(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 725 817 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
30.04.2014 Bulletin 2014/18

(21) Application number: **12802195.3**

(22) Date of filing: **15.06.2012**

(51) Int Cl.:
H04Q 9/00 *(2006.01)* ***F24F 11/02*** *(2006.01)*
H05B 37/02 *(2006.01)*

(86) International application number:
PCT/JP2012/065300

(87) International publication number:
WO 2012/176690 (27.12.2012 Gazette 2012/52)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **22.06.2011 JP 2011138075**

(71) Applicant: **Panasonic Corporation**
Kadoma-shi, Osaka 571-8501 (JP)

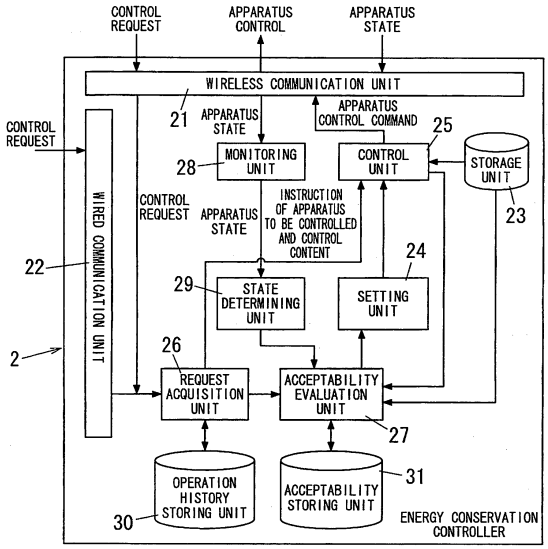
(72) Inventors:
- **NAKAKITA, Kenji**
  Osaka 540-6207 (JP)
- **TAKEHARA, Kiyotaka**
  Osaka 540-6207 (JP)

(74) Representative: **Müller-Boré & Partner**
Patentanwälte PartG mbB
Friedenheimer Brücke 21
80639 München (DE)

(54) ENERGY CONSERVATION CONTROLLER AND ENERGY CONSERVATION CONTROL SYSTEM

(57) Storage unit stores a plurality of control contents, corresponding to a plurality of energy conservation levels indicating degrees of energy conservation, respectively. Control unit reads, from storage unit, a control content corresponding to an energy conservation level in setting unit, and control an apparatus. Request acquisition unit defines, as reference time point, time point when control of apparatus is started based on control content, and acquires operation content by user within predetermined time periods before and after reference time point. Acceptability evaluation unit evaluates, as degree of acceptance, degree of user's acceptability to energy conservation automatic control performed by control unit at reference time point, based on operation content acquired by request acquisition unit. Setting unit, when degree of acceptance is higher than first threshold value, increases energy conservation level so that energy to be consumed in apparatus is made smaller than energy at reference time point.

Fig. 1



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Description

TECHNICAL FIELD

[0001] The invention relates to an energy conservation controller and an energy conservation control system, which control an apparatus to be controlled to suppress energy to be consumed in the apparatus to be controlled, and conserve energy.

BACKGROUND ART

[0002] Recently, interest in energy conservation has been increased, and awareness of energy conservation has grown even in standard homes, and for example, apparatuses with low power consumption are preferentially selected and purchased. As a system for achieving the energy conservation, there has been proposed a system, which is configured to automatically control operation of an apparatus to be controlled, such as an air conditioner, so as to reduce energy to be consumed in the apparatus to be controlled (hereinafter, referred to as "energy conservation automatic control") (e.g., Japanese Patent Application Publication No. 2008-241161).

[0003] In the system (air conditioning control system) described in this document, a server device acquires user's demand through an input device, and compares demand information intended to increase energy consumption with a first reference value, thereby changing a target temperature toward a direction of increasing the energy consumption. Further, the server device compares demand information intended to decrease the energy consumption with a second reference value, thereby changing the target temperature toward a direction of decreasing the energy consumption. Furthermore, the server device changes the first and second reference values based on a goal attainment level with respect to the energy conservation.

[0004] Thus, the conventional system reflects the user's demand relevant to increase or decrease of the energy consumption to the target temperature set in the air conditioning device or the like, and accordingly, a user can specify (demand) a level indicating the degree of the energy conservation during the energy conservation automatic control (hereinafter, referred to as an "energy conservation level"). In short, the user freely sets the energy conservation level and accordingly the user can change effect of the energy conservation achieved by the energy conservation automatic control.

[0005] Although awareness of energy conservation has grown, it is difficult to expect operation for changing the energy conservation level to obtain higher effect of the energy conservation (that is, to reduce energy to be consumed), from a user that has grown accustomed to comfort and convenience in a state where an apparatus to be controlled is not subjected to the energy conservation automatic control. As a result, even in an energy conservation control system that is capable of changing the energy conservation level by the user operation, the user hardly changes further the energy conservation level that has been already set by the user, toward a direction of obtaining higher effect of the energy conservation. Therefore, there is a possibility that the energy conservation automatic control is performed under a condition of low effect of the energy conservation. That is, in the conventional energy conservation control system, it is difficult to perform proper energy conservation automatic control that can obtain maximally high effect of the energy conservation in a range acceptable to the user comfortably.

DISCLOSURE OF THE INVENTION

[0006] It is an object of the present invention to provide an energy conservation controller and an energy conservation control system, which can perform proper energy conservation automatic control that can obtain maximally high effect of energy conservation in a range acceptable to a user comfortably.

[0007] An energy conservation controller of the invention includes: a storage unit configured to previously store a plurality of control contents for an apparatus to be controlled, corresponding to a plurality of energy conservation levels that indicate degrees of energy conservation, respectively; a setting unit configured to set an energy conservation level; a control unit configured to refer to the storage unit, and then control the apparatus to be controlled, based on a control content corresponding to the energy conservation level that has been set in the setting unit; a request acquisition unit configured to define, as a reference time point, a time point when the control unit starts to control the apparatus to be controlled based on the control content, the request acquisition unit being configured to acquire an operation content performed by a user for control of the apparatus to be controlled within a predetermined time period of at least one of before and after the reference time point; and an acceptability evaluation unit configured to evaluate, as a degree of acceptance, a degree of the user's acceptability to control performed by the control unit at the reference time point, based on the operation content that has been acquired by the request acquisition unit. The setting unit is configured to, when the degree of acceptance is higher than a first threshold value, change the energy conservation level so that energy to be consumed in the apparatus to be controlled is made smaller than energy that has been consumed in the

apparatus to be controlled at the reference time point.

[0008] In this configuration, the setting unit is configured to, when the degree of acceptance is higher than a first threshold value, change the energy conservation level so that energy to be consumed in the apparatus to be controlled is made smaller than energy that has been consumed in the apparatus to be controlled at the reference time point, and accordingly, it is possible to perform proper energy conservation automatic control that can obtain maximally high effect of energy conservation in a range acceptable to a user comfortably.

[0009] In the energy conservation controller, preferably, the setting unit is configured to, when the degree of acceptance is lower than a second threshold value, change the energy conservation level so that the energy to be consumed in the apparatus to be controlled is made larger than the energy that has been consumed in the apparatus to be controlled at the reference time point.

[0010] Preferably, the energy conservation controller further includes an acceptability storing unit configured to store an accumulation value obtained by accumulating a plurality of degrees of acceptance evaluated within a certain period by the acceptability evaluation unit. In this energy conservation controller, preferably, the acceptability evaluation unit is configured to add a positive number, as the degree of acceptance, to the accumulation value stored in the acceptability storing unit, when determining that the operation content performed by the user has accepted control content of the control unit, and is configured to add a negative number, as the degree of acceptance, to the accumulation value stored in the acceptability storing unit, when determining that the operation content performed by the user has resisted the control content of the control unit. In this energy conservation controller, preferably, the setting unit is configured to change the energy conservation level through comparing the accumulation value with the first threshold value or the second threshold value.

