

DESCRIPTION

Title of Invention

DEVICE, PLANT MANAGEMENT SYSTEM, METHOD, AND PROGRAM

Technical Field

[0001]

The present invention relates to a device, a plant management system, a method, and a program.

Background Art

[0002]

In the related art, sensors are provided in a plant and the operational status of the plant is monitored through measurement values of the sensors. For example, PTL 1 discloses a plant operation support device including an event history/operation history that stores an event acquired from a plant and the operation history of the operation of the plant, and a guidance DB that stores the guidance of an operation content to be notified to an operator in response to an event of the plant. The plant operation support device is configured to search for the same operation history as the operation content of the designated guidance stored in the guidance DB and the number of occurrences of the operation history from an event history/operation history database by operation history search

means A105, and to display a search result on a screen display unit.

Citation List

Patent Literature

[0003]

[PTL 1] Japanese Unexamined Patent Publication No.

2007-193512

Summary of Invention

Technical Problem

[0004]

Here, a plurality of factors are considered in a case where an abnormality occurs in the plant. For that reason, even in a case where the same abnormality occurred in the past, a different response may be required in a case where an abnormality occurring currently is caused by a different factor.

[0005]

Accordingly, even in a case where a response is taken based on the past operation history as in a method in the related art, the factor of a current abnormality may be different from the factor of the past abnormality. For this reason, the response is not necessarily appropriate.

[0006]

One of exemplary objects of an aspect of the present

invention is to provide a device, a plant management system, a method, and a program that can more appropriately respond to an abnormality having occurred.

Solution to Problem

[0007]

In order to solve the above-described problems, a device according to an aspect of the present invention is a device that includes a display screen on which an operating state of a plant is displayed. The device includes: an abnormality detection unit detecting that an abnormality has occurred in the plant; a response information storage unit in which response information on responses to abnormalities occurred in the past is stored; and a display control unit that displays guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on the response information, for responses capable of being taken for abnormalities related to the abnormality, on the display screen in a case where the abnormality is detected.

[0008]

In the device described above, the display control unit may display the aggregation result information in a graph format representing a proportion of each of the responses taken in the past.

[0009]

In the device described above, the graph may include a graph that represents a proportion of each of the responses taken in the past in the plant, a graph that represents a proportion of each of the responses taken in the past in the same type of plant as the plant, and a graph that represents a proportion of each of the responses taken in the past in all plants.

[0010]

In the device described above, the display control unit may display the aggregation result information in a list format representing a number of times of each of the responses taken in the past.

[0011]

The device described above may further include a reception unit that receives, after the response is taken for the detected abnormality, an input of information on the response in a questionnaire format.

[0012]

The device described above may further include a response information generation unit that generates the response information based on the received information.

[0013]

The device described above may further include a guidance information storage unit in which the guidance information is stored in association with the abnormality.

[0014]

A plant management system according to another aspect of the present invention includes the plant, and the device described above.

[0015]

A method according to another aspect of the present invention is a method for a device including a display screen on which an operating state of a plant is displayed. The method includes: detecting that an abnormality has occurred in the plant; and displaying guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on response information on responses to abnormalities occurred in the past, for responses capable of being taken for abnormalities related to the abnormality, on the display screen in a case where the abnormality is detected.

[0016]

A program according to another aspect of the present invention is a program for a device including a display screen on which an operating state of a plant is displayed. The program causes a computer to execute: detecting that an abnormality has occurred in the plant; and displaying guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on response information on responses to abnormalities occurred in the past, for responses capable of being taken for abnormalities

related to the abnormality, on the display screen in a case where the abnormality is detected.

[0017]

Any combination of the above-described components or objects obtained through the mutual substitutions of the components and expressions of the present invention among a method, a device, a system, a computer program, a data structure, a recording medium, and the like are also effective as aspects of the present invention.

Advantageous Effects of Invention

[0018]

According to the present invention, it is possible to more appropriately respond to an abnormality having occurred.

Brief Description of Drawings

[0019]

FIG. 1 is a schematic diagram showing an overall configuration of a plant of an embodiment.

FIG. 2 is a diagram showing the functional blocks of a device according to the embodiment.

FIG. 3 is a diagram showing the physical configuration of the device according to the embodiment.

FIG. 4 is a diagram showing a first example of a guide display screen displayed on the device according to the

embodiment.

FIG. 5 is a diagram showing an example of a numerical value check table included in the first example of the guide display screen shown in FIG. 4.

FIG. 6 is a diagram showing examples of an aggregation result area included in the first example of the guide display screen shown in FIG. 4.

FIG. 7 is a diagram showing a second example of the guide display screen displayed on the device according to the embodiment.

FIG. 8 is a diagram showing examples of aggregation result information included in the second example of the guide display screen shown in FIG. 7.

FIG. 9 is a diagram showing an information collection screen displayed on the device according to the embodiment.

FIG. 10 is a flowchart illustrating an example of guide display processing performed by the device according to the embodiment.

Description of Embodiments

[0020]

Although the present invention will be described below through embodiments of the invention with reference to the drawings, the following embodiments do not limit the inventions defined in the claims and not all combinations of features

described in the embodiments are essential to technical solutions of the invention. The same or equivalent components, members, and processing shown in each drawing will be denoted by the same reference signs, and the description thereof will not be repeated as appropriate.

[0021]

First, a configuration of a plant of an embodiment will be described with reference to FIG. 1. FIG. 1 is a schematic diagram showing the overall configuration of the plant 1 of the embodiment. As shown in FIG. 1, the plant 1 is, for example, a power generation plant (incineration plant) including a circulating fluidized bed boiler, and includes a boiler that generates steam by combusting fuel while circulating a circulation material such as silica sand fluidized at a high temperature. Not only fossil fuel such as coal but also, for example, non-fossil fuel (woody biomass, waste tires, waste plastic, sludge, or the like) can be used as the fuel of the plant 1. The steam generated in the plant 1 is used to drive a turbine 100. The plant targeted by the present embodiment is not limited to a power generation plant or an incineration plant including a boiler and may be a plant such as a chemical plant or a wastewater treatment plant from which process data can be acquired.

[0022]

The plant 1 is configured to combust the fuel in a furnace

2, to separate the circulation material from exhaust gas through a cyclone 3 that functions as a solid-gas separation device, and to return the separated circulation material to the furnace 2 so that the circulation material is circulated. The separated circulation material is sent back to a lower portion of the furnace 2 through a circulation material recovery pipe 4 connected to a lower portion of the cyclone 3. A lower portion of the circulation material recovery pipe 4 and the lower portion of the furnace 2 are connected to each other through a loop seal portion 4a at which a flow channel is narrowed. Accordingly, a state in which a predetermined amount of the circulation material is stored in the lower portion of the circulation material recovery pipe 4 is established. The exhaust gas from which the circulation material is removed by the cyclone 3 is supplied to a rear flue 5 through an exhaust gas flow channel 3a.

