite direction 22, a real-time image captured by the camera 20; and the image adding device 100 configured to cause the monitor 30 to display an additional image changing in accordance with the position of the vehicle body 10 based on contents stored, in association with position information, in a database, and the current position of the vehicle body 10.

[0076] According to this the vehicle 1, by displaying an additional image corresponding to the current position of the vehicle 1 on the monitor 30, it is possible to transmit, to a person who sees the image, information corresponding to the current position of the person. Thus, the monitor 30 for transmitting information to the outside of the vehicle can be more effectively utilized.

[0077] The image adding device 100 may be configured to cause the monitor 30 to display the additional image including an advertisement in accordance with the position of the vehicle body 10. In this case, the monitor 30 can be effectively utilized for more effective advertisement.

[0078] The image adding device 100 may be configured to: identify an in-field facility included in the real-time image based on the current position and a travel direction of the vehicle 1 and map information; and cause the monitor 30 to display the additional image including an advertisement of the in-field facility. In this case, it is possible to further improve the effect of advertisement by displaying the advertisement related to the image of the camera 20.

[0079] The image adding device 100 may be configured to cause the monitor 30 to display the additional image that associates the

advertisement of the in-field facility with the in-field facility in the real-time image. In this case, the monitor 30 can be more effectively utilized by a synergistic effect of the information transmission by the image of the camera 20 and the information transmission by the additional image.

5 [0080] The camera 20 may be provided on the vehicle body 10 to capture the front D11 of the vehicle body 10, and the monitor 30 may be provided on the rear face 13 of the vehicle body 10 and configured to display the real-time image toward the rear D12 of the vehicle body 10. In this case, the monitor 30 can be effectively used to transmit information to a
10 following vehicle.

[0081] The image adding device 100 may be configured to cause the monitor 30 to display the additional image including an indication of the expected exit position of the vehicle body 10 from the road on which the vehicle body 10 currently travels based on a route along which the vehicle
15 body 10 is scheduled to travel. In this case, it is possible to reduce the stress on the driver of the following vehicle and prevent unreasonable passing.

[0082] The camera 20 may be provided on the vehicle body 10 to capture the rear D12 of the vehicle body 10, and the monitor 30 may be provided
20 on the front face 12 of the vehicle body 10 and configured to display the real-time image toward the front D11 of the vehicle body 10. In this case, when the vehicle 1 stops at an intersection for waiting for a right turn, the monitor 30 can be effectively used to transmit information to the driver of an oncoming vehicle waiting for a right turn at the same intersection.

25 [0083] The camera 20 may be provided on the vehicle body 10 to capture the direction that the first side face 14 of the vehicle body 10 faces, and

the monitor 30 may be provided on the second side face 15 of the vehicle body 10 and configured to display the real-time image captured by the camera 20 toward the direction that the second side face 15 faces. In this case, the monitor 30 can be effectively used to transmit information to a pedestrian on a sidewalk, for example.

[0084] The vehicle 1 may further include a second camera provided on the vehicle body 10 so as to face between the direction that the camera 20 faces and the opposite direction 22 and configured to capture the surroundings of the vehicle body 10, and the monitor 30 may be configured to display the real-time image and a second real-time image captured by the second camera. In this case, by widening the visual field range by using both the camera 20 and the second camera, it is possible to increase the benefit of the image displayed on the monitor 30 and improve the information transmission effect by the monitor 30.

[0085] The image adding device 100 may be configured to reduce, compared to the first stop period in which the vehicle body 10 stops in accordance with the road condition, a display size of the additional image in the second stop period in which the vehicle body 10 stops for boarding or alighting of the person. In the second stop period, it is considered that the necessity of the image of the camera 20 increases compared to the first stop period. For example, in the second stop period, the person is more likely to cross the road to board or alight from the vehicle 1, and thus the image of the front of the vehicle is more necessary in the following vehicle. Therefore, by making the display size of the additional image in the second stop period smaller than that in the first stop period, it is possible to transmit information that matches the needs more.

[0086] The image adding device 100 may be configured to fade, compared to the first stop period in which the vehicle body 10 stops in accordance with the road condition, a display of the additional image in the second stop period in which the vehicle body 10 stops for boarding or alighting of the person. Also in this case, by fading the display of the additional image in the second stop period compared to that in the first stop period, it is possible to transmit information that matches the needs more.

[0087] The image adding device 100 may be configured to cause the monitor 30 to further display an attention calling image including an indication that a person is boarding or alighting from the vehicle body 10 while the vehicle body 10 stops. In this case, it is possible to improve the benefit of the image displayed on the monitor 30 and improve the information transmission effect by the monitor 30.

[0088] The image adding device 100 may be configured to cause the monitor 30 to further display an emphasizing image that emphasizes an image of the moving object in the real-time image. In this case, it is possible to improve the benefit of the image displayed on the monitor 30 and improve the information transmission effect by the monitor 30.

[0089] The image adding device 100 may be configured to cause the monitor 30 to further display an image received from another vehicle 1. In this case, it is possible to improve the benefit of the image displayed to the monitor 30 and improve the information transmission effect by the monitor 30.

