difficult to grasp a cause of the abnormality in the plant and a countermeasure for the abnormality.

[0005]

Embodiments of the present invention provide a system, a device, and a method capable of showing a state of a plant to an operator in an easy-to-understand manner when an abnormality occurs in the plant.

SOLUTION TO PROBLEM

[0006]

According to a first aspect of the present invention, there is provided a system for displaying a state of a plant. The system includes a first display function including displaying an abnormality display indicating an occurrence of an abnormality having a possibility of stopping the plant and prompting an operator to confirm the abnormality; a second display function including displaying image information indicating a position of a tube in an entire plant and a position of a sensor provided in the tube and indicating an abnormal state of the tube detected by the sensor in a prescribed mode when the abnormality display is selected by the operator in the first display function; and a third display function including displaying data of the sensor as a basis of the abnormal state indicated in the prescribed mode, wherein the second display function further displays determination information that is used when the state of the tube is determined based on process data related to the plant.

[0007]

According to the above aspect, when an abnormality occurs in the plant, since a state of the plant that should be grasped by an operator can be displayed in a stepwise and sequential manner, the state of the plant can be easily shown to the operator.

[0008]

According to a second aspect of the present invention, there is provided a method for displaying a state of a plant. The method includes displaying an abnormality display indicating an occurrence of an abnormality having a possibility of stopping the plant and displaying a first display prompting an operator to confirm the abnormality; receiving a selection of the abnormality display from the operator; displaying image information that indicates a position of a tube in the entire plant and a position of a sensor provided in the tube displaying a second display and displaying an abnormal state of the tube detected by the sensor in a prescribed mode when the abnormality display is selected by the operator; receiving a selection of the display in the prescribed mode from the operator; and displaying a third display

indicating data of the sensor as a basis of the abnormal state indicated in the prescribed mode when the display of the abnormal state of the tube is selected by the operator, wherein the displaying the second display further displays determination information that is used when the state of the tube is determined based on process data related to the plant.

[0009]

According to the above aspect, when an abnormality occurs in the plant, since a state of the plant that should be grasped by an operator can be displayed in a stepwise and sequential manner, the state of the plant can be easily shown to the operator.

[0010]

Disclosed herein is a device including a display screen for displaying a state of a plant. The device is configured to display, in a first area of the display screen, an occurrence of an abnormality having a possibility of stopping the plant; and display, in a second area of the display screen, an occurrence history of an abnormality affecting an operation efficiency of the plant.

[0011]

According to this disclosure, it is possible to easily recognize both a serious abnormality such as a bursting and an abnormality related to a decrease in the operation efficiency.

[0012]

It should be noted that the expression which is configured to display “an occurrence of an abnormality” includes not only a case where it is determined that an abnormality occurs but also a case where there is a high possibility that an abnormality will occur in the future.

[0013]

In addition, the expression which is configured to display “an occurrence history of an abnormality” includes a case in which the device is configured to display a history indicating it is determined that an abnormality occurs and a case in which the device is configured to display a history indicating that there is a high possibility that an abnormality will occur in the future.

[0014]

The occurrence history of the abnormality displayed in the second area may be displayed in a mode in which time information indicating an occurrence time of the abnormality and information indicating contents of the abnormality are arranged in an order of the occurrence time. The occurrence time of the abnormality includes not only a time when it is

determined that an abnormality occurs, but also a time when it is determined that there is a high possibility that an abnormality will occur in the future.

[0015]

According to this disclosure, since the time information indicating the occurrence time of the abnormality that affects the operation efficiency and a stable operation of the plant and the information indicating the contents of the abnormality are displayed in a state in which the occurrence time and the information are arranged in the order of the occurrence time, it is possible to recognize occurrence times of a plurality of abnormalities that lead to a decrease in the operation efficiency.

[0016]

The plant may include a plurality of sensors, and the occurrence history of the abnormality displayed in the second area may be displayed in a mode in which the number of times that data obtained by these sensors indicates an abnormal value is arranged for each sensor.

[0017]

According to this disclosure, since the number of times that a sensor shows an abnormal value can be displayed for each sensor, it is possible to easily specify a problematic sensor.