[0023]

The boiler includes the furnace 2 for combusting fuel and a heat exchanger for generating steam or the like using heat obtained from combustion. A middle portion of the furnace 2 is provided with a fuel supply port 2a through which the fuel is supplied, and an upper portion of the furnace 2 is provided with a gas outlet 2b through which combustion gas is exhausted. The fuel that is supplied to the furnace 2 from a fuel supply device (not shown) is supplied to the inside of the furnace 2 through

the fuel supply port 2a. Further, a furnace wall of the furnace 2 is provided with a furnace wall pipe 6 for heating boiler feedwater. The boiler feedwater flowing through the furnace wall pipe 6 is heated by combustion in the furnace 2.

[0024]

In the furnace 2, a solid matter including the fuel supplied from the fuel supply port 2a is fluidized by air for combustion and fluidization introduced from an air supply line 2c provided at the lower portion of the furnace 2 and the fuel is combusted at a temperature of, for example, approximately 800°C to 900°C while being fluidized. The combustion gas generated in the furnace 2 is introduced into the cyclone 3 while entraining the circulation material. The cyclone 3 separates the circulation material from gas using centrifugal action, returns the separated circulation material to the furnace 2 through the circulation material recovery pipe 4, and sends the combustion gas from which the circulation material has been removed to the rear flue 5 from the exhaust gas flow channel 3a.

[0025]

A part of the circulation material called an in-furnace bed material remains in a bottom portion of the furnace 2. The bed material may include bed materials or combustion residues having large particle sizes unsuitable for circulation and fluidization, and a fluidization failure may be caused by these

bed materials unsuitable as the circulation material. For that reason, in order to suppress a fluidization failure, the in-furnace bed material is continuously or intermittently exhausted to the outside from an exhaust port 2d provided at the bottom portion of the furnace 2. Metal or unsuitable materials having large particle sizes or the like are removed from the exhausted bed material on a circulation line (not shown), and the bed material is then supplied to the furnace 2 again or discarded as it is. The circulation material of the furnace 2 circulates in a circulation system that includes the furnace 2, the cyclone 3, and the circulation material recovery pipe 4.

[0026]

The rear flue 5 includes a flow channel through which the gas exhausted from the cyclone 3 flows to a rear stage. The rear flue 5 includes, as an exhaust heat recovery unit that recovers the heat of the exhaust gas, a superheater 10 that generates superheated steam and an economizer 12 that preheats the boiler feedwater. The exhaust gas flowing through the rear flue 5 is cooled by exchanging heat with the steam or the boiler feedwater flowing through the superheater 10 and the economizer 12. Further, a steam drum 8 in which the boiler feedwater having passed through the economizer 12 is stored is provided, and is also connected to the furnace wall pipe 6.

[0027]

The economizer 12 transfers the heat of the exhaust gas to the boiler feedwater to preheat the boiler feedwater. The economizer 12 is connected to a pump 7 by a pipe 21 and is connected to the steam drum 8 by a pipe 22. The boiler feedwater that is supplied from the pump 7 to the economizer 12 through the pipe 21 and preheated by the economizer 12 is supplied to the steam drum 8 through the pipe 22.

[0028]

A downcast pipe 8a and the furnace wall pipe 6 are connected to the steam drum 8. The boiler feedwater stored in the steam drum 8 moves down through the downcast pipe 8a, is introduced into the furnace wall pipe 6 on the lower side of the furnace 2, and then flows toward the steam drum 8. The boiler feedwater present in the furnace wall pipe 6 is heated by combustion heat generated in the furnace 2, and is vaporized in the steam drum 8 to form steam.

[0029]

A saturated steam pipe 8b through which the steam present in the steam drum 8 is exhausted is connected to the steam drum 8. The saturated steam pipe 8b connects the steam drum 8 to the superheater 10. The steam present in the steam drum 8 is supplied to the superheater 10 through the saturated steam pipe 8b. The superheater 10 superheats the steam using the heat of the exhaust gas to generate superheated steam. The superheated steam is supplied to the turbine 100 provided outside the plant 1 through

a pipe 10a and is used to generate power.

[0030]

The pressure and the temperature of the steam exhausted from the turbine 100 are lower than the pressure and the temperature of the steam exhausted from the superheater 10. Although not particularly limited, the pressure of the steam supplied to the turbine 100 is in the range of approximately 10 to 17 MPa and the temperature thereof is in the range of approximately 530°C to 570°C.

[0031]

A condenser 102 is provided downstream of the turbine 100. The steam exhausted from the turbine 100 is supplied to the condenser 102, is condensed into saturated water in the condenser 102, and is then supplied to the pump 7. A generator that converts kinetic energy obtained from the rotation of the turbine 100 into electrical energy is connected to the turbine 100.

[0032]

A pump 7a supplies make-up water to maintain a water level of the condenser 102 constant. FIG. 1 shows a make-up water flow rate u1 (an example of the "process data") of the make-up water replenished by the pump 7a.

[0033]

The process data (data related to the operation of the plant 1) handled in the present embodiment may be arbitrary data related to the plant 1. For example, the process data may be

the data (an example of the "process data") of the states of the plant 1 measured by sensors and, more specifically, may include the measurement values of a temperature, a pressure, a flow rate, and the like in the plant 1. FIG. 1 shows a boiler feedwater flow rate u_2 (an example of the "process data") of the boiler feedwater supplied from the pump 7 to the economizer 12. Further, FIG. 1 shows a boiler outlet steam flow rate u_3 (an example of the "process data") of the steam supplied from the superheater 10 to the turbine 100 and shows a saturated steam flow rate u_4 (an example of the "process data") of the saturated steam supplied from the steam drum 8 to the superheater 10. The make-up water flow rate u_1 may be controlled to follow the saturated steam flow rate u_4 . Furthermore, the boiler feedwater flow rate u_2 may be controlled to follow adjustment while both the boiler outlet steam flow rate u_3 (or a superheated steam flow rate) and the liquid level of the steam drum 8 are monitored.

