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

(11) **EP 4 047 166 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.08.2022 Bulletin 2022/34

(21) Application number: **21218389.1**

(22) Date of filing: **30.12.2021**

(51) International Patent Classification (IPC):
E05F 15/71 *(2015.01)*

(52) Cooperative Patent Classification (CPC):
E05F 15/71; E05Y 2400/32; E05Y 2400/81; E05Y 2900/542; E05Y 2900/55

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

(30) Priority: **17.02.2021 JP 2021023671**

(71) Applicant: **TOYOTA JIDOSHA KABUSHIKI KAISHA**
Toyota-shi, Aichi-ken, 471-8571 (JP)

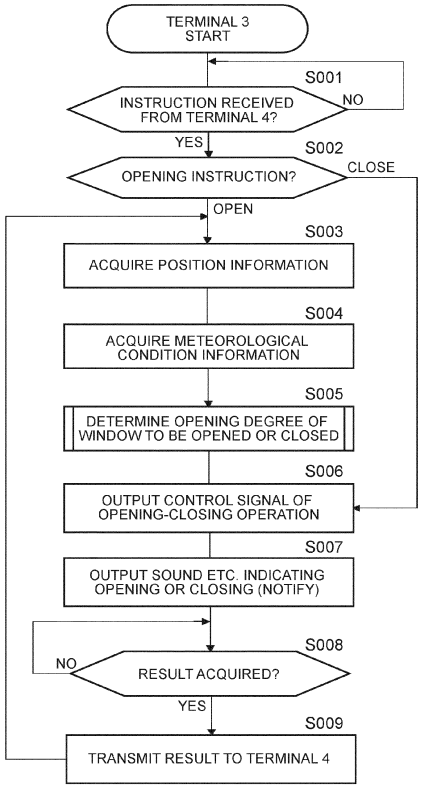
(72) Inventors:
- **KATOH, Tatsunori**
  TOYOTA-SHI, AICHI-KEN, 471-8571 (JP)
- **HADANO, Hiroyasu**
  TOYOTA-SHI, AICHI-KEN, 471-8571 (JP)

(74) Representative: **Cabinet Beau de Loménie**
158, rue de l'Université
75340 Paris Cedex 07 (FR)

(54) INFORMATION PROCESSING DEVICE, INFORMATION PROCESSING METHOD, AND PROGRAM

(57) An information processing device executes: acquiring meteorological condition information that is information indicating a meteorological condition in a geographical area to which a position of a moving body belongs; and controlling an opening degree of a window included in the moving body based on the meteorological condition information.

FIG. 5



EP 4 047 166 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present disclosure relates to an information processing device, an information processing method, and a program.

2. Description of Related Art

[0002] There is a known power window device that can be remotely controlled. At the time of closing the window glass by remote control, the power window device once moves the window glass in the opening direction and then moves the window glass in the closing direction after outputting an alarm sound for a predetermined time (for example, Japanese Unexamined Patent Application Publication No. 2007-016441 (JP 2007-016441 A)).

SUMMARY OF THE INVENTION

[0003] An object of the present disclosure is to provide an information processing device, an information processing method, and a program capable of setting the opening degree of a window included in a moving body to an appropriate opening degree corresponding to a meteorological condition.

[0004] An aspect of the present disclosure provides an information processing device including a control unit that executes: acquiring meteorological condition information that is information indicating a meteorological condition in a geographical area to which a position of a moving body belongs; and controlling an opening degree of a window included in the moving body based on the meteorological condition information.

[0005] Aspects of the present disclosure may include at least one of an information processing method, an information processing system, a program, and a recording medium on which the program is recorded that have the same characteristics as the information processing device.

[0006] According to the present disclosure, the opening degree of the window included in the moving body can be set to an appropriate opening degree corresponding to the meteorological condition.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Features, advantages, and technical and industrial significance of exemplary embodiments of the invention will be described below with reference to the accompanying drawings, in which like signs denote like elements, and wherein:

FIG. 1 shows an example of an information processing system according to an embodiment;
FIG. 2 shows a configuration example of a terminal 3 according to the embodiment;
FIG. 3 shows an example of a data structure of a table;
FIG. 4 shows a configuration example of a terminal 4 of a user;
FIG. 5 is a flowchart showing an example of processing in the terminal 3;
FIG. 6 is a flowchart showing an example of processing in the terminal 3;
FIG. 7 shows an example of a data structure of a vehicle database included in a server 2 in a modification; and
FIG. 8 is a flowchart showing an example of processing in the server 2 in the modification.

DETAILED DESCRIPTION OF EMBODIMENTS

[0008] An information processing device according to an embodiment executes acquiring meteorological condition information that is information indicating a meteorological condition in a geographical area to which a position of a moving body belongs, and controlling an opening degree of a window included in the moving body based on the meteorological condition information.

[0009] With the information processing device, the opening degree of the window included in the moving body is controlled in accordance with the meteorological condition information. Thereby, the opening degree of the window can be controlled (adjusted) to the optimum state in accordance with short-term weather at that time that is indicated by the meteorological condition information. Thus, it is possible to perform ventilation while suppressing objects (rain, snow, leaves, and the like) that may enter the moving body from entering the moving body when the window is open due to the meteorological condition.

[0010] Here, the meteorology indicates changes in the atmosphere such as changes in temperature and atmospheric pressure and phenomena such as rain and snow that result from changes in the atmosphere. The meteorological condition includes short-term weather, long-term weather, and climate. The short-term weather, the long-term weather, and the climate indicate states or conditions such as being clear or rainy, snow, temperature, humidity, and wind speed in an area (geographical area). In addition, the short-term weather, the long-term weather, and the climate are distinguished by length of the period (predetermined period) representing the meteorological condition. In general, the short-term weather indicates meteorological conditions for several hours to several days. The long-term weather is longer than the short-term weather, but indicates meteorological conditions for a relatively short period such as one week or one month. The Japan Meteorological Agency states that the long-term weather represents an average short-term weather condition for about five days to one month. The climate refers to an average meteorological condition for

a long period of one month or more. The climate can also be regarded as a season.

[0011] The moving body includes a vehicle, a train, and the like provided with windows. The windows included in the moving body are windows that can be opened and closed, and the number and installation positions of the windows are not specifically limited.

[0012] The following configuration may be adopted for the information processing device. That is, the control unit sets the opening degree of the window when the meteorological condition information indicates the short-term weather of rainfall or snowfall to be smaller than the opening degree applied to the window in the short-term weather without rainfall or snowfall. Thus, when it is raining or snowing, the opening degree of the window is set to be smaller, which makes it difficult for rain or snow to enter the moving body. Thus, it is possible to suppress the inside of the moving body from getting wet.

[0013] The following configuration may be adopted for the information processing device. That is, the control unit sets the opening degree of the window to be smaller as the amount of rainfall or snowfall increases. The larger the amount of rainfall or snowfall, the easier for the moving body to get wet. Therefore, by setting the opening degree of the window to be smaller, it is possible to suppress the moving body from getting wet.

[0014] The following configuration may be adopted for the information processing device. That is, when the meteorological condition information indicates the short-term weather of rainfall or snowfall, the control unit sets the opening degree of the window provided in a roof of the moving body to be smaller than the opening degree applied to the window provided in the side surface of the moving body. The window provided in the roof is more likely to allow rain or snow to enter the moving body than the window provided in the side surface. Thus, by setting the opening degree of the window provided in the roof to be smaller, it is possible to suppress the inside of the moving body from getting wet.

[0015] The following configuration may be adopted for the information processing device. That is, when the meteorological condition information indicates the climate in which leaf fall occurs, the control unit sets the opening degree of the window to be smaller than the opening degree of the window applied in the climate other than the climate in which leaf fall occurs. By setting the opening degree of the window in the climate (season) in which leaf fall occurs to be smaller, it is possible to suppress the leaves from entering the moving body.

[0016] The following configuration may be adopted for the information processing device. That is, when the meteorological condition information indicates the climate in which leaf fall occurs, the control unit sets the opening degree of the window provided in the roof of the moving body to be smaller than the opening degree applied to the window provided in the side surface of the moving body. The window provided in the roof is more likely to allow leaves to enter the moving body than the window provided in the side surface. Thus, by setting the opening degree of the window provided in the roof to be smaller, it is possible to suppress the leaves from entering the moving body.

