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DESCRIPTION

SCREEN CREATION SUPPORT DEVICE

5 Field

[0001] The present invention relates to a screen
creation support device that supports creation of a
monitoring screen where a status information item about a
device to be controlled is displayed in cases where a
10 control device controls the device to be controlled
according to a control program.

Background

[0002] In cases where a control device controls devices
15 to be controlled according to a control program, a
conventional screen creation support device that has been
proposed supports creation of a monitoring screen where
status information items about the devices to be controlled
are displayed. The control device is, for example, a
20 programmable logic controller. The device to be controlled
is, for example, a machining device or a ventilator.
Examples of a status of the device to be controlled include
temperature of the machining device and an on or off
position of the ventilator. The conventional screen
25 creation support device creates, on a screen editing screen
for creating the monitoring screen, status display fields
where status information items about the devices to be
controlled are displayed, and assigns a label included in
the control program to the status display field according
30 to an instruction from an operator of the screen creation
support device (refer to, for example, Patent Literature 1
or 2).

Citation List

Patent Literatures

[0003] Patent Literature 1: PCT International

5 Publication No. 2011/089688

Patent Literature 2: Japanese Patent No. 5295464

Summary

Technical Problem

10 [0004] The conventional screen creation support device
creates the status display fields on the screen editing
screen, but the status display fields are displayed with no
differentiations being made as to whether or not the status
display fields are each assigned the label included in the
15 control program. As such, the operator cannot judge, by
just looking at the screen editing screen, whether or not
the label included in the control program is assigned to
each of the status display fields.

[0005] The present invention has been made in view of
20 the above, and an object of the present invention is to
obtain a screen creation support device that enables an
operator to judge, by just looking at a screen editing
screen, whether or not a label in a control program is
assigned to a status display field is included.

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Solution to Problem

[0006] To solve the above problems and achieve the
object, the present invention is a screen creation support
device that supports creation of a monitoring screen where
30 a status information item about a device to be controlled
is displayed in cases where a control device controls the
device to be controlled according to a control program.

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The present invention includes: a program determining unit that determines whether or not a label included in the control program is assigned to a status display field that is to be included on the monitoring screen and is to
5 include display of the status information item about the device to be controlled, the label being a variable name used in the control program for control of the device to be controlled; and a differentiation display control unit that causes, on a screen editing screen, display of the status
10 display field that is determined by the program determining unit as being assigned the label included in the control program in a form differentiated from cases where the status display field is not assigned the label included in the control program.

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Advantageous Effect of Invention

[0007] The screen creation support device according to the present invention enables an operator to judge, by just looking at the screen editing screen, whether or not the
20 label included in the control program is assigned to the status display field.

Brief Description of Drawings

[0008] FIG. 1 illustrates a configuration of a system
25 according to an embodiment.

FIG. 2 illustrates a configuration of a screen creation support device according to the embodiment.

FIG. 3 illustrates a screen editing screen according to the embodiment.

30 FIG. 4 illustrates a display field list and a label list as examples that a list display control unit of the screen creation support device according to the embodiment

causes a display device to display.

FIG. 5 illustrates a label list as an example reflective of a case where a control program according to the embodiment includes many labels.

5 FIG. 6 illustrates a first example of a label list obtained after filtering according to the embodiment.

FIG. 7 illustrates a second example of the label list obtained after the filtering according to the embodiment.

10 FIG. 8 illustrates status display fields as examples that are caused to be displayed on the screen editing screen by a differentiation display control unit of the screen creation support device according to the embodiment.

15 FIG. 9 illustrates a first status display field that is being caused by a secondary-display control unit of the screen creation support device according to the embodiment to include display of a first secondary-display field and a second secondary-display field.

20 FIG. 10 illustrates a processor that is used when implementing at least some of those functions of a screen display control unit, a reception unit, the list display control unit, an assignment unit, a filtering unit, an assignment determining unit, a program determining unit, the differentiation display control unit, and the secondary-display control unit of the screen creation support device according to the embodiment.

FIG. 11 is a flowchart illustrating a procedure of a first operation of the screen creation support device according to the embodiment.

30 FIG. 12 is a flowchart illustrating a procedure of a second operation of the screen creation support device according to the embodiment.

FIG. 13 illustrates status display fields as other

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examples that are caused to be displayed on the screen editing screen by the differentiation display control unit of the screen creation support device according to the embodiment.

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Description of Embodiment

[0009] With reference to the drawings, a detailed description is hereinafter provided of a screen creation support device according to an embodiment of the present invention. It is to be noted that this embodiment is not
10 restrictive of the present invention.

[0010] Embodiment.

FIG. 1 illustrates a configuration of a system 1 according to the embodiment. The system 1 includes a control device 2 and a first, a second, and a third devices
15 3a, 3b, and 3c to be controlled that are controlled by the control device 2. The control device 2 controls the first device 3a to be controlled, the second device 3b to be controlled, and the third device 3c to be controlled according to a control program. The control device 2 is,
20 for example, a programmable logic controller.

[0011] The first, second and third devices 3a, 3b, and 3c to be controlled are an example of a plurality of devices to be controlled. The first device 3a to be
25 controlled is, for example, a machining device. The second device 3b to be controlled and the third device 3c to be controlled are, for example, ventilators. To be simplified, description of the embodiment is based on the assumption that the first device 3a to be controlled is the machining device, while the second device 3b to be controlled and the
30 third device 3c to be controlled are respectively a first ventilator and a second ventilator that have the same

function.