[0018]

The occurrence history of the abnormality displayed in the second area may include an occurrence history of an abnormality determined to occur based on data obtained from at least two of the sensors and an occurrence history of an abnormality determined to occur based on data obtained from a single one of the sensors.

[0019]

According to this disclosure, since it is possible to display the occurrence history of the abnormality for which the occurrence is determined based on data obtained from at least two of the sensors, it is possible to improve detection accuracy of the abnormality.

[0020]

The plant may be composed of a plurality of components, and the device may be configured to display at least one of the components having a possibility of causing an abnormality that affects the operation efficiency and a stable operation in a fourth area of the display screen in a mode different from other components.

[0021]

According to this disclosure, since at least one of the components having a possibility of causing an abnormality that affects the operation efficiency can be displayed in a mode different from the other components, it is possible to easily specify a problematic component.

[0022]

The device may be configured to display information indicating the operation efficiency of the plant in a fifth area of the display screen.

[0023]

According to this disclosure, since the information indicating the operation efficiency of the plant can be displayed, it is possible to easily recognize a decrease in the operation efficiency due to the abnormality.

[0024]

Disclosed herein is a system including a device having a display screen for displaying a state of a plant; and a control device configured to control the device, in which the device is configured to display, in a first area of the display screen, an occurrence of an abnormality having a possibility of stopping the plant, and display, in a second area of the display screen, an occurrence history of an abnormality affecting an operation efficiency of the plant.

[0025]

According to this disclosure, since it is possible to simultaneously display two pieces of information important for the operation of the plant on the display screen, it is possible to easily recognize both a serious abnormality such as a bursting and an abnormality related to a decrease in the operation efficiency.

[0026]

Disclosed herein is a device including a display screen for displaying a state of a plant, in which the device is configured to display, in a first area of the screen, image information indicating a position of a tube in the entire plant and a position of a sensor provided in the tube and display a state of the tube detected by the sensor in the first area in a prescribed mode; and display, in a second area of the screen, determination information that is used when the state of the tube is determined based on operation data of the plant.

[0027]

Disclosed herein is a system including: a display device having a screen for displaying a state of a plant; and a control device configured to control the display device, in which the display device is configured to display, in a first area of the screen, image information indicating a position of a tube in the entire plant and a position of a sensor provided in the tube and display a state of the tube detected by the sensor in the first area in a prescribed mode, and

display, in a second area of the screen, determination information that is used when the state of the tube is determined based on operation data of the plant.

[0028]

When such a configuration is adopted, image information indicating the position of the tube in the entire plant and the position of the sensor provided in the tube can be displayed in the first area of the screen, and the state of the tube detected by the sensor can be displayed in the prescribed mode. In addition, the determination information that is used when the state of the tube is determined based on the operation data of the plant can be displayed in the second area of the screen. Therefore, an operator who visually recognizes the screen of the device (the system) can grasp the position of the tube and the position of the sensor in the entire plant, and can also grasp the state of the tube determined or detected using different methods (both the sensor and the operation data of the plant). That is, the operator can efficiently grasp important information necessary for monitoring the tube by visually recognizing a single screen, and thus can make a comprehensive determination. As a result, the device (the system) can contribute to a stable operation of the plant. The "state of the tube" includes not only a state (an abnormal state) in which an abnormality such as a bursting or clogging occurs in the tube, but also a state (a normal state) in which such an abnormality does not occur. That is, the device (the system) can display not only an abnormal state of a tube but also a normal state of a tube.

[0029]

The device or system according to the above disclosure can be configured to display the determination information in the second area in time series. Examples of the determination information include a value obtained by calculating an abnormality degree of a tube based on the operation data, a value obtained by calculating a reliability degree of the state of the tube (the abnormality degree or the like) based on the operation data, and feature amount data that affects a state determination (a determination of the abnormality degree or the reliability degree) of the tube.

[0030]

When such a configuration is adopted, it is possible to grasp, in time series, the determination information related to the state of the tube determined based on the operation data of the plant.

[0031]

The device or system according to the above disclosure can be configured to display both a detection result of the state of the tube detected by the sensor and a determination result

of the state of the tube determined based on the operation data of the plant in the same format and in time series in the third area of the screen. The device or system may be configured to display a time axis in the second area and a time axis in the third area in conjunction with each other.

