SPECIFICATION

ENERGY MANAGEMENT SYSTEM AND MANAGEMENT APPARATUS

TECHNICAL FIELD

[0001]

The present invention relates to an energy management system and a management apparatus for managing an energy consumption amount in a building equipped with a plurality of energy consumption apparatuses, and more particularly, to an energy management system and a management apparatus receiving a reduction request for reducing the energy consumption amount in the building from an external apparatus and controlling operation states of the energy consumption apparatuses used in the building.

BACKGROUND ART

[0002]

Energy management systems managing energy consumption amounts in buildings such as houses and commercial buildings have already been known. As the energy management systems, there are systems (home energy management systems (hereinafter referred to as HEMS)) monitoring energy consumption statuses in houses using communication technologies or automatically controlling operation states of energy consumption apparatuses such as

home appliances.

[0003]

Furthermore, in recent years, systems (community energy management systems (hereinafter referred to as CEMS)) managing energy consumption amounts in units of communities have also been constructed. The CEMS enables sustainable social systems (so-called smart communities) realizing a low-carbon society to be created.

[0004]

Incidentally, the CEMS monitors energy demand and supply balance between each building present in a management target region and an energy supply source such as a power facility, and thus requests each house (specifically, the above-mentioned HEMS) present in the management target region to reduce an energy consumption amount in a situation in which power seems to be insufficient, for example, on extremely hot days in the summer season or the like. On the house side having received such a request, energy supply to a predetermined apparatus among the energy consumption apparatuses used in the house is forcibly cut off under apparatus control of the HEMS in some cases (hereinafter referred to as selective load cutoff). Here, in general, the selective load cutoff target apparatus is automatically determined according to a priority order or a selection criterion of

energy supply without consideration of circumstance of the user (for example, a resident of the house) side.

[0005]

The system performing unilateral energy management without consideration of the circumstance of the user side, as described above, lacks convenience and is difficult for the user to use. To resolve such a problem, there has been suggested a technology for realizing bidirectional energy management to which a request from an energy demand side to an energy supply side is reflected (for example, see Patent Document 1).

[0006]

In an energy management system disclosed in Patent Document 1, a system of the energy demand side and a system of the energy supply side each store conditions corresponding to a reduction request for reducing an energy consumption amount in advance, negotiation (exchange between one side suggesting a request condition regarding reduction in the energy consumption amount and the other side suggesting a possible condition or a compensation condition for the suggestion) is performed based on the conditions stored by the energy demand side and the energy supply side, and a reduction amount for which the mutual conditions are matched is calculated. Thus, in the energy management system disclosed in Patent Document 1, a load

cutoff target apparatus can be determined under the condition agreed by the both sides, that is, the energy demand side and the energy supply side.

PRIOR ART

PATENT DOCUMENT

[0007]

Patent Document 1: JP 2011-59939 A

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0008]

In the energy management system disclosed in Patent Document 1, however, while the load cutoff target apparatus is determined under the condition agreed by the system of the energy demand side and the system of the energy supply side, the determination is made by a control calculation unit mounted on each system and configured to perform a predetermined calculation process. Accordingly, a load cutoff target apparatus desired by the user may not necessarily accord with the load cutoff target apparatus determined by the foregoing calculation process, and there is a possibility that the intention of user may not be reflected when the load cutoff target apparatus is selected.

[0009]

Thus, the present invention is devised in view of the foregoing problem and an object of the present invention is to provide an energy management system and a management apparatus capable of reflecting an intension of a user to control of operation states of apparatuses determined among energy consumption apparatuses used in a building when a reduction request for reducing an energy consumption amount in the building is received from the outside.

MEANS FOR SOVING THE PROBLEM

[0010]

According to an aspect of the present invention, the foregoing problems can be solved by an energy management system including: a management apparatus configured to manage an energy consumption amount in a building equipped with a plurality of energy consumption apparatuses; and an energy consumption amount reduction request apparatus configured to transmit a reduction request for reducing the energy consumption amount in the building to the management apparatus. The management apparatus includes a reception unit configured to receive the reduction request, an operation state control unit configured to control an operation state of a control target apparatus among the plurality of energy consumption apparatuses to reduce the energy consumption amount in the building, an information acquisition unit configured to acquire information

indicating a designated apparatus designated as the control target apparatus among the plurality of energy consumption apparatuses by a user, and a storage unit configured to store the information acquired by the information acquisition unit. When the reception unit receives the reduction request, the operation state control unit reads the information stored in the storage unit, specifies the designated apparatus based on the information, and controls the operation state of the specified designated apparatus.

[0011]

According to an aspect of the present invention, the foregoing problems can be solved by a management apparatus for managing an energy consumption amount in a building equipped with a plurality of energy consumption apparatuses. The management apparatus includes: a reception unit configured to receive a reduction request for reducing an energy consumption amount in the building from an energy consumption amount reduction request apparatus transmitting the reduction request to the management apparatus; an operation state control unit configured to control an operation state of a control target apparatus among the plurality of energy consumption apparatuses to reduce the energy consumption amount in the building; an information acquisition unit configured to acquire information indicating a designated apparatus designated as the control

target apparatus among the plurality of energy consumption apparatuses by a user; and a storage unit configured to store the information acquired by the information acquisition unit. When the reception unit receives the reduction request, the operation state control unit reads the information stored in the storage unit, specifies the designated apparatus based on the information, and controls the operation state of the specified designated apparatus.

[0012]

In the above configurations, according to the aspects of the present invention, when the reduction request for reducing the energy consumption amount in the building is received, it is possible to control the operation state of the apparatus designated by the user as the control target apparatus among the energy consumption apparatuses used in the building. That is, in the energy management system and the management apparatus according to the aspects of the present invention, an intension of the user can be reflected and the control target apparatus can be determined when responding to the reduction request for reducing the energy consumption amount in the building. Thus, user-friendly energy management is realized, and thus the user can implement a more comfortable energy saving life.

[0013]

In the foregoing energy management system, the information acquisition unit may acquire the information indicating the designated apparatus designated as the control target apparatus among the plurality of energy consumption apparatuses by the user and a control condition set in regard to the operation state of the designated apparatus by the user. The storage unit may store the information acquired by the information acquisition unit and indicating the designated apparatus and the control condition. When the reception unit receives the reduction request, the operation state control unit may read the information stored in the storage unit, specify the designated apparatus and the control condition based on the information, and control the operation state of the specified designated apparatus under the specified control condition. In the configuration, since not only the control target apparatus but also the control condition at the time of the control of the operation state of the control target apparatus are determined reflecting the intention of the user, the user-friendly energy management is further realized.

[0014]

In the foregoing energy management system, the management apparatus may be a home server installed in a house which is the building. The energy consumption amount

reduction request apparatus may be an external server installed outside the house. The external server may be able to communicate with the home server and a third server managed by an energy supply business company supplying energy to the house via a network. When the third server commands the external server to transmit the reduction request via the network, the external server may transmit the reduction request to the home server via the network. In the configuration, for example, the energy management system (that is, the above-described CEMS) in units of communities can be constructed by locating the server (external server) intervened between the home server of each house and the server of the energy supply business company. Therefore, information collection from the server of the energy supply business company and information delivery to the home server of each house can be performed in an integrated manner in the foregoing external server.

[0015]

In the foregoing energy management system, the management apparatus may further include a calculation unit configured to calculate degree of change at a time of change in an energy consumption amount in the house due to controlling the operation state of the control target apparatus by the operation state control unit and a data transmission unit configured to transmit data indicating

the degree of change calculated by the calculation unit to the external server. In the configuration, it is possible to evaluate the effect when the reduction request for reducing the energy consumption amount is received and the energy consumption amount in the building is reduced, and to perform feedback of the result to the external server.