[0034]

In a case where a breach occurs in a pipe system constituting the plant 1, the make-up water flow rate u_1 rises or a difference between the boiler feedwater flow rate u_2 and the boiler outlet steam flow rate u_3 increases. A distributed control system (DCS; FIG. 2) 20 receives the process data of the plant 1 such as the make-up water flow rate u_1 , the boiler feedwater flow rate u_2 , the boiler outlet steam flow rate u_3 , and the saturated steam flow rate u_4 from the plant 1, monitors

the operational status of the plant 1, and monitors whether or not an abnormality has occurred in the plant 1. As will be described later, a device 30 shown in FIG. 2 evaluates the process data based on alarm determination logic set for each type of abnormality and issues an alarm in a case where an abnormality has occurred.

[0035]

Although the make-up water flow rate u_1 , the boiler feedwater flow rate u_2 , the boiler outlet steam flow rate u_3 , and the saturated steam flow rate u_4 have been exemplified as the process data, the process data related to the plant 1 may be other data or data calculated based on a plurality of process data. The process data related to the plant 1 may be other data such as a temperature and a pressure, or may be data that are acquired from the sensors or the like and are not subjected to calculation processing.

[0036]

Further, only one plant 1 is shown in the example shown in FIG. 1, but the present invention is not limited thereto. A plant management system 50 and a device 30 according to the present embodiment to be described below may target two or more plants.

[0037]

Next, a plant management system according to an embodiment will be described with reference to FIGS. 2 and 3. FIG. 2 is

a diagram showing the functional blocks of the device 30 according to the embodiment. FIG. 3 is a diagram showing the physical configuration of the device 30 according to the embodiment.

[0038]

The DCS 20 is a distributed control system for controlling the plant 1, and acquires process data from sensors and the like provided in the plant 1 and supplies control signals for controlling the plant 1 to the plant 1 based on the process data, as shown in FIG. 2.

[0039]

The plant management system 50 includes the plant 1 and the device 30. The device 30 is a device including a display screen, for example, a display device, a monitoring device, an operation support device, or the like. The device 30 is configured to display information on the display screen based on the process data from the DCS 20.

[0040]

The device 30 includes a controller 32 and a storage unit 33. The controller 32 includes, for example, an acquisition unit 321, an abnormality detection unit 322, an aggregation unit 323, a display control unit 324, a reception unit 325, and a response information generation unit 326 as functional components. The storage unit 33 stores various data, and stores, for example, a basic plant information DB 33A, a guidance

information DB 33B, and a response information DB 33C.

[0041]

The acquisition unit 321 is configured to acquire the process data from the DCS 20, for example. The acquisition unit 321 sequentially acquires the process data from the DCS 20 while the plant 1 is in operation. The acquired process data is stored in the storage unit 33 as information on the process of the plant 1 (hereinafter, also referred to as "process information"). The plant 1 is "in operation" as long as at least a part of the plant 1 is operating.

[0042]

Further, the acquisition unit 321 is configured to acquire alarm information from the DCS 20. The acquisition unit 321 acquires the alarm information from the DCS 20 each time an alarm is issued (an example of "generation") during the operation of the plant 1. The alarm information indicates an alarm generated in the plant 1 and is information on an alarm (warning) against an abnormality that has occurred. The alarm information includes an alarm item (the type of the alarm), alarm generation date and time (date and time when the alarm is generated), an alarm level (the level (importance) or the like of the alarm; classified into, for example, a high-level alert, a medium-level alert, a low-level alert, and the like), the value of the process data related to the alarm (for example, the value of the make-up water flow rate u1 or the boiler feedwater flow rate u2 determined

as abnormalities), and the like.

[0043]

In the DCS 20, whether or not an abnormality or the like has occurred in the plant 1 is determined and the alarm information is generated in a case where it is determined that an abnormality has occurred. The DCS 20 determines that an abnormality has occurred, for example, in a case where any value included in the process data exceeds a predetermined threshold, or in a case where a predetermined change has occurred in the tendency of a value included in the process data. More specifically, the DCS 20 may evaluate predetermined process data based on the alarm determination logic to determine whether or not an abnormality, which may occur in the plant 1 and is referred to as a rupture (a state in which metal materials such as a tube and a pipe constituting the boiler are damaged and breached and steam therein leaks to the outside as in a boiler tube leak; including a state in which a rupture is highly likely to occur in the future; the same applies hereinafter), has occurred. The alarm information generated by the DCS 20 will be particularly referred to as "DCS alarm information". Similarly, the device 30 may determine whether or not an abnormality or the like has occurred in the plant 1 based on the process data acquired by the acquisition unit 321 to determine that an abnormality has occurred. Alarm information generated in this case will be particularly referred to as "system alarm information".

Hereinafter, the DCS alarm information and the system alarm information will be collectively referred to as the "alarm information".

[0044]

The abnormality detection unit 322 is configured to detect that an abnormality has occurred in the plant 1. More specifically, the abnormality detection unit 322 is configured to detect that an abnormality has occurred in the plant 1 based on the above-described alarm information.

[0045]

The term "abnormality" in the present application is used in a broad sense, which is wider than a general meaning. For that reason, the "abnormality" in the present application may include not only a state that is generally recognized as an abnormality but also a state that is not usually referred to as an abnormality, for example, a case in which an event such as a state requiring attention or a state requiring caution occurs. Further, the "abnormality" in the present application may include various types of abnormalities having different levels (importance), for example, abnormalities of all levels from a major abnormality to a minor abnormality.

[0046]

Furthermore, in the present embodiment, all abnormalities that can be handled are classified in advance to be identifiable, and an identifier such as an abnormality ID is assigned to each

of the abnormalities. In addition, each abnormality is classified into a larger group, and an identifier such as an abnormality classification ID is also assigned to each abnormality. Further, the classification may be performed in stages into groups of a plurality of scales, for example, a relatively large-scale classification (major classification), a relatively medium-scale classification (medium classification), and a relatively small-scale classification (minor classification). In this case, for example, an abnormality major classification ID, an abnormality medium classification ID, and an abnormality minor classification ID are assigned to each abnormality instead of an abnormality classification ID or in addition to the abnormality classification ID. Information for identifying these abnormalities may be included in the DCS alarm information. Furthermore, the device 30 may acquire the information for identifying the abnormalities from another device that is connected via a network and manages the information.

[0047]

The aggregation unit 323 is configured to aggregate responses, which can be taken for abnormalities related to a detected abnormality, based on response information. The response information is stored in advance in the response information DB 33C of the storage unit 33. The aggregation unit 323 reads out the response information from the response

information DB 33C based on the abnormalities related to the detected abnormality.

