DESCRIPTION

AIR CONDITIONER CONTROL DEVICE AND AIR CONDITIONER APPARATUS

TECHNICAL FIELD

The technical field is a field related to air conditioning control devices and air conditioning apparatuses.

BACKGROUND ART

Hitherto, it has been demanded to improve an environment in a space where a worker is present to increase the work efficiency of the worker.

For example, a control device for an air-conditioner described in PTL 1 (Japanese Unexamined Patent Application Publication No. H10-259943) has been proposed in which the arousal level of a subject is grasped and an air conditioning operation for changing from a low-arousal-level state, such as a drowsy state, to a high-arousal-level state is executed to maintain high work efficiency of a person in a room.

SUMMARY OF INVENTION

Technical Problem

In the control device for the air conditioner described in PTL 1 described above, it is only disclosed that the set temperature, the air flow rate, and the air flow direction are changed to such an extent as not to provide discomfort to the subject to increase the arousal level of the subject. However, a new method for increasing the arousal level is desired.

In view of the issues described above, embodiments of the present disclosure provide an air conditioning control device and an air conditioning apparatus capable of bringing a subject to arousal.

Solution to Problem

According to a first aspect of the present disclosure, there is provided an air conditioning control device for controlling air conditioning means capable of changing an air environment of a target space, including a first information grasping unit and a control unit. The first information grasping unit is configured to grasp a predetermined comfort-related value relating to comfort of a subject. The control unit controls the air conditioning means so as to satisfy a predetermined discomfort condition on the basis of the comfort-related value grasped by the first information grasping unit, wherein the comfort-related value is grasped from at least a temperature and a humidity in the target space; the comfort-related value is a

PMV which is a thermal environment evaluation index; the control unit is configured to control the air conditioning means to increase an absolute value of the PMV of the subject grasped by the first information grasping unit so that the absolute value of the PMV of the subject is larger than a current value by one or more; the air conditioning control device further comprises a second information grasping unit configured to grasp an arousal level of the subject, and the control unit is configured to control the air conditioning means to perform control based on the comfort-related value grasped by the first information grasping unit to increase the arousal level of the subject grasped by the second information grasping unit.

The air conditioning means is not limited and may be configured to, for example, change at least one of the temperature, the humidity, or the wind velocity in the target space.

The comfort-related value is not limited and includes a value indicating human comfort, an environmental physical quantity that affects human comfort, a physical quantity correlated with the environmental physical quantity, and the like. The comfort-related value may be, for example, the value of the PMV (thermal environment evaluation index) of the subject, the discomfort index of the subject, the degree of deviation of the temperature of the target space from the set temperature when the air conditioning means is controlled using the set temperature as a target value, the temperature, the humidity, or the radiation in a space where the subject is present, the wind velocity at a location near the subject, or a value obtained by any one or a combination thereof.

The phrase "controls … so as to satisfy a predetermined discomfort condition on the basis of the comfort-related value" is not limited and may be used to indicate, for example, performing control so that the comfort-related value falls within a predetermined range in which the subject is predicted to feel more uncomfortable than the current value, or performing control so that the comfort-related value is shifted in a direction in which the subject feels more uncomfortable than the current value. For example, when the comfort-related value is the discomfort index of the subject, control may be performed so as to increase the level of discomfort on the discomfort index. When the comfort-related value is the PMV of the subject, control may be performed so as to increase the absolute value of the PMV. When the comfort-related value is the temperature of a space where the subject is present, control may be performed so as to satisfy a predetermined discomfort temperature condition.

In this air conditioning control device, it is possible to increase the arousal level of the subject by using a novel method of controlling the air conditioning means so as to satisfy a predetermined discomfort condition on the basis of the comfort-related value of the subject.

In an embodiment, in the air conditioning control device, the comfort-related value is grasped from at least a temperature and a humidity in the target space.

In this embodiment of the air conditioning control device, it is possible to more reliably worsen the comfort of the subject.