[0016]

In the foregoing energy management system, the external server may include a score granting unit configured to grant a score according to the degree of change calculated by the calculation unit to the user. When the score granting unit receives data indicating the degree of change calculated by the calculation unit via the network, the score granting unit may calculate a score according to the degree of change based on the data and grants the score to the user. In the configuration, the effect according to the aspect of the present invention in which the control target apparatus can be determined reflecting the intention of the user can be more efficient. That is, the intention of the user is reflected to the determination of the control target apparatus. Therefore, a higher score can be obtained as the reduction amount expected by the control of the operation state of the control target apparatus designated by the user is larger. Thus, motivation of the user for the reduction in the

energy consumption amount is increased, and thus the user actively responds to the reduction request.

[0017]

In the foregoing energy management system, a sensor configured to measure an energy consumption amount in the house and output a signal according to a result of the measurement may be provided. Based on the signal output by the sensor, the calculation unit may calculate, as the degree of change, a difference in the energy consumption amount in the house per unit time before and after the operation state control unit controls the operation state of the control target apparatus. In the configuration, when the degree of change in the energy consumption amount in the house caused by the control of the operation state of the control target apparatus is calculated, the degree of change in the energy consumption amount is calculated based on the signal output from the sensor, that is, the result of the measurement. Therefore, a calculation result with high credibility can be obtained.

EFFECT OF THE INVENTION

[0018]

In the energy management system according to the present invention, the control target apparatus of which the operation state is controlled for the purpose of responding to the reduction request for reducing the energy

consumption amount in the building can be determined reflecting the intention of the user. Accordingly, the user-friendly energy management is realized, and thus the user can implement a more comfortable energy saving life.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

[Fig. 1] Fig. 1 is a conceptual diagram illustrating an energy management system according to the present invention.

[Fig. 2] Fig. 2 is an explanatory diagram illustrating a house according to the present invention.

[Fig. 3] Fig. 3 is a block diagram illustrating a hardware configuration of a home server according to the present invention.

[Fig. 4] Fig. 4 is a diagram illustrating the configuration of the energy management system according to the present invention.

[Fig. 5] Fig. 5 is a diagram illustrating a structure of an execution environment of the home server according to the present invention.

[Fig. 6] Fig. 6 is a block diagram illustrating a hardware configuration of an external server according to the present invention.

[Fig. 7] Fig. 7 is a diagram illustrating an

example of a user manipulation screen.

[Fig. 8] Fig. 8 is a diagram illustrating a flow of an apparatus control process.

[Fig. 9] Fig. 9 is a diagram illustrating a flow of an eco-point granting process.

MODE FOR CARRING OUT THE INVENTION

[0020]

An energy management system according to an embodiment (hereinafter referred to as a present embodiment) of the present invention will be described with reference to Figs. 1 to 9. Fig. 1 is a conceptual diagram illustrating the energy management system according to the present invention. Fig. 2 is an explanatory diagram illustrating a house according to the present invention. Fig. 3 is a block diagram illustrating a hardware configuration of a home server according to the present invention. Fig. 4 is a diagram illustrating the configuration of the energy management system according to the present invention. Fig. 5 is a diagram illustrating a structure of an execution environment of the home server according to the present invention. Fig. 6 is a block diagram illustrating a hardware configuration of an external server according to the present invention. Fig. 7 is a diagram illustrating an example of a user manipulation

screen. Fig. 8 is a diagram illustrating a flow of an apparatus control process. Fig. 9 is a diagram illustrating a flow of an eco-point granting process.

Incidentally, among lines connecting constituent elements forming a present system S in Fig. 2, lines indicated by solid lines represent electric wirings and lines indicated by dashed lines represent communication lines.

[0021]

In the following description, the energy management system managing an energy consumption amount in a house H which is an example of a building will be described. Here, the house H is merely an example of the building. The present invention can be used in other buildings such as commercial buildings, buildings in factories, and stores.

In addition, in the following description, energy means power. Hereinafter, the energy management system managing a power consumption amount in the house H as the energy consumption amount in the house H will be described. However, as the energy consumption amount, for example, energy consumption amounts such as a gas use amount and a water use amount as well as the power consumption amount can be considered. The present invention can also be applied to systems managing the gas use amount and the water use amount.

[0022]

<Overall Configuration of Energy Management System According to the Present Embodiment>

First, an overview of the energy management system (hereinafter referred to as the present system S) according to the present embodiment will be described with reference to Figs. 1 and 2. The present system S is a CEMS (Community Energy Management System) managing power demand and supply balance in units of communities. Specifically, the present system S monitors a power supply amount of a power company supplying power to each house H in a management target community and a power load (power demand amount) in the management target community. For example, when the power load is likely to exceed the power supply amount, the present system S transmits a reduction request (hereinafter also referred to as a power-saving request) for reducing the power consumption amount to each house H present in the management target community via a network.

[0023]

In the present system S, when a load adjustment is performed (in other words, the power consumption amount is reduced) in each house H in response to the power-saving request, eco-points are granted as compensation for the load adjustment to a resident of the house H in which the load adjustment is performed. Here, the eco-points refer

to scores granted according to an energy-saving amount (reduction amount of the power consumption amount) in the house H and can be used as a substitution for money when commodities or services are purchased or can be used when point returning commodities or services are provided. As a method of using the eco-points, known methods can be used.

[0024]

When the foregoing present system S is constructed, as illustrated in Fig. 1, a home server 10 is installed in each house H present in the management target community and the power company has a power supply source server 50. Further, a CEMS server 40 is installed as an apparatus generally supervising the present system S.

[0025]

On the other hand, a plurality of power consumption apparatuses are equipped in each house H. Here, the power consumption apparatuses correspond to energy consumption apparatuses and specifically correspond to a home appliance, an illuminator, an air conditioner, a water heater, and an AV apparatus, a security equipment, and the like. In Fig. 2, to facilitate illustration, only an air conditioner Da and an illuminator Db are illustrated as the power consumption apparatuses. However, a combination of the power consumption apparatuses illustrated in Fig. 2 are merely an example. Of course, the number of power

consumption apparatuses greater than the power consumption apparatuses illustrated in Fig. 2 may be equipped in the house H or other kinds of power consumption apparatuses not illustrated in Fig. 2 may be equipped in the house H.

[0026]

In each house H, an HEMS (Home Energy Management System) is formed by the home server 10 and a communication network (hereinafter referred to as a home network TN) constructed in the house H. In the HEMS, the home server 10 functions as a management apparatus for managing the power consumption amount in the house H. Specifically, the home server 10 acquires information (data) regarding the power consumption amount in the house H by performing communication via the home network TN, visualizes (shows) the power consumption amount in the house H based on the acquired information, and informs a user (specifically, the resident of the house H) of the power consumption amount. For example, the home network TN is configured by an IP network in a wired manner using an Ethernet (registered trademark) cable or in a wireless manner using IEEE 802.1x or Bluetooth (registered trademark).

[0027]

The home server 10 according to the present embodiment can communicate with each power consumption apparatus in the house H via the home network TN and

control an operation state of the power consumption apparatus. That is, in the present system S, the operation state of a power consumption apparatus can be remotely controlled by transmitting a signal (control signal) for controlling the operation state of the power consumption apparatus from the home server 10 to the power consumption apparatus via the home network TN. The operation state of the power consumption apparatus receiving the control signal via the home network TN is changed to a state according to the control signal. Here, the operation state indicates a concept of controllable (adjustable) content concerning an operation of an apparatus, for example, an operation mode such as start and stop (ON and OFF), cooling and heating, and operational management values such as set temperature, or the like.

