

DESCRIPTION

Title of Invention: EXERCISE ASSISTANCE UNIT

5 TECHNICAL FIELD

[0001] The present disclosure relates to an exercise assistance unit that includes exercise equipment to assist a user in exercise.

BACKGROUND ART

10 [0002] There is known a technique (e.g., PTL 1) in a treadmill in which an exercise load (e.g., a rotation speed of a motor that rotates an endless belt) of the treadmill is controlled following a change in a heart rate of a user to maintain an exercise intensity intended by the user.

Citation List

15 Patent Literature

[0003] PTL 1: Unexamined Japanese Patent Publication No. 2002-177413

SUMMARY OF THE INVENTION

[0004] In recent years, when exercise equipment including bicycle type equipment and
20 the like besides the above-described treadmill is used, it is required to provide higher quality exercise assistance (training) based on exercise intensity intended by a user.

[0005] Thus, an object of the present disclosure is to provide an exercise assistance unit capable of performing higher quality exercise assistance (training) based on exercise intensity intended by a user when exercise equipment is used.

25 [0006] An exercise assistance unit according to the present disclosure includes exercise equipment used by a user to exercise, a blowing unit that blows an air flow toward the user, and a controller. The controller acquires information on a heart rate of the user. Then, the controller controls at least one of wind speed, temperature, and humidity of the air flow to be blown from the blowing unit based on the acquired information on a heart rate to
30 cause the user during exercise using the exercise equipment to have a heart rate within a predetermined range suitable for exercise intensity intended by the user.

[0007] The exercise assistance unit according to the present disclosure can provide higher quality exercise assistance (training) based on the exercise intensity intended by the user

when the exercise equipment is used.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Fig. 1 is a schematic configuration diagram of an exercise assistance unit

5 including a blower according to a first exemplary embodiment of the present disclosure.

Fig. 2 is a schematic block diagram of the exercise assistance unit including the blower.

Fig. 3 is a schematic block diagram illustrating a configuration of the blower.

10 Fig. 4 is a schematic block diagram illustrating a configuration of a controller in the blower.

Fig. 5 is a flowchart illustrating processing of a blowing operation performed by the controller in the blower.

Fig. 6 is a flowchart illustrating processing in a first exercise assistance mode performed by the controller in the blower.

15 Fig. 7 is a flowchart illustrating processing in a second exercise assistance mode performed by the controller in the blower.

Fig. 8 is a schematic configuration diagram of an exercise assistance unit including a blower according to a second exemplary embodiment of the present disclosure.

20 Fig. 9 is a schematic block diagram of the exercise assistance unit including the blower.

Fig. 10 is a schematic block diagram illustrating a configuration of the blower.

Fig. 11 is a schematic block diagram illustrating a configuration of a controller in the blower.

25 Fig. 12 is a flowchart illustrating processing of a blowing operation performed by the controller in the blower.

Fig. 13 is a flowchart illustrating processing in a first exercise assistance mode performed by the controller in the blower.

Fig. 14 is a flowchart illustrating processing in a second exercise assistance mode performed by the controller in the blower.

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DESCRIPTION OF EMBODIMENTS

[0009] An exercise assistance unit according to the present disclosure includes exercise equipment used by a user to exercise, a blowing unit that blows an air flow toward the

user, and a controller. The controller acquires information on a heart rate of the user. Then, the controller controls at least one of wind speed, temperature, and humidity of the air flow to be blown from the blowing unit based on the acquired information on a heart rate to cause the user during exercise using the exercise equipment to have a heart rate within a predetermined range suitable for exercise intensity intended by the user.

[0010] Such a configuration enables the exercise assistance unit according to the present disclosure to control the air flow to be blown toward the user to achieve the exercise intensity intended by the user when the exercise equipment is used. This configuration controls not only a conventional exercise load caused by the exercise equipment but also the air flow to be blown from the blowing unit toward the user, so that the exercise assistance unit according to the present disclosure can provide higher quality exercise assistance (training) based on the exercise intensity intended by the user.

[0011] The exercise assistance unit according to the present disclosure acquires the information on a heart rate, including a first heart rate set based on a maximum heart rate and exercise intensity which are suitable for the user, and a second heart rate of the user during exercise using the exercise equipment, the second heart rate being transmitted from a heart rate sensor that measures the heart rate of the user. The controller performs the control by switching between a first exercise assistance mode and a second exercise assistance mode. In the first exercise assistance mode, the controller controls at least one of wind speed, temperature, and humidity of a first air flow to be blown from the blowing unit to cause the second heart rate to be less than or equal to the first heart rate. In the second exercise assistance mode, the controller controls at least one of wind speed, temperature, and humidity of a second air flow to be blown from the blowing unit to cause the second heart rate to exceed the first heart rate.

[0012] Such a configuration enables the exercise assistance unit according to the present disclosure to switch between the first exercise assistance mode of suppressing sweating of the user while maintaining body temperature of the user and the second exercise assistance mode of increasing the body temperature of the user to promote the sweating. Thus, the exercise assistance unit according to the present disclosure can reliably implement high quality exercise assistance (training) reflecting the intention of the user.

[0013] The exercise assistance unit according to the present disclosure is configured such that the controller implements at least one of increase in the wind speed, decrease in the temperature, and decrease in the humidity of the first air flow to cause the second heart rate

to be less than or equal to the first heart rate in the first exercise assistance mode. The controller implements at least one of decrease in the wind speed, increase in the temperature, and increase in the humidity of the second air flow to cause the second heart rate to exceed the first heart rate in the second exercise assistance mode.

5 **[0014]** In this way, the exercise assistance unit according to the present disclosure can effectively suppress the sweating of the user in the first exercise assistance mode, and can effectively promote the sweating of the user in the second exercise assistance mode.

10 **[0015]** The exercise assistance unit according to the present disclosure is configured such that the controller implements at least one of the wind speed, the temperature, and the humidity of the second air flow to be blown from the blowing unit to cause the second heart rate to be less than or equal to the maximum heart rate in the second exercise assistance mode.

15 **[0016]** In this way, the exercise assistance unit according to the present disclosure can reliably suppress a state of excessive exercise load on the user, so that the exercise assistance intended by the user can be continued for a long time in the second exercise assistance mode.

20 **[0017]** The exercise assistance unit according to the present disclosure may be configured such that after the second exercise assistance mode ends, the controller performs a third exercise assistance mode of implementing at least one of wind speed, temperature, and humidity of a third air flow to be blown from the blowing unit to cause the second heart rate to be less than or equal to the first heart rate.

25 **[0018]** In this way, the exercise assistance unit according to the present disclosure can promote evaporation of sweat of the user in the third exercise assistance mode, so that the body temperature of the user raised in the second exercise assistance mode can be effectively cooled down.

30 **[0019]** Hereinafter, a first exemplary embodiment of the present disclosure will be described with reference to the drawings.

35 **[0020]** (First exemplary embodiment)

First, a schematic configuration of exercise assistance unit 101 according to the first exemplary embodiment of the present disclosure, including blower 102, will be described with reference to Figs. 1 and 2. Fig. 1 is a schematic configuration diagram of exercise assistance unit 101 including blower 102. Fig. 2 is a schematic block diagram of exercise assistance unit 101 including blower 102. The drawings subsequent to Fig. 1 are

illustrated in which left and right are defined in a state where user U1 views display device 104 from the front. In the first exemplary embodiment, blowing an air flow from a pair of blowing units (first blowing unit 160L, second blowing unit 160R) described later of blower 102 may be simply referred to as blowing an air flow from blower 102.

5 **[0021]** Exercise assistance unit 101 includes exercise equipment 103 used by user U1 to exercise, and is fabricated as a box-shaped room unit. Exercise assistance unit 101 enables user U1 to use exercise equipment 103 while enjoying continuous exercise in an environment with realistic feeling (bodily sensation) suitable for a video (a landscape, a situation, or the like) projected on display device 104. When user U1 uses exercise
10 equipment 103, exercise assistance unit 101 causes blowers 102 disposed at both left and right ends of display device 104 to blow an air flow toward user U1 based on the heart rate of user U1 so that exercise intensity intended by user U1 is achieved. Then, exercise assistance unit 101 provides user U1 with exercise assistance (training) with higher quality than before by controlling the air flow (in particular, the wind speed or temperature and
15 humidity of the air flow) to be blown toward user U1. Exercise assistance unit 101 can also be referred to as an exercise assistance system.

[0022] Specifically, exercise assistance unit 101 includes exercise space S11 in which user U1 exercises and air conditioning space S12 as illustrated in Fig. 1. Air conditioning space S12 is configured to generate and store conditioned air to be supplied from the pair
20 of blowing units (first blowing unit 160L, second blowing unit 160R) constituting blower 102 to exercise space S11.

[0023] Exercise space S11 includes exercise equipment 103 installed at its center, and display device 104 and blower 102 (first blowing unit 160 L, second blowing unit 160R) that are installed on a wall surface in front of exercise equipment 103. Door 105 serving as
25 an entrance to exercise space S11 is provided in a wall surface behind exercise equipment 103 (see Fig. 2). Exercise space S11 is composed of a room (exercise room) surrounded by front, rear, left, right, top, and bottom wall surfaces.

[0024] Exercise equipment 103 is, for example, a bicycle type equipment such as a bicycle ergometer or a bicycle training machine, but may be a treadmill (a fitness machine
30 for running or walking indoors) or the like. User U1 sets exercise equipment 103 to a predetermined load level to use it. User U1 exercises using exercise equipment 103 described above while wearing wristband type heart rate sensor 180 on its wrist.