[0012] The system 1 also includes a temperature sensor 4 that detects temperature of the first device 3a to be controlled, and a display device 5 that displays information items. The system 1 also includes a display control device 6 that causes display of status information items about the first, second and third devices 3a, 3b, and 3c to be controlled on a monitoring screen displayed by the display device 5. This means that the status information items about the first, second and third devices 3a, 3b, and 3c to be controlled are displayed on the monitoring screen.

[0013] An example of the status information item about the first device 3a to be controlled is an information item indicative of an on or off position of the first device 3a to be controlled. Another example of the status information item about the first device 3a to be controlled is an information item indicative of the temperature of the first device 3a to be controlled. An example of the status information item about the second device 3b to be controlled is an information item indicative of an on or off position of the second device 3b to be controlled. An example of the status information item about the third device 3c to be controlled is an information item indicative of an on or off position of the third device 3c to be controlled.

[0014] The system 1 also includes a screen creation support device 7 that supports creation of the monitoring screen. The system 1 also includes a first communication network 8 over which the control device 2 communicates with the first, second and third devices 3a, 3b, and 3c to be controlled. The system 1 also includes a second communication network 9 over which the control device 2,

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the display device 5, the display control device 6, and the screen creation support device 7 communicate with one another.

[0015] Once the creation of the monitoring screen is completed by means of the screen creation support device 7, the first device 3a to be controlled transmits the information item indicative of its on or off position to the control device 2 over the first communication network 8. The control device 2 obtains the information item indicative of the on or off position of the first device 3a to be controlled from the first device 3a to be controlled and transmits this information item to the display control device 6 over the second communication network 9. The display control device 6 obtains the information item indicative of the on or off position of the first device 3a to be controlled from the control device 2 and transmits this information item to the display device 5 over the second communication network 9 to cause the display device 5 to display this information item on the monitoring screen.

[0016] The first device 3a to be controlled obtains the information item indicative of its temperature from the temperature sensor 4 and transmits this temperature information item to the control device 2 over the first communication network 8. The control device 2 obtains the information item indicative of the temperature of the first device 3a to be controlled from the first device 3a to be controlled and transmits this information item to the display control device 6 over the second communication network 9. The display control device 6 obtains the information item indicative of the temperature of the first device 3a to be controlled from the control device 2 and transmits this information item to the display device 5

over the second communication network 9 to cause the display device 5 to display this information item on the monitoring screen.

[0017] The second device 3b to be controlled transmits the information item indicative of its on or off position to the control device 2 over the first communication network 8. The control device 2 obtains the information item indicative of the on or off position of the second device 3b to be controlled from the second device 3b to be controlled and transmits this information item to the display control device 6 over the second communication network 9. The display control device 6 obtains the information item indicative of the on or off position of the second device 3b to be controlled from the control device 2 and transmits this information item to the display device 5 over the second communication network 9 to cause the display device 5 to display this information item on the monitoring screen. The information item indicative of the on or off position of the third device 3c to be controlled is similarly displayed on the monitoring screen of the display device 5.

[0018] FIG. 2 illustrates a configuration of the screen creation support device 7 according to the embodiment. As described above, the screen creation support device 7 is a device that supports creation of a monitoring screen. As illustrated in FIG. 2, the screen creation support device 7 includes a storage unit 10 that stores information used for creation of status display fields on the monitoring screen. FIG. 3 illustrates a screen editing screen 11 according to the embodiment. The screen editing screen 11 is a screen that is in the process of being made into the monitoring screen. The screen creation support device 7 also includes

a screen display control unit 12 that causes the display device 5 to display a blank screen editing screen 11 when the screen creation support device 7 is activated.

[0019] In addition to causing the display device 5 to display the blank screen editing screen 11, the screen display control unit 12 effects, based on the information stored in the storage unit 10, display of a rectangular frame 11b in an area 11a occupying a part of the screen editing screen 11 when the screen creation support device 7 is activated. The area 11a occupying the part is, for example, an upper area of the screen editing screen 11. As illustrated in FIG. 2, the screen creation support device 7 also includes a reception unit 13 that receives instructions from an operator of the screen creation support device 7.

[0020] When an instruction for creation of a status display field is received by the reception unit 13, the screen display control unit 12 creates the status display field on the screen editing screen 11. For example, the operator of the screen creation support device 7 uses, as an input unit, either a keyboard, a mouse, or both that are connected to a general-purpose personal computer to input into the screen creation support device 7 the rectangular frame 11b as a choice and a designated position where the status display field is to be created on the screen editing screen 11, and the reception unit 13 receives the choice and the designation as inputs. The screen display control unit 12 creates the status display field based on the choice and the designation that are received by the reception unit 13 and effects display of the status display field thus created on the screen editing screen 11.

[0021] In the FIG. 3 illustration, five status display

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fields 11c to 11g are being displayed. Those five status display fields 11c to 11g are the first status display field 11c, the second status display field 11d, the third status display field 11e, the fourth status display field 11f, and the fifth status display field 11g. Each of the five status display fields 11c to 11g has a figure similar to that of the frame 11b displayed in the area 11a occupying the part of the screen editing screen 11 and is an enlarged version of the frame 11b.

10 [0022] As illustrated in FIG. 2, the screen creation support device 7 also includes a list display control unit 14 that causes the display device 5 to display a display field list and a label list concurrently when an instruction directing that the display field list and the label list be displayed is received by the reception unit 13. The display field list is a list of those status display fields created on the screen editing screen 11, while the label list is a list of labels included in the control program. The labels are respective variable names that are used in the control program for control of the devices to be controlled. FIG. 4 illustrates a display field list 14a and a label list 14b as examples that the list display control unit 14 of the screen creation support device 7 according to the embodiment causes the display device 5 to display.