[0028]

In the present embodiment described above, communication with the apparatuses (specifically, the power consumption apparatuses and sensors 21, 22a, and 22b to be described below) present in the house H and control of the operation state of each power consumption apparatus are performed in an integrated manner by the home server 10. The configuration of the home server 10 will be described in detail below.

[0029]

The CEMS server 40 corresponds to an external server of the present invention and is connected to communicate with all of the home servers 10 present in the management target community of the CEMS via a network (hereinafter referred to as an outside network GN) such as the Internet, as illustrated in Fig. 1. In other words, the CEMS server 40 is installed outside the house H, and transmits and receives data to and from the home server 10 installed in each house H present in the management target community via the outside network GN.

[0030]

The CEMS server 40 can communicate with the power supply source serer 50 via the outside network GN. Here, the power supply source server 50 corresponds to a third server managed by an energy supply business company such as the power company supplying power as energy to the houses H. The power supply source server 50 commands the CEMS server 40 to transmit the power-saving request via the outside network GN. On the other hand, upon receiving this command, the CEMS server 40 transmits the power-saving request to each home server 10 present in the management target community of the CEMS. In this sense, the CEMS server 40 corresponds to an energy consumption amount reduction request apparatus transmitting a reduction request for reducing a power consumption amount in the house H to the

home server 10 installed in the house H.

[0031]

In the present system S, as described above, the CEMS server 40 is interposed between the home server 10 of each house H and the power supply source server 50, and the CEMS can be constructed by the CEMS server 40. By installing the CEMS server 40, information collection (specifically, acquisition of the command to transmit the power-saving request) from the power supply source server 50 and information delivery to the home server 10 of each house H can be performed in an integrated manner in the CEMS server 40.

[0032]

In the present embodiment, when the side of the house H responds to the power-saving request (in other words, the power consumption amount is reduced), the home server 10 calculates the reduction amount of the power consumption (a power consumption amount per unit time) in the house H and data indicating the calculation result is transmitted from the home server 10 to the CEMS server 40 via the outside network GN. On the other hand, when the CEMS server 40 receives the data indicating the foregoing calculation result, the CEMS server 40 calculates an eco-point according to the calculation result and grants the calculated eco-point to the resident (user) of the house H

in which the home server 10 serving as a transmission source of the foregoing data is installed.

[0033]

Then, information indicating the granted eco-point is stored in the CEMS server 40 in a form associated with ID information for specifying the user to which the eco-point is granted. That is, the CEMS server 40 according to the present embodiment has a function of not only granting the eco-point to the user responding to the power-saving request but also managing the eco-point granted to the user for each user (in other words, for each house H present in the management target community of the CEMS).

The eco-point is increased by an granted eco-point at the time of granting of a new eco-point and is decreased by a used eco-point when the eco-point is used. When the eco-point owned by a certain user is increased or decreased, the CEMS server 40 updates the information indicting the eco-point owned by this user to correct the eco-point by the increased or decreased amount.

[0034]

In the present system S having the above-described configuration, the resident of each house H who is the user of the present system S can view power demand and supply balance in his or her house and remotely control the power consumption apparatuses used in his or her house through

the function of the home server 10. Further, when the power-saving request is transmitted from the power company to the house H via the CEMS server 40, the home server 10 receives this power-saving request, operates an announcement apparatus (not illustrated), and informs the user of the reception of the power-saving request.

[0035]

Then, when the user performs a predetermined manipulation (specifically, a manipulation performed through a user manipulation screen to be described below) in the house H in order to adjust the power load in the house H in response to the power-saving request, the home server 10 generates a signal for controlling an operation state of a control target apparatus among the plurality of power consumption apparatuses equipped in the house H and transmits this control signal to the control target apparatus. The operation state of the control target apparatus receiving the foregoing control signal through the home network TN is changed in conformity with the control signal, so that the power consumption amount of the control target apparatus is changed (decreased). As a result, the power consumption amount (that is, the power amount consumed in the entire house H) in the house H is reduced.

[0036]

The home server 10 calculates a difference in the power consumption before and after the load adjustment in the house H as the result of the load adjustment of the user in response to the power-saving request and transmits data indicating the calculation result to the CEMS server 40. When the CEMS server 40 receives the data indicating the foregoing calculation result through the outside network GN, the CEMS server 40 calculates an eco-point based on the data and grants the calculated eco-point to the user responding to the power-saving request. As described above, the information indicating the granted eco-point is associated with the ID information for specifying the user in response to the power saving to be stored in the CEMS server 40 (specifically, a memory 40b to be described below).

[0037]

<Configuration of Home Server 10>

Next, the configuration of the above-described home server 10 will be described in detail with reference to Figs. 3 to 5.

As described above, the home server 10 is installed in each hose H present in the management target community of the present system S of the CEMS. As illustrated in Fig. 3, the home server 10 includes a CPU 10a, a memory 10b, a non-volatile storage device 10c, a communication interface

10d (notated as a communication I/F in Fig. 3), a display 11, and an input device 12. These constituent elements are connected to each other via a bus 10e. Various programs are stored in the non-volatile storage device 10c. By causing the CPU 10a to read and execute the programs stored in the non-volatile storage device 10c, functions to be described below are fulfilled by the home server 10.

[0038]

When the functions of the home server 10 having the foregoing configuration are described, the home server 10 is connected to communicate with the CEMS server 40 via the outside network GN, and thus can receive a power-saving request transmitted from the CEMS server 40 through communication via the outside network GN.

[0039]

The home server 10 is connected to communicate with the power consumption apparatuses in the house H via the home network TN, and thus can control an operation state of each power consumption apparatus through communication via the home network TN. For example, when the home server 10 receives a power-saving request from the CEMS server 40, the home server 10 attempts to control the operation state of a predetermined apparatus which is a control target apparatus among the plurality of power consumption apparatuses present in the house H and reduce the power

consumption amount (that is, adjust the power load) in order to reduce the power consumption amount in the house H in response to this power-saving request.

[0040]

In the present embodiment, the home server 10 can communicate with each power sensor group installed in the house H via the home network TN to acquire each result of the measurement of the power sensor group.

[0041]

Specifically, a sensor (hereinafter referred to as a main sensor 21) configured from a smart meter is mounted in the house H. The main sensor 21 corresponds to a sensor of the present invention, is mounted on, for example, a distribution board Dx, measures power consumption (in other words, a power consumption amount in the house H per unit time) of the entire house H, and outputs a signal according to the result of the measurement. Further, individual sensors (hereinafter referred to as individual sensors 22a and 22b) are mounted on the air conditioner Da and the illuminator Db, respectively. The individual sensors 22a and 22b are power sensors (for example, CT sensors) having a communication function and measure the power consumptions of the corresponding apparatuses.

[0042]

The sensors (that is, the main sensor 21 and the

individual sensors 22a and 22b and the same applies below) described above all output signals according to the result of the measurements. The signals are digital signals indicating numerical values of the result of the measurements. The home server 10 receives a signal indicating the result of the measurement of each sensor from each sensor via the home network TN and acquires the result of the measurement of each sensor by analyzing the received signal. The acquired result of the measurement (precisely, information indicating the result of the measurement) is temporarily stored in the memory 10b, and then is stored in the non-volatile storage device 10c.

[0043]

In the present embodiment, the measurement is normally performed by the respective sensors, and then the sensors 21, 22a, and 22b transmit signals according to the result of the measurements to the home server 10 at given intervals. However, the present invention is not limited thereto. The measurement by the sensors 21, 22a, and 22b may be performed at each predetermined time or may be performed only for a period of time in which the power consumption exceeds a given value.