[0011] In the energy conservation controller, preferably, the acceptability evaluation unit is configured: to, when the operation content performed by the user has an orientation of energy conservation, evaluate the operation content performed within a predetermined time period before the reference time point, more highly as the degree of acceptance, compared with the operation content performed within a predetermined time period after the reference time point; and to, when the operation content performed by the user has an orientation of non-energy-conservation, evaluate the operation content performed within the predetermined time period before the reference time point, more lowly as the degree of acceptance, compared with the operation content performed within the predetermined time period after the reference time point.

[0012] In the energy conservation controller, preferably, the setting unit is configured to, when a prescribed return time elapses after a time point of changing the energy conservation level to increase the energy to be consumed in the apparatus to be controlled, return the changed energy conservation level to the previous energy conservation level.

[0013] In the energy conservation controller, preferably, the setting unit is configured to determine the length of the prescribed return time according to the degree of acceptance so that the lower the degree of acceptance is, the longer the prescribed return time is.

[0014] In the energy conservation controller, preferably, the setting unit is configured to determine the magnitude of energy conservation level according to the degree of acceptance so that the lower the degree of acceptance is, the more the energy to be consumed in the apparatus to be controlled is increased.

[0015] An energy conservation control system of the invention includes: an apparatus to be controlled; a storage unit configured to previously store a plurality of control contents for the apparatus to be controlled, corresponding to a plurality of energy conservation levels that indicate degrees of energy conservation, respectively; a setting unit configured to set an energy conservation level; a control unit configured to refer to the storage unit, and then control the apparatus to be controll ed, based on a control content corresponding to the energy conservation level that has been set in the setting unit; an operating unit configured to receive, from a user, an operation relevant to control of the apparatus to be controlled; a request acquisition unit configured to define, as a reference time point, a time point when the control unit starts to control the apparatus to be controlled based on the control content, the request acquisition unit being configured to acquire an operation content received by the operating unit within a predetermined time period of at least one of before and after the reference time point; and an acceptability evaluation unit configured to evaluate, as a degree of acceptance, a degree of the user's acceptability to control performed by the control unit at the reference time point, based on the operation content that has been acquired by the request acquisition unit. The setting unit is configured to, when the degree of acceptance is higher than a first threshold value, change the energy conservation level so that energy to be consumed in the apparatus to be controlled is made smaller than energy that has been consumed in the apparatus to be controlled at the reference time point.

[0016] In this configuration, the setting unit is configured to, when the degree of acceptance is higher than a first threshold value, change the energy conservation level so that energy to be consumed in the apparatus to be controlled is made smaller than energy that has been consumed in the apparatus to be controlled at the reference time point, and accordingly, it is possible to perform proper energy conservation automatic control that can obtain maximally high effect of energy conservation in a range acceptable to a user comfortably.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Preferred embodiments of the invention will now be described in further details. Other features and advantages of the present invention will become better understood with regard to the following detailed description and accompanying drawings where:

Fig. 1 is a block diagram illustrating a schematic structure of an energy conservation controller according to First Embodiment;
Fig. 2 is a diagram illustrating a schematic system structure of an energy conservation control system according to the First Embodiment;
Fig. 3 is an explanatory diagram illustrating an operation of the energy conservation controller according to the First Embodiment;
Fig. 4A is an explanatory diagram illustrating, as one example, an operation of the energy conservation control system according to the First Embodiment;
Fig. 4B is an explanatory diagram illustrating, as one example, an operation of the energy conservation control system according to the First Embodiment;
Fig. 5A is an explanatory diagram illustrating, as one example, an operation of the energy conservation control system according to the First Embodiment;
Fig. 5B is an explanatory diagram illustrating, as one example, an operation of the energy conservation control system according to the First Embodiment; and
Fig. 6 is an explanatory diagram for an accumulation value of a plurality of degrees of acceptance used in the energy conservation controller according to the First Embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

(First Embodiment)

[0018] As shown in Fig. 2, an energy conservation control system according to the present embodiment includes a plurality of apparatuses to be controlled 11, 12 and 13 (simply referred to as "a plurality of apparatuses to be controlled 1" when in particular not distinguishing between the plurality of apparatuses), and an energy conservation controller 2 that is capable of communicating with the plurality of apparatuses to be controlled 1. The energy conservation controller 2 is connected to an Internet 4 via a modem 3. Also, a personal computer (PC) 5 is connected to the modem 3, and a center server 6 is connected to the Internet 4. In the present embodiment, all of the plurality of apparatuses to be controlled 1, energy conservation controller 2, modem 3 and PC 5 are installed in a house. The plurality of apparatuses to be controlled 1 includes a plurality of household electrical appliances, such as a lighting apparatus, an air conditioner (air conditioning device), a heater, a refrigerator and a washing machine.

[0019] The energy conservation controller 2 is configured to control the plurality of apparatuses to be controlled 1, based on the user's manual operation or the algorithm for the energy conservation automatic control. In this case, the plurality of apparatuses to be controlled 1 is not limited to a plurality of apparatuses consuming electric energy, and may be a plurality of apparatuses consuming water, gas and heat. For example, in the case of a plurality of apparatuses consuming water and gas, a water pipe and a gas pipe respectively for supplying water and gas are installed for each area within a building. Therefore, a plurality of valves for opening or closing the water and gas passages is installed at the water and gas pipes, and the energy conservation controller 2 can control the water and gas consumption by controlling the opening and closing states of the plurality of valves.

[0020] As shown in Fig. 1, the energy conservation controller 2 includes a wireless communication unit 21, a wired communication unit 22, a storage unit 23, a setting unit 24, a control unit 25, a request acquisition unit 26, a an acceptability evaluation unit 27, a monitoring unit 28 and a state determining unit 29. In this case, the energy conservation controller 2 includes a microcomputer, as the main structure, and realizes functions of the above-mentioned units by executing programs stored in a memory (not shown).

[0021] The wireless communication unit 21 is configured to be capable of wireless communication bi-directionally with the plurality of apparatuses to be controlled 1, and further to be capable of wireless communication also with an operating unit (not shown) configured to receive from a user, an operation relevant to control of an apparatus to be controlled 1. The wireless communication unit 21 transmits, to an apparatus to be controlled 1, a control signal for controlling the apparatus to be controlled 1, or receives, from an apparatus to be controlled 1, apparatus state information that represents an operational state of the apparatus to be controlled 1, or receives, from the operating unit, a control request by the user. The operating unit may be simply a wall switch or the like capable of only ON or OFF operation, or may be a remote control device that includes cursor keys and the like for setting the set temperature of an air conditioner for example, a touch panel display, or the like.

[0022] The wired communication unit 22 is connected to the operating unit, and is configured to receive, from the operating unit by communication, the control request by the user. Here, the plurality of apparatuses to be controlled 1 may be connected to the wired communication unit 22. In this case, the plurality of apparatuses to be controlled 1 and energy conservation controller 2 can transmit and receive the control signal and the apparatus state information by the wired communication.

[0023] The storage unit 23 is configured to previously store a plurality of control contents for an apparatuses to be controlled 1, corresponding to a plurality of energy conservation levels that indicate degrees of energy conservation, respectively. Here, an energy conservation level is a natural number. The more the natural number is, the higher effect of the energy conservation is. That is, it means that energy to be consumed in an apparatus to be controlled 1 is reduced. In the present embodiment, the storage unit 23 stores, for each control target, a plurality of control contents corresponding to a plurality of energy conservation levels, respectively. In this case, a control target is a combination: of an apparatus to be controlled 1 that is a target to be controlled; and an execution time of starting the control. Therefore, when a plurality of execution times is set for a single apparatus to be controlled 1, it is treated as a plurality of control targets.