In an embodiment, in the air conditioning control device, the comfort-related value is a PMV (thermal environment evaluation index). The control unit controls the air conditioning means to increase an absolute value of the PMV of the subject grasped by the first information grasping unit so that the absolute value of the PMV of the subject is larger than a current value.

In this embodiment of the air conditioning control device, it is possible to further reliably worsen the comfort of the subject.

In an embodiment, in the air conditioning control device, the control unit controls the air conditioning means to increase the absolute value of the PMV of the subject grasped by the first information grasping unit so that the absolute value of the PMV of the subject is larger than the current value by one or more.

In this embodiment of the air conditioning control device, it is possible to more reliably increase the arousal level by sufficiently worsening the comfort of the subject.

In an embodiment, in the air conditioning control device , the control unit controls the air conditioning means to continue control for four minutes or more, the control being control for increasing the absolute value of the PMV of the subject grasped by the first information grasping unit so that the absolute value of the PMV of the subject is larger than the current value by two or more.

In this embodiment of the air conditioning control device, it is possible to significantly increase the arousal level of the subject.

In an embodiment, in the air conditioning control device, the control unit continues control for at least one minute or more, the control being based on the comfort-related value grasped by the first information grasping unit.

In this embodiment of the air conditioning control device, it is possible to more reliably increase the arousal level by worsening the comfort of the subject for a sufficient period of time.

In an embodiment, in the air conditioning control device, the control unit sets a duration of control to thirty minutes or less, the control being based on the comfort-related value grasped by the first information grasping unit.

In this embodiment of the air conditioning control device, it is possible to prevent a reduction in the effect of improving the arousal level due to an excessively long period of time during which the subject is made uncomfortable.

In an embodiment, in the air conditioning control device, the control unit is capable of executing normal control for controlling the air conditioning means so that a set temperature

condition of the target space is satisfied. The control unit starts control in a case where a predetermined start condition is satisfied while the normal control is being executed, the control being based on the comfort-related value grasped by the first information grasping unit.

In this embodiment of the air conditioning control device, the control of worsening the comfort of the subject is not performed at all times, but can be performed only when a predetermined start condition is satisfied while the normal control is being executed. It is possible to prevent the control of worsening the comfort of the subject from being unnecessarily performed.

In an embodiment, in the air conditioning control device, the predetermined start condition is a condition regarding a predetermined time of day.

In this embodiment of the air conditioning control device, the control of worsening the comfort of the subject can be started only when a predetermined time of day is reached while the normal control is being executed.

In an embodiment, the air conditioning control device further includes a second information control unit. The second information control unit is configured to grasp physical and mental state information or biological state information of the subject. The control unit controls the air conditioning means to perform control based on the comfort-related value grasped by the first information grasping unit to increase an arousal level of the subject grasped by the second information grasping unit.

The arousal level is not limited and may be determined based on, for example, the heartbeat state of the user, the facial expression of the user, the temperature of the skin of the user, the number of breaths that the user takes per unit time, the brain wave of the user, or a combination thereof.

In this embodiment of the air conditioning control device, it is possible to more reliably increase the arousal level of the subject by making the subject uncomfortable.

In an embodiment, the air conditioning control device further includes a second information control unit. The second information control unit is configured to grasp physical and mental state information or biological state information of the subject. The predetermined start condition is a condition that an arousal level of the subject grasped by the second information grasping unit is equal to or less than a predetermined value.

In this embodiment of the air conditioning control device, providing discomfort to the subject when a reduction in the arousal level of the subject is confirmed makes it easy to keep the arousal level of the subject in a favorable state.

According to a second aspect of the present disclosure, there is provided an air conditioning apparatus including the above air conditioning control device.

This air conditioning apparatus can bring the subject to arousal.

BRIEF DESCRIPTION OF DRAWINGS

<Fig. 1> Fig. 1 is an overall configuration diagram of an air conditioning apparatus.

<Fig. 2> Fig. 2 is a block configuration diagram of the air conditioning apparatus.

<Fig. 3> Fig. 3 is a control flowchart for an arousal control mode.

