

SPECIFICATION

INFORMATION NOTIFICATION SYSTEM

TECHNICAL FIELD

[0001]

The present invention relates to an information notification system, and more particularly, to an information notification system that notifies a user of information relating to a measurement result of energy consumption amounts of energy consumption apparatuses used inside a building or information provided from an information source disposed outside a building.

BACKGROUND ART

[0002]

Information notification systems that notify users of information are known. Among such systems, there are systems called home management systems (hereinafter, referred to as HEMS). In such an HEMS, a home server is installed inside a house, and the home server collects measurement results from sensors by communicating with the sensors that measure energy consumption amounts of energy consumption apparatuses used inside the house and notifies a user (for example, a resident of the house) of information according to the measurement results. As a result, the user reviews his energy consumption behavior and keeps the practice of an energy saving behavior in mind.

[0003]

Meanwhile, in a community in which there are a plurality of houses having HEMS's installed thereto, there are cases where a system (a community energy management system, hereinafter referred to as a CEMS) implementing energy management in units of communities through a network such as the Internet is built. In the CEMS, a server (hereinafter, referred to as a CEMS server) controlling each HEMS is disposed, and a service for delivering information such as an advice relating to energy saving from the CEMS server to the home server of each house can be provided. The information delivered from the CEMS server is received by the home server through the network, and, finally, a user is notified of the content thereof.

[0004]

In a general HEMS, a notification of information for a user is made through a terminal (notification terminal) such as a notebook PC, a wall-type terminal, or a personal digital assistance (PDA) that is connectable to a network and has a web browser function (for example, see Patent Document 1). In a power monitoring system described in Patent Document 1, information relating to an electric utility unit rate is delivered from a center apparatus (corresponding to the CEMS server described above), and the information is received by the notification terminal through an integrated control board.

Then, on the notification terminal side that has received the information of the electric utility unit rate from the center apparatus, an electric utility unit rate applied to the current time zone and an electric utility unit rate applied to the next time zone are displayed. In addition, in

the information received from the center apparatus, information representing a time (hereinafter, referred to as a transition time) until a transition to the electric utility unit rate applied to the next time zone is included, and the notification terminal notifies a user of the transition time described above through light emission (more particularly, a pictogram mark displayed in accordance with light emission of LEDs).

CITATION LIST

PATENT DOCUMENT

[0005]

Patent Document 1: JP 2011-160607 A

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0006]

However, in the power monitoring system described in Patent Document 1, the notification terminal described above needs to be operated for notifying the user of the information, and the user is forced to perform an operation for operating the notification terminal. As above, a user's operation is necessary each time when the notification terminal is operated, and, as a result, it is inconvenient for the user to check the information, whereby it is difficult to increase a user's motivation for saving the energy. Accordingly, as a notification apparatus for the notification of the information, an apparatus that can perform notification of the information using a simplified manner without requiring user's efforts has been

requested. In addition, it is preferable that the notification apparatus respond also to a case where the information to be notified is diversified (for example, in a case where the number of types and categories of the information to be notified increases).

[0007]

The present invention is made in consideration of the above-described problems, and an object thereof is to provide an information notification system that notifies a user of information using a simplified manner and can respond also to a case where there are a plurality of types of information to be notified.

MEANS FOR SOLVING THE PROBLEM

[0008]

According to the present invention, there is provided an information notification system including: a communication apparatus that communicates with at least one apparatus of a measurement apparatus measuring an energy consumption amount of the inside of a building and transmitting measurement result data representing information according to a measurement result and an information delivery apparatus being installed outside the building and transmitting provision information data representing information provided for a user inside the building and an ornament-type notification apparatus that performs a notification operation according to reception data based on the reception data received by the communication apparatus at time of communicating with the at least one apparatus out of the measurement result data and the provision information data, wherein the communication apparatus transmits a request for

performing the notification operation to the notification apparatus based on the reception data, the notification apparatus includes: a light emitting mechanism that performs a light emitting operation for emitting light in a light emission form according to the reception data; a sound generating mechanism that performs a sound generating operation for giving off a sound according to the reception data; a vibration mechanism that performs a vibration operation for generating vibration in accordance with the reception data; and a control unit that controls the light emitting mechanism, the sound generating mechanism, and the vibration mechanism, and, when the performance request is received, the control unit performs at least one or more operations that are determined in accordance with the performance request out of the light emitting operation, the sound generating operation, and the vibration operation as the notification operation, whereby the above-described problem is solved.

[0009]

In the above-described information notification system, by performing the light emitting operation, the sound generating operation, or the vibration operation using the ornament-type notification apparatus, the user is notified of information. In other words, according to an information providing system of the present invention, in notifying the user of information, the user can be notified of the information in a simple manner without particularly requesting an operation from the user.

In addition, according to the present invention, the light emission form of the light emitting operation, a sound given off by the sound generating operation, and presence/no presence of the vibration operation

can be changed in accordance with the reception data. In other words, according to the present invention, a plurality of performance patterns of the notification operation are prepared, and, by appropriately using the performance pattern of the notification operation in accordance with the kind of information to be notified, a case where there are a plurality of kinds of information to be notified can be sufficiently responded.

[0010]

In addition, in the above-described information notification system, it is preferable that the communication apparatus be a home server that is installed to the inside of a house as the building, the information delivery apparatus be an external server that is connected to the home server through the Internet in a communicable manner, in the provision information data transmitted by the external server, target value data representing a target value of a power consumption amount consumed for a predetermined period inside the house be included, when the target value data are received, the communication apparatus calculate a ratio of an accumulated value of a power consumption amount that is actually consumed inside the house for the predetermined period to the target value and transmit the performance request according to the calculated ratio to the notification apparatus, and, when the performance request is received, the control unit perform at least one or more operations out of the light emitting operation for emitting light in a light emission form according to the ratio that is performed by the light emitting mechanism, the sound generating operation for giving off a sound according to the ratio that is performed by the sound generating mechanism, and the vibration operation that is

performed by the vibration mechanism as the notification operation.

[0011]

In addition, in the above-described information notification system, it is more preferable that, in the provision information data transmitted by the external server, unit rate data representing a current value of a unit rate of power supplied from the commercial power supply to the house be included, when the unit rate data is received, the communication apparatus specify the current value and transmit the performance request according to the specified current value to the notification apparatus, and, when the performance request is received, the control unit perform at least one or more operations out of the light emitting operation for emitting light in a light emission form according to the current value that is performed by the light emitting mechanism, the sound generating operation for giving off a sound according to the current value that is performed by the sound generating mechanism, and the vibration operation that is performed by the vibration mechanism as the notification operation.

[0012]

As above, since the user inside the house can be notified of the ratio of the accumulated value of the actual consumption amount to the target power consumption amount or the current value of the unit rate of power supplied from the commercial power supply, a change for reviewing the power demand-supply status of the inside of the house is given to the user, and an energy saving behavior can be urged.

[0013]

In addition, in the above-described information notification system, it

is still more preferable that an information processing terminal that forms a body that is separate from the notification apparatus and is communicable with the home server be further included, the information processing terminal include a display and acquire display data representing information to be displayed on the display by communicating with the home server, the information represented by the display data be same as information represented by the reception data, the notification apparatus be in a conductive state at time of performing the notification operation, the information processing terminal be in a conductive state at time of displaying the information represented by the display data on the display, and power consumed by the notification apparatus that is in the conductive state be smaller than power consumed by the information processing terminal that is in the conductive state. According to such a configuration, the effect of the present invention becomes more effective.

More specifically, in a case where the information processing terminal that is configured by a notebook PC, a wall-type terminal, a PDA, or the like is disposed to be separate from the notification apparatus, since a starting operation is necessary for a user to check the information using the information processing terminal, the notification apparatus that notifies the user of information in a simple manner without requiring such a starting operation is more useful. In addition, in a case where the notification of information is performed by the notification apparatus, the power consumption amount can be smaller than that of a case where the information is checked using the information processing terminal.

[0014]

In addition, in the above-described information notification system, it is more preferable that the communication apparatus implement a function for controlling operating states of energy consumption apparatuses used inside the building through a network disposed inside the building, the notification apparatus include an operation receiving mechanism that receives an operation performed when the user controls the operating states of the energy consumption apparatuses, and the control unit transmit a performance request of a control process for controlling the operating states of the energy consumption apparatuses to the communication apparatus based on the operation received by the operation receiving mechanism. According to the information notification system having such a configuration, since the notification apparatus has a function (remote control function) for remotely controlling the energy consumption apparatuses, the notification apparatus can be conveniently used by the user, whereby the convenience of using the notification apparatus is improved.

[0015]

In addition, in the above-described information notification system, it is still more preferable that, when the operation receiving mechanism repeatedly receives the operation a plurality of times, the control unit transmit the performance request of the control process for controlling the operating states of the energy consumption apparatuses to the communication apparatus. According to the information notification system having such a configuration, it can be prevented that the remote control of the energy consumption apparatuses using the notification apparatus is erroneously performed (erroneous operation).

EFFECTS OF THE INVENTION

[0016]

According to an information notification system of the present invention, since information is notified using an ornament-type notification apparatus through light, a sound, and vibration, in the notification of the information, the user can be notified of the information in a simple manner without particularly requiring an operation from the user. In addition, since a plurality of the performance patterns of the notification operation are prepared, by appropriately using the performance pattern of the notification operation in accordance with the kind of information to be notified, even a case where there are a plurality of kinds of information to be notified can be sufficiently responded.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

[Fig. 1] Fig. 1 is an explanatory diagram that illustrates a building to which an information notification system according to the present invention is installed.

[Fig. 2] Fig. 2 is an outline view of a notification apparatus according to the present invention.

[Fig. 3] Fig. 3 is a diagram that illustrates an example of relation between a home server according to the present invention and an external server.

[Fig. 4A] Fig. 4A is a block diagram that illustrates the

hardware configuration of the home server according to the present invention.

[Fig. 4B] Fig. 4B is a diagram that illustrates the configuration of the home server according to the present invention in the functional aspect.

[Fig. 4C] Fig. 4C is a configuration diagram relating to the performance environment of the home server according to the present invention.

[Fig. 5] Fig. 5 is a diagram that illustrates an example of a screen drawn in an information processing terminal according to the present invention.

[Fig. 6] Fig. 6 is a diagram that illustrates the configuration of the notification apparatus according to the present invention.

[Fig. 7] Figs. 7(A) to 7(C) are schematic diagrams that illustrate the notification apparatus that is in the state of performing a notification operation, and Fig. 7(D) is a schematic diagram that illustrates the appearance of receiving a user's operation in the notification apparatus.

[Fig. 8] Fig. 8 is a diagram that illustrates an example of the content of a light emitting operation according to the present invention.

[Fig. 9] Fig. 9 is a diagram that illustrates an example of the content of a sound generating operation according to the present invention.

[Fig. 10] Fig. 10 is a diagram that illustrates an example of an operation performed when the notification apparatus according to the present invention receives a user's response operation.

[Fig. 11] Fig. 11 is a diagram (1) that illustrates the flow of an

information notification process.

[Fig. 12] Fig. 12 is a diagram (2) that illustrates the flow of the information notification process.

[Fig. 13] Fig. 13 is a diagram (3) that illustrates the flow of the information notification process.

[Fig. 14] Fig. 14 is a diagram that illustrates the flow of an apparatus control process.

MODE FOR CARRYING OUT THE INVENTION

[0018]

An information notification system according to an embodiment (hereinafter, referred to as this embodiment) of the present invention will be described with reference to Figs. 1 to 14. Fig. 1 is an explanatory diagram that illustrates a building to which an information notification system according to the present invention is installed. Fig. 2 is an outline view of a notification apparatus according to the present invention. Fig. 3 is a diagram that illustrates an example of relation between a home server according to the present invention and an external server. Fig. 4A is a block diagram that illustrates the hardware configuration of the home server according to the present invention. Fig. 4B is a diagram that illustrates the configuration of the home server according to the present invention in the functional aspect. Fig. 4C is a configuration diagram relating to the performance environment of the home server according to the present invention. Fig. 5 is a diagram that illustrates an example of a screen drawn in an information processing terminal according to the present invention.

