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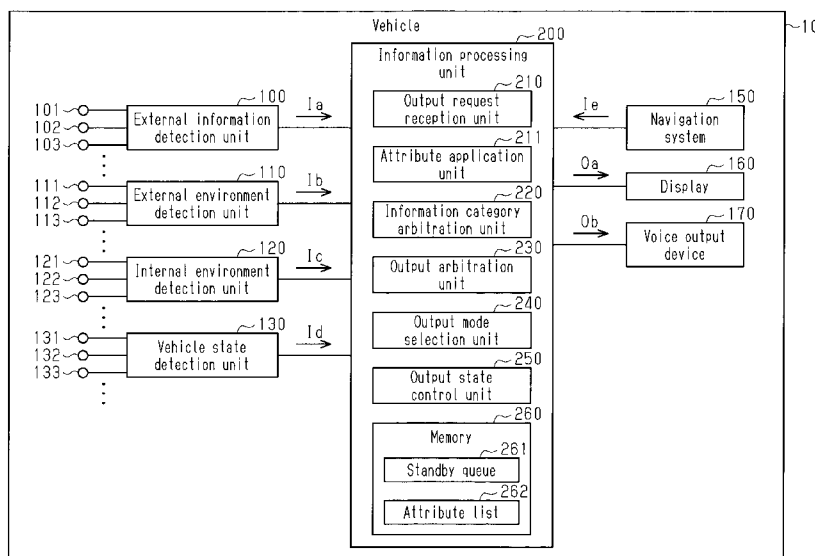
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(54) Title: INFORMATION OUTPUT DEVICE FOR MOBILE BODY



(57) Abstract: An information output device for a mobile body that receives different kinds of information in real time and outputs the information to provide to the user, includes an attribute application unit configured to apply an attribute, including a standby allowed period and a minimum output period, to each kind of information and an output arbitration unit configured to arbitrate output of first and second kinds of information having overlapping output times. When the standby allowed period of the second information is longer than the minimum output period of the first information, the output arbitration unit outputs the first information for at least the minimum output period of the first information and then switches output information to the second information within the standby allowed period of the second information from when the output of the first information starts.

Description

Title of Invention: INFORMATION OUTPUT DEVICE FOR MOBILE BODY

Technical Field

[0001] The present invention relates to a mobile body information output device that outputs information provided to a user of a mobile body such as a vehicle.

Background Art

[0002] A conventional information output device for a mobile body (e.g., vehicle) uses, for example, a display to provide a user (e.g., vehicle driver) with various kinds of information such as warnings and cautions related to the operation or state of the vehicle, route guides, recommendation information, and the like. When receiving information that is the subject provided to the user (hereafter, referred to as the provided information), the device is configured to sequentially output the provided information. However, the information output device may receive different kinds of the provided information at substantially the same time. In this regard, patent document 1 discloses a technique for comparing the different kinds of the provided information, which are received at substantially the same time, and applying a priority level to each kind of the provided information.

[0003] Patent document 1 describes an information processing device that automatically refers to information collected from a network to either automatically process and determine the priority level for every kind of the information provided to the user or assist manual determination of the priority level. More specifically, the information processing device automatically collects, analyzes, and compares the information that is collectable from a computer network to determine the priority level of each kind of the information provided by an information providing site or the like. When providing the user with information, the information processing device gives priority to important information based on the determination. Additionally, the information processing device assists the editor of the information providing site or the like for determining the significance level or priority order of the provided information. Alternatively, the information processing device automatically performs the entire determination process.

Citation List

Patent Literature

[0004] PTL 1: Japanese Laid-Open Patent Publication No. 2001-209655

Summary of Invention

Technical Problem

- [0005] The information processing device described in patent document 1 provides a user with information from a network in accordance with the priority level.
- [0006] For example, the different kinds of information provided to the user includes important information having high priority, such as information related to the operation or the state of the vehicle, particularly, information related to safety. When different kinds of provided information are required to be output, information having a high priority is normally output prior to the information having a low priority. In recent years, to improve convenience for users, the provided information output in vehicles tends to be diversified. Thus, there are many kinds of information that do not have a high priority but are valuable if provided at the "right time" or "right place" when the vehicle is moving. However, the output of such information, which is valuable if provided at the "right time" or "right place", may be postponed when competing with information having a high priority at the output time. As a result, the value of the information may be decreased or lost. Ultimately, the opportunity for outputting the information may be lost.
- [0007] When different kinds of the provided information have overlapping output times but do not have priority levels, the same problem occurs when adjusting the output times of the different kinds of the provided information. Moreover, such a problem also occurs in mobile bodies other than a vehicle.
- [0008] It is an object of the present invention to provide a mobile body information output device that outputs as many kinds of information having overlapping output times as possible.

Solution to Problem

- [0009] One aspect of the present invention is an information output device for a mobile body that receives different kinds of information in real time and outputs the information, which is to be provided to a user of the mobile body. The information output device includes an attribute application unit, which is configured to apply an attribute to each kind of information, and an output arbitration unit, which is configured to arbitrate output of a first kind of information and output of a second kind of information that are included in the information provided to the user and have overlapping output times. The attribute includes a standby allowed period, which is a length of time allowed for waiting before the information is output, and a minimum output period, which is a length of a minimum time needed to output the information. When the standby allowed period that is applied to the second kind of information is longer than the minimum output period that is applied to the first kind of information, the output arbitration unit outputs the first kind of information for at least the minimum output period of the first kind of information and then switches output information from the first kind of in-

formation to the second kind of information within the standby allowed period of the second kind of information from when the output of the first kind of information starts.

Brief Description of Drawings

- [0010] [fig.1]Fig. 1 is a schematic block diagram showing the structure of a first embodiment of an information output device for a mobile body.
- [fig.2]Fig. 2 is a flowchart showing the procedures for adjusting the output order of provided information in the first embodiment.
- [fig.3]Fig. 3 is a flowchart showing the procedures for outputting the provided information of which the output order has been adjusted in the first embodiment.
- [fig.4]Fig. 4 includes schematic diagrams each showing a standby allowed period, a minimum output period, and an output duration period applied to the provided information in the first embodiment, in which items (a) and (b) show the attributes applied to "information 1" and "information 2," respectively.
- [fig.5]Fig. 5 includes diagrams showing an output arbitration of the two kinds of information, namely, "information 1" and "information 2," in the first embodiment, in which item (a) shows the relationship of the attributes applied to "information 1" and "information 2," item (b) shows a determination result of the applicability of output orders of the two kinds of information based on the relationship shown in item (a), item (c) shows the relationship between the two kinds of information in terms of the standby allowed period and the output duration period, item (d) shows one example of a pattern for outputting the two kinds of information, and item (e) shows another example of pattern of outputting the two kinds of information.
- [fig.6]Fig. 6 includes diagrams showing output arbitrations of "information 1" and "information 2" in a second embodiment of an information output device for a mobile body, in which item (a) shows the relationship of the attributes applied to "information 1" and "information 2," item (b) shows a determination result of the applicability of output orders of the two kinds of information based on the relationship shown in item (a), item (c) shows the relationship between the two kinds of information in terms of the standby allowed period and the output duration period, and item (d) shows one example of a pattern for outputting the two kinds of information.
- [fig.7]Fig. 7 includes diagrams showing output arbitrations of "information 1" and "information 2" that differ in the attribute relationship from that of Fig. 6 in the second embodiment, in which item (a) shows the attribute relationship between "information 1" and "information 2," item (b) shows a determination result of the applicability of output orders of the two kinds of information based on the relationship shown in item (a), item (c) shows the relationship between the two kinds of information in terms of the standby allowed period and the output duration period, item (d) shows one example

of pattern of outputting the two kinds of information, and item (e) shows another example of a pattern for outputting the two kinds of information.

[fig.8]Fig. 8 includes diagrams showing output arbitrations of "information 1" and "information 2" that differ in the attribute relationship from that of Figs. 6 and 7 in the second embodiment, in which item (a) shows the attribute relationship between "information 1" and "information 2," item (b) shows a determination result of the applicability of output orders of the two kinds of information based on the relationship shown in item (a), item (c) shows the relationship between the two kinds of information in terms of the standby allowed period and the output duration period, item (d) shows one example of a pattern for outputting the two kinds of information, and item (e) shows another example of a pattern for outputting the two kinds of information.

