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(54) SYSTEM FOR PROVIDING SOFTWARE DEVELOPMENT ENVIRONMENT, METHOD FOR PROVIDING SOFTWARE DEVELOPMENT ENVIRONMENT, AND NON-TRANSITORY COMPUTER READABLE MEDIUM

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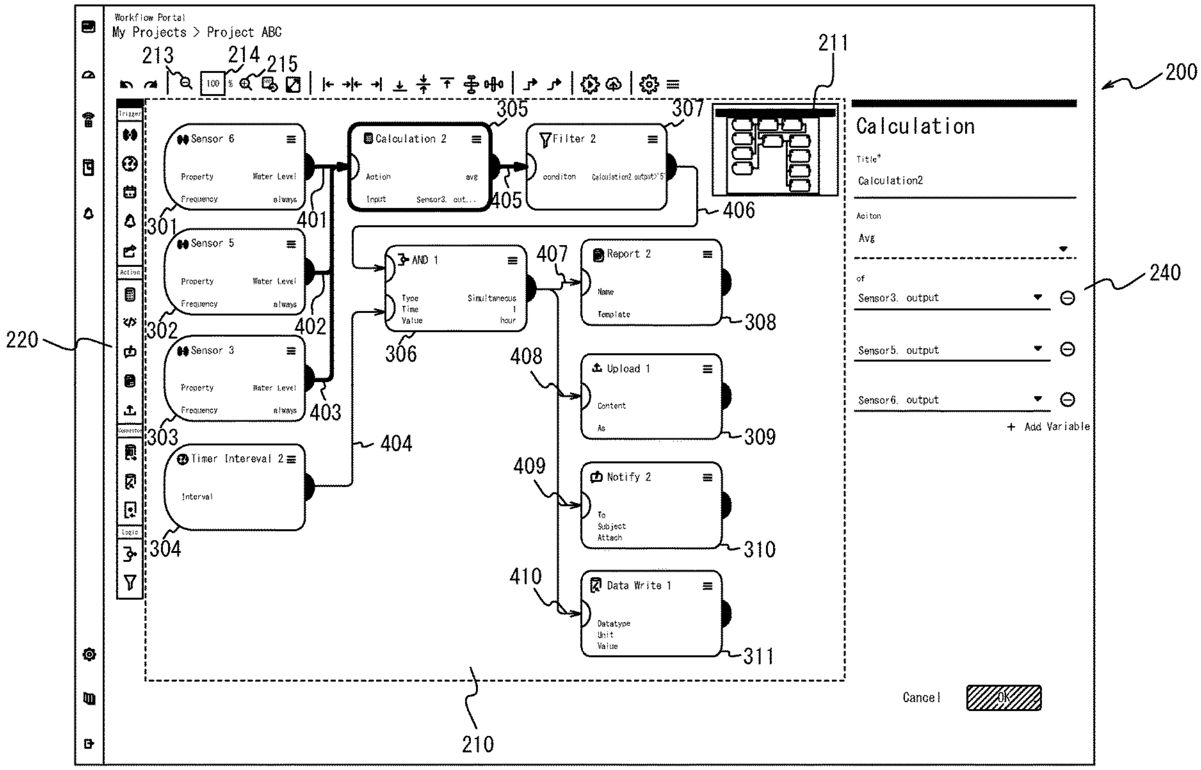
(57) **ABSTRACT**

A system for providing a software development environment, a method for providing a software development environment, and a non-transitory computer readable medium that can improve the convenience of a user interface of a software development environment are provided. A system for providing a software development environment to develop software by combining a plurality of development components includes an information processing apparatus (**30**) that includes a display (**35**) and a controller (**31**). The display (**35**) is configured to display a user interface (**200**) on which the plurality of development components and a plurality of links connecting the development components to each other are placed. When one development component among the plurality of development components is selected, the controller (**31**) is configured to display links (**401** to **403**, **405**) connected to the selected development component (**305**) on the display (**35**) in a display form with emphasis.



Calculation

Title*
Calculation2

Aciton
Avg

of
Sensor3. output
Sensor5. output
Sensor6. output

FIG. 1

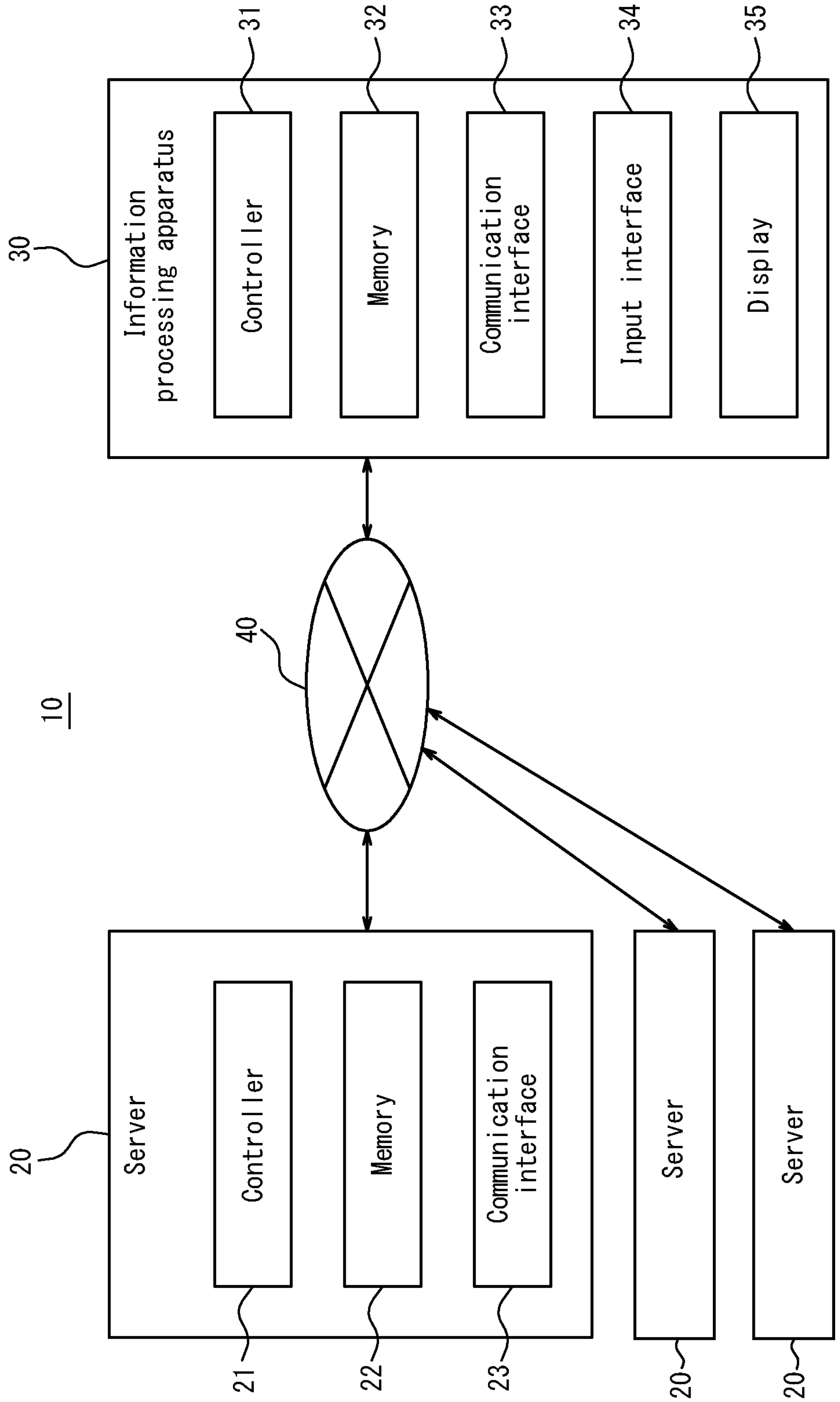

10
30
Information processing apparatus
31
Controller
32
Memory
33
Communication interface
34
Input interface
35
Display
40
20
Server
Controller
Memory
Communication interface
21
22
23
Server
20
Server
20

FIG. 2

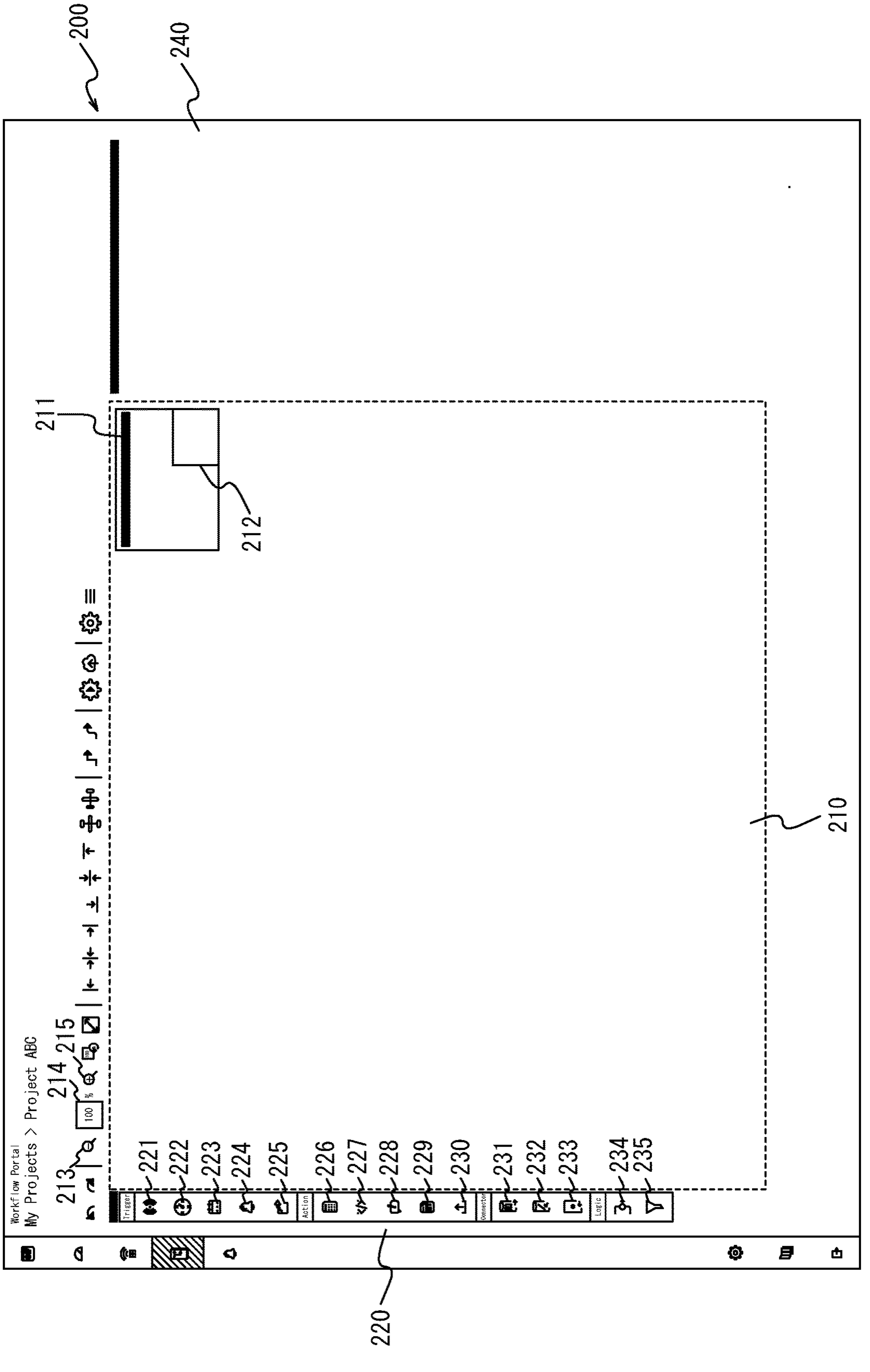
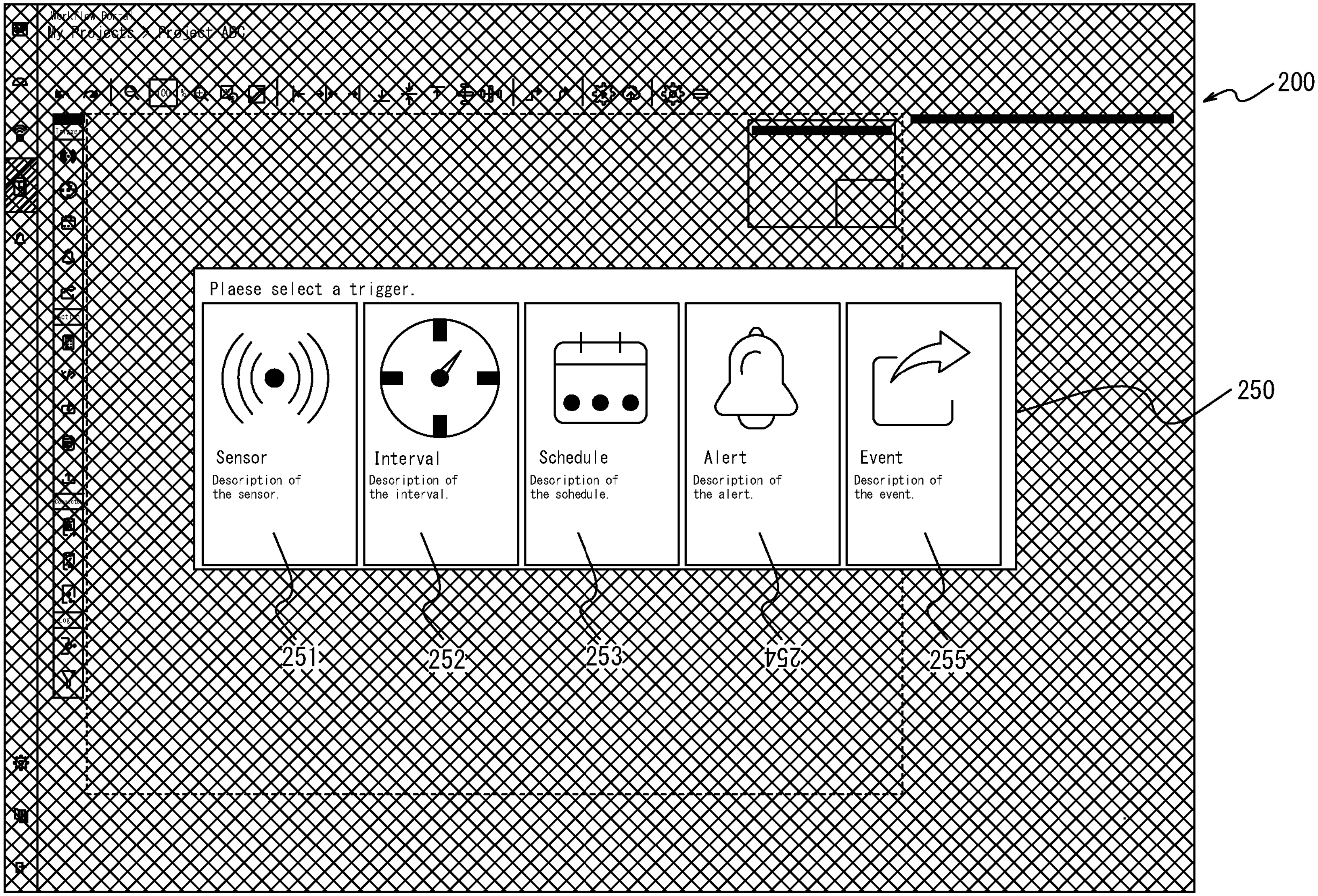

