

REGULATION CONTROL SYSTEM OF AIR CONDITIONING EQUIPMENT

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

This invention generally relates to air conditioning equipment techniques, and more specifically, to a regulation control system of air conditioning equipment, which combines with entrance guarding device and/or human body movement detecting device.

10 2. Description of Related Art

Air conditioning equipments are very popular applied electronic equipments in various kinds of buildings, especially in large-scale commercial places, such as office buildings, factory buildings, hotels, restaurants, hospitals, supermarkets, wholesale stores, and department stores; a present air conditioning equipment normally includes
15 at least air conditioner heater unit, air handling unit (AHU), precooling air handler (PAH), and fan coil unit (FCU); basically, an air conditioning equipment is capable of adjusting air temperature in an enclosed room to a pleasant condition for people to stay inside as well as taking in proper outdoor fresh air to avoid discomfort and danger caused by high levels of carbon dioxide inside a building.

20 An air conditioning equipment generally operates long hours or even 24 hours a day, energy consumed by the air conditioning equipment depends on factors, such as size of usage space, outdoor temperature, being shaded from sun or not, attendance at a specific time as well as usage pattern.

For instance, according to a newsletter study report issued by Bureau of Energy,
25 Ministry of Economic Affairs, R.O.C. on June 5th, 2007, in the study of air conditioner usage pattern on 1177 stores in five counties, including Taipei, Taichung,

Tainan, Kaohsiung, and Hualien, 22% of stores had air curtains and automatic doors, 19% of stores had only automatic doors, 21% of stores had only air curtains, and 38% of stores were leaving their doors broadly open; also according to the study report, adding automatic door could save 52% energy consumed, and it was about
5 NT\$10,000 (c.a. US\$300) saved per 535 square feet per one summer season.

In addition, setting temperature at air conditioning equipment is also a matter of usage pattern, according to an energy statistic report by Ministry of Economic Affairs, R.O.C., raising the preset temperature one Celsius degree up could save 6% consumed energy.

10 Obviously, the abovementioned air conditioning equipments of one-way control are capable of lowering down consumed energy by utilizing entrance guarding at usage surroundings of the air conditioning equipments, raising preset temperature, and saving energy thus; as a matter of fact, condition of entrance guarding and the setting of temperature are closely related.

15 Specifically, if the usage surroundings of an air conditioning equipment is installed with entrance guarding device, and the entrance guarding device includes, more specifically, automatic door for people to get in and go out as well as window exhaust fan; there are many factors that will cause the entrance guarding device open, such as when someone forgets to close the door, does not close it properly, or
20 intentionally leave the door open; according to prior air conditioning equipments, in order to control temperature of usage surroundings of an air conditioning equipment to be at a preset temperature, wind speed and/or compressor operation mechanism must be increased when the entrance guarding device is open and hot air is led into inside; naturally, increasing wind speed and/or compressor operation mechanism
25 consume more energy.

In fact, sometimes when a user feels it is too cold inside and some outside warm

air is welcome, the user might intentionally leave the foresaid entrance guarding device open; since the control system of prior air conditioning equipment is capable of executing air conditioning control process based on a preset temperature only, in a case that user intentionally leaves door open, more energy is definitely unnecessarily consumed and wasted.

Furthermore, in some public places, such as office buildings, schools, and others, air conditioning equipments sometimes keep operating even when there is no occupant inside, thereby causing unnecessary waste of energy; causes of the situation are: users forgot to turn off the air conditioning equipments, users planned to return but didn't, last users thought there were still other users in; the last users didn't know how to turn off the air conditioning equipments.

Hence, it is a highly urgent issue in the industry for how to provide a regulation control system of air conditioning equipment, which is capable of effectively regulating and controlling over air conditioning equipments based on usage condition of entrance guarding devices and/or whether users are inside the usage surroundings of the air conditioning equipments.

SUMMARY OF THE INVENTION

In view of the disadvantages of the prior art mentioned above, it is a primary objective of the present invention to provide a regulation control system of air conditioning equipment, which is capable of regulating and controlling operation of air conditioning equipments based on usage condition of entrance guarding devices.

