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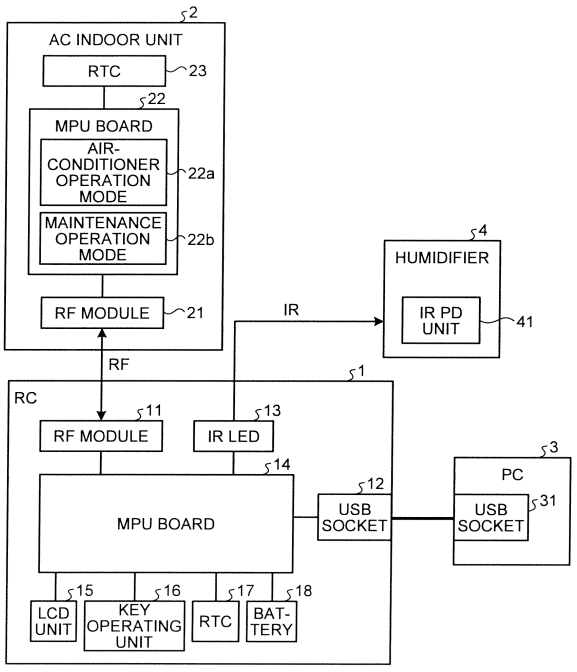
(54) Air conditioner

(57) An air conditioner (AC) includes an AC body (2) and a remote controller (RC) (1), wherein the AC body (2) includes a body receiver (21) that receives a control signal for controlling the operation from the RC (1), a body transmitter (21) that transmits operation information for the AC body (2) to the RC (1), and a maintenance-operation information generator (22) that generates contents of the maintenance operation and its operation time as the operation information, and the RC (1) includes a RC transmitter (11) that transmits a control signal for controlling the operation to the AC body (2), a RC receiver (11) that receives operation information for the AC body (2) transmitted from the AC body (2), and a display unit (15) that displays the contents of maintenance operation and the operation time included in the operation information received by the RC receiver (11).

FIG.2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an air conditioner that displays contents of a maintenance operation and its operation time.

2. Description of the Related Art

[0002] Recently, there has been an air conditioner for performing bidirectional communication between an air conditioner (hereinafter, "AC") body and a remote controller (hereinafter, "RC"), which is disclosed in, for example, Japanese Laid-open Patent Publication No. 2007-278696. This type of conventional technology includes one in which when an operation stop command is sent from the RC to the AC body, the AC body stops the operation, and information such as the operation time and power consumption (electricity expenses) is transmitted from the AC body to the RC, so that it is notified to a user.

[0003] In the AC during a cooling operation, dew drops are easily formed on a heat exchanger due to a difference between a room temperature and a temperature of the heat exchanger. Therefore, if the operation is stopped in this state, an internal humidity of an indoor unit becomes high, which causes mold and bad odor. Therefore, some of recent ACs automatically perform a drying operation in order to dry the dew drops formed on the heat exchanger or the like after the cooling operation is stopped.

[0004] A filter is provided in the indoor unit of the ACs so that dirt and dust in the air do not enter an air-intake, and some of the ACs have a function of automatically cleaning the filter when the operation is stopped after the operation time reaches a predetermined integrated operation time.

[0005] In this way, the conventional air conditioner automatically starts a maintenance operation (drying operation and filter cleaning) independently of a stop operation performed by the user when the AC satisfies predetermined conditions. Therefore, in the conventional air conditioner, when an operator controls the stop operation of the air conditioning operation, the operation time and power consumption (electricity expenses) of the air conditioning operation are transmitted from the AC body to the RC through bidirectional communication, however, the information for the maintenance operation is not transmitted.

[0006] When this is viewed from the operator, the operation is not stopped even if the stop operation of the air conditioner is performed. Therefore, because it is not known what type of operation is being operated and how long the operation is continued, the air conditioner may be forcibly stopped or a new air-conditioning operation may be started, that is, the maintenance operation is not satisfactorily performed.

[0007] Accordingly, it is an object in one aspect of an embodiment of the invention to provide an air conditioner capable of clearly recognizing contents of a maintenance operation and a time for the maintenance operation.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to at least partially solve the problems in the conventional technology.

[0009] According to an aspect of the present invention, an air conditioner includes an air conditioner body that performs maintenance operation after air conditioning is operated; and a remote controller that controls the operation of the air conditioner body, wherein the air conditioner body includes a body receiver that receives a control signal for controlling the operation from the remote controller, a body transmitter that transmits operation information for the air conditioner body to the remote controller, and a maintenance-operation information generator that generates contents of the maintenance operation and its operation time as the operation information, and the remote controller includes a remote-controller transmitter that transmits a control signal for controlling the operation to the air conditioner body, a remote-controller receiver that receives operation information for the air conditioner body transmitted from the air conditioner body, and a display unit that displays the contents of maintenance operation and the operation time included in the operation information received by the remote-controller receiver, wherein when the remote-controller transmitter transmits a control signal to stop the operation to the air conditioner body, the body receiver receives the control signal, the maintenance-operation information generator generates the contents of the maintenance operation and its operation time as the operation information, while when operation information is transmitted from the body transmitter, the remote-controller receiver receives the operation information and displays the contents of the maintenance operation and its operation time on the display unit.

[0010] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a diagram for explaining a relationship among an air conditioner body and a RC according to one embodiment of the present invention, a humidifier, and an externally connected device;

FIG. 2 is a block diagram of a schematic configura-

tion among the air conditioner body, the RC, the humidifier, and the externally connected device in FIG. 1;
FIG. 3 is a plan view of the RC of the air conditioner according to the present embodiment;
FIG. 4 is a sequence diagram of a pairing setting operation performed between the RC and AC according to the present embodiment;
FIG. 5 is a diagram of one example of AC model information that can be received during the pairing setting in FIG. 4;
FIG. 6 is a diagram of one example of AC model information minimum required for the pairing setting in FIG. 4;
FIG. 7 is a communication sequence diagram when log information is exchanged between the RC and the AC after the pairing setting according to the present embodiment;
FIG. 8 is a diagram of a display example when a start operation is performed from the RC to the air conditioner body while the operation is stopped;
FIG. 9 is a diagram of a display example when a stop operation is performed from the RC to the air conditioner body in operation;
FIG. 10 is a diagram of a display example when the stop operation is performed from the RC to the air conditioner body in operation and then an inner cleaning operation is performed;
FIG. 11 is a diagram of a display example when the stop operation is performed from the RC to the air conditioner body in operation and then an inner cleaning operation and a filter cleaning operation are performed;
FIG. 12 is a flowchart of the operation of the air conditioner according to the present embodiment;
FIG. 13 is a communication sequence diagram when log information is exchanged between the RC according to the present embodiment and PC;
FIG. 14 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 15 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 16 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 17 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 18 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 19 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 20 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 21 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 22 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 23 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 24 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 25 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 26 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 27 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;
FIG. 28 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information; and
FIG. 29 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

DESCRIPTION OF THE EMBODIMENT(S)

[0012] Exemplary embodiments of the present invention will be described with reference to the accompanying drawings.

First Example

Description of Configuration

[0013] FIG. 1 is a diagram for explaining a relationship among an air conditioner body and a RC according to one embodiment of the present invention, a humidifier, and an externally connected device. FIG. 2 is a block diagram of a schematic configuration among the air conditioner body, the RC, the humidifier, and the externally connected device in FIG. 1. FIG. 3 is a plan view of the RC of the air conditioner according to the present embodiment.

[0014] As illustrated in FIG. 1, the air conditioner according to the present embodiment is formed with an AC indoor unit 2 being an air conditioner body, a RC 1, and an outdoor unit (not illustrated). A remote operation and various settings are performed from the RC 1 to the AC indoor unit 2 using bidirectional communication through radio frequency (RF) modules. When the RC 1 acquires various operation information from the AC indoor unit 2, the information is displayed on a display unit of the RC 1, to be used for operation control and various settings.

The RC 1 according to the present embodiment has a wired connection with a personal computer (PC) 3 through a universal serial bus (USB) connection terminal being an external connection terminal to transmit the acquired various operation information thereto, so that the PC 3 can manage the operation information. The RC 1 according to the present embodiment can remotely operate a humidifier 4 or the like being a unit to be operated other than the AC indoor unit 2 using infrared light-emitting diode (IR LED) being an infrared transmitter.

[0015] Each schematic configuration of the RC 1, the AC indoor unit 2 being the air conditioner body, the PC 3 connected to the RC 1 through the USB connection terminal, and of the humidifier 4, which are configured as illustrated in FIG. 1, will be explained with reference to FIG. 2. The RC 1 includes an RF module 11 being a RC transmitter and an RC receiver including a transceiver and an antenna for performing bidirectional wireless communication with the AC indoor unit 2, a USB socket 12 for USB connection with the PC 3 that manages information, an IR LED 13 that transmits a command to the humidifier 4 through an infrared (IR) diode to control it, an MPU board 14 that mounts thereon a micro processor unit (MPU) including a memory that stores therein data such as the various operation information received from the AC indoor unit 2 for a fixed period (here, 40 days) and controls units of the RC 1, a liquid-crystal display (LCD) unit 15 being a display unit for displaying control information of the RC 1 and the operation information (operation time, power consumption, etc.) of the AC indoor unit 2, a key operating unit 16 through which an operation-targeted device is controlled, a real time clock (RTC) 17 being a timer dedicated for measuring time for time management, and a battery 18 for supplying power to the units of the RC 1.

[0016] As illustrated in FIG. 2, the AC indoor unit 2 includes an RF module 21 being a body receiver and a body transmitter for performing bidirectional wireless communication with the RF module 11 of the RC 1, and an MPU board 22 mounting thereon an MPU that controls the units of the AC indoor unit 2 based on commands from the RC 1 received by the RF module 21, collects the operation information for the AC indoor unit 2, calculates operation time and power consumption (electricity expenses) in an air-conditioner operation mode 22a or in a maintenance operation mode 22b, and also includes memory that stores therein data for a fixed period (here, 10 days). The MPU board 22 forms a maintenance-operation information generator that generates contents of characteristic maintenance operation according to the present invention and its operation time as operation information. The AC indoor unit 2 further includes an RTC 23 being a timer required for displaying a countdown for the operation time of the maintenance operation.

[0017] As illustrated in FIG. 2, the PC 3 includes a USB socket 31 for connecting a USB cable to the USB socket 12 of the RC 1. The PC 3 installs operation-information management software to thereby enable data transmission/reception upon USB connection, periodical collection of operation information from the AC indoor unit 2 through the RC 1, and continuous control of the operation on the PC screen.

[0018] As illustrated in FIG. 2, the humidifier 4 includes an infrared proximity detector (IR PD) unit 41 for receiving an infrared signal transmitted from the IR LED 13 of the RC 1. The RC 1 can control the humidifier 4 using this infrared signal (command).

[0019] As illustrated in FIG. 3, the RC 1 controlling the air conditioner includes the LCD unit 15 formed from a liquid-crystal display portion for displaying operation information (contents of maintenance information, operation time, power consumption, etc.), and the key operating unit 16 for controlling the operation of the AC indoor unit 2. The key operating unit 16 is provided with Start/Stop key 16a for controlling operation start and operation stop of the AC indoor unit 2, and also with OK key 16b required for start of pairing.

[0020] The air conditioner according to the present embodiment performs bidirectional wireless communication using the RF modules between the RC 1 and the AC indoor unit 2. Therefore, if a different model of AC is provided close to these two, the RC 1 cannot discriminate an operation-target device from the other, and thus the air conditioner requires previous pairing setting.

Pairing Setting

[0021] FIG. 4 is a sequence diagram of a pairing setting operation performed between the RC 1 and the AC indoor unit 2 according to the present embodiment. FIG. 5 is a diagram of one example of AC model information that can be received during the pairing setting in FIG. 4. FIG. 6 is a diagram of one example of AC model information minimum required for the pairing setting in FIG. 4.

[0022] First, when registration setting of the RC 1 is selected or when a pairing partner of the RC 1 is not stored on a nonvolatile memory (not illustrated, hereinafter, "EEPROM") mounted on the MPU board 14 of the RC 1 (when "Not registered" is displayed on the LCD unit 15), a mode is shifted to an RC registration setting mode, and a pairing screen is displayed, where a sequence to perform pairing with the AC indoor unit 2 appears. Likewise, when a pairing partner of the AC indoor unit 2 is not also registered, this is indicated by a lamp (not illustrated) provided in the AC indoor unit 2. As illustrated in FIG. 4, when the operator depresses a pairing button (not illustrated) provided in the AC indoor unit 2, a pairing execution status is indicated with sound of a buzzer and with blinking of the lamp, a pairing request signal of the AC indoor unit 2 is sent to the RF module 21, and the pairing is started (Step S60).

[0023] During displaying the pairing screen on the LCD unit 15 of the RC 1, by concurrently depressing the Start/Stop key 16a of the key operating unit 16 of the RC 1 illustrated in FIG. 3 and the OK key 16b provided inside an operation cover, the pairing request signal is sent to

the RF module 11, and the pairing is started (Step S61). "Pairing is being registered" is displayed on the LCD unit 15 of the RC 1. Here, communication for the pairing is performed between the RF modules 11 and 21 (Step S62), and after it is checked whether these are models whose pairing can be registered (Step S63), a pairing complete signal indicating completion of the pairing of the RF modules is transmitted from the RF module 21 to the MPU board 22 (Step S64), and the pairing complete signal indicating completion of the pairing of the RF modules is transmitted from the RF module 11 to the MPU board 14 (Step S65).

[0024] Then, an AC model information request is transmitted as general data from the RC 1 to the AC indoor unit 2 (Step S66). At this time, a signal indicating the AC model information that can be received from the AC indoor unit 2 includes, as illustrated in FIG. 5, a series name (Z/S), manufacturing year of the indoor unit (A to Z), a character string (model name: within 16 characters), a derivative model (1), and an AC ID (MAC address). When receiving the AC model information request by the AC indoor unit 2, the RF module 21 of the AC indoor unit 2 transmits a general-data transmission complete signal to the RC 1 to notify the RC 1 that the transmission has been successful (Step S67). The MPU board 14 of the RC 1 switches the RF module 11 to the reception mode (Step S68).

[0025] Subsequently, the MPU board 22 of the AC indoor unit 2 transfers the model information of the AC to the RC 1 (Step S69). When the RC 1 receives the model information of the AC indoor unit 2, the RF module 11 transmits an information transfer complete signal to the AC indoor unit 2, to notify the AC indoor unit 2 that the transmission has been successful (Step S70).

[0026] When acquiring the AC model information, the RC 1 notifies the RF module 11 that the reception mode is canceled (Step S71), and receives a reception mode complete signal (Step S72).

[0027] The MPU board 14 of the RC 1 determines whether the AC indoor unit 2 for setting the pairing is the corresponding model, based on the acquired AC model information. When the AC indoor unit 2 is the corresponding model and the received signal includes at least the signal illustrated in FIG. 6, the MPU board 14 of the RC 1 transmits the general data for the successful pairing to the AC indoor unit 2 (Step S73). When receiving the general data for the successful pairing, the RF module 21 of the AC indoor unit 2 notifies the RC 1 that the transmission of the general data is completed (transmission has been successful) (Step S74). The MPU board 14 of the RC 1 displays the success of the pairing on the LCD unit 15 for 5.5 seconds, and the operator selects "Z" or "S" according to the series name, so that the contents of the selected model are written to the EEPROM.

[0028] Meanwhile, when it is determined that the AC indoor unit 2 for performing the pairing setting is not the corresponding model, or when the received AC model information is any information other than the signal illustrated in FIG. 6, the MPU board 14 of the RC 1 transmits general data for unsuccessful pairing to the AC indoor unit 2 (Step S75). When receiving the general data for unsuccessful pairing, the RF module 21 of the AC indoor unit 2 notifies the RC 1 that transmission of the general data is completed (Step S76). The MPU board 14 of the RC 1 displays the unsuccessful pairing on the LCD unit 15 for 5.5 seconds, performs a pairing clearing process (Step S77), and receives notification that the pairing clearing process is completed (Step S78).

[0029] In the case of the unsuccessful pairing, the MPU board 22 of the AC indoor unit 2 also performs a pairing clearing process (Step S79), and receives notification that the pairing clearing process is completed (Step S80). The pairing setting is ended in this manner.

[0030] Between the RC 1 and the AC indoor unit 2 which end the pairing setting, operation control and various settings are performed from the RC 1 to the AC indoor unit 2 and the RC 1 requests an operation status log (history) stored in the AC indoor unit 2 according to the following communication sequence, thus acquiring the log.

Communication Sequence between AC and RC

[0031] FIG. 7 is a communication sequence diagram when log information is exchanged between the RC and the AC after the pairing setting according to the present embodiment. The RC 1 requests the operation status log from the AC indoor unit 2 every day at fixed time, to perform a collecting operation.

[0032] First, as illustrated in FIG. 7, when the time reaches fixed time (here, AM 0:30) based on the RTC 17, the MPU board 14 of the RC 1 transmits a log request to the MPU board 22 of the AC indoor unit 2 through the RF modules 11 and 21 (Step S81). The RC 1 transmits the log request and then waits for the log data sent from the AC indoor unit 2. When the log is not received after a predetermined time has passed during waiting for the log, the RC 1 determines this as a reception error due to reception time-out, ends the waiting for reception of the log, and ends the log collection on that day. Because the EEPROM of the MPU board 22 of the AC indoor unit 2 has a capacity such that logs for the AC operation status for 10 days at maximum can be stored, even if the reception error occurs, the logs are collectively transferred when the next log can be received.

[0033] As illustrated in FIG. 7, when sequentially receiving the log data from the AC indoor unit 2 (Steps S82, S83, ...), the RC 1 stores the log data in the EEPROM of the MPU board 14 at each time. A method of storing logs is implemented in such a manner that when the EEPROM has any area where data is not stored, the log is written to the area, while when the EEPROM has no area where data is not stored, the log is overwritten to the write area of the oldest log, and is stored therein. When receiving the end of log indicating the end of log data from the AC indoor unit 2 (Step S84), the RC 1 completes acquisition

of the logs.

[0034] Between the RC 1 and the AC indoor unit 2, the RC 1 transmits an operation control command to the AC indoor unit 2 at any time other than the fixed time, and acquires the operation status log from the AC indoor unit 2, so that the acquired operation status log can be displayed on the LCD unit 15 of the RC 1.

Contents of Maintenance Operation and Display of Operation Time

[0035] FIG. 8 is a diagram of a display example when a start operation is performed from the RC to the air conditioner body while the operation is stopped. FIG. 9 is a diagram of a display example when a stop operation is performed from the RC to the air conditioner body in operation. FIG. 10 is a diagram of a display example when the stop operation is performed from the RC to the air conditioner body in operation and then inner cleaning operation is performed. FIG. 11 is a diagram of a display example when the stop operation is performed from the RC to the air conditioner body in operation and then inner cleaning operation and a filter cleaning operation are performed.

[0036] When the AC indoor unit 2 is stopped and the RC 1 also displays the operation-stop screen as illustrated in FIG. 8, the operator depresses the Start/Stop key 16a of the RC 1, and an indicator is changed to "Operating" illustrated by an open arrow in response to the depression, and an indicator of the AC indoor unit 2 is also changed to "Operating". However, when communication cannot be established even if the Start/Stop key 16a of the RC 1 is depressed, "Communication x" illustrated by a black arrow and indicating that the communication is disabled" is displayed on the LCD unit 15. Therefore, the operator can learn, just by looking at the display of the RC 1, whether the communication is successfully established and the command is executed or the communication is disabled and the command is not executed.