[0017] The following configuration may be adopted for the information processing device. That is, the control unit controls the opening degree of the window based on the information indicating the wind speed in the area to which the position of the moving body belongs. The ease of ventilation in the moving body changes depending on the wind speed. Therefore, by controlling (adjusting) the opening degree of the window according to the wind speed, it is possible to set an appropriate opening degree for ventilation. When the wind speed is high, ventilation is possible with a small opening degree. When the opening degree of the window is not set to be larger than necessary, it is possible to suppress people other than the user (other people) and dust from entering the moving body.

[0018] The following configuration may be adopted for the information processing device. That is, the control unit performs control of notifying the inside or outside of the moving body of the information indicating opening or closing of the window when the window is opened or closed. Since people around the moving body can notice the opening and closing of the window, safety can be improved.

[0019] The following configuration may be adopted for the information processing device. That is, the control unit controls the opening degree of the window based on the position information of the moving body. For example, when the position of the moving body is in a place where there are many deciduous trees, entry of leaves can be suppressed by setting the opening degree of the window to be smaller than the opening degree of the window applied in a place where there is no deciduous tree.

[0020] The following configuration may be adopted for the information processing device. That is, the control unit performs control of opening or closing the window based on the meteorological condition information in response to an instruction from the terminal of the user. By opening or closing the window according to the instruction of the user, it is possible to suppress the window from being opened or closed more than necessary. However, the window can be opened or closed automatically by setting a timer or the like.

[0021] The following configuration may be adopted for the information processing device. That is, the control unit transmits the information regarding the result of the control of opening or closing the window to the terminal of the user. The window is not always opened or closed according to the instruction of the user. Therefore, by notifying the user of the result of opening or closing, the user can know the state of the window.

[0022] Hereinafter, the information processing device, the information processing method, and the program according to the embodiment will be described with reference to the drawings. The configuration of the embodi-

ment is illustrative, and the present disclosure is not limited to the configuration of the embodiment.

Configuration of Information Processing System

[0023] FIG. 1 shows an example of an information processing system according to an embodiment. In FIG. 1, the information processing system includes a network 1, and a server 2, a terminal 3, and a terminal 4 that are connected to the network 1.

[0024] The network 1 is, for example, a public communication network such as the Internet, and a wide area network (WAN) or other communication network may be adopted. The network 1 may include a cellular network such as Long Term Evolution (LTE) and 5G, or a wireless network (wireless path) such as a wireless local area network (LAN, including Wi-Fi) and Bluetooth Low Energy (BLE).

[0025] The terminal 3 is a terminal mounted on a vehicle 10 that is an example of the moving body, and can communicate with the server 2 and the terminal 4 via the network 1. The terminal 3 may be an in-vehicle terminal of the vehicle 10, or may be a terminal held by a driver or an occupant of the vehicle 10 at the time of boarding.

[0026] The vehicle 10 is a vehicle owned or managed by a user 11 and includes windows 52 (FIG. 2) that can be opened and closed by a power window device (window glass drive unit 51). For ventilation and the like in the vehicle 10, the user 11 may send an opening or closing instruction of the windows 52 from a position (remote location) away from the vehicle 10 through communication from the terminal 4 of the user 11 to the terminal 3. In response to this instruction, the terminal 3 controls the opening and closing of the windows 52.

[0027] The terminal 4 is a terminal owned or managed by the user 11, and is used for transmitting an instruction to open or close the windows 52 and receiving the result of the instruction. In the remote control of opening or closing the windows 52 using the terminal 4, the vehicle 10 does not necessarily have to be in a stopped state, and may be driven by a driver other than the user 11 or may be moving by autonomous driving.

[0028] The server 2 can be composed of a dedicated or general-purpose information processing device (computer) such as a personal computer (PC), a workstation (WS), or a server machine. The server 2 can communicate with the terminal 3 and the terminal 4 via the network 1 by the communication function. The connection to the network 1 may be wired or wireless. The server 2 may be a single information processing device or a set of two or more information processing devices (cloud). The server 2 may be a fixed terminal or a portable terminal. The server 2 supplies the meteorological condition information corresponding to the position of the vehicle 10 (terminal 3) to the terminal 3 in response to the request from the terminal 3 via the network 1. The meteorological condition information is information indicating the meteorological condition for a predetermined period (at least one of short-term weather, long-term weather, and climate) in the geographical area to which the position of the vehicle 10 (terminal 3) belongs.

Configuration of Terminal 3

[0029] FIG. 2 shows a configuration example of the terminal 3. The terminal 3 is, for example, a portable terminal having a wireless communication function (mobile terminal: a terminal having portability). The portable terminal is, for example, a smartphone, a tablet terminal, a laptop personal computer (PC), a personal digital assistant (PDA), or a wearable computer. However, the terminal 3 may be an in-vehicle terminal fixed (installed) on the vehicle 10.

[0030] The terminal 3 includes a processor 31, a storage device 32, a communication interface (communication IF) 33, an input device 34, a display 35, a Global Positioning System (GPS) receiver 36, a speaker 37, and an interface circuit (IF) 38 that are connected to each other via a bus B.

[0031] The storage device 32 includes a main storage device and an auxiliary storage device. The main storage device is used as at least one of a storage area for programs and data, a deployment area for programs, a work area for programs, and a buffer area for communication data. The main storage device is composed of a random access memory (RAM) or a combination of a RAM and a read only memory (ROM). The auxiliary storage device is used as a storage area for data and programs. A non-volatile storage medium is applied to the auxiliary storage device. The non-volatile storage medium is, for example, a hard disk, a solid state drive (SSD), a flash memory, or an electrically erasable programmable read-only memory (EEPROM). Further, the storage device 22 may include a drive device for a disk recording medium.

[0032] The communication IF 33 is a circuit that performs communication processing. For example, the communication IF 33 is a wireless communication circuit that performs wireless communication (LTE, 5G, wireless LAN (Wi-Fi), BLE, and the like).

[0033] The input device 34 includes keys, buttons, a pointing device, a touch panel, and the like, and is used for inputting information. The display 35 is, for example, a liquid crystal display or the like, and displays information and data. The GPS receiver 36 receives a signal from a GPS satellite and measures position information. The speaker 37 is used for audio output.

[0034] The IF 38 is electrically connected to the window glass drive unit 51 included in the vehicle 10. The window glass drive unit 51 includes a motor drive circuit, an actuator for opening and closing the window glass serving as the window 52, and the like. The window glass drive unit 51 drives and stops the motor with an operation amount corresponding to the opening degree of the window 52 to be opened or closed. The drive instruction of the motor is supplied from the processor 31.

[0035] In the present embodiment, the windows 52 that

can be opened and closed include a window 52a on the side surface at the driver seat, a window 52b on the side surface at the passenger seat, and a window 52c provided in the roof of the vehicle 10. When the windows 52a to 52c are not distinguished from each other, the notation of the windows 52 is used. However, the number and the installation location of the windows 52 can be set as appropriate, and it is not an essential requirement that the roof is provided with the window 52. On the contrary, a case may be included where the roof is provided with the window 52 that can be opened and closed and the side surface is not provided with the window 52 that can be opened and closed. Further, the windows on the side surface at the rear seat and the back surface of the vehicle 10 may be windows to be opened and closed.

[0036] The processor 31 is, for example, a central processing unit (CPU). The CPU is also referred to as a microprocessor unit (MPU). The processor 31 may have a single processor configuration or a multiprocessor configuration. Further, a single physical CPU connected by a single socket may have a multi-core configuration. The processor 31 may include arithmetic devices of various circuit configurations such as a digital signal processor (DSP) or a graphics processing unit (GPU). Further, the processor 31 may have a configuration that cooperates with at least one of an integrated circuit (IC), another digital circuit, an analog circuit, and the like. The integrated circuit includes a large scale integration (LSI), an application-specific integrated circuit (ASIC), a programmable logic device (PLD), and the like. The PLD includes, for example, a field-programmable gate array (FPGA). The processor 31 also includes a so-called microcontroller (MCU), a system-on-a-chip (SoC), a system LSI, a chipset, or the like.

[0037] The processor 31 performs various processes by executing various programs stored in the storage device 32. For example, the processor 31 accesses the server 2 via the network 1 and performs a process of acquiring (receiving) the meteorological condition information of the area to which the position of the vehicle 10 belongs from the server 2. Further, in response to the opening-closing instruction from the terminal 4, the processor 31 performs a process of determining the opening degree of the window 52 to be opened or closed based on the meteorological condition information. The opening-closing instruction is an opening instruction or a closing instruction for one window 52 to be operated.