[0048]

The abnormalities related to the detected abnormality are, for example, abnormalities identical to or similar to the detected abnormality. The degree (range) of similarity can be set as appropriate. The aggregation unit 323 determines, for example, whether or not an abnormality is the abnormality identical to or similar to the detected abnormality based on the abnormality classification ID described above. The aggregation unit 323 reads out response information, which was taken for the abnormality identical to or similar to the detected abnormality in the past, from the response information DB 33C. Then, the aggregation unit 323 aggregates the responses to the abnormalities occurred in the past for each response, which can be taken, in the read-out response information.

[0049]

Then, the aggregation unit 323 generates information indicating a result aggregated for each response (hereinafter, also referred to as "aggregation result information") based on the result. The aggregation result information includes, for example, information indicating a proportion of each response to all responses or information indicating the number of times of each response. The aggregation result information is stored in the storage unit 33.

[0050]

The display control unit 324 is configured to generate display data based on the process data, the alarm information, and the like, and to display information on the display screen based on the display data. More specifically, the display control unit 324 is configured to display information on guidance for responding to the abnormality (hereinafter, also referred to as "guidance information") and the above-described aggregation result information on the display screen. The guidance information is stored in advance in the guidance information DB 33B of the storage unit 33. The display control unit 324 reads out the guidance information from the guidance information DB 33B based on the detected abnormality. An example of a screen displayed on the display screen by the display control unit 324 will be described later.

[0051]

As described above, in a case where an abnormality is detected, guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on the response information, for responses that can be taken for abnormalities related to the abnormality are displayed on the display screen. Accordingly, the guidance information and the aggregation result information can be displayed together. Therefore, since it is possible to provide information for supporting the selection of an

appropriate response from among available responses to an operator who views the display screen, it is possible to more appropriately respond to an abnormality, which has occurred, than in the related art.

[0052]

Further, the display control unit 324 is configured to display the aggregation result information on the display screen in a graph format representing a proportion of each response taken in the past. Accordingly, an operator who views the display screen can easily ascertain the proportion of each response.

[0053]

The type of a graph displayed on the display screen is not particularly limited, and may be, for example, a pie chart, a bar graph, a line graph, a band graph, or the like.

[0054]

The reception unit 325 is configured to receive, after a response is taken for the detected abnormality, the input of information on the response in a questionnaire format. The questionnaire is performed in a form in which answers are input to questions prepared in advance. The questionnaire is to generate the response information on the taken response, and usually includes a plurality of questions. Specifically, in a case where the response to the detected abnormality is taken and the abnormality is resolved, a screen to which the

questionnaire is input is displayed on the display screen. The reception unit 325 receives information that is input to the screen by, for example, the operator or the like. An example of the screen to which the questionnaire is input will be described later.

[0055]

Since a response to the detected abnormality is taken and the input of information on the response is received in a questionnaire format as described above, more accurate information can be easily collected as compared with a case where a response history is routinely collected.

[0056]

The response information generation unit 326 is configured to generate the response information based on the information received by the reception unit 325. Accordingly, the response information can be stored in the response information DB 33C stored in the storage unit 33, so that the response information based on the collected information can be easily accumulated.

[0057]

A plurality of pieces of basic information on the plant 1 (hereinafter, also referred to as "basic plant information") are stored in the basic plant information DB 33A. The basic plant information includes, for example, information on the fuel, the scale, the region, and the like of the plant 1. The type of the plant 1 can be classified based on the basic plant information.

It is possible to determine, for example, whether or not a plant is in the same state as the state of a certain plant, whether or not a plant has the same scale as the scale of a certain plant, and the like, by accessing the basic plant information DB 33A and referring to the basic plant information. Further, in a case where the plant management system 50 and the device 30 according to the present embodiment target a plurality of plants 1, an identifier for identifying the plant, for example, a plant ID is assigned to each plant 1. In this case, the basic plant information includes the plant ID.

[0058]

A plurality of pieces of guidance information are stored in the guidance information DB 33B. One or a plurality of abnormalities are associated with the guidance information, and the guidance information includes guidance for responding to the abnormalities. Further, the guidance information includes information for identifying the associated abnormalities, for example, abnormality IDs and/or abnormality classification IDs. In general, a plurality of factors are considered for a certain abnormality. Furthermore, for each factor, there may also be a plurality of responses that can be taken. Therefore, the guidance included in the guidance information comprehensively includes factors and responses considered for the associated abnormalities. For that reason, in a case where the guidance information is displayed on the display screen, a number of

options are provided to an operator of the plant management system 50 or the device 30. The guidance information DB of the present embodiment corresponds to an example of a "guidance information storage unit" of the present invention.

[0059]

As described above, the guidance information DB 33B stores the guidance information in association with abnormalities and is stored in the storage unit 33. In a case where an abnormality is detected, the guidance information associated with the abnormality can be immediately read out.

[0060]

A plurality of pieces of response information are stored in the response information DB 33C. The response information is associated with abnormalities that occurred in the past. For that reason, the response information includes information for identifying the associated abnormalities, for example, abnormality IDs, and may further include abnormality classification IDs. Further, in a case where the plant management system 50 and the device 30 according to the present embodiment target a plurality of plants 1, the response information includes the plant IDs of plants 1 in which the associated abnormalities have occurred.

[0061]

At least some of the basic plant information DB 33A, the guidance information DB 33B, and the response information DB

33C stored in the storage unit 33 may be subjected to predetermined normalization so that any group unit thereof is subdivided. The information (data) stored in the basic plant information DB 33A, the guidance information DB 33B, and the response information DB 33C is not limited to a case where the information is stored in a database format, and may be stored in any structure and format such as a table format, a block format, and a file format.

[0062]

In addition, at least one of the plurality of functional blocks of the controller 32 of the device 30 described above may be realized in cooperation with another device (not shown).

[0063]

As shown in FIG. 3, the device 30 physically includes a central processing unit (CPU) 30a, a random access memory (RAM) 30b, a read only memory (ROM) 30c, a communication unit 30d, an input unit 30e, and a display unit 30f. These respective components are connected to a bus such that data can be transmitted to and received from each other via the bus. The respective functional blocks of the device 30 shown in FIG. 2 are realized by the physical components shown in FIG. 3.

[0064]

Although a case where the device 30 is constituted by a single computer will be described in the present embodiment, the device 30 may be realized by a plurality of computers in

combination. For example, a display constituting a different display unit for displaying other information may be provided in addition to the display unit 30f. Further, the device 30 may be constituted by a tablet terminal. In a case where the device 30 is constituted by a tablet terminal, the device 30 can be carried and, for example, a user can use the device 30 while patrolling the plant 1. Furthermore, the components shown in FIG. 3 are examples, and the device 30 may include components other than these components or may not include some of these components. In addition, some of the components may be provided at remote locations. For example, a control device including the CPU 30a and the like may be provided at a remote location. In this case, the device 30 including the display unit 30f and the like may be configured to acquire control signals, which are generated in the control device provided at the remote location, via a network.