[0024] When an apparatus to be controlled 1 is a lighting apparatus, a control content includes parameters, such as ON or OFF, a dimming level, and the like. When the apparatus to be controlled 1 is an air conditioner or a heater, the control content includes parameters, such as ON or OFF, a set temperature, and the like. Further, the control content includes, as a parameter, an execution time of starting the control. Further, in the case of the intermittent control where ON and OFF of the apparatus to be controlled 1 are switched repeatedly at regular intervals, the control content includes, as a parameter, a time ratio of an ON time period to an OFF time period. Similarly, when the energy conservation operation (in the case of the cooling operation of the air conditioner, the set temperature is set high) and the non-energy-conservation operation (in the case of the cooling operation of the air conditioner, the set temperature is set low) are alternately performed repeatedly, the control content further includes, as a parameter, a time ratio of a time period for the energy conservation operation to a time period for the non-energy-conservation operation. The control content may be directed to a plurality of apparatuses to be controlled 1, as scene control. In this case, the storage unit 23 stores, for each scene, the control content.

[0025] Here, the plurality of energy conservation levels is respectively made to correspond to the plurality of control contents so that a higher energy conservation level is made to correspond to a control content that can obtain higher effect of the energy conservation (that can set energy to be consumed in an apparatus to be controlled 1 lower). Specifically, when the plurality of control contents includes simply an ON or OFF parameter, high or low effect of the energy conservation depends on the length of an ON time period. For this reason, the plurality of control contents is set so that a plurality of execution times, as a parameter, differs from each other depending on the plurality of energy conservation levels. When the plurality of control contents includes a parameter capable of being set in stages, such as a dimming level or a set temperature, the plurality of control contents is set so that a plurality of values of the parameter differs in stages depending on the plurality of energy conservation levels. When the plurality of control contents includes the intermittent control, or the repetition of the energy conservation operation and the non-energy-conservation operation, the plurality of control contents is set so that a plurality of time ratios of the parameter differs from each other depending on the plurality of energy conservation levels.

[0026] The setting unit 24 is configured to set an energy conservation level to be applied in the control unit 25. In the present embodiment, the setting unit 24 is configured to change the energy conservation level to be applied in the control unit 25, according to the evaluation result of the acceptability evaluation unit 27. The details will be described below. In the present embodiment, the setting unit 24 is configured to set, for each control target, the energy conservation level. As described above, when the control content is directed to a plurality of apparatuses to be controlled 1 as the scene control, the setting unit 24 is configured to set the energy conservation level for each scene.

[0027] The control unit 25 is configured to refer to the storage unit 23, read out, from the storage unit 23, a control content corresponding to the energy conservation level that has been set in the setting unit 24, and control an apparatus to be controlled 1 based on the control content. That is, the control unit 25 specifies a control content and an apparatus to be controlled 1 that is the control target, generates a control signal, and controls the apparatus to be controlled 1 by transmitting the control signal to the apparatus to be controlled 1 through the wireless communication unit 21.

[0028] In the present embodiment, the control for the apparatus to be controlled 1 performed by the control unit 25 includes two types of controls: the energy conservation automatic control; and the manual control. The energy conservation automatic control is to automatically control the apparatus to be controlled 1 based on the control content so that the energy to be consumed (electric power to be consumed) in the apparatus to be controlled 1 is reduced. The manual control is to control the apparatus to be controlled 1 by the user manual operation. That is, when the current time reaches the execution time, the control unit 25 is configured to perform the energy conservation automatic control based on the control content so as to reduce the energy to be consumed in the apparatus to be controlled 1.

[0029] When the apparatus to be controlled 1 is a lighting apparatus for example, the control unit 25 turns off the apparatus to be controlled 1 or reduces the dimming level (dims the light) through the energy conservation automatic control, thereby reducing the energy to be consumed. When the apparatus to be controlled 1 is an air conditioner

(performing the cooling operation), the control unit 25 turns off the apparatus to be controlled 1 or increases the set temperature through the energy conservation automatic control, thereby reducing the energy to be consumed. When the apparatus to be controlled 1 is a heater, the control unit 25 turns off the apparatus to be controlled 1 or reduces the set temperature through the energy conservation automatic control, thereby reducing the energy to be consumed. The magnitude of the energy conservation effect obtained through the energy conservation automatic control varies according to the energy conservation level set in the setting unit 24. The higher the energy conservation level is, the more the energy conservation effect is increased. Further, when the operating unit receives an operation from the user, the control unit 25 is configured to perform the manual control of controlling the apparatus to be controlled 1 according to the operation content (control request).

[0030] The request acquisition unit 26 is configured to define, as a reference time point, a time point when the control unit 25 starts to control the apparatus to be controlled 1, based on the control content. Further, the request acquisition unit 26 is configured to acquire the operation content performed by the user to the operating unit within a determination period set over a predetermined time period before the reference time point and a predetermined time period after the reference time point. That is, the request acquisition unit 26 is configured to define, as the reference time point, the time point when the control unit 25 starts to perform the energy conservation automatic control to the apparatus to be controlled 1, and acquire the operation content in the case where the user operated the operating unit within the predetermined time periods before and after that, from the operating unit, via the wireless communication unit 21 or wired communication unit 22.

[0031] In the present embodiment, the request acquisition unit 26 is configured to acquire the operation content performed by the user to the operating unit even within a period other than the determination period. Here, the predetermined time periods before and after the reference time point when the energy conservation automatic control is started are defined as the determination period used for determining whether or not the request acquisition unit 26 acquired the operation content. However, only one of the predetermined time periods before and after the reference time point may be set as the determination period.

[0032] The acceptability evaluation unit 27 is configured to evaluate, as a degree of acceptance, a degree of the user's acceptability to the energy conservation automatic control performed by the control unit 25 at the reference time point, based on the operation content acquired by the request acquisition unit 26 within the determination period and the control content of the energy conservation automatic control performed by the control unit 25. The degree of acceptance is a measure that shows to what degree the user has accepted the energy conservation automatic control automatically performed by the control unit 25 according to the control content. In other words, if the degree of acceptance is high, it means that the user has not resisted the energy conservation automatic control (has accepted the energy conservation automatic control), and if the degree of acceptance is low, it means that the user has resisted the energy conservation automatic control (has not accepted the energy conservation automatic control).

[0033] Basically, the acceptability evaluation unit 27 is configured to compare the control content of the energy conservation automatic control with the operation content of the manual control performed within the predetermined time periods before and after a time point when the energy conservation automatic control is started, and evaluate the degree of acceptance in response to whether or not the control orientations thereof (an orientation of further energy conservation or an orientation of further non-energy-conservation) are the same as each other. That is, the acceptability evaluation unit 27 is configured to determine that the user has accepted the energy conservation automatic control, when both of the energy conservation automatic control and the manual control have the orientation of further the energy conservation, and then increase the degree of acceptance, as the evaluation result. On the other hand, the acceptability evaluation unit 27 is configured to determine that the user has not accepted the energy conservation automatic control, when the energy conservation automatic control has the orientation of further energy conservation and the manual control has the orientation of further non-energy-conservation (the increase in energy), and decrease the degree of acceptance, as the evaluation result. The specific method for evaluating the degree of acceptance will be described below. In the present embodiment, the acceptability evaluation unit 27 evaluates, for each control target, a degree of acceptance. However, in the scene control where the control content is directed to a plurality of apparatuses to be controlled 1 as above, the acceptability evaluation unit 27 evaluates, for each scene, the degree of acceptance.

[0034] The monitoring unit 28 is configured to acquire the apparatus state information from an apparatus to be controlled 1 via the wireless communication unit 21, whenever the operational state of the apparatus to be controlled 1 is changed. Examples of the apparatus state information include ON or OFF of the apparatus to be controlled 1, the dimming level (in the case of a lighting apparatus), the set temperature (in the case of an air conditioner or a heater), energy consumed in the apparatus to be controlled 1, and the like.

[0035] The state determining unit 29 is configured to determine the current state for each apparatus to be controlled 1, based on the apparatus state information acquired by the monitoring unit 28. When an apparatus to be controlled 1 is an air conditioner or the like for example, the energy consumed in the apparatus to be controlled 1 is changed according to room temperature and the like even at the same set temperature. However, the state determining unit 29 is configured to determine effect of the energy conservation obtained through the control performed by the control unit 25, based on

the actual energy that has been consumed in the apparatus to be controlled 1. The determination result of the state determining unit 29 is outputted to the acceptability evaluation unit 27.