[0023] The control program is used when the control device 2 controls the first, second and third devices 3a, 3b, and 3c to be controlled. In the embodiment, the control program specifically includes a first instruction that directs that the first device to be controlled 3a be turned on or off, a second instruction that directs that the information item indicative of the temperature of the

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first device 3a to be controlled be obtained by means of the temperature sensor 4, a third instruction that directs based on the temperature of the first device 3a to be controlled and a reference temperature that the second
5 device 3b to be controlled be turned on or off, and a fourth instruction that directs based on the temperature of the first device 3a to be controlled and the reference temperature that the third device 3c to be controlled be turned on or off.

10 [0024] As illustrated in FIG. 4, the display field list 14a includes a list 14c of the plurality of status display fields and a column 14d where a plurality of labels are to be displayed. The list 14c and the column 14d are displayed contiguously. When the five status display
15 fields 11c to 11g described with reference to FIG. 3 are created on the screen editing screen 11, the list 14c is provided with five rows correspondingly. Entered in each of the five rows is a character string that specifies any one of the first through fifth status display fields 11c to
20 11g.

[0025] The column 14d includes five blanks 15a to 15e corresponding to the first through fifth status display fields 11c to 11g, respectively. Each of the five blanks 15a to 15e is displayed to be contiguous to any one of the
25 first through fifth status display fields 11c to 11g.

[0026] The label list 14b is a list of those labels included in the control program. As described above, the system 1 includes, in the embodiment, the first device 3a to be controlled, the second device 3b to be controlled,
30 and the third device 3c to be controlled, and the first device 3a to be controlled is the machining device, while the second and third devices 3b and 3c to be controlled are

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the first ventilator and the second ventilator,
respectively. The control program includes the first
instruction that directs that the first device 3a to be
controlled be turned on or off, the second instruction that
5 directs that the information item indicative of the
temperature of the first device 3a to be controlled be
obtained by means of the temperature sensor 4, the third
instruction that directs that the second device to be
controlled 3b be turned on or off, and the fourth
10 instruction that directs that the third device to be
controlled 3c be turned on or off.

[0027] This means that the control program includes the
four labels that respectively represent (1) the on or off
position of the machining device, (2) the temperature of
15 the machining device, (3) the on or off position of the
first ventilator, and (4) the on or off position of the
second ventilator. Accordingly, the label list 14b
includes the four labels respectively representing (1) the
on or off position of the machining device, (2) the
20 temperature of the machining device, (3) the on or off
position of the first ventilator, and (4) the on or off
position of the second ventilator.

[0028] The reception unit 13 includes a function of
receiving an assignment instruction directing that at least
25 one of the labels included in the displayed label list 14b
effected by the list display control unit 14 be assigned to
each of the plurality of status display fields included in
the displayed display field list 14a effected by the list
display control unit 14. As illustrated in FIG. 2, the
30 screen creation support device 7 also includes an
assignment unit 16 that assigns the at least one of the
labels included in the label list 14b to each of the five

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status display fields 11c to 11g according to the assignment instruction received by the reception unit 13.

[0029] For example, the operator of the screen creation support device 7 uses, as the input unit, either the

5 keyboard, the mouse, or both that are connected to the general-purpose personal computer to input into the screen creation support device 7 an instruction directing that any one of the five blanks 15a to 15e in the column 14d of the display field list 14a be selected and an instruction
10 directing that any one of the four labels included in the label list 14b be selected. The reception unit 13 receives the instructions as inputs from the operator. The instructions received by the reception unit 13 correspond to an assignment instruction. According to the assignment
15 instruction received, the assignment unit 16 assigns the one label included in the label list 14b to the any one of the blanks 15a to 15e. The assignment unit 16 also assigns the label the assignment unit 16 has assigned to the any one of the blanks 15a to 15e to the status display field
20 corresponding to that blank.

[0030] Assuming that the reception unit 13 receives an instruction directing that the blank 15c be selected from among the five blanks 15a to 15e in the column 14d of the display field list 14a and an instruction directing that
25 the label representing (3) the on or off position of the first ventilator be selected from among the four labels included in the label list 14b, as indicated by an arrow 16a, the assignment unit 16 assigns the blank 15c the label representing (3) the on or off position of the first
30 ventilator. The assignment unit 16 assigns the label representing (3) the on or off position of the first ventilator to the third status display field 11e that

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corresponds to the blank 15c. In this way, the assignment unit 16 assigns at least one of the labels included in the label list 14b to each of the five status display fields 11c to 11g.

5 [0031] As illustrated in FIG. 2, the screen creation support device 7 also includes a filtering unit 17 that performs filtering on the plurality of labels included in the label list 14b based on a data type of the label or a character string included in the label. As described above,
10 the control program includes, in the embodiment, the four labels respectively representing (1) the on or off position of the machining device, (2) the temperature of the machining device, (3) the on or off position of the first ventilator, and (4) the on or off position of the second
15 ventilator.

[0032] However, there is a case where the control program includes a very large number of labels numbering, for example, 1,000. In that case, the label list 14b includes the very large number of labels. With the
20 displayed label list 14b including the very large number of labels, the operator cannot easily select a label for assignment to each of blanks in the column 14d of the display field list 14a.

[0033] The reception unit 13 includes a function of
25 receiving an instruction directing that filtering be performed on the plurality of labels included in the label list 14b. When the filtering instruction is received by the reception unit 13, the filtering unit 17 carries out filtering according to the instruction received by the
30 reception unit 13. The list display control unit 14 causes the display device 5 to display a label list 14b that is a list of labels selected, as a result of the filtering

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performed by the filtering unit 17, from the list of the plurality of labels included in the control program.