[0065]

The CPU 30a is a calculation unit that performs control related to the execution of a program stored in the RAM 30b or the ROM 30c and the calculation and processing of data. The CPU 30a is a calculation unit that executes a program (monitoring program) for displaying explanatory text and graphs of the process data of the plant 1. The CPU 30a receives various data from the input unit 30e or the communication unit 30d, and displays a calculation result of data on the display unit 30f

or stores the calculation result in the RAM 30b.

[0066]

The RAM 30b is a part of the storage unit in which data can be rewritten, and may be constituted by, for example, a semiconductor storage element such as a DRAM or an SRAM. The RAM 30b may store the program to be executed by the CPU 30a and data such as the process data of the plant 1. The program and the data are merely exemplary, and the RAM 30b may store data other than the program and the data or may not store a part of the program and the data.

[0067]

The ROM 30c is a part of the storage unit from which data can be read out, and may be constituted by, for example, a semiconductor storage element such as a flash memory or an HDD. The ROM 30c may store, for example, a computer program for executing various types of processing described in the present embodiment and data that is not rewritten. The data that is not rewritten includes, for example, information on the plant 1 and the specifications of components of the plant 1. Further, the ROM 30c may store, for example, data such as the process data of the plant 1, indexes (an operation ratio, efficiency, and the like) related to the operation of the plant 1, and a scheduled outage period.

[0068]

The communication unit 30d is an interface that connects

the device 30 to other devices. The communication unit 30d may be connected to a communication network such as the Internet.

[0069]

The input unit 30e receives the input of data corresponding to operations performed by an operator and may include, for example, a keyboard and a touch panel.

[0070]

The display unit 30f includes a screen on which calculation results of the CPU 30a are visually displayed, and may be constituted by, for example, a liquid crystal display (LCD). The display unit 30f may display explanatory text and graphs of the process data. Further, the display unit 30f may be provided such that a plurality of displays are connected to form one screen.

[0071]

The computer program for executing various types of processing described in the present embodiment may be provided as being stored in a computer-readable storage medium such as the ROM 30c, or may be provided by the communication unit 30d via the connected communication network. In the device 30, the CPU 30a executes a program, so that various operations included in the present embodiment are implemented. The program can be stored in a storage medium. The storage medium in which the program is stored may be a non-transitory computer readable storage medium. These physical components are merely exemplary

and do not necessarily have to be independent components. For example, the device 30 may include a large scale integration (LSI) in which the CPU 30a and the RAM 30b or the ROM 30c are integrated.

[0072]

Next, a first example of a guide display screen displayed on the display screen of the device will be described with reference to FIGS. 4 to 6. FIG. 4 is a diagram showing the first example of a guide display screen DP1 displayed on the device 30 according to the embodiment. FIG. 5 is a diagram showing an example of a numerical value check table R23 included in the first example of the guide display screen DP1 shown in FIG. 4. FIG. 6 is a diagram showing an example of an aggregation result area R25 included in the first example of the guide display screen DP1 shown in FIG. 4.

[0073]

The device 30 is configured to display the guide display screen DP1 shown in FIG. 4 on the display screen in a case where an abnormality of the plant 1 is detected. The guide display screen DP1 transitions from, for example, a dashboard display screen on which various latest indices related to the operation of the plant 1 are displayed at predetermined time intervals. On the guide display screen DP1, an operator can check the state of the plant 1 in detail through specific process data.

[0074]

The guide display screen DP1 includes a first area R1 and a second area R2. In the case of the first example shown in FIG. 4, the first area R1 includes a first graph (scatter diagram) of "boiler efficiency (loss method) (%)" and "boiler load (%)" and a second graph showing a temporal change in "boiler efficiency (loss method) (%)". That is, the first area R1 is configured to display the graphs of first process data (boiler efficiency (loss method) in the first example) and second process data (a boiler load in the first example) related to the first process data. Since the graphs of not only the first process data but also the graph of the related second process data are displayed as described above, the state of the plant 1 can be monitored from various perspectives.

[0075]

A threshold used to detect whether or not an abnormality has occurred may be displayed together in the first graph. Similarly, a threshold used to detect whether or not an abnormality has occurred may be displayed together in the second graph, and a time at which the cause of the abnormality has occurred may be displayed together in the second graph. Further, the device 30 is not limited to displaying one graph of the second process data related to the first process data, and may display two or more graphs. In the case of the first example, another graph of the second process data is displayed in a case where a transition button shown as "1/10" at a lower portion in the

guide display screen DP1 is pressed.

[0076]

Furthermore, the device 30 is configured to display the second graph of the first process data different from the first graph in the first area R1. In a case where the first graph (scatter diagram) of "boiler efficiency (loss method) (%)" which is the first process data and the second graph showing a temporal change in "boiler efficiency (loss method) (%)" are shown and a plurality of types of graphs are displayed for the first process data, the state of the plant 1 can be monitored from various perspectives. The device 30 may display three or more graphs related to the first process data.

[0077]

The display control unit 324 of the device 30 is configured to display the guidance information and the aggregation result information in the second area R2 of the display screen adjacent to the first area R1. The first example is a case where an abnormality in which boiler efficiency decreases is detected. In the case of this example, "boiler efficiency" is displayed in a guide name, "boiler efficiency (input-output method)" is displayed in a content, and a year, a month, a day, an hour, a minute, and a second ("YY/MM/DD h:m:s" in FIG. 4) at which an abnormality has occurred are displayed in the date and time of occurrence.

[0078]

The second area R2 includes a guidance area R20 in which guidance information for responding to the detected abnormality is displayed in the field of a response method. The guidance area R20 is divided into, for example, "1. Evaluation purpose", "2. Factor of occurrence", and "3. Response method", and the field of "3. Response method" is further divided into "(1) Numerical value check" and "(2) On-site check". Each item displays information using text, numerical values, a table, or the like.