[0025] Here, heart rate sensor 180 measures the heart rate (e.g., a second heart rate to be

described later) of user U1 at a predetermined interval (e.g., an interval of 10 seconds).

Then, heart rate sensor 180 transmits the measured heart rate as heart rate information to blower 102 (controller 170 to be described later) by wireless communication.

5 **[0026]** Display device 104 includes, for example, a large display screen such as a digital signage that is an information medium displaying various videos or characters. Display device 104 according to the first exemplary embodiment displays a video according to an exercise assistance program (e.g., a video program for cycling in nature or a video program for traveling on a mountain road with ups and downs) that is set suitable for the load level of exercise equipment 103.

10 **[0027]** Blower 102 is configured to feed an air flow from each of blowing units paired (first blowing unit 160L, second blowing unit 160R) provided at the respective left and right ends of display device 104 toward user U1 who uses exercise equipment 103. Details of blower 102 will be described later. The pair of blowing units (first blowing unit 160L, second blowing unit 160R) corresponds to the “air blower” according to the present
15 disclosure.

[0028] As illustrated in Fig. 2, blower 102 is installed in air conditioning space S12. Blower 102 includes air conditioner 140, a pair of air blowers (air blower 143L, air blower 143R), and controller 170. Air conditioner 140 includes air conditioning device 141 and humidity controller 142 to generate and store conditioned air to be supplied from the pair
20 of blowing units (first blowing unit 160L, second blowing unit 160R) to exercise space S11. As with exercise space S11, air conditioning space S12 is composed of a room (air conditioning room) surrounded by front, rear, left, right, top, and bottom wall surfaces.

[0029] Air conditioner 140 adjusts temperature and humidity of air inside air conditioning space S12 to predetermined conditions with air conditioning device 141 and
25 humidity controller 142. As a result, air (conditioned air) satisfying the predetermined conditions (temperature, humidity) is stored inside air conditioning space S12. Here, air conditioning device 141 takes in air in air conditioning space S12, and feeds the taken air into air conditioning space S12 while controlling temperature of the taken air. Humidity controller 142 takes in air in air conditioning space S12, and feeds the taken air into air
30 conditioning space S12 while controlling humidity of the taken air.

[0030] As illustrated in Fig. 2, the pair of air blowers (air blower 143L, air blower 143R) feeds the conditioned air conditioned by air conditioner 140 to the corresponding pair of blowing units (first blowing unit 160L, second blowing unit 160R). Specifically, air blower

143L feeds the conditioned air conditioned by air conditioner 140 to first blowing unit 160L through a duct (not illustrated) at predetermined wind speed (blast volume). In contrast, air blower 143R feeds the conditioned air conditioned by air conditioner 140 to second blowing unit 160R through a duct (not illustrated) at predetermined wind speed (blast volume).

5 [0031] Then, the conditioned air (first blow-out air flow 130L, second blow-out air flow 130R) fed from the pair of blowing units (first blowing unit 160L, second blowing unit 160R) is fed toward user U1 who uses exercise equipment 103.

10 [0032] Controller 170 controls operation of air conditioner 140, the pair of air blowers (air blower 143L, air blower 143R), which are described above, and a pair of switching units (first switching unit 144L, second switching unit 144R) to be described later. Controller 170 according to the first exemplary embodiment controls the operation of air conditioner 140 and the pair of air blowers (air blower 143L, air blower 143R) based on the heart rate of user U1 to adjust the wind speed (blast volume), the temperature, and the

15 humidity of the air flow to be fed toward user U1. Details of controller 170 will be described later. Controller 170 includes, for example, a computer system including a processor and a memory. Then, when the processor executes a program stored in the memory, the computer system functions as controller 170. Here, the program executed by the processor is assumed to be recorded in advance in the memory of the computer system.

20 The program may be provided by being recorded in a non-temporary recording medium such as a memory card, or may be provided through a telecommunication line such as the Internet.

[0033] Next, a detailed configuration of blower 102 will be described with reference to Fig. 3. Fig. 3 is a schematic block diagram illustrating the configuration of blower 102.

25 [0034] As illustrated in Fig. 3, air conditioning space S12 according to the first exemplary embodiment is divided into two air conditioning spaces (first air conditioning space S12a, second air conditioning space S12b). Each air conditioning space is provided with air conditioner 140 and the pair of air blowers (air blower 143L, air blower 143R), constituting blower 102. As a result, blower 102 can generate conditioned air different in

30 temperature and humidity conditions for each air conditioning space and blow the conditioned air.

[0035] Specifically, first air conditioning space S12a is provided with first air conditioner 140a as air conditioner 140, first air blower 143L1 as air blower 143L, and third air blower

143R1 as air blower 143R.

[0036] First air conditioner 140a includes first air conditioning device 141a as air conditioning device 141, and first humidity controller 142a as humidity controller 142.

Then, first air conditioner 140a adjusts the air inside first air conditioning space S12a to

5 satisfy first conditions (first temperature and first humidity) with first air conditioning device 141a and first humidity controller 142a. As a result, conditioned air under the first conditions is stored in first air conditioning space S12a. The conditioned air in first air conditioning space S12a is mainly used for blowing an air flow (first air flow) in first exercise assistance mode M1 described later.

10 **[0037]** First air blower 143L1 feeds the conditioned air (the air under the first conditions) stored in first air conditioning space S12a as conditioned air 130L1. Conditioned air 130L1 is blown out from first blowing unit 160L as first blow-out air flow 130L when first damper 144L1 is opened.

[0038] Third air blower 143R1 feeds conditioned air (air under the first conditions) stored
15 in first air conditioning space S12a as conditioned air 130R1. Conditioned air 130R1 is blown out from second blowing unit 160R as second blow-out air flow 130R when third damper 144R1 is opened.

[0039] First air blower 143L1 and third air blower 143R1 according to the first exemplary embodiment are controlled to operate in cooperation with each other as a pair of
20 air blowers. Then, blower 102 in first exercise assistance mode M1 feeds the conditioned air stored in first air conditioning space S12a as the first air flow from the pair of blowing units (first blowing unit 160L, second blowing unit 160R) toward user U1. The first air flow includes conditioned air 130L1 (first blow-out air flow 130L) fed toward user U1 by first air blower 143L1 and conditioned air 130R1 (second blow-out air flow 130R) fed
25 toward user U1 by third air blower 143R1.

[0040] In contrast, second air conditioning space S12b is provided with second air conditioner 140b as air conditioner 140, second air blower 143L2 as air blower 143L, and fourth air blower 143R2 as air blower 143R. Second air conditioner 140b includes second air conditioning device 141b as air conditioning device 141 and second humidity controller
30 142b as humidity controller 142. Then, second air conditioner 140b adjusts the air inside second air conditioning space S12b to satisfy second conditions (second temperature and second humidity) with second air conditioning device 141b and second humidity controller 142b. Here, the second conditions is set to have higher temperature and higher humidity

than the first conditions, for example. As a result, conditioned air under the second conditions is stored in second air conditioning space S12b. The conditioned air in second air conditioning space S12b is mainly used for blowing an air flow (second air flow) in second exercise assistance mode M2 described later.

5 **[0041]** Second air blower 143L2 feeds the conditioned air (the air under the second conditions) stored in second air conditioning space S12b, as conditioned air 130L2. Conditioned air 130L2 is then blown out from first blowing unit 160L as first blow-out air flow 130L when second damper 144L2 is opened.

10 **[0042]** Fourth air blower 143R2 feeds the conditioned air stored in second air conditioning space S12b, as conditioned air 130R2. Conditioned air 130R2 is then blown out from second blowing unit 160R as second blow-out air flow 130R when fourth damper 144R2 is opened.

15 **[0043]** Second air blower 143L2 and fourth air blower 143R2 according to the first exemplary embodiment are controlled to operate in cooperation with each other as a pair of air blowers. Then, blower 102 in second exercise assistance mode M2 feeds the conditioned air stored in second air conditioning space S12b as a second air flow from the pair of blowing units (first blowing unit 160L, second blowing unit 160R) toward user U1. The second air flow includes conditioned air 130L2 (first blow-out air flow 130L) fed toward user U1 by second air blower 143L2 and conditioned air 130R2 (second blow-out
20 air flow 130R) fed toward user U1 by fourth air blower 143R2.

25 **[0044]** As illustrated in Fig. 3, second air conditioning space S12b is provided with first switching unit 144L and second switching unit 144R. Here, first switching unit 144L and second switching unit 144R are disposed near first blowing unit 160L and second blowing unit 160R, respectively.

30 **[0045]** First switching unit 144L includes first damper 144L1 and second damper 144L2, and switches the conditioned air fed from air blower 143L to first blowing unit 160L between conditioned air 130L1 from first air blower 143L1 and conditioned air 130L2 from second air blower 143L2. Specifically, first switching unit 144L causes first damper 144L1 to be opened and second damper 144L2 to be closed so that conditioned air 130L1 from first air blower 143L1 is fed to first blowing unit 160L as first blow-out air flow 130L. Alternatively, first switching unit 144L causes first damper 144L1 to be closed and second damper 144L2 to be opened so that conditioned air 130L2 from second air blower 143L2 is fed to first blowing unit 160L as first blow-out air flow 130L. As described

above, first switching unit 144L can easily switch temperature and humidity conditions of first blow-out air flow 130L blown out from first blowing unit 160L between the first conditions (first temperature and first humidity) and the second conditions (second temperature and second humidity).