[0037] When the AC indoor unit 2 is operating and the RC 1 also displays a screen of "Operating" as illustrated in FIG. 9, the operator depresses the Start/Stop key 16a of the RC 1, and the log is requested from the AC indoor unit 2 before an operation-stop status is displayed. The MPU board 22 of the AC indoor unit 2 calculates electricity expenses and an operation time in the air-conditioner operation mode 22a and transmits the calculated results to the RC 1, so that the electricity expenses and the operation time of Today's operation (air-conditioning operation) can be displayed in "Notice" indicated by an open arrow. After 5.5 seconds have passed since the display of "Notice", the operation-stop status indicated by an open arrow is displayed. A total of today's electricity expenses and a total of yesterday's electricity expenses are displayed on the operation-stop screen.

[0038] Power consumption of the AC fluctuates caused by a cooling or heating operation mode and a set temperature. Therefore, the power consumption is determined in such a manner that the AC indoor unit 2 measures the power consumption in real time, integrates power consumptions to determine power consumption, and determines the power consumption using the determined power consumption and the electricity expenses per unit time stored in the MPU board 22 of the AC indoor unit 2, although these are not illustrated.

[0039] When the AC indoor unit 2 is in air-conditioning operation and the RC 1 also displays a screen of "in cooling operation" as illustrated in FIG. 10, the operator depresses the Start/Stop key 16a of the RC 1, the log is requested from the AC indoor unit 2 similarly to the case of FIG. 9, and the today's electricity expenses and its operation time calculated by the MPU board 22 of the AC indoor unit 2 are displayed on the RC 1. Here, the MPU board 22 of the AC indoor unit 2 determines that the air-conditioning operation is cooling operation and condensation may be formed on the heat exchanger or the like, and automatically starts inner cleaning operation for drying the inside of the indoor unit after the air-conditioning operation is stopped, to perform the inner cleaning operation of the maintenance operation. The inner cleaning operation time is determined according to the cooling operation time before the operation is stopped using a table stored in the MPU board 22 of the AC indoor unit 2.

[0040] At the time of starting the maintenance operation, the MPU board 22 of the AC indoor unit 2 calculates electricity expenses required for the maintenance operation from the maintenance operation time and from the electricity expenses per unit time of the maintenance operation stored in the MPU board 22 of the AC indoor unit 2, and transmits information for the maintenance operation mode, the operation time, and for the electricity expenses to the RC 1, and the RC 1 displays thereon the received information.

[0041] The RC 1 displays a remaining time of the inner cleaning operation (remaining: about 90 minutes) using the maintenance operation time information after 5.5 seconds have passed since the display, and the remaining time is counted down on the display. The measurement of the countdown is performed by the RTC 17 of the RC 1. Alternatively, the measurement is performed by the RTC 23 of the AC indoor unit 2, and the countdown information may be transmitted to the RC 1 and displayed thereon.

[0042] In this manner, at the time of the maintenance operation, the indicator indicating that "inner cleaning operation" as illustrated in FIG. 10 is performed and the "remaining operation time" are displayed on the LCD unit 15 of the RC 1. This enables the operator to learn the contents of the maintenance operation after the operation is stopped and the remaining time of the maintenance operation. Therefore, these pieces of information help the operator determine whether a normal operation is waited until the end of the maintenance operation or the maintenance operation is suspended to perform the nor-

mal operation, depending on the remaining time. For example, if the operator depresses the Start/Stop key 16a of the RC 1 when some time still remains, the inner cleaning operation is suspended, and the operation-stop screen indicated by the white allow is displayed. The operation-stop screen displays thereon a total of the today's electricity expenses and a total of the yesterday's electricity expenses, and displays an amount of money including electricity expenses required for the inner cleaning operation up to its suspension in the total of the today's electricity expenses.

[0043] When the inner cleaning operation as illustrated in FIG. 10 is displayed and the maintenance operation is ended without suspension, as illustrated by the black arrow, the operation time only for the maintenance operation (here, inner cleaning operation) and actual electricity expenses are displayed, and the operation-stop status indicated by the white arrow is then displayed. The operation-stop screen displays thereon the total of the today's electricity expenses and the total of the yesterday's electricity expenses.

[0044] When the AC indoor unit 2 is in the air-conditioning operation and the RC 1 also displays thereon a screen of "in cooling operation" as illustrated in FIG. 11, and when the operator depresses the Start/Stop key 16a of the RC 1, similarly to the case of FIG. 10, the RC 1 requests the log from the AC indoor unit 2, and the electricity expenses for today's operation and the operation time calculated by the MPU board 22 of the AC indoor unit 2 are displayed on the RC 1. Similarly to FIG. 10, the MPU board 22 of the AC indoor unit 2 determines that the air-conditioning operation is the cooling operation and condensation may be formed on the heat exchanger or the like, and automatically starts the inner cleaning operation after the air-conditioning operation is stopped. At this time, the AC indoor unit 2 transmits information for the maintenance operation mode, the operation time, and for the electricity expenses to the RC 1, and the RC 1 displays thereon the received information.

[0045] The RC 1 displays a countdown of the remaining operation time during the inner cleaning operation, using the maintenance operation time information, after 5.5 seconds have passed since the display of the information.

[0046] The inner cleaning is finished after 90 minutes, and the RC 1 displays an operation time only for the inner cleaning operation and actual electricity expenses as indicated by the white arrow. When it is determined that the air-conditioning operation time reaches a predetermined air-conditioning operation integrated time, as illustrated in FIG. 11, the MPU board 22 of the AC indoor unit 2 automatically starts the filter cleaning operation for cleaning the filter as indicated by the white arrow. At this time, also, the AC indoor unit 2 transmits information for the maintenance operation mode, the operation time, and for the electricity expenses to the RC 1, similarly to the inner cleaning operation, and the RC 1 displays the received information. Thereafter, during the filter cleaning operation, the operation status and the countdown of the remaining time are displayed on the RC 1. The countdown display is similar to the case of the inner cleaning operation, and may therefore be performed by using either one of the RTCs in the RC 1 and in the AC indoor unit 2.

[0047] When the maintenance operation is ended without suspension of the filter cleaning operation illustrated in FIG. 11 (after 10 minutes), as illustrated by the white arrow, the operation time only for the filter cleaning operation and the electricity expenses are displayed, and the operation-stop status indicated by the next white arrow is then displayed. The operation-stop screen displays thereon a total of the today's electricity expenses and a total of the yesterday's electricity expenses.

Contents of Maintenance Operation and Display of Operation Time

[0048] FIG. 12 is a flowchart of the operation of the air conditioner according to the present embodiment. The operation in the case of automatically performing maintenance operation after the air-conditioning operation will be explained with reference to FIG. 12. First, it is determined whether the stop of the air-conditioning operation is required by the operator during the air-conditioning operation (Step S100). When the stop of the air-conditioning operation is not required, the AC indoor unit 2 waits until the stop of the air-conditioning operation is required (Step S101).

[0049] When the operator stops the air-conditioning operation through the RC 1 (Yes at Step S100), the MPU board 22 of the AC indoor unit 2 calculates an operation time and electricity expenses for the air-conditioning operation, and the information for the air-conditioning operation time and the electricity expenses or the like is transmitted from the AC indoor unit 2 to the RC 1 through the RF module 21, and the RC 1 acquires the information for the air-conditioning operation time and the electricity expenses or the like (Step S102). The AC indoor unit 2 determines whether the maintenance operation is required after the air-conditioning operation is ended. When the maintenance operation is not required (No at Step S103), the MPU board 14 of the RC 1 displays the acquired operation time and electricity expenses for the air-conditioning operation (Step S104).

[0050] At Step S103, when it is determined that the maintenance operation is required (Yes at Step S103), the MPU board 22 of the AC indoor unit 2 extracts a preset maintenance operation time from the table stored in the MPU board 22 of the AC indoor unit 2, calculates the electricity expenses, and generates the information for the maintenance operation (Step S105). The AC indoor unit 2 transmits the maintenance operation information to the RC 1, and the RC 1 displays the maintenance operation time and the electricity expenses on the LCD unit 15 of the RC 1 (Step S106). The RC 1 displays a countdown of the remaining operation time based on the

operation time sent from the AC indoor unit 2 (Step S107). The RC 1 sets the reception wait status from the AC indoor unit 2 to be off for energy saving until completion of the countdown, and notifies the AC indoor unit 2 of the completion after the countdown is completed. The AC indoor unit 2 calculates a maintenance operation time and its actual electricity expenses, and calculates a total operation time of the air-conditioning operation and the maintenance operation and electricity expenses therefor, and transmits the information to the RC. The RC 1 displays the maintenance operation time and the electricity expenses on the LCD unit 15 (Step S108), and, thereafter, displays the total operation time and electricity expenses for the air-conditioning operation and the maintenance operation (Step S109).

[0051] As explained above, when the maintenance operation is automatically started after the air-conditioning operation is stopped, the air conditioner according to the present embodiment causes the RC 1 to display thereon the contents of the maintenance operation and the time required for the maintenance operation. Therefore, the operator can get to know what kind of maintenance operation is being performed after the air-conditioning operation is stopped, and learn even how long the maintenance operation is continued. Therefore, these pieces of information help the operator determine how to perform the following operation using the RC. Particularly, when the operation time of the maintenance operation is displayed as the countdown, the operator can learn the remaining time of the maintenance operation, and this information helps the operator determine whether the normal operation is waited until the end of the maintenance operation or the maintenance operation is suspended to perform the normal operation.

Communication Sequence between RC and PC

[0052] The RC 1 according to the present embodiment includes the USB socket 12 being an external connection terminal connecting to the PC 3 that can manage operation information for the AC indoor unit 2. Therefore, by USB-connecting the RC 1 and the PC 3, the operation information for the AC indoor unit 2 can be collected to the PC 3 through the RC 1, which enables the PC 3 to manage the operation information for the AC indoor unit 2.

[0053] FIG. 13 is a communication sequence diagram when log information is exchanged between the RC and PC according to the present embodiment. The logs of the operation status of the AC stored in the EEPROM of the MPU board 14 of the RC 1 are transmitted to the PC 3 according to the communication sequence between the AC indoor unit 2 and the RC 1. The EEPROM of the MPU board 14 of the RC 1 has a capacity such that the logs received from the AC for 40 days at maximum can be stored.

[0054] First, when the RC 1 and the PC 3 are USB-connected to each other, a series of processes (enumeration) until communication becomes possible by the USB driver is performed, and completion of the enumeration allows communication between the RC 1 and the PC 3 (Step S85). During the enumeration, an indicator of "connection is detected: USB-connected" is displayed on the LCD unit 15 of the RC 1.

[0055] When the enumeration is completed, the PC 3 requests the AC information from the RC 1 (Step S86). The RC 1 responds to the request and transmits the AC information stored in the EEPROM of the MPU board 14 to the PC 3 (Step S87). The AC information includes a product name of an AC, a series name, a performance range, manufacturing year of the indoor unit, a voltage to be used, an AC MAC address, room information, and a RC type.

[0056] The PC 3 checks the received AC information against the managed AC information, and identifies to which of ACs the received AC information corresponds. When a plurality of ACs are managed by the PC 3, it is necessary to check to which of the ACs the received AC information corresponds.

[0057] The PC 3 requests AC-operation setting information from the RC 1 in order to load the operation setting information (Step S88). The RC 1 responds to this request and transmits the AC-operation setting information stored in the EEPROM of the MPU board 14 to the PC 3 (Step S89). The AC-operation setting information includes a volume level, with or without voice, switching to an energy saving function (human sensor), equipped with an inner cleaning function or not, a time for maintenance, equipped with an energy saving fan or not, equipped with an auto powerful function or not, and current switching.

[0058] The PC 3 requests a log from the RC 1 in order to load the log (Step S90). The RC 1 responds to this log request from the PC 3 and transmits the log data thereto (Step S91). The PC 3 and the RC 1 repeat a request for next data and transmission of log data (Steps S92, S93, S94) respectively. The RC 1 transmits "End of log" to the PC 3 when no log data to be transmitted remains (Step S95), and the log loading process is thereby completed in the PC 3. Thereafter, the USB connection for connecting the PC 3 and the RC 1 is disconnected (Step S96), and the RC 1 is thereby released from the communication mode with the PC 3, so that the display of the LCD unit 15 shifts to the normal display.

[0059] In this manner, the operation log of the AC temporarily stored (logs for 10 days at maximum can be stored) in the AC indoor unit 2 is transmitted to the RC 1 and stored therein (logs for 40 days at maximum can be stored), and the log stored in the RC 1 is transferred to the PC 3 when the RC 1 and the PC 3 are USB-connected to each other. The PC 3 uses the operation-information management software pre-installed therein to enable management of the operation information for the AC indoor unit 2 as illustrated in FIG. 14 to FIG. 29.

Management of Operation Information in PC

[0060] FIG. 14 to FIG. 29 are diagrams of a PC screen example through which the operation information for the AC is managed based on the log information acquired by the PC. First, the screen as illustrated in FIG. 14 is displayed in the PC 3 using the operation-information management software. The operator clicks on a "Select AC" tag 100, and clicks on a button 101 of "Living room 1" provided in the Select AC tag 100. Then clicking on a calendar tag 102 allows to display a calendar screen 103 in which dairy operation time and electricity expenses, monthly and yearly electricity expenses, monthly target electricity expenses for the AC in the "Living room 1" are described. This enables the operator to continuously check the operation status and the electricity expenses for each AC, thus using the information for efficient usage and setting of the AC.

[0061] When the PC 3 and the RC 1 are USB-connected to each other, as illustrated in FIG. 15, the RC 1 is connected to the PC 3, and a window 104 indicating "Receiving data" is displayed. When new operation information is loaded into the PC 3, as illustrated in FIG. 16, a screen in which operation times and electricity expenses up to the previous day stored in the RC 1 are added to the calendar screen 103 is displayed.

[0062] The operator clicks on a graph tag 105 on the screen in the state of FIG. 16, and, as illustrated in FIG. 17, a graph screen 106 in which dairy electricity expenses are illustrated by a bar graph can be displayed. This enables the operator to get to know at a glance an increase and a decrease of the electricity expenses of the AC for one month. In addition, as cumulative electricity expenses of the AC required for "Living room 1", a total of electricity expenses for one month, a total of electricity expenses for the previous month, a total of annual electricity expenses, a total of electricity expenses for the previous year, and monthly target electricity expenses, or the like are also displayed, and therefore the operation status of the AC can be obtained from various angles.

[0063] In the screen of FIG. 18, by clicking on an all-rooms total button 108 in the Select AC tag 100, the graph screen 106 in which electricity expenses for the Living-room 1 button 101 and electricity expenses for a Bedroom 1 button 107 are added up respectively is displayed in different colors (different densities in a monochrome display). This enables the operator to get to know at a glance the total of the electricity expenses for the ACs in all the rooms and its breakdown. In addition, the graph screen 106 is provided with a "Reduce" button 109 and an "Enlarge" button 110. For example, when the Enlarge button 110 is clicked in the state of FIG. 18, a graph rate changes as illustrated in FIG. 19 in the graph screen 106, so that the graph can be enlarged. This enables the operator to clearly learn a fine change of electricity expenses.

[0064] For example, as illustrated in FIG. 20, a large number of ACs such as the Living-room 1 button 101, a Dining-room 1 button 111, a Japanese-room 1 button 112, a Bedroom 1 button 113, a Kids-room 1 button 114, Another room 1 button 115, a Kids-room 2 button 116 are registered in the Select AC tag 100. In this case, by clicking the all-rooms total button 108, the graph indicating the total of electricity expenses for all the rooms for each day is displayed. As for the graph indicating the total of electricity expenses for all the rooms for one day, the electricity expenses for each room are further displayed in different colors (different densities in monochrome display), and this enables the operator to get to know at a glance the breakdown of the electricity expenses even for the large number of ACs.

[0065] In the graph display illustrated in FIG. 18, by clicking on a specific day, as illustrated in FIG. 21, a window 117 indicating details of the operation status on that day can be opened. The electricity expenses and the operation time for all the rooms on that day, and an average temperature of outside air temperatures, or the like can be displayed on the window 117.

[0066] Furthermore, an AC-setting confirmation screen 119 as illustrated in FIG. 22 is a screen obtained when the Living-room 1 button 101 of the Select AC tag 100 is clicked and a "Confirm AC setting" tag 118 is clicked. The AC-setting confirmation screen 119 is used to easily confirm the details of setting contents of the AC registered in the Living-room 1 button 101 on the screen of the PC 3. Moreover, each function of the setting contents is also displayed on the AC-setting confirmation screen 119, so that when a setting content is to be changed, the operator can change the setting content while understanding it right. In addition, by clicking on a Next page button 120, as illustrated in FIG. 23, an AC-setting confirmation screen 119 at the next page is displayed. When the setting content is to be changed, the setting content to be changed is clicked, so that contents to be changed are displayed as a menu and the setting content is changed by clicking on a desired content. If the operator wants to return to the AC-setting confirmation screen 119 at the previous page, a Previous page button 121 is clicked. The setting information changed in this manner is sent from the USB-connected PC 3 to the RC 1. When a command or the like is sent from the RC 1 to the AC indoor unit 2, the changed setting information is sent with the command, so that the setting of the AC indoor unit 2 is changed.

[0067] In the calendar display in FIG. 16, when a One point advice button 123 illustrated in FIG. 24 is clicked, a One-point advice window 122 is opened, and some advice for the operator to efficiently use the AC is displayed. When a plurality of One-point advice windows 122 are provided, by clicking a Next page button 122a or a Previous page button 122b, another One-point advice window 122 can be opened (see FIG. 25).

[0068] As illustrated in FIG. 26, a file management tag 124 adjacent to the Select AC tag 100 is clicked, to display a Load button 125 for loading data from CD-ROM or the like, a Write button 126 for writing data to CD-R or the like, a Delete Model button 127 for deleting a model of

ACs registered in the AC selection tag, a File button 128 for writing a file to a flexible disk (FD) or the like, a "How to use this software" button 129 for displaying Help for the PC software, and a button 130 for "About this software" with which a name, a source, and version information of the PC software are displayed. For example, the Delete Model button 127 among these buttons is clicked, to open a window 131 as illustrated in FIG. 27, and a list of already registered models is displayed. For example, the Living-room 1 button among the window 131 is clicked, to open a confirmation window 132 to confirm the deletion, as illustrated in FIG. 28, and by clicking on "Yes" or "No", it can be deleted or the deletion thereof can be cancelled.

[0069] As illustrated in FIG. 29, the button 130 for "About this software" in the file management tag 124 is clicked, to enable display of a screen 133 in which a name of the PC software, a name of its source, or released date, although it is not illustrated, are displayed.

[0070] As explained above, in the air conditioner according to the present embodiment, the operation information for the AC indoor unit 2 can be managed even by the PC 3 through the RC 1. Therefore, the contents which cannot be displayed within the display screen of the RC 1 can be displayed in detail using a display of an externally connected device such as the PC 3. Particularly, in the setting screen of the AC as illustrated in FIG. 23 and FIG. 24, functions for inner cleaning and filter cleaning intervals for the maintenance operation are described, so that the operator understands the contents, which enables the operator to appropriately set the maintenance operation. Moreover, when the contents of the maintenance operation are displayed on the LCD unit 15 of the RC 1, the operator can appropriately determine whether the maintenance operation is continued or is suspended to perform normal operation.

[0071] According to the present invention, the RC transmitter transmits the control signal for stopping the operation to the air conditioner body, the body receiver receives the control signal, the maintenance-operation information generator generates the contents of the maintenance operation and its operation time as the operation information. When the operation information is transmitted from the body transmitter, the RC receiver receives the operation information and displays the contents of the maintenance operation and its operation time on the display unit. Thus, there is such an effect that because the contents of the maintenance operation and the operation time are transmitted from the air conditioner body to the RC and are displayed on the display unit, the contents of the maintenance operation and the time required for the maintenance operation can be obtained, and these pieces of information thereby help the operator determine how to perform the operation using the RC.