[0090] The vehicle 1 according to another aspect of the present disclosure includes: the camera 20 provided on the vehicle body 10 so as to capture

the rear D12 of the vehicle body 10; and the monitor 30 provided on the front face 12 of the vehicle body 10 and configured to display a real-time image captured by the camera 20 toward the front D11 of the vehicle body 10.

5 [0091] Although the embodiments have been described above, the present invention is not necessarily limited to the illustrated embodiments, and can be appropriately modified without departing from the gist thereof. For example, the vehicle 1 may be a vehicle that can travel on a public road, and is not limited to a bus. For example, the vehicle 1 may be a
10 freight vehicle such as a truck, or may be a tram.

Reference Signs List

[0092] 1: vehicle; 10: vehicle body; 12: front face; 13: rear face; 14: first side face; 15: second side face; D21: left direction; D22: right direction; D11: front; D12: rear; 20: camera; 21: viewing direction; 22: opposite
15 direction; 30: monitor; 100: image adding device.

CLAIMS

[Claim 1]

A vehicle comprising:

a camera provided on a vehicle body so as to capture surroundings
5 of the vehicle body;

a monitor provided on a surface facing an opposite direction of a
direction that the camera faces among outer surfaces of the vehicle body
and configured to display, toward the opposite direction, a real-time image
captured by the camera; and

10 an image adding device configured to cause the monitor to display
an additional image changing in accordance with a position of the vehicle
body based on contents stored, in association with position information,
in a database, and a current position of the vehicle body,

wherein the image adding device is configured to reduce,
15 compared to a first stop period in which the vehicle body stops in
accordance with a road condition, a display size of the additional image in
a second stop period in which the vehicle body stops for boarding or
alighting of a person.

[Claim 2]

20 A vehicle comprising:

a camera provided on a vehicle body so as to capture surroundings
of the vehicle body;

a monitor provided on a surface facing an opposite direction of a
direction that the camera faces among outer surfaces of the vehicle body
25 and configured to display a real-time image captured by the camera toward
the opposite direction; and

an image adding device configured to cause the monitor to display an additional image that changes in accordance with a position of the vehicle body based on contents stored, in association with position information, in a database, and a current position of the vehicle body,

5 wherein the image adding device is configured to fade, compared to a first stop period in which the vehicle body stops in accordance with a road condition, a display of the additional image in a second stop period in which the vehicle body stops for boarding or alighting of a person.

[Claim 3]

10 The vehicle according to claim 1 or 2, wherein the image adding device is configured to cause the monitor to display the additional image including an advertisement in accordance with the position of the vehicle body.

[Claim 4]

15 The vehicle according to claim 1 or 2, wherein the image adding device is configured to: identify an in-field facility included in the real-time image based on a current position and a travel direction of the vehicle and map information; and cause the monitor to display the additional image including an advertisement of the in-field facility.

20 [Claim 5]

The vehicle according to claim 4, wherein the image adding device is configured to cause the monitor to display the additional image that associates the advertisement of the in-field facility with the in-field facility in the real-time image.

25 [Claim 6]

The vehicle according to any one of claims 1 to 5, wherein the

camera is provided on the vehicle body to capture a front of the vehicle body, and

wherein the monitor is provided on a rear face of the vehicle body and configured to display the real-time image toward a rear of the vehicle body.

[Claim 7]

The vehicle according to claim 6, wherein the image adding device is configured to cause the monitor to display the additional image including an indication of an expected exit position of the vehicle body from a road on which the vehicle body currently travels based on a route along which the vehicle body is scheduled to travel.

[Claim 8]

The vehicle according to any one of claims 1 to 5, wherein the camera is provided on the vehicle body to capture a rear of the vehicle body, and

wherein the monitor is provided on a front face of the vehicle body and configured to display the real-time image toward a front of the vehicle body.

[Claim 9]

The vehicle according to any one of claims 1 to 5, wherein the camera is provided on the vehicle body to capture a direction that a first side face of the vehicle body faces, and

wherein the monitor is provided on a second side face of the vehicle body and configured to display the real-time image captured by the camera in a direction that the second side face faces.

[Claim 10]

The vehicle according to any one of claims 1 to 9, further comprising a second camera provided on the vehicle body so as to face between the direction that the camera faces and the opposite direction and configured to capture surroundings of the vehicle body,

5 wherein the monitor is configured to display the real-time image and a second real-time image captured by the second camera.

[Claim 11]

The vehicle according to any one of claims 1 to 10, wherein the image adding device is configured to cause the monitor to further display
10 an attention calling image including an indication that a person is boarding or alighting from the vehicle body during the second stop period.

[Claim 12]

The vehicle according to any one of claims 1 to 11, wherein the image adding device is configured to cause the monitor to further display
15 an emphasizing image that emphasizes an image of a moving object in the real-time image.

[Claim 13]

The vehicle according to any one of claims 1 to 12, wherein the image adding device is configured to cause the monitor to further display
20 an image received from another vehicle.