[0034] FIG. 5 illustrates the label list 14b as an example reflective of the case where the control program according to the embodiment includes many labels. The FIG. 5 label list 14b includes labels about respective on or off positions of many ventilators, such as "on or off position of first ventilator", "on or off position of second ventilator", and "on or off position of third ventilator". The FIG. 5 label list 14b also includes labels about respective temperatures from many temperature sensors, such as "temperature from first temperature sensor", "temperature from second temperature sensor", and "temperature from third temperature sensor". The FIG. 5 label list 14b also includes labels about many buttons, such as "first button", "second button", and "third button".

[0035] FIG. 6 illustrates a first example of the label list 14b obtained after the filtering according to the embodiment. In cases where, for example, a character string saying "ventilator" is received by the reception unit 13 with the FIG. 5 label list 14b being displayed, the filtering unit 17 performs such filtering as to select from the FIG. 5 label list 14b only those labels each including the character string saying "ventilator". Based on the filtering performed by the filtering unit 17, the list display control unit 14 causes the display device 5 to display the FIG. 6 label list 14b. Among those many labels included in the FIG. 5 label list 14b, the only labels included in the FIG. 6 label list 14b are the ones each including the character string saying "ventilator".

[0036] In cases where, for example, "a bit type" is received as a data type by the reception unit 13 with the

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FIG. 5 label list 14b being displayed, the filtering unit 17 performs such filtering as to select only those bit-type labels from the FIG. 5 label list 14b. Based on the filtering performed by the filtering unit 17, the list display control unit 14 causes the display device 5 to display the FIG. 6 label list 14b. Among those many labels included in the FIG. 5 label list 14b, the only labels included in the FIG. 6 label list 14b are the bit-type ones.

[0037] FIG. 7 illustrates a second example of the label list 14b obtained after the filtering according to the embodiment. In cases where, for example, "a word type" is received as a data type by the reception unit 13 with the FIG. 5 label list 14b being displayed, the filtering unit 17 performs such filtering as to select only those word-type labels from the FIG. 5 label list 14b. Based on the filtering performed by the filtering unit 17, the list display control unit 14 causes the display device 5 to display the FIG. 7 label list 14b. Among those many labels included in the FIG. 5 label list 14b, the only labels included in the FIG. 7 label list 14b are the word-type ones.

[0038] As described above, the list display control unit 14 causes the display device 5 to display the label list 14b that is the list of the labels selected, as a result of the filtering performed by the filtering unit 17, from the list of the plurality of labels included in the control program. After filtering, the label list 14b has a smaller number of labels than before the filtering. As such, the operator can select, with relative ease, a label for assignment to each of the blanks in the column 14d of the display field list 14a.

[0039] In the example mentioned earlier, the labels are

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those four respectively representing (1) the on or off position of the machining device, (2) the temperature of the machining device, (3) the on or off position of the first ventilator, and (4) the on or off position of the second ventilator. An example of the label is a variable representing the on or off position of the device to be controlled, such as (1), (3), and (4). Another example of the label is a variable representing the input from the device to be controlled. An example of that input is the temperature. Yet another example of the label is a variable representing an input effected by operation of the monitoring screen. An example of that input is an on or off position of the button.

[0040] As illustrated in FIG. 2, the screen creation support device 7 also includes an assignment determining unit 18 that determines, for each of the five status display fields 11c to 11g illustrated in FIG. 3, whether or not any label is being assigned, and a program determining unit 19 that determines, for each of the five status display fields 11c to 11g, whether or not the label included in the control program is assigned. Specifically, the assignment determining unit 18 determines whether or not each of the five status display fields 11c to 11g is being assigned any label. The label is the variable name that is used in the control program for control of any of the devices to be controlled or, alternatively, is what is assigned by a screen creator as being extraneous to any of the devices to be controlled. In cases where each of the five status display fields 11c to 11g is determined by the assignment determining unit 18 as being assigned the label, the program determining unit 19 determines whether or not the assigned label is included in the control program while

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having the variable name used in the control program for control of the device to be controlled.

[0041] The screen creation support device 7 also includes a differentiation display control unit 20 that causes on the screen editing screen 11, when each of the five status display fields 11c to 11g is determined by the program determining unit 19 as being assigned the label included in the control program, display of each of the status display fields 11c to 11g in a form differentiated from cases where the status display field is not assigned the label included in the control program.

[0042] FIG. 8 illustrates status display fields as examples that are caused to be displayed on the screen editing screen 11 by the differentiation display control unit 20 of the screen creation support device 7 according to the embodiment. An assumption is made that in FIG. 8, the status display field with added oblique lines is actually displayed in blue, the status display field illustrated with a single-line frame is actually displayed in gray, and the status display field illustrated with a double-line frame is actually displayed in red.

[0043] An assumption is made that the first status display field 11c is assigned the label that represents (1) the on or off position of the machining device and is included in the control program, while the second status display field 11d is assigned a label that says "ABCDE" and is not included in the control program. With respect to the second status display field 11d, an assumption is made, for example, that a character string saying "ABCDE" is entered into the screen creation support device 7 by means of, as the input unit, either the keyboard, the mouse, or both that are connected to the general-purpose personal

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computer and is received by the reception unit 13, and the assignment unit 16 assigns the second status display field 11d the label that says "ABCDE" and is not included in the control program.

5 [0044] Moreover, an assumption is made that the third status display field 11e is assigned the label that represents (3) the on or off position of the first ventilator and is included in the control program, while the fourth status display field 11f is assigned the label
10 that represents (4) the on or off position of the second ventilator and is included in the control program. Furthermore, an assumption is made that the fifth status display field 11g is assigned no label.

[0045] Assigned to the first status display field 11c is
15 the label that is included in the control program, representing (1) the on or off position of the machining device. As such, as illustrated in FIG. 8, the differentiation display control unit 20 causes on the screen editing screen 11 display of the first status
20 display field 11c in a form differentiated from both the second status display field 11d that is not being assigned the label included in the control program and the fifth status display field 11g that is being assigned no label.