Claims

1. An air conditioner comprising:

an air conditioner body (2) that performs maintenance operation after air conditioning is operated; and
a remote controller (1) that controls the operation of the air conditioner body, wherein
the air conditioner body (2) includes
a body receiver (21) that receives a control signal for controlling the operation from the remote controller (1),
a body transmitter (21) that transmits operation information for the air conditioner body (2) to the remote controller (1), and
a maintenance-operation information generator (22) that generates contents of the maintenance operation and its operation time as the operation information, and
the remote controller (1) includes
a remote-controller transmitter (11) that transmits a control signal for controlling the operation to the air conditioner body (2),
a remote-controller receiver (11) that receives operation information for the air conditioner body (2) transmitted from the air conditioner body (2), and
a display unit (15) that displays the contents of maintenance operation and the operation time included in the operation information received by the remote-controller receiver (11), wherein
when the remote-controller transmitter (11) transmits a control signal to stop the operation to the air conditioner body (2), the body receiver receives the control signal, the maintenance-operation information generator generates the contents of the maintenance operation and its operation time as the operation information, while when operation information is transmitted from the body transmitter (21), the remote-controller receiver (11) receives the operation information and displays the contents of the maintenance operation and its operation time on the display unit (15).

2. The air conditioner according to claim 1, further comprising a timer (17, 23) that manages time provided in at least one of the air conditioner body (2) and the remote controller (1), wherein
after the operation time of the maintenance operation is displayed on the display unit (15), the timer (17, 23) is used to display a countdown, of a remaining time of the maintenance operation.

3. The air conditioner according to claim 2, wherein when the timer (17, 23) is provided in the air conditioner body (2), countdown information is transmitted

from the body transmitter (21) to the remote-controller receiver (11) for each fixed time after the countdown is started, and the contents of the maintenance operation and the remaining time are displayed on the display unit (15).

FIG.1

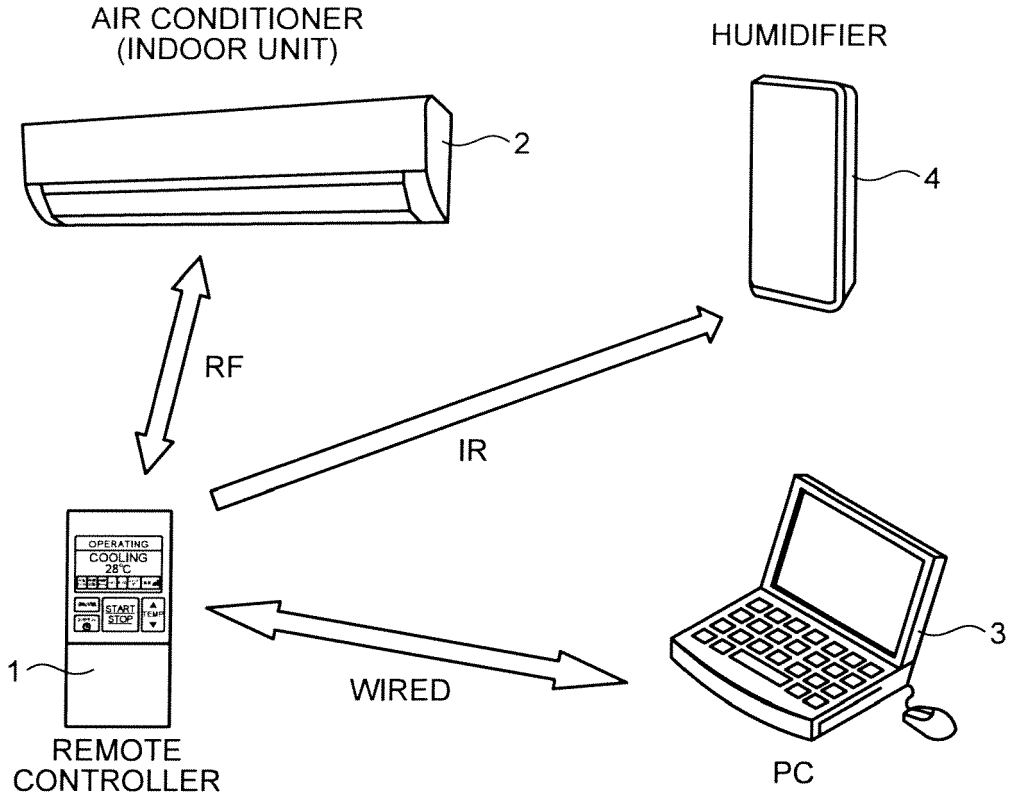

AIR CONDITIONER
(INDOOR UNIT)
HUMIDIFIER
2
4
RF
IR
OPERATING
COOLING
28°C
START
STOP
1
3
WIRED
REMOTE
CONTROLLER
PC

FIG.2

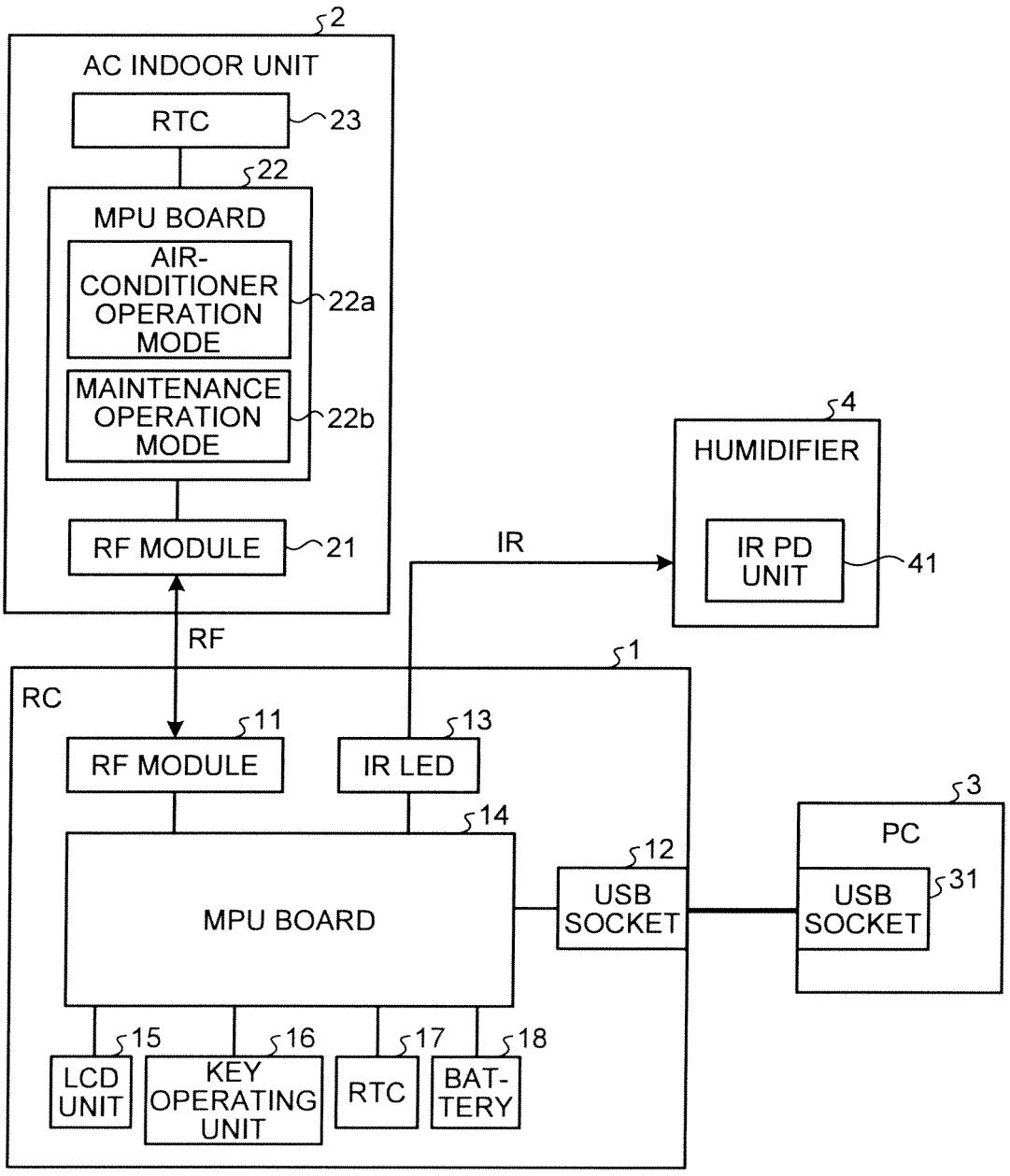

2
AC INDOOR UNIT
RTC
23
22
MPU BOARD
AIR-CONDITIONER OPERATION MODE
22a
MAINTENANCE OPERATION MODE
22b
RF MODULE
21
RF
IR
4
HUMIDIFIER
IR PD UNIT
41
1
RC
11
RF MODULE
13
IR LED
14
MPU BOARD
12
USB SOCKET
3
PC
USB SOCKET
31
15
LCD UNIT
16
KEY OPERATING UNIT
17
RTC
18
BAT-TERY

FIG.3

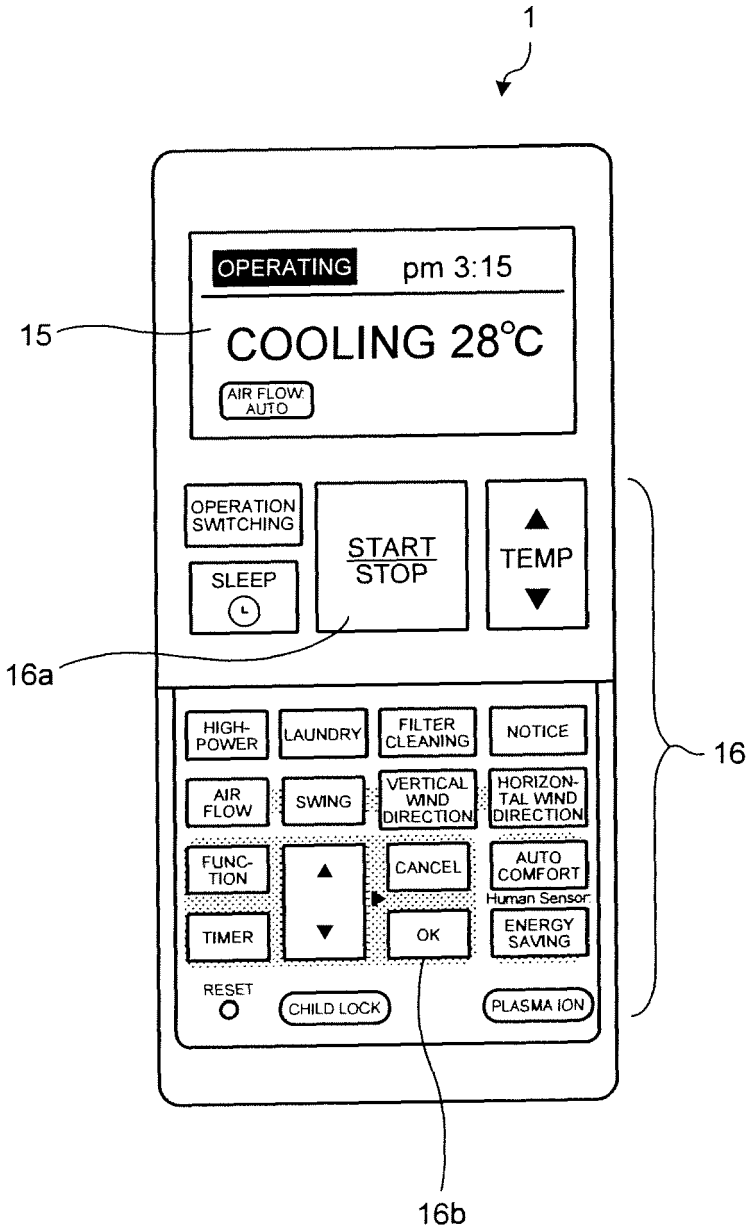

1
OPERATING
pm 3:15
15
COOLING 28°C
AIR FLOW AUTO
OPERATION SWITCHING
SLEEP
START STOP
TEMP
16a
HIGH-POWER
LAUNDRY
FILTER CLEANING
NOTICE
AIR FLOW
SWING
VERTICAL WIND DIRECTION
HORIZON-TAL WIND DIRECTION
FUNC-TION
CANCEL
AUTO COMFORT
Human Sensor
TIMER
OK
ENERGY SAVING
RESET
CHILD LOCK
PLASMA ION
16
16b

FIG.4

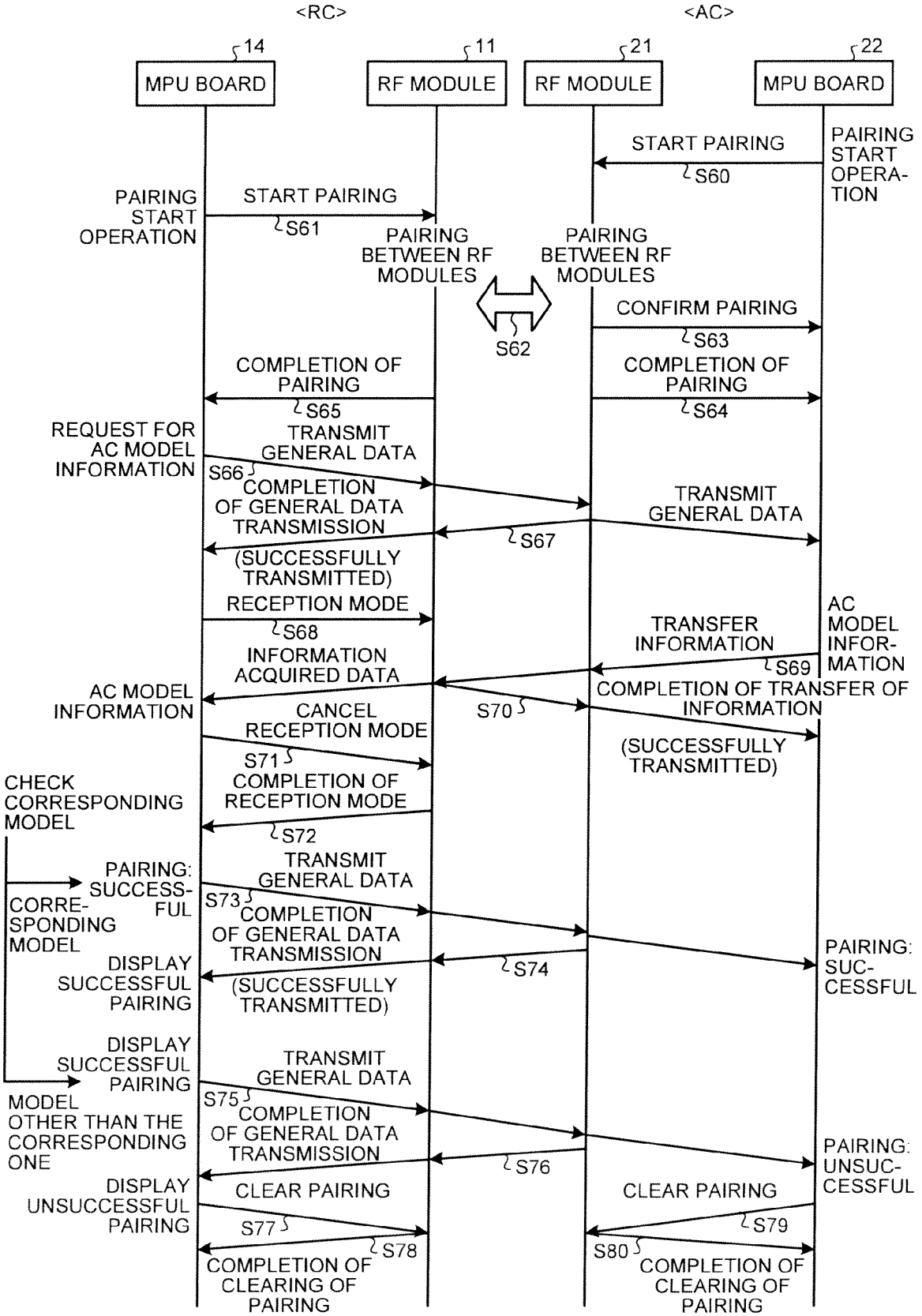

<RC>
<AC>
14
11
21
22
MPU BOARD
RF MODULE
RF MODULE
MPU BOARD
START PAIRING
S60
PAIRING START OPERA-TION
PAIRING START OPERATION
START PAIRING
S61
PAIRING BETWEEN RF MODULES
PAIRING BETWEEN RF MODULES
S62
CONFIRM PAIRING
S63
COMPLETION OF PAIRING
S65
COMPLETION OF PAIRING
S64
REQUEST FOR AC MODEL INFORMATION
TRANSMIT GENERAL DATA
S66
COMPLETION OF GENERAL DATA TRANSMISSION
TRANSMIT GENERAL DATA
S67
(SUCCESSFULLY TRANSMITTED)
RECEPTION MODE
S68
TRANSFER INFORMATION
S69
AC MODEL INFOR-MATION
INFORMATION ACQUIRED DATA
AC MODEL INFORMATION
CANCEL RECEPTION MODE
S70
COMPLETION OF TRANSFER OF INFORMATION
(SUCCESSFULLY TRANSMITTED)
S71
COMPLETION OF RECEPTION MODE
S72
CHECK CORRESPONDING MODEL
PAIRING: SUCCESS-FUL
CORRE-SPONDING MODEL
TRANSMIT GENERAL DATA
S73
COMPLETION OF GENERAL DATA TRANSMISSION
S74
PAIRING: SUC-CESSFUL
DISPLAY SUCCESSFUL PAIRING
(SUCCESSFULLY TRANSMITTED)
DISPLAY SUCCESSFUL PAIRING
MODEL OTHER THAN THE CORRESPONDING ONE
TRANSMIT GENERAL DATA
S75
COMPLETION OF GENERAL DATA TRANSMISSION
S76
PAIRING: UNSUC-CESSFUL
DISPLAY UNSUCCESSFUL PAIRING
CLEAR PAIRING
CLEAR PAIRING
S77
S78
S79
S80
COMPLETION OF CLEARING OF PAIRING
COMPLETION OF CLEARING OF PAIRING

FIG.5

AC MODEL INFORMATION	SERIES NAME: Z/S
	MANUFACTURING YEAR OF INDOOR UNIT: A TO Z
	CHARACTER STRING: (MODEL NAME, WITHIN 16 CHARACTERS)
	DERIVATIVE MODEL: 1
	AC ID (MAC ADDRESS)