In the present embodiment, based on the signals output by the sensors 21, 22a, and 22b, the home server 10 can calculate a cumulative value of the power consumption

amount actually consumed in the house H during a predetermined period (for example, a period from the beginning of a month to the end of the month) or a difference in the power consumption of the house H before and after the load adjustment.

[0044]

Incidentally, the home server 10 according to the present embodiment communicates with an information terminal 30 via the home network TN to transmit and receive data to and from the information terminal 30. The information terminal 30 is a terminal that has a browsing function and is configured by a terminal with portability, such as a smartphone, a PDA, a note type PC, or a digital photo frame on which predetermined application software is mounted, in the present embodiment. Hereinafter, the information terminal 30 configured by a PDA on which a touch panel 31 is mounted will be described as an example.

[0045]

For example, the information terminal 30 is used for a user to view a current power load in the house H. That is, the information terminal 30 communicates with the home server 10 via the home network TN and receives data (specifically, data indicating the result of the measurement of each sensor acquired by the home server 10) indicating a current power load from the home server 10.

Then, the information terminal 30 displays information (hereinafter referred to as power load information) indicating the data received from the home server 10 on the touch panel 31 serving as a display.

[0046]

Specifically, a program (hereinafter referred to as a communication program) for communicating with the home server 10 via the home network TN including communication for display of the power load information on the display is mounted on the information terminal 30. The communication program is activated when the user performs a predetermined manipulation (for example, a manipulation of touching an icon displayed on the touch panel 31) and requests the home server 10 to transmit data indicating the current power load via the home network TN. Thereafter, when the forgoing data is received from the home server 10, the data is loaded through a process of the communication program, so that a screen (not illustrated) displaying the power load information is accordingly drawn on the touch panel 31.

[0047]

Further, in the present embodiment, the user can use the information terminal 30 to designate an apparatus (control target apparatus) of which an operation state is to be controlled by the home server 10 among the power consumption apparatuses used in the house H. That is, in

the present embodiment, it is possible to reflect the intention of the user and determine which apparatus is used as the control target apparatus among the power consumption apparatuses used in the house H (in other words, determine an apparatus of which an operation state is to be controlled).

[0048]

When the information terminal 30 receives a manipulation (hereinafter referred to as a designation manipulation) performed to designate the control target apparatus by the user through the touch panel 31, the information terminal 30 generates data indicating a power consumption apparatus (hereinafter referred to as a designated apparatus) designated through the designation manipulation and transmits the data to the home server 10. When the home server 10 receives the foregoing data from the information terminal 30 and receives a power-saving request from the CEMS server 40, the home server 10 specifies the designated apparatus based on the foregoing data and controls the operation state of the specified designated apparatus.

[0049]

As described above, the home server 10 according to the present embodiment has a function of specifying the designated apparatus designated as the control target

apparatus among the plurality of power consumption apparatuses by the user through the information terminal 30 and controlling the operation state of the specified designated apparatus. When the home server 10 reduces the power consumption amount in the house H to respond to the power-saving request from the CEMS server 40, the control of the operation state of the control target apparatus which is the designated apparatus designated by the user is achieved through this function. Accordingly, the power load adjustment to which the intention of the user is reflected is performed in the house H. As a result, user-friendly energy management is realized, and thus the user can implement a more comfortable energy saving life.

[0050]

The home server 10 according to the present embodiment has a function of calculating the degree of change in the power consumption amount in the house H as the effect of the power load adjustment performed to respond to the power-saving request from the CEMS server 40. The degree of change in the power consumption amount refers to an index indicating a reduction extent (degree) at the time of the reduction in the power consumption amount through the power load adjustment. In the present embodiment, a difference in the power consumption (a power consumption amount in the house H per unit time) in the

house H before and after performing the power load adjustment is assumed to be calculated as the degree of change.

[0051]

Then, when the home server 10 calculates the degree of change in the power consumption amount in the house H, the home server 10 transmits data (hereinafter referred to as calculation result data) indicating the calculation result to the CEMS server 40. As described above, the side of the CEMS server 40 receiving the calculation result data calculates an eco-point according to the calculation result and grants the calculated eco-point to the resident of the house H in which the home server 10 transmitting the calculation result data is installed.

[0052]

The configuration of the home server 10 will be described again based on the functions described above. As illustrated in Fig. 4, the home server 10 includes a reception unit 101, an apparatus control unit 102, an information acquisition unit 103, a storage unit 104, a calculation unit 105, and a transmission unit 106.

The reception unit 101 communicates with the CEMS server 40 via the outside network GN to receive a power-saving request from the CEMS server 40. The reception unit 101 is configured by hardware (specifically, the CPU 10a,

the memory 10b, the non-volatile storage device 10c, and the communication interface 10d) of the home server 10 and software (specifically, a program for communicating with the CEMS server 40 via the outside network GN) mounted on the home server 10.

[0053]

The reception unit 101 is interlocked with the announcement apparatus (not illustrated) installed in the house H, and thus operates the foregoing announcement apparatus when receiving a power-saving request from the CEMS server 40. Accordingly, the announcement apparatus performs a predetermined announcement process to announce a notice of a power-saving request to the user in the house H.

[0054]

The apparatus control unit 102 corresponds to an operation state control unit of the present invention and controls the operation state of the control target apparatus among the plurality of power consumption apparatuses present in the house H to reduce the power consumption amount in the house H. The apparatus control unit 102 is configured by an apparatus control program, and the CPU 10a, the memory 10b, the non-volatile storage device 10c, and the communication interface 10d of the home server 10. Here, the apparatus control program is developed to generate a control signal for switching an

operation state of the control target apparatus to a desired state and communicate with the control target apparatus via the home network TN to transmit the control signal to the control target apparatus.

[0055]

In the present embodiment, the apparatus control unit 102 is configured to switch a communication scheme according to the kind of communicating power consumption apparatus and perform communication in the communication scheme corresponding to the apparatus.

[0056]

Specifically, the power consumption apparatuses present in the house H include apparatuses of which communication schemes (synonymous with communication standards and communication protocols) are mutually different. In general, the power consumption apparatuses utilizing a common communication scheme are recommended to be used in the house H on which the HEMS is mounted. For example, it is desirable to consolidate apparatuses so that the ECHONET standard suggested by the ECHONET consortium is utilized. On the other hand, the power consumption apparatus in the house H may include apparatuses utilizing standards other than the ECHONET standard due to the reason that the user purchases the power consumption apparatuses arbitrarily (without regard to the communication scheme) in

some cases. In the cases, the communication schemes may be different between the power consumption apparatuses used in the house H.

Accordingly, in the present embodiment, the apparatus control unit 102 switches a communication scheme according to the kind of control target apparatus when the apparatus control unit 102 transmits a control signal to the control target apparatus.

[0057]

More specifically, when the power consumption apparatuses in the house H are classified into three kinds of apparatuses, that is, first standard apparatuses, second standard apparatuses, and third standard apparatuses, according to the difference in the communication scheme, the apparatus control unit 102 utilizes the communication scheme corresponding to the first standard apparatuses to communicate with the first standard apparatuses and then switches the communication scheme to the communication scheme corresponding to the second standard apparatuses (or the third standard apparatuses) to communicate with the second standard apparatuses (or the third standard apparatuses).

[0058]

In the switching of the communication scheme according to the kind of apparatus, as described, in the

present embodiment, an execution environment illustrated in Fig. 5 is constructed in the home server 10. Specifically, an OS 201, a JAVA (registered trademark) virtual machine (hereinafter referred to as a JVM) 202, an OSGi (Open Services Gataway initiative) framework 203, and software (hereinafter also referred to as a bundle) operating on the OSGi framework 203 are installed in the home server 10. Thus, the apparatus control unit 102 includes the foregoing programs (that is, the OS 201, the JVM 202, the OSGi framework 203, and the bundle operating on the framework) as constituent elements and can perform communication in the communication scheme according to the kind of power consumption apparatus in cooperation with the constituent elements.

