DESCRIPTION

MANAGEMENT DEVICE

BACKGROUND ART

In recent years, utilization of an Internet of Things (IoT) system for remotely monitoring and operating equipment by connecting a control terminal that controls the equipment to a management apparatus (server) through the Internet or the like has been considered. In the IoT system, access to the management apparatus changes according to usage statuses of users, operation statuses of equipment, and so forth. Thus, the load on the management apparatus significantly varies depending on usage statuses of users and so forth. Accordingly, the IoT system is designed so that the management apparatus can withstand a peak load (for example, Patent Literature 1 (International Publication No. 2014/017053) and so forth). For example, auto-scaling may be used so that the management apparatus can withstand a peak load.

SUMMARY OF THE INVENTION

<Technical Problem>

However, system design enabling the management apparatus to withstand a peak load may result in excessive specifications or the like of the management apparatus. In addition, use of auto-scaling causes the operation cost of the management apparatus to vary each time, leading to an issue that the cost for system installation is unpredictable.

Embodiments of the present disclosure provide a management apparatus capable of withstanding a peak load without increasing the specifications.

<Solution to Problem>

In an embodiment, the present disclosure is connected through a network to each of a control terminal that is associated with one or more pieces of equipment to control one or more pieces of equipment and transmits equipment information related to the equipment, and a monitoring terminal that transmits a request related to the equipment and monitors a state of the equipment. Here, the management apparatus includes a receiving unit, a calculation unit,

a load detecting unit, a load determining unit, and a reduction control unit. The receiving unit receives the request and the equipment information. The calculation unit executes calculation of information processing that is based on the information received by the receiving unit. The load detecting unit detects a load of information processing by a processing unit. The load determining unit determines whether or not the load detected by the load detecting unit is above a threshold value. The reduction control unit executes reduction control to reduce the load on the calculation unit if the load determining unit determines that the load is above the threshold value.

The management apparatus according to the above embodiment reduces the load on the processing unit if the load determining unit determines that the load is above the threshold value, and is thus capable of withstanding a peak load without increasing the specifications.

In the present disclosure, a "threshold value" is not limited to the value at one specific point, but includes a value derived from an arithmetic expression or the like.

In an embodiment of the present disclosure, the management apparatus further includes a threshold value setting unit for setting the threshold value.

In the above embodiment, the threshold value setting unit is further included, which enables a manager who operates the management apparatus to adjust a communication load on the entire system.

In an embodiment of the present disclosure, in the management apparatus, if the load determining unit determines that the load is above the threshold value, the reduction control unit transmits a reduction control notification indicating that the reduction control is to be executed to the control terminal.

In the above embodiment, the reduction control unit transmits the reduction control notification to the control terminal, and thus reduction control can be executed on the control terminal side. For example, if reduction control is control to change the communication condition between the management apparatus and the control terminal, the communication condition of the control terminal can be changed to reduce the load on the processing unit.

In an embodiment of the present disclosure, in the management apparatus, the load determining unit determines whether or not the load is below the threshold value after determining that the load is above the threshold value. If the load determining unit determines that the load is below the threshold value, the reduction control unit transmits a

cancellation notification indicating that the reduction control is to be canceled to the control terminal.

In the above embodiment, the cancellation notification is transmitted to the control terminal if it is determined that the load is below the threshold value. Thus, the reduction control can be canceled when the load on the entire system is not heavy.

In an embodiment of the present disclosure, in the management apparatus, if the load determining unit determines that the load is above the threshold value, the reduction control unit transmits a reduction control notification indicating that the reduction control is to be executed to the monitoring terminal. The reduction control unit executes the reduction control when receiving, from the monitoring terminal, an approval notification indicating approval for execution of the reduction control in response to transmission of the reduction control notification.

In the above embodiment, reduction control is executed when receiving, from the monitoring terminal, an approval notification in response to transmission of a reduction control notification, and thus it is possible to provide an equipment management system in which the intention of a monitor or the like who operates the monitoring terminal is reflected.

In an embodiment of the present disclosure, in the management apparatus, the threshold value is set by the monitoring terminal.

In the above embodiment, the threshold value of the load is set by the monitoring terminal, and thus it is possible to provide an equipment management system in which the intention of a monitor or the like who operates the monitoring terminal is reflected.

In an embodiment of the present disclosure, in the management apparatus, the load detecting unit detects the load on the basis of any one of or an arbitrary combination of memory usage, CPU load, network load, and an amount of access from an external system. Accordingly, the management apparatus according to the above embodiment is capable of withstanding a peak load without increasing the specifications.