[0046] Respectively assigned to the third and fourth
25 status display fields 11e and 11f are the labels included in the control program. As such, as illustrated in FIG. 8, the differentiation display control unit 20 causes on the screen editing screen 11 display of each of the third and fourth status display fields 11e and 11f in the form
30 differentiated from both the second status display field 11d that is not being assigned the label included in the control program and the fifth status display field 11g that

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is being assigned no label.

[0047] Assigned to the second status display field 11d is the label that is not included in the control program, saying "ABCDE". What is more, the label assigned to the second status display field 11d is extraneous to any of the devices to be controlled. The second status display field 11d is determined by the assignment determining unit 18 as being assigned the label, but the label assigned to the second status display field 11d is not determined by the program determining unit 19 as being the label included in the control program. As such, as illustrated in FIG. 8, the differentiation display control unit 20 causes on the screen editing screen 11 display of the second status display field 11d in a form differentiated from both the form of the first status display field 11c that is being assigned the label included in the control program and the form of the fifth status display field 11g that is being assigned no label.

[0048] The fifth status display field 11g is being assigned no label. As such, as illustrated in FIG. 8, the differentiation display control unit 20 causes on the screen editing screen 11 display of the fifth status display field 11g in the form differentiated from both the form of the first status display field 11c that is being assigned the label included in the control program and the form of the second status display field 11d that is not being assigned the label included in the control program.

[0049] As illustrated in FIG. 2, the screen creation support device 7 also includes a secondary-display control unit 21 that causes display of a plurality of secondary-display fields in the status display field displayed on the screen editing screen 11. Respectively displayed in the

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plurality of secondary-display fields are the status information items about a device to be controlled or one of the plurality of devices to be controlled. In the embodiment, the secondary-display control unit 21 causes display of a first secondary-display field 21a and a second secondary-display field 21b in the first status display field 11c. FIG. 9 illustrates the first status display field 11c that is being caused by the secondary-display control unit 21 of the screen creation support device 7 according to the embodiment to include display of the first secondary-display field 21a and the second secondary-display field 21b.

[0050] When an instruction is received by the reception unit 13, directing that the first and second secondary-display fields 21a and 21b be displayed in the first status display field 11c, the secondary-display control unit 21 causes display of the first and second secondary-display fields 21a and 21b in the first status display field 11c. According to the instruction received by the reception unit 13, the assignment unit 16 assigns two labels to the first status display field 11c and assigns one of the two labels to the first secondary-display field 21a and the other to the second secondary-display field 21b.

[0051] The program determining unit 19 determines even for each of the first and second secondary-display fields 21a and 21b whether or not the label included in the control program is assigned. When each of the first and second secondary-display fields 21a and 21b is determined by the program determining unit 19 as being assigned the label included in the control program, the differentiation display control unit 20 causes on the screen editing screen 11 display of each of the first secondary-display field 21a

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and the second secondary-display field 21b in a form differentiated from cases where the label included in the control program is not assigned.

[0052] At least some of those functions of the screen display control unit 12, the reception unit 13, the list display control unit 14, the assignment unit 16, the filtering unit 17, the assignment determining unit 18, the program determining unit 19, the differentiation display control unit 20, and the secondary-display control unit 21 may be implemented by use of a processing circuit. The processing circuit is dedicated hardware. The processing circuit is, for example, a single circuit, a composite circuit, a programmed processor, a parallel programmed processor, an application specific integrated circuit (ASIC), a field-programmable gate array (FPGA), or a combination of these. Some of the screen display control unit 12, the reception unit 13, the list display control unit 14, the assignment unit 16, the filtering unit 17, the assignment determining unit 18, the program determining unit 19, the differentiation display control unit 20, and the secondary-display control unit 21 may be the dedicated hardware distinct from the rest.

[0053] FIG. 10 illustrates a processor 33 that is used when implementing at least some of those functions of the screen display control unit 12, the reception unit 13, the list display control unit 14, the assignment unit 16, the filtering unit 17, the assignment determining unit 18, the program determining unit 19, the differentiation display control unit 20, and the secondary-display control unit 21 of the screen creation support device 7 according to the embodiment. This means that the at least some of the functions of the screen display control unit 12, the

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reception unit 13, the list display control unit 14, the assignment unit 16, the filtering unit 17, the assignment determining unit 18, the program determining unit 19, the differentiation display control unit 20, and the secondary-
5 display control unit 21 may be implemented by use of the processor 33 that executes a program stored in a memory 32. The processor 33 is a central processing unit (CPU), a processing unit, an arithmetic unit, a microprocessor, a microcomputer, or a digital signal processor (DSP). FIG.
10 10 also illustrates the memory 32.

[0054] When implemented by use of the processor 33, the at least some of the functions of the screen display control unit 12, the reception unit 13, the list display control unit 14, the assignment unit 16, the filtering unit
15 17, the assignment determining unit 18, the program determining unit 19, the differentiation display control unit 20, and the secondary-display control unit 21 are implemented by the processor 33 and software, firmware, or a combination of software and firmware. The software or
20 the firmware is described as the program and is stored in the memory 32. The processor 33 reads out and executes the program stored in the memory 32 for implementation of the at least some of the functions of the screen display control unit 12, the reception unit 13, the list display
25 control unit 14, the assignment unit 16, the filtering unit 17, the assignment determining unit 18, the program determining unit 19, the differentiation display control unit 20, and the secondary-display control unit 21.