200
240
Workflow Portal
My Projects > Project ABC
100
%
213
214
215
211
212
210
Trigger
Action
Connector
Logic
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
220

FIG. 3


Workflow Portal
My Projects > Project ABC

Plaese select a trigger.

Sensor
Description of the sensor.

Interval
Description of the interval.

Schedule
Description of the schedule.

Alert
Description of the alert.

Event
Description of the event.

FIG. 4

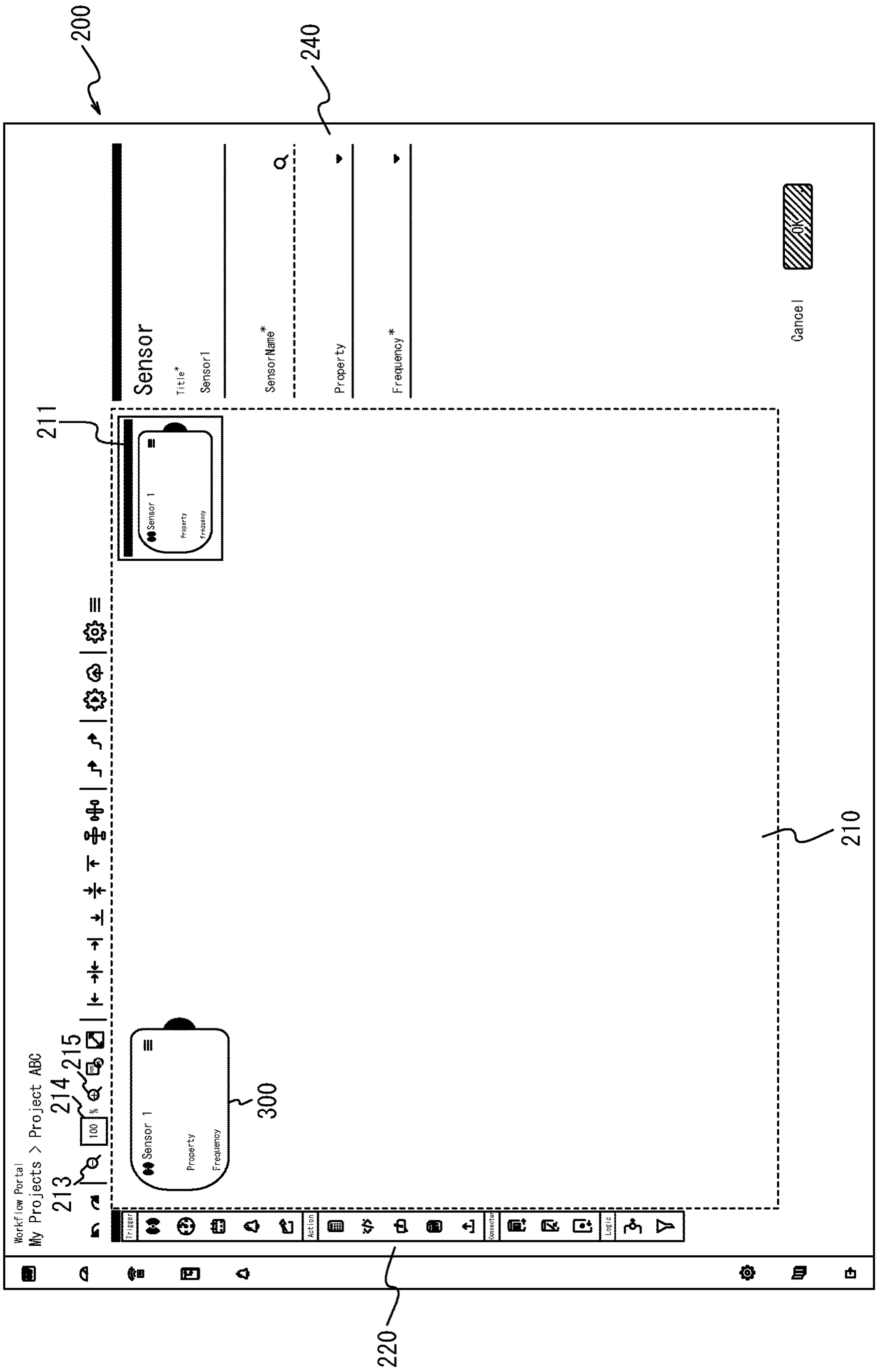

200
240
211
210
215
214
213
300
220
Workflow Portal
My Projects > Project ABC
100 %
Trigger
Action
Connector
Logic
Sensor 1
Property
Frequency
Sensor 1
Property
Frequency
Sensor
Title*
Sensor1
SensorName*
Property
Frequency*
Cancel
OK

FIG. 5

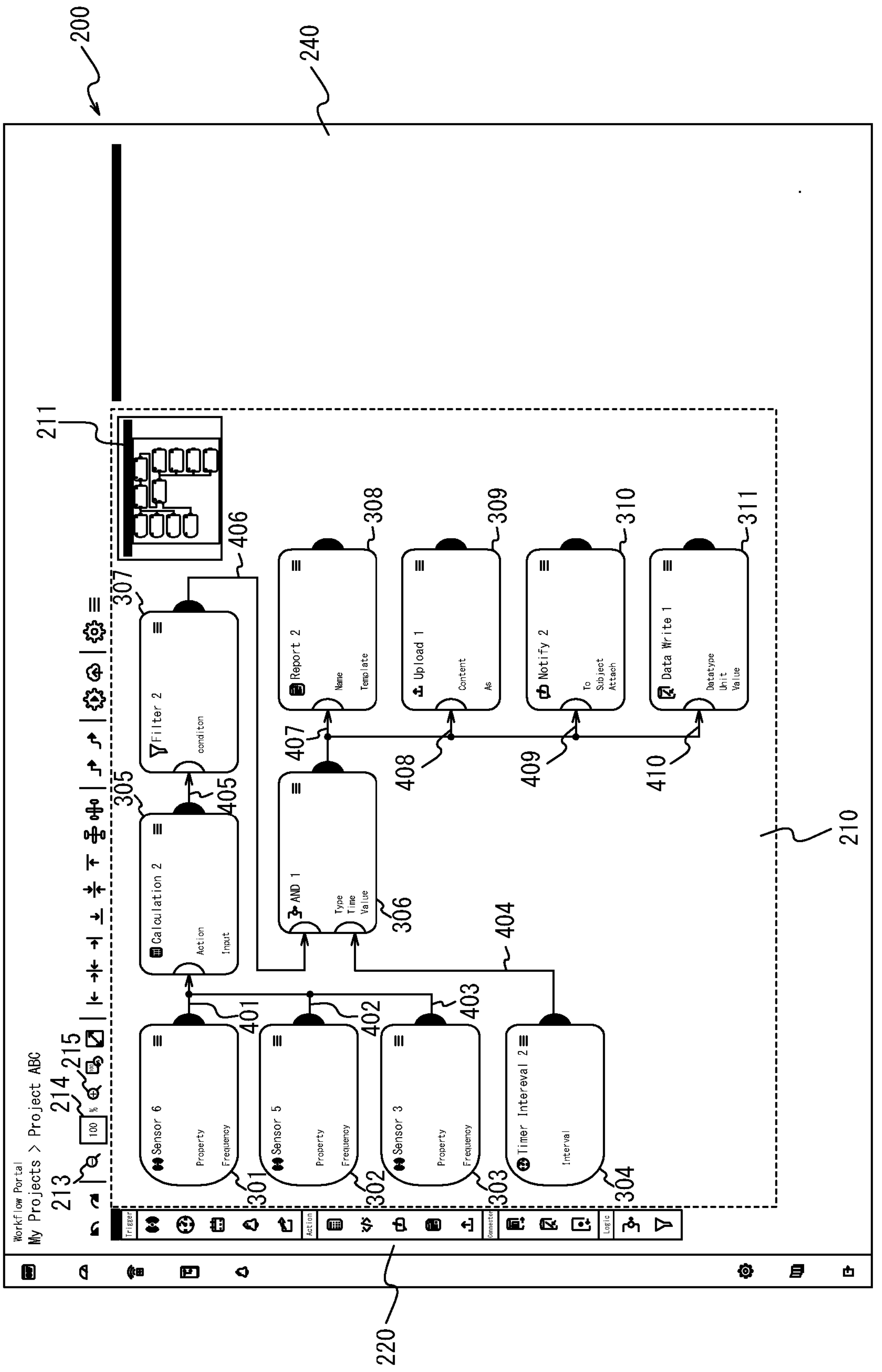

200
240
211
210
220
213
214
215
Workflow Portal
My Projects > Project ABC
100 %
Trigger
Action
Connector
Logic
Sensor 6
Property
Frequency
301
Sensor 5
Property
Frequency
302
Sensor 3
Property
Frequency
303
Timer Intereval 2
Interval
304
Calculation 2
Action
Input
305
AND 1
Type
Time
Value
306
Filter 2
conditon
307
Report 2
Name
Template
308
Upload 1
Content
As
309
Notify 2
To
Subject
Attach
310
Data Write 1
Datatype
Unit
Value
311
401
402
403
404
405
406
407
408
409
410