[0059]

The OSGi framework 203 is constructed on the JVM 202 and manages life cycles such as download, installation, activation, and stop of the bundle operating on the OSGi framework 203. The bundle operating on the OSGi framework 203 can dynamically be substituted and a plurality of bundles can be executed in parallel.

[0060]

As the bundle operating on the OSGi framework 203, there is a standard bundle and an application bundle. The standard bundle refers to a bundle formed from a basic

protocol such as the HTTP (Hypertext Transfer Protocol) or the UPnP (Universal Plug and Play). The application bundle refers to application software registered in the OSGi framework 203 and includes various communication bundles 204a, 204b, and 204c. The communication bundles correspond to the respective communication schemes of the power consumption apparatuses present in the house H and are installed according to the communication schemes.

[0061]

When the CPU 10a executes the various communication bundles 204a, 204b, and 204c, the communication can be performed according to the communication scheme corresponding to a communication target power consumption apparatus. The executed communication bundle can be substituted by the function of the OSGi framework 203 of dynamically substituting the bundle when it is necessary to switch the communication scheme according to the kind of power consumption apparatus. When the communication bundle is substituted, switching of the communication scheme utilized by the apparatus control unit 102 is carried out.

[0062]

When the communication bundle 204a, 204b, and 204c are registered in the OSGi framework 203, interfaces for using the functions of the communication bundles 204a, 204b, and 204c are registered in registries (also referred to as

service registries). On the other hand, the OSGi framework 203 provides an API formed by integrating these interfaces. An interface group (hereinafter referred to as a general API) formed as the API is used as a function that activates or substitutes the communication bundles 204a, 204b, and 204c.

[0063]

The general API is opened and provided to develop a program (for example, a communication program executed by the information terminal 30) executed by an apparatus other than the home server 10. That is, when the general API is used at the time of development of a program (for example, a program for communicating with the home server 10 and requesting the home server 10 to perform control of the power consumption apparatus), the side of a program developer can easily develop the foregoing program without consciousness of the difference in the communication scheme between the apparatuses.

[0064]

When the general API is used in a program, information (code) for requesting the home server 10 to perform the control of the power consumption apparatus is embedded in the program in a REST (Representational State Transfer) format. For example, a URI or a request parameter of the home server 10 is embedded as information

for using the general API in a communication program (a program for requesting the home server 10 to perform the control of the power consumption apparatus from the information terminal 30) mounted on the information terminal 30.

Then, when the communication program is executed on the side of the information terminal 30, the information terminal 30 communicates with the home server 10 in the HTTP (Hypertext Transfer Protocol) format, activates the apparatus control unit 102, and causes the apparatus control unit 102 to perform the control of the operation state of the power consumption apparatus.

[0065]

The information acquisition unit 103 is a unit that specifies an apparatus (control target apparatus) to be controlled by the apparatus control unit 102. Specifically, the information acquisition unit 103 acquires information indicating a designated apparatus designated as the control target apparatus among the plurality of power consumption apparatuses present in the house H by the user, from data transmitted from the information terminal 30. The information acquisition unit 103 is configured by an information acquisition program, and the CPU 10a, the memory 10b, the non-volatile storage device 10c, and the communication interface 10d of the home server 10. The

information acquisition program is a program for acquiring information indicating the designated apparatus by receiving data indicating the power consumption apparatus (designated apparatus) designated through a designation manipulation by the user from the information terminal 30 and analyzing the data.

[0066]

The storage unit 104 is mainly configured by the memory 10b and the non-volatile storage device 10c and stores information acquired by the foregoing information acquisition unit 103, that is, the information indicating the power consumption apparatus designated as the control target apparatus by the user.

[0067]

The calculation unit 105 calculates the difference in the power consumption in the house H before and after performing the power load adjustment performed in response to a power-saving request from the CEMS server 40. The calculation unit 105 is configured by a calculation program, and the CPU 10a, the memory 10b, the non-volatile storage device 10c, and the communication interface 10d of the home server 10. The calculation program is a program for receiving a signal according to the result of the measurement of the above-described main sensor 21 from the main sensor 21 and calculating the difference in the power

consumption in the house H before and after performing the power load adjustment based on the signal. That is, when the main sensor 21 measures the power consumption in the entire house H each before and after performing the power load adjustment and outputs the signal according to the result of the measurement to the home server 10, the calculation unit 105 of the home server 10 receives the signal output from the main sensor 21 and calculates the difference in the power consumption in the house H before and after performing the power load adjustment based on this signal.

[0068]

The transmission unit 106 corresponds to a data transmission unit of the present invention and transmits calculation result data indicating the calculation result of the calculation unit 105 to the CEMS server 40. The transmission unit 106 is configured by a data transmission program, and the CPU 10a, the memory 10b, the non-volatile storage device 10c, and the communication interface 10d of the home server 10. The data transmission program is a program for generating the foregoing calculation result data and transmitting the generated calculation result data to the CEMS server 40 via the outside network GN. The calculation result data corresponds to data indicating the degree of change in the power consumption amount

(specifically, the difference in the power consumption) in the house H before and after performing the power load adjustment calculated by the calculation unit 105.

[0069]

When the home server 10 having the above-described configuration is equipped in each house H, as described above, the power load adjustment to which the intention of the resident (user) of the house H is reflected is performed.

Specifically, when the user performs a designation manipulation of designating the control target apparatus through the touch panel 31 of the information terminal 30, data indicating the designated apparatus designated through the designation manipulation is transmitted from the information terminal 30 and the data is received by the information acquisition unit 103 of the home server 10. The information acquisition unit 103 acquires information indicating the designated apparatus designated by the user by analyzing the data received from the information terminal 30 and the information is stored in the storage unit 104.

[0070]

Here, the designation manipulation performed on the control target apparatus through the touch panel 31 can be constantly received. Whenever the user performs the

designation manipulation, the foregoing series of processes (processes performed to acquire information indicating the designated apparatus designated by the user) is repeatedly performed. Then, the information stored in the storage unit 104 is updated whenever the foregoing series of processes is performed. As a result, the information indicating the designated apparatus designated by the user through the most recently performed designation manipulation is stored in the storage unit 104.

The detailed content of the designation manipulation of the user will be described below.

[0071]

When the reception unit 101 receives a power-saving request from the CEMS server 40, the apparatus control unit 102 reads the information stored in the storage unit 104, specifies a designated apparatus (an apparatus designated as the control target apparatus by the user), and controls the operation state of the specified designated apparatus. Thus, the power load in the house H is adjusted.

[0072]

In the present embodiment, when the apparatus control unit 102 controls the operation state of the control target apparatus, the calculation unit 105 calculates the difference in the power consumption of the house H before and after the power load adjustment (that is, before and

after the operation state of the control target apparatus is controlled by the apparatus control unit 102) as the degree of change at the time of the change in the power consumption amount in the house H. The transmission unit 106 transmits data (calculation result data) indicating the calculation result to the CEMS server 40 via the outside network GN. Thus, it is possible to evaluate the achievement of the power load adjustment performed in response to the power-saving request and perform feedback of the result to the CEMS server 40. On the other hand, the CEMS server 40 grants the eco-point obtained according to the difference in the power consumption before and after the power load adjustment as the compensation for the power load adjustment performed in response to the power-saving request.

[0073]

<Configuration of CEMS Server 40>

Next, the configuration of the above-described CEMS server 40 will be described with reference to Figs. 4 and 6.