It is another objective of the present invention to provide a regulation control system of air conditioning equipment, which is capable of regulating and controlling operation of an air conditioning equipment based on whether users are inside the usage surroundings of the air conditioning equipment.

It is a further objective of the present invention to provide a regulation control system of air conditioning equipment, which is capable of regulating and control operation of air conditioning equipment based on usage condition of entrance guarding device and/or whether users are inside the usage surroundings of the air conditioning equipment.

To achieve the aforementioned and other objectives, a regulation control system of air conditioning equipment is provided according to the present invention, which is for regulating and controlling air conditioning equipments; the regulation control system comprises: one entrance guarding device, which is for detecting usage condition of entrance and/or windows, also the entrance guarding device has a timer unit that is for calculating time period of opening/closing at the entrance and/or windows, and then data of air conditioning usage surroundings condition are produced based on detected condition of opening/closing, the data of air conditioning usage surroundings condition include condition and time period of opening/closing at entrance and/or windows; and an air conditioning control device, which includes a storage module that stores a set of preset regulation parameters corresponding to different data of air conditioning usage surroundings condition, and then based on the data of air conditioning usage surroundings condition derived from the entrance guarding device with referring to the preset regulation parameters, the air conditioning control device executes regulation and control over air conditioning equipments.

In another embodiment of the present invention, the regulation control system of air conditioning equipment of the present invention, which is for regulating and controlling air conditioning equipments, further comprises: a human body movement detecting device that is for detecting usage condition that whether users are inside the usage surroundings of the air conditioning equipment, and then based on the detected

usage condition, data of air conditioning usage surroundings condition are generated;
and an air conditioning control device, which includes a storage module that stores a
set of preset regulation parameters corresponding to different data of air conditioning
usage surroundings condition, and the air conditioning control device executes
5 regulation and control over the air conditioning equipments based on the data of air
conditioning usage surroundings condition derived from the human body movement
detecting device with referring to the preset regulation parameters.

In a further embodiment of the present invention, the regulation control system
of air conditioning equipment, which is for regulating and controlling air conditioning
10 equipments further comprises: an entrance guarding device, which is for detecting
usage condition of entrance and/or windows, and the entrance guarding device also
has a timer unit that is for calculate time period of opening/closing at the entrance
and/or windows, and then based on detected condition of opening/closing, data of air
conditioning usage surroundings condition are generated, the data of air conditioning
15 usage surroundings condition include condition and time period of opening/closing at
the entrance and/or windows; a human body movement detecting device, which is for
detecting usage condition that whether users are inside the usage surroundings of the
air conditioning equipments, and then based on the detected usage condition, data of
air conditioning usage surroundings condition are generated; and an air conditioning
20 control device, which includes a storage module that stores a set of preset regulation
parameters corresponding to different data of air conditioning usage surroundings
condition, and the air conditioning control device executes regulation and control
over the air conditioning equipments based on the data of air conditioning usage
surroundings condition derived from the entrance guarding device and/or the human
25 body movement detecting device with referring to the preset regulation parameters.

Compared with the prior regulation control techniques of air conditioning

equipment, the regulation control system of air conditioning equipment of the present invention combines entrance guarding device and/or human body movement detecting device with air conditioning control device, and provides the air conditioning control device with data of air conditioning usage surroundings
5 condition generated by the entrance guarding device and/or human body movement detecting device, and then the air conditioning control device executes regulation and control over the air conditioning equipment based on the data of air conditioning usage surroundings condition with referring to preset regulation parameters; accordingly, the air conditioning equipment is adjusted properly to a preset usage
10 condition, thereby reaching objective of energy management of air conditioning equipment.

BRIEF DESCRIPTION OF DRAWINGS

The present invention can be more fully understood by reading the following
15 detailed description of the preferred embodiments, with reference made to the accompanying drawings, wherein:

FIG. 1 is an application structure diagram of first embodiment of a regulation control system of air conditioning equipment of the present invention;

FIG. 2 is an application structure diagram of second embodiment of a regulation
20 control system of air conditioning equipment of the present invention; and

FIG. 3 is an application structure diagram of third embodiment of a regulation control system of air conditioning equipment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

25 The following illustrative embodiments are provided to illustrate the disclosure of the present invention, these and other advantages and effects can be apparently

understood by those in the art after reading the disclosure of this specification. The present invention can also be performed or applied by other different embodiments. The details of the specification may be on the basis of different points and applications, and numerous modifications and variations can be devised without
5 departing from the spirit of the present invention.