FIG.6

AC MODEL INFORMATION	SERIES NAME: Z OR S
	MANUFACTURING YEAR OF INDOOR UNIT: A
	DERIVATIVE MODEL: 1

FIG.7

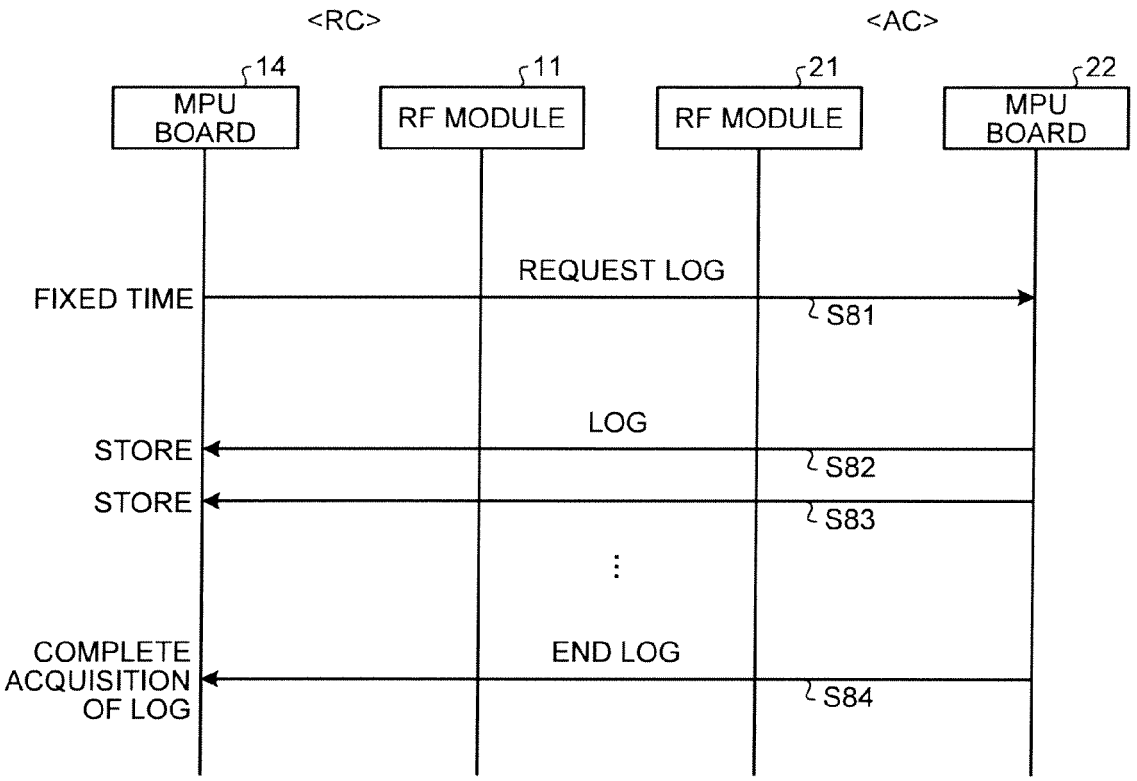

<RC>
<AC>
14
11
21
22
MPU BOARD
RF MODULE
RF MODULE
MPU BOARD
REQUEST LOG
FIXED TIME
S81
LOG
STORE
S82
STORE
S83
COMPLETE ACQUISITION OF LOG
END LOG
S84

FIG.8

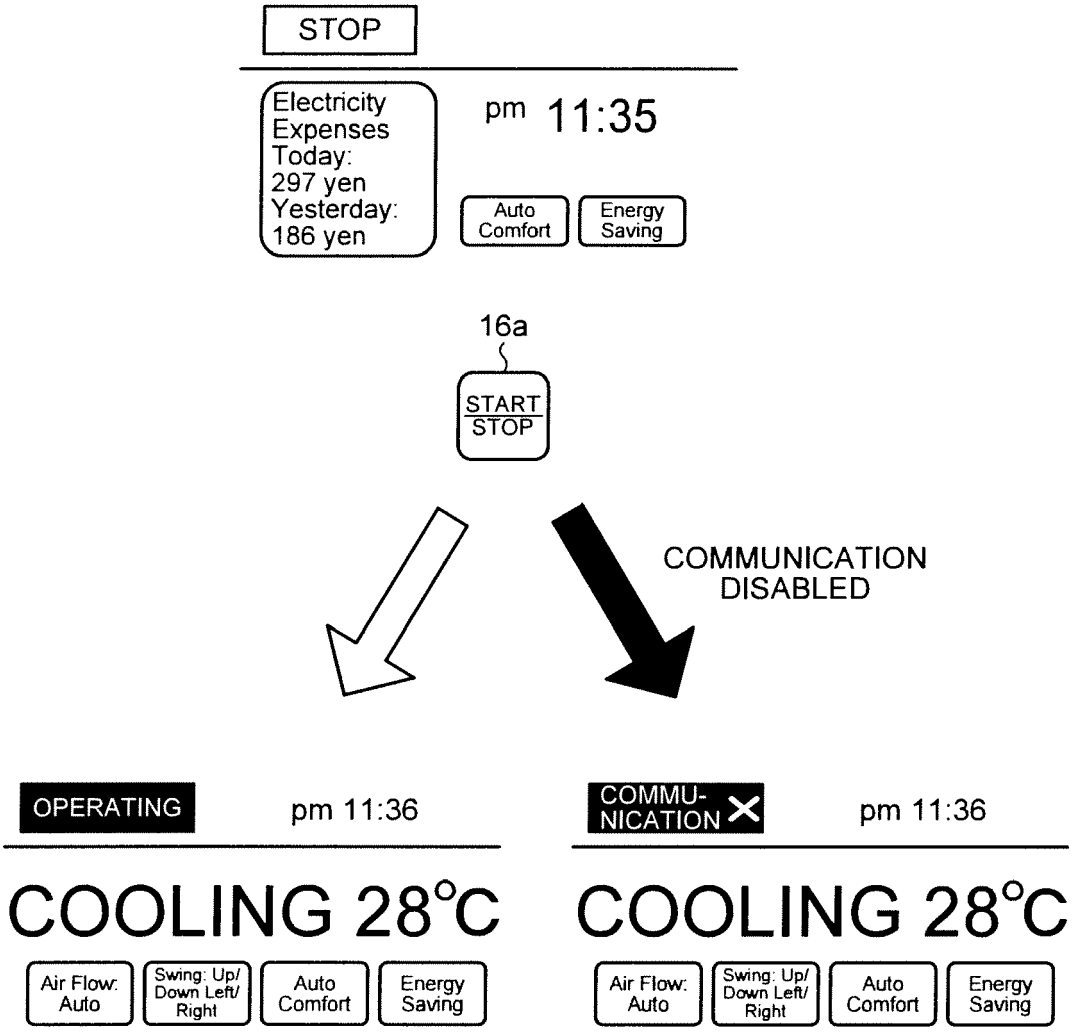

STOP
Electricity Expenses Today: 297 yen Yesterday: 186 yen
pm 11:35
Auto Comfort
Energy Saving
16a
START/STOP
COMMUNICATION DISABLED
OPERATING
pm 11:36
COOLING 28°C
Air Flow: Auto
Swing: Up/ Down Left/ Right
Auto Comfort
Energy Saving
COMMU-NICATION
pm 11:36
COOLING 28°C
Air Flow: Auto
Swing: Up/ Down Left/ Right
Auto Comfort
Energy Saving

FIG.9

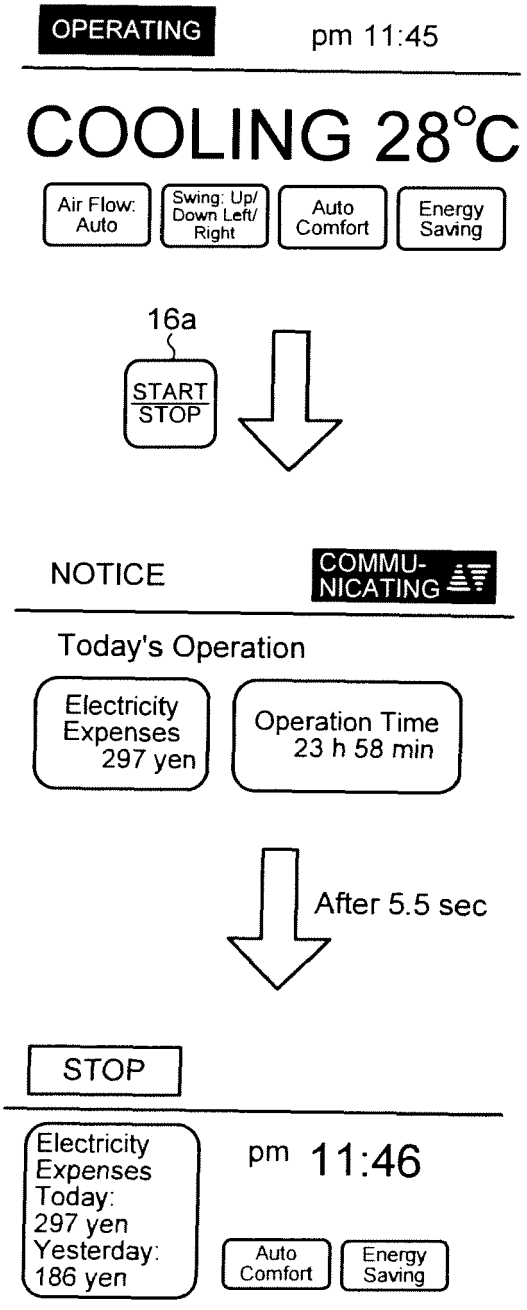

OPERATING
pm 11:45
COOLING 28°C
Air Flow: Auto
Swing: Up/ Down Left/ Right
Auto Comfort
Energy Saving
16a
START STOP
NOTICE
COMMU- NICATING
Today's Operation
Electricity Expenses 297 yen
Operation Time 23 h 58 min
After 5.5 sec
STOP
Electricity Expenses Today: 297 yen Yesterday: 186 yen
pm 11:46
Auto Comfort
Energy Saving

FIG.10

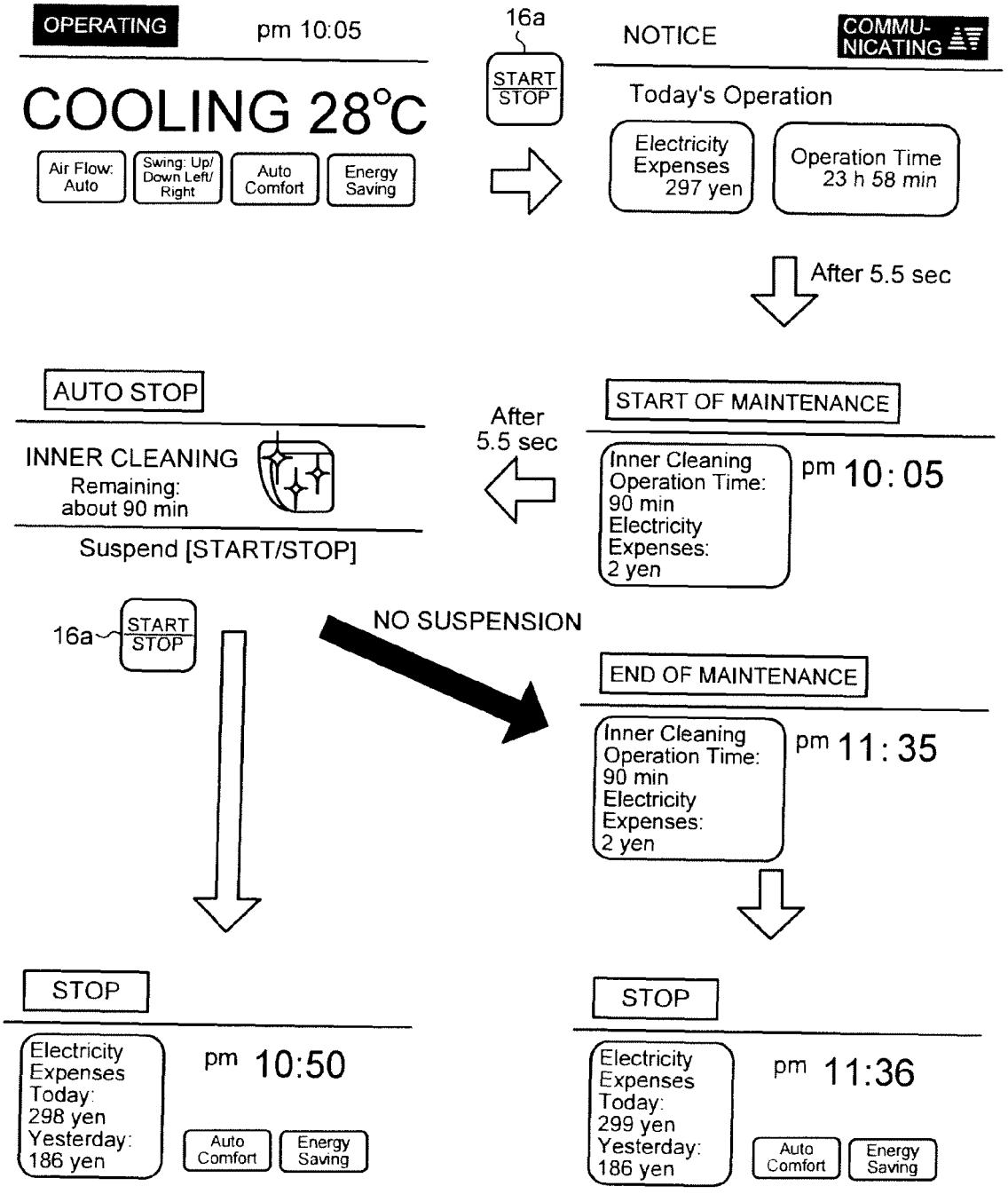

OPERATING
pm 10:05
COOLING 28°C
Air Flow: Auto
Swing: Up/ Down Left/ Right
Auto Comfort
Energy Saving
16a
START STOP
NOTICE
COMMU-NICATING
Today's Operation
Electricity Expenses 297 yen
Operation Time 23 h 58 min
After 5.5 sec
START OF MAINTENANCE
Inner Cleaning Operation Time: 90 min
Electricity Expenses: 2 yen
pm 10:05
After 5.5 sec
AUTO STOP
INNER CLEANING
Remaining: about 90 min
Suspend [START/STOP]
16a
START STOP
NO SUSPENSION
END OF MAINTENANCE
Inner Cleaning Operation Time: 90 min
Electricity Expenses: 2 yen
pm 11:35
STOP
Electricity Expenses Today: 298 yen
Yesterday: 186 yen
pm 10:50
Auto Comfort
Energy Saving
STOP
Electricity Expenses Today: 299 yen
Yesterday: 186 yen
pm 11:36
Auto Comfort
Energy Saving

FIG.11

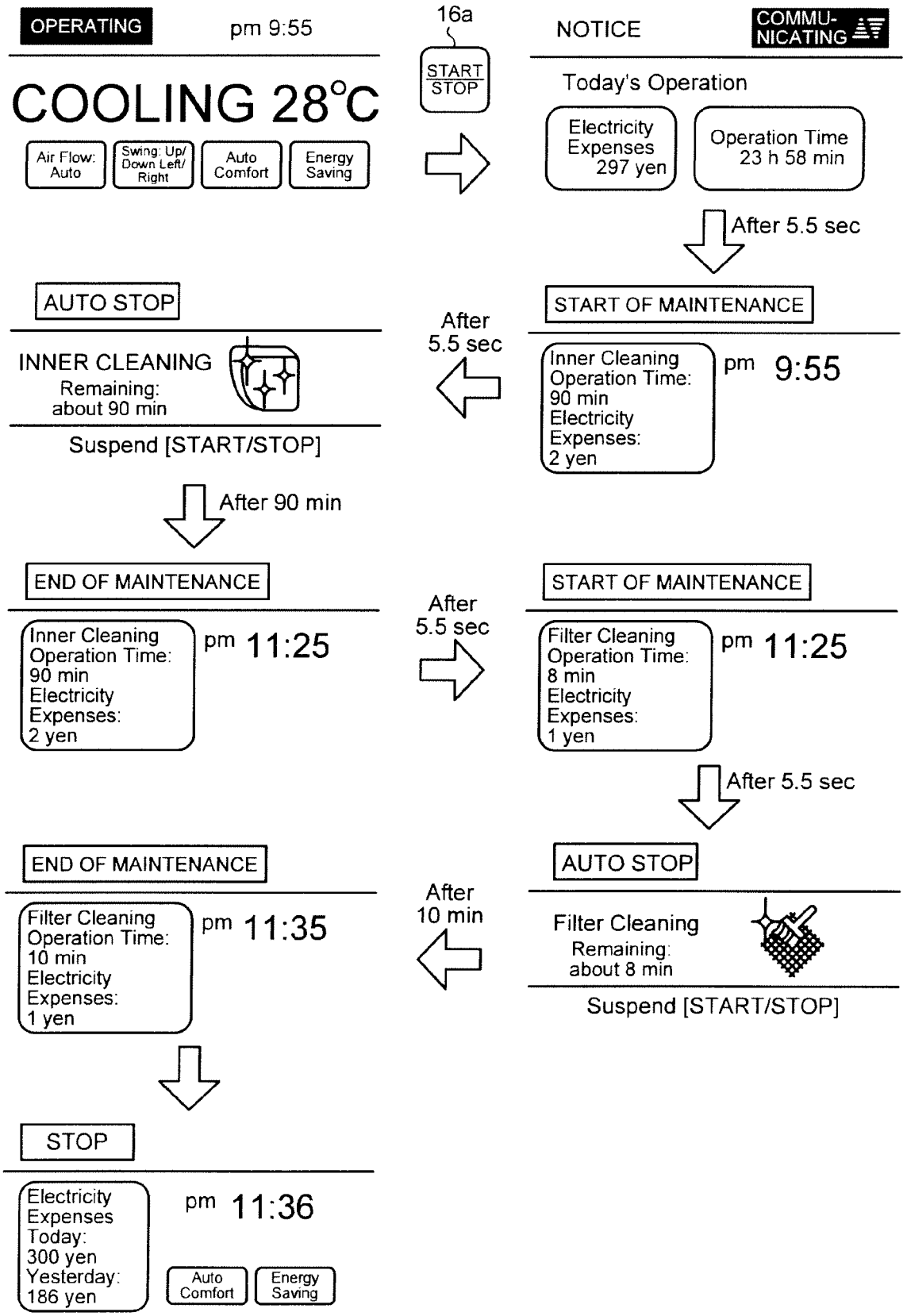

OPERATING
pm 9:55
COOLING 28°C
Air Flow: Auto
Swing: Up/ Down Left/ Right
Auto Comfort
Energy Saving
16a
START STOP
NOTICE
COMMU-NICATING
Today's Operation
Electricity Expenses 297 yen
Operation Time 23 h 58 min
After 5.5 sec
START OF MAINTENANCE
Inner Cleaning Operation Time: 90 min Electricity Expenses: 2 yen
pm 9:55
After 5.5 sec
AUTO STOP
INNER CLEANING
Remaining: about 90 min
Suspend [START/STOP]
After 90 min
END OF MAINTENANCE
Inner Cleaning Operation Time: 90 min Electricity Expenses: 2 yen
pm 11:25
After 5.5 sec
START OF MAINTENANCE
Filter Cleaning Operation Time: 8 min Electricity Expenses: 1 yen
pm 11:25
After 5.5 sec
AUTO STOP
Filter Cleaning
Remaining: about 8 min
Suspend [START/STOP]
After 10 min
END OF MAINTENANCE
Filter Cleaning Operation Time: 10 min Electricity Expenses: 1 yen
pm 11:35
STOP
Electricity Expenses Today: 300 yen Yesterday: 186 yen
pm 11:36
Auto Comfort
Energy Saving