[fig.9]Fig. 9 includes diagrams showing output arbitrations of "information 1" and "information 2" that differ in the attribute relationship from those of Figs. 6 to 8 in the second embodiment, in which item (a) shows the attribute relationship between "information 1" and "information 2," item (b) shows a determination result of the applicability of output orders of the two kinds of information based on the relationship shown in item (a), item (c) shows the relationship between the two kinds of information in terms of the standby allowed period and the output duration period, item (d) shows one example of a pattern for outputting the two kinds of information, and item (e) shows another example of a pattern for outputting the two kinds of information.

[fig.10]Fig. 10 includes diagrams showing "information 1" and "information 2" that differ in the attribute relationship from those of Figs. 6 to 9 in the second embodiment when "information 2" is not output, in which item (a) shows the attribute relationship between "information 1" and "information 2," item (b) shows a determination result of the applicability of output orders of the two kinds of information based on the relationship shown in item (a), item (c) shows the relationship between the two kinds of information in terms of the standby allowed period and the output duration period, and item (d) shows one example of a pattern for outputting the two kinds of information.

[fig.11]Fig. 11 is a list showing an example of priority levels applied to each kind of information in a third embodiment of an information output device for a mobile body.

Description of Embodiments

[0011] First Embodiment

[0012] A first embodiment of an information output device for a mobile body will now be described with reference to Figs. 1 to 5. Fig. 1 shows an information output device for a mobile body that is installed in a vehicle 10, which is an automobile and is one

example of the mobile body, provides various kinds of information provided to the user of the vehicle such as the driver. The various kinds of provided information, which include textual information, image information, voice information, or the like, are output through a human machine interface (HMI) as at least one of image and voice. The HMI includes a display 160, which shows an image or the like, and a voice output device 170, which outputs a voice or a sound. The user receives the textual information and the image information from the display 160 as visual information Oa and the voice information from the voice output device 170 as audible information Ob.

[0013] As shown in Fig. 1, the vehicle 10 includes an external information detection unit 100, which detects external information, an external environment detection unit 110, which detects the external environment of the vehicle, an internal environment detection unit 120, which detects the internal environment of the vehicle, a vehicle state detection unit 130, which detects the state of the vehicle, and a navigation system 150, which guides routes or the like. The vehicle 10 also includes the display 160, which outputs the visual information Oa such as an image, and the voice output device 170, which outputs the audible information Ob such as a voice. Further, the vehicle 10 includes an information processing unit 200, which performs processes such as arbitrating the output order of the various kinds of provided information and outputting the provided information. The information processing unit 200, the external information detection unit 100, the external environment detection unit 110, the internal environment detection unit 120, the vehicle state detection unit 130, and the navigation system 150 are each connected to an in-vehicle LAN. The information processing unit 200 is configured to be capable of receiving provided information Ia to Id, which is to be provided to the user, through the in-vehicle LAN. A controller area network (CAN) or the like is used as the in-vehicle LAN. Additionally, the information processing unit 200, the display 160 and the voice output device 170 are each connected to the in-vehicle LAN such as the CAN. The information processing unit 200 is configured to be capable of transmitting the visual information Oa and the audible information Ob related to the provided information, which is to be provided to the user, through the in-vehicle LAN.

[0014] The external information detection unit 100 is connected to a position detection unit 101, which detects the current position of the vehicle 10, a road-vehicle communication unit 102, which communicates with an infrastructure device located on the road, and a public communication unit 103, which communicates with a base station for public communication, and obtains information from the outside of the vehicle 10 through each unit. Additionally, the external information detection unit 100 may be connected to an inter-vehicle communication unit, which communicates with another vehicle, or a communication unit capable of communicating with a mobile information

terminal such as a mobile phone or a smartphone through near field communication. The position detection unit 101 receives a GPS satellite signal and detects the current position of the vehicle 10 based on the received GPS satellite signal. The position detection unit 101 may transmit position information indicating the current position of the vehicle 10 in latitude and longitude to the navigation system 150 through the in-vehicle LAN. The road-vehicle communication unit 102 communicates with an infrastructure device such as an optical beacon device located on the road to obtain traffic information such as traffic restriction information, traffic jam information, and travel time. The public communication unit 103 obtains the state of e-mails, which are sent or received through the public communication line. The external information detection unit 100 selects information that is to be provided to the user from the obtained information and transmits the selected information to the information processing unit 200 as provided information Ia. The provided information Ia is mainly output as general information. Here, the general information is the provided information that excludes warning information and caution information, which will be described below, and subject to arbitration in the present embodiment.

[0015] The external environment detection unit 110 is connected to an in-vehicle camera 111, which captures an image of the vehicle external environment such as the front of the vehicle, a laser sensor 112, which detects obstacles or the like located in front of the vehicle, and an ultrasound sensor 113, which detects relatively close obstacles or the like around the vehicle, and obtains information related to the vehicle external environment from each device. The in-vehicle camera 111 detects information such as the location of preceding vehicles, traffic lanes, obstacles, and pedestrians based on the captured image of the vehicle external environment. The laser sensor 112 detects information such as the distance from the preceding vehicle and the speed relative to the preceding vehicle. The ultrasound sensor 113 detects the distance from a human, a preceding vehicle, an obstacle, or the like that are relatively close to the vehicle. The external environment detection unit 110 selects information that is to be provided to the user from the obtained information and transmits the selected information to the information processing unit 200 as provided information Ib. Additionally, when determining that the vehicle may crash into or contact an obstacle or that the vehicle may move away from a traffic lane based on the obtained information, the external environment detection unit 110 selects the detected information as warning information or caution information, which is provided to the user, and transmits the selected information to the information processing unit 200 as the provided information Ib. Here, the provided information Ib is categorized and output in accordance with the significance in terms of safety or the like as warning information, caution information, or general information.

- [0016] The internal environment detection unit 120 is connected to a temperature detection unit 121, which detects the temperature of the vehicle, a seat position detection unit 122, which detects the position of a seat, and a luminance detection unit 123, which detects the luminance in the passenger compartment, and obtains information related to the vehicle internal environment from each unit. Additionally, the internal environment detection unit 120 may be connected to a detection unit that detects the passenger or the like. The internal environment detection unit 120 selects information that is to be provided to the user from the obtained information and transmits the selected information to the information processing unit 200 as provided information Ic. Here, the provided information Ic is mainly output as general information.
- [0017] The vehicle state detection unit 130 is connected to a speed detection unit 131, which detects the speed of the vehicle 10, an acceleration detection unit 132, which detects the acceleration of the vehicle 10, and a steering angle detection unit 133, which detects the steering angle of the vehicle 10, and obtains the detected speed, the acceleration, and the steering angle as information related to the state of the vehicle. Additionally, the vehicle state detection unit 130 may be connected to another detection device and detect the state around the corners of the vehicle. The vehicle state detection unit 130 selects information that is to be provided to the user from the obtained information and transmits the selected information to the information processing unit 200 as provided information Id. Additionally, when detecting that a failure, an abnormality, or fuel shortage has occurred or is likely to occur based on the obtained information, the vehicle state detection unit 130 selects the detected information as information provided to the user and transmits the selected information to the information processing unit 200 as the provided information Id. Here, the provided information Id is categorized in accordance with the significance in terms of safety or the like and categorized as caution information or general information.
- [0018] The navigation system 150 guides routes for the vehicle 10 based on the current position of the vehicle 10, which is obtained from the position detection unit 101, a set destination, and stored road map data. When a destination is set, the navigation system 150 searches a traveling route from the current position of the vehicle 10 to the destination and indicates the searched traveling route in the map displayed on a screen. Thus, the driver is provided with an image of the route guide. Additionally, when detecting that the vehicle 10 is approaching a point having information useful to or preferred by the driver, the navigation system 150 selects the information as information that is to be provided to the user and transmits the selected information, which is useful to or preferred by the driver, to the information processing unit 200 as provided information Ie. Examples of information useful to the driver include the route guide in addition to the location of desirable car dealer shops and filling stations

depending on the state of the vehicle. Examples of information preferred by the driver include restaurants and shops corresponding to the preferences of the driver. Here, the provided information Ie is mainly output as general information.

[0019] The information processing unit 200 receives the provided information Ia to Ie in real time as information that is provided to the user. The information processing unit 200 is capable of specifying the content of the provided information Ia to Ie, which is received through the CAN communication, based on message IDs of the CAN. Additionally, even when receiving the provided information Ia to Ie through a communication means other than the CAN communication, the content of the provided information Ia to Ie may be specified based on information contained in a communication message including the provided information Ia to Ie or information contained in the provided information Ia to Ie.