Fig. 6 is a diagram that illustrates the configuration of the notification apparatus according to the present invention. Figs. 7(A) to 7(C) are schematic diagrams that illustrate the notification apparatus that is in the state of performing a notification operation, and Fig. 7(D) is a schematic diagram that illustrates the appearance of receiving a user's operation in the notification apparatus. Fig. 8 is a diagram that illustrates an example of the content of a light emitting operation according to the present invention. Fig. 9 is a diagram that illustrates an example of the content of a sound generating operation according to the present invention. Fig. 10 is a diagram that illustrates an example of an operation performed when the notification apparatus according to the present invention receives a user's response operation. Figs. 11 to 13 are diagrams that illustrate the flow of an information notification process. Fig. 14 is a diagram that illustrates the flow of an apparatus control process.

[0019]

<<Overview of Information Notification System According to this Embodiment>>

The information notification system (hereinafter, this system S) according to this embodiment will be reviewed with reference to Figs. 1 to 3. Among lines joining elements configuring this system S illustrated in Fig. 1, solid lines represent electrical wirings, and broken lines represent communication lines.

[0020]

Hereinafter, a configuration in which this system S is installed to a house H as an example of a building will be described as an example.

However, the house H is merely an example of the building, and the information notification system according to the present invention can be used in the other buildings, for example, an office building, a building disposed inside a factory, a store, and the like.

[0021]

<Configuration of Information Notification System According to this Embodiment>

This system S manages a power consumption amount of the inside of the house H as an energy consumption amount of the inside of the house H and notifies a user (for example, a resident of the house H) of information relating to the power consumption of the inside of the house H. More specifically, this system S is a so-called home energy management system (HEMS) and, for the purpose of reducing the power consumption amount of the inside of the house H, visualizes (visually represents) the power consumption amount of power consumption apparatuses used inside the house H and notifies the user of the visualized information.

[0022]

The power consumption apparatuses correspond to energy consumption apparatuses and, more specifically, are a home appliance, a lighting device, an air conditioner, a hot-water heater, an AV device, security equipment, and the like. Inside the house H according to this embodiment, a plurality of power consumption apparatuses are used. In other words, this system S is installed to the house H in which at least one or more power consumption apparatuses are used.

[0023]

In Fig. 1, for the convenience of illustration, only an air conditioner 7a and a lighting device 7b are illustrated as power consumption apparatuses. However, a combination of the power consumption apparatuses illustrated in Fig. 1 is merely an example, and it is apparent that power consumption apparatuses corresponding to a number that is the number of the power consumption apparatuses illustrated in Fig. 1 or more may be installed inside the house H, and a power consumption apparatus of a type not illustrated in Fig. 1 may be installed inside the house H.

[0024]

In the house H, as illustrated in Fig. 1, electric power (hereinafter, referred to as system power) is received from a commercial power supply 4, and electric power can be generated using solar energy as natural energy by using a power generating unit 1 installed to the house H. The electric power (hereinafter, referred to as generated power) generated by the power generating unit 1 and the system power are supplied to the power consumption apparatuses installed inside the house H through a distribution board 2. The generated power is converted from DC power into AC power by a power conditioner 5 that is installed between the power generating unit 1 and the distribution board 2.

[0025]

The unit rate (in other words, the power rate) of the system power is changed in accordance with the time zone. For example, the unit rate of the late-night time zone is set to be slightly less than that of the day time zone. In addition, the unit rate of the system power may be changed in accordance with the season, a change in the oil price, or the like.

[0026]

In this embodiment, the power generating unit 1 is linked with the commercial power supply 4, and accordingly, a surplus of the generated power can inversely flow (electric power selling) to the commercial power supply 4. In addition, in this embodiment, a storage battery 3 is disposed, and the system power or the generated power can be stored in the storage battery 3. Then, the electric power (hereinafter, referred to as stored power) stored in the storage battery 3 is discharged at appropriate timing and, similar to the other power, is supplied to the power consumption apparatuses disposed inside the house H through the distribution board 2. In addition, between the storage battery 3 and the distribution board 2, a bidirectional inverter 6 is installed. Through this bidirectional inverter 6, the system power and the generated power are converted from AC power into DC power at the time of being stored in the storage battery 3, and the stored power is converted from DC power into AC power at the time of being discharged.

[0027]

In the house H to which the HEMS (in other words, this system S) is installed, a sensor group that measures electric power is disposed. More specifically, a sensor 21 configured by a smart meter is attached to the distribution board 2. The sensor 21 configured by this smart meter corresponds to a measurement device and measures a power consumption amount (more precisely, a total power consumption amount that is consumed inside the house H) that is consumed inside the house H as an energy consumption amount. Particularly, in this embodiment, the sensor 21 measures an accumulated value of the power consumption amount during a

predetermined period. Here, while the predetermined period is set to a period of one month in this embodiment, another period (for example, one day or one week) may be set. In addition, when a predetermined period elapses after start of the measurement, the sensor 21 resets the measurement result and then restarts a next measurement.

[0028]

In addition, sensors 22a and 22b are respectively attached to the air conditioner 7a and the lighting device 7b. These sensors 22a and 22b are electric power sensors each having a communication function and measure power consumption amounts of corresponding apparatuses.

[0029]

Furthermore, sensors 23a, 23b, and 23c used for respectively measuring the generated power, the system power, and the stored power are disposed. More specifically, the sensor 23a for the generated power is arranged between the power conditioner 5 and the distribution board 2, the sensor 23b for the system power is arranged between a power receiving facility, which is not illustrated in the figure, disposed inside the house H and the distribution board 2, and the sensor 23c for the stored power is attached to a predetermined position in the storage battery 3.

[0030]

Each one of the sensors 21, 22a, 22b, and 23a to 23c described hereinbefore outputs (transmits) measurement result data that represents information according to a measurement result. Here, the information according to the measurement result is a value (in other words, a measurement value) acquired by digitizing the measurement result, and the

measurement result data representing the information according to the measurement result is acquired by converting the digitized measurement result into a digital signal. The sensor 21, which measures a power consumption amount consumed inside the house H, out of the sensors 21, 22a, 22b, and 23a to 23c constantly monitors instantaneous power consumption of the house H and, when the instantaneous power consumption is at a predetermined level or higher, outputs (transmits) report data used for reporting such a situation.

[0031]

The measurement result data and the report data can be acquired through a network (hereinafter, referred to as a home network TN) disposed inside the house. In other words, this system S can communicate with the sensors 21, 22a, 22b, and 23a to 23c through the home network TN. For example, the home network TN is configured by a wired IP network using an Ethernet (registered trademark) cable or a wireless IP network using IEEE 802.1x or Bluetooth (registered trademark).

[0032]

In addition, this system S can control the operating states of the power consumption apparatuses described above by communicating with the power consumption apparatuses through the home network TN. In other words, this system S can remotely control the operating state of each one of the power consumption apparatuses starting from the air conditioner 7a and the lighting device 7b through the home network TN.

[0033]

More specifically, this system S transmits signals (control signals)

used for controlling the operating states of the power consumption apparatuses to the power consumption apparatuses through the home network TN. Meanwhile, on the power consumption apparatus side that has received the control signal through the home network TN, the operating state of the power consumption apparatus changes to a state according to the control signal. Here, the operating state is a concept representing a current state of a controllable (adjustable) item relating to the operation including start/stop (on/off), an operation mode such as a cooling mode or a warming mode, an operation management value such as a set temperature, and the like.

[0034]

As above, this system S can perform monitoring and control of each power consumption apparatus and visualization (visual representation) of power demand-supply balance inside the house H through communication made through the home network TN. The functions of this system S described above are realized by the home server 10 (home gateway) installed inside the house H and an apparatus (more specifically, a portable terminal 30 or a robot 50 to be described later) serving as an interface when the user performs control of the power consumption apparatuses or monitoring of the power demand-supply balance of the inside of the house H.

[0035]

The home server 10 corresponds to a communication apparatus according to the present invention and integrally manages communication target apparatuses by transmitting/receiving data or signals to/from the communication target apparatuses (more specifically, the power

consumption apparatuses and the sensors 21, 22a, 22b, and 23a to 23c) that are present inside the house H through the home network TN. In other words, in this embodiment, the acquisition of the measurement result data from the sensors 21, 22a, 22b, and 23a to 23c and the transmission of control signals to the power consumption apparatus are performed in a unified manner by the home server 10.

[0036]

However, among the power consumption apparatuses, there are apparatuses having mutually-different communication modes (communication specifications; the same meaning as that of communication protocols). Generally, in the house H to which the HEMS is installed, it is recommended to use power consumption apparatuses employing a common communication mode, and, for example, it is preferable that the power consumption apparatuses be uniformized as apparatuses employing the ECHONET specification proposed by the ECHONET consortium. Meanwhile, since a user purchases a power consumption apparatus arbitrarily (regardless of the communication mode), there is a case where an apparatus having a specification other than the ECHONET specification is included in the power consumption apparatuses disposed inside the house H. In such a case, the communication modes of the power consumption apparatuses used in the house H are different from each other.

[0037]

Accordingly, the home server 10 according to this embodiment is configured to be communicable in a communication mode corresponding to a communication target apparatus by changing the communication mode in

accordance with the communication target apparatus. Here, a case will be described as an example in which communication target apparatuses disposed inside the house H are divided into three kinds of a first specification apparatus, a second specification apparatus, and a third specification apparatus based on differences in the communication mode. For example, the home server 10, in order to communicate with the first-specification apparatus, employs a communication mode corresponding to the first specification apparatus and thereafter, in order to communicate with the second specification apparatus, switches the communication mode to a communication mode corresponding to the second specification apparatus. The function of the home server 10 for performing switching among the communication modes in accordance with the kind of the apparatus in this way will be described later in detail.

[0038]

In this system S, an information processing terminal that communicates with the home server 10 through the home network TN and a notification apparatus that is connected to the home server 10 through a USB connector 50b are included. Both these apparatuses are interposed between the home server 10 and a user and serve as interfaces at the time of controlling the power consumption apparatuses or monitoring the power demand-supply balance of the inside of the house H.

[0039]

The notification apparatus is an ornament-type apparatus that notifies a user of predetermined information. Particularly, the notification apparatus according to this embodiment is a communication robot

(hereinafter, simply referred to as the robot 50) having an appearance illustrated in Fig. 2. This robot 50 receives a performance request transmitted from the home server 10 and performs a predetermined notification operation. The robot 50 according to this embodiment, as illustrated in Fig. 2, has a form imitating a mascot having a long egg shape. However, the form of the robot 50 is not limited thereto but may be designed to be an arbitrary shape (for example, a form imitating an animal or a person).

[0040]

In addition, as described above, the robot 50 is connected to the home server 10 through the USB connector 50b and transmits/receives data to/from the home server 10. Furthermore, the robot 50 according to this embodiment is electrically connected to the home server 10 through the above-described USB connector 50b, and, while the home server 10 is in the conductive state (turned-on state), power is supplied from the home server 10 to the robot 50 to be maintained in the conductive state (turned-on state). In other words, the power supply source (power supply) of the robot 50 is linked to the power supply of the home server 10.

[0041]

The robot 50 according to this embodiment can select and perform at least one or more operations out of a light emitting operation for emitting light in a form according to information to be notified, a sound generating operation for giving off a sound according to information to be notified, and a vibration operation for generating vibration in accordance with information to be notified as notification operations. In addition, the configuration and

the operation of the robot 50 will be described later in detail.

[0042]

The information processing terminal is a terminal having a browsing function, forms a body that is separate from the above-described notification apparatus (more specifically, the robot 50), and is connected to the home server 10 through the home network TN in a communicable manner. In addition, the information processing terminal includes a display used for displaying information (more specifically, information represented by acquisition data acquired from the home server 10) and, in this embodiment, is configured by a terminal (hereinafter, referred to as a portable terminal 30) having portability such as a smartphone, a PDA, a notebook PC, a digital photo frame to which predetermined application software is installed, or the like.

[0043]

Various programs (applications) are installed to the portable terminal 30, and, as one thereof, there is a program for drawing a screen (for example, see Fig. 5; hereinafter referred to as an energy management screen) on which measurement results acquired from the sensors 21, 22a, 22b, and 23a to 23c are displayed. This program (hereinafter, referred to as an energy management program) is operated as a user performs a predetermined operation (for example, an operation of touching an icon displayed on a touch panel 31) on the touch panel 31 mounted in the portable terminal 30.