First embodiment

Please refer to FIG. 1, which is an application structure diagram of the first embodiment of a regulation control system of air conditioning equipment of the present invention. In the present embodiment, the regulation control system of air
10 conditioning equipment 10 of the present invention is applicable to any air conditioning equipment 100 installed inside various kinds of buildings, especial large-scaled commercial places, such as office buildings, factory buildings, hotels, restaurants, hospitals, supermarket, wholesale stored, department stores, and so on; the air conditioning equipment 100 combines air conditioner heater unit 1001, air
15 handling unit (AHU) 1002, precooling air handler (PAH) 1003, and fan coil unit (FCU) 1004.

It must be specifically stated herein, the air conditioning equipment 100 is not restricted to the aforesaid combination of air conditioner heater unit 1001, air handling unit (AHU) 1002, precooling air handler (PAH) 1003, and fan coil unit
20 (FCU) 1004; it can be a part or parts of the combination.

The regulation control system of air conditioning equipment 10 of the present invention comprises an entrance guarding device 102, an air conditioning control device 104, and an alerting module 106.

The entrance guarding device 102 is for detecting usage condition of entrance 20
25 and windows 21, also the entrance guarding device 102 includes a timer unit 1022 that is for calculating time period of opening/closing at the entrance 20 and windows

21; and then data of air conditioning usage surroundings condition are generated based on detected condition of opening/closing, the data of air conditioning usage surroundings condition consists of condition and time period of opening/closing at entrance 20 and windows 21.

5 Specifically, the entrance guarding device 102 of the present embodiment can be an entrance guarding device that centrally detects usage conditions of entrance 20 and windows 21, and is for centrally detecting usage conditions of more than an entrance 20 and windows 21; in addition, the entrance guarding device 102 has one-way infrared detecting unit, two-way infrared detecting unit, electromagnetic switch,
10 ultrasonic sensor unit and/or radio frequency identification (RFID) unit installed at each entrance 20 and windows 21, and condition of opening/closing at each of the entrances 20 and windows 21 is detected via at least one of the aforesaid units.

 The air conditioning control device 104 includes a storage module 1042 that is for storing a set of preset regulation parameters corresponding to different data of air
15 conditioning usage surroundings condition, and the air conditioning control device executes regulation and control over the air conditioning equipment 100 based on the data of air conditioning usage surroundings condition generated by the entrance guarding device 102 with referring to the preset regulation parameters.

 In the present embodiment, the preset regulation parameters include the
20 following contents:

 A first regulation parameter, which is for adjusting room temperature of air conditioning equipment 100 up to a corresponding preset temperature each time when the timer unit 1022 calculates a time period of opening at entrance 20 and windows 21 reaching a first preset time period; for example, the first preset time period is
25 preset as 5 minutes, and when the timer unit 1022 calculates that an entrance 20 or window 21 has been open for 5 minutes, preset temperature is raised one Celsius

degree up, and 5 minutes later if the entrance or window is still open, the preset temperature is raised one Celsius degree up again.

A second regulation parameter, which is for turning off operation of air conditioning equipment each time when the timer unit 1022 calculates a time period
5 of opening at entrance or window reaching a second preset time period; for example, the second preset time period is preset as 30 minutes, and when the timer unit 1022 calculates that an entrance 20 or window 21 has been open for 30 minutes, then the air conditioning equipment 100 is turned off.

A third regulation parameter, which overpowers the foresaid first and second
10 regulation parameters and thus allows air conditioning equipment 100 to keep operating even when entrance 20 and/or windows 21 are open without the need of adjusting preset temperature; in other words, when entrance 20 and/or windows 21 are open, the third regulation parameter instructs the air conditioning equipment 100 to keep operating at present preset temperature, thus to keep room temperature in
15 accordance with the preset temperature at present.