[0020] The information processing unit 200 is an electronic control unit (ECU) and includes a processor or a processing circuitry that includes a microcomputer having an arithmetic unit and a memory. The information processing unit 200 executes various kinds of controls in accordance with programs stored in the memory. More specifically, the information processing unit 200 includes an output request reception unit 210, which receives the provided information Ia to Ie, an attribute application unit 211, which applies the corresponding attribute to each kind of provided information, and an information category arbitration unit 220, which determines whether or not to arbitrate the output order based on the priority level corresponding to the attribute. Additionally, the information processing unit 200 includes an output arbitration unit 230, which determines the priority of the output order of two kinds of provided information, an output mode selection unit 240, which selects the output mode of the provided information, and an output state control unit 250, which controls the output state of the provided information. Further, the information processing unit 200 includes a memory 260, which is capable of storing various kinds of parameters, programs, and data.

[0021] The memory 260 includes a known memory device. The memory 260 holds a standby queue 261, in which information waits to be output, and an attribute list 262, which holds attributes of the provided information that are determined in accordance with the message ID of the CAN. The standby queue 261 is configured to be capable of inputting and outputting the provided information. The input provided information is sequentially stored and added after the provided information stored at the tail of the standby queue 261. Additionally, when outputting the provided information, the provided information at the head of the standby queue 261 is output and deleted, and the remaining stored provided information is reordered. The attribute list 262 includes an information category (information priority level), a standby allowed period, a minimum output period, an output duration period, and the like as the attributes corre-

sponding to the provided information. Here, at least only the necessary attributes need to be set as the attributes corresponding to the provided information. In the present embodiment, at least only the standby allowed period and the minimum output period need to be held in the memory 260.

[0022] The attributes associated with the provided information will now be described. The information category (information priority level) is an attribute related to the category (type) of the provided information. The priority level is applied to the provided information in accordance with the associated information category. In the present embodiment, different kinds of the provided information are divided into three information categories, namely, warning information, caution information, and general information. The warning information and the caution information have high priority levels. The general information has a lower priority level than the warning information and the caution information.

[0023] Further, the provided information is associated with three attributes, namely, the standby allowed period, the minimum output period, and the output duration period. Fig. 4 shows "information 1" and "information 2" as the provided information. As shown in item (a) of Fig. 4, "information 1" is associated with a standby allowed period St1, a minimum output period Nt1, and an output duration period Ot1. As shown in item (b) of Fig. 4, "information 2" is associated with a standby allowed period St2, a minimum output period Nt2, and an output duration period Ot2.

[0024] Each of the standby allowed periods St1, St2 has the length of time allowed for waiting before the provided information is output, that is, the length of time from the present time until the information needs to be output. For example, when a location where information of a lane restriction is obtained is distant from a location where the lane may be appropriately changed, the standby allowed period is the time allowed for waiting before the lane restriction information is output. Here, in a mobile body, the standby allowed period is calculated based on speed and distance. Thus, the speed and distance may be used instead of the time.

[0025] Each of the minimum output periods Nt1, Nt2 has the length of the minimum time that is needed for the user such as the driver to be aware of the output provided information. The minimum output period is set to be longer than the time in which the user would most likely not be aware of the provided information. Thus, the provided information is highly likely to be recognized when output for at least each of the minimum output periods Nt1, Nt2. For example, when the provided information is textual information or voice information, the minimum output period is set to the minimum length of time in which the content of each of the textual information and the voice information is assumed to be recognized. When the textual information or the voice information includes "you have received a new mail," the minimum output

period is set so that the user may recognize the textual information or the voice information corresponding to at least "new mail." For example, when sequentially showing texts on a narrow display area, the minimum output period is set to the time needed until "new mail" is shown. When output through a voice, the minimum output period is set to the time needed until the words "new mail" are generated.

[0026] Each of the output duration periods Ot1, Ot2 is the length of the desired time for continuously outputting the provided information from the present time. The output duration periods Ot1, Ot2 are respectively set to have a length of time that is at least the sum of the standby allowed periods St1, St2 and the minimum output periods Nt1, Nt2 associated with the provided information. Each of the output duration periods Ot1, Ot2 may be used, for example, to set sufficient time needed for the user such as the driver to recognize the output provided information, the time needed to completely output the content of the provided information, and the time until the provided information becomes worthless. Here, even when the output duration periods Ot1, Ot2 are set, the provided information may be switched to the information that is to be output next if there is any such information. When there is no information that is to be output next, the provided information may continue to be output even after the output duration period ends.

[0027] The output order setting process and the information output process, which are performed by the information processing unit 200, will now be described with reference to Figs. 2 to 5.

[0028] As shown in Fig. 2, when the provided information Ia to Ie is input, the information processing unit 200 starts the output order setting process. When the output order setting process is started, the output request reception unit 210 sequentially receives the input provided information Ia to Ie that is subject to the output order setting process (step S10). The output request reception unit 210 filters the message IDs of the CAN to selectively receive the provided information Ia to Ie that is subject to the output order setting process.

[0029] When the provided information Ia to Ie is received, the attribute application unit 211 specifies the information attribute for every one of the received provided information Ia to Ie and applies the specified information attribute to the received provided information Ia to Ie (step S11). The attribute application unit 211 obtains a message ID of the CAN for every kind of the provided information Ia to Ie, specifies the information attribute corresponding to the obtained message ID from the attribute list 262, and associates the specified information attributes with the provided information Ia to Ie. As a result, each kind of the provided information Ia to Ie is associated with the information category (information priority level), the standby allowed period, the minimum output period, and the output duration period.

- [0030] When an information attribute is associated with each kind of the provided information Ia to Ie, the information category arbitration unit 220 performs an information category arbitration (step S12). In the information category arbitration, by referring to the information category (information priority level) associated with each kind of the provided information Ia to Ie, a high priority level is set for the provided information that is associated with warning information or caution information under the information category, and a low priority level is set for the provided information that is associated with general information under the information category. The information category arbitration unit 220 determines whether or not each kind of the provided information Ia to Ie has a high priority level based on the information category (step S13). When it is determined that the provided information Ia to Ie has the high priority level (YES in step S13), the information category arbitration unit 220 has the output state control unit 250 perform output state control so that the provided information Ia to Ie is quickly output (step S16). In the present embodiment, the general information, which has a low priority level, is subject to the output arbitration, and the warning information and the caution information, which has high priority levels, are not subject to the output arbitration. Thus, the warning information and the caution information are quickly output. The detail of the output state control will be described later.
- [0031] When it is determined that the provided information Ia to Ie does not have the high priority level (NO in step S13), the output arbitration unit 230 adjusts the output order of the provided information Ia to Ie (step S14). Here, when only one kind of the provided information Ia to Ie is input before the next output is allowed, the output arbitration unit 230 transmits the provided information Ia to Ie to the output mode selection unit 240 without adjusting the output order (proceeds to step S15). When two kinds of the provided information Ia to Ie are input before the next output is allowed, the output arbitration unit 230 adjusts the output order. The two kinds of the provided information Ia to Ie are received before the next output is allowed and configure consecutive information, for example, information input to the information processing unit 200 at substantially the same time.
- [0032] The arbitration of the output order performed by the output arbitration unit 230 on two kinds of the provided information Ia to Ie will now be described with reference to items (a) to (d) of Fig. 5. For the sake of brevity, in the description, "information 1" refers to one of two kinds of the provided information Ia to Ie, and "information 2" refers to the other one of the two kinds of the provided information Ia to Ie. "Information 1" corresponds to a first kind of information, and "information 2" corresponds to a second kind of information. The output arbitration unit 230 adjusts the output order of "information 1" and "information 2" based on the relationship in the standby allowed period and the minimum output period between "information 1" and

"information 2." Here, the attributes of "information 1" include the standby allowed period St1 and the minimum output period Nt1, and the attributes of "information 2" include the standby allowed period St2 and the minimum output period Nt2. As illustrated in items (a) to (d) of Fig. 5, the relationship in the attributes between "information 1" and "information 2" is "minimum output period Nt1 < standby allowed period St2" and "minimum output period Nt2 > standby allowed period St1." More specifically, as shown in item (b) of Fig. 5, while "information 2" is waiting to be output, "information 1" can be output. However, while "information 1" is waiting to be output, "information 2" cannot be output. Thus, the output order of "information 1" to "information 2" is applicable, and the output order of "information 2" to "information 1" is not applicable. When the order is set so that "information 1" is first output and "information 2" is then output as shown in item (d) of Fig. 5, "information 1" may be output during the minimum output period Nt1 (output pattern 1). Alternatively, as shown in item (e) of Fig. 5, "information 1" may be output during the standby allowed period St2 of "information 2" (output pattern 2). Here, "output pattern 1" obtains at least the minimum recognizability for "information 1" and also obtains a long output period for "information 2" to increase the recognizability of "information 2." Also, "output pattern 2" obtains a long output period for "information 1" to increase the recognizability of "information 1" and also obtains at least the minimum recognizability for "information 2."