[0032]

When such a configuration is adopted, both the detection result of the state of the tube detected by the sensor and the determination result of the state of the tube determined based on the operation data of the plant can be displayed in the same format (for example, in a bar chart format) and in time series in the third area of the screen. Therefore, an operator can visually recognize and grasp tube state determination (detection) results that are obtained using different methods and are in the same format, and can make a comprehensive determination.

[0033]

The device or system according to the above disclosure may be configured to display detection information detected by a specific sensor in the fourth area in time series when the specific sensor is selected from sensors displayed in the first area.

[0034]

When such a configuration is adopted, the detection information detected by the selected sensor (specific sensor) among the sensors displayed in the first area of the screen can be grasped in time series.

[0035]

The device or system according to the above disclosure can be configured to display the detection information in the fourth area of a screen different from the screen.

[0036]

When such a configuration is adopted, the detection information detected by the selected sensor (specific sensor) among the sensors displayed in the first area of the screen can be displayed in the fourth area of the screen different from the screen having the first area and the like. Therefore, there is an advantage in that the detection information can be enlarged and displayed on the screen (the fourth area) different from the screen having the first area and the like, and a time history and the like of the detection information can be grasped in detail.

[0037]

Disclosed herein is a device including a display screen for displaying a state of a plant. The device is configured to display, in a first area of the display screen, a graph of first process data related to the plant; and display, in a second area of the display screen which is adjacent to the first area, an explanatory text related to the first process data.

[0038]

According to the above disclosure, since the graph of the first process data is displayed in the first area of the display screen and the explanatory text related to the first process data is displayed in the adjacent second area, it is easy to understand what kind of event occurs and it is easy to understand what kind of countermeasure is required.

[0039]

In the above disclosure, a graph of second process data related to the first process data may be displayed in the first area.

[0040]

According to the above disclosure, since not only a graph of the first process data but also a graph of the related second process data are displayed, it is possible to monitor the state of the plant from various angles.

[0041]

In the disclosure, another graph of the first process data different from the graph of the first process data may be displayed in the first area.

[0042]

According to this disclosure, it is possible to monitor the state of the plant from various angles by displaying a plurality of types of graphs of the first process data.

[0043]

In the above disclosure, the display screen may be configured to display, on the display screen, a first screen showing a warning when at least one of a plurality pieces of process data is in an abnormal state and configured to be display a second screen on the display screen by transitioning the display screen from the first screen to the second screen in response to the selection of the warning, and the second screen may include the first area and the second area.

[0044]

According to this disclosure, an outline of the state of the plant can be confirmed through the plurality of pieces of process data on the first screen, and the state of the plant can be confirmed in detail through specific process data on the second screen.

[0045]

In the above disclosure, a warning may be displayed in a third area of the first screen, and a graph of one or a plurality pieces of representative process data related to the plant may be displayed in a fourth area adjacent to the third area.

[0046]

According to this disclosure, it is possible to quickly grasp a possibility of an abnormality by displaying the warning in the third area of the first screen, and it is possible to confirm the outline of the state of the plant by displaying the graph of the representative process data in the fourth area of the first screen.

[0047]

In the above disclosure, the explanatory text may include a sentence describing a method of capturing an event from the graph.

[0048]

According to this disclosure, it is possible to confirm a method of capturing an event from a graph, and it is easy to understand what kind of event occurs.

[0049]

In the above disclosure, the explanatory text may include a sentence describing a method of optimizing a state of the first process data.

[0050]

According to this disclosure, it is possible to confirm a method of optimizing the state of the first process data, and it is easy to understand what kind of countermeasure is required.

[0051]

Disclosed herein is a system including: a device having a display screen for displaying a state of a plant; and a control device configured to control the device, in which the device is configured to display, in a first area of the display screen, a graph of first process data related to the plant, and display, in a second area of the display screen which is adjacent to the first area, an explanatory text related to the first process data.

[0052]

According to this disclosure, since the graph of the first process data is displayed in the first area of the display screen and the explanatory text related to the first process data is displayed in the adjacent second area, it is easy to understand what kind of event occurs and it is easy to understand what kind of countermeasure is required.