[0079]

Specifically, in the first example, the explanatory text "With regard to boiler efficiency (loss method), the balance of boiler efficiency calculated by the loss method with respect to the boiler load (output heat) is evaluated for the purpose of detecting an abnormality in boiler efficiency. In a case where this evaluation item occurs, the following factors are considered." is displayed in "1. Evaluation purpose". Further, two factors "(1) Moisture in fuel increases and exhaust gas loss increases (2) Exhaust gas temperature (T1004.PV) rises and exhaust gas loss increases" are displayed in "2. Factor of occurrence". Furthermore, the table R23 shown in FIG. 5 is displayed in "(1) Numerical value check" of "3. Response method". The table R23 includes items of "Name", "Tag.", "Check content", and "Remarks", and a plurality of rows (records) in which content to be numerically checked is written are stored in the table

R23. In addition, two check items "a. Check the calorific value and moisture content of fuel to be used. b. Check the outflow status of steam or the like flowing out of various systems" are displayed in "(2) On-site check" of "3. Response method". The information displayed in the guidance area R20 is included in the guidance information stored in the guidance information DB 33B.

[0080]

Further, the second area R2 further includes an aggregation result area R25 in a part of the field of the response method. Aggregation result information indicating results aggregated for responses, which can be taken for abnormalities related to a detected abnormality, is displayed in the aggregation result area R25.

[0081]

Specifically, in the first example, the aggregation result information is displayed in a graph format representing a proportion of each response taken in the past in "(3) Questionnaire Result" of "3. Response method". For example, as shown in FIG. 6, the graph includes three graphs of a first pie chart R25A, a second pie chart R25B, and a third pie chart R25C. The first pie chart R25A is a pie chart representing a proportion of each response in a target plant, that is, the plant 1 for which the device 30 displays various plant data as an object to be monitored. The second pie chart R25B is a pie chart

representing a proportion of each response in the same-state plants, that is, one or a plurality of plants determined to be in the same state as the plant 1. The third pie chart R25C is a pie chart representing a proportion of each response in all plants, that is, all plants including the plant 1.

[0082]

As described above, the graph displayed in the aggregation result area R25 includes the first pie chart R25A that represents a proportion of each response taken in the past in the plant 1, the second pie chart R25B that represents a proportion of each response taken in the past in the same type of plant as the plant 1, and the third pie chart R25C that represents a proportion of each response taken in the past in all the plants. Accordingly, it is possible to easily compare a proportion of each response in the target plant 1 with a proportion of each response in other plants.

[0083]

Further, the aggregation result information displayed in the aggregation result area R25 is not limited to a graph format. For example, the display control unit 324 may display the aggregation result information in a list format representing the number of times of each response taken in the past. Accordingly, it is possible to list and ascertain the number of times of each response taken in the past.

[0084]

In the first example, each of the first pie chart R25A, the second pie chart R25B, and the third pie chart R25C consists of three responses of "Change in fuel co-firing ratio (increase in moisture)", "Operation of soot blower (progression of ash adhesion)", and "Others". The area (angle) of each sector of the pie chart is proportional to a proportion (ratio) of each response to the entirety. In the example shown in FIG. 6, the first pie chart R25A for the target plant and the second pie chart R25B for the plant being in the same state show that "Operation of soot blower (progression of ash adhesion)" is a response having a relatively high proportion in a plurality of responses to abnormalities occurred in the past.

[0085]

In a case where an abnormality in which boiler efficiency decreases is detected as in the first example, the shutdown of the plant may be caused by the melting of the circulation material, the excessive exhaust of emissions, or the like. In that case, two factors of "1) Moisture in fuel increases" and "2) Exhaust gas temperature rises" are considered as factors. The same content as these factors is written in "2. Factor of occurrence" of the guidance area R20. Accordingly, an operator can ascertain a plurality of factors that are considered for a certain abnormality by viewing the guidance area R20 of the guide display screen DP1.

[0086]

Further, the aggregation result information is displayed in the second area R2 of the guide display screen DP1 together with the guidance information. Accordingly, an operator can obtain a hint, for example, from the first pie chart R25A, the second pie chart R25B, and the third pie chart shown in FIG. 6, that the influence of "1) Moisture in fuel increases" is small, "2) Exhaust gas temperature rises" is highly likely to be a main factor, and the response of "2) Exhaust gas temperature rises" is effective means for an abnormality, which has occurred, by viewing the aggregation result area R25 of the guide display screen DP1.

[0087]

Next, a second example of the guide display screen displayed on the display screen of the device will be described with reference to FIGS. 7 and 8. FIG. 7 is a diagram showing the second example of the guide display screen DP1 displayed on the device 30 according to the embodiment. FIG. 8 is a diagram showing examples of the aggregation result information R25 included in the second example of the guide display screen DP1 shown in FIG. 7.

[0088]

In the second example, components identical or similar to those of the first example will be denoted by the same or similar reference signs. Hereinafter, a difference from the first example will be mainly described. Further, the same actions and

effects caused by the same components will not be sequentially mentioned. Furthermore, since the second example of the guide display screen DP1 is substantially the same as the first example of the guide display screen DP1, the description thereof will be appropriately omitted.

[0089]

In the case of the second example shown in FIG. 7, the first area R1 includes a first graph (scatter diagram) of "steam temperature (°C)" and "boiler load (%)" and a second graph showing a temporal change in "steam temperature (°C)". That is, the first area R1 is configured to display the graphs of first process data (steam temperature (°C) in the second example) and second process data (a boiler load in the second example) related to the first process data.

[0090]

The second example is a case where an abnormality in which a steam temperature is less than a predetermined value is detected. In the case of this example, in the second area R2, "steam temperature" is displayed in a guide name, "steam temperature" is displayed in a content, and a year, a month, a day, an hour, a minute, and a second ("YY/MM/DD h:m:s" in FIG. 7) at which an abnormality has occurred are displayed in the date and time of occurrence.

[0091]

Further, in the second example, the explanatory text "With

regard to steam temperature, the balance of steam temperature with respect to the boiler load (output heat) is evaluated for the purpose of detecting an abnormality in steam temperature. In a case where this evaluation item occurs, the following factors are considered." is displayed in "1. Evaluation purpose" in the guidance area R20. Furthermore, five factors "(1) Change of fuel (co-firing ratio, properties) (2) Change in air distribution (3) Change in particle size of supplied sand material (4) Progression of ash adhesion (5) Influence due to abnormality control" are displayed in "2. Factor of occurrence". In addition, as in the first example, the table R23 shown in FIG. 5 is displayed in "(1) Numerical value check" of "3. Response method". Further, two check items "a. Check the calorific value and moisture content of fuel to be used. b. Check the particle size of supplied sand" are displayed in "(2) On-site check" of "3. Response method".

[0092]

In the second example, each of the first pie chart R25A, the second pie chart R25B, and the third pie chart R25C consists of six responses of "Change of fuel (co-firing ratio, properties)", "Change in air distribution", "Change in particle size of supplied sand material", "Progression of ash adhesion", "Influence due to abnormality control", and "Others". The area (angle) of each sector of the pie chart is proportional to a proportion (ratio) of each response to the entirety. In the

example shown in FIG. 8, the first pie chart R25A for the target plant, the second pie chart R25B for the plant being in the same state, and the third pie chart R25C for all plants show that "Change in particle size of supplied sand material" is a response having a relatively high proportion in a plurality of responses to abnormalities occurred in the past.