[0036] The energy conservation controller 2 of the present embodiment, in addition to the above-mentioned configuration, includes an operation history storing unit 30 and an acceptability storing unit 31, as shown in Fig. 1. The operation history storing unit 30 is configured to store the operation content acquired by the request acquisition unit 26. The acceptability storing unit 31 is configured to store the degree of acceptance evaluated by the acceptability evaluation unit 27.

[0037] The operation history storing unit 30 is configured to store, as the operation history, a time when the request acquisition unit 26 acquired the operation content, an apparatus to be controlled 1 subjected to the control, and the control content. When the user operates the operating unit to control a plurality of apparatuses to be controlled 1 that are "LIGHTING No. 1", "LIGHTING No. 2", and "SWITCH No. 1" connected to a home electric appliance for example, a table as shown in the following Table 1 is stored in the operation history storing unit 30.

[Table 1]

TIME	APPARATUS TO BE CONTROLLED	OPERATION CONTENT
12: 53	LIGHTING No. 1	OFF
12: 53	LIGHTING No. 2	OFF
12: 59	SWITCH No. 1	ON

[0038] In the present embodiment, the acceptability evaluation unit 27 is configured to evaluate the degree of acceptance, based on the operation history stored in the operation history storing unit 30 in this way and the control content of the energy conservation automatic control performed by the control unit 25.

[0039] The acceptability storing unit 31 is configured to store an accumulation value of the degrees of acceptance evaluated by the acceptability evaluation unit 27 for each control target, namely, for each energy conservation automatic control. In this way, the acceptability storing unit 31 stores the degrees of acceptance for each control target, and accordingly, to what degree the user has accepted (or has resisted) each energy conservation automatic control is clearly defined. The acceptability storing unit 31 is configured to obtain the accumulation value of the degrees of acceptance in unit of a certain period (e.g., a week). When the certain period elapses, the accumulation value of the degrees of acceptance is overwritten with new accumulation value of the degrees of acceptance in the next certain period.

[0040] Here, the setting unit 24 of the present embodiment is configured to change the energy conservation level for the control content to be applied by the control unit 25 upon subsequent energy conservation automatic control, in response to high or low of the degree of acceptance evaluated by the acceptability evaluation unit 27 as described above. That is, the setting unit 24 is configured to increase the energy conservation level so that the energy to be consumed in the apparatus to be controlled 1 is smaller than the energy consumed at the reference time point, when the degree of acceptance is higher than a predetermined first threshold value. Further, the setting unit 24 is configured to reduce the energy conservation level so that the energy to be consumed in the apparatus to be controlled 1 is larger than the energy consumed at the reference time point, when the degree of acceptance is lower than a predetermined second threshold value. Here, the second threshold value is set lower than the first threshold value. However, the second threshold value may be the same as the first threshold value.

[0041] In short, the energy conservation controller 2 is configured to increase the energy conservation level when determining that the user's acceptability to the energy conservation automatic control is high, that is, the user has accepted the energy conservation automatic control. When the energy conservation level is increased, the parameters of the control content are changed so that the effect of the energy conservation is increased (the energy to be consumed in the apparatus to be controlled 1 is reduced). Therefore, the effect of the energy conservation by subsequent energy conservation automatic control is improved. At this time, by changing the parameters, the energy conservation controller 2 brings forward a time of starting the energy conservation automatic control, or sets longer an OFF period of the apparatus to be controlled 1 or a period of the energy conservation operation, or reduces the dimming level, or increases the set temperature upon the cooling operation, thereby improving the effect of the energy conservation.

[0042] On the other hand, the energy conservation controller 2 is configured to reduce the energy conservation level when determining that the user's acceptability to the energy conservation automatic control is low, that is, the user has not accepted (has resisted) the energy conservation automatic control. When the energy conservation level is reduced, the parameters of the control content are changed so that the effect of the energy conservation is decreased (the energy to be consumed in the apparatus to be controlled 1 is increased). Therefore, the effect of the energy conservation by subsequent energy conservation automatic control is decreased. At this time, by changing the parameters, the energy conservation controller 2 brings backward a time of starting the energy conservation automatic control, or sets shorter

an OFF period of the apparatus to be controlled 1 or a period of the energy conservation operation, or increases the dimming level, or decreases the set temperature upon the cooling operation, thereby reducing the effect of the energy conservation.

[0043] In the present embodiment, the setting unit 24 is configured to change the energy conservation level, according to the accumulation value of the degrees of acceptance stored in the acceptability storing unit 31. The accumulation value of the degrees of acceptance accurately reflects the user's acceptability to the energy conservation automatic control, compared with a degree of acceptance itself evaluated from a single operation. As a result, the setting unit 24 can change the energy conservation level, according to the degree of acceptance having high reliability.

[0044] Operation relevant to changing of the parameters of the control content, of the energy conservation controller 2, will be explained with reference to Fig. 3.

[0045] In the energy conservation controller 2, the request acquisition unit 26 receives the operation content (control request) performed by the user from the operating unit (S1 in Fig. 3), and then stores the received operation content in the operation history storing unit 30, as the operation history (S2). Then, in the energy conservation controller 2, the acceptability evaluation unit 27 determines (evaluates) the user's acceptability to the energy conservation automatic control, based on the operation history and the content of the energy conservation automatic control (S3), and adds the degree of acceptance to the accumulation value (accumulation point), and stores it in the acceptability storing unit 31 (S4).

[0046] After that, in the energy conservation controller 2, the setting unit 24 refers to the accumulation value of the degrees of acceptance stored in the acceptability storing unit 31, and then determines whether or not change of the parameters of the control content, namely change of the energy conservation level, is required, based on the comparison result obtain by comparing the accumulation value with the first and second threshold values (S5). At this time, in the energy conservation controller 2, when determining that the change of the parameters is required (S5: YES), the setting unit 24 changes the parameters through changing the energy conservation level (S6) and then the processing is returned to "S1". On the other hand, in the energy conservation controller 2, when determining that the change of the parameters is not required (S5: NO), the processing is returned to "S1" without the change of the energy conservation level in the setting unit 24.

[0047] Next, a method for evaluating the degree of acceptance and a method for changing the energy conservation level in the energy conservation controller 2 will be explained while citing a concrete example. Hereinafter, as an example, it is assumed that the acceptability evaluation unit 27 is configured to derive the degree of acceptance represented as a point (score) of any one of integral numbers from "-5" to "5", according to conditions described in the following Table 2. In this case, if the degree of acceptance is a positive number, it means that the user has accepted the energy conservation automatic control. On the other hand, if the degree of acceptance is a negative number, it means that the user has resisted the energy conservation automatic control.

[Table 2]

	MANUAL CONTROL: ENERGY CONSERVATION EFFECT EQUAL TO OR HIGHER THAN AUTOMATIC CONTROL	MANUAL CONTROL: ENERGY CONSERVATION EFFECT HIGHER THAN SETTING AT START POINT OF DETERMINATION PERIOD AND LOWER THAN AUTOMATIC CONTROL	MANUAL CONTROL: ENERGY CONSERVATION EFFECT EQUAL TO OR LOWER THAN SETTING AT START POINT OF DETERMINATION PERIOD	LEAVING
BEFORE FACT	5	3	-5	
AFTER FACT	4	1	-4	2

[0048] That is, the acceptability evaluation unit 27 compares the operation history with the control content of the energy conservation automatic control, and evaluates the degree of acceptance, based on a relative relationship between a timing (reference time point) of the energy conservation automatic control and a timing of the manual control, in addition to the orientation of control (further energy conservation or further non-energy-conservation). In the example of Table 2, the degree of acceptance differs depending on whether the timing of the manual control is before the reference time point ("before the fact") or after the reference time point ("after the fact"), and also depending on whether or not the operation for the manual control is performed. Further, in the example of Table 2, when the manual control has been performed, the degree of acceptance differs depending on whether or not the effect of the energy conservation as a result of the manual control is higher than the energy conservation automatic control, and also depending on whether

or not the effect of the energy conservation as a result of the manual control is higher than before. Although not shown in Table 2, the degree of acceptance may differ depending on a time difference between the energy conservation automatic control and the manual control.