[0044]

As the energy management program is operated, the portable

terminal 30 communicates with the home server 10 and requests the home server 10 to transmit data relating to the measurement results acquired from the sensors 21, 22a, 22b, and 23a to 23c. The home server 10 that has received the request acquires the above-described measurement result data by communicating with the sensors 21, 22a, 22b, and 23a to 23c. Thereafter, the home server 10 generates response data in accordance with the acquired measurement result data and transmits the response data to the portable terminal 30. When the above-described response data is received (acquired) through the home network TN, the portable terminal 30 analyzes the data and specifies the measurement results acquired from the sensors 21, 22a, 22b, and 23a to 23c.

[0045]

As a result of the performance of the above-described process, the energy management screen is drawn on the touch panel 31 as the display and, on the energy management screen, the measurement results acquired from the sensors 21, 22a, 22b, and 23a to 23c are displayed as information represented by the above-described response data. Through such an energy management screen, the user can visually recognize the power consumption amount of each power consumption apparatus or the power demand-supply balance of the inside of the house H. Here, the above-described response data corresponds to display data displayed on the touch panel 31 that is acquired as the portable terminal 30 communicates with the home server 10.

[0046]

The user can perform switching between the operating states of the power consumption apparatus of which an operation button is pressed by

performing an operation of pressing the operation button (for example, one of operation buttons B1 to B6 illustrated in Fig. 5) disposed on the energy management screen through the touch panel 31 while the energy management screen is drawn on the touch panel 31.

[0047]

More specifically, when the user operation (more specifically, the operation of pressing one of the operation buttons B1 to B6) performed through the touch panel 31 is received, the portable terminal 30 transmits a request for performing a control process for controlling an apparatus (in other words, an apparatus of which the operating state is controlled and hereinafter will be referred to as a control target apparatus) that is a target for the user operation out of the power consumption apparatuses used inside the house H to the home server 10 by communicating with the home server 10. When the request for performing the control process is received, the home server 10 generates a control signal according to the user operation and transmits the signal to the control target apparatus. Then, when the power consumption apparatus that is the control target apparatus receives the above-described control signal, the operating state of the control target apparatus is changed in accordance with the control signal.

[0048]

As described above, the HEMS (in other words, this system S) is built in the form in which the portable terminal 30 and the robot 50 are built into the home server 10 as the core.

In addition, in this embodiment, a community is formed by aggregating a plurality of houses H to which the HEMS's are installed, and a

system that performs energy management (power monitoring), in other words, a community energy management system (CEMS) is built in units of the communities.

[0049]

As a server used for controlling the HEMS of each house H, a CEMS server 40 is disposed. The CEMS server 40 is an external server that is installed outside the house H (for example, inside a management facility of the community) and, as illustrated in Fig. 3, is connected to the home server 10 of each house H in a communicable manner through an outside-home network GN formed by the Internet. In addition, the CEMS server 40 delivers data representing information toward the user of each house H to each home server 10 by communicating with the home server 10 of each house H. From such a meaning, the CEMS server 40 may be regarded as being in correspondence with an information delivery apparatus that transmits provision information data representing information data to be provided for the user inside each house H.

[0050]

As the provision information data delivered from the CEMS server 40, there are unit rate data that represents the current value of the unit rate of power supplied to each house H within the community from the commercial power supply 4, power-saving request data that requests each house H within the community to perform power saving, weather data that represents information relating to the weather of a region to which the community belongs, and notification data that represents other information relating to the community to be notified to the user of each house H. Here,

the above-described provision information data is merely an example, and data representing information other than the above-described information may be included in the provision information data.

[0051]

In addition, in the provision information data delivered from the CEMS server 40, other than the data described above, target value data that represents a target value of the power consumption amount consumed during a predetermined period inside the house H is included. Here, the predetermined period, for example, is a period set for collecting a total consumption amount of power in charging a power usage fee and is usually a period from a predetermined date of each month to the predetermined date of the next month. However, the above-described period may be arbitrarily set and, for example, may be set to a period in units of one day or a period in units of one year.

[0052]

The target value data described above will now be described. In transmitting the target value data from the CEMS server 40, a target value of the power consumption amount consumed during a predetermined period is set to each house H in advance, and it is necessary to store a setting result of the target values in a storage unit (hereinafter, referred to as a CS-side storage unit 42) of the CEMS server 40 as data.

[0053]

The sequence of storing the setting result of the target values of the power consumption amounts on the CEMS server side 40 will now be described. For example, an input screen (not illustrated in the figure) used

for inputting the above-described target values is displayed on the display 11 of the home server 10 by inputting a URL of the CEMS server 40 using an input device 12 of the home server 10, and the target values are input through a keyboard not illustrated in the figure or the like. The home server 10 that has received this input operation generates data that represents the content of the input operation and transmits the data to the CEMS server 40. Meanwhile, the CEMS server 40 receives the data representing the content of the input operation, and data (target value data) representing the target values input from the home server 10 side and data (transmission source ID data) representing a transmission source ID that is allocated so as to specify the transmission source of the above-described data are generated based on the data. Finally, such data is stored in the CS-side storage unit 42 in the state being associated with each other.

[0054]

A series of operations performed for setting the target values as described above is repeated on a regular basis and, for example, is performed on a date corresponding to a date several days before the first day of a period to which the target values are applied.

In this embodiment, while it has been described that the target values are set on the home server 10 side, and the target value data representing the target values are managed (stored) on the CEMS server 40 side, the setting of the target values may be performed on the CEMS server 40 side. For example, it may be configured such that, on the CEMS server 40 side, data (hereinafter, referred to as actual power consumption amount data) representing a power consumption amount that is actually consumed

for a predetermined period (more specifically, the last year or the last month) inside the house H is received from the home server 10 of the house H, and the target values are automatically set based on the received actual power consumption data.

[0055]

When the target data transmission request is received on the home server 10 side, the CEMS server 40 specifies the home server 10 that is the transmission source of the request based on the transmission source ID data, then reads target value data corresponding to the specified home server 10 among the target value data stored in the CS-side storage unit 42, and transmits the target value data to the home server 10.

[0056]

When the target value data is transmitted from the CEMS server 40, the home server 10 that has requested the data transmission receives the target value data. In addition, the home server 10 requests the sensor 21 configured by the smart meter to transmit the measurement result data of the power consumption amount by being triggered upon the reception of the target value data. Here, the measurement result data transmitted from the sensor 21, as described above, is in accordance with the accumulated value of the power consumption amounts consumed inside the house H and, more specifically, is in accordance with an accumulated value of the power consumption amount that is actually consumed inside the house H from the start of a predetermined period to the current time point (more specifically, a time point when the home server 10 requests the measurement result data from the sensor 21).

[0057]

When the target value data transmitted from the CEMS server 40 and the measurement result data transmitted from the sensor 21 are received, the home server 10 specifies a target value (more specifically, a target value applied at the current time point) for a predetermined period from the target value data and specifies the accumulated value (more specifically, the accumulated value of the power consumption amount that is actually consumed inside the house H from the start of the period to which the above-described target value is applied to the current time point) from the measurement result data. Thereafter, the home server 10 calculates a ratio of the specified accumulated value to the above-described target value. Then, the home server 10 requests the above-described robot 50 to perform a notification operation according to the above-described calculated ratio.

[0058]

In this embodiment, while the CEMS server 40 has been described as an example of the external server, a server other than the CEMS server 40 out of servers connected to the Internet, for example, a server possessed by the management company of the house H, a server possessed by a system development company that has built the HEMS, a server possessed by an aggregator, or a server possessed by a power company may be configured to serve as an external server that transmits the above-described provision information data.

[0059]

<Configuration of Each Unit of Information Notification System According to this Embodiment>

Next, the configuration (excluding the robot 50 that is the notification apparatus) of each unit of this system S described until now will be described in detail with reference to Figs. 4A, 4B, 4C, and 5.

(1) Home Server 10

The hardware configuration of the home server 10 that forms the core of this system S will now be described. As illustrated in Fig. 4A, the home server 10 includes: a CPU 10a; a memory 10b; a non-volatile storage device 10c; a communication interface 10d (represented as a communication I/F in Fig. 4A); a display 11; and an input device 12, and such components are interconnected through a bus 10e. In the non-volatile storage device 10c, various programs (for example, a communication program, a USB driver, and the like) are stored.

[0060]

When the configuration of the home server 10 is described again from the functional aspect, as illustrated in Fig. 4B, it includes an external data acquiring unit 101, a measurement result data acquiring unit 102, a response data transmitting unit 103, an apparatus control unit 104, and a robot driving unit 105. Such units are configured by the above-described hardware (in other words, the CPU 10a, the memory 10b, the non-volatile storage device 10c, the communication interface 10d, and the display 11) configuring the home server 10 and various programs stored in the non-volatile storage device 10c.

[0061]

The external data acquiring unit 101 requests the CEMS server 40 to perform data transmission by communicating with the CEMS server 40

through the outside-home network GN and receives data (provision information data) transmitted from the CEMS server 40. The received provision information data is temporarily stored in the memory 10b and thereafter is stored in the non-volatile storage device 10c.

[0062]

The measurement result data acquiring unit 102 instructs the sensors 21, 22a, 22b, and 23a to 23c to measure the power consumption amounts and transmit the measurement result data and receives the measurement result data through the home network TN. For example, when a data transmission request issued from the portable terminal 30 is received when the energy management program is operated on the portable terminal 30 side, the measurement result data acquiring unit 102 starts communicating with the sensors 21, 22a, 22b, and 23a to 23c and acquires the measurement result data. In addition, when the target value data is received from the CEMS server 40, the measurement result data acquiring unit 102 requests the sensor 21 configured by the smart meter to transmit the measurement result data in accordance therewith and receives the measurement result data according to the accumulated value of the power consumption amount consumed inside the house H from the sensor 21.

[0063]

The response data transmitting unit 103 generates response data in accordance with the measurement result data acquired by the measurement result data acquiring unit 102 and transmits the response data to the portable terminal 30. On the portable terminal 30 side that has received the response data, as a result of the analysis of the response data, the energy

management screen on which the measurement results acquired by the sensors 21, 22a, 22b, and 23a to 23c are displayed is drawn on the touch panel 31. In other words, the response data corresponds to display data that represents information displayed on the touch panel 31 by the portable terminal 30 communicating with the home server 10. The information represented by the response data is the same as the information represented by the home server 10 and, more particularly, represents the measurement results acquired by the sensors 21, 22a, 22b, and 23a to 23c. In this embodiment, the response data is in the XML format. Accordingly, the portable terminal 30 that has received the response data can display the above-described measurement result in the format according to the specification of the portable terminal 30.

[0064]

The apparatus control unit 104 communicates with a control target apparatus out of the power consumption apparatuses used inside the house H through the home network TN and transmits a control signal to the control target apparatus. This apparatus control unit 104 generates a control signal based on an operation performed by the user for controlling the operating state of the power consumption apparatus that is the control target apparatus and transmits the control signal to the control target apparatus. Here, the user operation performed for controlling the operating state of the control target apparatus, as described above, is received by the portable terminal 30 through the touch panel 31. The portable terminal 30 that has received the user operation requests the apparatus control unit 104 to perform a process (control process) for controlling the operating state of

the apparatus (in other words, the control target apparatus) that is the target for the user operation.

[0065]

Then, when the request for performing the control process that is transmitted from the portable terminal 30 is received, the apparatus control unit 104 generates a control signal according to the user operation and transmits the control signal to the control target apparatus.

[0066]

In addition, in this embodiment, the user operation performed for controlling the operating state of the control target apparatus may be received also by the robot 50. In other words, when the user performs a predetermined operation (more specifically, three grasping operations to be described later) for the robot 50, the robot 50 transmits the request for performing the control process to the home server 10 (more specifically, the apparatus control unit 104). Then, when the request for performing the control process that has been transmitted from the robot 50 is received, the apparatus control unit 104 transmits a control signal to a predetermined control target apparatus. A mechanism (more specifically, an operation receiving mechanism 55) included in the robot 50 for receiving the above-described user operation will be described later.

[0067]

When the control of the operating state of the control target apparatus that has received the control signal is completed, the apparatus control unit 104 receives a signal (more specifically, a signal representing the completion of the control of the operating state on the control target

apparatus side; hereinafter, referred to as a control completion signal) transmitted from the control target apparatus.