[0093]

In a case where an abnormality in which a steam temperature is less than the predetermined value is detected as in the second example, an uneconomical operation may be caused by a significant decrease in the efficiency of the plant. In that case, five factors of "1) Change of fuel (co-firing ratio, properties)", "2) Change in air distribution", "3) Change in particle size of supplied sand material", "4) Progression of ash adhesion", and "5) Influence due to abnormality control" are considered as factors. The same content as these factors is written in "2. Factor of occurrence" of the guidance area R20. Accordingly, an operator can ascertain a plurality of factors that are considered for a certain abnormality by viewing the guidance area R20 of the guide display screen DP1.

[0094]

Further, the aggregation result information is displayed in the second area R2 of the guide display screen DP1 together with the guidance information. Accordingly, an operator can evaluate, for example, from the first pie chart R25A, the second

pie chart R25B, and the third pie chart shown in FIG. 8, that the influences of "1) Change of fuel (co-firing ratio, properties)", "2) Change in air distribution", "4) Progression of ash adhesion", and "5) Influence due to abnormality control" are small and the response of "3) Change in particle size of supplied sand material" is effective means for an abnormality in which a steam temperature is less than the predetermined value, by viewing the aggregation result area R25 of the guide display screen DP1. As a result, it is easy to specify highly likely factors and responses.

[0095]

Next, an information collection screen displayed on the display screen of the device will be described with reference to FIG. 9. FIG. 9 is a diagram showing the information collection screen DP2 displayed on the device 30 according to the embodiment.

[0096]

The device 30 is configured to display the information collection screen DP2 shown in FIG. 9 on the display screen in a case where the detected abnormality of the plant 1 is resolved. The information collection screen DP2 transitions from the guide display screen DP1, for example, after a predetermined time has elapsed since the predetermined process data has fallen below a threshold. The information collection screen DP2 may transition from the guide display screen DP1 at any timing by

an operation of an operator.

[0097]

The information collection screen DP2 includes an input area R30 and an input support area R31. The reception unit 325 of the device 30 is configured to receive an input in a questionnaire format in the input area R30. In the example shown in FIG. 9, a question of "Which countermeasure was effective?" and the sentences of answer options for the question of "control of steam drum level", "malfunction of regulating valve", "cleaning of regulating valve", and "..." are displayed in the input area R30. The question and the answer options displayed in the input area R30 may be created using a failure mode and effects analysis (FMEA) method. The input area R30 includes a text box written as "Others" and is configured such that any sentence can be filled in the text box. Accordingly, an operator can select an answer from a plurality of options included in the input area R30 and can also freely input an answer.

[0098]

An example in which there is one question displayed in the input area R30 and there are a plurality of answer options has been shown in FIG. 9, but the present invention is not limited thereto. A plurality of questions may be displayed in the input area R30, and there may be one or a plurality of answers for each question.

[0099]

Further, the input support area R31 is configured to display information for supporting an input to the input area R30. In the example shown in FIG. 9, the graph of predetermined process data before a response is taken for the most recently detected abnormality (the graph of "Before" in FIG. 9) and the graph of the predetermined process data after the response is taken (the graph of "After" in FIG. 9) are displayed in the input support area R31. Since the two graphs of process data before and after the response is taken are displayed as described above, the input of a more accurate answer can be supported.

[0100]

Next, a processing procedure executed by the device according to the embodiment will be described with reference to FIG. 10. FIG. 10 is a flowchart illustrating an example of guide display processing S100 performed by the device 30 according to the embodiment.

[0101]

Further, in the following description, it is assumed that the plant 1 is in operation, the basic plant information is stored in the basic plant information DB 33A, and the guidance information is stored in the guidance information DB 33B. Furthermore, it is assumed that the device 30 stores response information on past abnormalities occurred in the plant 1 in the response information DB 33C and also stores response information for plants other than the plant 1 in the response

information DB 33C.

[0102]

First, the abnormality detection unit 322 determines whether or not an abnormality has occurred in the plant 1 (S101). The abnormality detection unit 322 makes a determination based on the alarm information described above. The abnormality detection unit 322 repeats Step S101 until determining that an abnormality has occurred in the plant 1.

[0103]

In a case where it is determined that an abnormality has occurred in the plant 1 (Yes in S101), the display control unit 324 acquires the guidance information stored in the guidance information DB 33B (S102). The abnormality detection unit 322 determines that an abnormality has occurred in Step S101, and reads out and acquires the guidance information associated with the abnormality from the guidance information DB 33B.

[0104]

Next, the aggregation unit 323 aggregates responses that can be taken for abnormalities related to the abnormality detected in Step S101 by the abnormality detection unit 322, based on the response information stored in the response information DB 33C (S103).

[0105]

Next, the aggregation unit 323 generates aggregation result information based on results aggregated in Step S103

(S104). For example, as described with reference to FIGS. 6 and 8, in a case where a pie chart is displayed on the display screen, the aggregation unit 323 calculates a proportion (ratio) of each response taken in the past to the entirety and generates the aggregation result information including the information on the proportion (ratio).

[0106]

Next, the display control unit 324 displays the guidance information acquired in Step S102 and the aggregation result information generated in Step S104 on the display screen (S105). As described with reference to FIGS. 4 and 7, the display control unit 324 displays the guidance information in the guidance area R20 and displays the aggregation result information in the aggregation result area R25 on the guide display screen DP1.

[0107]

After Step S105, the device 30 ends the guide display processing S100.

[0108]

The contents and order of the steps of the guide display processing S100 described in the present embodiment are merely examples, and the guide display processing S100 is not limited to this example. Further, the order of the flowchart shown in FIG. 10 may be changed as long as there is no contradiction in the processing.

[0109]

Furthermore, the processing described in the present embodiment may be realized by the hardware of the device, or may be realized through the execution of the program stored in the storage device by a processor. In a case where the program is executed, the program may be stored in a storage medium. The storage medium in which the program is stored may be a non-transitory computer readable storage medium. The non-transitory storage medium is not particularly limited, and may be, for example, a storage medium such as a USB memory or a CD-ROM.