[0053]

It should be noted that any combination of the above-described components and components and expressions of the present invention may be mutually replaced by a method, a device, a system, a computer program, a data structure, a recording medium, or the like, which is also effective as an aspect of the present invention.

## ADVANTAGEOUS EFFECTS OF INVENTION

[0054]

According to embodiments of the present invention, it is possible to show a state of a plant to an operator in an easy-to-understand manner when an abnormality occurs in the plant.

## BRIEF DESCRIPTION OF DRAWINGS

[0055]

FIG. 1 is a schematic diagram showing an overall configuration of a plant according to an embodiment of the present invention.

FIG. 2 is a diagram showing functional blocks of a system according to the embodiment of the present invention.

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

FIG. 4 is a diagram showing details of the functional blocks of the system according to the present embodiment.

FIG. 5 is a flowchart showing a method according to the embodiment of the present invention.

FIG. 6 is a diagram showing a display function of the system according to the present embodiment.

FIG. 7 is a diagram showing a display function of the system according to the present embodiment.

FIG. 8 is a diagram showing a display function of the system according to the present embodiment.

FIG. 9 is a diagram showing a display function of the system according to the present embodiment.

FIG. 10 is a diagram showing a display function of the system according to the present embodiment.

FIG. 11 is a diagram showing a display function of the system according to the present embodiment.

FIG. 12 is a diagram showing a display function of the system according to the present embodiment.

FIG. 13 is a diagram showing a display function of the system according to the present embodiment.

FIG. 14 is a diagram showing a display function of the system according to the present embodiment.

**CLAIMS**

1. A system for displaying a state of a plant, comprising:

a first display function including displaying an abnormality display indicating an occurrence of an abnormality having a possibility of stopping the plant and prompting an operator to confirm the abnormality;

a second display function including displaying image information indicating a position of a tube in an entire plant and a position of a sensor provided in the tube and indicating an abnormal state of the tube detected by the sensor in a prescribed mode when the abnormality display is selected by the operator in the first display function; and

a third display function including displaying data of the sensor as a basis of the abnormal state indicated in the prescribed mode,

wherein the second display function further displays determination information that is used when the state of the tube is determined based on process data related to the plant.

2. The system according to claim 1, wherein at least one of the first display function, the second display function, and the third display function further displays an explanatory text related to the abnormality.

3. The system according to claim 1 or 2,

wherein the second display function further displays an abnormality confirmation display for determining that the abnormality has been confirmed by the operator, and

wherein when the abnormality confirmation display is selected by the operator in the second display function, the first display function displays the abnormality display in a different mode.

4. The system according to any one of claims 1 to 3, wherein the first display function includes:

displaying, in a first area of a display screen of the plant, the occurrence of the abnormality having the possibility of stopping the plant; and

displaying, in a second area of the display screen, an occurrence history of an abnormality that affects an operation efficiency of the plant.

5. The system according to any one of claims 1 to 3, wherein the second display function includes:

displaying, in a first area of a display screen of the plant, the image information indicating the position of the tube in the entire plant and the position of the sensor provided in the tube and display, in the first area, the abnormal state of the tube detected by the sensor in the prescribed mode; and

displaying, in a second area of the display screen, the determination information that is used when the state of the tube is determined based on operation data of the plant.

6. A method of displaying a state of a plant, comprising:

displaying an abnormality display indicating an occurrence of an abnormality having a possibility of stopping the plant and displaying a first display prompting an operator to confirm the abnormality;

receiving a selection of the abnormality display from the operator;

displaying image information that indicates a position of a tube in an entire plant and a position of a sensor provided in the tube and displaying a second display indicating an abnormal state of the tube detected by the sensor in a prescribed mode when the abnormality display is selected by the operator;

receiving a selection of the display in the prescribed mode from the operator; and

displaying a third display indicating data of the sensor as a basis of the abnormal state indicated in the prescribed mode when the display of the abnormal state of the tube is selected by the operator,

wherein the displaying the second display further displays determination information that is used when the state of the tube is determined based on process data related to the plant.