FIG. 6

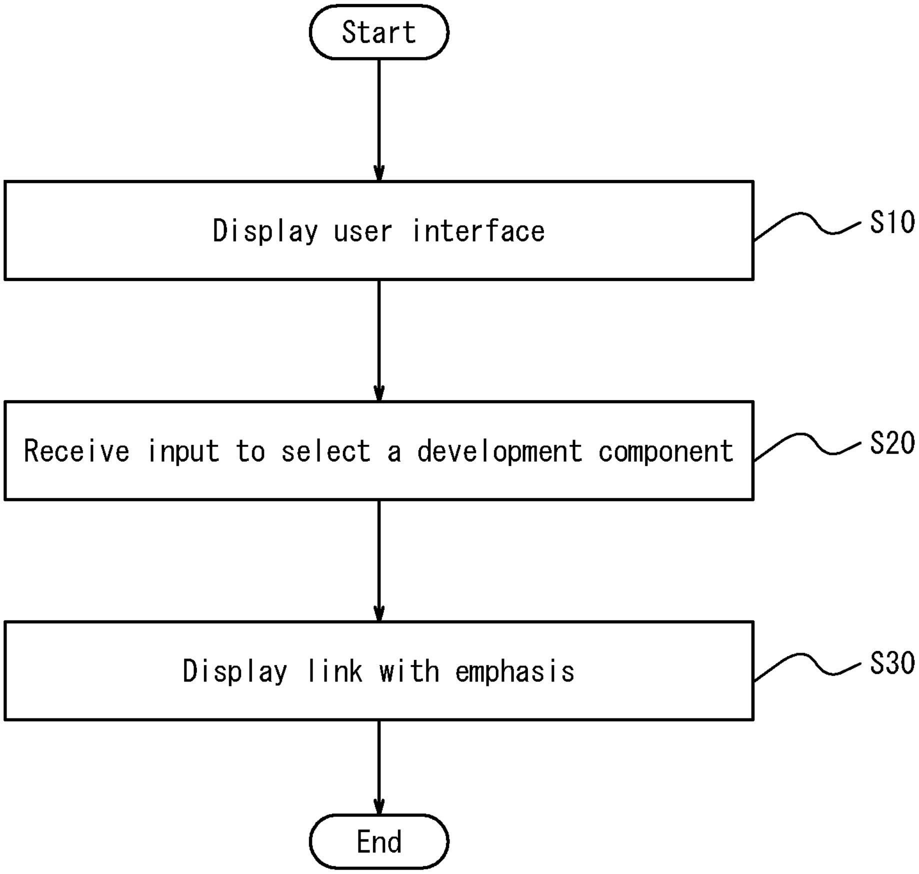
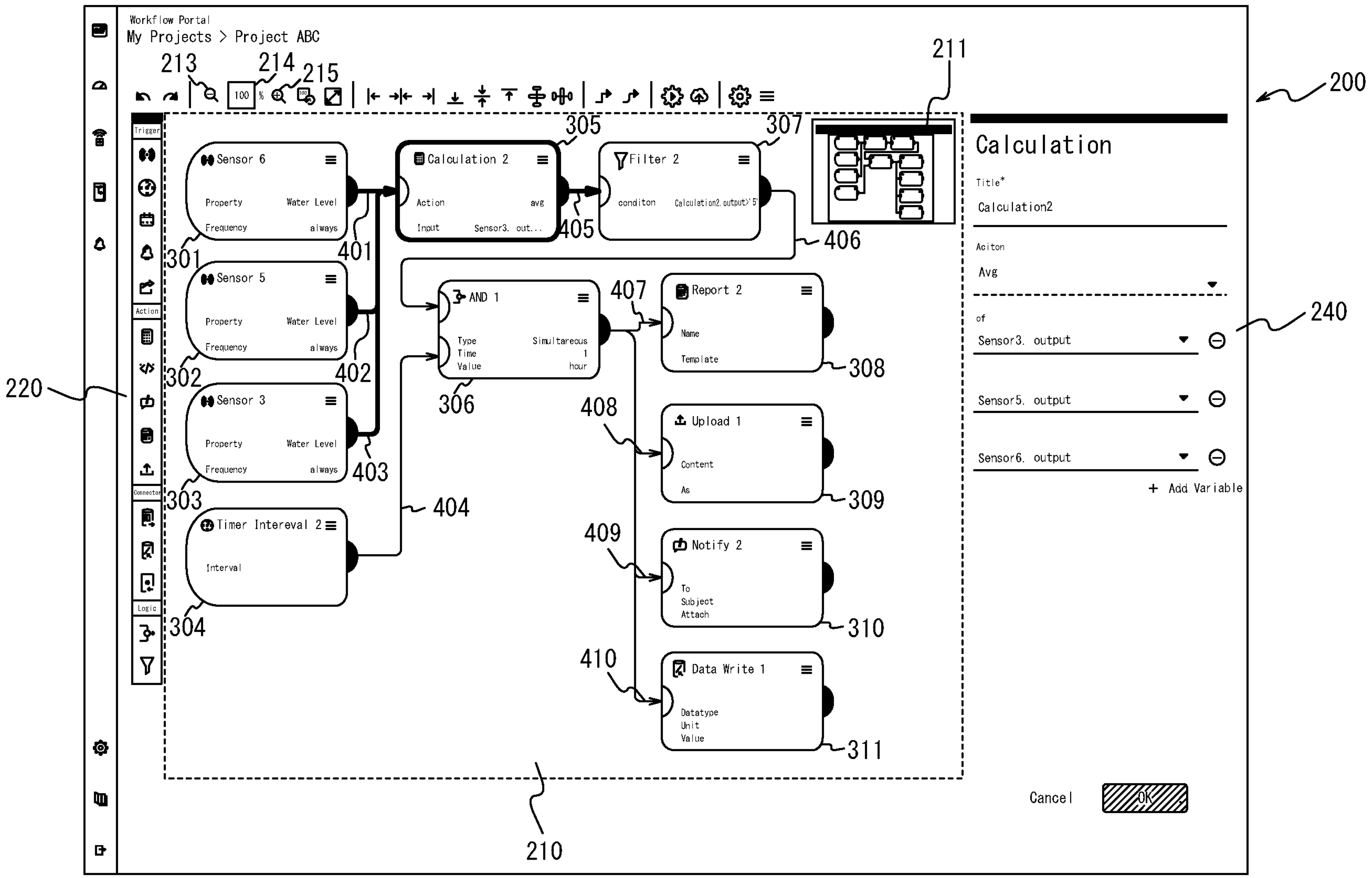

Start
Display user interface
S10
Receive input to select a development component
S20
Display link with emphasis
S30
End

FIG. 7



Calculation

Title*
Calculation2

Aciton
Avg ▾

of
Sensor3. output ▾ ⊖
Sensor5. output ▾ ⊖
Sensor6. output ▾ ⊖
+ Add Variable

Cancel OK

FIG. 8

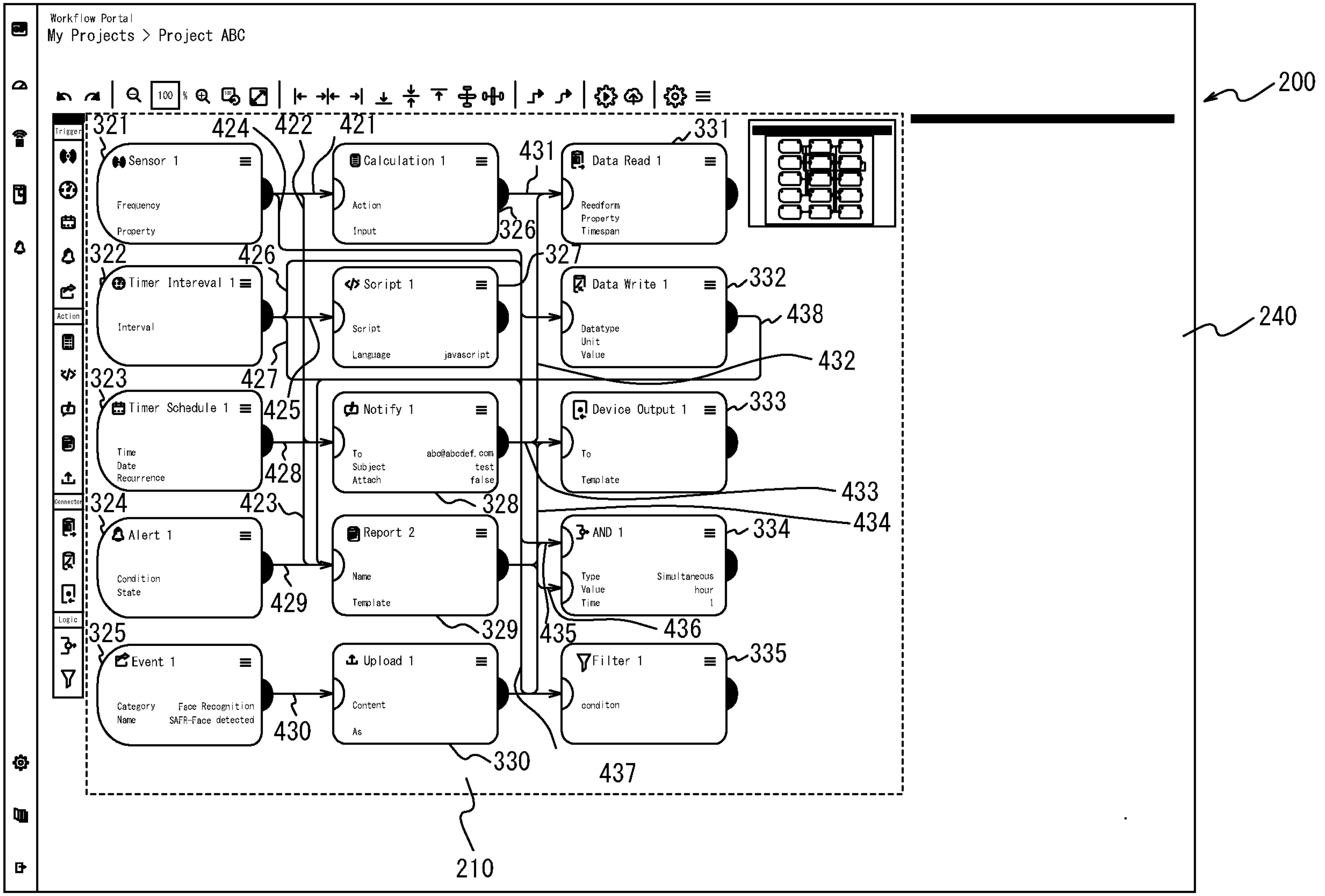
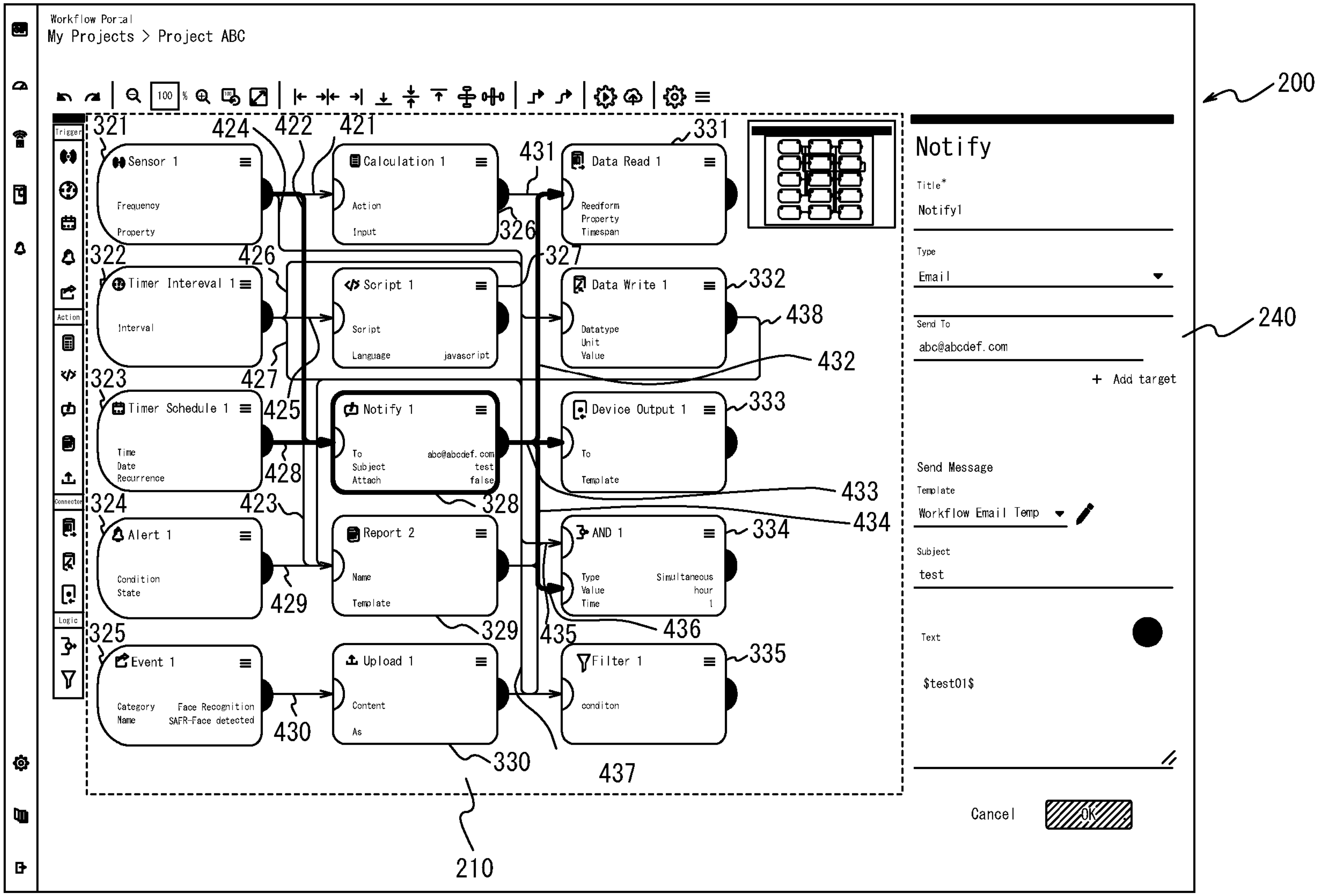