[0049] As one example of deriving the degree of acceptance according to the conditions in Table 2, a case where the energy conservation automatic control is performed for the apparatus to be controlled 12 as the lighting apparatus will be explained with reference to Figs. 4A and 4B. In this case, the control content is to turn off the apparatus to be controlled 12 at an execution time.

[0050] Fig. 4A shows a case where control of turning off the apparatus to be controlled 12 has been performed by the manual control at a time t2 before a time t3 that is the execution time of the energy conservation automatic control. In Fig. 4A, the time t3 is a reference time point, and a period from a time t1 to a time t4, as the predetermined time periods before and after the reference time point, is a determination period T0. In this case, the same control content as the energy conservation automatic control has been performed by the manual control before the reference time point within the determination period T0, and accordingly, the acceptability evaluation unit 27 determines that control of obtaining "energy conservation effect equal to or higher than automatic control" has been performed "before the fact", and determines that the degree of acceptance is "5", through Table 2.

[0051] On the other hand, Fig. 4B shows a case where control of turning on the apparatus to be controlled 12 has been performed by the manual control at a time t3 after a time t2 that is the execution time of the energy conservation automatic control. In Fig. 4B, the time t2 is a reference time point, and a period from a time t1 to a time t4, as the predetermined time periods before and after the reference time point, is a determination period T0. In this case, an orientation opposite to that of the energy conservation automatic control, namely an increase of energy, has been performed by the manual control after the reference time point within the determination period T0. That is, by the manual control, the apparatus to be controlled 12 has been changed to the same state as an ON-state at a start point of the determination period T0, and accordingly, the acceptability evaluation unit 27 determines that control of obtaining "energy conservation effect equal to or lower than setting at start point of determination period" has been performed "after the fact", and determines that the degree of acceptance is "-4", through Table 2.

[0052] As another example of deriving the degree of acceptance according to the conditions in Table 2, a case where the energy conservation automatic control is performed for the apparatus to be controlled 11 as the air conditioner (upon the cooling operation) will be explained with reference to Figs. 5A and 5B. In this case, the control content is to change the set temperature of the apparatus to be controlled 11 from 21 degrees to 24 degrees at an execution time.

[0053] Fig. 5A shows a case where control of changing, to 25 degrees, the set temperature of the apparatus to be controlled 11 has been performed by the manual control at a time t3 after a time t2 that is the execution time of the energy conservation automatic control. In Fig. 5A, the time t2 is a reference time point, and a period from a time t1 to a time t4, as the predetermined time periods before and after the reference time point, is a determination period T0. In this case, the same orientation as the energy conservation automatic control, namely further energy conservation, has been performed by the manual control after the reference time point within the determination period T0, and accordingly, the acceptability evaluation unit 27 determines that control of obtaining "energy conservation effect equal to or higher than automatic control" has been performed "after the fact" and determines that the degree of acceptance is "4", through Table 2.

[0054] On the other hand, Fig. 5B shows a case where control of changing, to 22 degrees, the set temperature of the apparatus to be controlled 11 has been performed by the manual control at a time t3 after a time t2 that is the execution time of the energy conservation automatic control. In Fig. 5B, the time t2 is a reference time point, and a period from a time t1 to a time t4, as the predetermined time periods before and after the reference time point, is a determination period T0. In this case, the change of the set temperature by the manual control has been performed after the reference time point within the determination period T0, thereby obtaining the energy conservation effect higher than the set temperature of 21 degrees at a start point of the determination period T0, but obtaining the energy conservation effect lower than the energy conservation automatic control. Accordingly, the acceptability evaluation unit 27 determines that control of obtaining "energy conservation effect higher than setting at start point of determination period and lower than automatic control" has been performed "after the fact" and determines that the degree of acceptance is "1", through Table 2.

[0055] In a case where the operation for the manual control has not been performed within the determination period ("leaving" in Table 2), the acceptability evaluation unit 27 determines that the user has accepted the energy conservation automatic control to a certain degree, and determines that the degree of acceptance is "2", through Table 2.

[0056] The acceptability evaluation unit 27 adds the degree of acceptance evaluated as described above to the accumulation value (accumulation point) of the degrees of acceptance stored in the acceptability storing unit 31. That is, the accumulation point stored in the acceptability storing unit 31 is increased if the degree of acceptance evaluated by the acceptability evaluation unit 27 is a positive number, and is decreased if the degree of acceptance evaluated by the acceptability evaluation unit 27 is a negative number.

[0057] As a result, the accumulation point of the degrees of acceptance is changed on one-dimensional axis as shown

in Fig. 6, according to the evaluation result of the acceptability evaluation unit 27. The setting unit 24 compares the accumulation point with the first and second threshold values, and increases the energy conservation level if the accumulation point exceeds the first threshold value (e.g., "+10"), and reduces the energy conservation level if the accumulation point falls below the second threshold value (e.g., "-10"). The degree of acceptance (the accumulation value of the degrees of acceptance) is continually changed, and accordingly, even if temporarily increased or reduced, the energy conservation level may be returned to an original level in response to the change of the degree of acceptance after that.

[0058] According to the energy conservation controller 2 of the present embodiment as explained above, the energy conservation level of the energy conservation automatic control is automatically changed in response to the degree of acceptance that represents the degree of the user's acceptability to the energy conservation automatic control. That is, the energy conservation controller 2 can improve effect of the energy conservation through automatically increasing the energy conservation level in accordance with the increase in the degree of acceptance, even if it is difficult to expect the operation for changing the energy conservation level from the user himself. Therefore, the energy conservation controller 2 gradually increases the energy conservation level, when the user becomes accustomed to the energy conservation automatic control and becomes accepting of the energy conservation automatic control even if the user at first resists the energy conservation automatic control. Accordingly, the energy conservation controller 2 can improve effect of the energy conservation.

[0059] In addition, the energy conservation controller 2 automatically reduces the energy conservation level in accordance with the decrease in the degree of acceptance, and accordingly, it is possible to adjust effect of the energy conservation in a range acceptable to the user comfortably. Therefore, the energy conservation controller 2 can perform proper energy conservation automatic control that can obtain maximally high effect of the energy conservation in the range acceptable to the user comfortably.

[0060] The setting unit 24 may be configured to determine the magnitude of energy conservation level according to high or low of the degree of acceptance so that the lower the degree of acceptance (the accumulation value of the degrees of acceptance) is, the less the energy conservation level is, and reversely, so that the higher the degree of acceptance (the accumulation value of the degrees of acceptance) is, the more the energy conservation level is. Accordingly, the effect of the energy conservation by subsequent energy conservation automatic control can be minutely set depending on to what degree the user has accepted the energy conservation automatic control, and therefore, the energy conservation controller 2 can perform more proper energy conservation automatic control.

[0061] In Table 2 of the present embodiment, when the content of the manual control has an orientation of energy conservation (that is, "energy conservation effect equal to or higher than automatic control" and "energy conservation effect higher than setting at start point of determination period and lower than automatic control" in Table 2), the content of the manual control performed within a predetermined time period before the reference time point (before the fact) is set to a higher value, as the degree of acceptance, compared with that performed within a predetermined time period after the reference time point (after the fact). When the content of the manual control has an orientation of non-energy-conservation (that is, "energy conservation effect equal to or lower than setting at start point of determination period" in Table 2), the content of the manual control performed within a predetermined time period before the reference time point (before the fact) is set to a lower value, as the degree of acceptance, compared with that performed within a predetermined time period after the reference time point (after the fact). That is, even if the manual control is the same, the degree of acceptance differs depending on whether the timing of the operation is before the reference time point or after the reference time point. Therefore, it is possible to determine more accurately whether or not the content of the user manual control is motivated toward the energy conservation, and accordingly, it is possible to perform more proper energy conservation automatic control.