In order to be accord with a raised preset temperature, air conditioning equipment 100 can temporarily stop air conditioner heater unit 1001 or air handling unit 1002 from operating by increasing temperature preset at the air conditioner heater unit 1001 or air handling unit 1002, and the air conditioning equipment 100
20 begins to operate again and turns on the fan coil unit 1004 to get in outdoor fresh air when room temperature reaching the raised preset temperature; and it is based on the raised preset temperature and actual temperature of usage surroundings to decide if the precooling air handler 1003 is to be turned on and run, thereby regulating temperature of usage surroundings to be in accord with the raised preset temperature.

25 Alerting module 106, which generates an alerting message and then sends it to the air conditioning control device 104 each time when entrance 20 and/or windows

21 are open; in the present embodiment, the alerting message, which is generated by the alerting module 106 and then sent to the air conditioning control device 104 when entrance 20 and/or windows 21 are open, can further be used to inform management crew of the condition of opening/closing at the entrance 20 and/or windows 21.

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Second embodiment

Please refer to FIG. 2, which is an application structure diagram of the second embodiment of a regulation control system of air conditioning equipment of the present invention; in the present invention, air conditioning equipment 100 is same as
10 in the first embodiment; and the regulation control system of air conditioning equipment 10 of the present invention comprises a human body movement detecting device 103 and an air conditioning control device 104.

The human body movement detecting device 103 is for detecting usage condition that if users are inside the usage surroundings of air conditioning equipments; data of air conditioning usage surroundings condition are generated
15 based on the detected usage condition; in the present embodiment, the human body movement detecting device 103 has a timer unit 1032, and the human body movement detecting device 103 is capable of verifying whether users are inside the surroundings of the air conditioning equipment by utilizing an infrared temperature
20 induction unit, an image acquisition identification unit, and/or an audio perception unit.

The air conditioning control device 104, which includes a storage module 1044 that has a set of preset regulation parameters corresponding to different data of air conditioning usage surroundings condition, executes regulation and control over the
25 air conditioning equipment 100 based on the data of air conditioning usage surroundings condition generated by the human body movement detecting device 103

with referring to the preset regulation parameters.

In the present embodiment, the preset regulation parameters may include the following contents:

5 A fourth regulation parameter, if users are in the usage surroundings of the air conditioning equipment 100, instructs to turn on operation of the air conditioning equipment 100.

A fifth regulation parameter, if no user is inside the usage surroundings of the air conditioning equipment 100, instructs to turn off operation of the air conditioning equipment 100.

10 The sixth regulation parameter, which instructs to turn off operation of the air conditioning equipment 100 only if there is no user inside the usage surroundings of the air conditioning equipment 100 and also the timer unit 1032 calculates a time period of condition that indicates no user is inside the usage surroundings of the air conditioning equipment 100 reaching a third preset time period.

15 **Third embodiment**

Please refer to FIG. 3, which is an application structure diagram of the third embodiment of a regulation control system of air conditioning equipment of the present invention; air conditioning equipment of the present embodiment is the same as in the first and second embodiments; and the regulation control system of air conditioning equipment of the present invention comprises an entrance guarding
20 device 102, a human body movement detecting device 103, an air conditioning control system 104 and an alerting module 106.

Wherein, the entrance guarding device 102, the human body movement detecting device 103, and the alerting module 106 are the same as in the first and
25 second embodiments, therefore, it is no need of repetitive descriptions herein.

The air conditioning control system 104, which includes a storage module 1046

that stores a set of preset regulation parameters corresponding to different data of air conditioning usage surroundings condition, executes regulation and control over the air conditioning equipment 100 based on the data of air conditioning usage surroundings condition generated by the entrance guarding device 102 and/or the human body movement detecting device 103 with referring to the preset regulation parameters.

In the present embodiment, the preset regulation parameters include the first regulation parameter through the sixth regulation parameter of the foresaid first and second embodiments, relations among the first regulation parameter through the sixth regulation parameter can be of intersection, union, and/or difference sets.