200
240
Workflow Portal
My Projects > Project ABC
100 %
Trigger
Action
Connector
Logic
321
Sensor 1
Frequency
Property
322
Timer Intereval 1
Interval
323
Timer Schedule 1
Time
Date
Recurrence
324
Alert 1
Condition
State
325
Event 1
Category Face Recognition
Name SAFR-Face detected
424
422
421
426
427
425
428
423
429
430
Calculation 1
Action
Input
Script 1
Script
Language javascript
Notify 1
To abc@abcdef.com
Subject test
Attach false
Report 2
Name
Template
Upload 1
Content
As
326
327
328
329
330
431
Data Read 1
Reedform
Property
Timespan
331
Data Write 1
Datatype
Unit
Value
332
438
432
Device Output 1
To
Template
333
433
434
AND 1
Type Simultaneous
Value hour
Time 1
334
435
436
Filter 1
conditon
335
437
210

FIG. 9



Workflow Poral
My Projects > Project ABC

Sensor 1
Frequency
Property

Timer Intereval 1
Interval

Timer Schedule 1
Time
Date
Recurrence

Alert 1
Condition
State

Event 1
Category Face Recognition
Name SAFR-Face detected

Calculation 1
Action
Input

Script 1
Script
Language javascript

Notify 1
To abc@abcdef.com
Subject test
Attach false

Report 2
Name
Template

Upload 1
Content
As

Data Read 1
Reedform
Property
Timespan

Data Write 1
Datatype
Unit
Value

Device Output 1
To
Template

AND 1
Type Simultaneous
Value hour
Time 1

Filter 1
conditon

Notify

Title*
Notify1

Type
Email

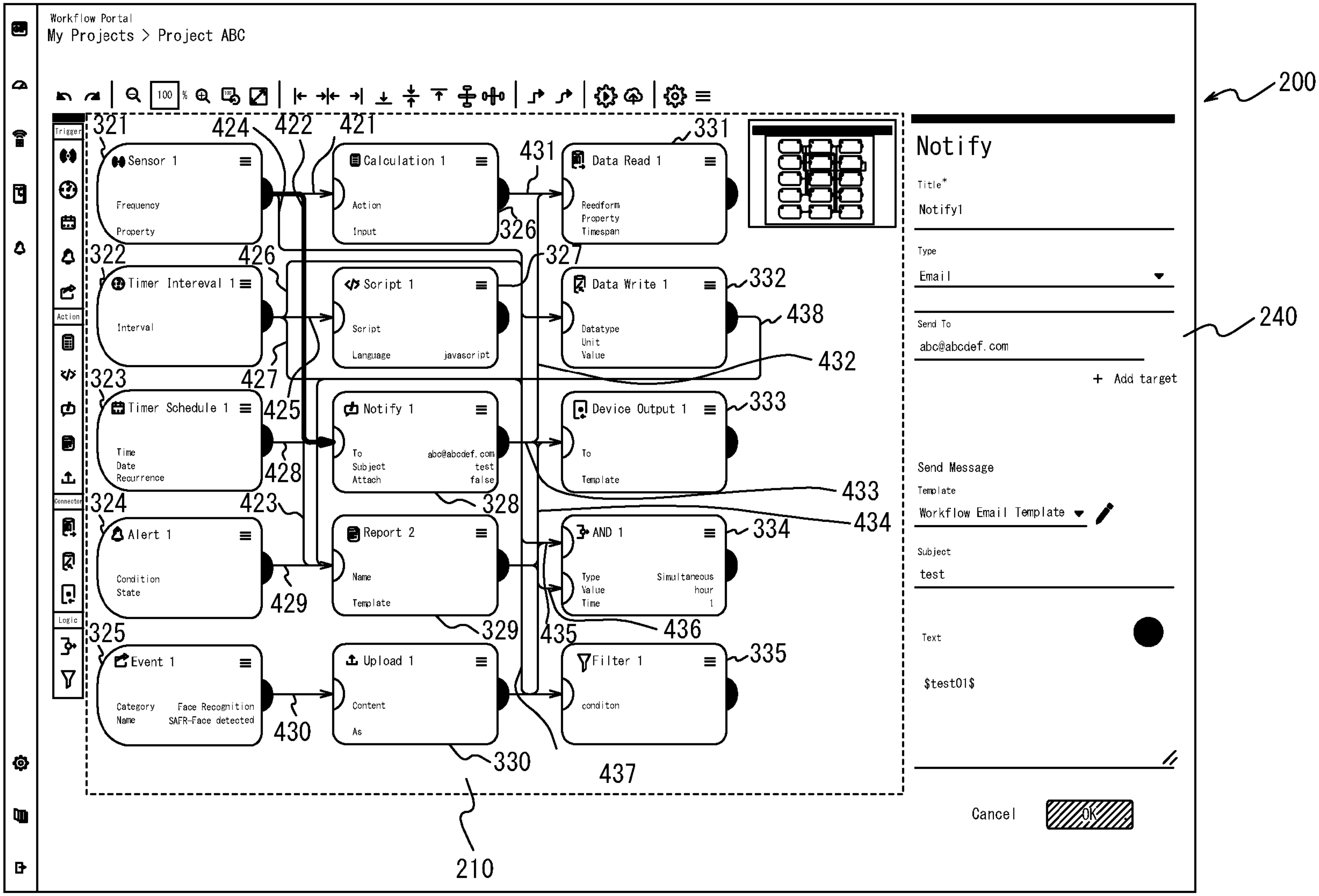
Send To
abc@abcdef.com

Send Message
Template
Workflow Email Temp

Subject
test

Text
$test01$

FIG. 10



Notify

Title*
Notify1

Type
Email

Send To
abc@abcdef.com

+ Add target

Send Message

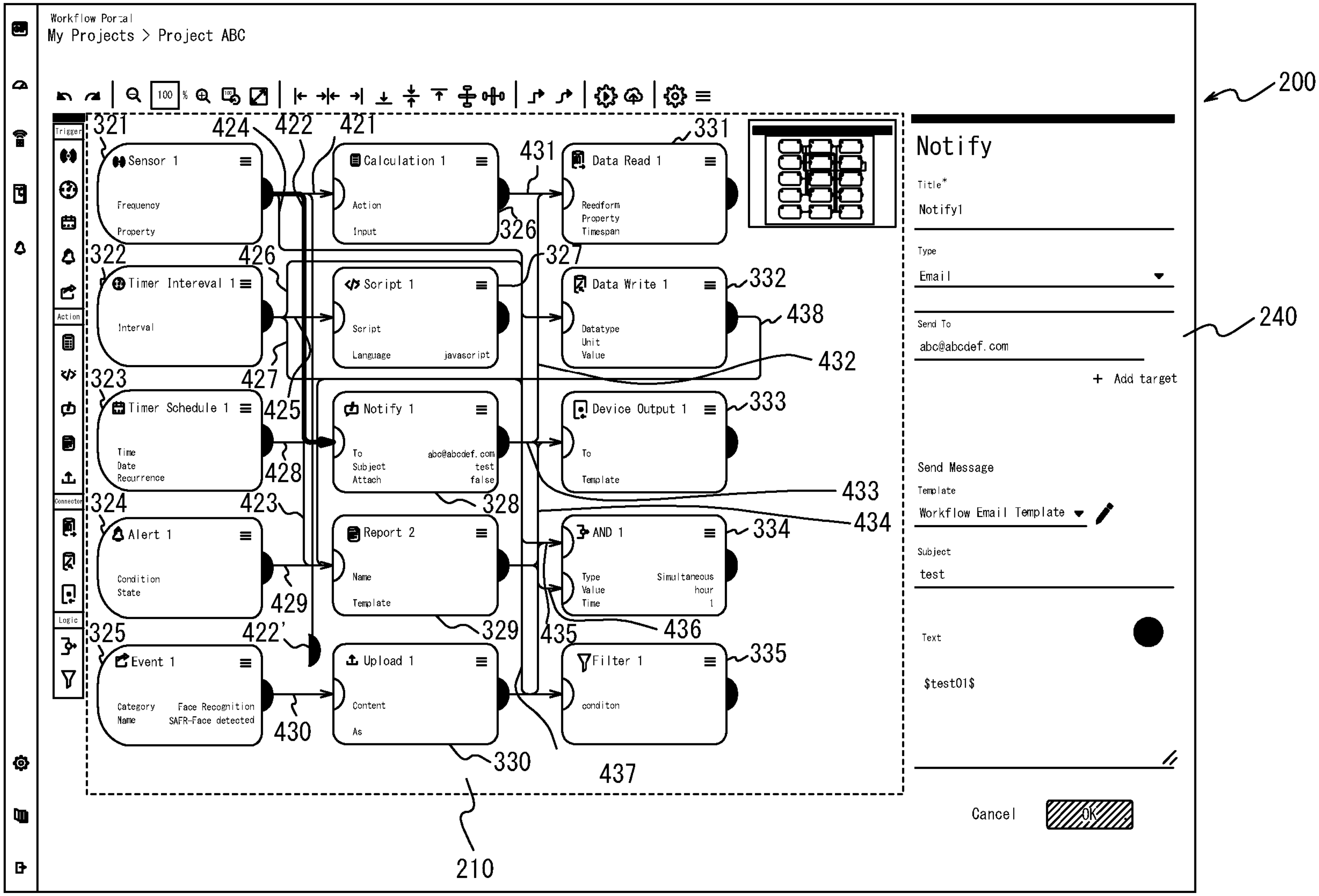
Template
Workflow Email Template

Subject
test

Text
$test01$

Cancel OK

FIG. 11



Notify

Title*
Notify1

Type
Email

Send To
abc@abcdef.com

+ Add target

Send Message

Template
Workflow Email Template

Subject
test

Text
$test01$

Cancel OK

FIG. 12

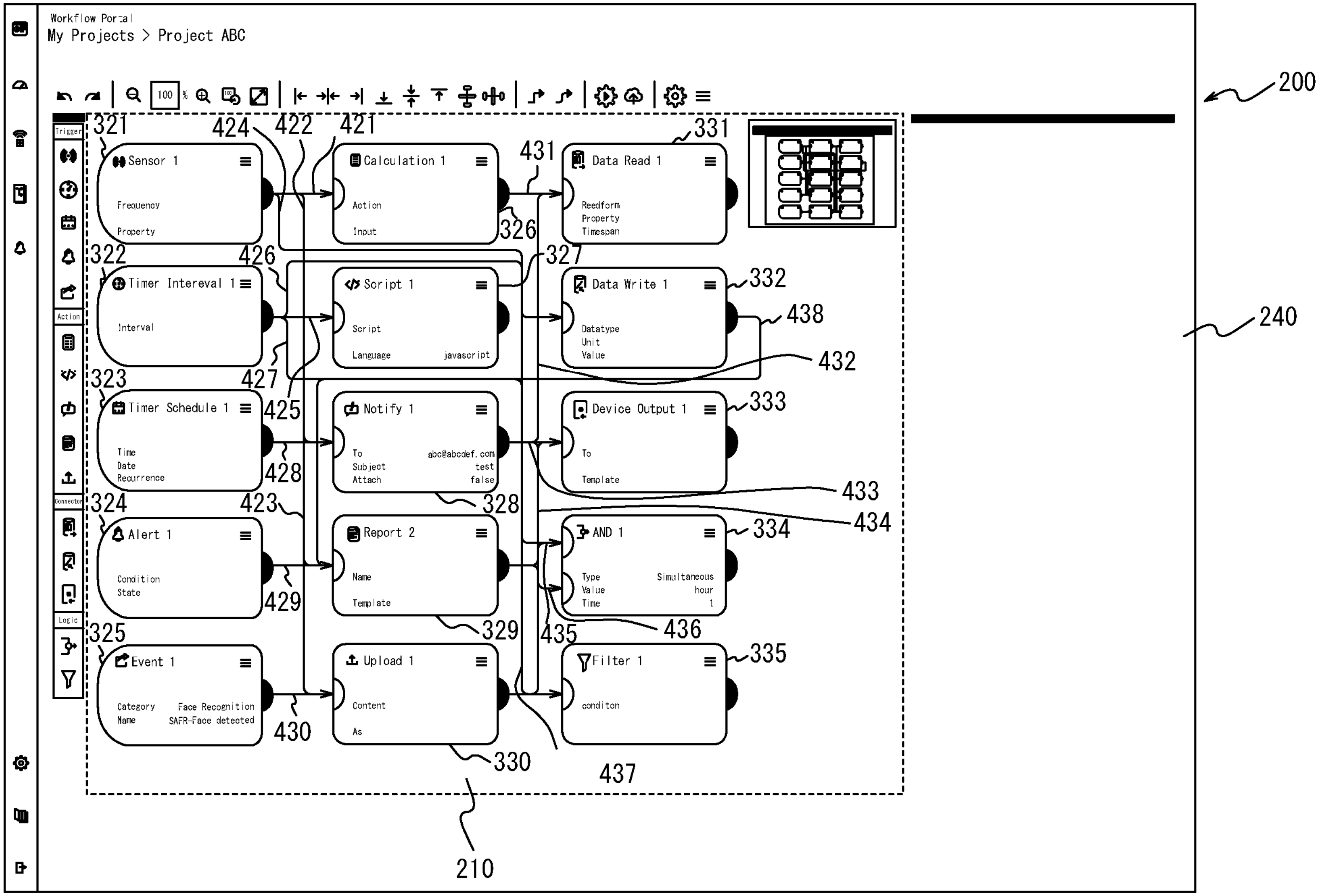
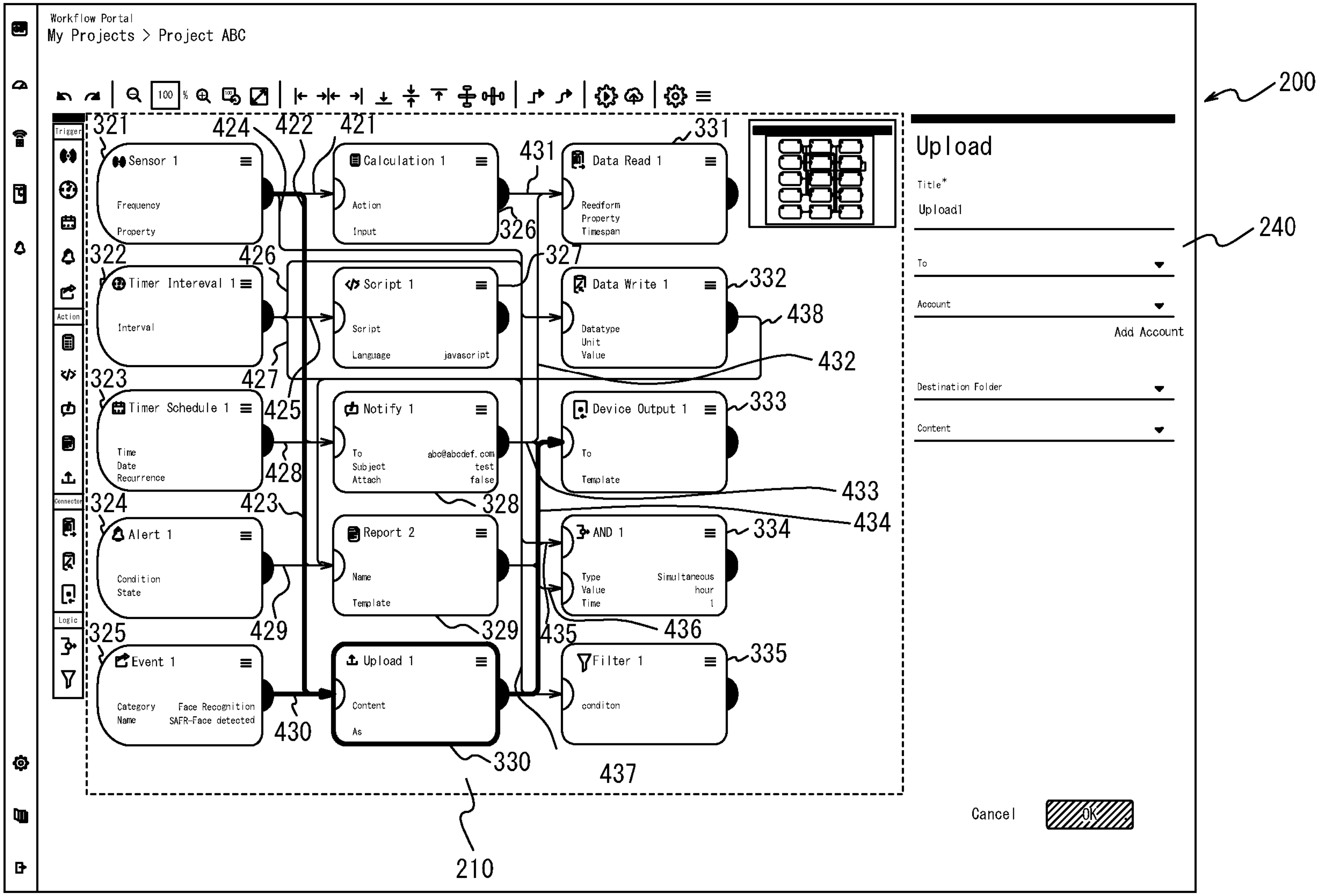

200
240
210
Workflow Portal
My Projects > Project ABC
100 %
Trigger
Action
Connector
Logic
321
Sensor 1
Frequency
Property
322
Timer Intereval 1
Interval
323
Timer Schedule 1
Time
Date
Recurrence
324
Alert 1
Condition
State
325
Event 1
Category Face Recognition
Name SAFR-Face detected
Calculation 1
Action
Input
Script 1
Script
Language javascript
Notify 1
To abc@abcdef.com
Subject test
Attach false
Report 2
Name
Template
Upload 1
Content
As
331
Data Read 1
Reedform
Property
Timespan
332
Data Write 1
Datatype
Unit
Value
333
Device Output 1
To
Template
334
AND 1
Type Simultaneous
Value hour
Time 1
335
Filter 1
conditon
326
327
328
329
330
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438