[0055] In other words, in cases where the processor 33
30 is used for implementation of the at least some of the functions of the screen display control unit 12, the reception unit 13, the list display control unit 14, the

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assignment unit 16, the filtering unit 17, the assignment
determining unit 18, the program determining unit 19, the
differentiation display control unit 20, and the secondary-
display control unit 21, the screen creation support device
5 7 includes the memory 32 that stores the program according
to which steps are eventually carried out by some of the
screen display control unit 12, the reception unit 13, the
list display control unit 14, the assignment unit 16, the
filtering unit 17, the assignment determining unit 18, the
10 program determining unit 19, the differentiation display
control unit 20, and the secondary-display control unit 21.
The program stored in the memory 32 can be the one that
causes a computer to carry out a procedure or a method by
which the some of the screen display control unit 12, the
15 reception unit 13, the list display control unit 14, the
assignment unit 16, the filtering unit 17, the assignment
determining unit 18, the program determining unit 19, the
differentiation display control unit 20, and the secondary-
display control unit 21 are performed.

20 [0056] The memory 32 corresponds to, for example, a
nonvolatile or volatile semiconductor memory such as a
random-access memory (RAM), a read-only memory (ROM), a
flash memory, an erasable programmable read-only memory
(EPROM), or an electrically erasable programmable read-only
25 memory (EEPROM); a magnetic disk; a flexible disk; an
optical disk; a compact disk; a mini disk; a digital
versatile disk (DVD); or the like.

[0057] Some of the plurality of functions of the screen
display control unit 12, the reception unit 13, the list
30 display control unit 14, the assignment unit 16, the
filtering unit 17, the assignment determining unit 18, the
program determining unit 19, the differentiation display

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control unit 20, and the secondary-display control unit 21 may be implemented by use of dedicated hardware, while the rest of the plurality of functions may be implemented by software or firmware. As described above, the plurality of functions of the screen display control unit 12, the reception unit 13, the list display control unit 14, the assignment unit 16, the filtering unit 17, the assignment determining unit 18, the program determining unit 19, the differentiation display control unit 20, and the secondary-display control unit 21 can be implemented by the hardware, the software, the firmware, or the combination of these.

[0058] A description is provided next of operation of the screen creation support device 7 according to the embodiment. The operation of the screen creation support device 7 includes a first operation and a second operation. In the first operation, each of the five status display fields 11c to 11g is assigned any of the plurality of labels included in the control program for display on the screen editing screen 11. The second operation is a display operation for the five status display fields 11c to 11g displayed on the screen editing screen 11 after the first operation. The first operation and the second operation are described in sequence.

[0059] So, the description is provided first of the first operation of the screen creation support device 7. FIG. 11 is a flowchart illustrating a procedure of the first operation of the screen creation support device 7 according to the embodiment. Once the screen creation support device 7 is activated, the screen display control unit 12 causes the display device 5 to display a blank screen editing screen 11 (S1). When an instruction for creation of a status display field is received by the

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reception unit 13, the screen display control unit 12 creates the status display field on the screen editing screen 11 (S2). When an instruction directing that a display field list and a label list be displayed is

5 received by the reception unit 13, the list display control unit 14 causes the display device 5 to display the display field list 14a and the label list 14b concurrently (S3).

[0060] When an assignment instruction is received by the reception unit 13, directing that at least one of the
10 labels included in the label list 14b be assigned to each of the plurality of status display fields included in the display field list 14a, the assignment unit 16 assigns each of the five status display fields 11c to 11g the at least one of the labels included in the label list 14b (S4).

15 [0061] It is to be noted that when an instruction directing that filtering be performed is received by the reception unit 13 in step S3 with the display device 5 displaying the display field list 14a and the label list 14b, the filtering unit 17 carries out filtering according
20 to the instruction received by the reception unit 13. The list display control unit 14 causes the display device 5 to display a label list 14b that is a list of labels selected, as a result of the filtering performed by the filtering unit 17, from the list of the plurality of labels included
25 in the control program.

[0062] When an instruction is received by the reception unit 13 after the step S2 creation of the status display field on the screen editing screen 11, directing that a plurality of secondary-display fields be displayed in the
30 status display field, the secondary-display control unit 21 causes display of the plurality of secondary-display fields in the status display field. According to the instruction

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received by the reception unit 13, the assignment unit 16 assigns a label to each of the plurality of secondary-display fields.

[0063] The description is provided next of the second operation of the screen creation support device 7. FIG. 12 is a flowchart illustrating a procedure of the second operation of the screen creation support device 7 according to the embodiment. The assignment determining unit 18 determines whether or not each of the five status display fields 11c to 11g on the screen editing screen 11 is being assigned any label (S11). When each of the five status display fields 11c to 11g is determined by the assignment determining unit 18 as being assigned no label (No in S11), the operation of the screen creation support device 7 moves on to step S13 that is described later.

[0064] When each of the five status display fields 11c to 11g is determined by the assignment determining unit 18 as being assigned the label (Yes in S11), the program determining unit 19 determines whether or not the assigned label is included in the control program (S12). When each of the five status display fields 11c to 11g is determined by the program determining unit 19 as being assigned the label included in the control program, the differentiation display control unit 20 causes on the screen editing screen 11 display of the status display field that is being assigned the label included in the control program in a form differentiated from the cases where the label included in the control program is not assigned (S13).

[0065] In step S13, the status display field that is being assigned the label not included in the control program is caused by the differentiation display control unit 20 to be displayed, on the screen editing screen 11,

in a form differentiated from both the form of the status display field assigned the label included in the control program and a form of the status display field assigned no label.