FIG.12

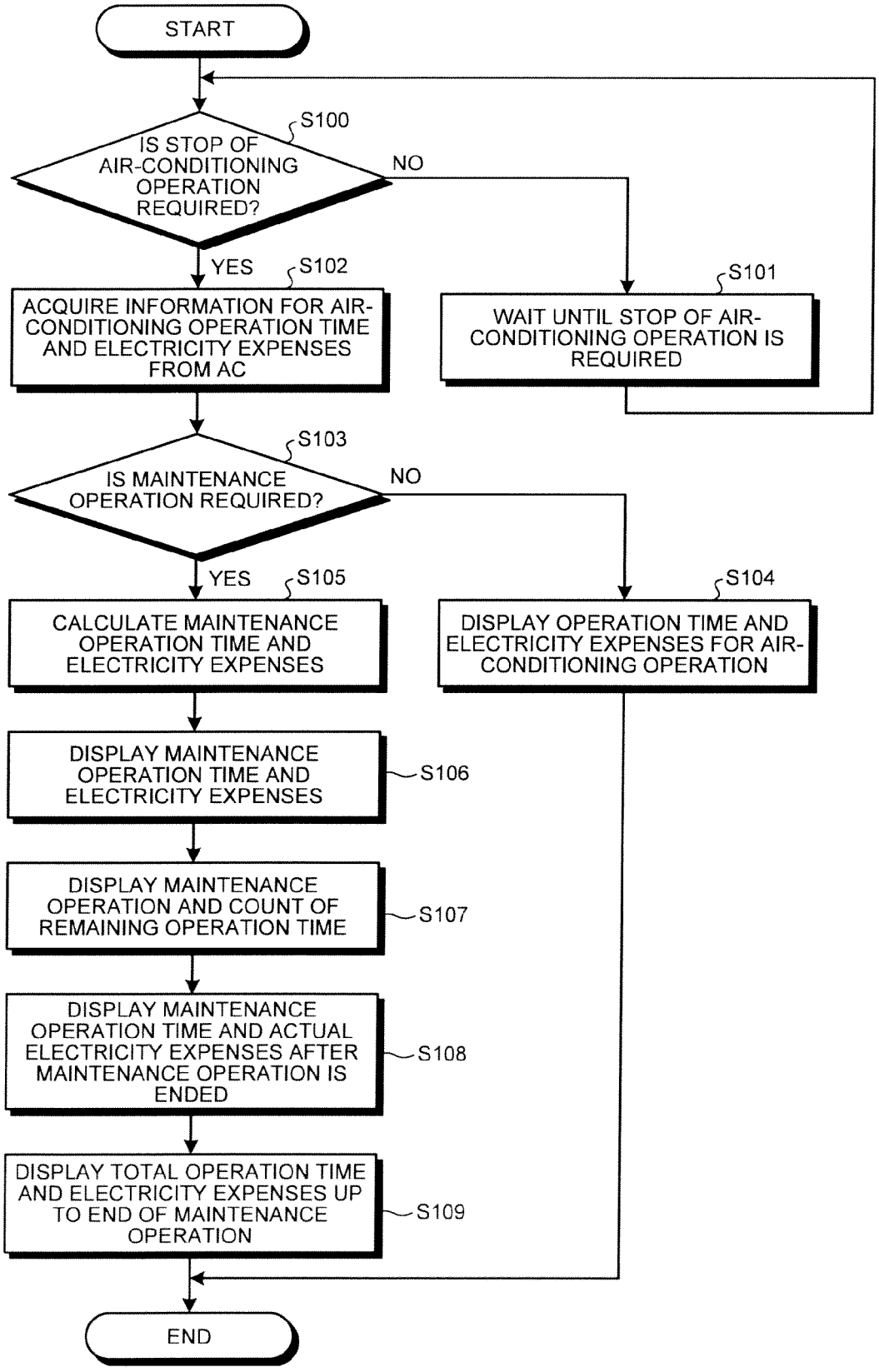

START
S100
IS STOP OF AIR-CONDITIONING OPERATION REQUIRED?
NO
YES
S102
ACQUIRE INFORMATION FOR AIR-CONDITIONING OPERATION TIME AND ELECTRICITY EXPENSES FROM AC
S101
WAIT UNTIL STOP OF AIR-CONDITIONING OPERATION IS REQUIRED
S103
IS MAINTENANCE OPERATION REQUIRED?
NO
YES
S105
CALCULATE MAINTENANCE OPERATION TIME AND ELECTRICITY EXPENSES
S104
DISPLAY OPERATION TIME AND ELECTRICITY EXPENSES FOR AIR-CONDITIONING OPERATION
DISPLAY MAINTENANCE OPERATION TIME AND ELECTRICITY EXPENSES
S106
DISPLAY MAINTENANCE OPERATION AND COUNT OF REMAINING OPERATION TIME
S107
DISPLAY MAINTENANCE OPERATION TIME AND ACTUAL ELECTRICITY EXPENSES AFTER MAINTENANCE OPERATION IS ENDED
S108
DISPLAY TOTAL OPERATION TIME AND ELECTRICITY EXPENSES UP TO END OF MAINTENANCE OPERATION
S109
END

FIG.13

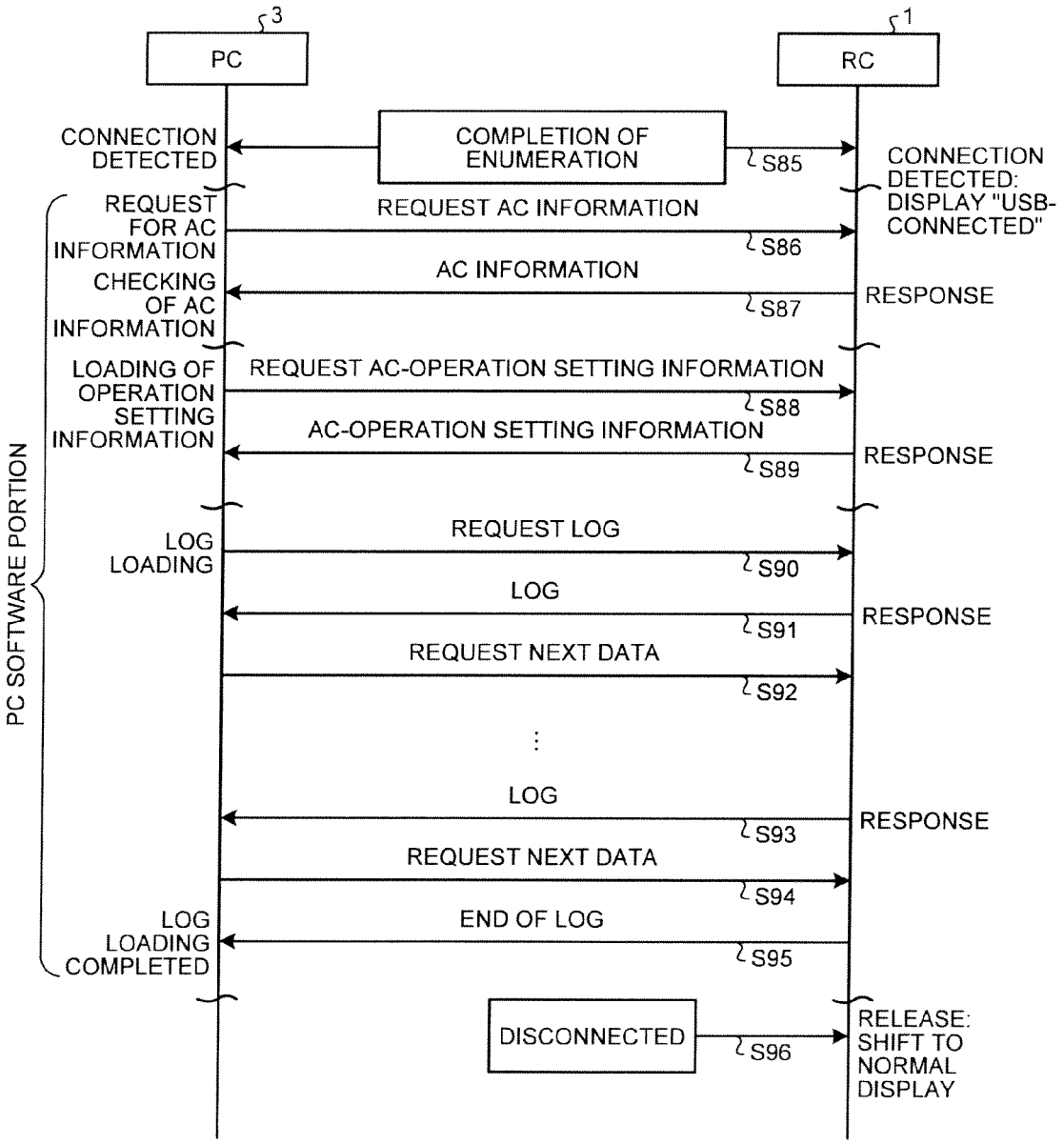

3
PC
1
RC
CONNECTION DETECTED
COMPLETION OF ENUMERATION
S85
CONNECTION DETECTED: DISPLAY "USB-CONNECTED"
REQUEST FOR AC INFORMATION
REQUEST AC INFORMATION
S86
CHECKING OF AC INFORMATION
AC INFORMATION
S87
RESPONSE
LOADING OF OPERATION SETTING INFORMATION
REQUEST AC-OPERATION SETTING INFORMATION
S88
AC-OPERATION SETTING INFORMATION
S89
RESPONSE
PC SOFTWARE PORTION
LOG LOADING
REQUEST LOG
S90
LOG
S91
RESPONSE
REQUEST NEXT DATA
S92
LOG
S93
RESPONSE
REQUEST NEXT DATA
S94
LOG LOADING COMPLETED
END OF LOG
S95
DISCONNECTED
S96
RELEASE: SHIFT TO NORMAL DISPLAY

FIG.14

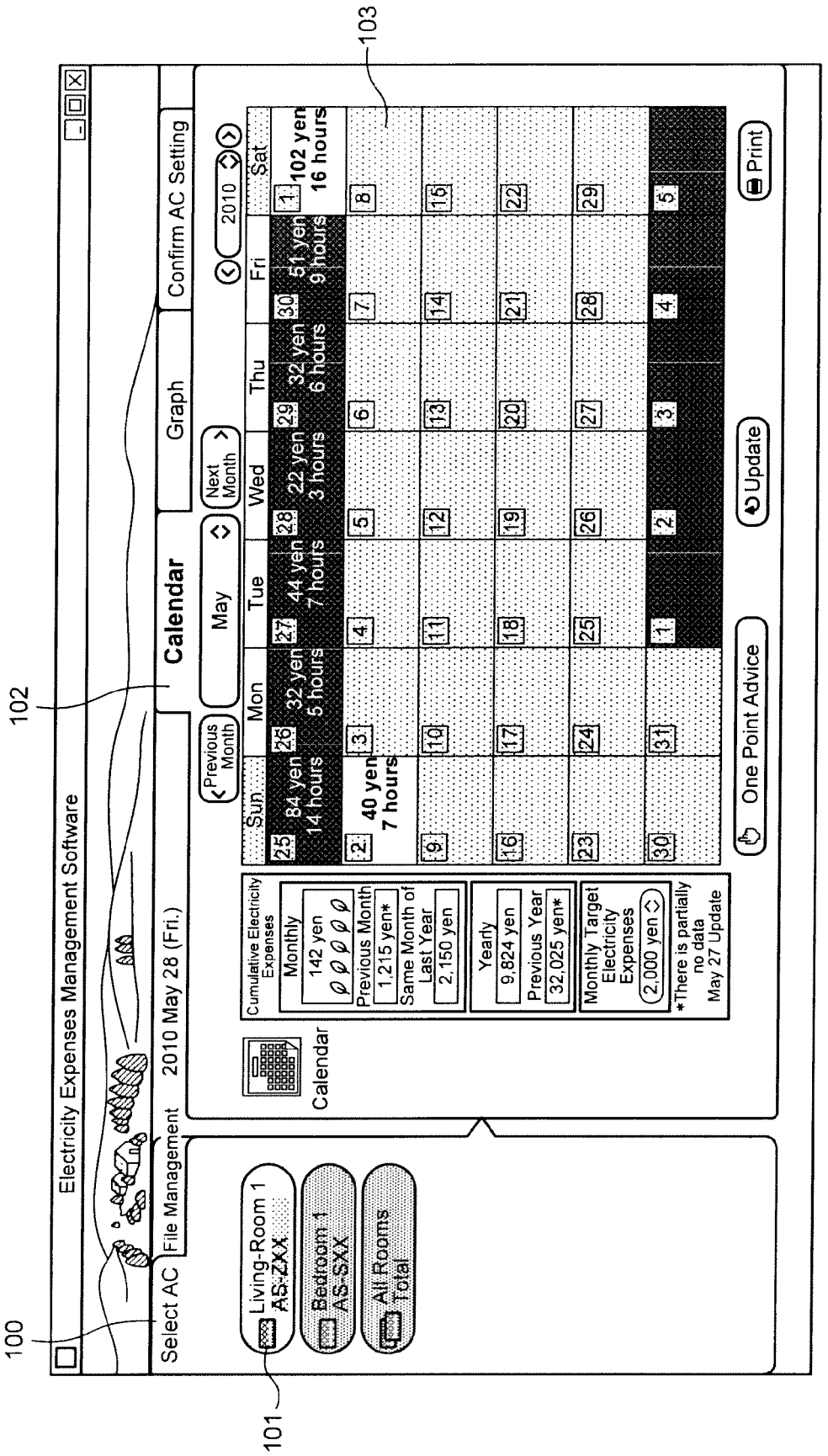

100
101
102
103
Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Living-Room 1
AS-ZXX
Bedroom 1
AS-SXX
All Rooms
Total
Previous Month
May
Next Month
2010
Sun
Mon
Tue
Wed
Thu
Fri
Sat
84 yen
14 hours
32 yen
5 hours
44 yen
7 hours
22 yen
3 hours
32 yen
6 hours
51 yen
9 hours
102 yen
16 hours
40 yen
7 hours
Calendar
Cumulative Electricity Expenses
Monthly
142 yen
Previous Month
1,215 yen*
Same Month of Last Year
2,150 yen
Yearly
9,824 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,000 yen
*There is partially no data
May 27 Update
One Point Advice
Update
Print

FIG.15

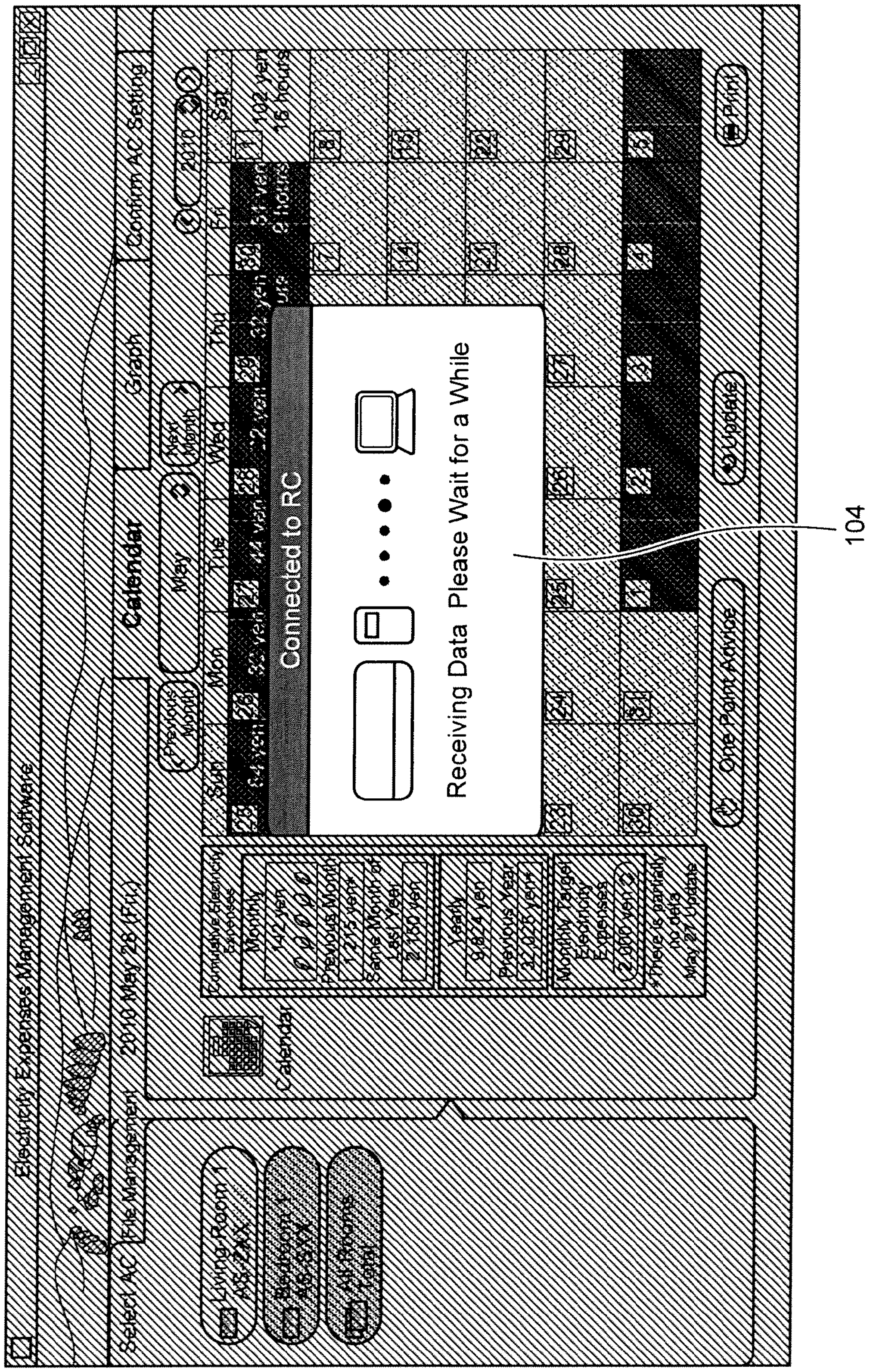

Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri)
Calendar
Graph
Confirm AC Setting
Previous Month
May
Next Month
2010
Sun
Mon
Tue
Wed
Thu
Fri
Sat
Connected to RC
Receiving Data Please Wait for a While
One Point Advice
Update
Print
Living Room 1
Bedroom 1
All Rooms Total
104

FIG.16

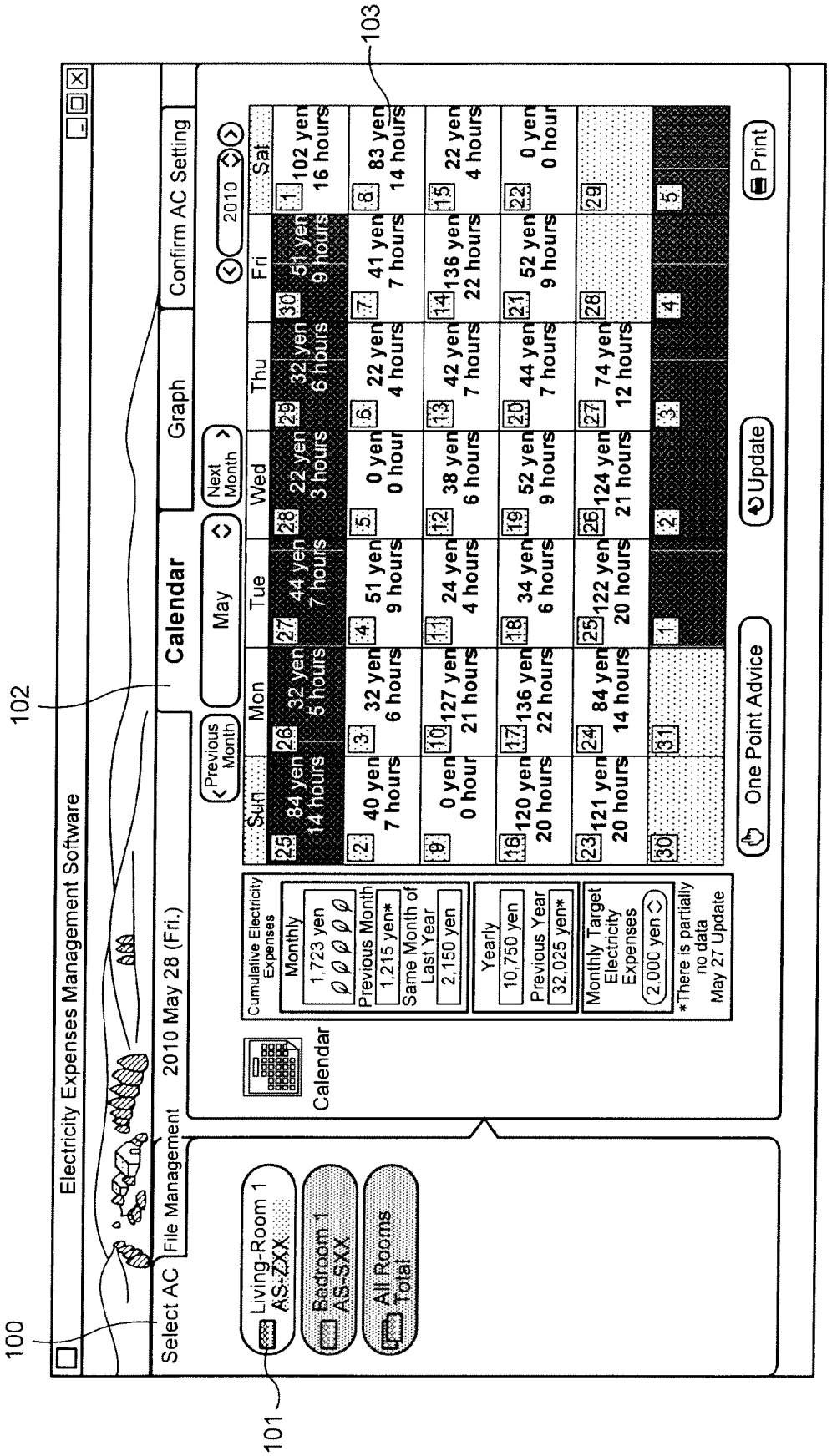

100
101
102
103
Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Living-Room 1
AS-ZXX
Bedroom 1
AS-SXX
All Rooms
Total
Previous Month
May
Next Month
2010
Sun Mon Tue Wed Thu Fri Sat
Update
Print
One Point Advice
Cumulative Electricity Expenses
Monthly
1,723 yen
Previous Month
1,215 yen*
Same Month of Last Year
2,150 yen
Yearly
10,750 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,000 yen
*There is partially no data
May 27 Update
Calendar