Configuration of Table

[0038] FIG. 3 shows an example of a data structure of a table stored in the storage device 32 of the terminal 3. The table stores a record including a vehicle ID that is identification information of the vehicle 10, position information of the vehicle 10, information indicating the geographical area to which the position of the vehicle 10 belongs, the meteorological condition information, and information indicating the opening degree of each of the windows 52a, 52b, and 52c. Although the position information of the terminal 3 is used as the position information of the vehicle 10, the position information of the vehicle 10 may be acquired using another GPS receiver provided in the vehicle 10. Further, the position information of the vehicle 10 may be acquired from the network 1 through communication.

[0039] As the meteorological condition information, information indicating the meteorological condition (short-term weather, long-term weather, and climate) in the area is stored. However, it is not necessary to have all of the short-term weather, the long-term weather and the climate, and information of at least one of the short-term weather, the long-term weather, and the climate is sufficient as long as the opening degree can be determined appropriately. The information indicating the short-term weather as the meteorological condition information indicates changes in temperature, humidity, wind speed, and the like for several hours to several days (for example, on the day). The information indicating the long-term weather indicates, for example, an average short-term weather condition of about five days to one month. The information indicating the climate indicates the average state of the meteorology over a long period of one month or more, and includes information indicating the a season, especially the season of leaf fall.

[0040] In addition, the information indicating the opening degree of each of the windows 52a, 52b, and 52c is stored in the table. The storage device 32 includes information indicating the positions in the vehicle 10 (roofs or side surfaces) where the windows 52a, 52b, and 52c are respectively provided, and the opening degree may be determined in consideration of these positions.

Configuration of Terminal 4

[0041] FIG. 4 shows a configuration example of the terminal 4 of the user 11. The terminal 4 is, for example, a portable terminal having a wireless communication function (mobile terminal: a terminal having portability), but may be a fixed terminal.

[0042] The terminal 4 includes a processor 41, a storage device 42, a communication interface (communication IF) 43, an input device 44, and a display 45 that are connected to each other via a bus 46.

[0043] To the processor 41, the storage device 42, the communication IF 43, the input device 44, and the display 45, the same configurations as those described for the processor 31, the storage device 32, the communication IF 33, the input device 34, and the display 35 can be applied. However, the configurations having different performance from those applied to the terminal 3 are applied depending on the difference in usage, purpose of use, and the like. For example, when the terminal 4 is a fixed terminal, the communication IF 43 may be a network interface card (NIC).

Operation Example

Processing of Terminal 3

[0044] In the terminal 3, the processor 31 executes the program stored in the storage device 32. Through the execution of the program, the terminal 3 performs a process of acquiring the meteorological condition information corresponding to the position information of the vehicle 10. Further, in response to the instruction to open or close the window 52 from the terminal 4 of the user 11, the processor 31 determines the opening degree of the window 52 to be opened or closed based on the meteorological condition information, and performs a process of controlling opening-closing operation.

[0045] FIG. 5 is a flowchart showing an example of the processing in the terminal 3. In step S001, the processor 31 of the terminal 3 waits for a message including an opening-closing instruction (opening or closing instruction) of the window 52 from the terminal 4. When the opening-closing instruction is received, the process proceeds to step S002.

[0046] In step S002, the processor 31 determines whether the opening-closing instruction is an opening instruction or a closing instruction with respect to the window 52 to be operated. When it is determined that the opening-closing instruction is an opening instruction, the process proceeds to step S003. When it is determined that the opening-closing instruction is a closing instruction, the process proceeds to step S006.

[0047] In step S003, the processor 31 acquires the position of the terminal 3 (vehicle 10) using a GPS receiver 36 and updates the position information of the table. In step S004, the processor 31 acquires the meteorological condition information. That is, the terminal 3 transmits the position information of the vehicle 10 to the server 2. The server 2 acquires the meteorological condition information corresponding to the position information by reading from the storage device, acquisition through communication, or the like, and transmits the meteorological condition information to the terminal 3. At the terminal 3, the processor 31 acquires the meteorological condition information received from the server 2 through the communication IF 33 and stores the meteorological condition information in the storage device 32.

[0048] In step S005, the opening degree of the window to be opened or closed is determined. FIG. 6 is a flowchart showing an example of a subroutine for determining the opening degree of the window. In step S101, the window 52 to be operated is specified based on the information included in the opening-closing instruction.

[0049] In step S102, it is determined whether the meteorological condition information stored in step S002 and the meteorological condition information stored in the table are the same, that is, whether there is a difference in the meteorological condition information. When it is determined that there is no difference (NO in S102), in step S111, the processor 31 does not update the meteorological condition information in the table, reads from the table the opening degree of the window 52 to be opened or closed that is stored in the table, that is, the opening degree of the window 52 to be opened or closed that is calculated based on the previous meteorological condition information, and determines the read opening degree as an opening degree to be applied at this time. This reduces the load of calculating the opening degree. Then, the process returns to step S006.

[0050] On the other hand, when it is determined that there is a difference (YES in S102), the processor 31 updates the meteorological condition information in the table with the meteorological condition information acquired in step S002. Further, the opening degree of the window 52 (any of the windows 52a to 52c) specified in step S101 is set as an initial value. Here, the initial value of the opening degree indicates the opening degree in the case where it is not necessary to adjust the opening degree in consideration of rainfall or snowfall, leaf fall, a wind speed, and the like.

[0051] In step S104, the processor 31 determines whether it is necessary to adjust the opening degree due to rainfall or snowfall. That is, the processor 31 determines whether the information indicating the short-term weather in the meteorological condition information indicates the short-term weather of rainfall or snowfall. At this time, when it is determined that the information indicates the short-term weather of rainfall or snowfall, the process proceeds to step S105; otherwise, the process proceeds to step S106.

[0052] In step S105, the processor 31 sets the value of the opening degree to be smaller than the initial value, with the minimum opening degree (determined in advance) of the window 52 specified in step S101 set as a limit. The amount of decrease (adjustment amount) in opening degree at this time can be appropriately set, and the adjustment amount is determined in advance and stored in the storage device 32. The adjustment amount is set to such an amount that the opening degree of the window 52 in the case where the meteorological condition information indicates the short-term weather of rainfall or snowfall becomes smaller than the opening degree applied to the window 52 in the short-term weather without rainfall or snowfall.

[0053] The processor 31 may be configured to select an opening degree to be applied from a plurality of adjustment opening degrees prepared in advance in the storage device 32 and the like such that the opening degree becomes smaller as the amount of rainfall or snowfall included in the meteorological condition information increases.

[0054] Further, when the meteorological condition information indicates the short-term weather of rainfall or snowfall, the processor 31 may set the opening degree of the window 52c provided in the roof of the vehicle 10 to be smaller than the opening degree applied to the window 52a or 52b provided in the side surface of the vehicle 10, based on the position information of the windows 52

stored in the storage device 32.

[0055] In step S106, the processor 31 determines whether it is necessary to adjust the opening degree due to leaf fall. That is, the processor 31 determines whether the information indicating the short-term weather, the long-term weather, and the climate included in the meteorological condition information is information indicating the occurrence of leaf fall (first determination). For example, it is determined whether the information indicating the climate is information indicating the season of leaf fall.

[0056] Further, the processor 31 determines whether the position of the vehicle 10 belongs to a place with a large amount of leaf fall using the information indicating a place with a large amount of lead fall such as the inside or the vicinity of a deciduous forest that is stored in the storage device 32 and the like (second determination).

[0057] When at least one of the first and second determinations is YES, that is, when it is determined that the meteorological condition is a meteorological condition in which leaf fall occurs or the vehicle 10 is located in a place with a large amount of leaf fall, the process proceeds to step S107; otherwise, the process proceeds to step S108. As described above, in the present embodiment, the processor 31 controls the opening degree of the window 52 based on the position information of the vehicle 10. In the present embodiment, an example in which the first and second determinations are made is shown, but at least one of the first and second determinations may be made.

[0058] In step S107, the processor 31 reduces the opening degree from the initial value by the adjustment amount determined in advance in accordance with leaf fall as in step S105, with the minimum opening degree set as the limit. That is, when the meteorological condition information indicates the climate in which leaf fall occurs, the processor 31 sets the opening degree of the window 52 to be smaller than the opening degree of the window 52 applied in the climate other than the climate in which leaf fall occurs.