[0033] The output arbitration unit 230 adjusts the output order of "information 1" and "information 2" to "information 1" and then "information 2" and selects "output pattern 1" or "output pattern 2." The output arbitration unit 230 may extend the output period of the information that is received first (in a sequential order) by the output request reception unit 210. For example, "output pattern 2" may be selected when "information 1" is first received, and "output pattern 1" may be selected when "information 2" is first received. Alternatively, instead of the reception order, the output arbitration unit 230 may extend the output period of the information having high significance. For example, "output pattern 2" may be selected when "information 1" has high significance, and "output pattern 1" may be selected when "information 2" has high significance. Here, the significance level may be applied in accordance with further categorized general information. Alternatively, the significance level may be applied in accordance with further specified priority levels. Alternatively, the significance level may be applied based on the values of the message IDs of the CAN.

[0034] When the output pattern including the output order is selected, the output mode selection unit 240 selects the output mode of "information 1" (step S15). When the output period of "information 1" is the minimum output period Nt1, the output mode selection unit 240 changes the output mode of the information serving as "information

1" to a mode of simply expressed information. In the simply expressed information, the expression of the information is simplified so that the content of the provided information is briefly transmitted. Thus, the simply expressed information allows the user to correctly recognize the content of the provided information even when the output period is shorter than when the information is output in the normal expression. The use of the simply expressed information increases the recognizability of the provided information even when the output period is short. Thus, even when the output period is short, the content of the provided information may be recognized in a further ensured manner.

- [0035] The simply expressed information is prepared in advance and associated with the normal output expression of the provided information. For example, a predetermined association chart (not shown) is set in the memory 260. In one example, when the normal output expression is "you have received a new mail," "mail" is prepared in advance as the associated simply expressed information. More specifically, when the provided information is textual information, the simply expressed information may be simply expressed in a mode that would not be strange to the user. Additionally, when the textual information is properly clipped, the user may quickly recognize the correct content of the provided information. Additionally, when the display area of the provided information is limited, the simply expressed information may be simply expressed in a mode that shortens the time needed for indicating the information.
- [0036] When the output period of "information 2" is the minimum output period Nt_2 , the output mode selection unit 240 may change the output mode of the information serving as "information 2" to a mode of simply expressed information.
- [0037] The output state control unit 250 controls the output state of the information to output "information 1" and "information 2" in accordance with the output order and the output mode, which have been specified (step S16). When receiving "information 1" and "information 2," the output state control unit 250 stores "information 2," which has a later output order, in the standby queue 261 together with the output mode set for "information 2". Also, the output state control unit 250 sets "information 1," which has an earlier output order, as the information that is subject to output and ends the output order setting process.
- [0038] As shown in Fig. 3, "information 1" and "information 2" are output through the information output process. When "information 1" is set as the output subject information, the output state control unit 250 performs the information output process so that "information 1" is output in the set output mode in the set output period. More specifically, when "information 1" is set as the output subject information in the above output state control, the output state control unit 250 receives "information 1" as the output subject information (step S20). The output state control unit 250 sets a period

that is set in "information 1" as an output period and the output mode that is set in "information 1" as the output mode to output the information based on the setting (step S21 of Fig. 3). In this case, for example, the minimum output period Nt1 or the standby allowed period St2 is set as the output period. Additionally, the output state control unit 250 outputs a signal to at least one of the display 160 and the voice output device 170 so that "information 1" is output in the set output mode. When the signal is transmitted to the display 160 and the voice output device 170 from the output state control unit 250, the display 160 and the voice output device 170 output "information 1" in the mode that allows the user to recognize "information 1."

[0039] When the output period of "information 1" ends, the output state control unit 250 stops outputting information (step S22). This ends the output of "information 1" from the display 160 and the voice output device 170. Then, the output state control unit 250 determines whether or not another type of the provided information is waiting to be output (step S23). The output state control unit 250 refers to the standby queue 261 to check whether or not another type of the provided information is waiting to be output. For example, when "information 2" is stored in the standby queue 261 and determined that the provided information is waiting to be output (YES in step S23), the output state control unit 250 obtains the information (here, "information 2") that is at the head of the waiting order. Then, the output state control unit 250 returns to the step S20 and performs the process such as receiving the obtained "information 2" as the information that is subject to the output process (step S20).

[0040] When it is determined that there is no provided information waiting to be output from the standby queue 261 (NO in step S23), the output state control unit 250 ends the information output process.

[0041] An information output device for a mobile body such as that described above may adjust the output modes of different kinds of information having overlapping output times so that as many kinds of information as possible are output.

[0042] The present embodiment of the information output device for a mobile body has the advantages described below.

[0043] (1) When different kinds of provided information Ia to Ie (e.g., "information 1" and "information 2") have overlapping output times, the standby allowed periods St1, St2 and the minimum output periods Nt1, Nt2 of "information 1" and "information 2" are compared to arbitrate the output mode of each kind of the information so that two kinds of information are both output. This increases the output opportunities for each kind of information. Thus, different kinds of information having overlapping output times are adjusted so that more kinds of information can be output.

[0044] (2) When the minimum output periods Nt1, Nt2 are used as the output period, the output information is changed to the simply expressed information. This increases the

recognizability of provided information (e.g., "information 1" and "information 2") even when the output period is short. More specifically, the content of information that is to be provided is recognized even when the output period is short.

- [0045] (3) When information having a high priority obtains a longer output period, the recognizability of the information having a high priority is increased.
- [0046] (4) When provided information that is issued first obtains a longer output period, situations in which the first issued information is not recognized are reduced.
- [0047] (5) The minimum output period has the length of the minimum time needed for the user to recognize the provided information. This maintains at least the minimum recognizability of information that is to be output. Additionally, more information can be output while maintaining the recognizability of the information.

[0048] Second Embodiment

[0049] A second embodiment of an information output device for a mobile body will now be described with reference to Figs. 6 to 10. In the present embodiment, the output arbitration unit 230 adjusts "information 1" and "information 2" having attributes that differ from those described in the first embodiment. Here, the description will focus on configurations and processes that differ from those of the first embodiment. For the sake of simplicity, the same structure and process will not be described in detail.

[0050] Fig. 6 includes items (a) to (d) showing an example of the output arbitration when the attribute relationship between "information 1" and "information 2" is "output period $Ot1 < \text{standby allowed period } St2$." As shown in item (b) of Fig. 6, while "information 2" is waiting to be output, "information 1" can be output. However, while "information 1" is waiting to be output, "information 2" cannot be output. Thus, the output order of "information 1" and then "information 2" is applicable, and the output order of "information 2" and then "information 1" is not applicable. When the output order is set to "information 1" and then "information 2," as shown in item (d) of Fig. 6, "information 1" may be output for the output duration period $Ot1$. This obtains a long output period for "information 1" and increases the recognizability of "information 1" and also obtains at least the minimum recognizability for "information 2." Although not shown in Fig. 6, "information 1" may be output during the standby allowed period $St2$ of "information 2" or the minimum output period $Nt1$. Thus, when the output arbitration is performed on "information 1" and "information 2" having overlapping output times, only the time attributes including the minimum output period and the output duration period are compared so that "information 1" and "information 2" are both output.