FIG.17

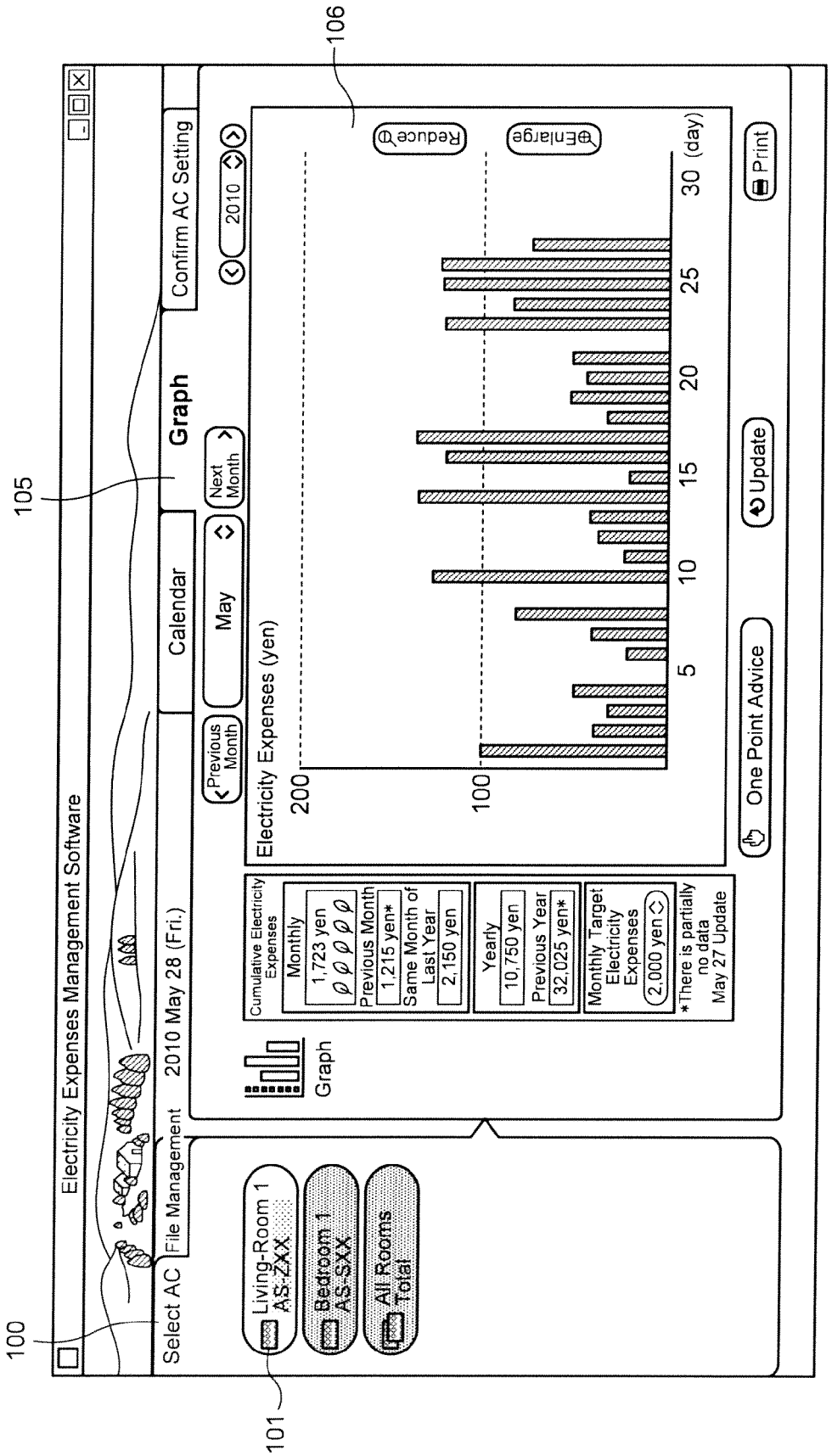

Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Living-Room 1 AS-ZXX
Bedroom 1 AS-SXX
All Rooms Total
Graph
Previous Month
May
Next Month
2010
Reduce
Enlarge
Electricity Expenses (yen)
200
100
5
10
15
20
25
30 (day)
Cumulative Electricity Expenses
Monthly
1,723 yen
Previous Month
1,215 yen*
Same Month of Last Year
2,150 yen
Yearly
10,750 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,000 yen
*There is partially no data May 27 Update
One Point Advice
Update
Print
100
101
105
106

FIG.18

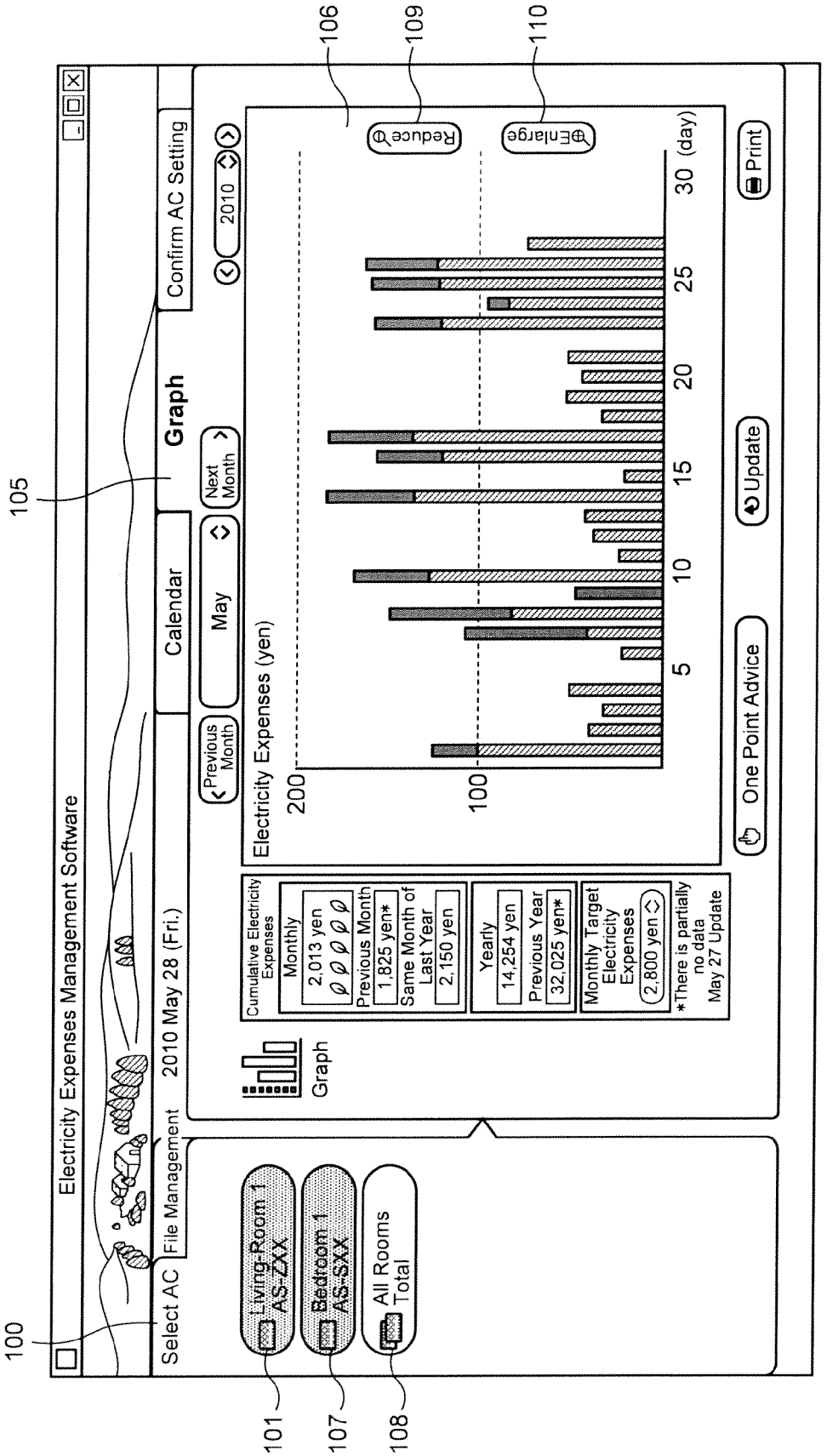

100
105
106
109
110
Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Previous Month
May
Next Month
2010
Reduce
Enlarge
Print
Update
One Point Advice
Electricity Expenses (yen)
200
100
5
10
15
20
25
30 (day)
Cumulative Electricity Expenses
Monthly
2,013 yen
Previous Month
1,825 yen*
Same Month of Last Year
2,150 yen
Yearly
14,254 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,800 yen
*There is partially no data
May 27 Update
Graph
Living-Room 1
AS-ZXX
Bedroom 1
AS-SXX
All Rooms Total
101
107
108

FIG.19

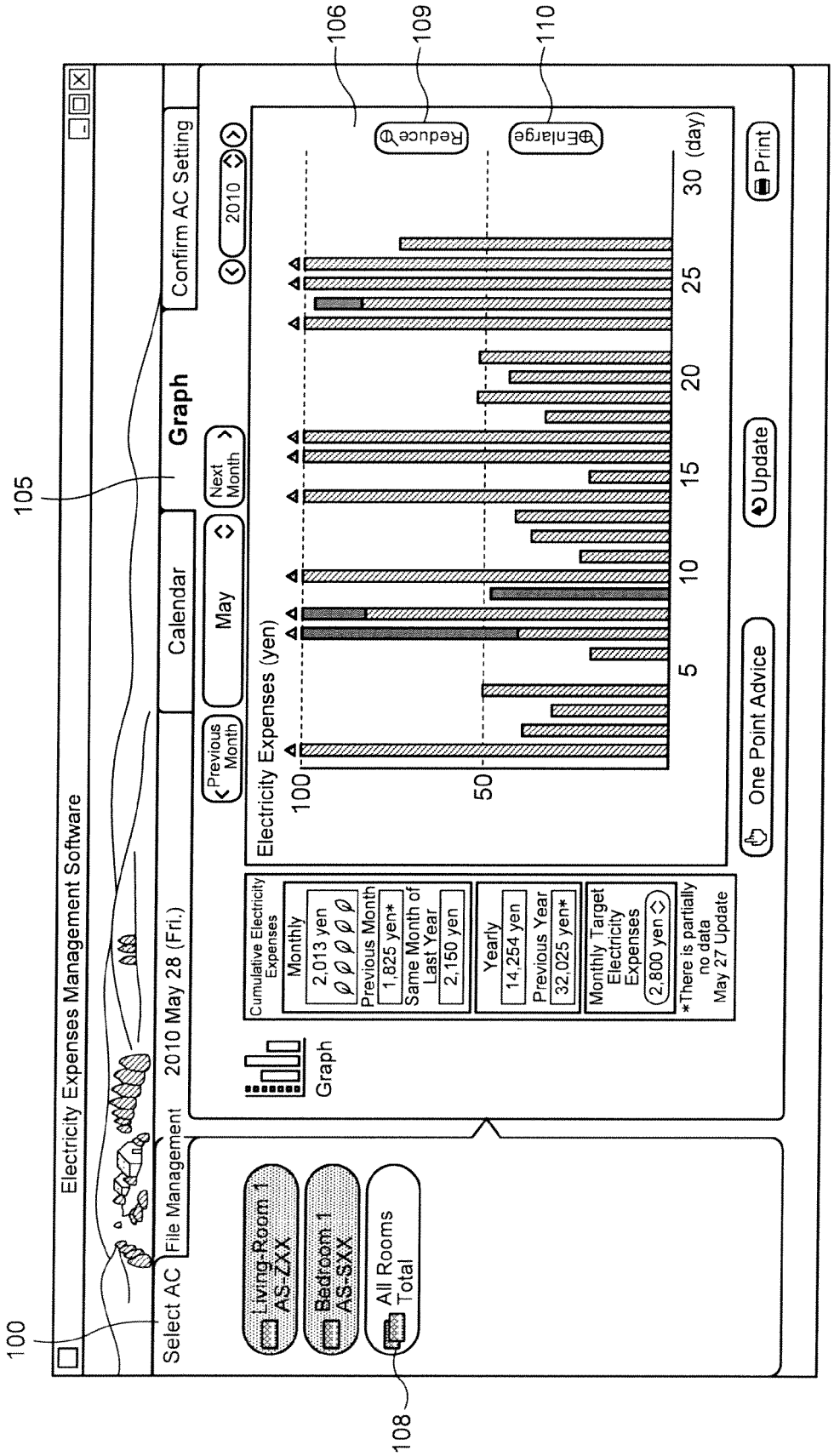

100
105
106
109
110
108
Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Previous Month
May
Next Month
2010
Living-Room 1
AS-ZXX
Bedroom 1
AS-SXX
All Rooms
Total
Graph
Electricity Expenses (yen)
100
50
5
10
15
20
25
30 (day)
Reduce
Enlarge
Print
Update
One Point Advice
Cumulative Electricity Expenses
Monthly
2,013 yen
Previous Month
1,825 yen*
Same Month of Last Year
2,150 yen
Yearly
14,254 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,800 yen
*There is partially no data
May 27 Update

FIG.20

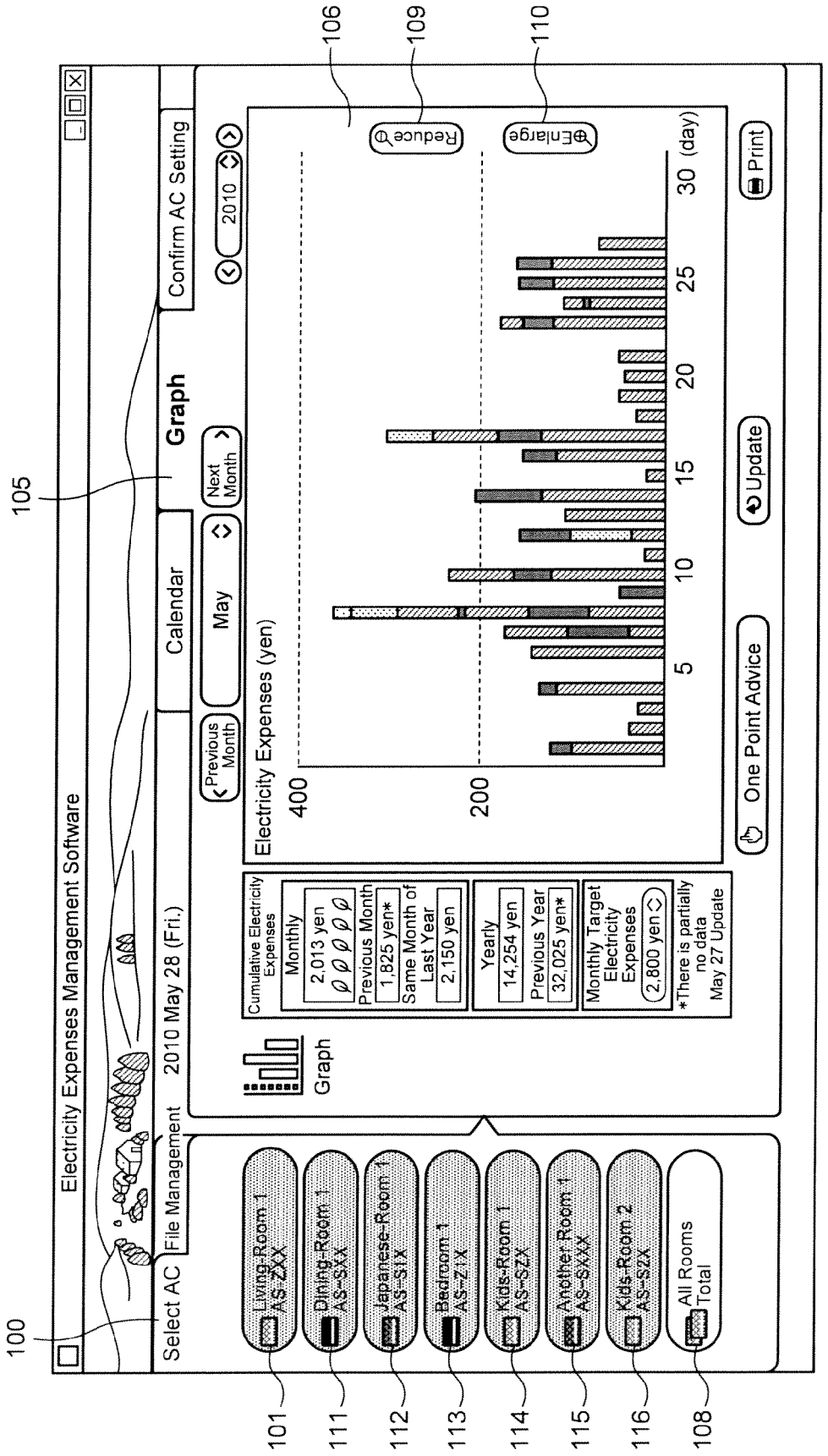

100
105
106
109
110
Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Previous Month
May
Next Month
2010
Reduce
Enlarge
Print
Update
One Point Advice
Electricity Expenses (yen)
400
200
5
10
15
20
25
30 (day)
Cumulative Electricity Expenses
Monthly
2,013 yen
Previous Month
1,825 yen*
Same Month of Last Year
2,150 yen
Yearly
14,254 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,800 yen
*There is partially no data
May 27 Update
Graph
Living-Room 1
AS-ZXX
Dining-Room 1
AS-SXX
Japanese-Room 1
AS-S1X
Bedroom 1
AS-Z1X
Kids-Room 1
AS-SZX
Another Room 1
AS-SXXX
Kids-Room 2
AS-S2X
All Rooms Total
101
111
112
113
114
115
116
108