The CEMS server 40 is installed in a facility (not illustrated) present in the management target community of the present system S. As illustrated in Fig. 6, the CEMS server 40 includes a CPU 40a, a memory 40b, a non-volatile storage device 40c, a communication interface 40d (notated as a communication I/F in Fig. 6), a display 41, and an

input device 42. These constituent elements are connected to each other via a bus 40e. The non-volatile storage device 40c stores various programs.

[0074]

When the configuration of the CEMS server 40 is described again in terms of functions, as illustrated in Fig. 4, the CEMS server 40 includes a CS-side reception unit 301, a power-saving request unit 302, an eco-point granting unit 303, and an eco-point management unit 304. The units (that is, the CS-side reception unit 301, the power-saving request unit 302, the eco-point granting unit 303, and the eco-point management unit 304) of the CEMS server 40 are configured by hardware (specifically, the CPU 40a, the memory 40b, the non-volatile storage device 40c, and the communication interface 40d) of the above-described CEMS server 40 and software (specifically, programs stored in the non-volatile storage device 40c).

[0075]

The CS-side reception unit 301 receives a power-saving request transmission command from the power supply source server 50 via a network (specifically, the outside network GN). The power-saving request unit 302 transmits a power-saving request to the home server 10 of each house H present in the management target community of the present system S in response to the power-saving request

transmission command received by the CS-side reception unit 301.

[0076]

In the present embodiment, the power-saving request unit 302 calculates a power-saving request amount (power reduction request amount) for which each house H is requested at the time of the transmission of the power-saving request and transmits the power-saving request in a format in which data indicating the calculated power-saving request amount is embedded. Here, for example, the power-saving request amount is calculated by receiving data indicating an aim value of a power-saving amount to be achieved in the management target community of the present system S along with a power-saving request transmission command from the power supply source server 50 and dividing the aim value by the number of houses H present in the management target community. At this time, the value obtained by dividing the aim value by the number of houses H may be weighted according to the scales (for example, floor spaces) of the houses H.

[0077]

The eco-point granting unit 303 corresponds to a score granting unit and grants, to the user, an eco-point according to the difference in the power consumption in the house H (that is, the degree of change in the power

consumption amount in the house H) before and after performing the power load adjustment calculated by the calculation unit 105 of the home server 10. More specifically, when the eco-point granting unit 303 receives the data (that is, the calculation result data calculated by the calculation unit 105 and indicating the difference in the power consumption in the house H before and after performing the power load adjustment) transmitted by the transmission unit 106 of the home server 10 via the outside network GN, the eco-point granting unit 303 calculates an eco-point according to the calculation result of the calculation unit 105 based on the data and grants the calculated eco-point to the user of the house H in which the home server 10 serving as the transmission source of the data is installed.

[0078]

Here, the eco-point granting unit 303 according to the present embodiment is configured to grant the eco-point according to the difference in the power consumption in the house H before and after performing the power load adjustment. According to this configuration, the effect of the present system S in which the control target apparatus can be determined reflecting the intention of the user can be more efficient. That is, when the intention of the user is reflected to the determination of the control target

apparatus, the user can obtain a higher eco-point by designating the power consumption apparatus of which a power-saving amount is expected to be larger by control of an operation condition as the control target apparatus. As a result, motivation of the user for the power load adjustment is increased, and thus the user actively responds to the power-saving request.

[0079]

In the present embodiment, the eco-point is granted according to the difference in the power consumption in the house H before and after performing the power load adjustment, and the calculation unit 105 of the home server 10 is configured to calculate the difference based on an output signal from the main sensor 21, that is, the result of the measurement of the main sensor 21. Accordingly, in the present embodiment, the calculation unit 105 suggests a calculation result (in other words, a well-substantiated calculation result) with high credibility as the difference in the power consumption in the house H before and after performing the power load adjustment, and the side of the CEMS server 40 (more specifically, the eco-point granting unit 303) can grant a proper eco-point according to the calculation result.

[0080]

The eco-point management unit 304 manages the eco-

points granted by the eco-point granting unit 303 for each user (in other words, for each house H). Specifically, the eco-point management unit 304 stores information indicating the eco-point granted by the eco-point granting unit 303 in the memory 40b in association with ID information for specifying the user to which the eco-point is granted. When the eco-point owned by a given user is increased or decreased, the eco-point management unit 304 updates the information indicating the eco-point owned by the user and corrects the eco-point by the increased or decreased amount.

[0081]

<Designation Manipulation of User>

Next, the designation manipulation performed by the user to designate the control target apparatus of which the operation state is controlled among the plurality of power consumption apparatuses present in the house H will be described with reference to Fig. 7.

As described above, the user in the present embodiment performs a designation manipulation through the touch panel 31 of the information terminal 30. In other words, the designation manipulation of the user can be received by the touch panel 31 of the information terminal 30.

[0082]

Specifically, when the user performs the designation

manipulation, the user performs a manipulation (for example, a manipulation of touching an icon displayed on the touch panel 31) to activate a communication program for communicating with the home server 10 via the home network TN. Thus, the communication program is activated and data indicating a current power load is first received from the home server 10 via the home network TN. Based on the data, a screen (not illustrated) displaying power load information is drawn on the touch panel 31. When the user performs a predetermined manipulation on the screen, a user manipulation screen illustrated in Fig. 7 is drawn on the touch panel 31.

[0083]

When the user manipulation screen is described, as illustrated in Fig. 7, the power consumption apparatuses (in the example illustrated in Fig. 7, the air conditioner and the illuminator) which are candidates of the control target apparatus are displayed and arranged in the vertical direction of the screen. In a display field of each power consumption apparatus, candidates of control conditions are displayed. In the example illustrated in Fig. 7, a control condition, "switch off," and a control condition, "raise (lower) set temperature by 1°C," are displayed for the apparatus "air conditioner." Here, the control conditions are control conditions when the operation state of the

power consumption apparatus is controlled.

[0084]

A check box CB is installed for each control condition. When the user presses (touches) a region in which the check box CB is located on the touch panel 31, a check is marked in the check box CB or a check marked in the check box CB is vanished. The manipulation of marking a check in the check box CB corresponds to the designation manipulation of the user. That is, when the user designates the control target apparatus, the user marks the check in the check box CB installed in the display field of the apparatus designated as the control target apparatus among the power consumption apparatuses displayed in the user manipulation screen.

[0085]

In the present embodiment, the user can designate the control target apparatus and also set the control condition for the operation state of the apparatus (designated apparatus) designated as the control target apparatus by performing the manipulation of marking the check in the check box CB.

[0086]

When the user performs the manipulation of marking the check in the check box CB and then presses a setting completion button SB displayed in the user manipulation

screen on the touch panel 31, data indicating the power consumption apparatus and the control conditions corresponding to the check box CB in which the check is marked is generated on the side of the information terminal 30. The data is data indicating the designated apparatus designated as the control target apparatus by the user and the control conditions set for the operation state of the designated apparatus by the user and is transmitted to the home server 10 via the home network TN.

[0087]

On the other hand, on the side of the home server 10, the information acquisition unit 103 receives the foregoing data and acquires information indicating the designated apparatus designated as the control target apparatus by the user and the control conditions set for the operation state of the designated apparatus by the user from the data. The information (information indicating the designated apparatus and the control conditions) acquired by the information acquisition unit 103 is stored in the storage unit 104 and is read by the apparatus control unit 102 when the reception unit 101 receives a power-saving request from the CEMS server 40. As a result, the apparatus control unit 102 specifies the designated apparatus and the control condition from the read information and controls the operation state of the specified designated apparatus under

the specified control conditions.