[0062] The setting unit 24 is not limited to the configuration of changing the energy conservation level, according to the accumulation value of the degrees of acceptance stored in the acceptability storing unit 31. The setting unit 24 may be configured to change the energy conservation level, according to the degree of acceptance whenever the degree of acceptance is evaluated by the acceptability evaluation unit 27.

(Second Embodiment)

[0063] An energy conservation controller 2 of the present embodiment is different from that of the First Embodiment in that the setting unit 24 is configured to, when a prescribed return time elapses after a time point of changing the energy conservation level so as to be reduced, return the changed energy conservation level to the previous energy conservation level.

[0064] That is, when the return time elapses after a time point of changing the energy conservation level from a first level to a second level (where, the first level is more than the second level) so as to increase the energy to be consumed in the apparatus to be controlled 1, the setting unit 24 returns the energy conservation level to the first level. In other words, when the degree of acceptance of a user to the energy conservation automatic control is low (that is, the user has resisted the energy conservation automatic control), the energy conservation controller 2 temporarily reduces the

energy conservation level, but again increases the energy conservation level when the return time elapses.

[0065] According to this configuration, even when the energy conservation automatic control has not been accepted by the user, the energy conservation controller 2 does not hold the energy conservation level in a low state, but returns to the previous energy conservation level when the return time elapses. Accordingly, the energy conservation controller 2 can improve effect of the energy conservation. Therefore, while the energy conservation controller 2 realizes high effect of the energy conservation, because the energy conservation level is temporarily reduced, the user can accept the energy conservation automatic control comfortably.

[0066] Here, instead of setting the return time as fixed length, the setting unit 24 may be configured to determine the length of the return time according to high or low of the degree of acceptance so that the lower the degree of acceptance is, the longer the return time is. That is, the setting unit 24 sets the return time as variable length, and the lower the degree of acceptance is, the longer the setting unit 24 makes the return time.

[0067] Accordingly, the lower the degree of acceptance of the user to the energy conservation automatic control is, the longer the setting unit 24 makes a time period from a time point of reducing the energy conservation level to a time point of returning to the previous energy conservation level, and as a result, a time period during which the energy conservation level is in a low state is increased. Therefore, the user's resistance to the energy conservation automatic control is decreased, and the user can easily accept the energy conservation automatic control.

[0068] The other structures and functions are similar to those of the First Embodiment.

[0069] Although the present invention has been described with reference to certain preferred embodiments, numerous modifications and variations can be made by those skilled in the art without departing from the true spirit and scope of this invention, namely claims.

Claims

1. An energy conservation controller, comprising:

a storage unit configured to previously store a plurality of control contents for an apparatus to be controlled, corresponding to a plurality of energy conservation levels that indicate degrees of energy conservation, respectively;
a setting unit configured to set an energy conservation level;
a control unit configured to refer to the storage unit, and then control the apparatus to be controlled, based on a control content corresponding to the energy conservation level that has been set in the setting unit;
a request acquisition unit configured to define, as a reference time point, a time point when the control unit starts to control the apparatus to be controlled based on the control content, the request acquisition unit being configured to acquire an operation content performed by a user for control of the apparatus to be controlled within a predetermined time period of at least one of before and after the reference time point; and
an acceptability evaluation unit configured to evaluate, as a degree of acceptance, a degree of the user's acceptability to control performed by the control unit at the reference time point, based on the operation content that has been acquired by the request acquisition unit,
wherein the setting unit is configured to, when the degree of acceptance is higher than a first threshold value, change the energy conservation level so that energy to be consumed in the apparatus to be controlled is made smaller than energy that has been consumed in the apparatus to be controlled at the reference time point.

2. The energy conservation controller according to claim 1,
wherein the setting unit is configured to, when the degree of acceptance is lower than a second threshold value, change the energy conservation level so that the energy to be consumed in the apparatus to be controlled is made larger than the energy that has been consumed in the apparatus to be controlled at the reference time point.

3. The energy conservation controller according to claim 2, further comprising an acceptability storing unit configured to store an accumulation value obtained by accumulating a plurality of degrees of acceptance evaluated within a certain period by the acceptability evaluation unit,
wherein the acceptability evaluation unit is configured to add a positive number, as the degree of acceptance, to the accumulation value stored in the acceptability storing unit, when determining that the operation content performed by the user has accepted control content of the control unit,
the acceptability evaluation unit being configured to add a negative number, as the degree of acceptance, to the accumulation value stored in the acceptability storing unit, when determining that the operation content performed by the user has resisted the control content of the control unit, and
wherein the setting unit is configured to change the energy conservation level through comparing the accumulation

value with the first threshold value or the second threshold value.

4. The energy conservation controller according to claim 1,
wherein the acceptability evaluation unit is configured:

to, when the operation content performed by the user has an orientation of energy conservation, evaluate the operation content performed within a predetermined time period before the reference time point, more highly as the degree of acceptance, compared with the operation content performed within a predetermined time period after the reference time point; and
to, when the operation content performed by the user has an orientation of non-energy-conservation, evaluate the operation content performed within the predetermined time period before the reference time point, more lowly as the degree of acceptance, compared with the operation content performed within the predetermined time period after the reference time point.

5. The energy conservation controller according to claim 2,
wherein the setting unit is configured to, when a prescribed return time elapses after a time point of changing the energy conservation level to increase the energy to be consumed in the apparatus to be controlled, return the changed energy conservation level to the previous energy conservation level.

6. The energy conservation controller according to claim 5,
wherein the setting unit is configured to determine the length of the prescribed return time according to the degree of acceptance so that the lower the degree of acceptance is, the longer the prescribed return time is.

7. The energy conservation controller according to any one of claims 2 to 6,
wherein the setting unit is configured to determine the magnitude of energy conservation level according to the degree of acceptance so that the lower the degree of acceptance is, the more the energy to be consumed in the apparatus to be controlled is increased.

8. An energy conservation control system, comprising:

an apparatus to be controlled;
a storage unit configured to previously store a plurality of control contents for the apparatus to be controlled, corresponding to a plurality of energy conservation levels that indicate degrees of energy conservation, respectively;
a setting unit configured to set an energy conservation level;
a control unit configured to refer to the storage unit, and then control the apparatus to be controlled, based on a control content corresponding to the energy conservation level that has been set in the setting unit;
an operating unit configured to receive, from a user, an operation relevant to control of the apparatus to be controlled;
a request acquisition unit configured to define, as a reference time point, a time point when the control unit starts to control the apparatus to be controlled based on the control content, the request acquisition unit being configured to acquire an operation content received by the operating unit within a predetermined time period of at least one of before and after the reference time point; and
an acceptability evaluation unit configured to evaluate, as a degree of acceptance, a degree of the user's acceptability to control performed by the control unit at the reference time point, based on the operation content that has been acquired by the request acquisition unit,
wherein the setting unit is configured to, when the degree of acceptance is higher than a first threshold value, change the energy conservation level so that energy to be consumed in the apparatus to be controlled is made smaller than energy that has been consumed in the apparatus to be controlled at the reference time point.