5 **[0046]** In contrast, second switching unit 144R includes third damper 144R1 and fourth damper 144R2, and switches the conditioned air fed from air blower 143R to second blowing unit 160R between conditioned air 130R1 from third air blower 143R1 and conditioned air 130R2 from fourth air blower 143R2. Specifically, second switching unit 144R causes third damper 144R1 to be opened and fourth damper 144R2 to be closed so
10 that conditioned air 130R1 from third air blower 143R1 is fed to second blowing unit 160R as second blow-out air flow 130R. Alternatively, second switching unit 144R causes third damper 144R1 to be closed and fourth damper 144R2 to be opened so that conditioned air 130R2 from fourth air blower 143R2 is fed to second blowing unit 160R as second blow-out air flow 130R. As described above, second switching unit 144R can easily switch
15 temperature and humidity conditions of second blow-out air flow 130R blown out from second blowing unit 160R between the first conditions (first temperature and first humidity) and the second conditions (second temperature and second humidity), as in first blow-out air flow 130L.

[0047] Here, first switching unit 144L and second switching unit 144R are controlled to
20 operate in cooperation with each other. Then, first switching unit 144L and second switching unit 144R are switched to feed conditioned air under the first conditions (first temperature and first humidity) in first exercise assistance mode M1. Alternatively, first switching unit 144L and second switching unit 144R are switched to feed conditioned air under the second conditions (second temperature and second humidity) in second exercise
25 assistance mode M2.

[0048] Next, controller 170 of blower 102 will be described with reference to Fig. 4. Fig. 4 is a schematic block diagram illustrating a configuration of controller 170 in blower 102.

[0049] As illustrated in Fig. 4, controller 170 includes input unit 170a, storage unit 170b, timer 170c, processor 170d, and output unit 170e.

30 **[0050]** Input unit 170a receives first information on user setting information from operation panel 182, second information on temperature and humidity of indoor air in exercise space S11 from temperature and humidity sensor 181, and third information on a heart rate of user U1 from heart rate sensor 180. Input unit 170a outputs the received first

information to third information to processor 170d.

[0051] Here, operation panel 182 is a terminal that receives user setting information (e.g., registered name, age, gender, exercise intensity level, exercise assistance mode, etc.) input by user U1 when user U1 uses exercise equipment 103 of exercise assistance unit 101.

5 Operation panel 182 is connected to controller 170 to be able to communicate with the controller in a wireless or wired manner. Operation panel 182 is provided with a start switch and a stop switch of exercise assistance unit 101, and further provided with a start switch and a stop switch for an exercise assistance program. Temperature and humidity sensor 181 senses temperature and humidity of indoor air in exercise space S11. Heart rate
10 sensor 180 is a wristband-type sensor that measures the heart rate of user U1 as described above.

[0052] The registered name may be a nickname, a membership number (registration number), or the like instead of the name of user U1 as long as user U1 can be identified.

[0053] The age may be set by input of the birth date of user U1 instead of direct input of
15 an actual age.

[0054] The exercise intensity level can be set from, for example, three levels (strong, standard, weak). The exercise intensity levels include “strong” that has a target exercise intensity within a range from 70% to 80%, “standard” that has a target exercise intensity within a range from 60% to 70%, and “weak” that has a target exercise intensity within a
20 range from 50% to 60%. The target exercise intensity is used to specify a first heart rate of user U1 to be described later. The target exercise intensity according to the first exemplary embodiment is set to: 75% when the “strong” is selected among the exercise intensity levels; 65% when the “standard” is selected among the exercise intensity levels; and 55% when the “weak” is selected among the exercise intensity levels.

25 **[0055]** The exercise assistance mode is selectable from first exercise assistance mode M1 and second exercise assistance mode M2. For example, first exercise assistance mode M1 is configured to implement exercise assistance for suppressing sweating by maintaining the body temperature of user U1, and second exercise assistance mode M2 is configured to implement exercise assistance for promoting sweating by raising the body temperature of
30 user U1. Although details will be described later, first exercise assistance mode M1 is configured such that wind speed, temperature, and humidity of the air flow (first air flow) to be blown from blower 102 are controlled to cause user U1 during exercise using exercise equipment 103 to have a heart rate within a predetermined range in which the

second heart rate is less than or equal to the first heart rate. In contrast, second exercise assistance mode M2 is configured such that wind speed, temperature, and humidity of the air flow (second air flow) to be blown from blower 102 are controlled to cause user U1 during exercise using exercise equipment 103 to have a heart rate within a predetermined range in which the second heart rate is more than the first heart rate.

5 [0056] Storage unit 170b stores fourth information, fifth information, and sixth information. The fourth information relates to exercise assistance programs corresponding to respective exercise assistance modes (first exercise assistance mode M1 and second exercise assistance mode M2). The fifth information relates to air blow setting in each exercise assistance mode. The sixth information relates to setting information (user setting information previously input from operation panel 182, and the like) corresponding to the registered name. Storage unit 170b outputs the stored fourth information to sixth information to processor 170d. Based on the sixth information stored in storage unit 170b, input of the first information related to the user setting information from operation panel 182 may be partially eliminated.

10 [0057] Timer 170c outputs seventh information on the current time to processor 170d.

[0058] Processor 170d receives the first information to the third information from input unit 170a, the fourth information to the sixth information from storage unit 170b, and the seventh information from timer 170c. Processor 170d determines control information related to blowing operation of blower 102 in the exercise assistance mode (first exercise assistance mode M1, second exercise assistance mode M2) selected by user U1 using the received first information to seventh information. This determination method will be described later. Processor 170d outputs the determined control information to output unit 170e.

20 [0059] Output unit 170e receives the control information from processor 170d. Output unit 170e is electrically connected to each device (first air blower 143L1, second air blower 143L2, third air blower 143R1, fourth air blower 143R2, first air conditioner 140a, second air conditioner 140b, first switching unit 144L, second switching unit 144R) of blower 102. Then, output unit 170e outputs a signal (control signal) for controlling the blowing operation of blower 102 (operation of each device constituting blower 102) based on the received control information.

25 [0060] Each device of blower 102 then receives the signal from output unit 170e, and performs control based on the received signal.

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[0061] As described above, controller 170 controls the blowing operation of blower 102 in the exercise assistance mode (first exercise assistance mode M1, second exercise assistance mode M2) selected by user U1. That is, exercise assistance unit 101 includes controller 170 that acquires information on a heart rate of user U1. Then, controller 170 controls at least one of wind speed, temperature, and humidity of air flows to be blown from the pair of blowing units (first blowing unit 160L, second blowing unit 160R) based on the acquired information on a heart rate to cause user U1 during exercise using exercise equipment 103 to have a heart rate within a predetermined range suitable for exercise intensity intended by user U1.

[0062] Next, a processing procedure of the blowing operation in blower 102 will be described with reference to Figs. 5 to 7. Fig. 5 is a flowchart illustrating processing of the blowing operation performed by controller 170 in blower 102. Fig. 6 is a flowchart illustrating processing in first exercise assistance mode M1 performed by controller 170 in blower 102. Fig. 7 is a flowchart illustrating processing in second exercise assistance mode M2 performed by controller 170 in blower 102.

[0063] As illustrated in Fig. 5, when controller 170 receives a signal (startup switch on) related to startup of exercise assistance unit 101 from operation panel 182, exercise assistance unit 101 is started up and enters a standby state (step S100). After that, when user U1 inputs the user setting information (first information) from operation panel 182 (step S101), controller 170 determines a maximum heart rate and an exercise intensity level (target exercise intensity) corresponding to user U1 based on the input user setting information. Then, controller 170 determines the first heart rate corresponding to a target exercise heart rate based on the determined maximum heart rate and exercise intensity level (target exercise intensity) (step S102).

[0064] Specifically, controller 170 determines the maximum heart rate (hereinafter, also referred to as a "maximum heart rate of user U1") corresponding to user U1 based on the age of user U1 included in the user setting information. At this time, controller 170 calculates the maximum heart rate of user U1 by Expression (1) below.

[0065] Maximum heart rate = 220 - age... Expression (1)

Controller 170 may calculate the maximum heart rate based on a factor other than the age of user U1 (e.g., gender) or based on a combination of the age of user U1 and a factor other than the age.

[0066] Controller 170 determines the target exercise intensity corresponding to the

exercise intensity level (exercise intensity level selected by user U1) included in the user setting information, and then calculates and determines the first heart rate of user U1 by Expression (2) below. As described above, the target exercise intensity according to the first exemplary embodiment is set to: 75% that corresponds to the exercise intensity level “strong”; 65% that corresponds to the exercise intensity level “standard”; or 55% that corresponds to the exercise intensity level “weak”.

[0067] First heart rate = maximum heart rate × target exercise intensity... Expression (2)

Controller 170 may calculate the first heart rate based on, for example, the Karvonen method using a resting heart rate.

[0068] Subsequently, controller 170 determines the exercise assistance mode selected by user U1 based on information on the exercise assistance mode included in the user setting information (step S103). When the exercise assistance mode selected by user U1 is first exercise assistance mode M1, controller 170 shifts to first exercise assistance mode M1 (step S110). When the exercise assistance mode selected by user U1 is second exercise assistance mode M2, controller 170 shifts to second exercise assistance mode M2 (step S120).

[0069] After that, when each exercise assistance mode ends, exercise assistance unit 101 enters the standby state (step S104). Then, when controller 170 receives a signal (stop switch on) related to a stop of exercise assistance unit 101 from operation panel 182, exercise assistance unit 101 stops operating.

[0070] Subsequently, processing procedures of first exercise assistance mode M1 in step S110 and second exercise assistance mode M2 in step S120 will be described. First, a processing flow in first exercise assistance mode M1 after the processing proceeds to step S110 will be described with reference to Fig. 6.