[0068]

The robot driving unit 105 supplies power to the robot 50 through the USB connector 50b and transmits a request for performing a notification operation to the robot 50. More specifically, this robot driving unit 105 is configured by the co-operation of the CPU 10a, the memory 10b, the non-volatile storage device 10c, and a USB port (not illustrated in the figure) of the home server 10 and a robot driver 205 and a USB driver 206 (for example, see Fig. 4C) stored in the non-volatile storage device 10c.

[0069]

When the data (provision information data) is received by the external data acquiring unit 101 from the CEMS server 40, the robot driving unit 105 according to this embodiment transmits a request for performing a notification operation according to the data to the robot 50 through a USB circuit.

[0070]

In addition, in this embodiment, when the external data acquiring unit 101 acquires the target value data from the CEMS server 40, and the measurement result data acquiring unit 102 receives the measurement result data from the sensor 21, the robot driving unit 105 specifies a target value for a predetermined period and an accumulated value of the power consumption amount that is actually consumed inside the house H for the predetermined period based on the data. Then, the robot driving unit 105 calculates the ratio of the accumulated value to the above-described target

value and then transmits a request for performing a notification operation according to the calculated ratio to the robot 50 through the USB circuit.

[0071]

As above, the robot driving unit 105 transmits a request for performing a notification operation to the robot 50 based on reception data received by the home server 10 from a communication destination such as the measurement result data and the provision information data.

In addition, in this embodiment, when the apparatus control unit 104 receives the above-described control completion signal, the robot driving unit 105 transmits a request for performing a notification operation according to the control completion signal to the robot 50. Furthermore, in this embodiment, the sensor 21 measuring the power consumption amount consumed inside the house H transmits report data used for giving a notification indicating that the instantaneous power consumption of the house H is a predetermined level or higher. When this report data is received on the home server 10 side (for example, the measurement result data acquiring unit 102), the robot driving unit 105 transmits a request for performing a notification operation according to the report data to the robot 50.

[0072]

In addition, the home server 10 having the above-described functions mounted thereon implements a function for performing communication in a communication mode according to each communication target apparatus by performing switching between communication modes in accordance with the type of the apparatus (communication target apparatus) that is

communicable through the home network TN. For example, in order to control an apparatus belonging to the first specification apparatus out of the power consumption apparatuses disposed inside the house H, the above-described apparatus control unit 104 employs a communication mode corresponding to the first specification apparatus. Thereafter, in order to control an apparatus belonging to the second specification apparatus, the apparatus control unit 104 switches the communication mode to a communication mode corresponding to the second specification apparatus.

[0073]

The above-described function of the home server 10, in other words, the function for performing communication in a communication mode corresponding to the communication target apparatus is realized by the performance environment of the home server 10 illustrated in Fig. 4C. More specifically, the home server 10 includes an OS 201, a JAVA (registered trademark) virtual machine (hereinafter, referred to as a JVM) 202, an open services gateway initiative (OSGi) framework 203, and software (hereinafter, referred also to as a bundle) operating on the OSGi framework 203.

[0074]

The OSGi framework 203 is built on the JVM 202 and manages the life cycle of the bundle operating on the OSGi framework 203 such as downloading, installing, operating, and stopping. The bundle operating on the OSGi framework 203 can be dynamically changed, and a plurality of bundles may be performed in a parallel manner.

[0075]

As the bundles operating on the OSGi framework 203, there are a

standard bundle and an application bundle. The standard bundle is acquired by bundling a basic protocol such as the hypertext transfer protocol (HTTP) or universal plug and play (UPnP). The application bundle is application software registered in the OSGi framework 203. In this application bundle, a first-specification apparatus communication bundle 204a, a second-specification apparatus communication bundle 204b, and a third-specification apparatus communication bundle 204c are included. The first-specification apparatus communication bundle 204a is an application for communicating with the first-specification apparatus in a communication mode corresponding to the first specification apparatus. Similarly, the second-specification apparatus communication bundle 204b is an application for communicating with the second-specification apparatus in a communication mode corresponding to the second specification apparatus, and the third-specification apparatus communication bundle 204c is an application for communicating with the third-specification apparatus in a communication mode corresponding to the third specification apparatus.

[0076]

As the above-described three bundles 204a, 204b, and 204c are performed by the CPU 10a, the home server 10 performs communication in a communication mode corresponding to the communication target apparatus. In addition, in a case where an apparatus employing a new communication mode is introduced into the house H, application software for communicating with the introduced apparatus in a communication mode corresponding to the introduced apparatus may be registered in the OSGi framework 203. Accordingly, even in a case where an apparatus employing a new

communication mode is introduced into the house H, the home server 10 can communicate with the above-described apparatus by selecting a bundle (more specifically, registered application software) used for performing communication in the new communication mode.

[0077]

In the bundle operating on the OSGi framework 203, the above-described robot driver 205 is included (see Fig. 4C).

[0078]

According to the function of the OSGi framework 203 for dynamically changing the bundle, the communication bundle to be performed can be changed in accordance with the communication target apparatus communicating with the home server 10. In other words, the communication mode employed by the home server 10 is changed in accordance with the change of the communication bundle. In addition, when each communication bundle is registered in the OSGi framework 203, an interface for using the function of each communication bundle is registered in a registry (service registry). In addition, the OSGi framework 203 provides integration of such interfaces as an application program interface (hereinafter, referred to as a general-purpose API).

[0079]

The general-purpose API is used by a program (for example, a program that is executed by the portable terminal 30) executed by an apparatus other than the home server 10 and is a function for operating the above-described communication bundles 204a, 204b, and 204c or changing over therebetween during the execution of the program. The

general-purpose API is open to the public and is provided for the development of a program (for example, a program executed by the portable terminal 30) executed by an apparatus other than the home server 10. In other words, by using the general-purpose API when a program is developed, the program developer side does not need to consider a difference between communication target apparatuses in the communication mode, and, by using information (code) for using (requesting) the general-purpose API such as a URI of the home server 10, the home server 10 is enabled to perform communication in a communication mode corresponding to the communication target apparatus.

[0080]

As above, in this embodiment, as a structure for absorbing a difference (a difference between communication modes employed by the communication target apparatuses) in the communication bundle, the above-described general-purpose API is mounted in the home server 10. The general-purpose API is open to the public and, for example, when a program mounted in the portable terminal 30 is developed for controlling the operating states of the power consumption apparatuses disposed inside the house H, information for using the general-purpose API is embedded in the program. As above, by only embedding the information for using the general-purpose API, a program requesting the home server 10 to perform communication according to the communication mode that corresponds to the communication target apparatus can be developed, whereby the program development can be easily performed. Accordingly, the degree of freedom for a program developer in the program development is improved, and

accordingly, a program responding to a user's request can be developed more easily.

[0081]

Here, the information using the general-purpose API is information (code) that is used for requesting the performance of communication between the home server 10 and the communication target apparatus in compliance with the representational state transfer (REST). Here, a communication protocol applied when a communication performing request is transmitted from the apparatus (more specifically, for example, the portable terminal 30) requesting the performance of communication to the home server 10 is the HTTP. Accordingly, in the communication performing request transmitted to the home server 10, the URI (address) of the home server 10 and the like are included.

[0082]

(2) Portable Terminal 30

The portable terminal 30, as described above, is an information processing terminal that is connected to the home server 10 in a communicable manner through the home network TN. The portable terminal 30 is configured by a CPU, a memory, a communication interface, and the like not illustrated in the figure, and an energy management program and an apparatus control program are installed thereto. The energy management program is a program for requesting the home server 10 to transmit data relating to the measurement results acquired by the sensors 21, 22a, 22b, and 23a to 23c, receiving response data transmitted from the home server 10, and analyzing and expanding the response data.

[0083]

By executing the above-described energy management program, the energy management screen illustrated in Fig. 5 is drawn on the touch panel 31, and the measurement results acquired by the sensors 21, 22a, 22b, and 23a to 23c are displayed on the energy management screen. Through such an energy management screen, the user can visually recognize the power consumption amount of each power consumption apparatus and the demand-supply balance of the inside of the house H.

[0084]

The apparatus control program is a program used for transmitting a performance request of the control process for controlling the operating state of the control target apparatus to the home server 10 based on an operation (more specifically, an operation of pressing the operation buttons B1 to B6 on the energy management screen) for controlling the operating state of the power consumption apparatus that is performed by the user through the energy management screen. In this apparatus control program, as described above, the information for using the general-purpose API is embedded, and, in the data that is generated and transmitted by the apparatus control program for requesting the performance of the control process, data used for requesting the home server 10 to perform communication according to a communication mode that corresponds to the communication target apparatus is included. In this embodiment, the apparatus control program is operated in accordance with the operating of the energy management program and thereafter is in a reception waiting state until the above-described user operation is performed.

[0085]

Here, the energy management screen will be described. As illustrated in Fig. 5, items representing the power demand-supply balance of the inside of the house H are displayed. More specifically, on the energy management screen, a plurality of (six in the example illustrated in Fig. 5) display areas Ar1 to Ar6 are disposed. A value representing the generated power amount according to a power generating unit 1 is displayed in the display area Ar1, a value representing the received power amount (power selling amount) received from the commercial power supply 4 is displayed in the display area Ar2, and a value representing the stored power amount of the storage battery 3 is displayed in the display area Ar3.

[0086]

In the display area Ar4, a value representing a total consumption amount of the power of the inside of the house H is displayed. More specifically, an accumulated value of the power consumption amount that is actually consumed inside the house H from the start of a predetermined period (more specifically, the current month) to the current time point is displayed. In addition, in the display area Ar4, a target value of the power consumption amount that is consumed inside the house H for a predetermined period (more specifically, the current month) is additionally displayed.

Main apparatuses (for example, apparatuses having high use frequencies) out of the power consumption apparatuses used inside the house H are allocated to the display areas Ar5 and Ar6. In the example illustrated in Fig. 5, the display Ar5 is allocated to the air conditioner 7a, and

the display area Ar6 is allocated to the lighting device 7b.

[0087]

In the display areas Ar5 and Ar6 that are allocated to the power consumption apparatuses, in addition to the values representing the power consumption of the power consumption apparatuses, operation buttons B1 to B6 are displayed. The operation buttons B1 to B6 will now be described. The operation buttons B1, B2, B4, and B5 are buttons used for changing the operation/stop (on/off) of corresponding apparatuses. The operation buttons B1 and B4 having “ON” represented therein are buttons used for setting corresponding apparatuses to be in the operating state (On-state), and the operation buttons B2 and B5 having “OFF” represented therein are buttons used for setting corresponding apparatuses to be in the stop state (Off-state).

[0088]

The operation/stop (on/off) states of the apparatuses can be checked from the display areas Ar5 and Ar6 corresponding thereto. More specifically, the operation buttons B1 and B4 represented as “ON” are turned on for the apparatuses that are in the operating state, and the operation buttons B2 and B5 represented as “OFF” are turned on for the apparatuses that are in the stop state. For example, in the case illustrated in Fig. 5, it can be checked that the air conditioner 7a and the lighting device 7b are in the operating state.

[0089]

The operation buttons B3 and B6 are buttons that are used for performing detailed setting of the operating states of the corresponding apparatuses. When the operation buttons B3 and B6 are pressed, a

detailed setting screen not illustrated in the figure is drawn to overlap the energy management screen in the pop-up form. Through this detailed setting screen, a user can control the operating state of the control target apparatus by setting an operation mode such as a cooling mode or a warming mode or an operation management value such as a set temperature.

[0090]

By disposing the operation buttons B1 to B6 as described above, the user can perform an operation for controlling the operating state of the control target apparatus. In other words, by user's pressing the operating buttons B1 to B6, a performance request of the control process is transmitted from the portable terminal 30 to the home server 10 such that the control process is performed with the power consumption apparatus that is the target for the operation being set as the control target apparatus. On the home server 10 that has received the performance request, a control signal according to the operation is generated and is transmitted to the control target apparatus based on the above-described operation (more specifically, a button pressed by the user out of the operation buttons B1 to B6).