5 [0066] When any of the status display fields includes display of a plurality of secondary-display fields, the assignment determining unit 18 determines whether or not each of the plurality of secondary-display fields is being assigned any label. When each of the plurality of
10 secondary-display fields is determined by the assignment determining unit 18 as being assigned the label, the program determining unit 19 determines whether or not the assigned label is included in the control program. When each of the plurality of secondary-display fields is
15 determined by the program determining unit 19 as being assigned the label included in the control program, the differentiation display control unit 20 causes on the screen editing screen 11 display of the secondary-display field that is being assigned the label included in the
20 control program in a form differentiated from the cases where the label included in the control program is not assigned. The secondary-display field that is being assigned the label not included in the control program is caused by the differentiation display control unit 20 to be
25 displayed, on the screen editing screen 11, in a form differentiated from both the form of the secondary-display field assigned the label included in the control program and a form of the secondary-display field assigned no label.
[0067] As described above, when each of the five status
30 display fields 11c to 11g created on the screen editing screen 11 is assigned the label included in the control program, the screen creation support device 7 according to

the embodiment causes the status display field to be displayed, on the screen editing screen 11, in the form differentiated from the cases where the status display field is not assigned the label included in the control program. In other words, the screen creation support device 7 enables the operator to judge, by just looking at the screen editing screen 11, whether or not the label included in the control program is assigned to the status display field.

10 [0068] In the above-described embodiment, the five status display fields 11c to 11g are created on the screen editing screen 11. However, a very large number of status display fields numbering, for example, 1,000 are often created on the screen editing screen 11. In cases where
15 the very large number of status display fields are created on a screen editing screen 11, a conventional screen creation support device displays those many status display fields with no differentiations being made as to whether or not the status display fields are each assigned the label
20 included in the control program.

[0069] Thus, an operator of the conventional screen creation support device cannot judge, by just looking at the screen editing screen, whether or not the label included in the control program is assigned to each of
25 those many status display fields. Accordingly, the operator may have to refer to a table for each of those many status display fields to judge whether or not the label included in the control program is assigned. Making judgments for the very large number of status display
30 fields numbering, for example, 1,000 is a relatively heavy work load for the operator.

[0070] On the other hand, the screen creation support

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device 7 according to the embodiment causes the status display field that is assigned the label included in the control program to be displayed, on the screen editing screen 11, in the form differentiated from the cases where the label included in the control program is not assigned. As such, even in cases where the screen editing screen 11 displays the very large number of status display fields, with use of the screen creation support device 7, the operator can judge, by just looking at the screen editing screen 11, whether or not the label included in the control program is assigned to each of those many status display fields. In other words, the screen creation support device 7 can lessen the work load that requires the operator to judge, during creation of the monitoring screen, whether or not the label included in the control program is assigned. The more the status display fields increase in number, the less the work load on the operator tends to be.

[0071] The screen creation support device 7 according to the embodiment also causes, on the screen editing screen 11, all the status display fields that are each assigned the label included in the control program to be displayed each in the form differentiated from the cases where the status display field is not assigned the label included in the control program. As such, by creating, on the screen editing screen 11, the same number of status display fields as there are labels in the control program, the operator of the screen creation support device 7 can later judge, by just looking at the screen editing screen 11, whether or not creation of the monitoring screen is complete. This means that the screen creation support device 7 can lessen a work load for the operator.

[0072] The screen creation support device 7 according to

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the embodiment causes the display device 5 to concurrently display the display field list 14a illustrating the status display fields created on the screen editing screen 11, and the label list 14b illustrating the labels included in the control program. As such, the screen creation support device 7 can lessen a work load that requires the operator to assign the labels included in the control program to the status display fields compared with when the input unit is used for character entry.

10 [0073] The screen creation support device 7 according to the embodiment includes the filtering unit 17 that performs filtering on the plurality of labels included in the label list 14b based on the data type of the label or the character string included in the label. As such, even when
15 the control program includes the very large number of labels numbering, for example, 1,000, the screen creation support device 7 can cause, based on the filtering, display of the label list 14b including only the specified data-type labels or the labels each including the specified
20 character string. In other words, the screen creation support device 7 can achieve a reduced number of labels in the label list 14b and thus can lessen the work load that requires the operator to assign the labels to the status display fields.

25 [0074] There are cases where the control program includes the labels corresponding to the plurality of statuses of the device to be controlled. Including the plurality of secondary-display fields in the status display field that corresponds to that device to be controlled and
30 assigning the corresponding label to each of the plurality of secondary-display fields make understanding of the association between that device to be controlled and the

plurality of statuses relatively easy when the monitoring screen is viewed. The screen creation support device 7 according to the embodiment has the secondary-display control unit 21 that causes display of the plurality of secondary-display fields in the status display field displayed on the screen editing screen 11. As such, the screen creation support device 7 enables a person looking at the monitoring screen to easily understand the association between the plurality of statuses and the corresponding device to be controlled.

[0075] As described with reference to FIG. 8 in the embodiment, for each of the five status display fields 11c to 11g displayed on the screen editing screen 11, the differentiation display control unit 20 of the screen creation support device 7 causes the status display field that is determined by the program determining unit 19 as being assigned the label included in the control program and the status display field not assigned the label included in the control program to have different colors. However, the differentiation display control unit 20 may cause the status display field that is determined by the program determining unit 19 as being assigned the label included in the control program and the status display field not assigned the label included in the control program to have different shapes, different font sizes, or different font thicknesses.

[0076] FIG. 13 illustrates status display fields as other examples that are caused to be displayed on the screen editing screen 11 by the differentiation display control unit 20 of the screen creation support device 7 according to the embodiment. In FIG. 13, the second status display field 11d is of elliptic shape, the third status

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display field 11e is shadowed, and those characters entered in the fourth status display field 11f are thicker than characters entered in the other status display fields.