[0071] As illustrated in Fig. 6, controller 170 in first exercise assistance mode M1 receives a signal related to a start of the exercise assistance program (start switch on) from operation panel 182, and then determines whether the exercise assistance program is started (step S111). As a result, when the signal related to the start of the exercise assistance program is not input and the exercise assistance program is not started (No in step S111), controller 170 continues to wait for input of the signal related to the start of the exercise assistance program (step S111). In contrast, when the signal related to the start of the motion support program is input and the exercise assistance program is started (Yes in

step S111), controller 170 causes blower 102 to blow the first air flow (step S112).

Specifically, controller 170 causes blower 102 to blow the first air flow under conditions such as wind speed A [m/s], temperature B [°C], and humidity C [%] based on the exercise assistance program in first exercise assistance mode M1. Temperature B and humidity C

5 correspond to the first temperature and the first humidity under the first conditions, respectively.

[0072] User U1 exercises using exercise equipment 103 according to the exercise assistance program in first exercise assistance mode M1. Then, controller 170 determines the second heart rate, which is the heart rate of user U1 during exercise, based on the
10 information (third information) on the heart rate of user U1 from heart rate sensor 180 (step S113).

[0073] Subsequently, controller 170 determines whether the determined second heart rate is less than or equal to the first heart rate determined in step S102 described above (step S114). As a result, when the second heart rate is less than or equal to the first heart rate
15 (Yes in step S114), controller 170 maintains blowing conditions of the first air flow from blower 102 without changing the blowing conditions (step S115). Specifically, controller 170 sets the current blowing conditions of the first air flow (wind speed A, temperature B, humidity C) as new blowing conditions of the first air flow (wind speed A, temperature B, humidity C) without change.

[0074] In contrast, when the second heart rate is not less than or equal to the first heart rate (No in step S114), i.e., when the second heart rate exceeds the first heart rate, controller 170 changes the blowing conditions of the first air flow from blower 102 (step S116). Specifically, controller 170 increases the wind speed (wind speed A + ΔA), and reduces the temperature (temperature B - ΔB) and the humidity (humidity C - ΔC), with
25 respect to the current blowing conditions of the first air flow (wind speed A, temperature B, humidity C). That is, controller 170 sets the changed blowing conditions of the first air flow (wind speed A + ΔA , temperature B - ΔB , humidity C - ΔC) as new blowing conditions of the first air flow (wind speed A, temperature B, humidity C). Although all of the wind speed, the temperature, and the humidity of the first air flow are changed in the
30 first exemplary embodiment as described above, at least one of the wind speed, the temperature, and the humidity of the first air flow may be changed as described above.

[0075] After step S115 or step S116 ends, controller 170 receives a signal related to an end of the exercise assistance program, or a signal related to a stop of the exercise

assistance program, from operation panel 182, and determines whether the exercise assistance program ends (step S117). As a result, when the signal related to the end of the exercise assistance program is not input and the exercise assistance program does not end (No in step S117), controller 170 causes blower 102 to blow the first air flow under the

5 new blowing conditions (step S112). Specifically, controller 170 controls first air conditioner 140a constituting blower 102 to set the conditioned air in first air conditioning space S12a to temperature B and humidity C as new blowing conditions. At the same time, controller 170 controls the pair of air blowers (first air blower 143L1, third air blower 143R1) constituting blower 102 so that the first air flow to be fed has wind speed A.

10 **[0076]** In contrast, when the exercise assistance program ends (Yes in step S117), controller 170 causes blower 102 to stop blowing the first air flow (step S118). Specifically, controller 170 controls the pair of air blowers (first air blower 143L1, third air blower 143R1) to stop the blowing operation. Then, first exercise assistance mode M1 ends.

15 **[0077]** Exercise assistance unit 101 according to the first exemplary embodiment performs at least one of increasing wind speed, reducing temperature, and reducing humidity, for the blowing conditions of the first air flow in first exercise assistance mode M1. As a result, increase in skin surface temperature of user U1 is suppressed more than before the change of the blowing conditions, so that sweating of user U1 is suppressed.

20 The second heart rate of user U1 accordingly decreases due to the change of the blowing conditions, so that exercise assistance unit 101 according to the first exemplary embodiment can finally reduce the second heart rate of user U1 to less than or equal to the first heart rate.

[0078] As described above, controller 170 in first exercise assistance mode M1 controls

25 the blowing operation of blower 102 to cause user U1 during exercise using exercise equipment 103 to have a heart rate within the predetermined range in which the second heart rate is less than or equal to the first heart rate. That is, controller 170 in first exercise assistance mode M1 implements at least one of increase in the wind speed, decrease in the temperature, and decrease in the humidity of the first air flow to cause the second heart rate

30 to be less than or equal to the first heart rate.

[0079] Next, a processing flow in second exercise assistance mode M2 after the processing proceeds to step S120 will be described with reference to Fig. 7.

[0080] As illustrated in Fig. 7, controller 170 in second exercise assistance mode M2

receives a signal related to a start of the exercise assistance program (start switch on) from operation panel 182, and then determines whether the exercise assistance program is started (step S121). As a result, when the signal related to the start of the exercise assistance program is not input and the exercise assistance program is not started (No in step S121), controller 170 continues to wait for input of the signal related to the start of the exercise assistance program (step S121). In contrast, when the signal related to the start of the motion support program is input and the exercise assistance program is started (Yes in step S121), controller 170 causes blower 102 to blow the second air flow (step S122). Specifically, controller 170 causes blower 102 to blow the second air flow under conditions such as wind speed D [m/s], temperature E [°C], and humidity F [%] based on the exercise assistance program in second exercise assistance mode M2. Temperature E and humidity F correspond to the second temperature and the second humidity under the second conditions, respectively.

[0081] User U1 exercises using exercise equipment 103 according to the exercise assistance program in second exercise assistance mode M2. Then, controller 170 determines the second heart rate, which is the heart rate of user U1 during exercise, based on the information (third information) on the heart rate of user U1 from heart rate sensor 180 (step S123).

[0082] Subsequently, controller 170 determines whether the determined second heart rate exceeds the first heart rate determined in step S102 described above (step S124). As a result, when the second heart rate does not exceed the first heart rate (No in step S124), i.e., when the second heart rate is less than or equal to the first heart rate, controller 170 changes the blowing conditions of the second air flow from blower 102 (step S125). Specifically, controller 170 reduces the wind speed (wind speed D - ΔD), and increases the temperature (temperature E + ΔE) and the humidity (humidity F + ΔF), with respect to the current blowing conditions of the second air flow (wind speed D, temperature E, humidity F). That is, controller 170 sets the changed blowing conditions of the second air flow (wind speed D - ΔD , temperature E + ΔE , humidity F + ΔF) as new blowing conditions of the second air flow (wind speed D, temperature E, humidity F). Although all of the wind speed, the temperature, and the humidity of the second air flow are changed in the first exemplary embodiment as described above, at least one of the wind speed, the temperature, and the humidity of the second air flow may be changed as described above.

[0083] In contrast, when the determined second heart rate exceeds the first heart rate (Yes

in step S124), controller 170 further determines whether the second heart rate is less than or equal to the maximum heart rate corresponding to user U1 (step S126). The maximum heart rate corresponding to user U1 is determined based on the user setting information input in step S101 as described above. As a result, when the second heart rate is less than

5 or equal to the maximum heart rate (Yes in step S126), controller 170 maintains blowing conditions of the second air flow from blower 102 without changing the blowing conditions (step S127). Specifically, controller 170 sets the current blowing conditions of the second air flow (wind speed D, temperature E, humidity F) as new blowing conditions of the second air flow (wind speed D, temperature E, humidity F) without change.

10 **[0084]** In contrast, when the second heart rate is not less than or equal to the maximum heart rate (No in step S126), i.e., when the second heart rate exceeds the maximum heart rate, controller 170 changes the blowing conditions of the second air flow from blower 102 (step S128). Specifically, controller 170 increases the wind speed (wind speed $D + \Delta D$), and reduces the temperature (temperature $E - \Delta E$) and the humidity (humidity $F - \Delta F$), with

15 respect to the current blowing conditions of the second air flow (wind speed D, temperature E, humidity F). That is, controller 170 sets the changed blowing conditions of the second air flow (wind speed $D + \Delta D$, temperature $E - \Delta E$, humidity $F - \Delta F$) as new blowing conditions of the second air flow (wind speed D, temperature E, humidity F). Although all of the wind speed, the temperature, and the humidity of the second air flow

20 are changed in the first exemplary embodiment as described above, at least one of the wind speed, the temperature, and the humidity of the second air flow may be changed as described above.

[0085] After each step (step S125, step S127, or step S128) ends, controller 170 receives a signal related to the end of the exercise assistance program, or a signal related to the stop

25 of the exercise assistance program, from operation panel 182, and determines whether the exercise assistance program ends (step S129). As a result, when the signal related to the end of the exercise assistance program is not input and the exercise assistance program does not end (No in step S129), controller 170 causes blower 102 to blow the second air flow under the new blowing conditions (step S122). Specifically, controller 170 controls

30 second air conditioner 140b constituting blower 102 to set the conditioned air in second air conditioning space S12b to temperature E and humidity F as new blowing conditions. At the same time, controller 170 controls the pair of air blowers (second air blower 143L2, fourth air blower 143R2) constituting blower 102 so that the second air flow to be fed has

wind speed D.

[0086] In contrast, when the exercise assistance program ends (Yes in step S129), controller 170 causes blower 102 to stop blowing the second air flow (step S130).

Specifically, controller 170 controls the pair of air blowers (second air blower 143L2,

5 fourth air blower 143R2) to stop the blowing operation. Then, second exercise assistance mode M2 ends.