[0059] Further, when the meteorological condition information indicates the climate in which leaf fall occurs and the window 52 to be opened or closed is the window 52c on the roof of the vehicle 10, the processor 31 may set the opening degree of the window 52c to be smaller than the opening degree applied to the window 52a or 52b on the side surface of the vehicle 10.

[0060] In step S108, the processor 31 determines whether it is necessary to adjust the opening degree due to the wind speed in the area to which the position of the vehicle 10 belongs. That is, the processor 31 refers to, for example, information indicating the wind speed that is included as the short-term weather information in the meteorological condition information, to determine whether the wind speed exceeds a threshold value.

[0061] When it is determined that the wind speed exceeds the threshold value, the process proceeds to step S109; otherwise, the process proceeds to step S110. A plurality of threshold values for the wind speed and an adjustment amount of the opening degree corresponding to each of the threshold values may be prepared such that the opening degree becomes smaller as the wind speed increases.

[0062] In step S109, the processor 31 reduces the opening degree from the initial value by the adjustment amount determined in advance as in step S105, with the minimum opening degree set as the limit.

[0063] In step S110, the processor 31 determines the opening degree at this point as a final opening degree, and ends the subroutine. The order of the processes of steps S104 and S105, the processes of steps S106 and S107, and the processes of steps S108 and S109 can be changed as appropriate.

[0064] With reference to FIG. 5, in step S006, the processor 31 outputs a control signal for opening-closing operation. In the case of an opening instruction, the processor 31 obtains a control amount (motor drive amount) corresponding to the opening degree of the window 52 calculated in step S005, and supplies a control signal indicating the drive amount to the window glass drive unit 51. In the case of a closing instruction, the processor 31 obtains a control amount for closing the window 52 (making the opening degree 0%), and supplies a control signal indicating the control amount to the window glass drive unit 51. The window glass drive unit 51 drives a motor based on the control amount to cause the window glass to open or close. As a result, the window 52 is opened or closed.

[0065] In step S007, when the window 52 is opened or closed, the processor 31 outputs a sound indicating opening or closing of the window 52 from the speaker 37 to at least one of the inside and the outside of the vehicle 10. Thus, the person in or around the vehicle 10 is notified of opening or closing of the window.

[0066] In step S008, the processor 31 waits for the acquisition of information indicating the result of the opening or closing operation from the window glass drive unit 51. For example, the processor 31 receives a signal or information indicating OK or NG of the opening or closing operation from the window glass drive unit 51, or receives a signal or information indicating NG (error) in the case of NG.

[0067] In step S009, the processor 31 performs a process of transmitting the information regarding the result of the control of opening or closing the window 52 to the terminal 4 of the user 11. That is, the processor 31 generates information indicating success (OK) or failure (NG) of the opening or closing operation in accordance with the signal or information obtained from the window glass drive unit 51, and transmits the information to the terminal 4 using the communication IF 33. As described above, in the present embodiment, the processor 31 performs the control of opening or closing the window 52 based on the meteorological condition information in response to the instruction from the terminal 4 of the user 11. Then, the processor 31 transmits the information regarding the

result of the control of opening or closing the window 52 to the terminal 4 of the user 11.

Effects of Embodiment

[0068] With the terminal 3 serving as the information processing device according to the embodiment, the opening degree of the window 52 included in the vehicle 10 is controlled in accordance with the meteorological condition information. Thereby, the opening degree of the window can be controlled (adjusted) to the optimum state in accordance with the short-term weather at that time that is indicated by the meteorological condition information. Thus, it is possible to perform ventilation while suppressing objects (rain, snow, leaves, and the like) that may enter the vehicle 10 from entering the vehicle 10 when the window 52 is open due to the meteorological condition.

Modifications

[0069] In the above-described embodiment, an example is shown in which the processor 31 of the terminal 3 operates as the "control unit of the information processing device". Instead of this configuration, a configuration (modification) in which the server 2 determines the opening degree of the window 52 instead of the terminal 3 may be adopted.

[0070] In the modification, the server 2 may have the same configuration as that of the terminal 4 shown in FIG. 4. The storage device 42 of the server 2 is configured to store a vehicle database (vehicle DB) as shown in FIG. 7. The vehicle DB is configured to store information in the record stored in the table of the terminal 3 regarding one or more vehicles (including the vehicle 10). In this case, the processor 41 of the server 2 performs the processing as shown in FIG. 8. In this way, the server 2 can centrally manage information on a plurality of vehicles.

[0071] In FIG. 8, the server 2 (processor 41) waits for the reception of the opening-closing instruction of the window 52 from the terminal 4 (S001). When receiving the opening-closing instruction, the server 2 determines whether the opening-closing instruction is an opening instruction or a closing instruction for the window 52 that is specified by the opening-closing instruction (S002). In the case of an opening instruction, the server 2 performs the same processes as of steps S003 to S005 described above.

[0072] The server 2 performs the process of step S006A instead of step S006. That is, the server 2 transmits the opening degree of the window 52 to be opened or closed (the opening degree obtained in S005 in the case of an opening instruction, the opening degree of 0% in the case of a closing instruction) to the terminal 3.

[0073] After that, the server 2 waits for the acquisition of the information indicating the result of the opening-closing operation from the terminal 3, and when acquiring the information indicating the result, the server 2 transmits (transfers) the information to the terminal 4. In this case, the terminal 3 does not perform the processes of steps S001 to S005 among the processes of FIG. 5, and when receiving the information indicating the opening degree of the window 52 to be opened or closed from the server 2, the processor 31 performs the processes of steps S005 to S009 shown in FIG. 5. However, in the modification, in step S009, the result is transmitted to the server 2 instead of the terminal 4. In this way, the server 2 may be operated as the "information processing device".

Others

[0074] The above-described embodiment is merely an example, and the present disclosure may be appropriately modified and implemented without departing from the scope thereof.

[0075] Further, the processes described as being executed by one device may be shared and executed by a plurality of devices. Alternatively, the processes described as being executed by different devices may be executed by one device. In the computer system, it is possible to flexibly change the hardware configuration (server configuration) for realizing each function.

[0076] The present disclosure can also be implemented by supplying a computer with a computer program that implements the functions described in the above embodiment and causing one or more processors of the computer to read and execute the program. Such a computer program may be provided to the computer by a non-transitory computer-readable storage medium connectable to the system bus of the computer, or may be provided to the computer via a network. The non-transitory computer-readable storage medium is a disc of any type such as a magnetic disc (floppy (registered trademark) disc, hard disk drive (HDD), and the like) and an optical disc (CD-ROM, DVD, Blu-ray disc, and the like). Further, the non-transitory computer-readable medium includes a read-only memory (ROM), a random access memory (RAM), an EPROM, an EEPROM, a magnetic card, a flash memory, an optical card, and a medium of any type that is appropriate for storing electrical commands.

Claims

1. An information processing device comprising a control unit (31) that executes acquiring meteorological condition information that is information indicating a meteorological condition in a geographical area to which a position of a moving body (10) belongs, and controlling an opening degree of a window (52) included in the moving body based on the meteorological condition information.

2. The information processing device according to claim 1, wherein the control unit (31) sets the opening degree of the window (52) when the meteorological condition information indicates short-term weather of rainfall or snowfall to be smaller than the opening degree applied to the window in short-term weather without rainfall or snowfall.

3. The information processing device according to claim 2, wherein the control unit (31) sets the opening degree of the window (52) to be smaller as an amount of rainfall or snowfall increases.

4. The information processing device according to any one of claims 1 to 3, wherein when the meteorological condition information indicates short-term weather of rainfall or snowfall, the control unit sets (31) the opening degree of the window (52c) provided in a roof of the moving body (10) to be smaller than the opening degree applied to the window (52a, 52b) provided in a side surface of the moving body.

5. The information processing device according to any one of claims 1 to 4, wherein when the meteorological condition information indicates climate in which leaf fall occurs, the control unit sets (31) the opening degree of the window (52) to be smaller than the opening degree of the window applied in climate other than the climate in which leaf fall occurs.

6. The information processing device according to any one of claims 1 to 5, wherein when the meteorological condition information indicates climate in which leaf fall occurs, the control unit (31) sets the opening degree of the window (52c) provided in a roof of the moving body to be smaller than the opening degree applied to the window (52a, 52b) provided in a side surface of the moving body.