FIG. 13



Upload

Title*

Upload1

To

Account

Add Account

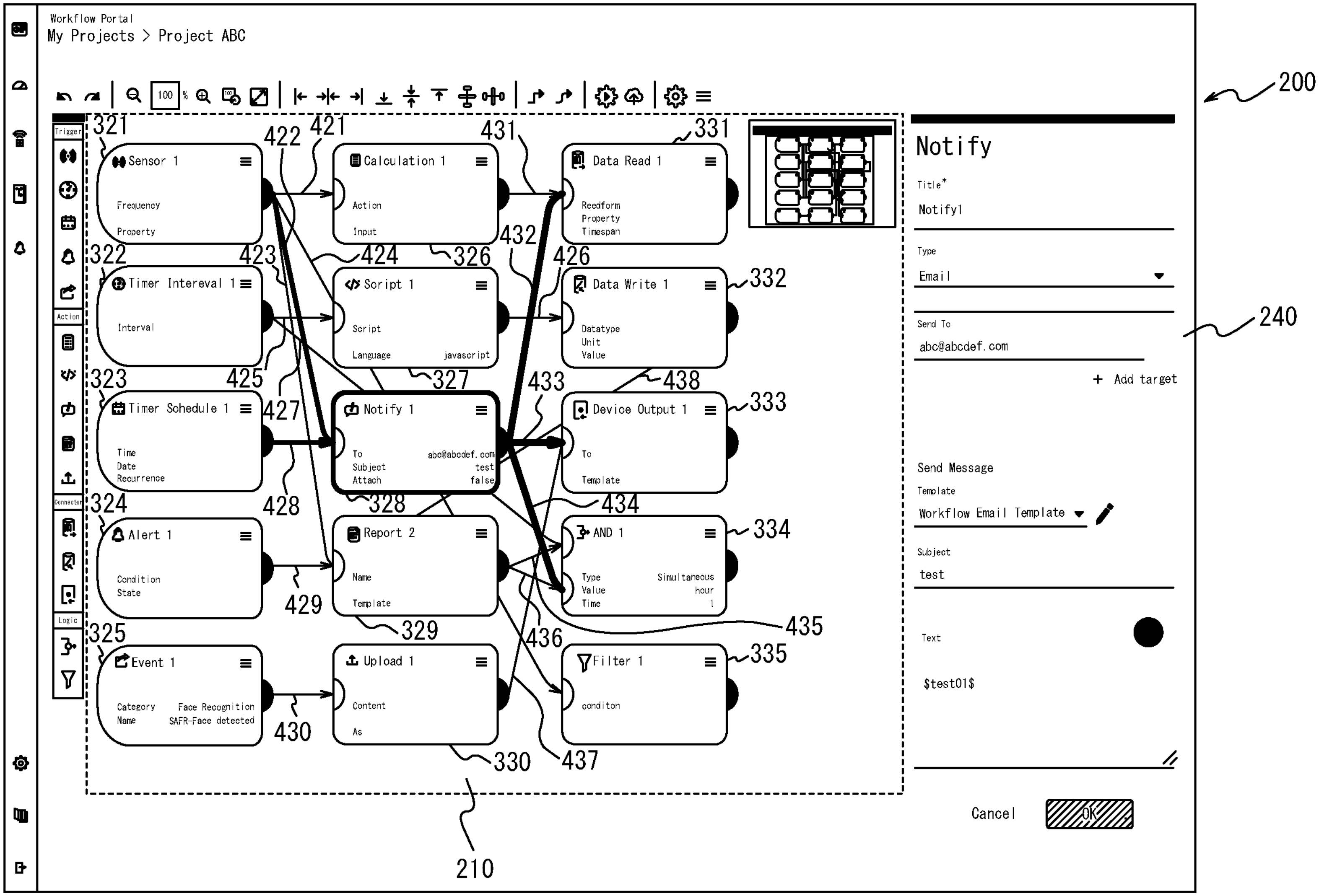
Destination Folder

Content

Cancel

OK

FIG. 14



Notify

Title*

Notify1

Type

Email

Send To

abc@abcdef.com

+ Add target

Send Message

Template

Workflow Email Template

Subject

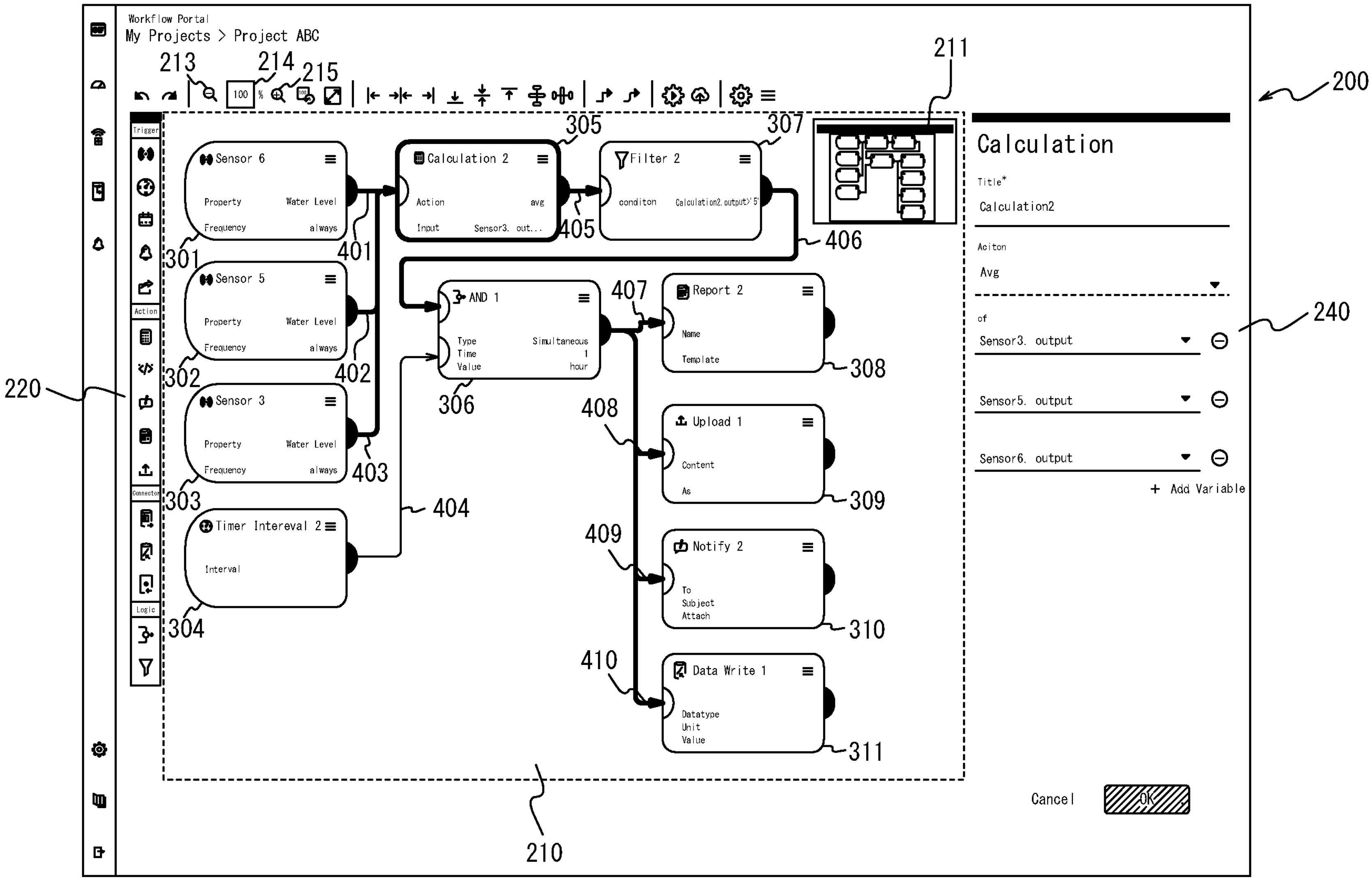
test

Text

$test01$

Cancel OK

FIG. 15



Workflow Portal
My Projects > Project ABC

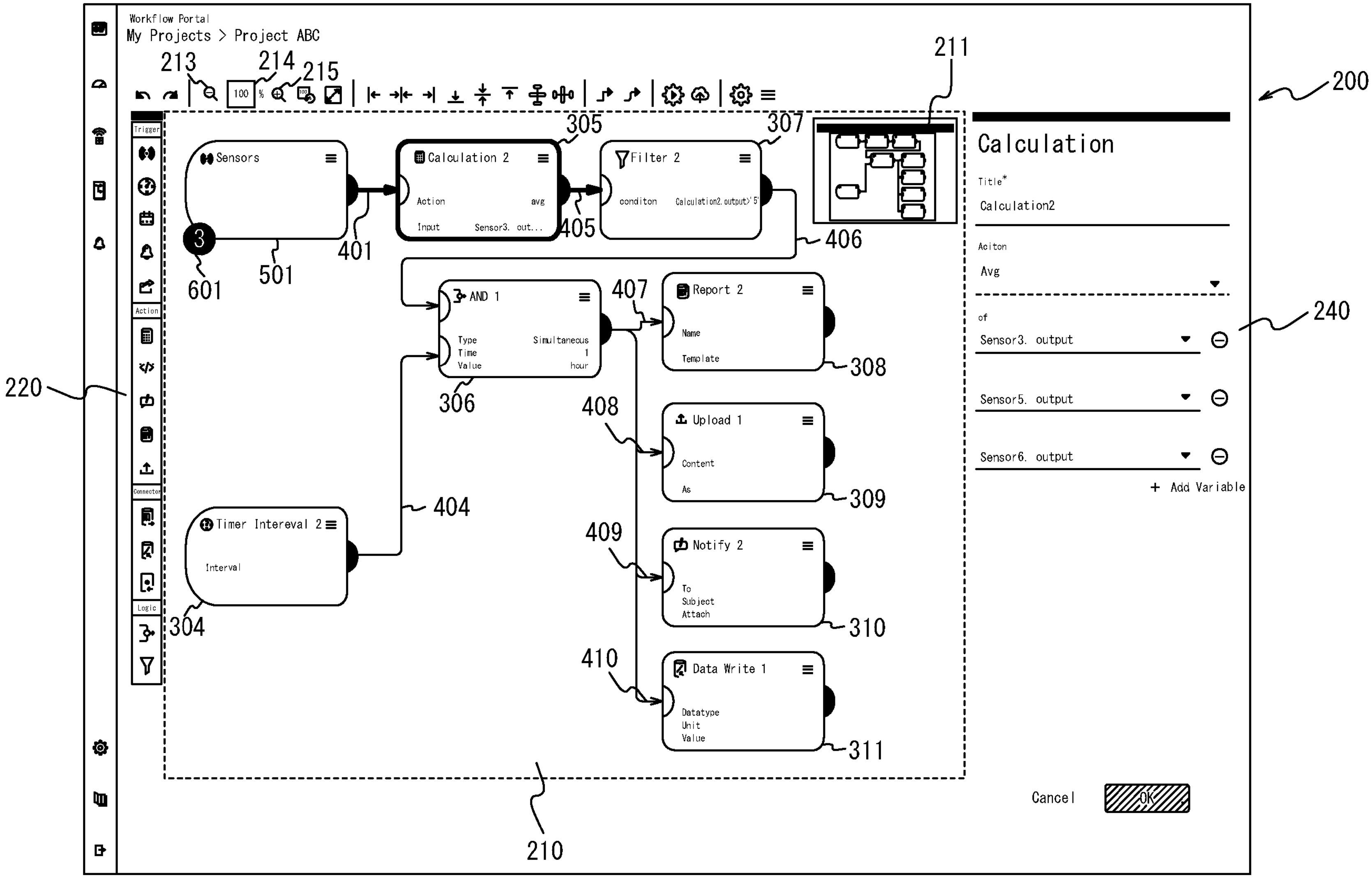
Calculation

Title*
Calculation2

Aciton
Avg

of
Sensor3. output
Sensor5. output
Sensor6. output

FIG. 16



Workflow Portal
My Projects > Project ABC

Calculation

Title*
Calculation2

Aciton
Avg

of
Sensor3. output
Sensor5. output
Sensor6. output

SYSTEM FOR PROVIDING SOFTWARE DEVELOPMENT ENVIRONMENT, METHOD FOR PROVIDING SOFTWARE DEVELOPMENT ENVIRONMENT, AND NON-TRANSITORY COMPUTER READABLE MEDIUM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to Japanese Patent Application No. 2020-114207 filed on Jul. 1, 2020, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a system for providing a software development environment, a method for providing a software development environment, and a non-transitory computer readable medium.

BACKGROUND

[0003] Along with advances in technology pertaining to the Internet of Things (JOT), systems have been proposed for automatic control of various devices, sensors, and the like connected to a network in plants, factories, buildings, residences, and the like. For example, various systems (engineering systems) have been constructed in plants, factories, and the like, such as a distributed control system, a manufacturing execution system (MES), a plant information management system (PIMS), and an enterprise resource planning (ERP) system.

[0004] The development of software implemented in these engineering systems, such as applications, workflow, and programs, has been achieved using an apparatus installed in a plant, such as a programmable logic controller (PLC). Patent literature (PTL) 1, for example, proposes technology to support software development using a visual programming tool. Specifically, PTL 1 discloses the development of software by representing various processes, such as functions, collectively as an object and representing the relationships between processes by wires connecting the processes.

CITATION LIST

Patent Literature

[0005] PTL 1: JP 2020-42679 A

SUMMARY

[0006] A system for providing a software development environment according to an embodiment is a system for providing a software development environment to develop software by combining a plurality of development components, the system including an information processing apparatus that includes a display and a controller, wherein the display is configured to display a user interface on which the plurality of development components and a plurality of links connecting the development components to each other are placed; and when one development component among the plurality of development components is selected, the controller is configured to display a link connected to the selected development component on the display in a display form with emphasis.

[0007] A method for providing a software development environment according to an embodiment is a method for providing a software development environment to develop software by combining a plurality of development components, the method including:

[0008] displaying a user interface on which the plurality of development components and a plurality of links connecting the development components to each other are placed; and

[0009] displaying, when one development component among the plurality of development components is selected, a link connected to the selected development component in a display form with emphasis.

[0010] A non-transitory computer readable medium according to an embodiment is a non-transitory computer readable medium storing a program, for providing a software development environment, configured to cause a processor to execute operations including:

[0011] displaying a user interface on which the plurality of development components and a plurality of links connecting the development components to each other are placed; and

[0012] displaying, when one development component among the plurality of development components is selected, a link connected to the selected development component in a display form with emphasis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In the accompanying drawings:

[0014] FIG. **1** is a functional block diagram of a system for providing a software development environment according to an embodiment of the present disclosure;

[0015] FIG. **2** is a diagram illustrating a user interface in the system for providing a software development environment according to an embodiment of the present disclosure;

[0016] FIG. **3** is a diagram illustrating a trigger selection dialog box in the system for providing a software development environment according to an embodiment of the present disclosure;

[0017] FIG. **4** is a diagram illustrating a user interface in which the development component selected in the trigger selection dialog box is placed;

[0018] FIG. **5** is a diagram illustrating a user interface on which a plurality of development components is placed;

[0019] FIG. **6** is a flowchart illustrating a method for providing a software development environment according to an embodiment of the present disclosure;

[0020] FIG. **7** is a diagram illustrating an overview of operations in the method for providing a software development environment according to an embodiment of the present disclosure;

[0021] FIG. **8** is a diagram illustrating an overview of operations in the method for providing a software development environment according to an embodiment of the present disclosure;

[0022] FIG. **9** is a diagram illustrating an overview of operations in the method for providing a software development environment according to an embodiment of the present disclosure;

[0023] FIG. **10** is a diagram illustrating an overview of operations for changing the destination of a link displayed with emphasis;

[0024] FIG. **11** is a diagram illustrating an overview of operations for changing the destination of a link displayed with emphasis;

[0025] FIG. **12** is a diagram illustrating an overview of operations for changing the destination of a link displayed with emphasis;

[0026] FIG. **13** is a diagram illustrating an overview of operations for changing the destination of a link displayed with emphasis;

[0027] FIG. **14** is a diagram illustrating an example of the case of changing the line type of links;

[0028] FIG. **15** is a diagram illustrating a display example of the case of emphasizing links connected indirectly to a selected development component; and

[0029] FIG. **16** is a diagram illustrating an example in which an integrated object is displayed in the system for providing a software development environment according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0030] When numerous objects are combined to develop software using the technology in PTL 1, however, the relationship between objects becomes harder to grasp as the number of combined objects increases. In other words, there is room for improvement in the convenience of the user interface of the software development environment.