[0087] That is, the information on a heart rate of user U1 includes the first heart rate that is set based on the maximum heart rate and the exercise intensity corresponding to user U1, and the second heart rate of user U1 during exercise using exercise equipment 103, the

10 second heart rate being transmitted from heart rate sensor 180. Controller 170 can implement first exercise assistance mode M1 and second exercise assistance mode M2 by switching between the modes. First exercise assistance mode M1 is configured to control at least one of wind speed, temperature, and humidity of the first air flow to be blown from the pair of blowing units (first blowing unit 160L, second blowing unit 160R) to cause the
15 second heart rate to be less than or equal to the first heart rate. Second exercise assistance mode M2 is configured to control at least one of wind speed, temperature, and humidity of the second air flow to be blown from the pair of blowing units (first blowing unit 160L, second blowing unit 160R) to cause the second heart rate to exceed the first heart rate.

[0088] Exercise assistance unit 101 according to the first exemplary embodiment

20 implements at least one of the decrease in the wind speed, the increase in the temperature, and the increase in the humidity, for the blowing conditions of the second air flow in second exercise assistance mode M2 when the second heart rate of user U1 does not exceed the first heart rate. As a result, increase in skin surface temperature of user U1 is promoted more than before the change of the blowing conditions, so that the body
25 temperature of user U1 increases to promote sweating of user U1. The second heart rate of user U1 accordingly increases due to the change of the blowing conditions, so that exercise assistance unit 101 according to the first exemplary embodiment can finally increase the second heart rate of user U1 to more than the first heart rate. When the second heart rate of user U1 exceeds the maximum heart rate, at least one of the increase in the wind speed, the
30 decrease in the temperature, and the decrease in the humidity is implemented for the blowing conditions of the second air flow. As a result, increase in skin surface temperature of user U1 is suppressed more than before the change of the blowing conditions, so that sweating of user U1 is suppressed. The second heart rate of user U1 accordingly decreases

due to the change of the blowing conditions, so that exercise assistance unit 101 according to the first exemplary embodiment can finally reduce the second heart rate of user U1 to less than or equal to the maximum heart rate. That is, exercise assistance unit 101 according to the first exemplary embodiment can reliably suppress a state of excessive exercise load on user U1.

5 [0089] As described above, controller 170 in second exercise assistance mode M2 controls the blowing operation of blower 102 to cause user U1 during exercise using exercise equipment 103 to have a heart rate within the predetermined range in which the second heart rate is less than or equal to the maximum heart rate and is more than the first heart rate. That is, controller 170 in second exercise assistance mode M2 implements at least one of the decrease in the wind speed, the increase in the temperature, and the increase in the humidity of the second air flow, to cause the second heart rate to exceed the first heart rate. Controller 170 in second exercise assistance mode M2 implements at least one of the decrease in the wind speed, the increase in the temperature, and the increase in the humidity of the second air flow to cause the second heart rate to exceed the first heart rate.

15 [0090] As described above, exercise assistance unit 101 in each exercise assistance mode is configured to implement the exercise assistance for user U1 so that user U1 during exercise using exercise equipment 103 has a heart rate (the second heart rate) within a predetermined range in which the second heart rate is less than or equal to the first heart rate, or is less than or equal to the maximum heart rate and more than the first heart rate.

[0091] As described above, exercise assistance unit 101 including blower 102, according to the first exemplary embodiment, enables enjoying effects below.

[0092] (1) Exercise assistance unit 101 in each exercise assistance mode (first exercise assistance mode M1, second exercise assistance mode M2) is configured to control wind speed, temperature, and humidity of an air flow (the first air flow or the second air flow) to be blown from blower 102 based on the first heart rate corresponding to user U1 to cause user U1 during exercise using exercise equipment 103 to have the second heart rate satisfying predetermined conditions. This configuration controls not only a conventional exercise load caused by the exercise equipment, but also the air flow to be blown from blower 102 toward user U1. That is, when user U1 uses exercise equipment 103, exercise assistance unit 101 can control the air flow to be blown toward user U1 to cause user U1 to have intended exercise intensity. Thus, exercise assistance unit 101 can implement exercise

assistance (training) based on the exercise intensity intended by user U1 with higher quality.

5 [0093] (2) Exercise assistance unit 101 is configured such that the information on a heart rate of user U1 includes the first heart rate that is set based on the maximum heart rate and an exercise intensity level corresponding to user U1, and the second heart rate of user U1 during exercise using exercise equipment 103, the second heart rate being transmitted from heart rate sensor 180. Controller 170 is then configured to be capable of implementing first exercise assistance mode M1 and second exercise assistance mode M2 by switching between the modes. First exercise assistance mode M1 is configured to control at least one of wind speed, temperature, and humidity of the first air flow to be blown from blower 102 to cause the second heart rate to be less than or equal to the first heart rate. Second exercise assistance mode M2 is configured to control at least one of wind speed, temperature, and humidity of the second air flow to be blown from blower 102 to cause the second heart rate to exceed the first heart rate. This configuration enables exercise assistance unit 101 to switch between first exercise assistance mode M1 of suppressing sweating of user U1 while maintaining body temperature of user U1 and second exercise assistance mode M2 of increasing the body temperature of user U1 to promote the sweating. Thus, exercise assistance unit 101 can reliably implement exercise assistance (training) reflecting an intention of user U1.

20 [0094] (3) Exercise assistance unit 101 is configured to implement at least one of increase in the wind speed, decrease in the temperature, and decrease in the humidity of the first air flow in first exercise assistance mode M1 to cause the second heart rate to be less than or equal to the first heart rate. Exercise assistance unit 101 is configured to implement at least one of decrease in the wind speed, increase in the temperature, and increase in the humidity of the second air flow in second exercise assistance mode M2 to cause the second heart rate to exceed the first heart rate. This configuration enables exercise assistance unit 101 to effectively suppress the sweating of user U1 in first exercise assistance mode M1, and effectively promote the sweating of user U1 in second exercise assistance mode M2.

25 [0095] (4) Exercise assistance unit 101 is configured to implement at least one of the wind speed, the temperature, and the humidity of the second air flow to be blown from blower 102 in second exercise assistance mode M2 to cause the second heart rate to be less than or equal to the maximum heart rate. This configuration enables exercise assistance unit 101 to reliably suppress a state of excessive exercise load on user U1, so that exercise

assistance intended by user U1 can be continued for a long time in second exercise assistance mode M2.

[0096] (5) Exercise assistance unit 101 is configured to control wind speed, temperature, and humidity of an air flow to be fed toward user U1 based on contents of an image displayed on display device 104, so that exercise assistance unit 101 can improve bodily sensation (realistic feeling) of user U1 who receives the air flow.

[0097] (6) Exercise assistance unit 101 is configured to store conditioned air under the first conditions (first temperature and first humidity) in first air conditioning space S12a in advance and feed the conditioned air with air blower 143L. Exercise assistance unit 101 is also configured to store conditioned air under the second conditions (second temperature and second humidity) in second air conditioning space S12b in advance and feed the conditioned air with air blower 143R. This configuration enables exercise assistance unit 101 to continue blowing by maintaining the blowing conditions (the first conditions or the second conditions) even when a blast volume generated by blower 102 (first blowing unit 160L, second blowing unit 160R) temporarily increases to be more than the amount of conditioned air that can be generated by air conditioner 140.

[0098] Although the present disclosure is described above based on the first exemplary embodiment, the present disclosure is not limited to the first exemplary embodiment at all, and it can be easily inferred that various modifications and variations can be made without departing from the gist of the present disclosure. For example, the numerical values mentioned in the first exemplary embodiment are merely examples, and other numerical values can be naturally used.

[0099] Although exercise assistance unit 101 according to the first exemplary embodiment is configured to end the exercise assistance program only in second exercise assistance mode M2, exercise assistance unit 101 may be modified as follows. For example, an exercise assistance unit according to a first modification of the first exemplary embodiment is configured such that after second exercise assistance mode M2 ends, third exercise assistance mode M3 is performed in which at least one of wind speed, temperature, and humidity of a third air flow to be blown from blower 102 is implemented to cause the second heart rate to be less than or equal to the first heart rate. Here, blowing operation of blower 102 in third exercise assistance mode M3 is controlled as in the blowing operation of blower 102 in first exercise assistance mode M1, so that description thereof will be eliminated. In this way, the exercise assistance unit according to the first

modification of the first exemplary embodiment can promote evaporation of sweat of user U1 in third exercise assistance mode M3, so that the body temperature of user U1 raised in second exercise assistance mode M2 can be effectively cooled down.

5 **[0100]** Exercise assistance unit 101 according to the first exemplary embodiment may be modified as follows. An exercise assistance unit according to a second modification of the first exemplary embodiment is configured to implement fourth exercise assistance mode M4 for controlling at least one of the wind speed, the temperature, and the humidity of the third air flow to be blown from blower 102 to cause the second heart rate to be less than or equal to the first heart rate before second exercise assistance mode M2 starts. Here,
10 blowing operation of blower 102 in fourth exercise assistance mode M4 is controlled as in the blowing operation of blower 102 in first exercise assistance mode M1, so that description thereof will be eliminated. In this way, the exercise assistance unit according to the second modification of the first exemplary embodiment can warm up user U1 in fourth exercise assistance mode M4 while sweating of user U1 is suppressed, so that the exercise
15 assistance in second exercise assistance mode M2 can be performed more effectively.

