

DESCRIPTION

INPUT DEVICE, VEHICLE ENVIRONMENT MONITORING APPARATUS, ICON
SWITCH SELECTION METHOD, AND PROGRAM

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Technical Field

[0001] The present invention relates to an input device, a vehicle environment monitoring apparatus, an icon switch selection method, and a program. Particularly, the present invention relates to an input device for selecting an icon switch to enter a desired instruction, a vehicle environment monitoring apparatus comprising the input
10 device, an icon switch selection method for selecting an icon switch displayed on a screen, and a program used with a controller controlling a display device displaying information.

Background Art

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[0002] A navigation device mounted on a vehicle such as an ordinary car or a vehicle environment monitoring apparatus monitoring the environment of a vehicle is operated generally by making a selection among multiple icon switches displayed on a screen via a remote operation device such as a remote controller or a touch panel.

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[0003] In some of the above kind of devices, a remote operation device provided with a selection switch such as a joystick is used to place an instruction marker such as a pointer displayed on the screen on a desired icon switch so as to select the icon switch. To do so, the user has to watch the screen carefully for a certain amount of time while operating the device.

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[0004] Then, recently, from the viewpoint of reducing the user workload, various methods for assisting the user operation in moving an instruction marker onto an icon switch to reduce the amount of time for which the user has to watch the screen carefully have been proposed (for example, Patent Literature 1 to 3).

Prior Art Documents

Patent Literatures

[0005] Patent Literature 1: Unexamined Japanese Patent Application KOKAI
Publication No. 2004-252760;

5 Patent Literature 2: Unexamined Japanese Patent Application KOKAI
Publication No. H10-240445; and

Patent Literature 3: Unexamined Japanese Patent Application KOKAI
Publication No. H8-87395.

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Disclosure of Invention

Problem to be Solved by the Invention

[0006] The method described in the Patent Literature 1 makes the user operating the
remote operation means feel a resistance force according to an icon switch corresponding
to the position of the instruction marker when the user moves the instruction marker to a
15 desired icon switch.

[0007] The method described in the Patent Literature 2 moves the instruction marker
onto an icon switch when the instruction marker is located in a region including the icon
switch on the screen. The method described in the Patent Literature 3 calculates the
distance between each icon switch and the instruction marker on the screen and moves the
20 instruction marker to the nearest icon switch.

[0008] However, in the above methods, when the user tries to position the instruction
marker on any one of the icon switches on the screen, the user has to be aware of the
position of the instruction marker even in the region between icon switches on the screen.

[0009] The present invention is invented in view of the above circumstances and a
25 first exemplary object of the present invention is to provide an input device for easily
entering a desired instruction in a short time.

[0010] A second exemplary object of the present invention is to provide an easily

operable vehicle environment monitoring apparatus.

[0011] A third exemplary object of the present invention is to provide an icon switch selection method for easily selecting a desired icon switch in a short time.

[0012] A fourth exemplary object of the present invention is to provide a program
5 to be executed by a controller controlling a display screen for easily selecting a desired icon switch in a short time.

Means for Solving the Problem

[0013] The input device according to a first exemplary aspect of the present invention is an input device for entering instructions into a given device, characterized
10 by comprising: a display means (18) defining an invisible pointer moving on a screen according to input from an external source and displaying multiple icon switches corresponding to the instructions and to which processing contents different from each other are assigned in multiple regions defined by dividing the screen on a one-by-one basis; a selection means (17) selecting the icon switch displayed in the region
15 containing the position of the pointer, even if the position of the pointer is not moved to the icon switch provided that the position of the pointer is contained in one of the multiple regions; and an output means (17) outputting a signal indicating the icon switch selected by the selection means (17).

[0014] The sizes of the regions may be defined according to the frequencies of use
20 of the icon switches displayed. The icon switches may be displayed in parts of the regions.

[0015] The vehicle environment monitoring apparatus (10) according to a second exemplary aspect of the present invention is a vehicle environment monitoring apparatus (10) for monitoring vehicle environment, characterized by comprising the
25 above input device and an imaging means (15) capturing images of the vehicle environment, wherein the display means (18) displays images captured by the imaging means (15) on the screen of the input device in a superimposed manner on the icon switches.