[0110]

As described above, according to the present embodiment, in a case where an abnormality is detected, guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on response information, for responses that can be taken for abnormalities related to the abnormality are displayed on the display screen. Accordingly, the guidance information and the aggregation result information can be displayed together. Therefore, since it is possible to provide information for supporting the selection of an appropriate response from among available responses to an operator who views the display screen, it is possible to more appropriately respond to an abnormality, which has occurred, than in the related art.

[0111]

Aspects described through the above-described embodiments can be used in appropriate combination according to the application or can be used with modifications or improvements, and the present invention is not limited to the description of the above-mentioned embodiments. It is apparent from the disclosure of the claims that embodiments with such combinations, modifications, or improvements may also be included in the technical scope of the present invention.

[0112]

The present disclosure includes, for example, the following aspects. The correspondence with the above-described embodiments is shown by expressions in parentheses.

[0113]

[Supplementary Note 1]

A device 30 according to an aspect of the present disclosure is a device 30 that includes a display screen on which an operating state of a plant 1 is displayed, and includes: an abnormality detection unit 322 detecting that an abnormality has occurred in the plant 1; a response information storage unit 33C in which response information on responses to abnormalities occurred in the past is stored; and a display control unit 324 that displays guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on the response information, for responses capable of being taken for

abnormalities related to the abnormality, on the display screen in a case where the abnormality is detected.

[0114]

[Supplementary Note 2]

In the device 30 according to Supplementary Note 1, the display control unit 324 may display the aggregation result information in a graph format representing a proportion of each of the responses taken in the past.

[0115]

[Supplementary Note 3]

In the device 30 according to Supplementary Note 2, the graph may include a graph R25A that represents a proportion of each of the responses taken in the past in the plant 1, a graph R25B that represents a proportion of each of the responses taken in the past in the same type of plant as the plant 1, and a graph R25C that represents a proportion of each of the responses taken in the past in all plants.

[0116]

[Supplementary Note 4]

In the device 30 according to Supplementary Note 1, the display control unit 324 may display the aggregation result information in a list format representing a number of times of each of the responses taken in the past.

[0117]

[Supplementary Note 5]

The device 30 according to Supplementary Note 1 may further include a reception unit 325 that receives, after the response is taken for the detected abnormality, an input of information on the response in a questionnaire format.

[0118]

[Supplementary Note 6]

The device 30 according to Supplementary Note 5 may further include a response information generation unit 326 that generates the response information based on the received information.

[0119]

[Supplementary Note 7]

The device 30 according to Supplementary Note 5 may further include a guidance information storage unit 33B in which the guidance information is stored in association with the abnormality.

[0120]

[Supplementary Note 8]

A plant management system 50 according to another aspect of the present disclosure includes: the plant 1; and the device 30 according to any one of Supplementary Notes 1 to 7.

[0121]

[Supplementary Note 9]

A method according to another aspect of the present disclosure is a method for a device 30 including a display screen

on which an operating state of a plant 1 is displayed, and includes: detecting that an abnormality has occurred in the plant 1; and displaying guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on response information on responses to abnormalities occurred in the past, for responses capable of being taken for abnormalities related to the abnormality, on the display screen in a case where the abnormality is detected.

[0122]

[Supplementary Note 10]

A program according to another aspect of the present disclosure is a program for a device 30 including a display screen on which an operating state of a plant 1 is displayed, and causes a computer to execute: detecting that an abnormality has occurred in the plant 1; and displaying guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on response information on responses to abnormalities occurred in the past, for responses capable of being taken for abnormalities related to the abnormality, on the display screen in a case where the abnormality is detected.

Reference Signs List

[0123]

- 1 Plant
- 2 Furnace
 - 2a Fuel supply port
 - 2b Gas outlet
 - 2c Air supply line
 - 2d Exhaust port
- 3 Cyclone
 - 3a Exhaust gas flow channel
- 4 Circulation material recovery pipe
 - 4a Loop seal portion
- 5 Rear flue
- 6 Furnace wall pipe
- 7 Pump
 - 7a Pump
- 8 Steam drum
 - 8a Downcast pipe
 - 8b Saturated steam pipe
- 10 Superheater
 - 10a Pipe
- 12 Economizer
- 13 Area
- 21 Pipe
- 22 Pipe
- 30 Device
 - 30a CPU

- 30d Communication unit
- 30e Input unit
- 30f Display unit
- 32 Controller
- 33 Storage unit
- 33A Basic plant information DB
- 33B Guidance information DB
- 33C Response information DB
- 100 Turbine
- 102 Condenser
- 321 Acquisition unit
- 322 Abnormality detection unit
- 323 Aggregation unit
- 324 Display control unit
- 325 Reception unit
- 326 Response information generation unit
- S100 Guide display processing

CLAIMS

1. A device that includes a display screen on which an operating state of a plant is displayed, the device comprising:

an abnormality detection unit detecting that an abnormality has occurred in the plant;

a response information storage unit in which response information on responses to abnormalities occurred in the past is stored; and

a display control unit that displays guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on the response information, for responses capable of being taken for abnormalities related to the abnormality, on the display screen in a case where the abnormality is detected.

2. The device according to claim 1, wherein the display control unit displays the aggregation result information in a graph format representing a proportion of each of the responses taken in the past.

3. The device according to claim 2, wherein the graph includes a graph that represents a proportion of each of the responses taken in the past in the plant, a graph that represents a proportion of each of the responses taken in the past in the

same type of plant as the plant, and a graph that represents a proportion of each of the responses taken in the past in all plants.

4. The device according to claim 1, wherein the display control unit displays the aggregation result information in a list format representing a number of times of each of the responses taken in the past.

5. The device according to claim 1, further comprising: a reception unit that receives, after the response is taken for the detected abnormality, an input of information on the response in a questionnaire format.

6. The device according to claim 5, further comprising: a response information generation unit that generates the response information based on the received information.

7. The device according to claim 1, further comprising: a guidance information storage unit in which the guidance information is stored in association with the abnormality.

8. A plant management system comprising:

the plant; and

the device according to any one of claims 1 to 7.

9. A method for a device including a display screen on which an operating state of a plant is displayed, the method comprising:

detecting that an abnormality has occurred in the plant;
and

displaying guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on response information on responses to abnormalities occurred in the past, for responses capable of being taken for abnormalities related to the abnormality, on the display screen in a case where the abnormality is detected.

10. A program for a device including a display screen on which an operating state of a plant is displayed, the program causing a computer to execute:

detecting that an abnormality has occurred in the plant;
and

displaying guidance information on guidance for responding to the abnormality and aggregation result information indicating results aggregated, based on response information on responses to abnormalities occurred in the past, for responses capable of being taken for abnormalities related to the abnormality, on the display screen in a case where the

abnormality is detected.