7. The information processing device according to any one of claims 1 to 6, wherein the control unit (31) controls the opening degree of the window (52) based on information indicating a wind speed in an area to which the position of the moving body (10) belongs.

8. The information processing device according to any one of claims 1 to 7, wherein the control unit (31) performs control of notifying an inside or an outside of the moving body (10) of information indicating opening or closing of the window (52) when the window is opened or closed.

9. The information processing device according to any one of claims 1 to 8, wherein the control unit (31) controls the opening degree of the window (52) based on position information of the moving body (10).

10. The information processing device according to any one of claims 1 to 9, wherein the control unit (31) performs control of opening or closing the window (52) based on the meteorological condition information in response to an instruction from a terminal (4) of a user.

11. The information processing device according to claim 10, wherein the control unit (31) transmits information regarding a result of the control of opening or closing the window (52) to the terminal (4) of the user.

12. An information processing method, wherein an information processing device executes:

acquiring meteorological condition information that is information indicating a meteorological condition in a geographical area to which a position of a moving body (10) belongs; and
controlling an opening degree of a window (52) included in the moving body based on the meteorological condition information.

13. The information processing method according to claim 12, wherein the information processing device sets the opening degree of the window (52) when the meteorological condition information indicates short-term weather of rainfall or snowfall to be smaller than the opening degree applied to the window in short-term weather without rainfall or snowfall.

14. The information processing method according to claim 13, wherein the information processing device sets the opening degree of the window (52) to be smaller as an amount of rainfall or snowfall increases.

15. The information processing method according to any one of claims 12 to 14, wherein when the meteorological condition information indicates short-term weather of rainfall or snowfall, the information processing device sets the opening degree of the window (52c) provided in a roof of the moving body to be smaller than the opening degree applied to the window (52a, 52b) provided in a side surface of the moving body (10).

16. The information processing method according to any one of claims 12 to 15, wherein when the meteorological condition information indicates climate in which leaf fall occurs, the information processing device sets the opening degree of the window (52) to be smaller than the opening degree of the window applied in climate other than the climate in which leaf fall occurs.

17. A program that causes a computer to execute:

acquiring meteorological condition information that is information indicating a meteorological condition in a geographical area to which a position of a moving body (10) belongs; and
controlling an opening degree of a window (52) included in the moving body based on the meteorological condition information.

18. The program according to claim 17, wherein the program causes the computer to perform control of setting the opening degree of the window (52) when the meteorological condition information indicates short-term weather of rainfall or snowfall to be smaller than the opening degree applied to the window in short-term weather without rainfall or snowfall.

19. The program according to claim 18, wherein the program causes the computer to perform control of setting the opening degree of the window (52) to be smaller as an amount of rainfall or snowfall increases.

20. The program according to any one of claims 17 to 19, wherein when the meteorological condition information indicates short-term weather of rainfall or snowfall, the program causes the computer to perform control of setting the opening degree of the window (52c) provided in a roof of the moving body (10) to be smaller than the opening degree applied to the window (52a, 52b) provided in a side surface of the moving body.