[0088]

In the present embodiment, as described above, since not only the control target apparatus but also the control conditions at the time of the control of the operation state of the control target apparatus are determined reflecting the intention of the user, more user-friendly energy management is realized.

[0089]

In the present embodiment, when the user marks the check in the check box CB, the information terminal 30 (more specifically, a calculation device (not illustrated) included in the information terminal 30) specifies the power consumption apparatus and the control conditions corresponding to the check box CB in which the check is marked and calculates a power reduction amount when the operation state of the specified power consumption apparatus is controlled under the specified control conditions. The power reduction amounts are calculated for all of the check boxes CB in which the checks are marked. As illustrated in Fig. 7, a result obtained by aggregating the calculated power reduction amounts is displayed as an expected power-saving amount on the user manipulation screen.

[0090]

As described above, when the user views the display (specifically, the expected power-saving amount) on the user manipulation screen, the user can understand the energy-saving effect when the power load adjustment is performed on the power consumption apparatus and under the control conditions designated by the user. Thus, the user can select (designate) the power consumption apparatus and the control conditions suitable for the efficient power load adjustment among the power consumption apparatuses and the control conditions displayed on the user manipulation screen.

[0091]

As described above, the data indicating the calculation value of the power-saving request amount for each house H is embedded in the power-saving request for each house H from the CEMS server 40. Here, when the side of the home server 10 receives the power-saving request, the data indicating the calculation value of the foregoing power-saving request amount is transmitted from the home server 10 to the information terminal 30 and the side of the information terminal 30 receives the data. Then, it is suitable to display the calculation value of the foregoing power-saving request amount on the user manipulation screen. In this configuration, since the designation manipulation can be performed viewing the power-saving request amount,

it is easy to designate the control target apparatus and set the control conditions so that the power-saving request amount is satisfied.

[0092]

<Power Management Process in the Present System S>

Next, a power management process in the present system S will be described as an operation example of the present system S with reference to Figs. 8 and 9.

The power management process in the present system S starts when the power-saving request transmission command is transmitted from the power supply source server 50 to the CEMS server 40. The power management process includes an apparatus control process (see Fig. 8) of controlling the operation state of the power consumption apparatus in the house H to adjust the power load in the house H and an eco-point granting process (see Fig. 9) of granting an eco-point as the compensation for the power load adjustment.

[0093]

As illustrated in Fig. 8, the apparatus control process is mainly performed in the house H and starts when the CS-side reception unit 301 of the CEMS server 40 receives the power-saving request transmission command from the power supply source server 50 (S001). Thereafter, on the side of the CEMS server 40, the power-saving request unit 302 transmits the power-saving request to the home

server 10 of each house H present in the management target community of the present system S in response to the command from the power supply source server 50 (S002). On the other hand, in each house H, the reception unit 101 receives the power-saving request from the CEMS server 40 via the outside network GN (S003). In the present embodiment, as described above, the reception unit 101 is interlocked with the announcement apparatus (not illustrated). When the reception unit 101 receives the power-saving request, the announcement apparatus operates and performs a predetermined announcement process to inform the user in the house H that the power-saving request is made.

[0094]

When the user in the house H knows that the power-saving request is made through the foregoing announcement process, the user performs the designation manipulation of designating the control target apparatus to respond to the power-saving request. The designation manipulation is performed in the above-described order on the user manipulation screen displayed on the touch panel 31 of the information terminal 30. As described above, in the designation manipulation, the user designates the control target apparatus among the plurality of power consumption apparatuses equipped in the house H and sets the control

conditions in regard to the operation state of the apparatus designated as the control target apparatus.

[0095]

Then, in a step in which the user completes the designation manipulation (specifically, when the user presses the setting completion button SB displayed in the user manipulation screen on the touch panel 31), the information terminal 30 generates the data indicating the designated apparatus designated as the control target apparatus by the user and the control conditions set by the user in regard to the operation state of the designated apparatus and transmits the data to the home server 10 via the home network TN. On the side of the home server 10, the information acquisition unit 103 analyzes the data received from the information terminal 30 and acquires the information indicating the designated apparatus and the control conditions described above (S004). The foregoing information acquired by the information acquisition unit 103 is stored in the storage unit 104 (S005).

[0096]

Thereafter, the apparatus control unit 102 reads the foregoing information stored in the storage unit 104 and specifies the designated apparatus designated as the control target apparatus by the user and the control conditions set in regard to the operation state of the

designated apparatus by the user (S006). Then, the apparatus control unit 102 controls the operation state of the foregoing designated apparatus under the control conditions by transmitting a control signal generated according to the specified control conditions to the specified designated apparatus (S007). When the plurality of designated apparatuses are present, step S007 described above is repeatedly performed for each of the designated apparatuses.

[0097]

When the control of the operation state of the designated apparatus is completed, a control completion signal is output from the designated apparatus and the signal is received by the side of the home server 10 (S008). Then, the apparatus control process ends when the operation states of all of the apparatuses designated as the control target apparatus by the user are controlled and the control completion signals are received.

[0098]

When the apparatus control process ends, subsequently, the eco-point granting process starts. As illustrated in Fig. 9, the eco-point granting process starts when the calculation unit 105 of the home server 10 first calculates the difference in the power consumption in the house H before and after performing the power load adjustment as an

index indicating the effect of the power load adjustment (S011). As described above, the difference in the power consumption in the house H before and after performing the power load adjustment is calculated based on the signal according to the result of the measurement of the main sensor 21. Therefore, when the calculation unit 105 calculates the difference in the power consumption in the house H before and after performing the power load adjustment, the calculation unit 105 acquires the signal (the signal according the result of the measurement) output by the main sensor 21 each before and after performing the power load adjustment.

[0099]

In the present embodiment, the difference in the power consumption in the house H before and after performing the power load adjustment has been calculated as the index indicating the effect of the power load adjustment. However, for example, a reduction amount of the power consumption amount during a period in which the power load adjustment is performed and then a predetermined time passes may be calculated.

[0100]

When the difference in the power consumption in the house H before and after performing the power load adjustment is calculated, the transmission unit 106 of the

home server 10 generates the calculation result data indicating the calculation result and the transmission unit 106 transmits the calculation result data to the CEMS sever 40 (S012). The eco-point granting unit 303 of the CEMS server 40 receives the transmitted calculation result data via the outside network GN (S013). Thereafter, the eco-point granting unit 303 calculates the eco-point according to the calculation result indicated by the data based on the received calculation result data (S014).

[0101]

When the calculation of the eco-point ends, the eco-point corresponding to the calculation value is granted to the user of the house H in which the home server 10 serving as the above-described calculation result data transmission source is installed. Specifically, the eco-point management unit 304 of the CEMS server 40 generates the information indicating the eco-point calculated by the eco-point granting unit 303 and the ID information for specifying the user to which the eco-point is granted and stores the information and the ID information in association therewith (S015). Thus, the eco-point owned by each user is managed for each user in the CEMS server 40.

[0102]

When the above-described order is completed, the eco-point granting process ends and the power management

process in the present system S accordingly ends. Then, whenever a power-saving request transmission command is transmitted from the power supply source server 50 to the CEMS server 40, the above-described series of processes is repeatedly performed.

[0103]

<<Other Embodiments>>

In the foregoing embodiment, the energy management system according to the present invention has been mainly described. In the description of the foregoing embodiment, the content of the home server 10 serving as the management apparatus according to the present invention is included.

However, the foregoing embodiment has been described to facilitate the understanding of the present invention and does not limit the present invention. The present invention can be modified or amended without departing the gist of the present invention and, of course, include the equivalents of the present invention.