[0051] Fig. 7 includes items (a) to (e) showing an example of the output arbitration when the attribute relationship between "information 1" and "information 2" is "output period $Ot1 > \text{standby allowed period } St2 > \text{minimum output period } Nt1$." In this case, as shown in item (b) of Fig. 7, while "information 2" is waiting to be output, "information 1" can

be output. Additionally, when "standby allowed period $St1$ is greater than or equal to minimum output period $Nt2$ " is satisfied, "information 2" can be output while "information 1" is waiting to be output. However, when "standby allowed period $St1 < \text{minimum output period } Nt2$ " is satisfied, "information 2" cannot be output while "information 1" is waiting to be output. Thus, the output order of "information 1" and then "information 2" is applicable. The output order of "information 2" and then "information 1" is applicable when " $St1$ is greater than or equal to $Nt2$ " is satisfied and not applicable when " $St1 < Nt2$ " is satisfied. Here, when the output order is set to "information 1" and then "information 2," as shown in item (d) of Fig. 7, "information 1" may be output during the minimum output period $Nt1$ (output pattern 1). This obtains at least the minimum recognizability for "information 1." When the output order is set to "information 2" and then "information 1," as shown in item (e) of Fig. 7, "information 2" may be output during the minimum output period $Nt2$ (output pattern 2). This obtains at least the minimum recognizability of "information 2." Here, the significance level or sequential order of the information may be used to determine the output order that is to be selected. For example, when the relationship between "information 1" and "information 2" is " $H(\text{information 1}) > L(\text{information 2})$ " in terms of the significance level, the output pattern is selected so that recognition of "information 1" is further ensured. Thus, when the output arbitration is performed on "information 1" and "information 2" having overlapping output times, only the time attributes are compared so that "information 1" and "information 2" are both output.

[0052] Fig. 8 includes items (a) to (e) showing an example of the output arbitration when the attribute relationship between "information 1" and "information 2" is "output period $Ot2 < \text{standby allowed period } St1$." In this case, as shown in item (b) of Fig. 8, while "information 1" is waiting to be output, "information 2" can be output. However, while "information 2" is waiting to be output, "information 1" cannot be output. Thus, the output order of "information 2" and then "information 1" is applicable, and the output order of "information 1" and then "information 2" is not applicable. When the output order is set to "information 2" and then "information 1," as shown in items (d) and (e) of Fig. 8, "information 2" may be output for the minimum output period $Nt2$ (output pattern 1) or for the output duration period $Ot2$ (output pattern 2). Thus, when the output arbitration is performed on "information 1" and "information 2" having overlapping output times, only the time attributes are compared so that "information 1" and "information 2" are both output.

[0053] Fig. 9 includes items (a) to (e) showing an example of the output arbitration when the attribute relationship between "information 1" and "information 2" is "output period $Ot2 > \text{standby allowed period } St1 > \text{minimum output period } Nt2$." In this case, as shown in item (b) of Fig. 9, while "information 1" is waiting to be output, "information 2" can

be output. Additionally, when "standby allowed period $St1$ is greater than or equal to minimum output period $Nt2$ " is satisfied, "information 1" can be output while "information 2" is waiting to be output. However, when "standby allowed period $St1 < \text{minimum output period } Nt2$ " is satisfied, "information 1" cannot be output while "information 2" is waiting to be output. Thus, the output order of "information 2" and then "information 1" is applicable, and the output order of "information 1" and then "information 2" is applicable when " $St1$ is greater than or equal to $Nt2$ " is satisfied and is not applicable when " $St1 < Nt2$ " is satisfied. When the output order is set to "information 2" and then "information 1," as shown in item (d) of Fig. 9, "information 2" may be output during the minimum output period $Nt2$ (output pattern 1). This obtains at least the minimum recognizability for "information 2." When the output order is set to "information 1" and then "information 2," as shown in item (e) of Fig. 9, "information 1" may be output during the minimum output period $Nt1$ (output pattern 2). This obtains at least the minimum recognizability for "information 1." The significance level or sequential order of the information may be used to determine the output order that is to be selected. Thus, when the output arbitration is performed on "information 1" and "information 2" having overlapping output times, only the time attributes are compared so that "information 1" and "information 2" are both output.

[0054] Fig. 10 shows a referential example in which the comparison of the time attributes cannot adjust to output both of "information 1" and "information 2". In this case, the output information is selected in accordance with a predetermined condition such as the significance level or sequential order of the information.

[0055] Fig. 10 includes items (a) to (d) showing an example of the output arbitration when the attribute relationship between "information 1" and "information 2" is "output period $Ot1 > \text{minimum output period } Nt1 > \text{standby allowed period } St2$." In this case, as shown in item (b) of Fig. 10, "information 2" cannot be output while "information 1" is waiting to be output, and "information 1" cannot be output while "information 2" is waiting to be output. Thus, the output order of "information 2" and then "information 1" is not applicable, and the output order of "information 1" and then "information 2" is not applicable. Here, as shown in item (d) of Fig. 10, when the relationship between "information 1" and "information 2" is " $H(\text{information 1}) > L(\text{information 2})$ " in terms of the significance level, "information 1" is determined to be the provided information having a high priority, and only "information 1" is output. Thus, "information 2" is not output. In this manner, even when the time attributes are compared, information having a high priority or the like may be only output based on the priority levels or the like of "information 1" and "information 2."

[0056] An information output device for a mobile body such as that described above may adjust the output modes of different kinds of information having overlapping output

times so that as many kinds of information as possible are output.

[0057] The present embodiment of the information output device for a mobile body has the advantage described below in addition to advantages (1) to (5) of the first embodiment.

[0058] (6) The output period of information is set to one of the output duration periods Ot1, Ot2, which are longer than the minimum output periods Nt1, Nt2. This increases the recognizability of the output information and allows the user to easily recognize the output information.

[0059] Third Embodiment

[0060] A third embodiment of an information output device for a mobile body will now be described with reference to Fig. 11. The present embodiment differs from the first and second embodiments in that the information category arbitration unit 220 and the output arbitration unit 230 further categorize priority levels. Here, the description will focus on configurations and processes that differ from those of the first and second embodiments. For the sake of simplicity, the same structure and process will not be described in detail.

[0061] As shown in Fig. 11, attributes applied to the provided information include information category (information priority level) including "emergency," "alert, warning," "caution," "feedback (FB) information," "general information," and "past information." "Emergency" is a category of information notifying serious danger or the like. "Alert, warning" is a category of information notifying danger or the like. "Caution" is a category of information notifying an increase in danger or the like. "Feedback (FB) information" is a category of information notifying a response to an operation such as an operation result of the vehicle 10. "General information" is a category of information including provided information that may be selected by the user or the like. "Past information" is a category of information that does not have to be notified in real time such as a driving evaluation result.

[0062] The above information categories are each applied with the corresponding priority level. For example, priority level 5 is applied to "emergency," priority level 4 is applied to "alert, warning," priority level 3 is applied to "caution," priority level 2 is applied to "FB information," priority level 1 is applied to "general information," and priority level 0 is applied to "past information."

[0063] The information category arbitration unit 220 determines that priority levels 5 to 3 are high and that priority levels 2 and 1 are low. Thus, when the information category (information priority level) is "emergency," "alert, warning," or "caution," the information category arbitration unit 220 determines that the provided information is not subject to the output adjustment. When the information category (information priority level) is "FB information" or "general information," the information category arbitration unit 220 determines that the provided information is subject to the output ar-

bitration. The information category arbitration unit 220 performs the output arbitration on "FB information" and "general information." "Past information" does not need to be output in real time. Thus, when the output time of "past information" is overlapped with that of a different kind of information, the "past information" waits to be output and is not subject to the output arbitration.

[0064] When outputting the arbitrated information, the output arbitration unit 230 considers the priority level of the information categories. For example, when "information 1" and "information 2" can each be output and either one can be output first, the information that is to be output first is selected in accordance with the priority level. Additionally, for example, when "information 1" and "information 2" can each be output and have different output periods, the output period is extended in accordance with the priority level. Further, for example, when only one of "information 1" and "information 2" can be output, the provided information that is to be output is selected based on the priority level.

[0065] Thus, the output arbitration is performed so that "information 1" and "information 2" having overlapping output times can both be output based on the comparison of the time attributes and the comparison of the priority level.

[0066] As described above, the present embodiment of the information output device for a mobile body has the advantage described below in addition to advantages (1) to (6) of the first and second embodiments.

[0067] (7) When information having a high priority obtains a longer output period, the recognizability of the information having a high priority is increased.

[0068] Other Embodiments

[0069] Each of the above embodiments may be modified as follows.

[0070] In each embodiment, when the output period of the provided information is the minimum output periods $Nt1$, $Nt2$, the output expression of the provided information is changed to the mode of the simply expressed information. Instead, when the output period of the provided information is shorter than the output duration period, the output expression of the provided information may be changed to the mode of the simply expressed information. This maintains the recognizability of the provided information even when the output period is somewhat shortened.