Fig. 1

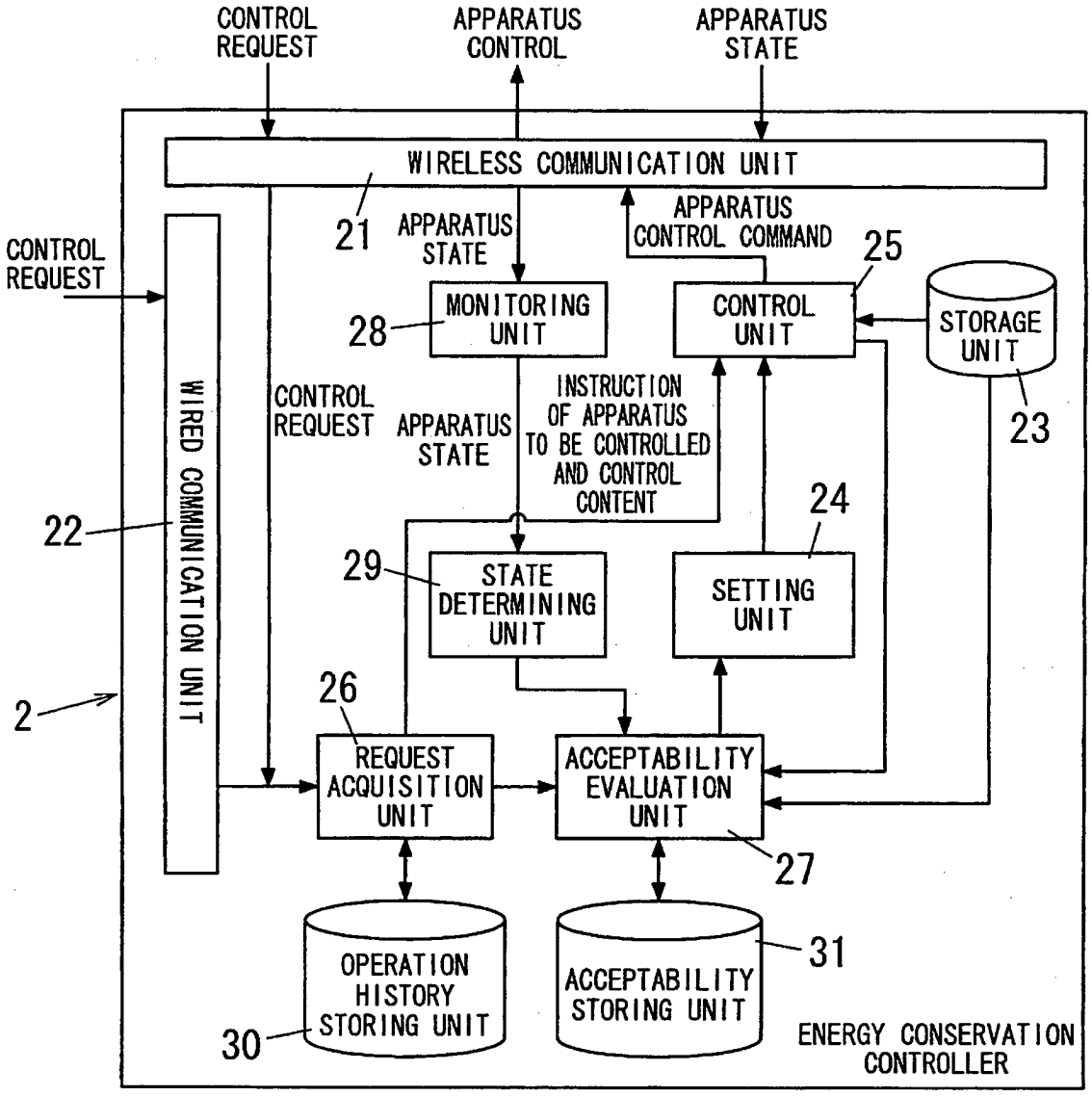

CONTROL REQUEST
APPARATUS CONTROL
APPARATUS STATE
WIRELESS COMMUNICATION UNIT
21
APPARATUS STATE
APPARATUS CONTROL COMMAND
25
CONTROL REQUEST
MONITORING UNIT
28
CONTROL UNIT
STORAGE UNIT
23
WIRED COMMUNICATION UNIT
CONTROL REQUEST
APPARATUS STATE
INSTRUCTION OF APPARATUS TO BE CONTROLLED AND CONTROL CONTENT
22
24
29
STATE DETERMINING UNIT
SETTING UNIT
2
26
REQUEST ACQUISITION UNIT
ACCEPTABILITY EVALUATION UNIT
27
OPERATION HISTORY STORING UNIT
30
ACCEPTABILITY STORING UNIT
31
ENERGY CONSERVATION CONTROLLER

Fig. 2

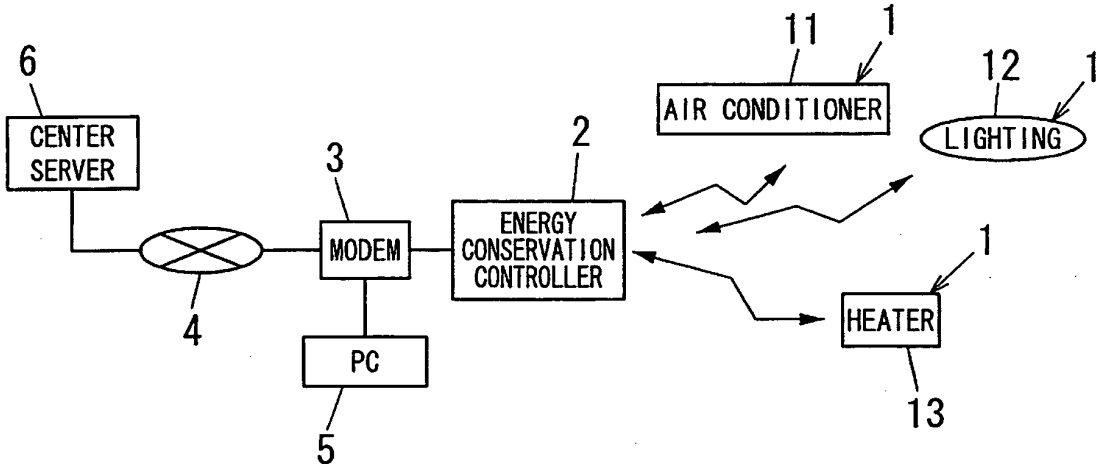

6
CENTER SERVER
4
3
MODEM
5
PC
2
ENERGY CONSERVATION CONTROLLER
11
1
AIR CONDITIONER
12
1
LIGHTING
1
HEATER
13

Fig. 3

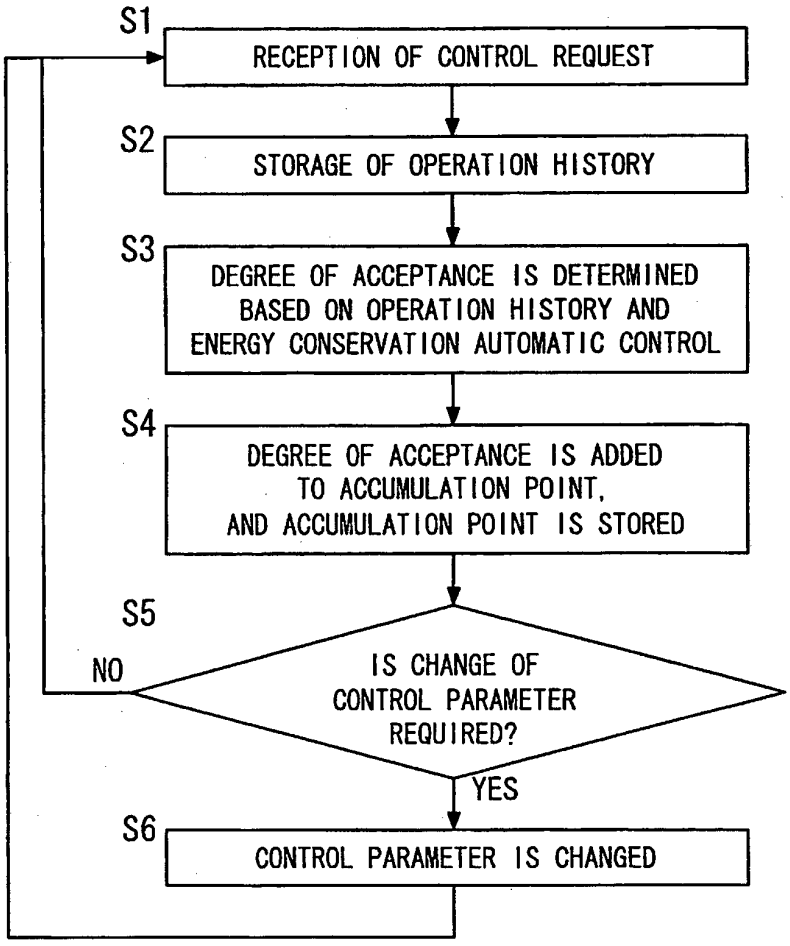

S1
RECEPTION OF CONTROL REQUEST
S2
STORAGE OF OPERATION HISTORY
S3
DEGREE OF ACCEPTANCE IS DETERMINED BASED ON OPERATION HISTORY AND ENERGY CONSERVATION AUTOMATIC CONTROL
S4
DEGREE OF ACCEPTANCE IS ADDED TO ACCUMULATION POINT, AND ACCUMULATION POINT IS STORED
S5
NO
IS CHANGE OF CONTROL PARAMETER REQUIRED?
YES
S6
CONTROL PARAMETER IS CHANGED