[0101] Exercise assistance unit 101 according to the first exemplary embodiment stores conditioned air under the first conditions (first temperature and first humidity) in first air conditioning space S12a in advance and feeds the conditioned air with air blower 143L. Exercise assistance unit 101 also stores conditioned air under the second conditions
20 (second temperature and second humidity) in second air conditioning space S12b in advance and feeds the conditioned air with air blower 143R. Thus, when exercise assistance unit 101 is modified in combination with second exercise assistance mode M2 to fourth exercise assistance mode M4 as described above, the exercise assistance unit according to this modification can switch conditions (particularly, temperature and
25 humidity conditions) of an air flow to be blown out from blower 102 between the first conditions and the second conditions without delay.

[0102] Although exercise assistance unit 101 according to the first exemplary embodiment is configured to store conditioned air under the first conditions (first temperature and first humidity) to be used in first exercise assistance mode M1 and
30 conditioned air under the second conditions (second temperature, second humidity) to be used in second exercise assistance mode M2 in air conditioning spaces (S12a, S12b), respectively, exercise assistance unit 101 may be modified as follows. For example, an exercise assistance unit according to a third modification of the first exemplary

embodiment is configured to prepare conditioned air under one condition corresponding to one of the exercise assistance modes by using one air conditioning space. This configuration enables downsizing of the exercise assistance unit according to the third modification of the first exemplary embodiment.

- 5 **[0103]** Exercise assistance unit 101 according to the first exemplary embodiment may be modified in cooperation with contents of an image displayed on display device 104 by further installing various facilities such as a lighting facility, an acoustic facility, a ventilation facility, an air purification facility, a fragrance generation facility, and a space sterilization and deodorization facility. This configuration enables the exercise assistance
10 unit according to this modification to improve bodily sensation of an air flow when the air flow is fed from blower 102 toward user U1.

[0104] (Second exemplary embodiment)

The present disclosure relates to an exercise assistance unit that includes exercise equipment to assist a user in exercise.

- 15 **[0105]** There is known a technique (e.g., PTL 1) in a treadmill in which an exercise load (e.g., a rotation speed of a motor that rotates an endless belt) of the treadmill is controlled following a change in a heart rate of a user to maintain an exercise intensity intended by the user.

- [0106]** In recent years, when exercise equipment including bicycle type equipment and
20 the like besides the above-described treadmill is used, it is required to provide higher quality exercise assistance (training) based on exercise intensity intended by a user.

[0107] Thus, an object of the present disclosure is to provide an exercise assistance unit capable of performing higher quality exercise assistance (training) based on exercise intensity intended by a user when exercise equipment is used.

- 25 **[0108]** An exercise assistance unit according to the present disclosure includes exercise equipment used by a user to exercise, a blowing unit that blows an air flow toward the user, and a controller. The controller acquires information on sweating of the user, and controls at least one of wind speed, temperature, and humidity of the air flow to be blown from the blowing unit so that the sweating of the user is suppressed or promoted based on
30 the acquired information on the sweating of the user.

[0109] The exercise assistance unit according to the present disclosure can provide higher quality exercise assistance (training) based on the exercise intensity intended by the user when the exercise equipment is used.

[0110] An exercise assistance unit according to the present disclosure includes exercise equipment used by a user to exercise, a blowing unit that blows an air flow toward the user, and a controller. The controller acquires information on sweating of the user, and controls at least one of wind speed, temperature, and humidity of the air flow to be blown
5 from the blowing unit so that the sweating of the user is suppressed or promoted based on the acquired information on the sweating of the user.

[0111] Such a configuration enables the exercise assistance unit according to the present disclosure to control the air flow to be blown toward the user to achieve the exercise intensity intended by the user when the exercise equipment is used. This configuration
10 controls not only a conventional exercise load caused by the exercise equipment but also the air flow to be blown from the air blower toward the user, so that the exercise assistance unit according to the present disclosure can perform the exercise assistance (training) based on the exercise intensity (exercise without sweating or exercise with sweating) intended by the user with higher quality.

[0112] The exercise assistance unit according to the present disclosure enables the controller to perform the first exercise assistance mode and the second exercise assistance mode by switching between the modes. Here, the first exercise assistance mode is configured to suppress sweating of the user by implementing at least one of increase in wind speed, decrease in temperature, and decrease in humidity for the first air flow to be
20 blown from the blowing unit when it is determined that the user sweats based on information on sweating of the user. The second exercise assistance mode is configured to promote sweating of the user by implementing at least one of decrease in wind speed, increase in temperature, and increase in humidity for the second air flow to be blown from the blowing unit when it is determined that the user sweats based on information on
25 sweating of the user.

[0113] Such a configuration enables the exercise assistance unit according to the present disclosure to switch between the first exercise assistance mode of suppressing sweating of the user while maintaining body temperature of the user and the second exercise assistance mode of increasing the body temperature of the user to promote the sweating. Thus, the
30 exercise assistance unit according to the present disclosure can reliably implement the exercise assistance (training) reflecting the intention of the user.

[0114] The exercise assistance unit according to the present disclosure uses the information on sweating of the user, the information including image information from an

imaging device that captures an image of the user. Then, the controller determines whether the user sweats based on first image information acquired by photographing the user with the imaging device before exercise starts and second image information acquired by photographing the user with the imaging device during the exercise using the exercise equipment. This way easily enables determining whether the user sweats in a non-contact manner.

[0115] The exercise assistance unit according to the present disclosure is configured such that the controller implements at least one of increase in the wind speed, decrease in the temperature, and decrease in the humidity for the second air flow to suppress sweating of the user when a flow of sweat on the head of the user or a motion of wiping the sweat on the head of the user is determined based on the second image information acquired by photographing the user during the exercise using the exercise equipment after the determination that the user sweats in the second exercise assistance mode.

[0116] In this way, the exercise assistance unit according to the present disclosure can suppress a state of excessive exercise load on the user, so that the exercise assistance intended by the user can be continued for a long time in the second exercise assistance mode.

[0117] Hereinafter, a second exemplary embodiment of the present disclosure will be described with reference to the drawings.

[0118] First, a schematic configuration of exercise assistance unit 201 according to the second exemplary embodiment of the present disclosure, including blower 202, will be described with reference to Figs. 8 and 9. Fig. 8 is a schematic configuration diagram of exercise assistance unit 201 including blower 202. Fig. 9 is a schematic block diagram of exercise assistance unit 201 including blower 202. The drawings subsequent to Fig. 8 are illustrated in which left and right are defined in a state where user U2 views display device 204 from the front. In the second exemplary embodiment, blowing an air flow from a pair of blowing units (first blowing unit 260L, second blowing unit 260R) described later of blower 202 may be simply referred to as blowing an air flow from blower 202.

[0119] Exercise assistance unit 201 includes exercise equipment 203 used by user U2 to exercise, and is fabricated as a box-shaped room unit. Exercise assistance unit 201 enables user U2 to use exercise equipment 203 while enjoying continuous exercise in an environment with realistic feeling (bodily sensation) suitable for a video (a landscape, a situation, or the like) projected on display device 204. When user U2 uses exercise

equipment 203, exercise assistance unit 201 causes blowers 202 disposed at both left and right ends of display device 204 to blow air flows toward user U2 based on a sweating situation of user U2, particularly a sweating situation on the head of user U2, thereby achieving exercise intensity intended by user U2. Then, exercise assistance unit 201 provides user U2 with higher quality of exercise assistance (training) than before by controlling the air flow (in particular, the wind speed or temperature and humidity of the air flow) to be blown toward user U2. Exercise assistance unit 201 can also be referred to as an exercise assistance system.

[0120] Specifically, exercise assistance unit 201 includes exercise space S21 in which user U2 exercises and air conditioning space S22 as illustrated in Fig. 8. Air conditioning space S22 is configured to generate and store conditioned air to be supplied from the pair of blowing units (first blowing unit 260L, second blowing unit 260R) constituting blower 202 to exercise space S21.

[0121] Exercise space S21 includes exercise equipment 203 installed at its center, and display device 204, imaging device 280, and blower 202 (first blowing unit 260L, second blowing unit 260R) that are installed on a wall surface in front of exercise equipment 203. Door 205 serving as an entrance to exercise space S21 is provided in a wall surface behind exercise equipment 203 (see Fig. 9). Exercise space S21 is composed of a room (exercise room) surrounded by front, rear, left, right, top, and bottom wall surfaces.

[0122] Exercise equipment 203 is, for example, a bicycle type equipment such as a bicycle ergometer or a bicycle training machine, but may be a treadmill (a fitness machine for running or walking indoors) or the like. User U2 sets exercise equipment 203 to a predetermined load level to use it.

[0123] Display device 204 includes, for example, a large display screen such as a digital signage that is an information medium displaying various videos or characters. Display device 204 according to the second exemplary embodiment displays a video according to an exercise assistance program (e.g., a video program for cycling in nature or a video program for traveling on a mountain road with ups and downs) that is set suitable for the load level of exercise equipment 203.

[0124] Imaging device 280 is a camera that repeatedly captures an image of a forward region of display device 204 (a region including user U2 who uses exercise equipment 203). Upon a start of the exercise assistance program, imaging device 280 repeatedly generates an image of the forward region of display device 204 (particularly, an image

including the head of user U2) and outputs the image to controller 270 of blower 202 described later. That is, information on sweating of user U2 includes image information output from imaging device 280 that captures an image of user U2.

[0125] Blower 202 is configured to feed an air flow from each of blowing units paired
5 (first blowing unit 260L, second blowing unit 260R) provided at the respective left and right ends of display device 204 toward user U2 who uses exercise equipment 203. Details of blower 202 will be described later. The pair of blowing units (first blowing unit 260L, second blowing unit 260R) corresponds to the “blowing unit” according to the present disclosure.