[0071] In each embodiment, when the output period of the provided information is one of the minimum output periods $Nt1$, $Nt2$, the output expression of the provided information is changed to the mode of the simply expressed information. However, even when the output period of the provided information is the minimum output period, the output mode of the information does not have to be changed from the normal output expression to the mode of the simply expressed information. For example, when the minimum output period is set to a minimum time that allows for the recognition of the

normal output expression, the provided information may be recognized even when the provided information is output in the normal expression for the minimum output period.

- [0072] The attributes may be applied to the provided information Ia to Ie in any manner as long as the attributes can be obtained in correspondence with the provided information. For example, the attributes may be directly applied to the array of data including the provided information Ia to Ie. Alternatively, the attributes may be applied using IDs associated with attributes added to the array of data including the provided information Ia to Ie. Alternatively, the provided information Ia to Ie and the corresponding attributes may be controlled using a list or the like.
- [0073] In each embodiment, in step S11 of Fig. 2, the attribute application unit 211 associates each kind of the provided information Ia to Ie with the information category (information priority level), the standby allowed period, the minimum output period, and the output duration period. However, the provided information needs to be associated with only at least two of the information categories, namely, the standby allowed period and the minimum output period. In this case, in the output order setting process, steps S12 and S13 do not have to be performed. Thus, step 14 may be performed subsequent to step S11.
- [0074] In each embodiment, the information processing unit 200 is an in-vehicle ECU. Instead, the information processing unit may partially or entirely include a portable information processing device such as a smartphone or a mobile phone. For example, the vehicle information may be obtained via a camera incorporated in the smartphone or a near field communication device, and the portable information processing device may select the provided information and display the selected provided information on an incorporated screen.
- [0075] In each embodiment, the mobile body is the vehicle 10. However, the mobile body only needs to have information that is valuable at the right time or right place. For example, the mobile body may be a bicycle, a motorcycle, a railway vehicle, a vessel, or an aircraft.

Claims

- [Claim 1] An information output device for a mobile body, wherein the information output device receives different kinds of information in real time and outputs the information, which is to be provided to a user of the mobile body, the information output device comprising:
an attribute application unit configured to apply an attribute to each kind of information, wherein the attribute includes a standby allowed period, which is a length of time allowed for waiting before the information is output, and a minimum output period, which is a length of a minimum time needed to output the information; and
an output arbitration unit configured to arbitrate output of a first kind of information and output of a second kind of information that have overlapping output times, wherein
the information provided to the user includes the first kind of information and the second kind of information, and
when the standby allowed period that is applied to the second kind of information is longer than the minimum output period that is applied to the first kind of information, the output arbitration unit outputs the first kind of information for at least the minimum output period of the first kind of information and then switches output information from the first kind of information to the second kind of information within the standby allowed period of the second kind of information from when the output of the first kind of information starts.
- [Claim 2] The information output device according to claim 1, wherein
the attribute further includes an output duration period having a length of time that is at least a sum of the standby allowed period and the minimum output period, and
when the output duration period that is applied to the first kind of information is shorter than the standby allowed period of the second kind of information, the output arbitration unit is configured to output the first kind of information for at least the output duration period of the first kind of information and then switch the output information from the first kind of information to the second kind of information within the standby allowed period of the second kind of information from when the output of the first kind of information starts.
- [Claim 3] The information output device according to claim 1 or 2, wherein when an output period of the information provided to the user is the

minimum output period of the information provided to the user, the output arbitration unit is configured to output predetermined simply expressed information, in which the information provided to the user is simply expressed.

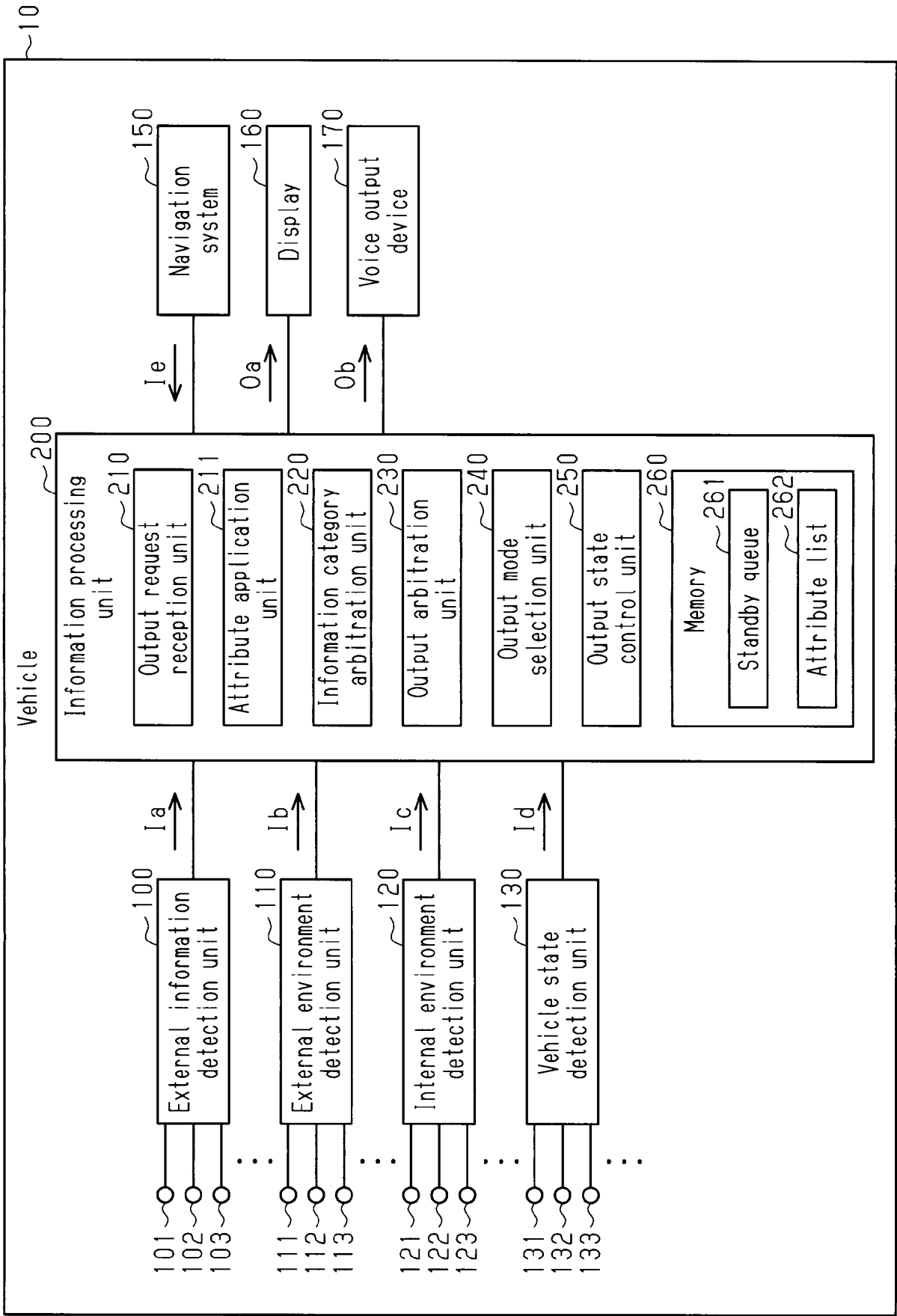
[Claim 4] The information output device according to claim 2, wherein when an output period of the information provided to the user is shorter than the output duration period of the information provided to the user, the output arbitration unit is configured to output predetermined simply expressed information, in which the information provided to the user is simply expressed.

[Claim 5] The information output device according to any one of claims 1 to 4, wherein
the attribute further includes a priority level that indicates a priority order of the corresponding information, and
the output arbitration unit is configured to adjust a time for switching the output information so that information having a higher priority level is output for a longer time.