In an embodiment of the present disclosure, in the management apparatus, if the load determining unit determines that the load is above the threshold value, the reduction control unit reduces the load by changing the communication condition between the management apparatus and the control terminal.

The management apparatus according to the above embodiment changes the

communication condition between the management apparatus and the control terminal if the load determining unit determines that the load is above the threshold value, and is thus capable of withstanding a peak load without increasing the specifications.

In an embodiment, of the present disclosure, in the management apparatus, the reduction control unit suppresses communication of part of a plurality of types of equipment information if the load is above the threshold value. Here, the control terminal transmits a plurality of types of equipment information related to equipment.

In the above embodiment, communication of part of the plurality of types of equipment information is suppressed if the load is above the threshold value, and thus the load on the calculation unit can be reduced. In addition, the total amount of communication can be reduced while securing communication of highly important equipment information in the plurality of types of state information.

In an embodiment of the present disclosure, the management apparatus further includes a communication condition storage unit that stores, in association with each piece of equipment, a communication condition of equipment information for which communication is to be suppressed in the plurality of types of equipment information.

In the above embodiment, a communication condition of equipment information for which communication is to be suppressed in the plurality of types of equipment information is stored in association with each piece of equipment, and thus the details of reduction control can be determined on the management apparatus side.

In an embodiment, in the management apparatus, if the load determining unit determines that the load is above the threshold value, the reduction control unit reduces the load by limiting a response to a request from the monitoring terminal.

The management apparatus according to the above embodiment limits a response to a request from the monitoring terminal if the load determining unit determines that the load is above the threshold value, and is thus capable of withstanding a peak load without increasing the specifications.

According to a first aspect of the present disclosure, there is provided an equipment management system including: a control terminal that transmits equipment information related to equipment; and a management apparatus that controls the control terminal through a network, wherein the management apparatus includes a calculation unit that executes

calculation of information processing that is based on information received from the control terminal, a load determining unit that determines a load level corresponding to a load of the information processing by the calculation unit, a reduction control unit that executes reduction control to reduce the load on the calculation unit in accordance with the load level, and a communication unit that transmits the load level to the control terminal, and the control terminal includes a communication condition changing unit that changes, in accordance with the load level, a communication condition of equipment information to be transmitted to the management apparatus.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the control terminal further includes a control-side storage unit that stores a degree of priority that is based on a type of the equipment and/or a type of information obtained from the equipment. The communication condition changing unit of the control terminal changes the communication condition of the equipment information in accordance with the load level and the degree of priority. With this configuration, the load on the management apparatus 30 can be reduced.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the management apparatus further includes a management-side storage unit that stores a degree of priority that is based on a type of the equipment and/or a type of information obtained from the equipment. The communication unit of the management apparatus transmits the degree of priority together with the load level to the control terminal. In the control terminal, the communication condition changing unit changes the communication condition in accordance with the load level and the degree of priority. This configuration makes it possible to provide an equipment management system that is centrally managed by the management apparatus.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the equipment to be managed is an air conditioner.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the degree of priority of the air conditioner is determined from any one of or an arbitrary combination of an installation status of the air conditioner, a usage status of the air conditioner, an attribute of the air conditioner, and a purpose of monitoring the air conditioner.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the communication unit of the management apparatus transmits a reduction control notification indicating that the reduction control is to be performed to the control terminal when the load level is determined.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the management apparatus suppresses an information processing capability of the calculation unit along with notifying the control terminal of the load level. With this configuration, the information processing capability of the management apparatus can be suppressed at the time of providing a notification of the load level.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the management apparatus further includes a threshold value setting unit for setting a threshold value corresponding to the load level. With this configuration, a manager who operates the management apparatus is able to adjust the load on the management apparatus based on communication in the entire equipment management system.

In an embodiment, the equipment management system according to the first aspect of the present disclosure further includes a monitoring terminal connected to the management apparatus through the network. The threshold value corresponding to the load level is determined by the monitoring terminal. With this configuration, the intention of a monitor or the like who operates the monitoring terminal can be reflected at the time of executing the reduction control.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the load determining unit of the management apparatus detects the load on the basis of any one of or an arbitrary combination of memory usage, CPU load, network load, and an amount of access from an external system.