[0031] It would be helpful to provide a system for providing a software development environment, a method for providing a software development environment, and a non-transitory computer readable medium that can improve the convenience of the user interface of a software development environment.

[0032] A system for providing a software development environment according to an embodiment is a system for providing a software development environment to develop software by combining a plurality of development components, the system including an information processing apparatus that includes a display and a controller, wherein the display is configured to display a user interface on which the plurality of development components and a plurality of links connecting the development components to each other are placed; and

[0033] when one development component among the plurality of development components is selected, the controller is configured to display a link connected to the selected development component on the display in a display form with emphasis.

[0034] According to the system for providing a software development environment of an embodiment, when one development component among the plurality of development components is selected, a link connected to the selected development component is thus displayed on the display in a display form with emphasis. This enables the user to grasp the relationship between development components easily. In other words, the convenience of the user interface of a software development environment can be improved by the system for providing a software development environment in an embodiment.

[0035] In an embodiment, the controller may be configured to display the selected development component on the display with emphasis.

[0036] According to the system for providing a software development environment of an embodiment, when one development component among the plurality of development components is selected, the selected development component is thus also displayed in a display form with emphasis, in addition to the link connected to the development component. This enables the user to grasp the relationship between development components more easily.

[0037] In an embodiment, the controller may be configured to display a link connected to an input port and a link connected to an output port of the selected development component on the display with emphasis in different colors.

[0038] According to the system for providing a software development environment of an embodiment, the link connected to the input port and the link connected to the output port of the selected development component are thus displayed with emphasis in different colors. This configuration enables the user to easily grasp the relationship between development components in a form that distinguishes between the input side and the output side.

[0039] In an embodiment, the controller may be configured to display a link connected to the selected development component on the display in a higher-level layer than a link not connected to the selected development component.

[0040] According to the system for providing a software development environment of an embodiment, the link connected to the selected development component is thus displayed on the display in a higher-level layer, thereby improving the operability when an operation to select the link is performed.

[0041] In an embodiment, the controller may be configured to display a link connected indirectly to the selected development component on the display with emphasis.

[0042] According to the system for providing a software development environment of an embodiment, the indirectly connected links are thus displayed with emphasis. This enables the user to easily grasp which development components are affected by the input and output of a certain development component.

[0043] In an embodiment, the controller may be configured to display a link connected directly to the selected development component and a link connected indirectly to the selected development component on the display with emphasis in different colors.

[0044] According to the system for providing a software development environment of an embodiment, the link connected directly to the selected development component and the link connected indirectly to the selected development component are thus displayed with emphasis in different colors. This configuration enables the user to easily grasp the relationship between development components in a form that distinguishes between directly connected links and indirectly connected links.

[0045] In an embodiment, the plurality of development components may include at least two development components that are of the same type and are connected to the same destination development component, and the at least two development components may be displayed by an integrated object corresponding to the at least two development components.

[0046] According to the system for providing a software development environment of an embodiment, the number of objects and the number of links are thus reduced, enabling the user to easily grasp the relationship between development components.

[0047] In an embodiment, the controller may be configured to display the integrated object in a display form that includes the number of integrated development components.

[0048] According to the system for providing a software development environment in an embodiment, the user can thus easily learn the number of integrated development components.

[0049] A method for providing a software development environment according to an embodiment is a method for providing a software development environment to develop software by combining a plurality of development components, the method including:

[0050] displaying a user interface on which the plurality of development components and a plurality of links connecting the development components to each other are placed; and

[0051] displaying, when one development component among the plurality of development components is selected, a link connected to the selected development component in a display form with emphasis.

[0052] According to the method for providing a software development environment of an embodiment, when one development component among the plurality of development components is selected, a link connected to the selected development component is thus displayed in a display form with emphasis. This enables the user to grasp the relationship between development components easily. In other words, the convenience of the user interface of a software development environment can be improved by the method for providing a software development environment in an embodiment.

[0053] A non-transitory computer readable medium according to an embodiment is a non-transitory computer readable medium storing a program, for providing a software development environment, configured to cause a processor to execute operations including:

[0054] displaying a user interface on which the plurality of development components and a plurality of links connecting the development components to each other are placed; and

[0055] displaying, when one development component among the plurality of development components is selected, a link connected to the selected development component in a display form with emphasis.