[0091]

In addition, it is apparent that, when the energy management screen is drawn on the touch panel 31, the state of the portable terminal 30 is the conductive state. In other words, when information (more specifically, the measurement results acquired by the sensors 21, 22a, 22b, and 23a to 23c displayed on the energy display screen) represented by the response data transmitted from the home server 10 is displayed on the touch panel 31 as a display, the portable terminal 30 is in the conductive state and thus

consumes electric power.

[0092]

(3) CEMS Server 40

The CEMS server 40 is configured by a CPU, a memory, a communication interface, and the like not illustrated in the figure, receives a data transmission request from the home server 10 (more specifically, the external data acquiring unit 101) through the outside-home network GN, and transmits data (provision information data) to the home server 10.

[0093]

As the provision information data, as described above, there are unit rate data that represents the current value of the unit rate of power supplied from the commercial power supply 4, power-saving request data that requests each house H to perform power saving, weather data that represents information relating to the weather of a region to which the community belongs, notification data that represents information to be notified to the user of each house H, and target value data that represents a target value of the power consumption amount consumed during a predetermined period within the house H are included. As the notification data representing the information to be notified to the user of each house H, for example, there is information notifying that the above-described target value has not been set or ranking information (hereinafter, referred to as energy saving ranking) of the amount of reduction of the power consumption amount within the community in each house H.

[0094]

Such provision information data is stored in the CS-side storage unit

42 that is configured by an auxiliary storage device such as an HDD, and data to be transmitted is read in accordance with the content of a data transmission request from the home server 10 and thereafter is transmitted to the home server 10.

[0095]

<<Features of Energy Management System According to this Embodiment>>

In this system S, as the home server 10 communicates with each power consumption apparatus and the sensors 21, 22a, 22b, and 23a to 23c through the home network TN, the monitoring and the controlling of each power consumption apparatus are performed in a unified manner. In addition, based on the data (more specifically, the above-described response data) transmitted from the home server 10, the energy management screen is drawn on the touch panel 31 of the portable terminal 30, and the measurement results acquired by the sensors 21, 22a, 22b, and 23a to 23c are displayed on the screen. Accordingly, the power demand-supply balance of the inside of the house H can be visualized (visually represented), and the user can visually recognize the power demand-supply balance of the inside of the house H by viewing the above-described energy management screen.

[0096]

However, as described under section “PROBLEM TO BE SOLVED BY THE INVENTION”, in the user’s viewing of the above-described energy management screen, an effort such as an operation for operating the portable terminal 30 is necessary. Since such an effort is necessary, it is inconvenient for the user to check the status of the power demand and supply of the inside of the house H, and it is difficult to urge an energy

saving behavior. On the other hand, when a constant conductive state is formed with the portable terminal 30 being operated, unnecessary power is consumed by the portable terminal 30.

[0097]

In consideration of the above-described situation, in this system S, as an interface used when the control of the power consumption apparatus or the monitoring of the power demand-supply status of the inside of the house H is performed, in addition to the portable terminal 30, the robot 50 that is the notification apparatus is disposed. By using this robot 50, the user can acquire information of various places starting from the information relating to the power demand-supply balance of the inside of the house H in a simpler manner. In addition, the robot 50 according to this embodiment can respond also to a case (in other words, the information to be notified is diversified) where there are a plurality of types of information to be notified.

Hereinafter, a configuration example and an operation example of the robot 50 according to this embodiment will be described with reference to Figs. 6 to 14.

[0098]

<Configuration Example of Robot 50>

Hereinafter, a configuration example of the robot 50 according to this embodiment will be described.

In describing the configuration example of the robot 50, the function included in the robot 50 will now be overviewed. The robot 50 receives a performance request transmitted from the home server 10 (more specifically, the robot driving unit 105) and performs a predetermined notification

operation. In order to request the performance of a notification operation, when the home server 10 receives data by communicating with the sensors 21, 22a, 22b, and 23a to 23c or the CEMS server 40, a signal to be transmitted to the robot 50 is generated by the robot driving unit 105 based on the reception data.

[0099]

Meanwhile, when the performance request of a notification operation is received, the robot 50 analyzes the request and performs the notification operation such that the user is notified of information according to the result of the analysis. Here, the performance request of the notification operation, as described above, is based on the reception data received by the home server 10 from the sensors 21, 22a, 22b, and 23a to 23c or the CEMS server 40, and the information to be notified to the user is the content represented by the reception data. Accordingly, the robot 50 performs the notification operation according to the reception data based on the reception data of the home server 10.

[0100]

Then, the robot 50 according to this embodiment, as described above, selects and performs one or more operations out of a light emitting operation for emitting light in a light emission form according to the information (in other words, the above-described reception data; hereinafter the same) to be notified, a sound generating operation for giving off a sound according to the information to be notified, and a vibration operation for generating vibration in accordance with the information to be notified as the notification operation.

[0101]

In order to perform the above-described three types of notification operations, the robot 50, as illustrated in Fig. 6, includes a light emitting mechanism 51, a sound generating mechanism 52, and a vibration mechanism 53. In addition, the robot 50 includes a controller 54 as a control unit that controls such mechanisms 51, 52, and 53. Furthermore, the above-described units (in other words, the light emitting mechanism 51, the sound generating mechanism 52, the vibration mechanism 53, and the controller 54) of the robot 50 are attached to the inside of the robot 50, more specifically, a frame not illustrated in the figure, and the frame is covered with a cover member 50a that is formed using rubber having a light transmitting property. This cover member 50a defines the external shape of the robot 50 and is elastically transformed (see (D) of Fig. 7) so as to be squeezed when the user grasps it.

[0102]

The light emitting mechanism 51 performs a light emitting operation for emitting light in a light emission form according to the information (reception data) to be notified. This light emitting mechanism 51 is configured by a known light emitting device (light source) such as an LED device. When the light emitting mechanism 51 performs the light emitting operation, the light is transmitted through the cover member 50a, and, as illustrated in (A) of Fig. 7, the whole robot 50 emits light.

Here, the light emission form at the time when the light emitting mechanism 51 performs the light emitting operation is a concept that represents the performance condition of the light emitting operation, and

more particularly, there are a light emission color, a light emission intensity (illuminance), a light emission mode (selection of turning-on or blinking), a blinking speed, and the like. The light emitting mechanism 51 performs switching between light emission forms in accordance with the category or the content of the information to be notified, and, in this embodiment, the light emission color, the light emission mode, and the blinking speed are changed.

[0103]

The sound generating mechanism 52 performs a sound generating operation for giving off a sound according to the information (reception data) to be notified. This sound generating mechanism 52 is configured by a known sound reproduction apparatus such as a small digital audio player and has a memory (not illustrated in the figure) in which a plurality of sound files are stored built therein. Then, the sound generating mechanism 52 reproduces a sound file that corresponds to the information to be notified out of the plurality of sound files stored in the memory. Accordingly, as illustrated in (B) of Fig. 7, a sound recorded in the above-described sound file is given off from a speaker (not illustrated in the figure). While the sound generating mechanism 52 according to this embodiment reproduces a sound file from electronic data, the present invention is not limited thereto, but, for example, a sound recorded in a tape, a compact disk, or the like may be configured to be reproduced.

[0104]

The vibration mechanism 53 performs a vibration operation for generating a vibration in accordance with the information (reception data) to

be notified. This vibration mechanism 53 is configured by a known vibration imparting device such as a vibrator. Thus, when the vibration operation is performed, as illustrated in (C) of Fig. 7, the entire robot 50 is vibrated. The vibration operation is performed so as to allow the user to be aware of a notification of predetermined information from the robot 50, and, in this embodiment, the vibration operation is performed for all the information notified from the robot 50. In other words, the robot 50 according to this embodiment performs the vibration operation first for attracting user's attention in notifying the user of the information.

[0105]

The controller 54, as illustrated in Fig. 6, is configured by a CPU 54a, a memory 54b, a communication interface 54c, a control circuit 54d, and the like and transmits/receives data to/from the home server 10 (more specifically, the robot driving unit 105) through a USB circuit in a state in which the USB connector 50b is connected to the USB port of the home server 10.

[0106]

In this embodiment, as described above, the power supply of the robot 50 is linked to the power supply of the home server 10, and, while the home server 10 is in the conductive state, power is supplied to the robot 50 from the home server 10 side through the USB circuit. From the viewpoint of performing the monitoring and controlling of the power demand-supply status of the inside of the house H, the home server 10 is in a constantly conductive state and accordingly, is in the constantly conductive state also for the robot 50. On the other hand, when the robot 50 performs the

notification operation, the state of the robot 50 is in the conductive state. In other words, in this embodiment, the robot 50 is constantly in the state in which the notification operation can be performed and immediately responds to the home server 10 and performs the notification operation when there is a request for performing the notification operation from the home server 10. However, the present invention is not limited to the above-described configuration. Thus, it may be configured such that the state of the robot 50 is changed based on timer control such that the robot 50 is generally in the conductive state but is in the non-conductive state (power-off state) in a predetermined time zone (for example, night time).

[0107]

In addition, in this embodiment, the power (power consumed for each unit time, and, hereinafter, the same) consumed by the robot 50 that is in the conductive state is smaller than the power consumed by the portable terminal 30 that is in the conductive state. In other words, the power consumption amount of a case where the robot 50 that is in the constantly conductive state is slightly smaller than that of a case where the portable terminal 30 is in the constantly conductive state.

[0108]

When the request for performing the notification operation is received from the home server 10, the controller 54 performs at least one or more of the light emitting operation performed by the light emitting mechanism 51, the sound generating operation performed by the sound generating mechanism 52, and the vibration operation performed by the vibration mechanism 53 as the notification operation in accordance with the

performance request.

[0109]

More specifically, when the request for performing the notification operation is received from the home server 10, the controller 54 analyzes the performance request and specifies a category of information (in other words, the information to be notified to the user through the notification operation) to be notified. In other words, in the performance request transmitted from the home server 10, data representing the category of the information to be notified is embedded, the controller 54 specifies the category based on the data. After the category of the information to be notified is specified, the controller 54 selects an operation corresponding to the above-described category from among the light emitting operation, the sound generating operation, and the vibration operation and performs the selected operation as the notification operation.

[0110]

In this embodiment, as the categories of the information to be notified, there are “the current value of the unit rate of the system power”, “a power-saving request”, “the weather of a region to which the community belongs”, “no set target value”, and “energy saving ranking”.

In addition, in the categories of the information to be notified, in addition to the above-described categories, a calculation result (hereinafter, referred to as a “calculation result of the ratio”) acquired by calculating the ratio of an accumulated value of the power consumption amount actually consumed inside the house H during a predetermined period to a target value during the predetermined period, information (hereinafter, referred to

as “control completion”) used for notifying that the control of the operating state of the power consumption apparatus that is the control target apparatus has been completed, and information (hereinafter, referred to as “instantaneous power consumption increase”) used for reporting that the instantaneous power consumption of the house H has increased to be at a predetermined level or higher are included.

[0111]

The correspondence relation between the category of information to be notified and an operation performed as the notification operation is formed as a table and is stored in the memory 54b. The controller 54 (more specifically, the CPU 54a) specifies an operation corresponding to the category of the information to be notified by referring to the table and performs the specified operation as the notification operation. In this embodiment, the correspondence relation between the category of information to be notified and an operation performed as the notification operation is configured as below.

Category “Current value of Unit Rate of System Power”: Light Emitting Operation, Sound Generating Operation, Vibration Operation

Category “Power-Saving Request”: Sound Generating Operation, Vibration Operation

Category “Weather of Region”: Sound Generating Operation, Vibration Operation

Category “No Set Target Value”: Sound Generating Operation, Vibration Operation

Category “Energy Saving Ranking”: Sound Generating Operation, Vibration

Operation

Category “Calculation Result of Ratio”: Light Emitting Operation, Vibration Operation

Category “Control Completion”: Sound Generating Operation, Vibration Operation

Category “Instantaneous Power Consumption Increase”: Light Emitting Operation, Vibration Operation

[0112]

In addition, the controller 54 analyzes the request for performing a notification operation received from the home server 10 and specifies the content of information to be notified. In other words, in the performance request transmitted from the home server 10, data representing the content of information to be notified is embedded, and the controller 54 specifies the content of the information based on the data. Here, the content of the information to be notified is a concept that represents the current state of each one of the above-described categories, and, for example, in the case of the information of the category “Weather of Region”, “Clear”, “Cloud”, and “Rain” correspond to the contents. After the content of the information to be notified is specified, the controller 54 performs operations corresponding to the above-described categories out of the light emitting operation, the sound generating operation, and the vibration operation in a form corresponding to the specified content of the information.