<Fig. 4> Fig. 4 is a block configuration diagram of an air conditioning apparatus according to modification A.

<Fig. 5> Fig. 5 is a control flowchart for an arousal control mode according to modification A.

<Fig. 6> Fig. 6 is a control flowchart for an arousal control mode according to modification B.

<Fig. 7> Fig. 7 is a control flowchart for an arousal control mode according to modification C.

<Fig. 8> Fig. 8 is a control flowchart for an arousal control mode according to modification D.

<Fig. 9> Fig. 9 is a graph illustrating a temporal change in the arousal level of the subject.

DESCRIPTION OF EMBODIMENTS

Hereinafter, an air conditioning control device according to an embodiment and an air conditioning apparatus provided with the air conditioning control device will be described with reference to the drawings. It should be noted that the following embodiment is a specific example of the present disclosure and is not intended to limit the technical scope of the content of the present disclosure, but can be modified, as appropriate, without departing from the spirit of the present disclosure.

(1) Air Conditioning Apparatus 100

Fig. 1 is a schematic configuration diagram of an air conditioning apparatus 100. The air conditioning apparatus 100 is an apparatus that performs air conditioning of a target space by performing a vapor compression refrigeration cycle.

The air conditioning apparatus 100 mainly includes an outdoor unit 2, an indoor unit 50, a liquid-refrigerant connection pipe 6 and a gas-refrigerant connection pipe 7 that connect the outdoor unit 2 and the indoor unit 50 to each other, an plurality of remote controls 50a,

CLAIMS

1. An air conditioning control device (70) for controlling air conditioning means (100) capable of changing an air environment of a target space, the air conditioning control device comprising:

a first information grasping unit (82, 83, 84, 51a, 51b, 92, 91) for grasping a predetermined comfort-related value relating to comfort of a subject; and

a control unit (73) that controls the air conditioning means so as to satisfy a predetermined discomfort condition on the basis of the comfort-related value grasped by the first information grasping unit,

wherein

the comfort-related value is grasped from at least a temperature and a humidity in the target space;

the comfort-related value is a PMV which is a thermal environment evaluation index;

the control unit is configured to control the air conditioning means to increase an absolute value of the PMV of the subject grasped by the first information grasping unit so that the absolute value of the PMV of the subject is larger than a current value by one or more;

the air conditioning control device further comprises a second information grasping unit (73) configured to grasp an arousal level of the subject, and

the control unit is configured to control the air conditioning means to perform control based on the comfort-related value grasped by the first information grasping unit to increase the arousal level of the subject grasped by the second information grasping unit.

2. The air conditioning control device according to claim 1, wherein

the control unit controls the air conditioning means to continue control for four minutes or more, the control being control for increasing the absolute value of the PMV of the subject grasped by the first information grasping unit so that the absolute value of the PMV of the subject is larger than the current value by two or more.

3. The air conditioning control device according to claim 1 or 2, wherein

the control unit continues control for at least one minute or more, the control being based on the comfort-related value grasped by the first information grasping unit.

4. The air conditioning control device according to any one of claims 1 to 3, wherein

the control unit sets a duration of control to thirty minutes or less, the control being based on the comfort-related value grasped by the first information grasping unit.

5. The air conditioning control device according to any one of claims 1 to 4, wherein

the control unit is capable of executing a normal control for controlling the air conditioning means so that a set temperature condition of the target space is satisfied, and

the control unit starts a second control in a case where a predetermined start condition is satisfied while the normal control is being executed, the second control being based on the comfort-related value grasped by the first information grasping unit.

6. The air conditioning control device according to claim 5, wherein

the predetermined start condition is a condition regarding a predetermined time of day.

7. The air conditioning control device according to claim 5, further comprising

a second information grasping unit (73) is configured to grasp physical and mental state information or biological state information of the subject, wherein

the predetermined start condition is a condition that an arousal level of the subject grasped by the second information grasping unit is equal to or less than a predetermined value.

8. An air conditioning apparatus (100) comprising

the air conditioning control device (70) according to any one of claims 1 to 7.