[0104]

For example, in the foregoing embodiment, the power-saving request is received from the CEMS server 40, and then the user's manipulation (designation manipulation) of designating the apparatus (control target apparatus) of which the operation state is controlled in the power load adjustment is received. However, the present invention is

not limited thereto and the foregoing user's manipulation may be received in advance before the power-saving request is received from the CEMS server 40. Here, when the power-saving request is received and then the control target apparatus is designated, the proper power consumption apparatus may be designated as the control target apparatus according to the magnitude of the power-saving request amount calculated on the side of the CEMS server 40. In this viewpoint, the foregoing embodiment is preferable.

[0105]

In the foregoing embodiment, the difference in the power consumption in the house H before and after performing the power load adjustment is calculated and the eco-point is granted according to the calculation result. That is, in the foregoing embodiment, the actually measured value of the power-saving amount through the power load adjustment is calculated and the eco-point is granted according to the actually measured value. However, the present invention is not limited thereto. The eco-point may be granted based on an estimated value of the power-saving amount, for example, an expected power-saving amount (more specifically, an expected power-saving amount displayed on the user manipulation screen of Fig. 7) when the operation state of the control target apparatus designated by the user is controlled.

[0106]

In the foregoing embodiment, the OSGi framework 203 is exemplified as a mechanism that switches the communication bundles according to the communication target apparatuses and integrates the interfaces for using the functions of the communication bundles to provide the interfaces as the API (general API). However, a mechanism using the existing technology other than the OSGi framework 203 may be used as long as the mechanism has the foregoing functions.

[0107]

In the foregoing embodiment, the designation manipulation of the user is received through the information terminal 30. However, the present invention is not limited thereto. The above-described user manipulation screen may be drawn on the display 11 of the home server 10 and the designation manipulation of the user may be received through an input device such as a keyboard or a mouse connected to the home server 10.

[0108]

In the foregoing embodiment, the eco-point (an example of a score) is granted to the user as the compensation when the user performs the power load adjustment in response to the power-saving request. However, the compensation when the power load adjustment is

performed is not limited to the eco-point. Another compensation may be used as long as the compensation may be an initiative encouraging the user to perform the power load adjustment. For example, free gifts, securities, or the like may be granted.

[0109]

In the foregoing embodiment, the reduction request (specifically, the power-saving request) for reducing the energy consumption amount in the house H has been transmitted from the CEMS server 40. However, the present invention is not limited thereto. The power-saving request may be transmitted directly from a server other than the CEMS server 40, for example, a server (for example, the above-described power supply source server 50) owned by the energy supply business company.

REFERENCE NUMERALS

[0110]

S present system

H house

TN home network

GN outside network

Dx distribution board

Da air conditioner

Db illuminator

CB check box

SB setting completion button

10 home server

- 10a CPU
- 10b memory
- 10c non-volatile storage device
- 10d communication interface
- 10e bus

11 display

12 input device

21 main sensor

22a, 22b individual sensor

30 information terminal

31 touch panel

40 CEMS server

- 40a CPU
- 40b memory
- 40c non-volatile storage device
- 40d communication interface
- 40e bus

41 display

42 input device

50 power supply source server

101 reception unit

102 apparatus control unit

103 information acquisition unit

104 storage unit

105 calculation unit

106 transmission unit

201 OS

202 JVM

203 OSGi framework

204a, 204b, 204c communication bundle

301 CS-side reception unit

302 power-saving request unit

303 eco-point granting unit

304 eco-point management unit

CLAIMS

1. An energy management system comprising:

a management apparatus configured to manage an energy consumption amount in a building equipped with a plurality of energy consumption apparatuses; and

an energy consumption amount reduction request apparatus configured to transmit a reduction request for reducing the energy consumption amount in the building to the management apparatus,

wherein the management apparatus includes

a reception unit configured to receive the reduction request,

an operation state control unit configured to control an operation state of a control target apparatus among the plurality of energy consumption apparatuses to reduce the energy consumption amount in the building,

an information acquisition unit configured to acquire information indicating a designated apparatus designated as the control target apparatus among the plurality of energy consumption apparatuses by a user, and

a storage unit configured to store the information acquired by the information acquisition unit, and

wherein when the reception unit receives the reduction request, the information acquisition unit

acquires the information indicating the designated apparatus designated by the user on a screen that displays an expected power-saving amount when the designated apparatus is controlled as the control target apparatus, the storage unit stores the information acquired by the information acquisition unit, and the operation state control unit reads the information stored in the storage unit, specifies the designated apparatus based on the information, and controls the operation state of the specified designated apparatus.

2. The energy management system according to claim 1,

wherein the information acquisition unit acquires the information indicating the designated apparatus designated as the control target apparatus among the plurality of energy consumption apparatuses by the user and a control condition set in regard to the operation state of the designated apparatus by the user, and

wherein when the reception unit receives the reduction request, the information acquisition unit acquires the information indicating the designated apparatus designated by the user on the screen that displays an expected power-saving amount when the designated apparatus is controlled as the control target apparatus under the control condition and indicating the

control condition set by the user on the screen, the storage unit stores the information indicating the designated apparatus and the control condition acquired by the information acquisition unit, and the operation state control unit reads the information stored in the storage unit, specifies the designated apparatus and the control condition based on the information, and controls the operation state of the specified designated apparatus under the specified control condition.

3. The energy management system according to claim 1 or 2,

wherein the management apparatus is a home server installed in a house which is the building,

wherein the energy consumption amount reduction request apparatus is an external server installed outside the house,

wherein the external server is able to communicate with the home server and a third server managed by an energy supply business company supplying energy to the house via a network, and

wherein when the third server commands the external server to transmit the reduction request via the network, the external server transmits the reduction request to the home server via the network.

4. The energy management system according to claim 3, wherein the management apparatus further includes

a calculation unit configured to calculate degree of change at a time of change in an energy consumption amount in the house due to controlling the operation state of the control target apparatus by the operation state control unit, and

a data transmission unit configured to transmit data indicating the degree of change calculated by the calculation unit to the external server.

5. The energy management system according to claim 4,

wherein the external server includes a score granting unit configured to grant a score according to the degree of change calculated by the calculation unit to the user, and

wherein when the score granting unit receives data indicating the degree of change calculated by the calculation unit via the network, the score granting unit calculates a score according to the degree of change based on the data and grants the score to the user.

6. The energy management system according to claim 4 or 5,

wherein a sensor configured to measure an energy

consumption amount in the house and output a signal according to a result of the measurement is provided, and

wherein based on the signal output by the sensor, the calculation unit calculates, as the degree of change, a difference in the energy consumption amount in the house per unit time before and after the operation state control unit controls the operation state of the control target apparatus.

7. A management apparatus for managing an energy consumption amount in a building equipped with a plurality of energy consumption apparatuses, the management apparatus comprising:

a reception unit configured to receive a reduction request for reducing an energy consumption amount in the building from an energy consumption amount reduction request apparatus transmitting the reduction request to the management apparatus;

an operation state control unit configured to control an operation state of a control target apparatus among the plurality of energy consumption apparatuses to reduce the energy consumption amount in the building;

an information acquisition unit configured to acquire information indicating a designated apparatus designated as the control target apparatus among the plurality of energy

consumption apparatuses by a user; and

a storage unit configured to store the information acquired by the information acquisition unit,

wherein when the reception unit receives the reduction request, the information acquisition unit acquires the information indicating the designated apparatus designated by the user on a screen that displays an expected power-saving amount when the designated apparatus is controlled as the control target apparatus, the storage unit stores the information acquired by the information acquisition unit, and the operation state control unit reads the information stored in the storage unit, specifies the designated apparatus based on the information, and controls the operation state of the specified designated apparatus.