[0113]

More specifically, in a case where the light emitting operation is performed as the notification operation, the light emitting operation is

performed in a light emission form corresponding to the specified content of the information. Here, the correspondence relation between the information content and the light emission form, as illustrated in Fig. 8, is formed as a table and is stored in the memory 54b. Thus, the controller 54 performs the light emitting operation in a light emission form corresponding to the specified content of the information by referring to the table.

[0114]

More specifically, for example, in a case where the category of the information to be notified is “Calculation Result of Ratio”, the light emitting mechanism 51 performs the light emitting operation in a predetermined light emission color, and the light emission color is determined based on the correspondence relation described in Table (1) represented in Fig. 8. For example, in a case where the above-described ratio is less than 50%, the light emission color is light blue, and, in a case where the above-described ratio is in the range of 51% to 70%, the light emission color is blue.

[0115]

In addition, in a case where the category of the information to be notified is “Instantaneous Power Consumption Increase”, the light emitting mechanism 51, as illustrated in Table (2) represented in Fig. 8, performs the light emitting operation while changing the light emission color.

Furthermore, in a case where the category of the information to be notified is “Current value of Unit Rate of System Power”, the light emitting mechanism 51 performs the light emitting operation in the blinking mode, and the blinking speed (blinking interval) is determined based on the correspondence relation described in Table (3) represented in Fig. 8. For

example, in a case where the current value of the unit rate is 0.5 times or less the standard rate, blinking is performed at the interval of 10 sec. On the other hand, in a case where the current value is in the range of 0.6 to 0.8 times the standard rate, blinking is performed at the interval of 8 sec.

[0116]

On the other hand, in a case where the sound generating operation is performed as the notification operation, a sound file corresponding to the specified information content is reproduced, and a sound recorded in the file is given off. Here, the correspondence relation between the information content and the sound (in other words, the sound file) is formed as a table as illustrated in Fig. 9 and is stored in the memory 54b, and the controller 54 performs the sound generating operation for giving off a sound corresponding to the specified information content by referring to the table.

[0117]

More specifically, for example, in a case where the category of information to be notified is “Power-Saving Request”, the controller 54 causes the sound generating mechanism 52 to reproduce a sound file in which a sound of “Save Power! Save Power!” is recorded.

In addition, in a case where the category of information to be notified is “Current value of Unit Rate of System Power”, the controller 54 compares the current value of the unit rate with the unit rate at the time of performing the notification operation for the same category in the previous time. Then, in a case where the current value is lower than the unit rate of the previous time, the controller 54 causes the sound generating mechanism 52 to reproduce a sound file in which a sound of “Rate Becomes Lower” is recorded.

On the other hand, in a case where the current value is higher than the unit rate of the previous time, the sound generating mechanism 52 is caused to reproduce a sound file in which a sound of “Rate Becomes Higher” is recorded.

[0118]

Furthermore, in a case where the category of information to be notified is “Control Completion”, the controller 54 causes the sound generating mechanism 52 to reproduce a sound file in which a sound of “Control Has Been Completed” is recorded. In addition, in a case where the category of information to be notified is “No Set Target Value”, the sound generating mechanism 52 is caused to reproduce a sound file in which a sound of “Target Value Has Not Been Set” is recorded.

In addition, in a case where the category of information to be notified is “Energy Saving Ranking”, the controller 54 compares the current ranking with the ranking at the time of performing the notification operation for the same category in the previous time. In a case where the rank is raised, the sound generating mechanism 52 is caused to reproduce a sound file in which a sound of “Rank Up” is recorded. On the other hand, in a case where the rank is lowered, the sound generating mechanism 52 is caused to reproduce a sound file in which a sound of “Rank Down” is recorded. Furthermore, in a case where there is no change in the rank, the sound generating mechanism 52 is caused to reproduce a sound file in which a sound of “Rank Remains Same” is recorded.

In a case where the category of information to be notified is “Weather of Region”, the controller 54 reproduces a sound file in which a sound of

“Today, It Is Clear” is recorded in a case where the weather of the day is clear, reproduces a sound file in which a sound of “Today, It Is Cloud” is recorded in a case where the weather of the day is cloud, and reproduces a sound file in which a sound of “Today, It Is Rainy” is recorded in a case where the weather of the day is rainy in the region.

[0119]

In this embodiment, the vibration operation is configured to be performed in the same form (for example, the same vibration time) regardless of the category and the content of information to be notified. However, the present invention is not limited thereto, but the performance form of the vibration operation may be changed in accordance with the category and the content of information to be notified.

[0120]

As described until now, the robot 50 according to this embodiment automatically performs the notification operation when a performance request is received from the home server 10. Accordingly, the robot 50 notifies the user of information of various places including the information relating to the power demand-supply status of the inside of the house H. From the viewpoint of the user, since notification of various kinds of information is automatically given in accordance with the notification operation of the robot 50 without particularly requiring an operation, the user can acquire information in a simple manner. In other words, according to the robot 50 of this embodiment, notification of information can be given in a simple manner without particularly requiring a user's operation.

[0121]

As above, according to this embodiment, since notification of information is given without particularly requiring a user's operation, the user can be allowed to be easily aware of his energy consumption behavior, and accordingly, a change for user's taking another look at the energy consumption behavior can be easily given.

[0122]

In addition, the robot 50 according to this embodiment performs the above-described three types of notification operations, and a plurality of performance patterns of the light emitting operation and the sound generating operation are prepared in accordance with the category and the content of information to be notified. Here, the performance pattern is the light emission form at the time of performing the light emitting operation (in this embodiment, the light emission color, the light emission mode, and the blinking speed) or the content of a sound generated at the time of performing the sound generating operation.

[0123]

By switching between the types and the performance patterns of the notification operation to be performed in accordance with information to be notified, even a case where the information to be notified is diversified (in other words, a case where there are a plurality of types of information to be notified) can be sufficiently responded.

In addition, for example, by changing the light emission color, the light emission mode, the blinking speed, and the like of the light emitting operation, notification of a plurality of kinds of information can be given simultaneously. More specifically, by changing the light emission color and

the blinking speed, information relating to the category “Calculation Result of Ratio” and the information relating to the category “Current value of Unit Rate of System Power” can be simultaneously notified.

[0124]

Furthermore, in this system S, the portable terminal 30 and the robot 50 are used together as the apparatuses used by the user for checking information relating to the power demand-supply status of the inside of the house H. Accordingly, the effect (effectiveness) of disposing the robot 50 is further improved.

More specifically, while the portable terminal 30 can provide more information than the robot 50, the portable terminal 30 requires efforts such as a starting operation for the user. In contrast to this, the robot 50 can notify the user of information in a simple manner without requiring a starting operation or the like, which is useful for the user. Thus, the effect thereof is more significant than that of a case where the robot 50 is individually disposed (in other words, a case where the portable terminal 30 is not used together).

[0125]

In addition, as described above, the power consumed by the robot 50 that is in the conductive state is smaller than the power consumed by the portable terminal 30 that is in the conductive state, and accordingly, the power consumption amount of a case where the robot 50 is in the constant conductive state is slightly smaller than the power consumption amount of a case where the portable terminal 30 is in the constantly conductive state. In other words, when the user desires information having a simple content

as the information relating to the power demand-supply status of the inside of the house H, in a case where the robot 50 is in the constant conductive state, the power consumption amount can be further reduced to some extent more than in a case where the portable terminal 30 is in the constant conductive state. Accordingly, in user's acquiring information relating to the power demand-supply status of the inside of the house H, by allowing the robot 50 to be in the constantly conductive state, acquiring simple information through the notification operation of the robot 50, and then operating the portable terminal 30 in a case where more detailed information is desired to be checked, an appropriate energy management behavior considering the power consumption amount can be realized.

[0126]

While the robot 50 according to this embodiment has the configuration for performing the notification operation described until now, the function for receiving an operation performed when the user controls the operating state of the power consumption apparatus is implemented therein. In other words, in this embodiment, the user can perform the operation performed when the operating state of the power consumption apparatus is controlled not only through the energy management screen drawn on the touch panel 31 of the portable terminal 30 but also through the robot 50.

[0127]

The configuration included in the robot 50 for receiving a user's operation performed when the operating state of the power consumption apparatus is controlled will now be described. In the robot 50, as illustrated in Fig. 6, the operation receiving mechanism 55 is included. This operation

receiving mechanism 55 receives an operation performed when the user controls the operating state of the power consumption apparatus, and, in this embodiment, is configured by a known operation receiving mechanism such as a pressure sensor arranged between a frame present inside the robot 50 and the cover member 50a covering the frame.

[0128]

The operation receiving mechanism 55 will now be described in detail. When the user, as illustrated in (D) of Fig. 7, performs an operation (hereinafter, referred to as a grasping operation) for grasping the robot 50 (more precisely, a position near a portion at which the operation receiving mechanism 55 is disposed) so as to be squeezed, the operation receiving mechanism 55 configured by the pressure sensor receives the grasping operation. Such a grasping operation corresponds to the operation performed when the user controls the operating state of the power consumption apparatus.

[0129]

When the grasping operation is received, the operation receiving mechanism 55 generates a signal and transmits the signal to the controller 54. When the signal transmitted from the operation receiving mechanism 55 is received, the controller 54 transmits a request for performing the control process for controlling the operating state of the power consumption apparatus to the home server 10 based on the signal (in other words, based on the grasping operation received by the operation receiving mechanism 55). When the request for performing the control process is received from the robot 50 side, the home server 10 (more specifically, the above-described

apparatus control unit 104) generates a control signal and transmits the control signal to the power consumption apparatus that is the control target apparatus out of the power consumption apparatuses disposed inside the house H.

[0130]

As above, the robot 50 according to this embodiment has the function (remote control function) for remotely controlling the operating state of the power consumption apparatus that is the control target apparatus in addition to the above-described function for performing the notification operation. As a result, the robot 50 that is the notification apparatus of information is easy for the user to use, and the convenience of the robot 50 is improved.

[0131]

In addition, in this embodiment, in a case where the home server 10 receives the request for performing the control process from the robot 50 side, the apparatus control unit 104 of the home server 10 generates and transmits control signals for all the power consumption apparatuses disposed inside the house H as the control target apparatuses except for the apparatuses (for example, the home server 10, a refrigerator, and the like) that need to be constantly operated and more particularly, generates and transmits control signals for turning off the power supply of the control target apparatuses. However, the present invention is not limited thereto, and control signals may be generated and transmitted only for apparatuses that are particularly designated by the user out of the power consumption apparatuses disposed inside the house H as the control target apparatuses.

[0132]

Furthermore, in this embodiment, when the operation receiving mechanism 55 repeatedly receives a plurality of grasping operations (more precisely, in a case where a plurality of grasping operations are received within a predetermined time), the controller 54 transmits the request for performing the control process to the home server 10.

[0133]

More specifically, as illustrated in Fig. 10, in accordance with the number of times of performing the grasping operation (in other words, the number of grasping operations received by the operation receiving mechanism 55), the response operation of the robot 50 differs. Only for a case where the number of times of performing the grasping operation is three, the controller 54 transmits a request for performing the control process to the home server 10. Accordingly, the remote control of the power consumption apparatuses using the robot 50 can be prevented from erroneously performed (erroneous operation).

[0134]

In other words, in a case where a user or the like unintentionally performs the grasping operation, when the controller 54 transmits the request for performing the control process to the home server 10 based on the grasping operation, the operating state of the power consumption apparatus changes against the user's intension. In contrast to this, in this embodiment, since the number of times of performing the grasping operation for transmitting the request for performing the control process is set to three times, even when the user or the like erroneously performs the grasping

operation once or twice, the transmission of the request for performing the control process from the robot 50 against the user's intension can be avoided.

[0135]

Hereinafter, the correspondence relation between the number of times of performing the grasping operation and the response operation of the robot 50 will be described more specifically.