In view of the above, the regulation control system of air conditioning equipment of the present invention combines entrance guarding device and/or human body movement detecting device and air conditioning control device, and provides the air conditioning equipment with data of air conditioning usage surroundings condition generated by the entrance guarding device and/or human body movement detecting device, and the air conditioning control device is capable of regulating and controlling over the air conditioning equipment based on the data of air conditioning usage surroundings condition with referring to preset regulation parameters; accordingly, the air conditioning equipment is regulated to a preset usage condition, thereby reaching objective of energy management of air conditioning equipment.

The foregoing descriptions of the detailed embodiments are only illustrated to disclose the features and functions of the present invention and not restrictive of the scope of the present invention. It should be understood to those in the art that all modifications and variations according to the spirit and principle in the disclosure of the present invention should fall within the scope of the appended claims.

CLAIMS

What is claimed is:

1. A regulation control apparatus for air conditioning equipment to be used to efficiently regulate and control air conditioning equipment operation in a controlled environment, the regulation control system for air conditioning equipment comprising:

an entrance-guarding device, which is for detecting usage patterns of entrances or windows; the entrance-guarding device having a timer unit that for measuring the time period of opening/closing of the entrance or windows, wherein the entrance-guarding device generates data pertaining to air conditioning usage patterns for the controlled environment based on the detected condition of opening/closing, the data for air conditioning usage patterns for the controlled environment including the condition and time period of opening/closing of the entrance or windows; and

an air conditioning control device, which includes a storage module that is for storing a set of preset regulation parameters corresponding to the data for air conditioning usage patterns in the condition environment, wherein the air conditioning control device is capable of executing regulation and control over the air conditioning equipment based on the data for air conditioning usage patterns in the controlled environment generated by the entrance-guarding device with reference to the preset regulation parameters,

wherein the preset regulation parameters consist of:

a first regulation parameter to indicate that the temperature of the controlled environment served by the air conditioning equipment should be raised to a corresponding preset temperature each time when the timer unit measures that the time period that an entrance/window has been open has reached a first preset time

period;

a second regulation parameter for turning off or reducing operation of the air conditioning equipment each time when the timer unit measures that the time period that an entrance/window has been open has reached a second preset time period; and

a third regulation parameter that is used to override the first and the second regulation parameters, thus allowing the air conditioning equipment to keep operating without adjusting the preset temperature when an entrance/window is open.

2. The regulation control apparatus for air conditioning equipment of claim 1, further comprising an alerting module, which generates an alerting message and then sends it to the air conditioning control device when an entrance/window is open.

3. The regulation control apparatus for air conditioning equipment of claim 1, wherein the air conditioning equipment combines an air conditioner heater/cooler unit, air handling unit, precooling air handler, or fan coil unit in various combination.

4. The regulation control apparatus for air conditioning equipment of claim 1, wherein the entrance-guarding device detects the conditions of opening and closing of an entrance/window by utilizing a one-way infrared detecting unit, a two-way infrared detecting unit, an electromagnetic switch, an ultrasonic sensor unit, and/or a radio frequency identification (FRID) unit.

5. A regulation control apparatus for air conditioning equipment to be used to efficiently regulate and control air conditioning equipment operation in a controlled environment, the regulation control apparatus for air conditioning equipment comprising:

a human body movement detecting device for detecting the usage patterns of whether or not users are inside the controlled environment served by the air conditioning equipment, wherein the human body movement detecting device generates data pertaining to air conditioning usage patterns in the controlled

environment, based on the detected usage patterns; and

an air conditioning control device, which includes a storage module that stores a set of preset regulation parameters corresponding to the data for air conditioning usage patterns in the controlled environment, wherein the air conditioning control device executes regulation and control over the air conditioning equipment based on the data for air conditioning usage patterns derived from the human body movement detecting device with reference to the preset regulation parameters,

wherein the human body movement detecting device has a timer unit, and the preset regulation parameters include:

a first regulation parameter that turns on operation of the air conditioning equipment when there are users inside the controlled environment served by the air conditioning equipment;

a second regulation parameter that turns off or reduces operation of the air conditioning equipment when there are no users inside the controlled environment served by the air conditioning equipment; and

a third regulation parameter that turns off or reduces operation of the air conditioning equipment only when there are no users inside the controlled environment served by the air conditioning equipment and also the timer unit indicates that no users have been present for a time period that has reached a preset time period.