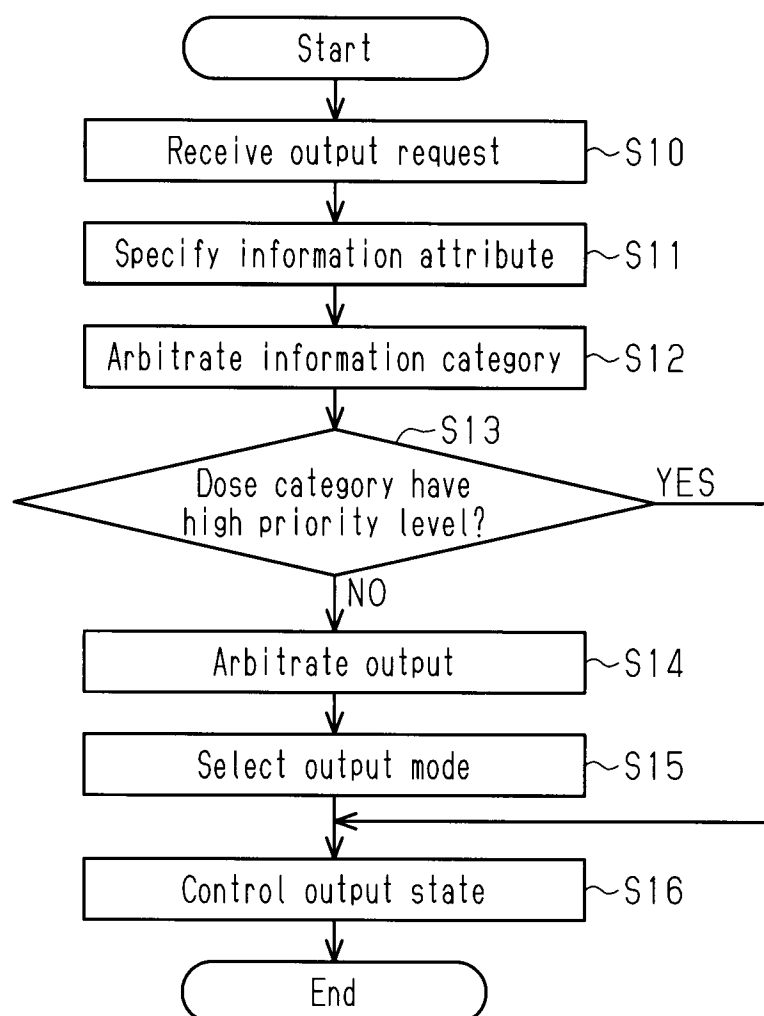
[Claim 6] The information output device according to any one of claims 1 to 4, wherein the output arbitration unit is configured to adjust a time for switching the output information so that information received earlier is output for a longer time.

[Claim 7] The information output device according to any one of claims 1 to 6, wherein the minimum output period has a length of a minimum time needed for the output information provided to the user to be recognized by the user.

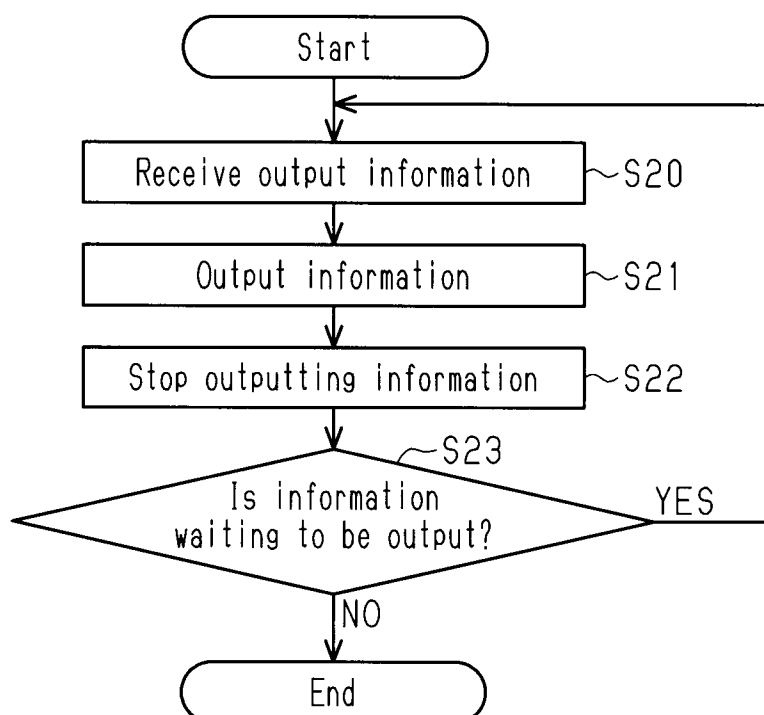
[Fig. 1]



[Fig. 2]

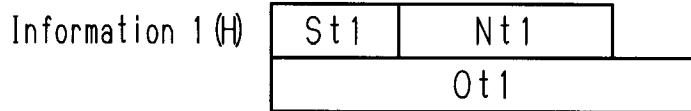


[Fig. 3]

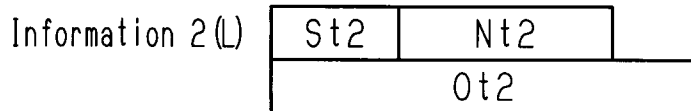


[Fig. 4]

(a)

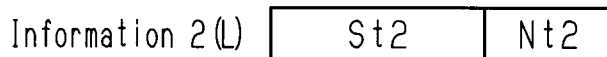
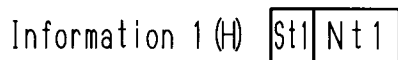


(b)



[Fig. 5]

(a)



(b)

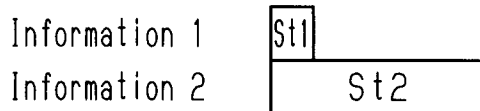
Output order

Information 1 to Information 2 Applicable

Information 2 to Information 1 Not Applicable

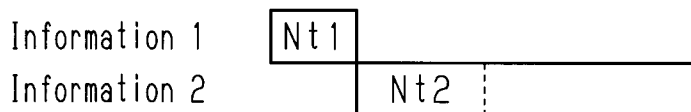
(c)

Standby allowed period, Output duration period



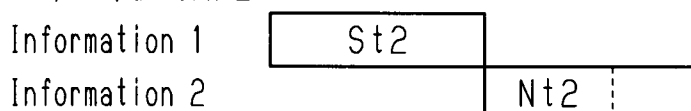
(d)

Output pattern 1



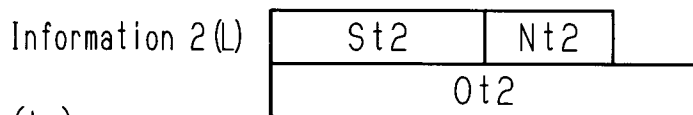
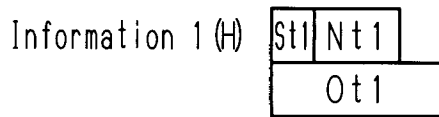
(e)

Output pattern 2



[Fig. 6]

(a)

Condition 1 $O_t1 < S_t2$ 

(b)

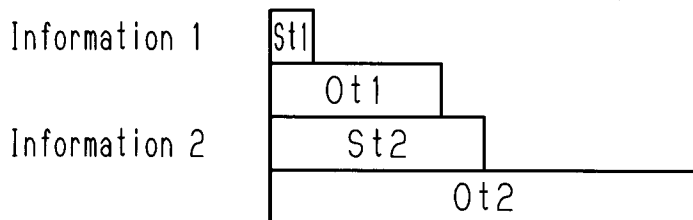
Output order

Information 1 to Information 2 Applicable

Information 2 to Information 1 Not Applicable

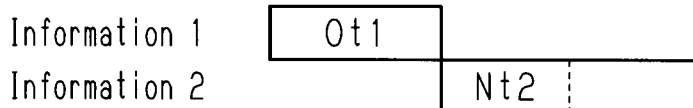
(c)

Standby allowed period, Output duration period



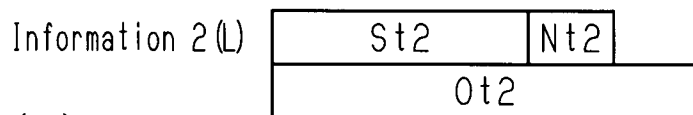
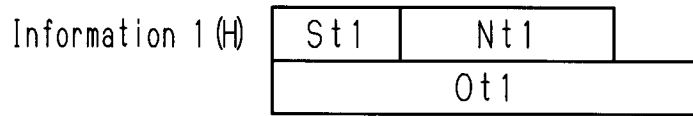
(d)

Output pattern



[Fig. 7]

(a)

Condition 2 $O_t1 > St2 > N_t1$ 

(b)