FIG.21

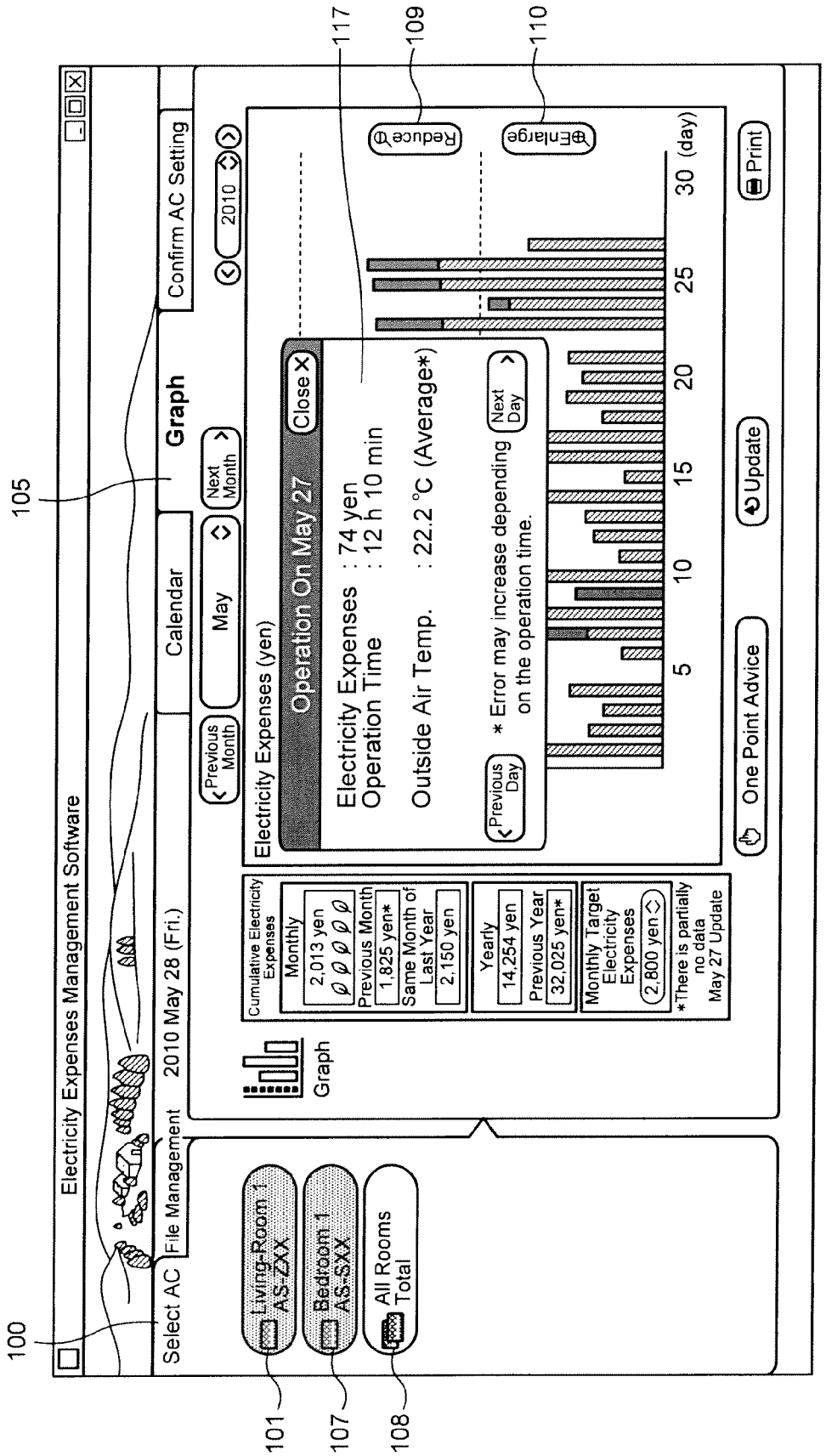

100
105
101
107
108
117
109
110
Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Living-Room 1 AS-ZXX
Bedroom 1 AS-SXX
All Rooms Total
Previous Month
May
Next Month
2010
Electricity Expenses (yen)
Operation On May 27
Close
Electricity Expenses : 74 yen
Operation Time : 12 h 10 min
Outside Air Temp. : 22.2 °C (Average*)
Previous Day
* Error may increase depending on the operation time.
Next Day
Reduce
Enlarge
5
10
15
20
25
30 (day)
Print
Update
One Point Advice
Cumulative Electricity Expenses
Monthly
2,013 yen
Previous Month
1,825 yen*
Same Month of Last Year
2,150 yen
Yearly
14,254 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,800 yen
*There is partially no data
May 27 Update
Graph

FIG.22

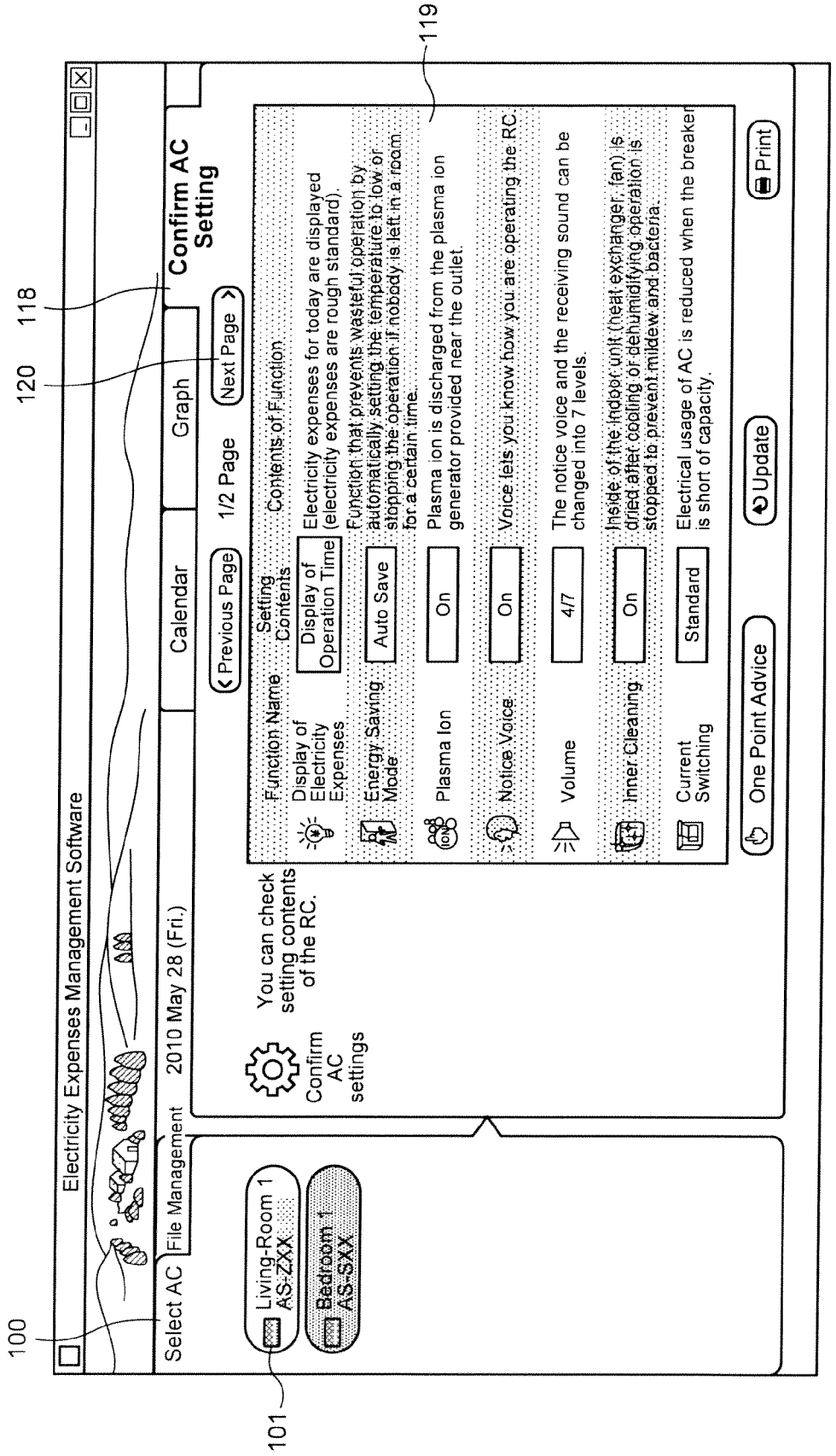

100
101
118
120
119
Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Living-Room 1 AS-ZXX
Bedroom 1 AS-SXX
Previous Page
1/2 Page
Next Page
Confirm AC settings
You can check setting contents of the RC.
Function Name
Setting Contents
Contents of Function
Display of Electricity Expenses
Display of Operation Time
Electricity expenses for today are displayed (electricity expenses are rough standard).
Energy Saving Mode
Auto Save
Function that prevents wasteful operation by automatically setting the temperature to low or stopping the operation if nobody is left in a room for a certain time.
Plasma Ion
On
Plasma ion is discharged from the plasma ion generator provided near the outlet.
Notice Voice
On
Voice lets you know how you are operating the RC.
Volume
4/7
The notice voice and the receiving sound can be changed into 7 levels.
Inner Cleaning
On
Inside of the indoor unit (heat exchanger, fan) is dried after cooling or dehumidifying operation is stopped to prevent mildew and bacteria.
Current Switching
Standard
Electrical usage of AC is reduced when the breaker is short of capacity.
One Point Advice
Update
Print

FIG.23

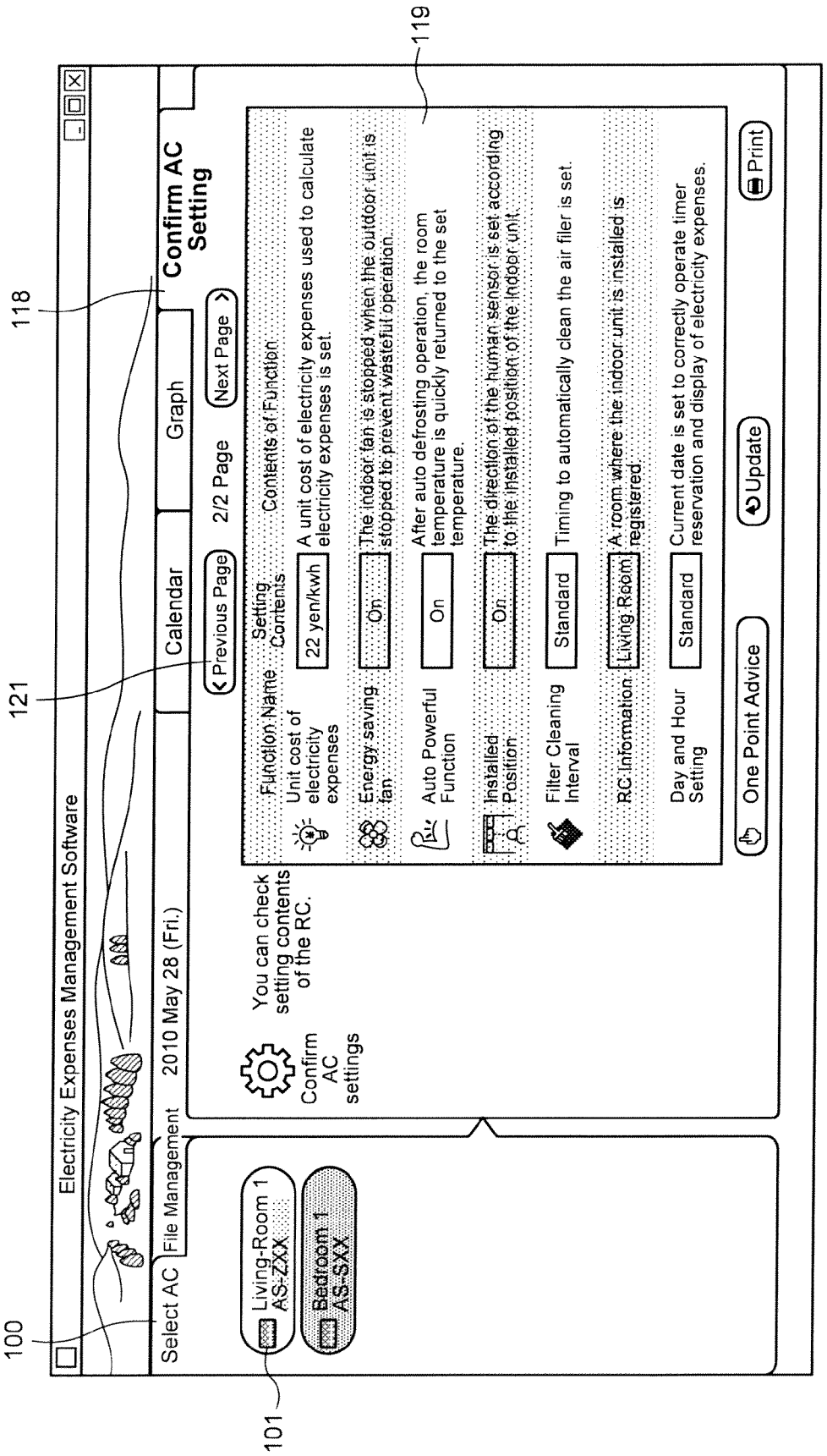

100
101
118
121
119
Electricity Expenses Management Software
Select AC
File Management
Living-Room 1 AS-ZXX
Bedroom 1 AS-SXX
2010 May 28 (Fri.)
Calendar
Graph
Confirm AC Setting
Previous Page
2/2 Page
Next Page
You can check setting contents of the RC.
Confirm AC settings
Function Name
Setting Contents
Contents of Function
Unit cost of electricity expenses
22 yen/kwh
A unit cost of electricity expenses used to calculate electricity expenses is set.
Energy-saving fan
On
The indoor fan is stopped when the outdoor unit is stopped to prevent wasteful operation.
Auto Powerful Function
On
After auto defrosting operation, the room temperature is quickly returned to the set temperature.
Installed Position
On
The direction of the human sensor is set according to the installed position of the indoor unit.
Filter Cleaning Interval
Standard
Timing to automatically clean the air filer is set.
RC Information
Living Room
A room where the indoor unit is installed is registered.
Day and Hour Setting
Standard
Current date is set to correctly operate timer reservation and display of electricity expenses.
One Point Advice
Update
Print

FIG.24

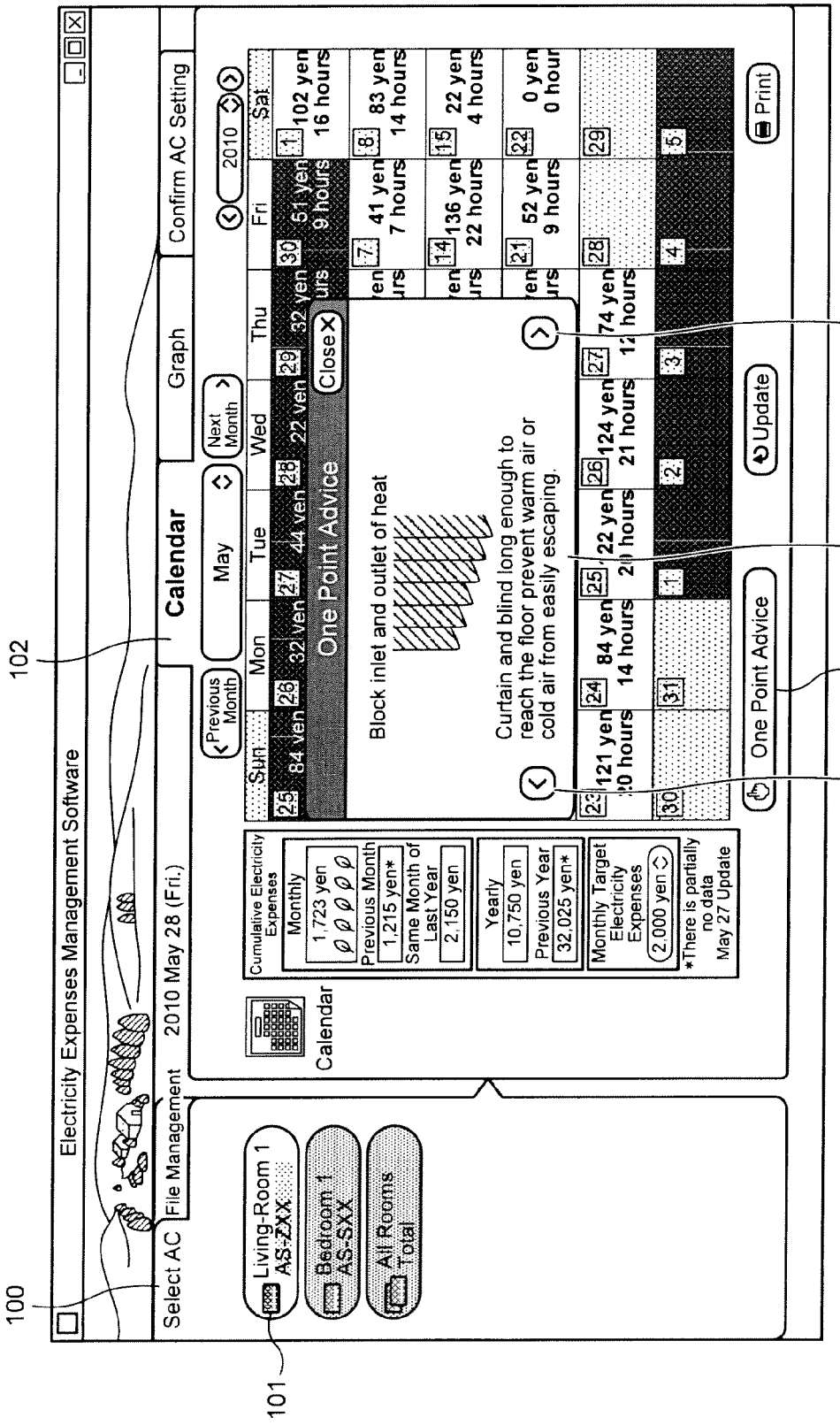

100
101
102
122
122a
122b
123
Electricity Expenses Management Software
Select AC
File Management
Calendar
Graph
Confirm AC Setting
2010 May 28 (Fri.)
Previous Month
May
Next Month
2010
Living-Room 1
AS-ZXX
Bedroom 1
AS-SXX
All Rooms Total
Sun Mon Tue Wed Thu Fri Sat
One Point Advice
Close
Block inlet and outlet of heat
Curtain and blind long enough to reach the floor prevent warm air or cold air from easily escaping.
Update
Print
Cumulative Electricity Expenses
Monthly
1,723 yen
Previous Month
1,215 yen*
Same Month of Last Year
2,150 yen
Yearly
10,750 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,000 yen
*There is partially no data
May 27 Update
Calendar