[0056] According to the non-transitory computer readable medium storing a program for providing a software development environment of an embodiment, when one development component among the plurality of development components is selected, a link connected to the selected development component is thus displayed in a display form with emphasis.

[0057] This enables the user to grasp the relationship between development components easily. In other words, the convenience of the user interface of a software development environment can be improved by the non-transitory computer readable medium that stores a program for providing a software development environment in an embodiment.

[0058] According to the present disclosure, a system for providing a software development environment, a method for providing a software development environment, and a non-transitory computer readable medium that can improve technology related to the user interface of a software development environment can be provided.

[0059] A system **10** for providing a software development environment according to an embodiment of the present disclosure is described below with reference to the drawings.

[0060] Identical or equivalent portions in the drawings are labeled with the same reference signs. In the explanation of the present embodiment, a description of identical or equivalent portions is omitted or simplified as appropriate.

[0061] An overview and configuration of the system **10** for providing a software development environment according to the present embodiment are described with reference to FIGS. **1** to **3**.

[0062] The system **10** for providing a software development environment according to the present embodiment includes a plurality of servers **20** and an information processing apparatus **30**. The servers **20** and the information processing apparatus **30** are communicably connected to a network **40**, such as a mobile communication network and/or the Internet. Each server **20** is, for example, installed in a data center or the like. Each server **20** is, for example, a server belonging to a cloud computing system or another computing system. In overview, the system **10** for providing a software development environment provides a user with an environment, for example on the cloud, for developing software by combining a plurality of development components. The user operates the information processing apparatus **30** to access the cloud, which is formed by the plurality of servers **20**, using a web browser on the information processing apparatus **30**, for example. The user can then develop software by combining a plurality of development components on an interface displayed by the web browser. The system **10** for providing a software development environment in FIG. **1** includes three servers **20**, but this example is not limiting. The system **10** for providing a software development environment may include fewer than three servers **20** or may include four or more servers **20**. The number of servers **20** may also be one.

[0063] The configurations of the server **20** and the information processing apparatus **30** according to the present embodiment are described below.

[0064] As illustrated in FIG. **1**, the server **20** includes a controller **21**, a memory **22**, and a communication interface **23**.

[0065] The controller **21** includes at least one processor, at least one dedicated circuit, or a combination thereof. The processor may, for example, be a general-purpose processor, such as a central processing unit (CPU) or graphics processing unit (GPU), or a dedicated processor specialized for particular processing. The dedicated circuit may, for example, be a field-programmable gate array (FPGA) or an application specific integrated circuit (ASIC). The controller **21** executes processing related to operation of the server **20** while controlling each component of the server **20**.

[0066] The memory **22** includes at least one semiconductor memory, at least one magnetic memory, at least one optical memory, or a combination of at least two of these. The semiconductor memory is, for example, random access memory (RAM) or read only memory (ROM). The RAM is, for example, static random access memory (SRAM) or dynamic random access memory (DRAM). The ROM is, for example, electrically erasable programmable read only memory (EEPROM). The memory **22** functions as, for example, a main memory, an auxiliary memory, or a cache memory. The memory **22** stores data to be used for operation of the server **20** and data resulting from operation of the server **20**.

[0067] The communication interface **23** includes at least one interface for communication with an external destination. The interface for communication may be an interface for wired communication or wireless communication. In the case of wired communication, the interface for communication may be a local area network (LAN) interface or a universal serial bus (USB), for example. In the case of wireless communication, the interface for communication may be an interface conforming to a mobile communication standard, such as Long Term Evolution (LTE), 4th Generation (4G), or 5th Generation (5G), or an interface conforming to short-range wireless communication such as Bluetooth® (Bluetooth is a registered trademark in Japan, other countries, or both). The communication interface **23** receives data for use in operation of the server **20** and transmits data resulting from operation of the server **20**.

[0068] The functions of the server **20** are implemented by a processor corresponding to the controller **21** executing a program according to the present embodiment. In other words, the functions of the server **20** are implemented by software. The program causes a computer to function as the server **20** by causing the computer to execute the operations of the server **20**. In other words, the computer functions as the server **20** by executing the operations of the server **20** in accordance with the program.

[0069] The program according to the present embodiment can be recorded on a computer readable recording medium. Computer readable recording media include non-transitory computer readable recording media, examples of which are a magnetic recording apparatus, an optical disc, a magneto-optical recording medium, and a semiconductor memory. The program is, for example, distributed by the sale, transfer, or lending of a portable recording medium such as a digital versatile disk (DVD) or a compact disk read only memory (CD-ROM) on which the program is recorded. The program may also be distributed by storing the program in the storage of an external server and transmitting the program from the external server to another computer. The program may also be provided as a program product.

[0070] A portion or all of the functions of the server **20** may be implemented by a dedicated circuit corresponding to the controller **21**. In other words, a portion or all of the functions of the server **20** may be implemented by hardware.

[0071] The information processing apparatus **30** includes a controller **31**, a memory **32**, a communication interface **33**, an input interface **34**, and a display **35**.

[0072] The controller **31** includes at least one processor, at least one dedicated circuit, or a combination thereof. The processor may be a general-purpose processor, such as a CPU or GPU, or a dedicated processor specialized for particular processing. The dedicated circuit is, for example, an FPGA or an ASIC. The controller **31** executes processing related to operation of the information processing apparatus **30** while controlling each component of the information processing apparatus **30**.

[0073] The memory **32** includes at least one semiconductor memory, at least one magnetic memory, at least one optical memory, or a combination of at least two of these. The semiconductor memory is, for example, RAM or ROM. The RAM is, for example, SRAM or DRAM. The ROM is, for example, EEPROM. The memory **32** functions as, for example, a main memory, an auxiliary memory, or a cache memory. The memory **32** stores data to be used for operation of the information processing apparatus **30** and data resulting from operation of the information processing apparatus **30**.

[0074] The communication interface **33** includes at least one interface for communication with an external destination. The interface for communication may be an interface for wired communication or wireless communication. In the case of wired communication, the interface for communication may be a LAN interface or a USB, for example. In the case of wireless communication, the interface for communication may be an interface conforming to a mobile communication standard, such as LTE, 4G, or 5G, or an interface conforming to short-range wireless communication such as Bluetooth®. The communication interface **33** receives data for use in operation of the information processing apparatus **30** and transmits data resulting from operation of the information processing apparatus **30**.

[0075] The input interface **34** includes at least one interface for input. The interface for input is, for example, a physical key, a capacitive key, a pointing device, or a touchscreen integrally provided with a display. The input interface **34** receives an operation for inputting data used in operation of the information processing apparatus **30**. Instead of being provided in the information processing apparatus **30**, the input interface **34** may be connected to the information processing apparatus **30** as an external input device. Any appropriate connection method can be used, such as USB, High-Definition Multimedia Interface (HDMI®) (HDMI is a registered trademark in Japan, other countries, or both), or Bluetooth®.

[0076] The display **35** includes at least one interface for display output. The interface for output is, for example, a display. The display may, for example, be a liquid crystal display (LCD) or an organic electro luminescence (EL) display. The display **35** outputs data resulting from operation of the information processing apparatus **30** by displaying the data. Instead of being provided in the information processing apparatus **30**, the display **35** may be connected to the information processing apparatus **30** as an external output device. Any appropriate connection method can be used, such as USB, HDMI®, or Bluetooth®.

[0077] The functions of the information processing apparatus **30** are implemented by a processor corresponding to the controller **31** executing a program according to the present embodiment. In other words, the functions of the information processing apparatus **30** are implemented by software. The program causes a computer to function as the information processing apparatus **30** by causing the computer to execute the operations of the information processing apparatus **30**. In other words, the computer functions as the information processing apparatus **30** by executing the operations of the information processing apparatus **30** in accordance with the program.

[0078] The computer in the present embodiment temporarily stores, in the main memory, the program recorded on a portable recording medium or transferred from a server, for example. The computer uses a processor to read the program stored in the main memory and executes processing with the processor in accordance with the read program. The computer may read the program directly from the portable recording medium and execute processing in accordance with the program. Each time the program is received from an external server, the computer may sequentially execute processing in accordance with the received program. Processing may be executed by an application service provider (ASP) type of service that implements functions only via execution instructions and result acquisition, without transmission of the program from an external server to the computer. Examples of the program include an equivalent to the program represented as information provided for processing by an electronic computer. For example, data that is not a direct command for a computer but that has the property of specifying processing by the computer corresponds to the "equivalent to the program".

[0079] A portion or all of the functions of the information processing apparatus **30** may be implemented by a dedicated circuit corresponding to the controller **31**. In other words, a portion or all of the functions of the information processing apparatus **30** may be implemented by hardware.

[0080] FIG. **2** illustrates an example of a user interface displayed on the display **35** of the information processing apparatus **30**. The user operates the input interface **34** of the information processing apparatus **30** to access the server **20** via a web browser, for example. The user then develops software by combining a plurality of development components on the user interface displayed in the web browser. It is thus not necessary in the present embodiment to install, on the information processing apparatus **30**, an application or the like that is specialized for the system **10** for providing a software development environment. In other words, as long as the information processing apparatus **30** includes a web browser application, the user can develop software by connecting to the server **20** from the information processing apparatus **30**.

[0081] The user interface **200** illustrated in FIG. **2** includes a builder area **210**, a development component selection area **220**, and a property area **240**. The builder area **210** is an area for a plurality of development components to be placed, connected, and the like. The user develops software by combining a plurality of development components in the builder area **210**. The builder area **210** includes an overview screen **211**. The overview screen **211** displays an overview of the placed development components using a reduced-size screen. In other words, the overview screen **211** is a screen displaying all of the placed development components at a reduced size. The range displayed by the builder area **210** (display area) is indicated in the overview screen **211** by a display range frame **212**. The display area of the builder area **210** can be expanded or reduced by magnification adjustment tools **213** to **215**. The development component selection area **220** is an area for displaying a plurality of development components **221** to **235** that are placeable in the builder area **210**. The property area **240** is an area for displaying and editing setting information and the like pertaining to a development component selected in the builder area **210**.

[0082] The development components in the present embodiment are classified into types such as trigger, action, connector, and logic. The development components **221** to **225** illustrated in FIG. **2** are classified as triggers. The development components classified as triggers are components pertaining to the occurrence of some sort of event, such as the acquisition of a sensor value from a sensor such as a temperature sensor, humidity sensor, or pressure sensor, the elapse of a predetermined length of time, or the occurrence of a predetermined alarm on a device. The development components **226** to **230** are classified as actions. The development components classified as actions are components pertaining to an operation, processing, or the like, such as calculation processing, notification, or uploading of data, that is performed when an event occurs. The development components **231** to **233** are classified as connectors. The development components classified as connectors are components pertaining to information processing with an external resource, such as connection to a database, device, or the like and the addition, updating, deletion, etc. of information thereon. The development components **234** to **235** are classified as logic. The development components classified as logic are components pertaining to the logical sum, filtering, or the like of input information. The user manipulates a mouse pointer or the like to develop software on the user interface **200**. For example, the user manipulates a mouse pointer to select a desired development component from the development component selection area **220** and then places, connects, etc. the selected, desired development component in the builder area **210**.

[0083] FIG. **3** is a diagram illustrating a trigger selection dialog box in the system for providing a software development environment according to an embodiment of the present disclosure. A trigger selection dialog box **250** illustrated in FIG. **3** is displayed when no development component has been placed in the builder area **210**. The trigger selection dialog box **250** is a dialog screen for the user to select a development component to place first in the builder area **210**. In other words, the user is prompted by the trigger selection dialog box **250** to perform the first operation necessary for software development. The user can thereby easily start developing software. The trigger selection dialog box **250** includes development components **251** to **255**, which respectively correspond to the development components **221** to **225** of the development component selection area **220**.

[0084] FIG. **4** is a diagram illustrating a user interface in which the development component selected in the trigger selection dialog box **250** is placed in the builder area **210**. For example, suppose that the user has operated a mouse pointer and selected the development component **251** pertaining to a sensor in the trigger selection dialog box **250**. In this case, as illustrated in FIG. **4**, a development component **300** corresponding to a sensor is placed in the builder area **210**. Properties are associated with the development component **300**. The properties include a variety of variables, conditional expressions, setting information, and the like pertaining to the development component. By selecting and setting properties such as various settings, variables, conditional expressions, and so forth from pulldown menus or the like in the property area **240**, the user defines various actions and the like for each development component. In other words, the user can develop software by placing and connecting development components and setting the setting information, with no need whatsoever for writing program code.

[0085] FIG. **5** is an example in which a plurality of development components has been placed and connected in the builder area **210**. In FIG. **5**, development components **301** to **311** have been placed and are connected by links **401** to **410**. The link **401** indicates that the output of the development component **301** is the input of the development component **305**. The link **402** indicates that the output of the development component **302** is the input of the development component **305**. The link **403** indicates that the output of the development component **303** is the input of the development component **305**. The link **404** indicates that the output of the development component **304** is the input of the development component **306**. The link **405** indicates that the output of the development component **305** is the input of the development component **307**. The link **406** indicates that the output of the development component **307** is the input of the development component **306**. The link **407** indicates that the output of the development component **306** is the input of the development component **308**. The link **408** indicates that the output of the development component **306** is the input of the development component **309**. The link **409** indicates that the output of the development component **306** is the input of the development component **310**. The link **410** indicates that the output of the development component **306** is the input of the development component **311**. Properties are associated with each of the development components **301** to **311**.