[0126] As illustrated in Fig. 9, blower 202 is installed in air conditioning space S22.
Blower 202 includes air conditioner 240, a pair of air blowers (air blower 243L, air blower 243R), and controller 270. Air conditioner 240 includes air conditioning device 241 and humidity controller 242 to generate and store conditioned air to be supplied from the pair
10 of blowing units (first blowing unit 260L, second blowing unit 260R) to exercise space S21. As with exercise space S21, air conditioning space S22 is composed of a room (air conditioning room) surrounded by front, rear, left, right, top, and bottom wall surfaces.

[0127] Air conditioner 240 adjusts temperature and humidity of air inside air conditioning space S22 to predetermined conditions with air conditioning device 241 and humidity controller 242. As a result, air (conditioned air) satisfying the predetermined
15 conditions (temperature, humidity) is stored inside air conditioning space S22. Here, air conditioning device 241 takes in air in air conditioning space S22, and feeds the taken air into air conditioning space S22 while controlling temperature of the taken air. Humidity controller 242 takes in air in air conditioning space S22, and feeds the taken air into air conditioning space S22 while controlling humidity of the taken air.

[0128] As illustrated in Fig. 9, the pair of air blowers (air blower 243L, air blower 243R)
25 feeds the conditioned air conditioned by air conditioner 240 to the corresponding pair of blowing units (first blowing unit 260L, second blowing unit 260R). Specifically, air blower 243L feeds the conditioned air conditioned by air conditioner 240 to first blowing unit 260L through a duct (not illustrated) at predetermined wind speed (blast volume). In
30 contrast, air blower 243R feeds the conditioned air conditioned by air conditioner 240 to second blowing unit 260R through a duct (not illustrated) at predetermined wind speed (blast volume).

[0129] Then, the conditioned air (first blow-out air flow 230L, second blow-out air flow

230R) fed from the pair of blowing units (first blowing unit 260L, second blowing unit 260R) is fed toward user U2 who uses exercise equipment 203.

[0130] Controller 270 controls operation of air conditioner 240, the pair of air blowers (air blower 243L, air blower 243R), which are described above, and a pair of switching
5 units (first switching unit 244L, second switching unit 244R) to be described later.

Controller 270 according to the second exemplary embodiment controls the operation of air conditioner 240 and the pair of air blowers (air blower 243L, air blower 243R) based on a sweating situation on the head of user U2 to adjust the wind speed (blast volume), the temperature, and the humidity of the air flow to be fed toward user U2. Details of

10 controller 270 will be described later. Controller 270 includes, for example, a computer system including a processor and a memory. Then, when the processor executes a program stored in the memory, the computer system functions as controller 270. Here, the program executed by the processor is assumed to be recorded in advance in the memory of the computer system. The program may be provided by being recorded in a non-temporary
15 recording medium such as a memory card, or may be provided through a telecommunication line such as the Internet.

[0131] Next, a detailed configuration of blower 202 will be described with reference to Fig. 10. Fig. 10 is a schematic block diagram illustrating the configuration of blower 202.

[0132] As illustrated in Fig. 10, air conditioning space S22 according to the second
20 exemplary embodiment is divided into two air conditioning spaces (first air conditioning space S22a, second air conditioning space S22b). Each air conditioning space is provided with air conditioner 240 and the pair of air blowers (air blower 243L, air blower 243R), constituting blower 202. As a result, blower 202 can generate conditioned air different in temperature and humidity conditions for each air conditioning space and blow the
25 conditioned air.

[0133] Specifically, first air conditioning space S22a is provided with first air conditioner 240a as air conditioner 240, first air blower 243L1 as air blower 243L, and third air blower 243R1 as air blower 243R.

[0134] First air conditioner 240a includes first air conditioning device 241a as air
30 conditioning device 241, and first humidity controller 242a as humidity controller 242.

Then, first air conditioner 240a adjusts the air inside first air conditioning space S22a to satisfy first conditions (first temperature and first humidity) with first air conditioning device 241a and first humidity controller 242a. As a result, conditioned air under the first

conditions is stored in first air conditioning space S22a. The conditioned air in first air conditioning space S22a is mainly used for blowing an air flow (first air flow) in first exercise assistance mode M1 described later.

[0135] First air blower 243L1 feeds the conditioned air (the air under the first conditions) stored in first air conditioning space S22a as conditioned air 230L1. Conditioned air 230L1 is blown out from first blowing unit 260L as first blow-out air flow 230L when first damper 244L1 is opened.

[0136] Third air blower 243R1 feeds conditioned air (air under the first conditions) stored in first air conditioning space S22a as conditioned air 230R1. Conditioned air 230R1 is blown out from second blowing unit 260R as second blow-out air flow 230R when third damper 244R1 is opened.

[0137] First air blower 243L1 and third air blower 243R1 according to the second exemplary embodiment are controlled to operate in cooperation with each other as a pair of air blowers. Then, blower 202 in first exercise assistance mode M1 feeds the conditioned air stored in first air conditioning space S22a as the first air flow from the pair of blowing units (first blowing unit 260L, second blowing unit 260R) toward user U2. The first air flow includes conditioned air 230L1 (first blow-out air flow 230L) fed toward user U2 by first air blower 243L1 and conditioned air 230R1 (second blow-out air flow 230R) fed toward user U2 by third air blower 243R1.

[0138] In contrast, second air conditioning space S22b is provided with second air conditioner 240b as air conditioner 240, second air blower 243L2 as air blower 243L, and fourth air blower 243R2 as air blower 243R. Second air conditioner 240b includes second air conditioning device 241b as air conditioning device 241 and second humidity controller 242b as humidity controller 242. Then, second air conditioner 240b adjusts the air inside second air conditioning space S22b to satisfy second conditions (second temperature and second humidity) with second air conditioning device 241b and second humidity controller 242b. Here, the second conditions is set to have higher temperature and higher humidity than the first conditions, for example. As a result, conditioned air under the second conditions is stored in second air conditioning space S22b. The conditioned air in second air conditioning space S22b is mainly used for blowing an air flow (second air flow) in second exercise assistance mode M2 described later.

[0139] Second air blower 243L2 feeds the conditioned air (the air under the second conditions) stored in second air conditioning space S22b, as conditioned air 230L2.

Conditioned air 230L2 is then blown out from first blowing unit 260L as first blow-out air flow 230L when second damper 244L2 is opened.

[0140] Fourth air blower 243R2 feeds the conditioned air stored in second air conditioning space S22b, as conditioned air 230R2. Conditioned air 230R2 is then blown out from second blowing unit 260R as second blow-out air flow 230R when fourth damper 244R2 is opened.

[0141] Second air blower 243L2 and fourth air blower 243R2 according to the second exemplary embodiment are controlled to operate in cooperation with each other as a pair of air blowers. Then, blower 202 in second exercise assistance mode M2 feeds the conditioned air stored in second air conditioning space S22b as a second air flow from the pair of blowing units (first blowing unit 260L, second blowing unit 260R) toward user U2. The second air flow includes conditioned air 230L2 (first blow-out air flow 230L) fed toward user U2 by second air blower 243L2 and conditioned air 230R2 (second blow-out air flow 230R) fed toward user U2 by fourth air blower 243R2.

[0142] As illustrated in Fig. 10, second air conditioning space S22b is provided with first switching unit 244L and second switching unit 244R. Here, first switching unit 244L and second switching unit 244R are disposed near first blowing unit 260L and second blowing unit 260R, respectively.

[0143] First switching unit 244L includes first damper 244L1 and second damper 244L2, and switches the conditioned air fed from air blower 243L to first blowing unit 260L between conditioned air 230L1 from first air blower 243L1 and conditioned air 230L2 from second air blower 243L2. Specifically, first switching unit 244L causes first damper 244L1 to be opened and second damper 244L2 to be closed so that conditioned air 230L1 from first air blower 243L1 is fed to first blowing unit 260L as first blow-out air flow 230L. Alternatively, first switching unit 244L causes first damper 244L1 to be closed and second damper 244L2 to be opened so that conditioned air 230L2 from second air blower 243L2 is fed to first blowing unit 260L as first blow-out air flow 230L. As described above, first switching unit 244L can easily switch temperature and humidity conditions of first blow-out air flow 230L blown out from first blowing unit 260L between the first conditions (first temperature and first humidity) and the second conditions (second temperature and second humidity).

[0144] In contrast, second switching unit 244R includes third damper 244R1 and fourth damper 244R2, and switches the conditioned air fed from air blower 243R to second

blowing unit 260R between conditioned air 230R1 from third air blower 243R1 and conditioned air 230R2 from fourth air blower 243R2. Specifically, second switching unit 244R causes third damper 244R1 to be opened and fourth damper 244R2 to be closed so that conditioned air 230R1 from third air blower 243R1 is fed to second blowing unit 260R as second blow-out air flow 230R. Alternatively, second switching unit 244R causes third damper 244R1 to be closed and fourth damper 244R2 to be opened so that conditioned air 230R2 from fourth air blower 243R2 is fed to second blowing unit 260R as second blow-out air flow 230R. As described above, second switching unit 244R can easily switch temperature and humidity conditions of second blow-out air flow 230R blown out from second blowing unit 260R between the first conditions (first temperature and first humidity) and the second conditions (second temperature and second humidity), as in first blow-out air flow 230L.

[0145] Here, first switching unit 244L and second switching unit 244R are controlled to operate in cooperation with each other. Then, first switching unit 244L and second switching unit 244R are switched to feed conditioned air under the first conditions (first temperature and first humidity) in first exercise assistance mode M1. Alternatively, first switching unit 244L and second switching unit 244R are switched to feed conditioned air under the second conditions (second temperature and second humidity) in second exercise assistance mode M2.