FIG.25

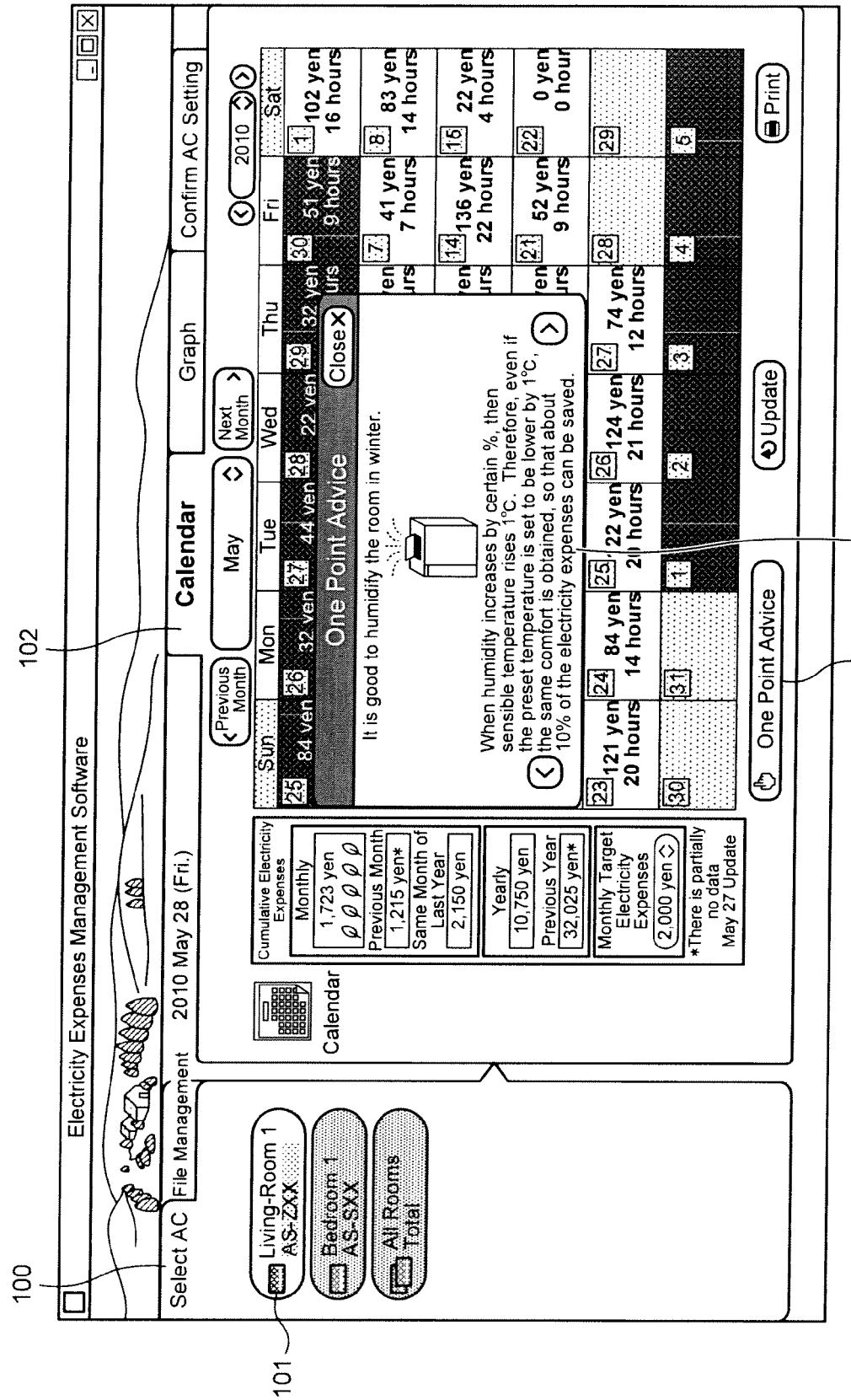

100
101
102
122
123
Electricity Expenses Management Software
Select AC
File Management
Calendar
Graph
Confirm AC Setting
Living-Room 1
AS-ZXX
Bedroom 1
AS-SXX
All Rooms
Total
Previous Month
May
Next Month
2010
Sun
Mon
Tue
Wed
Thu
Fri
Sat
One Point Advice
Close
It is good to humidify the room in winter.
When humidity increases by certain %, then sensible temperature rises 1°C. Therefore, even if the preset temperature is set to be lower by 1°C, the same comfort is obtained, so that about 10% of the electricity expenses can be saved.
Cumulative Electricity Expenses
Monthly
1,723 yen
Previous Month
1,215 yen*
Same Month of Last Year
2,150 yen
Yearly
10,750 yen
Previous Year
32,025 yen*
Monthly Target Electricity Expenses
2,000 yen
*There is partially no data
May 27 Update
Calendar
Update
Print
One Point Advice

FIG.26

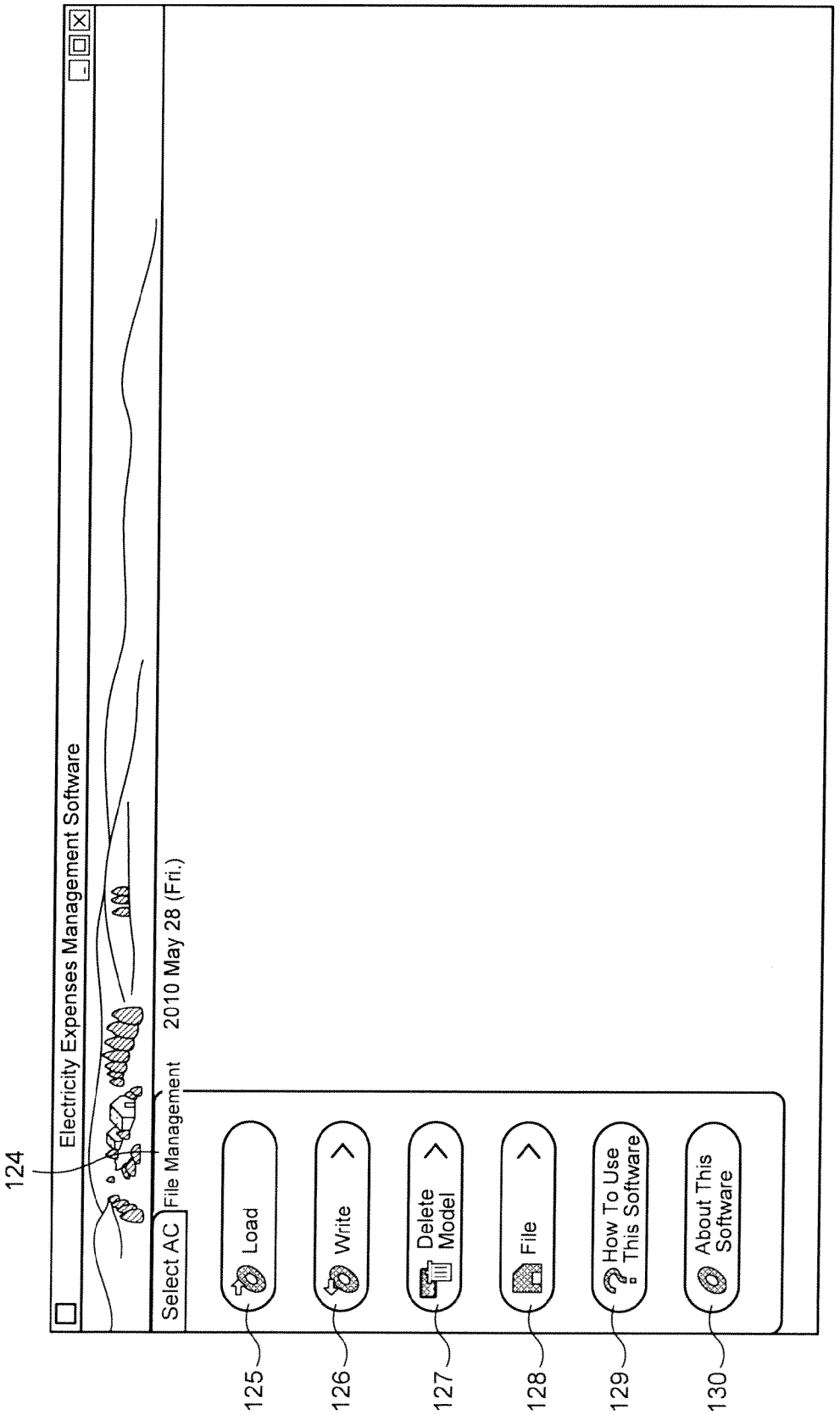

Electricity Expenses Management Software
2010 May 28 (Fri.)
Select AC
File Management
Load
Write
Delete Model
File
How To Use This Software
About This Software
124
125
126
127
128
129
130

FIG.27

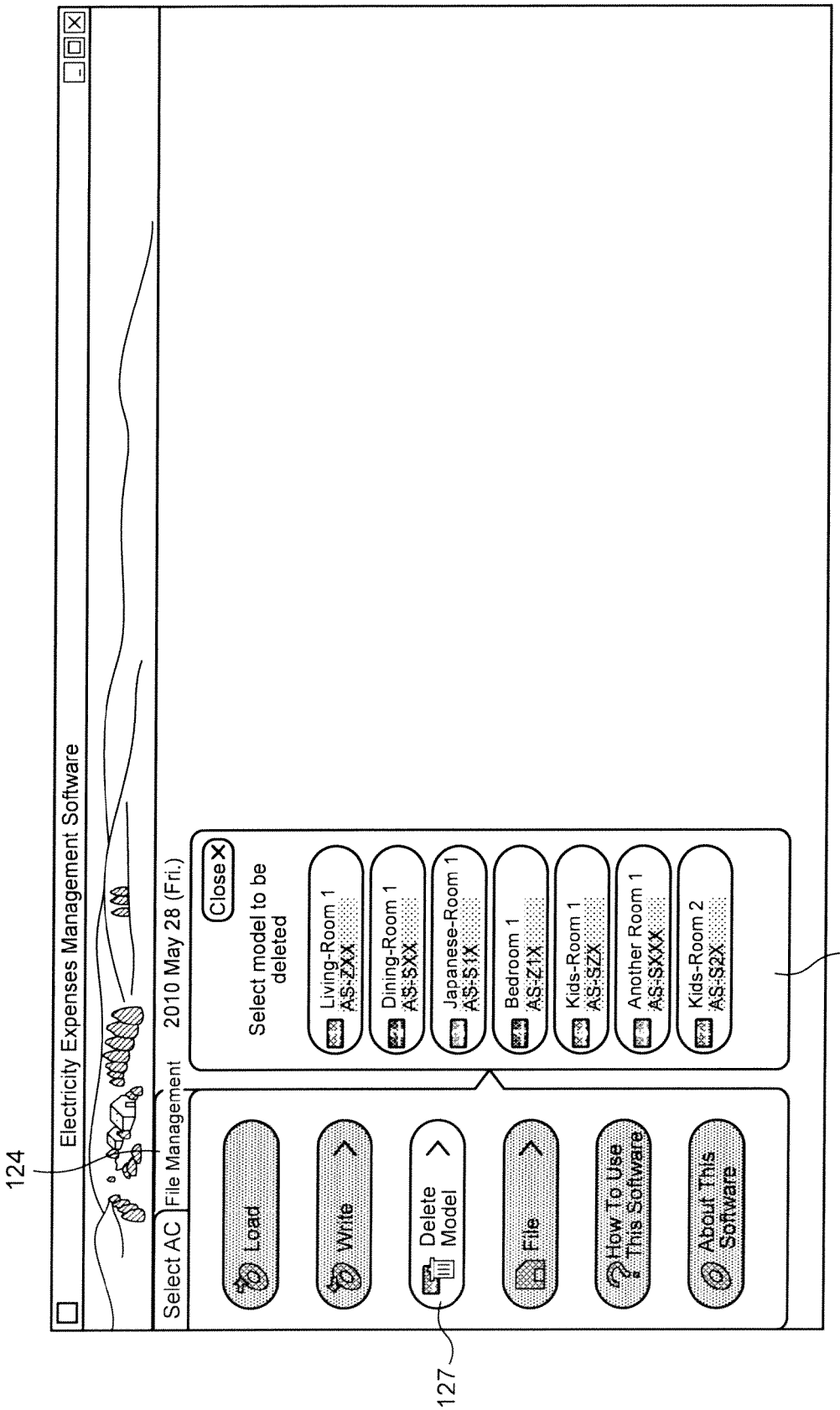

Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Load
Write
Delete Model
File
How To Use This Software
About This Software
Close
Select model to be deleted
Living-Room 1 AS-ZXX
Dining-Room 1 AS-SXX
Japanese-Room 1 AS-S1X
Bedroom 1 AS-Z1X
Kids-Room 1 AS-SZX
Another Room 1 AS-SXXX
Kids-Room 2 AS-S2X
124
127
131

FIG.28

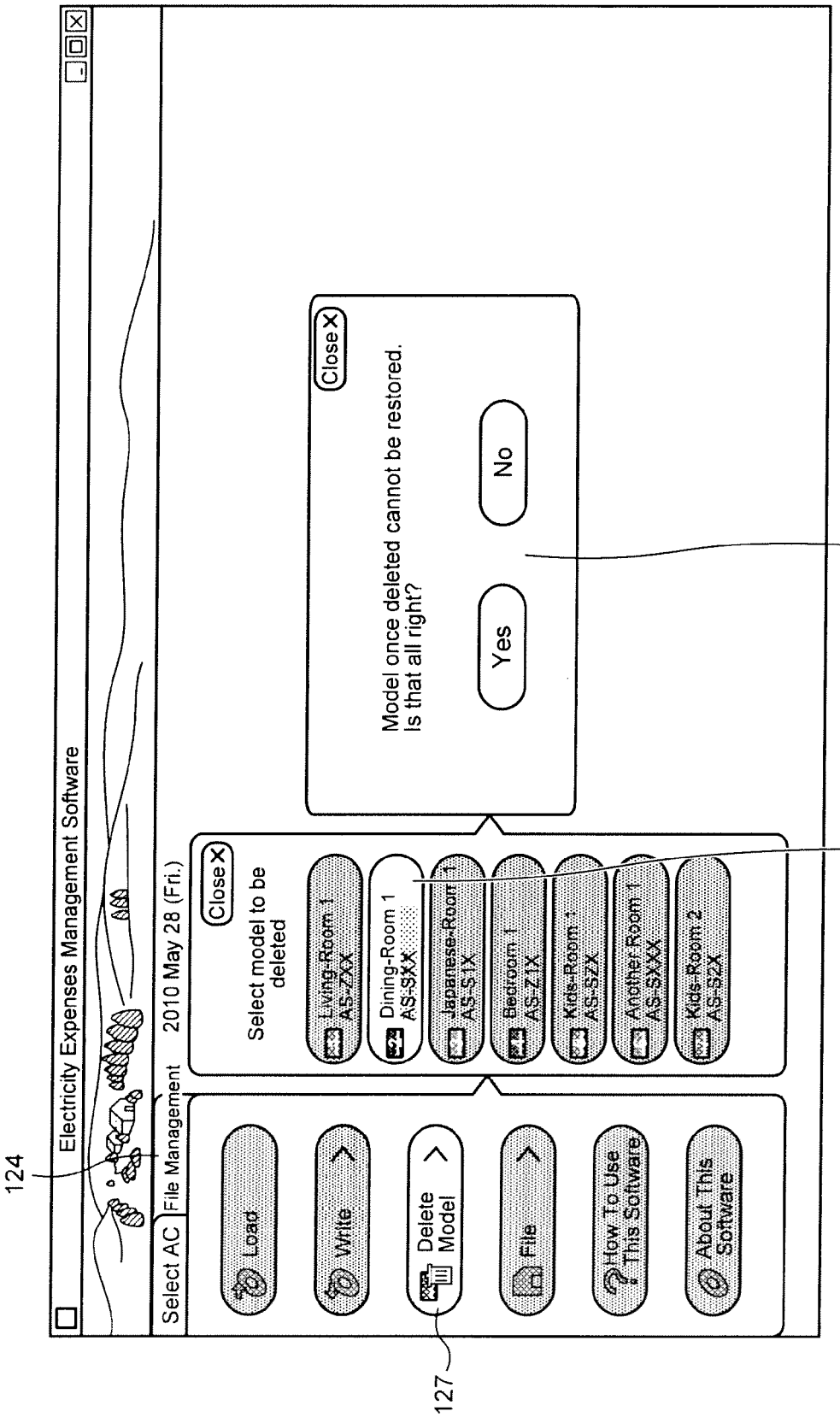
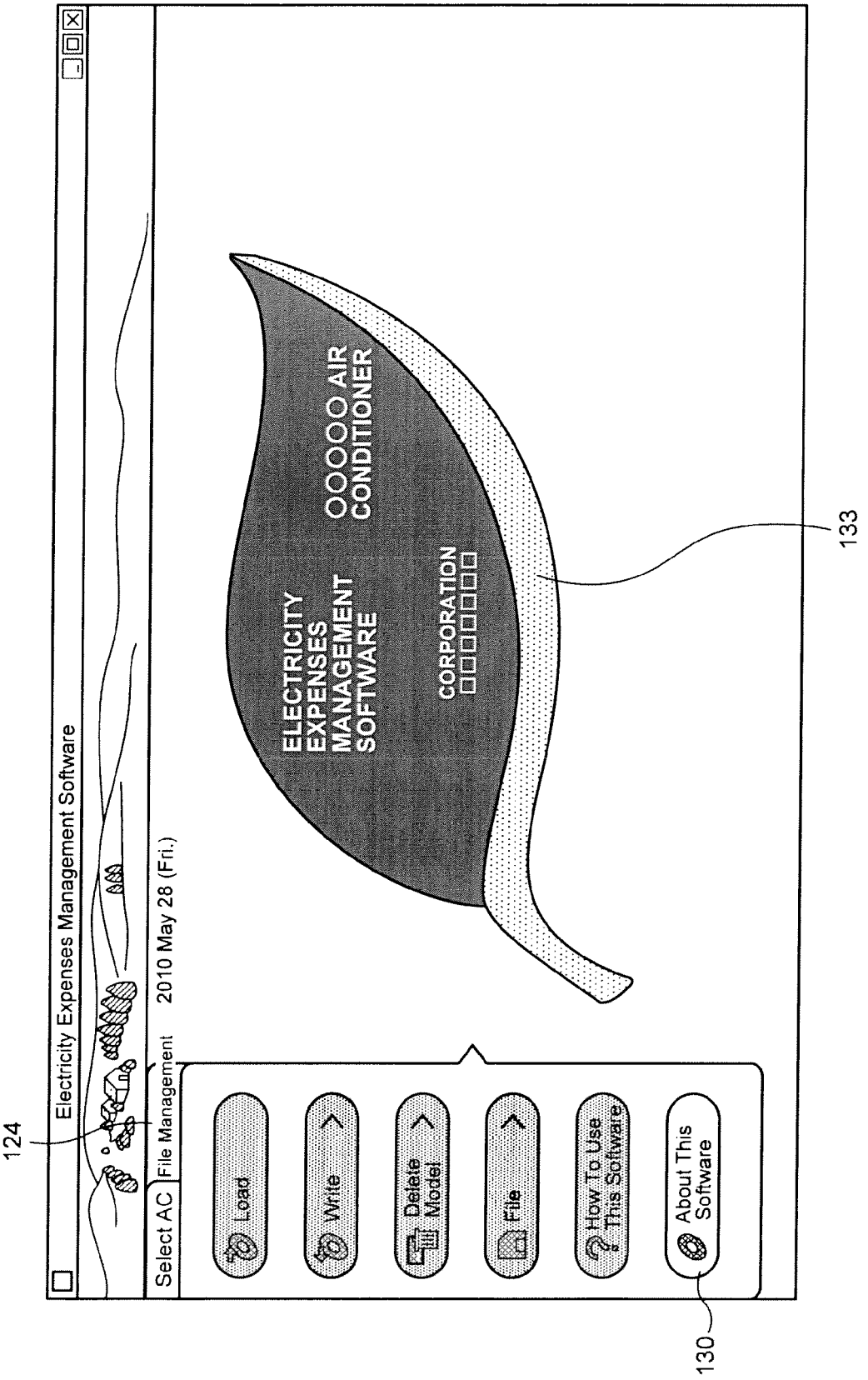

Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Load
Write
Delete Model
File
How To Use This Software
About This Software
Close
Select model to be deleted
Living-Room 1
AS-ZXX
Dining-Room 1
AS-SXX
Japanese-Room 1
AS-S1X
Bedroom 1
AS-Z1X
Kids-Room 1
AS-SZX
Another Room 1
AS-SXXX
Kids-Room 2
AS-S2X
Close
Model once deleted cannot be restored.
Is that all right?
Yes
No
124
127
131
132

FIG.29


Electricity Expenses Management Software
Select AC
File Management
2010 May 28 (Fri.)
Load
Write
Delete Model
File
How To Use This Software
About This Software
ELECTRICITY EXPENSES MANAGEMENT SOFTWARE
OOOOO AIR CONDITIONER
CORPORATION
124
130
133

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Patent documents cited in the description

- JP 2007278696 A **[0002]**