[0016] The icon switch selection method according to a third exemplary aspect of
30 the present invention is an icon switch selection method for selecting one of multiple icon switches displayed on a screen, characterized by including the following steps: defining an invisible pointer moving on a screen according to input from an external source; displaying multiple icon switches to which processing contents different from each other are assigned in multiple regions defined by dividing the screen on a one-by-
35 one basis; and selecting the icon switch displayed in the region containing the position

of the pointer, even if the position of the pointer is not moved to the icon switch provided that the position of the pointer is contained in one of the multiple regions. The icon switches may be displayed in parts of the regions.

[0017] The program according to a fourth exemplary aspect of the present invention is a program that allows a controller controlling a display device displaying information characterized by executing the following procedures: defining an invisible pointer moving on a screen according to input from an external source; displaying multiple icon switches to which processing contents different from each other are assigned in multiple regions defined by dividing the screen on a one-by-one basis; and selecting the icon switch displayed in the region containing the position of the pointer, even if the position of the pointer is not moved to the icon switch provided that the position of the pointer is contained in one of the multiple regions. The icon switches may be displayed in parts of the regions.

Effect of the Invention

[0018] A desired instruction can easily be entered in a short time. Furthermore, the amount of time for which the user has to carefully watch the screen on which multiple icon switches are displayed can be reduced.

Brief Description of Drawings

[0019] [FIG. 1] A block diagram of a navigation device according to an embodiment of the present invention;
 [FIG. 2] A plane view of the display device;
 [FIG. 3] A flowchart for explaining the vehicle environment monitoring procedure executed by the controller;
 [FIG. 4] An illustration showing a screen displayed while the imaging device is operated;

[FIG. 5] An illustration for explaining the icon switch selection method; and

[FIG. 6] An illustration showing a modified embodiment of a screen displayed while the imaging device is operated.

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Best Mode for Carrying Out the Invention

[0020] An embodiment of the present invention will be described hereafter with reference to FIGS. 1 to 5. A navigation device 100 is a device mounted on a vehicle such as an ordinary car. As shown in FIG. 1, the navigation device 100 according to this embodiment has a remote operation device 20 outputting infrared or other radio signals modulated in accordance with input from the user and a system body 10 operating based on the signals output from the remote operation device 20.

[0021] The system body 10 includes an interface 11, an information receiver 12, a location detection sensor 13, an external memory 14, an imaging device 15, an information storage 16, a controller 17, a display device 18, and an audio output device 19.

[0022] The interface 11 receives radio signals output from the remote operation device 20, converts the received radio signals to electric signals, and outputs them to the controller 17.

[0023] The information receiver 12 receives signals from satellites carrying the GPS (global positioning system) and outputs the current location information of a vehicle carrying the navigation device 100, the current time, and so on to the controller 17. Here, the information receiver 12 may include a VICS (vehicle information and communication system) information receiver obtaining traffic information using FM multiple broadcasting, radio beacon, or optical beacon, and/or a communication device capable of information communication with ATIS (advanced traffic information service) and other information centers and other vehicles via an information communication terminal such as a cell-phone.

[0024] The location detection sensor 13 includes various sensors such as earth magnetic sensors, gyro sensors, and vehicle speed sensors. The location detection sensor 13 detects the quantity of change in the position as the vehicle moves and outputs information including the detected quantity of change to the controller 17.

5 [0025] The external memory 14 is used to record information including map information, such as destination data and registered points data used for route search and route guidance. The external memory 14 can be, for example, an optical disc such as a CD (compact disc) and DVD (digital versatile disc), hard disc, or flash memory.

[0026] The imaging device 15 has, for example, a pair of cameras provided on the
10 vehicle door mirrors or side mirrors and outputs image information captured by the cameras to the controller 17.

[0027] The information storage 16 is composed of, for example, a SDRAM (synchronous dynamic random access memory) or HDD (hard disc drive) and stores various programs for route search, route guidance, and vehicle environment monitoring
15 with the use of the above-mentioned data stored in the external memory 14.