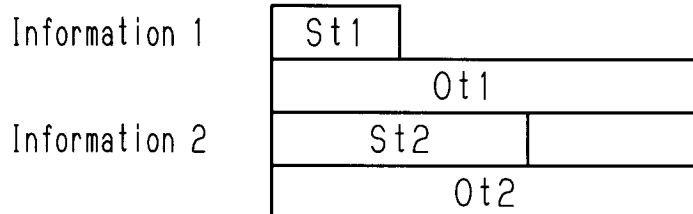
Output order

Information 1 to Information 2 Applicable

Information 2 to Information 1 Applicable (if $St1 \geq N_t2$)Information 2 to Information 1 Not Applicable (if $St1 < N_t2$)

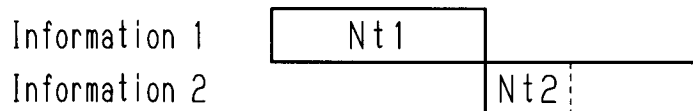
(c)

Standby allowed period, Output duration period



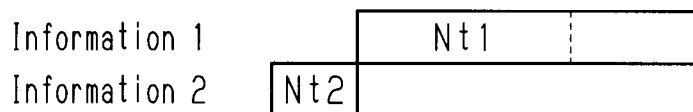
(d)

Output pattern 1



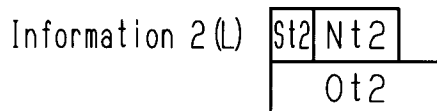
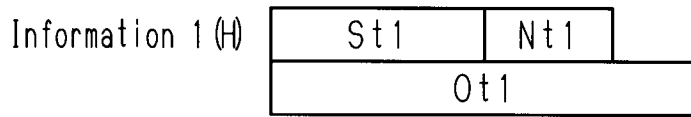
(e)

Output pattern 2



[Fig. 8]

(a)

Condition 3 $O_t2 < S_t1$ 

(b)

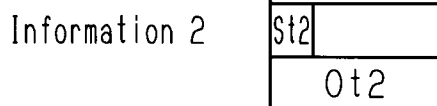
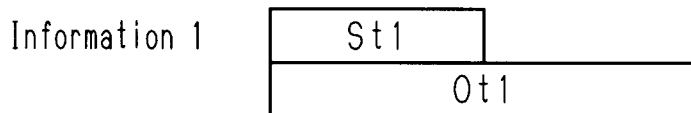
Output order

Information 2 to Information 1 Applicable

Information 1 to Information 2 Not Applicable

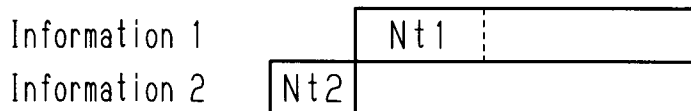
(c)

Standby allowed period, Output duration period



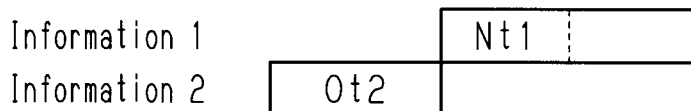
(d)

Output pattern 1



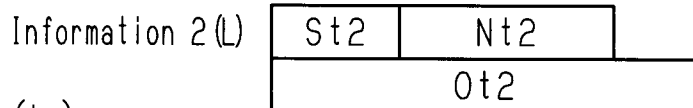
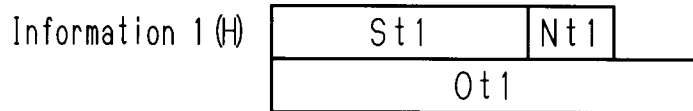
(e)

Output pattern 2



[Fig. 9]

(a)

Condition 4 $O_{t2} > S_{t1} > N_{t2}$ 

(b)

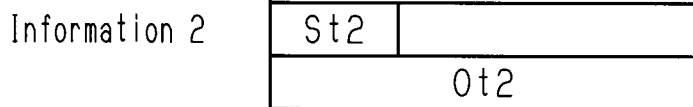
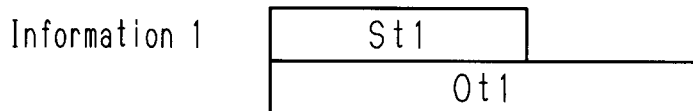
Output order

Information 2 to Information 1 Applicable

Information 1 to Information 2 Applicable (if $N_{t2} \leq S_{t1}$)Information 1 to Information 2 Not Applicable (if $N_{t2} > S_{t1}$)

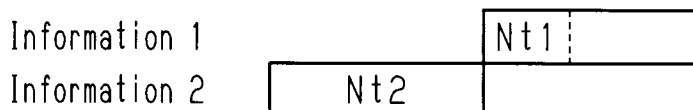
(c)

Standby allowed period, Output duration period



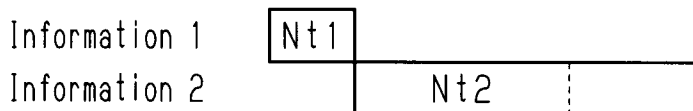
(d)

Output pattern 1



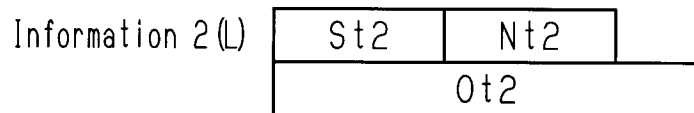
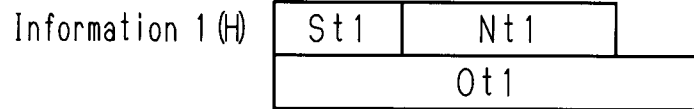
(e)

Output pattern 2



[Fig. 10]

(a)

Condition 5 $O_t1 > S_t2 < N_t1$ $\rightarrow O_t1 > N_t1 > S_t2$ 

(b)

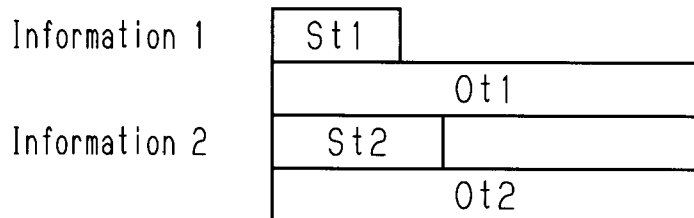
Output order

Information 1 to Information 2 Not Applicable

Information 2 to Information 1 Not Applicable

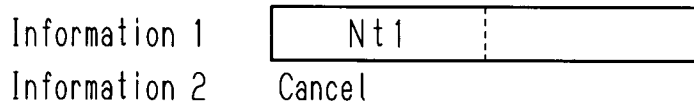
(c)

Standby allowed period, Output duration period



(d)

Output pattern



[Fig. 11]

Information category	Priority level
Emergency	5
Alert, Warning	4
Caution	3
FB information	2
General information	1
Past information	0

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2015/006484

A. CLASSIFICATION OF SUBJECT MATTER INV. G06F3/048 G08G1/09 H04H20/59 G01C21/00 G01C21/36 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) G06F G08G H04H G01C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 208 932 B1 (OHMURA HIROSHI [JP] ET AL) 27 March 2001 (2001-03-27) column 8, line 40 - column 9, line 45; figures 1-9, 70-74 column 11, line 45 - column 12, line 60 column 34, line 26 - column 36, line 15 -----	1-4, 7
X	US 2012/232781 A1 (SUGAWARA HISASHI [JP] ET AL) 13 September 2012 (2012-09-13) paragraph [0046] - paragraph [0057]; figures 2-14 paragraph [0073] - paragraph [0083] paragraph [0090] - paragraph [0102] -----	1, 5, 6
X	WO 2014/111988 A1 (DENSO CORP [JP]) 24 July 2014 (2014-07-24) paragraph [0023] - paragraph [0058]; figures 1-4 -/-	1
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 29 April 2016		Date of mailing of the international search report 18/05/2016
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Toader, Elena Lidia

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2015/006484

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	& US 2015/363155 A1 (HAYASHI YUUICHI [JP] ET AL) 17 December 2015 (2015-12-17) paragraph [0023] - paragraph [0031] paragraph [0038] - paragraph [0044] paragraph [0048] - paragraph [0058] ----- US 2013/038434 A1 (YAMADA YOSHIHISA [JP] ET AL) 14 February 2013 (2013-02-14) paragraph [0089] - paragraph [0097] paragraph [0111] - paragraph [0123] -----	1-7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/JP2015/006484

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			JP	5538069 B2		02-07-2014
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