FIG. 1

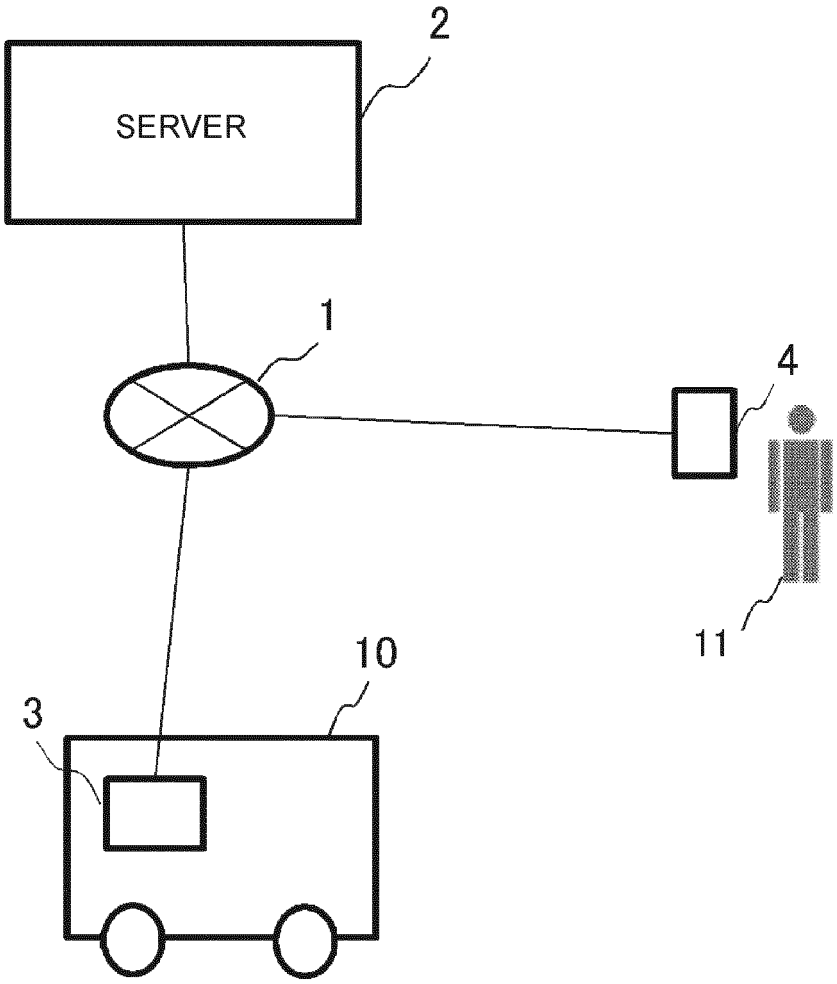


FIG. 2

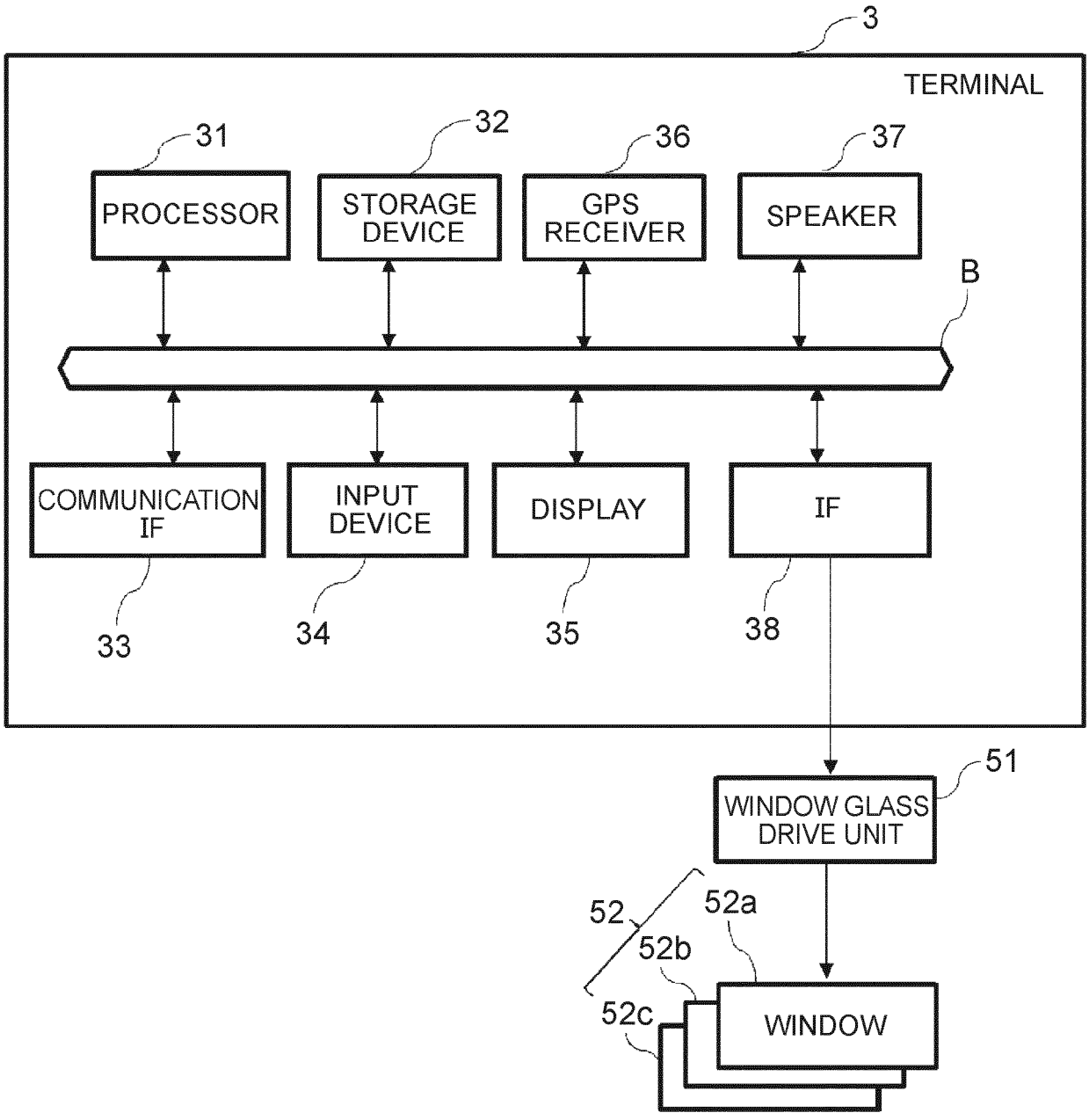

3
TERMINAL
31
PROCESSOR
32
STORAGE DEVICE
36
GPS RECEIVER
37
SPEAKER
B
COMMUNICATION IF
INPUT DEVICE
DISPLAY
IF
33
34
35
38
51
WINDOW GLASS DRIVE UNIT
52
52a
52b
52c
WINDOW

FIG. 3

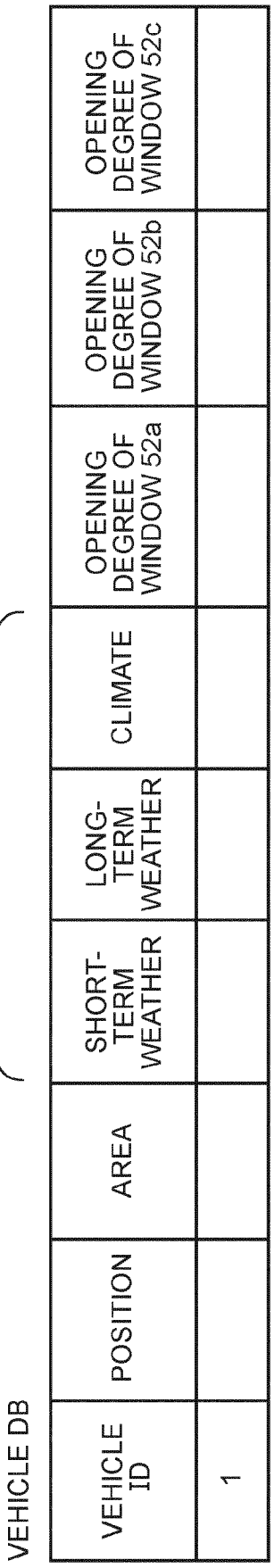

VEHICLE DB
METEOROLOGICAL CONDITION INFORMATION
VEHICLE ID
POSITION
AREA
SHORT-TERM WEATHER
LONG-TERM WEATHER
CLIMATE
OPENING DEGREE OF WINDOW 52a
OPENING DEGREE OF WINDOW 52b
OPENING DEGREE OF WINDOW 52c
1