Furthermore, the information storage 16 successively stores, for example, information containing operation contents entered by the user and history information such as information containing vehicle travel routes.

[0028] The display device 18 is composed of, for example, a liquid crystal display
20 and displays information supplied from the controller 17. As shown in FIG. 2, the display device 18 has a rectangular screen 18a. For example, an X-Y coordinate system having the point of origin (0, 0) at the bottom left corner in FIG. 2 is defined on the screen 18a. A position on the screen is identified by the coordinate values ranging from the point of origin (0, 0) to the coordinates (x_m , y_m) at the top right corner.

25 [0029] Returning to FIG. 1, the audio output device 19 is composed of a speaker or the like and produces audio output of information such as route guidance supplied from the controller 17.

[0030] The controller 17 is composed of a CPU (central processing unit) or the like. The controller 17 executes programs stored in the information storage 16 for route search and route guidance and outputs the results to the display device 18 and audio output device 19.

5 [0031] The remote operation device 20 comprises, for example, a joystick and multiple push buttons including a selection button. Operating the joystick provided to the remote operation device 20, the user can select a function of the navigation device 100 or enter a destination and search conditions into the controller 17 via the interface 11.

[0032] The operation method of the navigation device 100 having the above
 10 configuration will be described hereafter. When the navigation device 100 is activated, the controller 17 executes various programs stored in the information storage 16 and obtains the current location of the vehicle based on the location information supplied from the information receiver 12. Then, the controller 17 corrects the obtained current location based on, for example, information from the location detection sensor 13. The
 15 display device 18 displays the corrected current location along with map information on the screen 18a. Here, for example, multiple icon switches 18b₁ to 18b₆ including an icon switch 18b₁ for monitoring the vehicle environment and a pointer P for making a selection among the multiple icon switches 18b₁ to 18b₆ are displayed on the screen 18a of the display device 18. The icon switches 18b₁ to 18b₆ and pointer P are displayed on
 20 the screen 18a of the display device 18 under the control of the controller 17.

[0033] Here, in order for the user to monitor the vehicle environment using the imaging device 15, he/she operates the joystick of the remote operation device 20 to move the pointer P and place it on the icon switch 18b₁. The icon switch 18b₁ is an icon for starting monitoring the vehicle environment. Then, in this state, he/she presses down the
 25 selection button of the remote operation device 20. In response to that, the controller 17 executes programs shown in the flowchart in FIG. 3 to start monitoring the vehicle environment.

[0034] First, in the first Step 101, the controller 17 displays an initial screen as shown in FIG. 4 on the screen 18a of the display device 18. As shown in FIG. 4, the initial screen is composed of a vehicle environment image captured by the imaging device 15, an icon switch 1, and an icon switch 2. As shown in FIG. 4, when the initial screen is displayed, two regions, a region A1 and a region A2, are defined on the screen 18a.

The icon switches 1 and 2 are displayed in the regions A1 and A2, respectively.

[0035] In this embodiment, there is no visible borderline to divide the screen into the regions A1 and A2. For example, the controller 17 defines the region A1 as a rectangular region ranging from the point of origin (0, 0) to the coordinates (x_1 , y_m) and the region A2 as a rectangular region ranging from the coordinates (x_1+1 , 0), which has the X-coordinate value greater than the coordinates (x_1 , y_m) by 1 unit, to the coordinates (x_m , y_m), whereby the entire range of the screen is assigned to one of the regions (the regions A1 and A2 in this case).

[0036] In this state, the controller 17 defines an invisible virtual pointer P' (the virtual pointer P' hereafter) at any position on the screen, for example, at the center of the screen. The virtual pointer P' is invisible to the user; however, it moves on the screen according to position information output from the remote operation device 20.

[0037] In the next Step 102, the controller 17 detects the coordinates (x, y) of the position of the virtual pointer P' defined on the screen 18a of the display device 18 and determines whether the position coordinates (x, y) are in the range from (0, 0) to (x_1 , y_m), in other words whether the position coordinates of the pointer P' are in the region A1. The controller 17 proceeds to Step 103 if the determination turns out to be affirmative while it proceeds to Step 104 if the determination turns out to be negative.