First, in a case where the grasping operation is received only once within a predetermined time, the operation receiving mechanism 55 generates a signal representing that one grasping operation has been received and transmits the generated signal to the controller 54. The controller 54 that has received the signal requests the external data acquiring unit 101 of the home server 10 to communicate with the CEMS server 40, and accordingly, the external data acquiring unit 101 requests the CEMS server 40 to transmit data and acquires provision information data from the CEMS server 40. Then, when the robot driving unit 105 of the home server 10 transmits the request for performing a notification operation according to the acquired provision information data to the robot 50, on the robot 50 side, the controller 54 performs an operation corresponding to the above-described provision information data out of the light emitting operation, the sound generating operation, and the vibration operation as the notification operation.

[0136]

In this embodiment, as the notification operation performed by the robot 50 in a case where the grasping operation is received only once, a sound generating operation that gives off a predetermined sound (for example, a

sound corresponding to the weather of a region) is assumed to be performed.
[0137]

Next, in a case where the grasping operation is received twice within a predetermined time, the operation receiving mechanism 55 generates a signal representing that the grasping operation has been received twice and transmits the generated signal to the controller 54. The controller 54 that has received the signal reproduces the sound file, which has been reproduced at the time of previously performing the sound generating operation, again by controlling the sound generating mechanism 52 and performs the sound generating operation such that the sound that is the same as that of the previous sound generating operation is given off. In this way, the sound file reproduced by the previous sound generating operation can be reproduced again, and accordingly, for example, even in a case where the sound generating operation as the notification operation is performed while the user is absent from the house H, the user can check the content of the sound generating operation (in other words, the content of the sound generating operation that the user has missed) after returning to the house.

[0138]

In addition, in a case where the grasping operation is received three times within the predetermined time, the operation receiving mechanism 55 generates a signal representing that the grasping operation has been received three times or more and transmits the generated signal to the controller 54. The controller 54 that has received the signal, as described above, transmits the request for performing the control process to the home server 10 and performs the sound generating operation for giving off a

predetermined sound (for example, a sound representing that the request for performing the control process has been transmitted) by controlling the sound generating mechanism 52.

[0139]

In accordance with the above-described correspondence relation, the request for performing the control process is transmitted from the robot 50 (more precisely, the controller 54) to the home server 10. In this embodiment, while the number of times of performing the grasping operation for transmitting the request for performing the control process is set to three, the present invention is not limited thereto, and an arbitrary number of times that is at least twice or more may be set.

[0140]

<Example of Operation of Robot 50>

Next, an example of the operation of the robot 50 having the configuration described until now will be described. In describing the example of the operation of the robot 50, hereinafter, a series of operations (hereinafter, referred to as an information notification process) performed until the robot 50 is caused to perform the notification operation and a series of operations (hereinafter, referred to as an apparatus control process) after the robot 50 receives the grasping operation performed when the operating state of the power consumption apparatuses is controlled by the user will be described.

[0141]

(1) Information Notification Process

Hereinafter, the sequence of the information notification process will

be described. First, the information notification process of a case where the category of the information to be notified is “Calculation Result of Ratio” will be described as an example with reference to Fig. 11.

In starting the information notification process for information relating to the “Calculation Result of Ratio”, the user inputs a target value of the power consumption amount consumed in the house H for a predetermined period, and target value data representing the target value is stored in the CS-side storage unit 42 of the CEMS server 40.

[0142]

In the above-described state, the external data acquiring unit 101 of the home server 10 requests the CEMS server 40 to transmit the target value data by communicating with the CEMS server 40 through the outside-home network GN (S001). In accordance with the request for data transmission, the information notification process is started. In this embodiment, the request for data transmission is performed at the interval of about 30 minutes. Accordingly, in this embodiment, the information notification process for the information relating to the “Calculation Result of Ratio” is performed at the interval of about 30 minutes. However, the present invention is not limited thereto, and the interval at which the information notification process for the information relating to the “Calculation Result of Ratio” is performed may be arbitrarily set.

[0143]

Next, when the request for data transmission is received from the home server 10 (S002), the CEMS server 40 specifies the home server 10 that is the transmission source of the request, then reads target value data

corresponding to the specified home server 10 from the CS-side storage unit 42, and transmits the target value data to the home server 10 (S003).

[0144]

Thereafter, in the home server 10, the external data acquiring unit 101 receives the target value data transmitted from the CEMS server 40 through the outside-home network GN (S004). In addition, in this embodiment, in accordance with the reception of the target value data, the measurement result data acquiring unit 102 requests the sensor 21 that is configured by a smart meter to transmit measurement result data and receives the measurement result data from the sensor 21 (S005). Such measurement result data is data that represents a measurement value (information according to the measurement result) acquired when an accumulated value of the power consumption amount actually consumed inside the house H from the start of a period to which the target value is applied to the current time point is measured.

[0145]

Then, when the home server 10 receives the above-described measurement result data and the target value data, based on such data, the robot driving unit 105 specifies the target value for a predetermined period and an accumulated value of the power consumption amount actually consumed inside the house H for the predetermined period and calculates the ratio of the accumulated value to the above-described target value (S006). Thereafter, the robot driving unit 105 transmits a request for performing a notification operation according to the calculated ratio to the robot 50 (S007).

[0146]

On the robot 50 side, the controller 54 receives the request for performing a notification operation from the robot driving unit 105 through the USB circuit (S008), analyzes the performance request, specifies the category of information to be notified, and then, determines an operation corresponding to the specified category out of the light emitting operation, the sound generating operation, and the vibration operation as the notification operation to be performed (S009). After the category of the notification operation to be performed is determined, the controller 54 performs the determined notification operation by controlling the light emitting mechanism 51, the sound generating mechanism 52, and the vibration mechanism 53 (S0010). In the case of this specific example, since the category of the information to be notified is “Calculation Result of Ratio”, the light emitting operation and the vibration operation are performed by the robot 50 as the notification operations.

[0147]

In addition, in a case where the light emitting operation is performed as the notification operation, the controller 54 of the robot 50 specifies the content together with the category of the information to be notified and causes the light emitting mechanism 51 to perform the light emitting operation in a light emission form corresponding to the specified content.

[0148]

According to the series of sequences described until now, the robot 50 performs the light emitting operation and the vibration operation as the notification operations, and the user is notified of the ratio of the accumulated value of the actual consumption amount to the target power

consumption amount. As a result of this, a chance for reviewing the power demand-supply status of the inside of the house H and the energy consumption behavior of the user can be given to the user. In other words, since the user can check the amount of electric power that has been actually consumed until now to the target power consumption amount through the notification operation of the robot 50 in a simple manner, a chance for reviewing the energy consumption behavior performed thereafter may be easily given.

[0149]

In the above-described example, as the notification operations used for giving a notification of the ratio of the accumulated value of the actual consumption amount to the target power consumption amount, while the light emitting operation and the vibration operation are configured to be performed, the present invention is not limited thereto, and at least one or more of the light emitting operation, the sound generating operation, and the vibration operation may be performed as the notification operations.

[0150]

In the above-described example, while it has been described that the target value data representing the target value of the power consumption amount is stored in the CS-side storage unit 42 of the CEMS server 40, and, in calculating the ratio of the accumulated value of the actual consumption amount to the target power consumption amount, the target value data is acquired by communicating with the CEMS server 40 through the outside-home network GN, the present invention is not limited thereto. For example, the target value data may be configured to be stored in the home

server 10 (more specifically, the memory 10b or the non-volatile storage device 10c). In the case of such a configuration, as illustrated in Fig. 12, in calculating the ratio of the accumulated value of the actual consumption amount to the target power consumption amount, the target value data stored in the home server 10 is read (S011). The sequences S012 to S017 after the target value data is read are the same as the sequences S005 to S010 described in the example described above, and thus the description thereof will be omitted.

[0151]

Next, the information notification process of a case where the category of the information to be notified is “Current value of Unit Rate of System Power” will be described as an example with reference to Fig. 13.

The unit rate (in other words, the electric utility rate) of the system power changes in accordance with the time zone as described above, and, in a case where the unit rate changes, unit rate data representing the unit rate (in other words, the current value of the unit rate of the system power) after the change is delivered from the CEMS server 40 to the home server 10 disposed in each house H within the community (S021). This unit rate data is provision information data delivered by the CEMS server 40 and, for example, is generated in advance based on the rate system of the electric utility rate set by the power company, and, when it is time when the unit rate of the system power changes, the unit rate data is automatically delivered.

[0152]

Thereafter, in the home server 10, the external data acquiring unit

101 receives the unit rate data transmitted from the CEMS server 40 through the outside-home network GN (S022). Then, when the unit rate data is acquired on the home server 10 side, the robot driving unit 105 specifies the current value of the unit rate of the system power based on the unit rate data and then transmits a request for performing a notification operation according to the specified current value of the unit rate of the system power to the robot 50 (S023).

[0153]

On the robot 50 side, the controller 54 receives the request for performing the notification operation from the robot driving unit 105 through the USB circuit (S024), analyzes the performance request, specifies the category of information to be notified, and then, determines an operation corresponding to the specified category out of the light emitting operation, the sound generating operation, and the vibration operation as the notification operation to be performed (S025). After the category of the notification operation to be performed is determined, the controller 54 performs the determined notification operation by controlling the light emitting mechanism 51, the sound generating mechanism 52, and the vibration mechanism 53 (S026). In this specific example, since the category of the information to be notified is “Current value of Unit Rate of System Power”, the light emitting operation and the vibration operation are performed as the notification operations in the robot 50. More specifically, for example, in order to notify the user of an update of the current value of the unit rate of the system power, the robot 50 performs the vibration operation using the vibration generating mechanism 53 and performs the

light emitting operation using the light emitting mechanism 51 in a light emission form corresponding to the current value of the unit rate after update (more specifically, a light emission color that corresponds to the current value of the unit rate after the update).

[0154]

According to the series of sequences described until now, the robot 50 performs the light emitting operation and the vibration operation as the notification operations, and, as a result, the user can be notified of the current value of the unit rate of the system power. Accordingly, a chance for reviewing the energy consumption behavior of the user is given to the user, and the user's awareness of energy saving can be recalled.

[0155]

In the above-described example, as the notification operations used for giving a notification of the current value of the unit rate of the system power, while the light emitting operation and the vibration operation are described to be performed, the present invention is not limited thereto, and at least one or more of the light emitting operation, the sound generating operation, and the vibration operation may be performed as the notification operations.

[0156]

In addition, in the example described above, a case has been described in which the unit rate data representing the current value of the unit rate of the system power, which is included in the provision information data delivered by the CEMS server 40, is received by the home server 10, also in a case where the other provision information data, for example, the

power-saving request data, the weather data, or the like is received, according to the above-described sequence, a notification operation corresponding to the data may be configured to be performed.

[0157]

Furthermore, in a case where the sensor 21 transmits the above-described report data (data used for giving a notification indicating that the instantaneous power consumption in the house H is equal to a predetermined level or more), and the report data is received on the home server 10 side, the robot driving unit 105 requests the robot 50 to perform a notification operation for giving a notification indicating that the instantaneous power consumption has increased. Thereafter, according to the above-described sequences (S024 to 026), on the robot 50 side, the light emitting operation and the vibration operation are performed as notification operations corresponding to a category “Instantaneous Power Consumption Increase”. In addition, the light emitting operation performed in correspondence with the above-described category “Instantaneous Power Consumption Increase”, as described above, is performed while the emission color is changed.

[0158]

In addition, in a case where the control completion signal that is transmitted at the time of completing the control of the power consumption apparatus (control target apparatus) of which the operating state is controlled is received by the apparatus control unit 104 of the home server 10, the robot driving unit 105 requests the robot 50 to perform a notification operation used for giving a notification of the completion of the control.

Thereafter, according to the sequences (S024 to 026) as described above, on the robot 50 side, the sound generating operation and the vibration operation are performed as the notification operations corresponding to the category “Control Completion”.

[0159]

(2) Apparatus Control Process

Hereinafter, the apparatus control process will be described with reference to Fig. 14.

First, when the user performs an operation (grasping operation) of grasping the robot 50, on the robot 50 side, the operation receiving mechanism 55 receives the grasping operation (S031). Here, in a case where the number of times of performing the grasping operation received within a predetermined time by the operation receiving mechanism 55 is one (“once” in S032), the controller 54 of the robot 50 requests the external data acquiring unit 101 of the home server 10 to communicate with the CEMS server 40 (S033). Accordingly, the external data acquiring unit 101 requests the CEMS server 40 to transmit data (S034), and the CEMS server 40 delivers provision information data (more specifically, weather data) in accordance with the request (S035).