Anyhow the differentiation display control unit 20 causes

5 the status display field that is determined by the program determining unit 19 as being assigned the label included in the control program to be displayed, on the screen editing screen 11, in the form differentiated from the cases where the label included in the control program is not assigned.

10 [0077] In the embodiment, the system 1 includes the first device 3a to be controlled, the second device 3b to be controlled, and the third device 3c to be controlled.

However, with regard to the number of devices to be controlled, the system 1 may have only one device to be controlled. This means that displayed on the screen editing screen 11 may be one status display field.

15 [0078] Once the creation of the monitoring screen is completed by means of the screen creation support device 7, the status information items about the devices to be controlled are displayed in the status display fields on the monitoring screen.

[0079] The above configurations illustrated in the embodiment are examples of contents of the present invention, can be combined with other techniques that are publicly known and can be partly omitted or changed without departing from the gist of the present invention.

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Reference Signs List

[0080] 1 system; 2 control device; 3a first device to be controlled; 3b second device to be controlled; 3c third device to be controlled; 4 temperature sensor; 5 display device; 6 display control device; 7 screen

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creation support device; 8 first communication network; 9
second communication network; 10 storage unit; 11 screen
editing screen; 12 screen display control unit; 13
reception unit; 14 list display control unit; 16
5 assignment unit; 17 filtering unit; 18 assignment
determining unit; 19 program determining unit; 20
differentiation display control unit; 21 secondary-display
control unit; 32 memory; 33 processor.

CLAIMS

1. A screen creation support device that supports creation of a monitoring screen where a status information item about a device to be controlled is displayed in cases where a control device controls the device to be controlled according to a control program, the screen creation support device comprising:

a program determining unit to determine whether or not a label included in the control program is assigned to a status display field that is to be included on the monitoring screen and is to include display of the status information item about the device to be controlled, the label being a variable name used in the control program for control of the device to be controlled;

a differentiation display control unit to cause, on a screen editing screen, display of the status display field that is determined by the program determining unit as being assigned the label included in the control program in a form differentiated from cases where the status display field is not assigned the label included in the control program;

an assignment determining unit to determine whether or not the status display field is assigned a label,

wherein when the status display field is determined by the assignment determining unit as being assigned the label, the program determining unit determines whether or not the label assigned to the status display field is included in the control program.

2. The screen creation support device according to claim 1,

wherein the program determining unit determines for each of a plurality of the status display fields whether or not a label included in the control program is assigned, and

wherein the differentiation display control unit causes among the plurality of the status display fields, all status display fields that are each determined by the program determining unit as being assigned the label included in the control program to be displayed, on the screen editing screen, each in a form differentiated from the cases where the label included in the control program is not assigned.

3. The screen creation support device according to claim 1 or 2, further comprising:

a list display control unit to cause a display device to concurrently display a display field list that is a list of a plurality of the status display fields and a label list that is a list of a plurality of the labels included in the control program;

a reception unit to receive an instruction directing that at least one of the labels included in the label list that is caused by the list display control unit to be displayed be assigned to each of the plurality of the status display fields included in the display field list that is caused by the list display control unit to be displayed; and

an assignment unit to assign, according to the instruction received by the reception unit, the at least one of the labels included in the label list to each of the plurality of the status display fields.

4. The screen creation support device according to claim

3, further comprising a filtering unit to perform filtering on the plurality of the labels included in the label list based on one of a data type of the label and a character string included in the label,

wherein the reception unit receives an instruction directing that the filtering be performed on the plurality of the labels included in the label list,

wherein the filtering unit performs the filtering according to the instruction received by the reception unit, and

wherein the list display control unit causes, on the screen editing screen, display of a label list that is a list of labels selected, as a result of the filtering performed by the filtering unit, from the list of the plurality of the labels included in the control program.

5. A screen creation support device that supports creation of a monitoring screen where a status information item about a device to be controlled is displayed in cases where a control device controls the device to be controlled according to a control program, the screen creation support device comprising:

a program determining unit to determine whether or not a label included in the control program is assigned to a status display field that is to be included on the monitoring screen and is to include display of the status information item about the device to be controlled, the label being a variable name used in the control program for control of the device to be controlled;

a differentiation display control unit to cause, on a screen editing screen, display of the status display field that is determined by the program determining unit as being assigned the label included in the control program in a

form differentiated from cases where the status display field is not assigned the label included in the control program;

a list display control unit to cause a display device to concurrently display a display field list that is a list of a plurality of the status display fields and a label list that is a list of a plurality of the labels included in the control program;

a reception unit to receive an instruction directing that at least one of the labels included in the label list that is caused by the list display control unit to be displayed be assigned to each of the plurality of the status display fields included in the display field list that is caused by the list display control unit to be displayed;

an assignment unit to assign, according to the instruction received by the reception unit, the at least one of the labels included in the label list to each of the plurality of the status display fields; and

a secondary-display control unit to cause display of a plurality of secondary-display fields in the status display field displayed on the screen editing screen,

wherein each of the plurality of secondary-display fields is where the status information item about the device to be controlled is displayed,

wherein the assignment unit assigns the labels included in the label list to the status display field,

wherein the secondary-display control unit causes, based on the assignment performed by the assignment unit, the plurality of secondary-display fields to be displayed in the status display field displayed on the screen editing screen,

wherein the program determining unit determines even

for each of the plurality of secondary-display fields whether or not the label included in the control program is assigned, and

wherein when each of the plurality of secondary-display fields is determined by the program determining unit as being assigned the label included in the control program, the differentiation display control unit causes, on the screen editing screen, display of each of the plurality of secondary-display fields in a form differentiated from cases where each of the plurality of secondary-display fields is not assigned the label included in the control program.