[0038] In Step 103, the controller 17 selects the icon switch 1 displayed in the region A1. On the other hand, in Step 104, the controller 17 selects the icon switch 2 displayed in the region A2. In the navigation device 100 of this embodiment, the selected icon switch is displayed in a color different from the display color before the selection or

highlighted with thick outline so that it is immediately obvious. In this way, the user can easily identify the selected icon switch.

[0039] In the next Step 105, the controller 17 determines whether position information is received from the remote operation device 20. The position information
5 contains information on the coordinates (x, y) identifying a position on the screen. With the user operating the joystick provided to the remote operation device 20, the position information is output from the remote operation device 20. For easier understanding, the coordinates information output from the remote operation device 20 and received by the controller 17 is termed the received coordinates (x, y) hereafter. If the determination
10 turns out to be affirmative in Step 105, in other words if the position information containing the received coordinates (x, y) is received, the controller 17 moves the virtual pointer P' to the position on the screen corresponding to the received coordinates (x, y) and returns to Step 102. The procedures of Steps 102 to 105 are repeated until the determination turns out to be negative in Step 105.

15 [0040] On the other hand, if the determination turns out to be negative in Step 105, the controller 17 proceeds to the next Step 106.

[0041] In Step 106, the controller 17 determines whether the selection button provided to the remote operation device 20 is pressed down. This determination is made, for example, by determining whether a given signal output from the remote operation
20 device 20 is received.

[0042] If the determination turns out to be negative in Step 106, the controller 17 returns to Step 102 and repeats a series of procedures of Steps 102 to 106 until the determination turns out to be affirmative in Step 106. In this way, with the user operating the joystick, the virtual pointer P' moves, for example, from the region A1 to
25 the region A2 along an arrow Ya shown in FIG. 5. Then, as the virtual pointer P' moves, the icon switch 1 displayed in the region A1 having contained the virtual pointer P' is deselected and the icon switch 2 displayed in the region A2 containing the moved virtual

pointer P' is newly selected. On the other hand, in the case wherein the virtual pointer P' moves from the region A2 to the region A1, the icon switch 2 displayed in the region A2 having contained the virtual pointer P' is deselected and the icon switch 1 displayed in the region A1 containing the moved virtual pointer P' is newly selected as the virtual
 5 pointer P' moves.

[0043] On the other hand, if the determination turns out to be affirmative in Step 106, the controller 17 shifts to the next Step 107.

[0044] In step 107, the controller 17 outputs to the display device 18 a signal indicating the icon switch that is selected when the selection button of the remote
 10 operation device 20 is pressed down and starts a procedure corresponding to the icon switch. Then, after completing the procedure, the controller 17 returns to Step 101.

[0045] In the subsequent processing, screens corresponding to the procedure in Step 107 are displayed on the screen 18a of the display 18. Then, operating the remote operation device 20, the user selects an icon switch corresponding to each process and
 15 displayed on the screen 18a as appropriate so as to execute various operations of the imaging device 15, whereby he/she can view images captured by the imaging device 15 on the screen 18a.

[0046] In order to discontinue the operation of the imaging device 15, an icon switch assigned to discontinuation of the operation of imaging device 15 is displayed on the
 20 screen 18a of the display device 18 so that the user can select that icon switch.

[0047] As described above, in this embodiment, the screen 18a of the display device 18 is divided into two regions A1 and A2 and the icon switch displayed in the region containing the virtual pointer P' is selected. In this way, either the icon switch 1 or the icon switch 2 displayed on the screen 18a is selected at any time. Then, for example
 25 unlike in conventional devices, the user does not have to watch the screen carefully and perform an operation for moving an instruction marker such as a visible pointer to a desired icon switch. Therefore, the user can easily select a desired icon switch in a short

time. Furthermore, in this way, the user can enter a desired instruction without watching the screen carefully for a large amount of time. Therefore, the workload of the user can be reduced.