FIG. 4

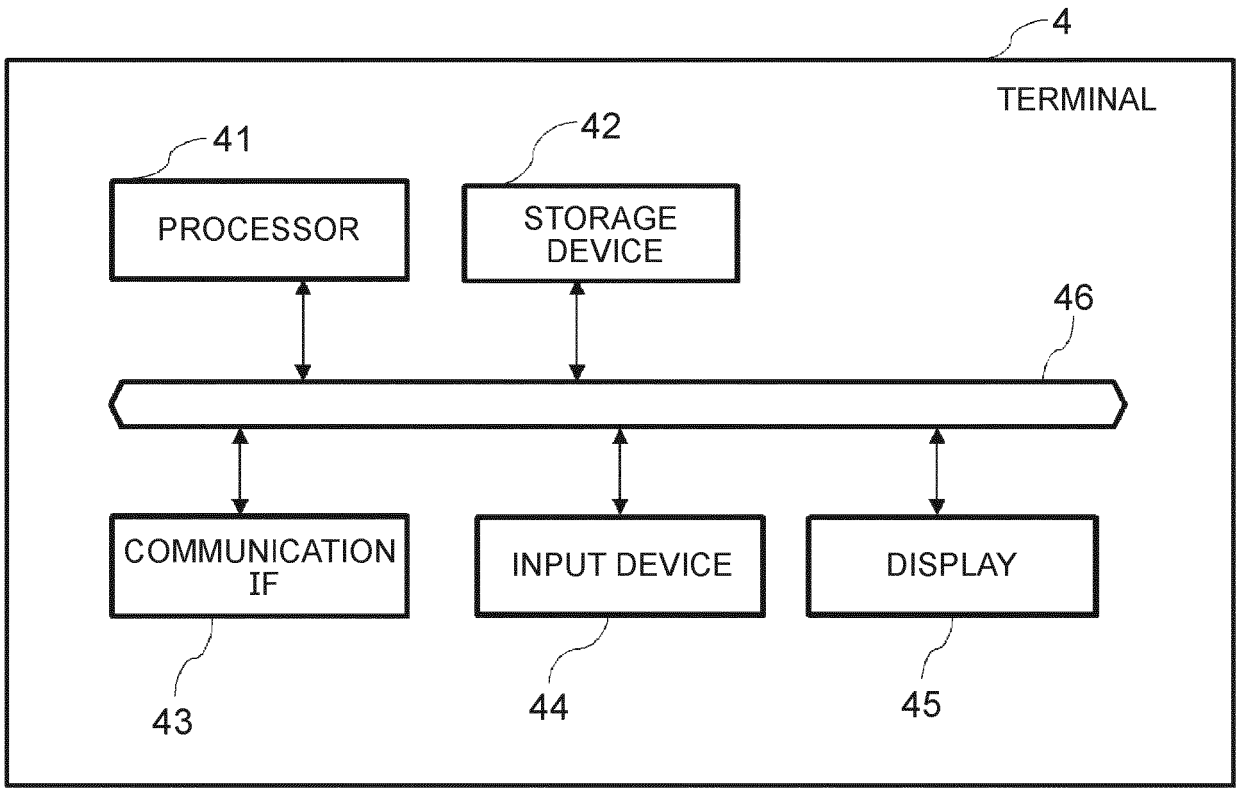

4
TERMINAL
41
PROCESSOR
42
STORAGE DEVICE
46
COMMUNICATION IF
INPUT DEVICE
DISPLAY
43
44
45

FIG. 5

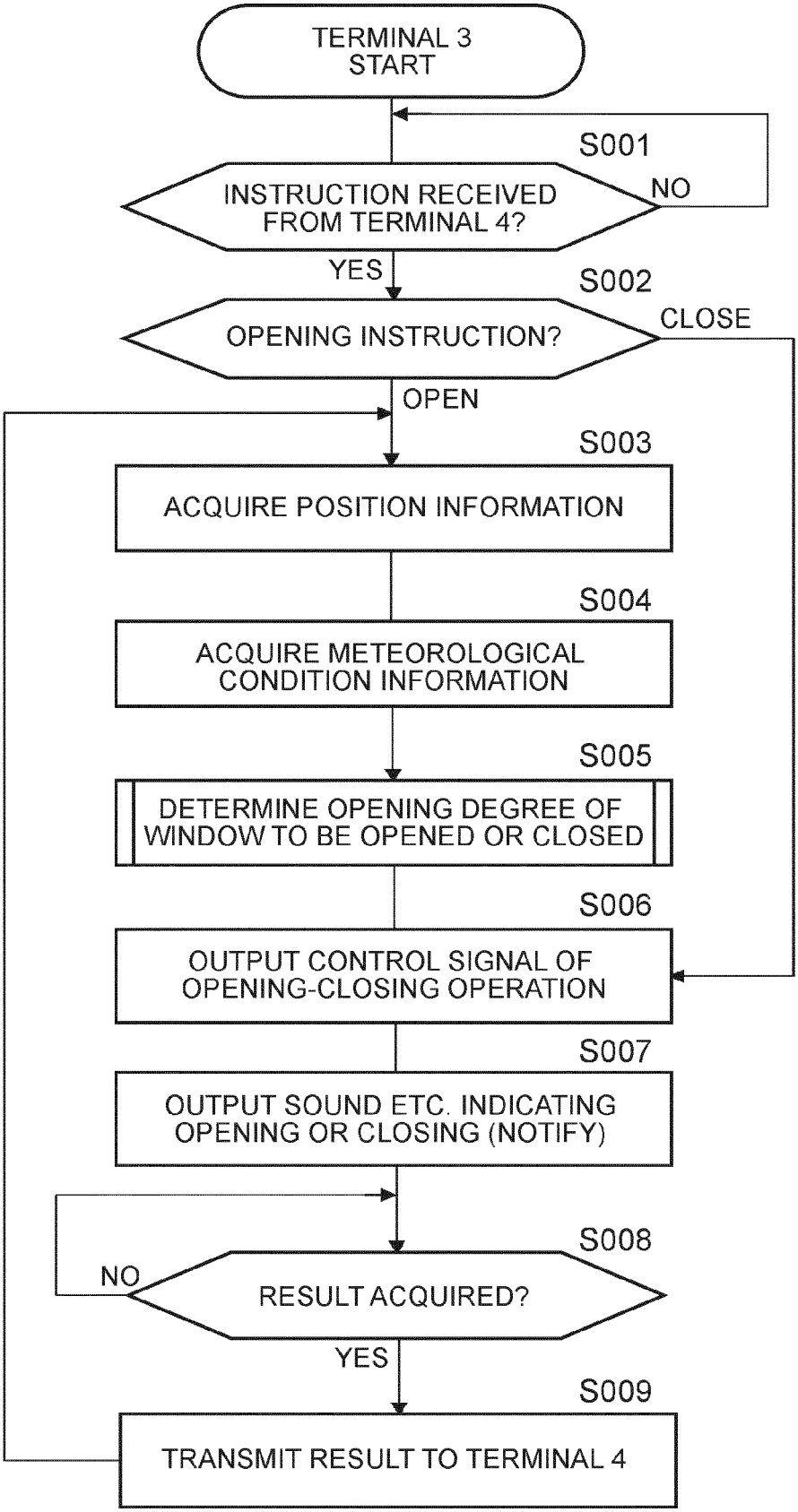

TERMINAL 3
START
S001
INSTRUCTION RECEIVED FROM TERMINAL 4?
NO
YES
S002
OPENING INSTRUCTION?
CLOSE
OPEN
S003
ACQUIRE POSITION INFORMATION
S004
ACQUIRE METEOROLOGICAL CONDITION INFORMATION
S005
DETERMINE OPENING DEGREE OF WINDOW TO BE OPENED OR CLOSED
S006
OUTPUT CONTROL SIGNAL OF OPENING-CLOSING OPERATION
S007
OUTPUT SOUND ETC. INDICATING OPENING OR CLOSING (NOTIFY)
S008
NO
RESULT ACQUIRED?
YES
S009
TRANSMIT RESULT TO TERMINAL 4

FIG. 6

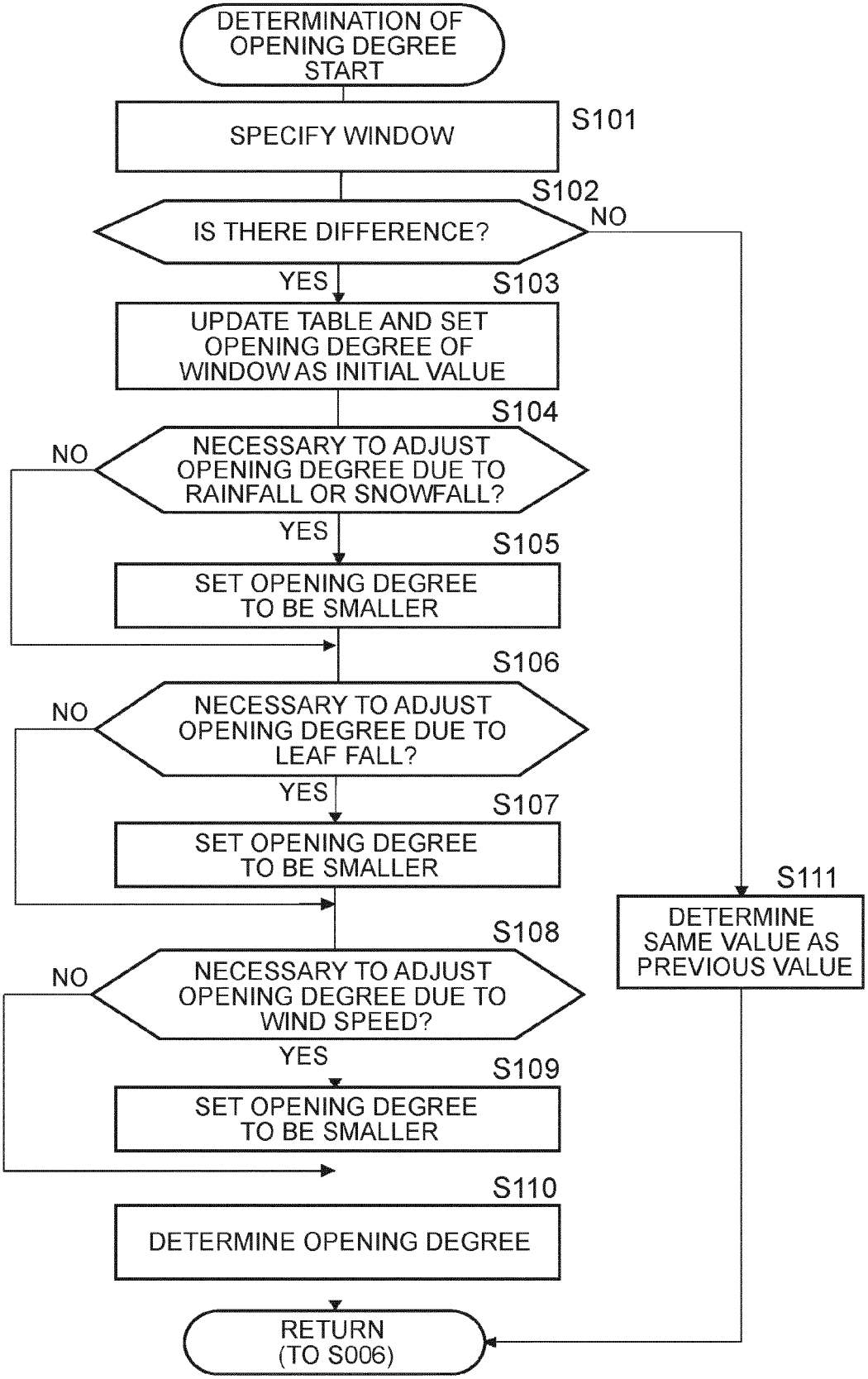

DETERMINATION OF OPENING DEGREE START
SPECIFY WINDOW
S101
S102
IS THERE DIFFERENCE?
NO
YES
S103
UPDATE TABLE AND SET OPENING DEGREE OF WINDOW AS INITIAL VALUE
S104
NO
NECESSARY TO ADJUST OPENING DEGREE DUE TO RAINFALL OR SNOWFALL?
YES
S105
SET OPENING DEGREE TO BE SMALLER
S106
NO
NECESSARY TO ADJUST OPENING DEGREE DUE TO LEAF FALL?
YES
S107
SET OPENING DEGREE TO BE SMALLER
S108
NO
NECESSARY TO ADJUST OPENING DEGREE DUE TO WIND SPEED?
YES
S109
SET OPENING DEGREE TO BE SMALLER
S110
DETERMINE OPENING DEGREE
S111
DETERMINE SAME VALUE AS PREVIOUS VALUE
RETURN (TO S006)