6. The regulation control apparatus for air conditioning equipment of claim 5, wherein the air conditioning equipment combines an air conditioner heater/cooler unit, air handling unit, precooling air handler, or fan coil unit in various combination.

7. The regulation control apparatus for air conditioning equipment of claim 5, wherein the human body movement detecting device is capable of verifying whether or not users are inside the controlled environment of the air conditioning equipment

by utilizing an infrared temperature induction unit, an image acquisition identification unit, or an audio perception unit.

8. A regulation control apparatus for air conditioning equipment to be used to efficiently regulate and control air conditioning equipment operation in a controlled environment, the regulation control system for air conditioning equipment comprising:

an entrance-guarding device for detecting usage patterns of entrance or windows, the entrance-guarding device having a timer unit that is for measuring the time period of opening/closing of the entrance or windows, wherein the entrance-guarding device generates data pertaining to air conditioning usage patterns in the controlled environment based on the detected condition of opening/closing, the data for air conditioning usage patterns in the controlled environment including the condition and time period of opening/closing of the entrance or windows;

a human body movement detecting device for detecting usage patterns as to whether users are in the controlled environment of the air conditioning equipment, wherein the human body movement detecting device generates data pertaining to air conditioning usage patterns in the controlled environment based on the detected usage patterns; and

an air conditioning control device, which includes a storage module that stores a set of preset regulation parameters corresponding to the data for air conditioning usage patterns in the controlled environment, wherein the air conditioning control device executes regulation and control over the air conditioning equipment based on data pertaining to air conditioning usage patterns in the controlled environment derived from the entrance-guarding device or human body detecting device with reference to the preset regulation parameters,

wherein the human body movement detecting device also has a timer unit, and

the preset regulation parameters include:

a first regulation parameter to indicate that the temperature of the controlled environment served by the air conditioning equipment should be raised to a corresponding preset temperature each time when the timer unit measures that the time period that an entrance/window has been open has reached a first preset time period;

a second regulation parameter for turning off or reducing operation of the air conditioning equipment each time when the timer unit measures that the time period that an entrance/window has been open has reached a second preset time period;

a third regulation parameter that is used to override the first and the second regulation parameters, thus allowing the air conditioning equipment to keep operating without adjusting the preset temperature when an entrance/window is open;

a fourth regulation parameter that turns on operation of the air conditioning equipment when there are users inside the controlled environment served by the air conditioning equipment;

a fifth regulation parameter that turns off or reduces operation of the air conditioning equipment when there are no users inside the controlled environment of the air conditioning equipment; and

a sixth regulation parameter turns off or reduces the air conditioning equipment only when there are no users inside the controlled environment served by the air conditioning equipment and also the timer unit indicates that no users have been present for a time period that has reached a third preset time period.

9. The regulation control apparatus for air conditioning equipment of claim 8, wherein the relation between the first regulation parameter through the sixth regulation parameter can be that of intersection, union, or difference sets to allow various combinations.

10. The regulation control apparatus for air conditioning equipment of claim 8, further comprising: an alerting module, which generates an alerting message and then sends it to the air conditioning control device when an entrance/window is open.
11. The regulation control apparatus for air conditioning equipment of claim 8, wherein the air conditioning equipment combines an air conditioner heater/cooler unit, air handling unit, precooling air handler, or fan coil unit in various combination.
12. The regulation control apparatus for air conditioning equipment of claim 8, wherein the entrance-guarding device detects the condition of opening/closing of an entrance or window by utilizing a one-way infrared detecting unit, a two-way infrared detecting unit, an electromagnetic switch, an ultrasonic sensor unit, or a radio frequency identification (FRID) unit.
13. The regulation control apparatus for air conditioning equipment of claim 8, wherein the human body movement detecting device is capable of determining if users are inside the controlled environment of the air conditioning equipment by utilizing an infrared temperature induction unit, an image acquisition identification unit, or an audio perception unit.