[0048] Furthermore, in this embodiment, no visible instruction marker such as a pointer is displayed on the screen 18a of the display device 18 while the imaging device 15 is operated. The visibility of an image captured by the imaging device 15 and displayed on the screen 18a is not obstructed, whereby the visibility of a display object displayed on the screen is improved. Furthermore, the system body 10 is operated based on the virtual pointer even while the vehicle environment is monitored. In this way, the user can monitor the vehicle environment without any strange feeling and with the same operability as navigation in which a visible pointer is used for operating the device.

[0049] In this embodiment, the remote operation device 20 outputs information including the coordinates (x, y) of the virtual pointer P'. However, the remote operation device 20 is not restricted thereto and can be configured to output signals including information for increasing/decreasing the coordinates of the current position of the virtual pointer P'. In such a case, with the X-coordinate value and Y-coordinate value of the virtual pointer P' being increased/decreased, the virtual pointer P' successively moves on the screen 18a of the display device 18 in accordance with instructions from the user.

Then, the icon switch in the region containing the position of the virtual pointer P' is selected in sequence.

[0050] Furthermore, the remote operation device 20 of this embodiment comprises a joystick and a selection button. However, the remote operation device 20 is not restricted thereto and can comprise a jog dial, direction keys, a cross-shaped button, and so on in place of a joystick. What matters is that the remote operation device 20 is configured to have the capability of outputting the position information of the virtual pointer P' or increasing/decreasing the coordinates of the position of the virtual pointer P'.

[0051] Furthermore, in this embodiment, the remote operation device 20 and system body 10 communicate by means of wireless signals (for example, infrared light).

However, the remote operation device 20 and system body 10 are not restricted thereto and can electrically be connected by a cable and communicate via the cable. This is a
5 kind of wired remote controller excluding touch panel type operation devices.

[0052] Furthermore, in this embodiment, the screen 18a of the display device 18 is divided into two regions so that two regions are defined on the screen 18a as shown in FIG. 5. However, as shown in FIG. 6, it is possible to divide the screen 18a into three or more regions and display icon switches 1 to 3 in the respective regions. Also in such a
10 case, the icon switch displayed in the region containing the position of the virtual pointer P' is selected at any time; the user can easily select a desired icon switch and, consequently, the amount of time for which the user watches the screen carefully can be reduced.

[0053] Furthermore, the size of a region in which an icon switch is displayed can be
15 determined according to the frequency of use and/or importance of the displayed icon switch. In this way, a frequently used icon switch is more easily selected, further reducing the operation load of the user. In such a case, for example, the controller 17 takes the statistics of frequency of use of icon switches, stores them in the information storage 16, and changes the sizes of icon switches based on the statistics. For example,
20 if two icon switches are used with a frequency ratio of 7:3, the controller 17 creates the regions in which the two icons are displayed with a size ratio of 7:3.

[0054] Furthermore, a resistance force can be applied to the joystick of the operation device when a different icon switch is selected. In this way, the user can easily recognize that a different icon switch is selected, whereby the user can select a desired
25 icon switch with higher accuracy. Here, a technique for applying a resistance force to the joystick of the remote operation device 20 is described in detail, for example, in Patent Literature 1 (Unexamined Japanese Patent Application KOKAI Publication No.

2004-252760). More specifically, when the virtual pointer P' has moved from a region to which the currently selected icon switch belongs to another region in which a desired icon switch is displayed, a force (resistance force) to return the joystick of the remote operation device 20 tilted by the user to the neutral position is applied. In this way, 5 operating the joystick according to the resistance force, the user can easily move the virtual pointer to the region containing a desired icon switch and simply select the desired icon switch. Alternatively, the user can continue to tilt the joystick against the resistance force so as to move the virtual pointer to another region.

[0055] Furthermore, in this embodiment, the virtual pointer P' is used. However, it 10 is possible that no virtual pointer is defined and the controller determines the coordinates of a position at which an intrinsically visible pointer is displayed and selects the icon switch in the region containing the position on the screen corresponding to the recognized coordinate values.

[0056] Furthermore, the icon switch selection method and input device described in 15 this embodiment are suitable not only for vehicle environment monitoring apparatuses but also for environment monitoring apparatuses used with other mobile means.