In an embodiment, the equipment management system according to the first aspect of the present disclosure further includes a monitoring terminal connected to the management apparatus through the network. The management apparatus provides the monitoring terminal with monitoring information available for display on the monitoring terminal, on the basis of equipment information received from the control terminal. The management apparatus limits a display item of the monitoring information in accordance with the degree of priority

of the equipment if the load level is determined. With this configuration, the load on the management apparatus can be reduced by limiting the display item of the monitoring information in accordance with the load level.

In an embodiment, in the equipment management system, when the load level is determined, the communication unit of the management apparatus transmits a reduction control notification indicating that the reduction control is to be executed to the monitoring terminal. With this configuration, a monitor or the like who operates the monitoring terminal can be allowed to recognize that the reduction control is being executed.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the management apparatus executes the reduction control when receiving, from the monitoring terminal, an approval notification indicating approval for execution of the reduction control in response to transmission of the reduction control notification. With this configuration, the intention of a monitor or the like who operates the monitoring terminal can be reflected in the reduction control of the management apparatus.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the management apparatus limits an information processing capability of the calculation unit along with limiting the display item of the monitoring information. With this configuration, the load on the calculation unit of the management apparatus can further be reduced.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the management apparatus transmits a reduction control notification indicating that the reduction control is to be executed to the control terminal, along with limiting the display item of the monitoring information.

In an embodiment, in the equipment management system according to the first aspect of the present disclosure, the management apparatus limits a request from the monitoring terminal to the equipment along with limiting the display item of the monitoring information.

According to a second aspect of the present disclosure, there is provided a management apparatus that controls, through a network, a control terminal that transmits information related to an air conditioner under a communication condition that is based on a load level and a degree of priority, including: a calculation unit that executes calculation of

information processing that is based on information received from the control terminal; a load determining unit that determines the load level corresponding to a load of the information processing by the calculation unit, a management-side storage unit that stores a degree of priority that is based on a type of the equipment and/or a type of information obtained from the equipment; and a communication unit that transmits the degree of priority together with the load level to the control terminal.

Use of the management apparatus according to the second aspect makes it possible to provide an equipment management system capable of reducing the load on the control terminal.

According to a third aspect of the present disclosure, there is provided a management apparatus that controls, through a network, a control terminal that transmits information related to an air conditioner under a communication condition that is based on a load level and a degree of priority, including: a calculation unit that executes calculation of information processing that is based on information received from the control terminal; a load determining unit that determines the load level corresponding to a load of the information processing by the calculation unit, a management-side storage unit that stores a degree of priority that is based on a type of the equipment and/or a type of information obtained from the equipment; and a communication unit that transmits a communication condition determined on the basis of the load level and the degree of priority to the control terminal.

Use of the management apparatus according to the third aspect makes it possible to provide an equipment management system capable of reducing the load on the control terminal.

In an embodiment, the management apparatus according to the third aspect of the present disclosure is connected to a monitoring terminal through the network. The management apparatus provides the monitoring terminal with monitoring information available for display on the monitoring terminal, on the basis of equipment information received from the control terminal. The management apparatus limits a display item of the monitoring information in accordance with the degree of priority of the air conditioner when the load level is determined. The load on the calculation unit can be reduced by limiting the display item of the monitoring information in accordance with the load level.

According to a fourth aspect of the present disclosure, there is provided a control

terminal connected through a network to a management apparatus that determines a load level corresponding to a load of information processing that is based on received information and transmits the load level, including: a determining unit that determines a degree of priority that is based on a type of an air conditioner and/or a type of information obtained from the air conditioner; and a communication condition changing unit that changes, in accordance with the load level and the degree of priority, a communication condition of equipment information to be transmitted.

Use of the control terminal according to the fourth aspect makes it possible to provide an equipment management system 1 capable of reducing the load on the management apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram illustrating the configuration of an equipment management system 1 according to one embodiment of the present disclosure.

Fig. 2 is a schematic diagram illustrating the configuration of an air conditioner 10 according to the embodiment.

Fig. 3 is a schematic diagram illustrating the functional blocks of individual apparatuses constituting the equipment management system 1 according to the embodiment.

Fig. 4 is a schematic diagram for describing the configuration of a communication condition database 31D according to the embodiment.

Fig. 5 is a sequence diagram for describing reduction control in the equipment management system 1 according to the embodiment.

Fig. 6 is a schematic diagram for describing an effect of reduction control in the embodiment.

Fig. 7 is a sequence diagram for describing reduction control in the equipment management system 1 according to modification example 1B.