FIG. 7

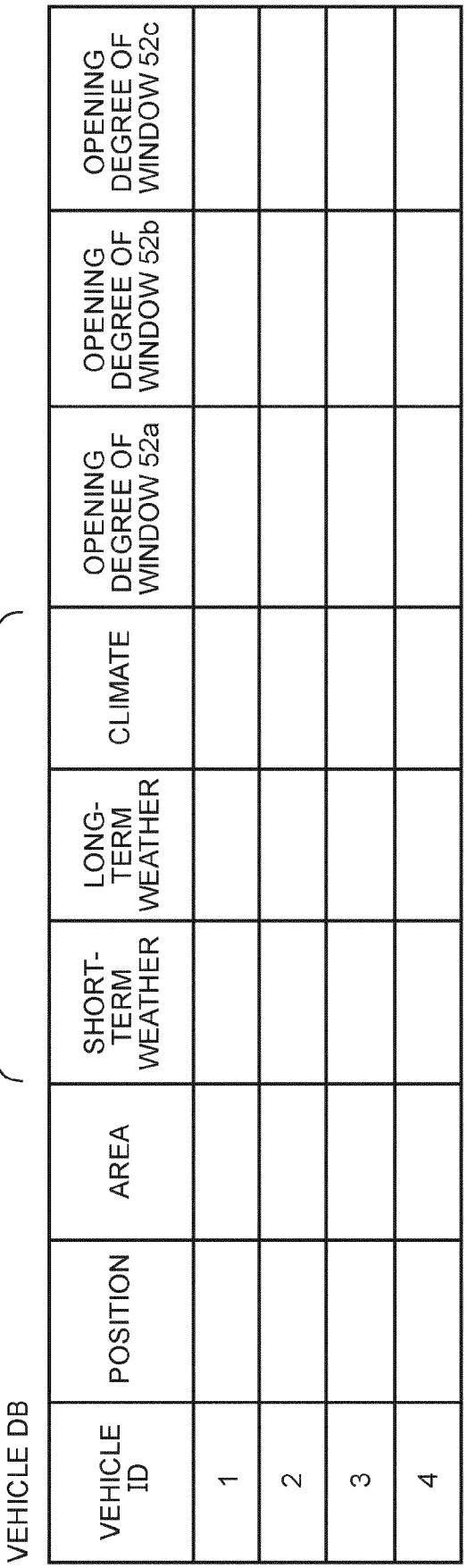
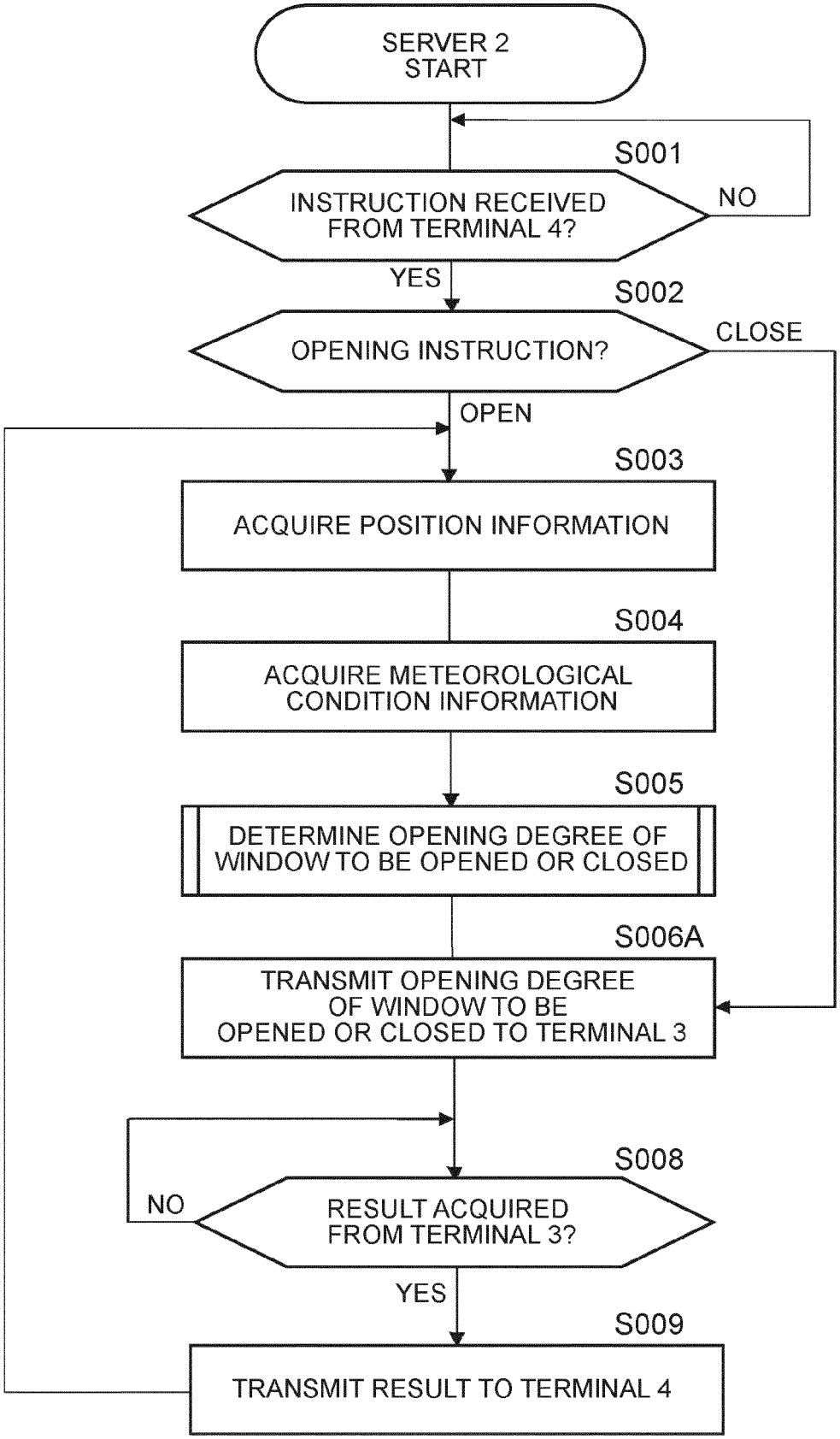

VEHICLE DB
METEOROLOGICAL CONDITION INFORMATION
VEHICLE ID
POSITION
AREA
SHORT-TERM WEATHER
LONG-TERM WEATHER
CLIMATE
OPENING DEGREE OF WINDOW 52a
OPENING DEGREE OF WINDOW 52b
OPENING DEGREE OF WINDOW 52c
1
2
3
4
...

FIG. 8


SERVER 2
START
S001
INSTRUCTION RECEIVED FROM TERMINAL 4?
NO
YES
S002
OPENING INSTRUCTION?
CLOSE
OPEN
S003
ACQUIRE POSITION INFORMATION
S004
ACQUIRE METEOROLOGICAL CONDITION INFORMATION
S005
DETERMINE OPENING DEGREE OF WINDOW TO BE OPENED OR CLOSED
S006A
TRANSMIT OPENING DEGREE OF WINDOW TO BE OPENED OR CLOSED TO TERMINAL 3
S008
NO
RESULT ACQUIRED FROM TERMINAL 3?
YES
S009
TRANSMIT RESULT TO TERMINAL 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 21 8389

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	CN 110 836 067 B (ANHUI JIANGHUAI AUTOMOBILE GROUP CORP LTD) 20 October 2020 (2020-10-20) * paragraphs [0050], [0071] - [0091], [0097] - [0100], [0105] *	1-3, 8-14, 17-19 5,6,16, 20	INV. E05F15/71
X Y	KR 2015 0080930 A (HYUNDAI MOBIS CO LTD [KR]) 13 July 2015 (2015-07-13) * paragraphs [0005] - [0006], [0015] *	1,2,12, 13,17,18 5,6,16, 20	
X	DE 10 2015 016535 A1 (DAIMLER AG [DE]) 9 June 2016 (2016-06-09) * paragraphs [0022] - [0023], [0027] - [0031]; figures *	1,2,4,6, 10,12, 13,15, 17,18,20	
X	US 2021/032922 A1 (HERMAN DAVID MICHAEL [US] ET AL) 4 February 2021 (2021-02-04) * paragraph [0041]; claim 1 *	1,2,7, 12,13, 17,18	TECHNICAL FIELDS SEARCHED (IPC) E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 May 2022	Witasse-Moreau, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 21 8389

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

31-05-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 110836067 B	20-10-2020	NONE	
KR 20150080930 A	13-07-2015	NONE	
DE 102015016535 A1	09-06-2016	NONE	
US 2021032922 A1	04-02-2021	CN 112302470 A	02-02-2021
		DE 102020120084 A1	04-02-2021
		US 2021032922 A1	04-02-2021

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2007016441 A **[0002]**