[0160]

Then, when the external data acquiring unit 101 receives the provision information data from the CEMS server 40 (S036), the robot driving unit 105 transmits a request for performing a notification operation according to the provision information data to the robot 50 (S037). On the robot 50 side, when the request for performing the notification operation is

received from the home server 10 side (S038), the controller 54 performs the operation corresponding to the above-described provision information data as the notification operations (S039). In this embodiment, since the provision information data transmitted from the CEMS server 40 is the weather data, the robot 50 performs the sound generating operation for giving off a sound according to the weather of the region as the notification operation.

[0161]

Next, a case will be described in which the number of times of performing the grasping operation received within the predetermined time by the operation receiving mechanism 55 is two (“twice” in S032). The controller 54 of the robot 50 specifies a sound file that is reproduced by the sound generating mechanism 52 at the time of performing the sound generating operation in the previous time (S040). Such a sound file specifying process is performed by the CPU 54a referring to a reproduction history of the sound file stored in the memory 54b. Then, after the specifying of the sound file is completed, the controller 54 reproduces the sound file reproduced in the previous time by controlling the sound generating mechanism 52 and thereby performs the sound generating operation for giving off the same sound as that of the previous time (S041).

[0162]

Next, a case will be described in which the number of times of performing the grasping operation received within the predetermined time by the operation receiving mechanism 55 is three (“three times” in S032). In this case, by performing the apparatus control process, the operating

states of the power consumption apparatuses disposed inside the house H are controlled by the apparatus control unit 104 of the home server 10.

[0163]

In other words, in this embodiment, in a step in which the operation receiving mechanism 55 receives the user's grasping operation three times within the predetermined time, first, the controller 54 transmits a request for performing the control process for controlling the operating state of the power consumption apparatus to the home server 10 (S042). In addition, as described above, the controller 54 transmits a request for performing the control process to the home server 10 and performs the sound generating operation for giving off a predetermined sound (for example, a sound representing that the request for performing the control process is transmitted) by controlling the sound generating mechanism 52 (S042).

[0164]

On the home server 10 side that has received the request for performing the control process, the apparatus control unit 104 performs the control process (S043). In other words, a control signal is transmitted to a control target apparatus out of the power consumption apparatuses used in the house H. In addition, as described above, in this embodiment, when the home server 10 receives the request for performing the control process from the robot 50 side, control signals for turning off the power are transmitted to all the apparatuses except for apparatuses (for example, the home server 10, a refrigerator, and the like) that need to be constantly operated out of the power consumption apparatuses disposed inside the house H.

[0165]

Then, in a step in which the control of the operating state of the control target apparatus is completed, the apparatus control unit 104 receives a control completion signal from the control target apparatus (S044), and, after the reception of the control completion signal, the robot driving unit 105 transmits a request for performing the notification operation according to the control completion signal to the robot 50 (S045). When the above-described performance request is received (S046), the controller 54 analyzes the performance request, specifies the category of information to be notified, and determines an operation corresponding to the specified category out of the light emitting operation, the sound generating operation, and the vibration operation as the notification operations to be performed (S047). After the category of the notification operation to be performed is determined, the controller 54 performs the determined notification operation by controlling the light emitting mechanism 51, the sound generating mechanism 52, and the vibration mechanism 53 (S048).

[0166]

More specifically, the category of the information to be notified is specified as “Control Completion”, and the sound generating operation for generating a sound representing the completion of the control process and the vibration operation are performed as the notification operations. In addition, in this embodiment, in giving a notification of the information of the category “Control Completion”, while the light emitting operation and the vibration operation are configured to be performed, the present invention is not limited thereto, and at least one or more of the light emitting operation, the sound generating operation, and the vibration operation may be

performed.

[0167]

<<Other Embodiments>>

In the above-described embodiment, mainly, the information notification system according to the present invention has been described. However, the above-described embodiment is for easy understanding of the present invention but is not for the purposes of limiting the present invention. The present invention may be changed or improved without departing from the concept thereof, and it is apparent that equivalents thereof are included therein.

[0168]

In addition, in the above-described embodiment, while the home server 10 communicating with both the sensor 21 as a measurement device that measures an energy consumption amount of the inside of the house H and transmits the measurement result data and the CEMS server 40 as an information delivery apparatus that transmits the provision information data has been described as an example of a communication apparatus, the present invention is not limited thereto. The communication apparatus may be a communication apparatus that communicates with at least one of the above-described measurement device and the above-described information delivery apparatus. The notification apparatus (corresponding to the robot 50 in the above-described embodiment) performing the notification operation may be an apparatus that performs a notification operation according to reception data based on the reception data received when communicating with at least one of the above-described apparatuses

out of the measurement result data and the provision information data. For example, the notification apparatus may be an apparatus that performs a notification operation according to reception data only when the measurement result data (or the provision information data) is received by the home server 10.

[0169]

Furthermore, in the above-described embodiment, as an example of the notification apparatus performing the notification operation, while the communication robot (robot 50) having a mascot shape has been described, the present invention is not limited thereto but, for example, may be an ornament having a sphere shape or a unique shape. In other words, any notification apparatus of the ornament type capable of changing the arrangement in a relatively easy manner and notifying the user of information in a simple manner may be used without any limitation.

[0170]

In addition, in the above-described embodiment, as a mechanism that executes a communication bundle switched in accordance with the communication target apparatus and integrates interfaces for using communication bundles so as to be provided as an API (general-purpose API), the OSGi framework 203 has been described as an example. However, an existing technology other than the OSGi framework 203 may be used as long as the above-described functions are included therein.

[0171]

Furthermore, in the above-described embodiment, the energy management screen on which the measurement results acquired by the

sensors 21, 22a, 22b, and 23a to 23c are displayed has been described to be drawn on the touch panel 31 installed to the portable terminal 30. However, the present invention is not limited thereto, but the energy management screen may be configured to be drawn on the display 11 of the home server 10.

[0172]

In addition, in the above-described embodiment, the robot 50 connected to the home server 10 through the USB has been described as an example, and the power is supplied in accordance with the power supply of the home server 10. However, the present invention is not limited thereto, but a notification apparatus that has a charging-type internal power supply and communicates with the home server 10 in a wireless manner may be used. For such a notification apparatus, a wiring such as a USB is not necessary, and the position thereof may be freely determined. Furthermore, it is preferable to employ wireless charging, in other words, a charging type for charging without being in contact with a charger for charging the internal power supply for freely determining the position thereof.

[0173]

In addition, in the above-described embodiment, the electric power has been described as an example of the energy, and the energy management system that manages the power consumption amount of the inside of the house H has been described. However, the present invention is not limited thereto, but a system including another energy consumption amount (a gas consumption amount or a water consumption amount) as a management target may be configured.

EXPLANATION OF REFERENCES

[0174]

S	This system
H	House
TN	Home Network
GN	Outside-home network
1	Power generating unit
2	Distribution board
3	Storage battery
4	Commercial power supply
5	Power conditioner
6	Bidirectional inverter
7a	Air conditioner
7b	Lighting device
10	Home server
10a	CPU
10b	Memory
10c	Non-volatile storage device
10d	Communication interface
10e	Bus
11	Display
12	Input device
21	Sensor
22a, 22b	Sensor

23a, 23b, 23c	Sensor
30	Portable terminal
31	Touch panel
40	CEMS server
42	CS-side storage unit
50	Robot
50a	Cover member
50b	USB connector
51	Light emitting mechanism
52	Sound generating mechanism
53	Vibration mechanism
54	Controller
54a	CPU
54b	Memory
54c	Communication interface
54d	Control circuit
55	Operation receiving mechanism
101	External data acquiring unit
102	Measurement result data acquiring unit
103	Response data transmitting unit
104	Apparatus control unit
105	Robot driving unit
201	OS
202	JVM
203	OSGi framework

204a First-specification apparatus communication bundle
204b Second-specification apparatus communication bundle
204c Third-specification apparatus communication bundle
205 Robot driver
206 USB driver
Ar1, Ar2, Ar3, Ar4, Ar5, Ar6 Display area
B1, B2, B3, B4, B5, B6 Operation button

CLAIMS

[Claim 1]

An information notification system comprising:

a communication apparatus that communicates with at least one apparatus of a measurement apparatus measuring an energy consumption amount of the inside of a building and transmitting measurement result data representing information according to a measurement result and an information delivery apparatus being installed outside the building and transmitting provision information data representing information provided for a user inside the building; and

an ornament-type notification apparatus that performs a notification operation according to reception data based on the reception data received by the communication apparatus at time of communicating with the at least one apparatus out of the measurement result data and the provision information data,

wherein the communication apparatus transmits a request for performing the notification operation to the notification apparatus based on the reception data,

wherein the notification apparatus includes:

a light emitting mechanism that performs a light emitting operation for emitting light in a light emission form according to the reception data;

a sound generating mechanism that performs a sound generating operation for giving off a sound according to the reception data;

a vibration mechanism that performs a vibration operation for generating vibration in accordance with the reception data; and

a control unit that controls the light emitting mechanism, the sound generating mechanism, and the vibration mechanism, and

wherein, when the performance request is received, the control unit performs at least one or more operations that are determined in accordance with the performance request out of the light emitting operation, the sound generating operation, and the vibration operation as the notification operation.

[Claim 2]

The information notification system according to claim 1,
wherein the communication apparatus is a home server that is installed to the inside of a house as the building,

wherein the information delivery apparatus is an external server that is connected to the home server through the Internet in a communicable manner,

wherein, in the provision information data transmitted by the external server, target value data representing a target value of a power consumption amount consumed for a predetermined period inside the house is included,

wherein, when the measurement result data and the target value data are received, the communication apparatus calculates a ratio of an accumulated value of a power consumption amount that is actually consumed inside the house for the predetermined period to the target value and transmits the performance request according to the calculated ratio to the notification apparatus, and

wherein, when the performance request is received, the control unit

performs at least one or more operations out of the light emitting operation for emitting light in a light emission form according to the ratio that is performed by the light emitting mechanism, the sound generating operation for giving off a sound according to the ratio that is performed by the sound generating mechanism, and the vibration operation that is performed by the vibration mechanism as the notification operation.

[Claim 3]

The information notification system according to claim 2,
wherein, in the provision information data transmitted by the external server, unit rate data representing a current value of a unit rate of power supplied from the commercial power supply to the house is included,
wherein, when the unit rate data is received, the communication apparatus specifies the current value and transmits the performance request according to the specified current value to the notification apparatus, and
wherein, when the performance request is received, the control unit performs at least one or more operations out of the light emitting operation for emitting light in a light emission form according to the current value that is performed by the light emitting mechanism, the sound generating operation for giving off a sound according to the current value that is performed by the sound generating mechanism, and the vibration operation that is performed by the vibration mechanism as the notification operation.

[Claim 4]

The information notification system according to claim 2 or 3, further comprising an information processing terminal that forms a body that is separate from the notification apparatus and is communicable with the home

server,

wherein the information processing terminal includes a display and acquires display data representing information to be displayed on the display by communicating with the home server,

wherein the information represented by the display data is same as information represented by the reception data,

wherein the notification apparatus is in a conductive state at time of performing the notification operation,

wherein the information processing terminal is in a conductive state at time of displaying the information represented by the display data on the display, and

wherein power consumed by the notification apparatus that is in the conductive state is smaller than power consumed by the information processing terminal that is in the conductive state.

[Claim 5]

The information notification system according to any one of claims 1 to 4,

wherein the communication apparatus implements a function for controlling operating states of energy consumption apparatuses used inside the building through a network disposed inside the building,

wherein the notification apparatus includes an operation receiving mechanism that receives an operation performed when the user controls the operating states of the energy consumption apparatuses, and

wherein the control unit transmits a performance request of a control process for controlling the operating states of the energy consumption

apparatuses to the communication apparatus based on the operation received by the operation receiving mechanism.

[Claim 6]

The information notification system according to claim 5, wherein, when the operation receiving mechanism repeatedly receives the operation a plurality of times, the control unit transmits the performance request of the control process for controlling the operating states of the energy consumption apparatuses to the communication apparatus.