Fig. 4A

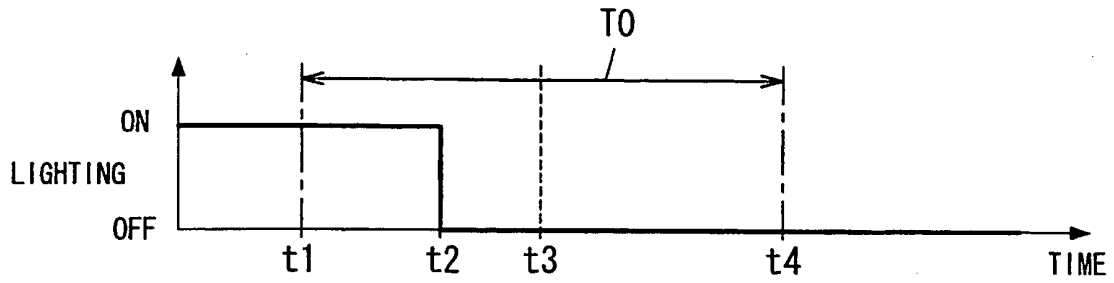

T0
ON
LIGHTING
OFF
t1
t2
t3
t4
TIME

Fig. 4B

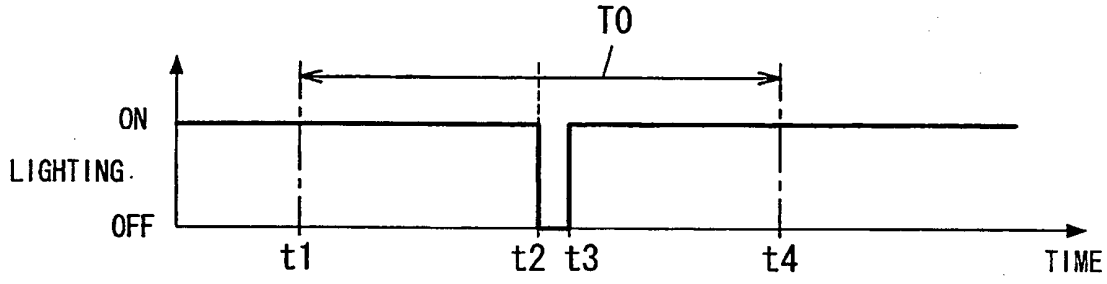

T0
ON
LIGHTING
OFF
t1
t2
t3
t4
TIME

Fig. 5A

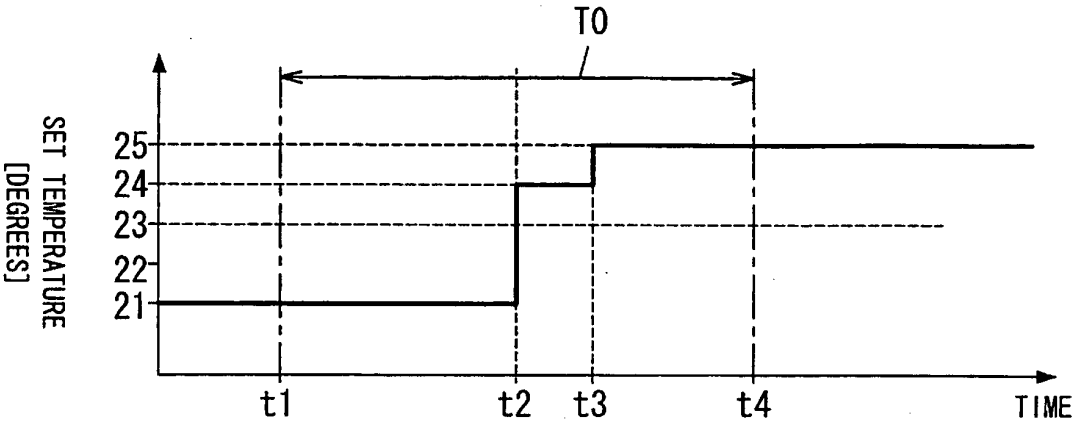


Fig. 5B

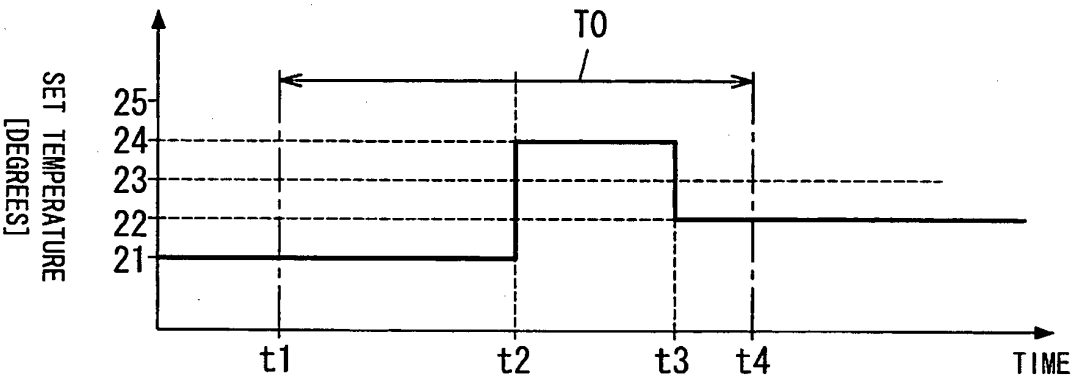
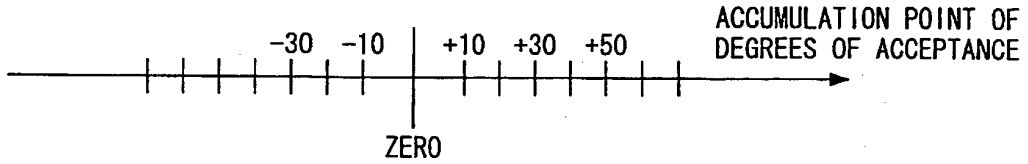


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/065300

A. CLASSIFICATION OF SUBJECT MATTER
H04Q9/00(2006.01)i, *F24F11/02*(2006.01)i, *H05B37/02*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04Q9/00, F24F11/02, H05B37/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2012
Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 2011/019011 A1 (Bunpei MAGORI), 17 February 2011 (17.02.2011), paragraphs [0001], [0022], [0023], [0025] to [0027], [0029], [0030], [0032], [0038], [0046] to [0058]; fig. 2 to 6 & JP 2011-38718 A	1-3,5-8 4
A	JP 2008-241161 A (Matsushita Electric Works, Ltd.), 09 October 2008 (09.10.2008), entire text; all drawings (Family: none)	1-8
A	JP 2010-281466 A (Daikin Industries, Ltd.), 16 December 2010 (16.12.2010), entire text; all drawings (Family: none)	1-8

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 July, 2012 (30.07.12)	07 August, 2012 (07.08.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/065300

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-041856 A (Hitachi, Ltd.), 26 February 2009 (26.02.2009), entire text; all drawings (Family: none)	1-8
A	JP 2000-121126 A (Toshiba Corp.), 28 April 2000 (28.04.2000), entire text; all drawings (Family: none)	1-8

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2008241161 A **[0002]**