Furthermore, besides environment monitoring apparatuses, they are also suitable for selection of icon switches displayed on a rear monitor and an in-vehicle camera display screen.

20 [0057] In some cases, the icon switch selection method and input device according to the present invention can be used for selecting an icon switch displayed on screens in the course of vehicle navigation, such as a screen for entering a destination and other conditions for route search and a screen displaying a map and the current location for route guidance. Also in such cases, the user can easily select a desired icon switch and, 25 consequently, the amount of time for which the user watches the screen carefully can be reduced. Furthermore, deterioration in the visibility of a screen due to an instruction marker such as an icon displayed on the screen can be avoided.

[0058] The present application is based on Japanese Patent Application No. 2008-300197 filed on November 25, 2008, of which the specification, scope of claims, and drawings are entirely incorporated herein by reference.

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Industrial Applicability

[0059] The input device according to the present invention is suitable for various input devices.

Description of Reference Numerals

10 [0060]

- 1 to 3 ... icon switch
- 10 ... system body
- 11 ... interface
- 12 ... information receiver
- 15 13 ... location detection sensor
- 14 ... external memory
- 15 ... imaging device (imaging means)
- 16 ... information storage
- 17 ... controller (selection means, processing means, control means)
- 20 18 ... display device (display means)
- 18a ... screen
- 18b ... icon switch
- 19 ... audio output device
- 20 ... remote operation device
- 25 100 ... navigation device
- A1, A2 ... region
- P ... pointer

P' ... virtual pointer

CLAIMS

1. An input device for entering instructions into a given device, characterized by comprising:

a display means (18) defining an invisible virtual pointer moving on a screen according to input from an external source and displaying multiple icon switches corresponding to the instructions and to which processing contents different from each other are assigned in parts of multiple regions defined by dividing the screen on a one-by-one basis for each of the multiple regions;

a selection means (17) selecting the icon switch displayed in the region containing the position of the pointer, even if the position of the pointer is not moved to the icon switch provided that the position of the pointer is contained in one of the multiple regions; and

a processing means (17) capable of starting a process of outputting information containing a processing content assigned to the icon switch selected by the selection means (17) to the given device even if the pointer does not overlap with the icon switch, wherein

the entire area of the screen is assigned to any one of the multiple regions.

2. The input device according to Claim 1, characterized in that the sizes of the regions are defined according to the frequencies of use of the icon switches displayed.

3. A vehicle environment monitoring apparatus (10) for monitoring vehicle environment, characterized by comprising:

the input device according to Claim 1; and

an imaging means (15) capturing images of the vehicle environment, wherein

the display means (18) displays images captured by the imaging means (15) on the screen of the input device in a superimposed manner on the icon switches.

4. An icon switch selection method for selecting one of multiple icon switches displayed on a screen, characterized by including the following steps:

defining an invisible virtual pointer moving on a screen according to input from an external source;

displaying multiple icon switches to which processing contents different from each other are assigned in parts of multiple regions on a one-by-one basis for each of the multiple regions, the multiple regions being defined by dividing the screen such that the

entire area of the screen is assigned to any one of the multiple regions;

selecting the icon switch displayed in the region containing the position of the pointer, even if the position of the pointer is not moved to the icon switch provided that the position of the pointer is contained in one of the multiple regions; and

5 outputting information containing a processing content assigned to the selected icon switch to a given device even if the pointer does not overlap with the icon switch.

5. A program that allows a controller controlling a display device displaying information, characterized by executing the following procedures:

10 defining an invisible virtual pointer moving on a screen according to input from an external source;

displaying multiple icon switches to which processing contents different from each other are assigned in part of multiple regions on a one-by-one basis for each of the multiple regions, the multiple regions being defined by dividing the screen such that the entire area of the screen is assigned to any one of the multiple regions;

15 selecting the icon switch displayed in the region containing the position of the pointer, even if the position of the pointer is not moved to the icon switch provided that the position of the pointer is contained in one of the multiple regions; and

outputting information containing a processing content assigned to the selected icon switch to a given device even if the pointer does not overlap with the icon switch.