[0086] FIG. **6** is a flowchart illustrating operations by the system **10** for providing a software development environment, i.e. an example of a method for providing a software development environment.

[0087] First, the controller **31** of the information processing apparatus **30** displays the user interface **200** on the display **35** (step S**10**). FIG. **5** is an example of the user interface **200** displayed in this case. As described above, the user interface **200** includes the builder area **210** and the development component selection area **220**, which displays a plurality of development components placeable in the builder area **210**. Here, a request to display the user interface **200** is based on an input operation from the user. For example, the controller **31** uses the input interface **34** to receive an input operation by the user on the web browser. Upon receiving the input operation, the controller **31** communicates with the server **20** via the communication interface **33** and receives data pertaining to the user interface **200**. The controller **31** then displays the user interface **200** on the display **35** based on the data. An authentication process or the like pertaining to the user may be performed by the server **20** and the information processing apparatus **30** as appropriate.

[0088] Next, the input interface **34** receives an input to select one of the development components **301** to **311** displayed in the builder area **210** (step S**20**). For example, the input interface **34** receives an input to select the development component **305**.

[0089] Subsequently, the controller **31** displays links connected to the selected development component in an emphasized display form on the display **35** (step S**30**). FIG. **7** illustrates an example of the emphasized display form. The links connected to the selected development component **305** are the links **401** to **403** and the link **405**. All of these links **401** to **403** and link **405** are displayed with more emphasis than the links not connected to the selected development component **305**. Here, the controller **31** may display links connected to the input port of the selected development component and links connected to the output port of the selected development component with emphasis in different colors. The input port of the development component in the present embodiment is the port to which the arrow-shaped end of each link is connected. The output port of the development component is the port to which the opposite end from the arrow-shaped end of each link is connected. In other words, the links connected to the input port of the selected development component are the links **401** to **403**. The link connected to the output port of the selected development component is the link **405**. For example, the links **401** to **403** are displayed with emphasis in blue. The link **405** is displayed with emphasis in a color other than blue (such as red).

[0090] In this way, according to the system **10** for providing a software development environment of the present embodiment, the links connected to a selected development component are displayed in an emphasized display form, as illustrated in FIG. **7**, for example. This enables the user to grasp the relationship between development components easily. In other words, the convenience of the user interface of a software development environment can be improved by the system **10** for providing a software development environment in the present embodiment.

[0091] As illustrated in FIG. **7**, the controller **31** may also display the selected development component (here, the development component **305**) with emphasis in addition to the links connected to the selected development component. When the selected development component is also displayed with emphasis, the user can more easily grasp the relationship between development components.

[0092] The form of the emphasized display is not limited to this example. For example, the display may be emphasized by appropriately changing any parameter such as brightness, the shade of the display color, or the contrast of the link or development component, or a combination thereof. Apart from changing these parameters, the display may also be emphasized by any form that stands out visually as compared to other links or development components.

[0093] The system **10** for providing a software development environment according to the present embodiment achieves a greater effect when a plurality of development components are present in the builder area **210** and have a complex connection relationship. FIG. **8** illustrates an example of the case when the number of placed development components is large. In FIG. **8**, the development components **321** to **335** have been placed in the builder area **210**. The link **421** indicates that the output of the development component **321** is the input of the development component **326**. The link **422** indicates that the output of the development component **321** is the input of the development component **328**. The link **423** indicates that the output of the development component **321** is the input of the development component **329**. The link **424** indicates that the output of the development component **321** is the input of the development component **335**. The link **425** indicates that the output of the development component **322** is the input of the development component **327**. The link **426** indicates that the output of the development component **322** is the input of the development component **332**. The link **427** indicates that the output of the development component **322** is the input of the development component **334**. The link **428** indicates that the output of the development component **323** is the input of the development component **328**. The link **429** indicates that the output of the development component **324** is the input of the development component **329**. The link **430** indicates that the output of the development component **325** is the input of the development component **330**. The link **431** indicates that the output of the development component **326** is the input of the development component **331**. The link **432** indicates that the output of the development component **328** is the input of the development component **331**. The link **433** indicates that the output of the development component **328** is the input of the development component **333**. The link **434** indicates that the output of the development component **328** is the input of the development component **334**. The link **435** indicates that the output of the development component **329** is the input of the development component **334**. The link **436** indicates that the output of the development component **329** is the input of the development component **334**. The link **437** indicates that the output of the development component **330** is the input of the development component **333**.

[0094] If the number of development components and links increases as in FIG. **8**, the connection relationship between development components can become hard to grasp. The controller **31** therefore displays the links connected to a development component with emphasis based on an input to select the development component. FIG. **9** illustrates an example of the development component **328** being selected. In this case, the links connected to the development component **328**, i.e. the links **422**, **428**, **432**, **433**, **434**, are displayed with emphasis. When the links connected to a selected development component are thus displayed with emphasis, the user can easily grasp the relationship between development components.

[0095] Furthermore, the controller **31** displays the links connected to a selected development component on the display **35** in a higher-level layer than links not connected to the selected development component. Operability can thereby be improved when an operation to select the links is performed. For example, the case of changing the destination of the link **422**, among the links displayed with emphasis in FIG. **9**, from the development component **328** to the development component **330** is described with reference to FIGS. **10** to **13**. The change in the destination of the link is an operation that may occur during debugging, improvement, or the like of software. An increase in operability increases productivity during debugging, improvement, and the like.

[0096] For example, when wishing to change the destination of the link **422**, the user selects the link **422**, which is displayed with emphasis. The input interface **34** receives this selection operation. FIG. **10** illustrates the link **422** in a selected state. As described above, the link **422** displayed with emphasis is displayed in a higher-level layer than links not displayed with emphasis. Therefore, even if links such as the link **423** overlap the link **422**, the overlapping links are not selected by mistake.

[0097] FIG. **11** is a drawing representing an operation screen while an end **422'** of the link **422** is being operated to change the destination to the development component **330**. The user can change the destination by performing a drag-and-drop operation or the like on the end **422'** of the link whose destination is to be changed.

[0098] FIG. **12** illustrates the state after the destination of the link **442** has been changed to the development component **330**. FIG. **13** is a diagram illustrating a display example in which the development component **330** is selected. It is clear that the destination of the link **422** has changed to the development component **330**.

[0099] The basic configuration of a link illustrated in the above embodiment is a combination of horizontal or vertical lines, but this example is not limiting. A link may be a line or a curve, extending horizontally, vertically, or diagonally, or a combination thereof, and the line type of a link may be changeable. FIG. **14** is a diagram illustrating an example of the case of changing the line type of the links in the display example of FIG. **8**. Switching the line type of links in this way enables the user to easily grasp the relationship between development components.

[0100] The controller **31** may, for example, display the links connected indirectly to a selected development component with emphasis on the display **35**. FIG. **15** is a diagram illustrating a display example of the case of emphasizing links connected indirectly to a selected development component. The development component **305** is selected in FIG. **15**. In this case, the links connected directly and indirectly to the development component **305** are emphasized. The links connected directly to the development component **305** are the links connected to the input port or the output port of the selected development component **305**. In the example in FIG. **15**, the links **401** to **403** and the link **405** are directly connected links. The links connected indirectly to the development component **305** are links, other than the directly connected links, that arrive at the selected development component **305** upon following links on the input side or the output side. In other words, the indirectly connected links are links, other than the directly connected links, that connect to a development component connected in series with the development component **305**. In the case of the development component **305**, the links **406** to **410** all arrive at the development component **305** upon following links on the input side. Accordingly, these links are links connected indirectly to the development component **305**. When the indirectly connected links are thus displayed with emphasis, the user can easily grasp which development components are affected by the input and output of a certain development component. Note that the link **404** is not included among the links connected indirectly to the development component **305**. The reason is that the development component **305** is not reached from the link **404** upon following links unidirectionally on either the input side or the output side.

[0101] The directly connected links and the indirectly connected links may be displayed with emphasis in different forms. In other words, the controller **31** may display the links connected directly to a selected development component and the links connected indirectly to the selected development component with emphasis in different colors on the display **35**. For example, when the links **401** to **403** are displayed with emphasis in blue, and the link **404** is displayed with emphasis in red, the links **406** to **410** may be displayed with emphasis in black. This configuration enables the user to easily grasp the relationship between development components in a form that distinguishes between directly connected links and indirectly connected links.

[0102] When a plurality of development components placed in the builder area **210** includes a plurality of development components of the same type, the development components of the same type may be displayed by an object that integrates a plurality of development components (integrated object). In other words, a plurality of development components of the same type may be displayed by an integrated object instead of by separate objects. The development components of the same type are development components associated with the same icon and connected to the same destination development component. For example, the icons of the development components **301**, **302**, **303** placed in the builder area **210** of FIG. **7**, described above, are all the same icon (an icon pertaining to a sensor). The development components **301**, **302**, **303** are all connected to the development component **305**. That is, the development components **301**, **302**, **303** are development components connected to the same destination development component. Accordingly, these development components may be displayed by an integrated object. FIG. **16** illustrates an example of the case of displaying these development components by an integrated object. In FIG. **16**, the development components **301**, **302**, **303** are replaced by an integrated object **501**. The integrated object **501** is displayed in a form that includes a corresponding icon (here, an icon illustrating a sensor) to facilitate identification of the type of the integrated development components. The links **401**, **402**, **403** that connected the respective development components **301**, **302**, **303** with the destination development component are displayed only by the link **401**. When the integrated object **501** is thus displayed, the number of objects and the number of links in the builder area **210** are reduced, enabling the user to easily grasp the relationship between development components.

[0103] The integrated object may be displayed in a display form that includes a badge indicating the number of integrated development components. The integrated object **501** in FIG. **16** includes a badge **601**. In FIG. **16**, three objects are integrated, i.e. the development components **301**, **302**, **303**. The badge therefore indicates "3". The badge enables the user to easily learn the number of integrated development components.

[0104] When the plurality of development components placed in the builder area **210** includes a plurality of development components of the same type, the development components of the same type have been described as being indicated by an integrated object, but this example is not limiting. For example, when the plurality of development components placed in the builder area **210** includes a plurality of development components of the same type, the development components of the same type may be indicated by an integrated object if a predetermined condition is satisfied. The predetermined condition may, for example, be the number of development components placed in the builder area **210**, the number of links, the display magnification, or a combination thereof.

[0105] The information processing apparatus **30** has been described as accessing the server **20** via a web browser in the present embodiment to provide the user with a software development environment, but this example is not limiting. For example, an application according to the system **10** for providing a software development environment may be installed on the information processing apparatus **30**, and a software development environment may be provided to the user by communication with the server **20** via the application.

1. A system for providing a software development environment to develop software by combining a plurality of development components, the system comprising an information processing apparatus that includes a display and a controller, wherein

the display is configured to display a user interface on which the plurality of development components and a plurality of links connecting the development components to each other are placed; and

when one development component among the plurality of development components is selected, the controller is configured to display a link connected to the selected development component on the display in a display form with emphasis.

2. The system for providing a software development environment of claim **1**, wherein the controller is configured to display the selected development component on the display with emphasis.

3. The system for providing a software development environment of claim **1**, wherein the controller is configured to display a link connected to an input port and a link connected to an output port of the selected development component on the display with emphasis in different colors.

4. The system for providing a software development environment of claim **1**, wherein the controller is configured to display a link connected to the selected development component on the display in a higher-level layer than a link not connected to the selected development component.

5. The system for providing a software development environment of claim **1**, wherein the controller is configured to display a link connected indirectly to the selected development component on the display with emphasis.

6. The system for providing a software development environment of claim **5**, wherein the controller is configured to display a link connected directly to the selected development component and the link connected indirectly to the selected development component on the display with emphasis in different colors.

7. The system for providing a software development environment of claim **1**, wherein

the plurality of development components includes at least two development components that are of the same type and are connected to the same destination development component, and

the at least two development components are displayed by an integrated object corresponding to the at least two development components.

8. The system for providing a software development environment of claim **7**, wherein the integrated object is displayed in a display form that includes a badge indicating the number of integrated development components.

9. A method for providing a software development environment to develop software by combining a plurality of development components, the method comprising:

displaying a user interface on which the plurality of development components and a plurality of links connecting the development components to each other are placed; and

displaying, when one development component among the plurality of development components is selected, a link connected to the selected development component in a display form with emphasis.

10. A non-transitory computer readable medium storing a program, for providing a software development environment, configured to cause a processor to execute operations comprising:

displaying a user interface on which a plurality of development components and a plurality of links connecting the development components to each other are placed; and

displaying, when one development component among the plurality of development components is selected, a link connected to the selected development component in a display form with emphasis.

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