[0146] Next, controller 270 of blower 202 will be described with reference to Fig. 11. Fig. 11 is a schematic block diagram illustrating a configuration of controller 270 in blower 202.

[0147] As illustrated in Fig. 11, controller 270 includes input unit 270a, storage unit 270b, timer 270c, processor 270d, and output unit 270e.

[0148] Input unit 270a receives first information on user setting information from operation panel 282, second information on temperature and humidity of indoor air in exercise space S21 from temperature and humidity sensor 281, and third information on image information that is obtained by photographing user U2 and output from imaging device 280. Input unit 270a outputs the received first information to third information to processor 270d. The image information obtained by photographing user U2 and output from imaging device 280 corresponds to sweating information on user U2 according to the present disclosure.

[0149] Here, operation panel 282 is a terminal that receives user setting information (e.g.,

registered name, age, gender, exercise intensity level, exercise assistance mode, etc.) input by user U2 when user U2 uses exercise equipment 203 of exercise assistance unit 201.

Operation panel 282 is connected to controller 270 to be able to communicate with the controller in a wireless or wired manner. Operation panel 282 is provided with a start

5 switch and a stop switch of exercise assistance unit 201, and further provided with a start switch and a stop switch for an exercise assistance program. Temperature and humidity sensor 281 senses temperature and humidity of indoor air in exercise space S21.

[0150] The registered name may be a nickname, a membership number (registration number), or the like instead of the name of user U2 as long as user U2 can be identified.

10 **[0151]** The age may be set by input of the birth date of user U2 instead of direct input of an actual age.

[0152] The exercise intensity level can be set from, for example, three levels (strong, standard, weak). The exercise intensity levels include “strong” that has a target exercise intensity within a range from 70% to 80%, “standard” that has a target exercise intensity
15 within a range from 60% to 70%, and “weak” that has a target exercise intensity within a range from 50% to 60%. The target exercise intensity according to the present exemplary embodiment is set to: 75% when the “strong” is selected among the exercise intensity levels; 65% when the “standard” is selected among the exercise intensity levels; and 55% when the “weak” is selected among the exercise intensity levels.

20 **[0153]** The exercise assistance mode is selectable from first exercise assistance mode M1 and second exercise assistance mode M2. For example, first exercise assistance mode M1 is configured to implement exercise assistance for suppressing sweating by maintaining the body temperature of user U2, and second exercise assistance mode M2 is configured to implement exercise assistance for promoting sweating by raising the body temperature of
25 user U2. Although details will be described later, first exercise assistance mode M1 is controlled to implement at least one of increase in wind speed, decrease in temperature, and decrease in humidity for the first air flow to be blown from blower 202 when it is determined that user U2 sweats based on information on sweating of user U2. In contrast, second exercise assistance mode M2 is controlled to implement at least one of decrease in
30 wind speed, increase in temperature, and increase in humidity for the second air flow when it is determined that user U2 sweats based on the information on sweating of user U2.

[0154] Storage unit 270b stores fourth information on exercise assistance programs corresponding to the respective exercise assistance modes (first exercise assistance mode

M1, second exercise assistance mode M2), fifth information on air blow setting in each of the exercise assistance modes, and sixth information on setting information (user setting information previously input from operation panel 282, and the like) corresponding to the registered name. Storage unit 270b outputs the stored fourth information to sixth

5 information to processor 270d. Based on the sixth information stored in storage unit 270b, input of the first information related to the user setting information from operation panel 282 may be partially eliminated.

[0155] Timer 270c outputs seventh information on the current time to processor 270d.

[0156] Processor 270d receives the first information to the third information from input
10 unit 270a, the fourth information to the sixth information from storage unit 270b, and the seventh information from timer 270c. Processor 270d determines control information related to blowing operation of blower 202 in the exercise assistance mode (first exercise assistance mode M1, second exercise assistance mode M2) selected by user U2 using the received first information to seventh information. This determination method will be
15 described later. Processor 270d outputs the determined control information to output unit 270e.

[0157] Here, processor 270d determines the sweating situation of user U2 based on the first image information acquired by photographing user U2 before exercise starts and the second image information acquired by photographing user U2 during the exercise using
20 exercise equipment 203, which are included in the image information (third information) that is acquired by photographing user U2 and output from imaging device 280.

Specifically, processor 270d detects various objects included in the captured image by a known method such as pattern matching (template matching), or detects objects existing in an imaging space. In the second exemplary embodiment, the object to be detected is the
25 head (or face) of user U2. Storage unit 270b also stores a pattern (predetermined image) indicating the head (or face) of a person as a pattern of the pattern matching. When the predetermined image is included in images included in each image information, processor 270d detects the predetermined image by pattern matching. Then, processor 270d determines whether there is a state change (corresponding to whether there is sweating) in
30 a part such as the forehead, the temple, the cheek, and the nose based on difference information between the first image information and the second image information on the detected head (or face) of user U2, and determines the sweating situation of user U2.

Alternatively, a sweating state in a part such as the forehead, the temple, the cheek, and the

nose of a person may be stored as a pattern of pattern matching (specific image). Then, when the specific image is included in images included in the second image information, the specific image may be detected by the pattern matching.

5 **[0158]** Processor 270d also determines an excessive sweating situation of user U2 based on the second image information captured in chronological order while user U2 exercises using exercise equipment 203, which is included in the image information (third information) that is obtained by photographing user U2 and output from imaging device 280. Specifically, processor 270d determines whether there is a flow of sweat generated on the head of user U2 or whether there is movement of the hand or the arm wiping sweat on
10 the head of user U2 based on difference information between the second image information at the time point when sweating of user U2 is determined and the second image information at the present time (latest), and determines the excessive sweating situation of user U2. Here, the excessive sweating situation is a state in which the amount of sweat of user U2 increases as the sweating progresses, and refers to, for example, a state
15 in which sweat generated on the face of user U2 drips.

[0159] Output unit 270e receives the control information from processor 270d. Output unit 270e is electrically connected to each device (first air blower 243L1, second air blower 243L2, third air blower 243R1, fourth air blower 243R2, first air conditioner 240a, second air conditioner 240b, first switching unit 244L, second switching unit 244R) of
20 blower 202. Then, output unit 270e outputs a signal (control signal) for controlling the blowing operation of blower 202 (operation of each device constituting blower 202) based on the received control information.

[0160] Each device of blower 202 then receives the signal from output unit 270e, and performs control based on the received signal.

25 **[0161]** As described above, controller 270 controls the blowing operation of blower 202 in the exercise assistance mode (first exercise assistance mode M1, second exercise assistance mode M2) selected by user U2. That is, exercise assistance unit 201 includes controller 270 that acquires information on sweating of user U2. Controller 270 controls at least one of wind speed, temperature, and humidity of an air flow to be blown from the pair
30 of blowing units (first blowing unit 260L, second blowing unit 260R) based on the acquired information on sweating of user U2 to suppress or promote sweating of user U2.

[0162] Next, a processing procedure of the blowing operation in blower 202 will be described with reference to Figs. 12 to 14. Fig. 12 is a flowchart illustrating processing of

the blowing operation performed by controller 270 in blower 202. Fig. 13 is a flowchart illustrating processing in first exercise assistance mode M1 performed by controller 270 in blower 202. Fig. 14 is a flowchart illustrating processing in second exercise assistance mode M2 performed by controller 270 in blower 202.

5 **[0163]** As illustrated in Fig. 12, when controller 270 receives a signal (startup switch on) related to startup of exercise assistance unit 201 from operation panel 282, exercise assistance unit 201 is started up and enters a standby state (step S200). After that, when user U2 inputs user setting information (first information) from operation panel 282 (step S201), controller 270 acquires an image (first image information) of user U2 before
10 exercise starts from imaging device 280 (step S202).

[0164] Subsequently, controller 270 determines the exercise assistance mode selected by user U2 based on information on the exercise assistance mode included in the user setting information (step S203). When the exercise assistance mode selected by user U2 is first exercise assistance mode M1, controller 270 shifts to first exercise assistance mode M1
15 (step S210). When the exercise assistance mode selected by user U2 is second exercise assistance mode M2, controller 270 shifts to second exercise assistance mode M2 (step S220).

[0165] After that, when each exercise assistance mode ends, exercise assistance unit 201 enters the standby state (step S204). Then, when controller 270 receives a signal (stop
20 switch on) related to a stop of exercise assistance unit 201 from operation panel 282, exercise assistance unit 201 stops operating.

[0166] Subsequently, processing procedures of first exercise assistance mode M1 in step S210 and second exercise assistance mode M2 in step S220 will be described. First, a processing flow in first exercise assistance mode M1 after the processing proceeds to step
25 S210 will be described with reference to Fig. 13.

[0167] As illustrated in Fig. 13, controller 270 in first exercise assistance mode M1 receives a signal related to a start of the exercise assistance program (start switch on) from operation panel 282, and then determines whether the exercise assistance program is started (step S211). As a result, when the signal related to the start of the exercise
30 assistance program is not input and the exercise assistance program is not started (No in step S211), controller 270 continues to wait for input of the signal related to the start of the exercise assistance program (step S211). In contrast, when the signal related to the start of the motion support program is input and the exercise assistance program is started (Yes in

step S211), controller 270 causes blower 202 to blow the first air flow (step S212). Specifically, controller 270 causes blower 202 to blow the first air flow under conditions such as wind speed A [m/s], temperature B [°C], and humidity C [%] based on the exercise assistance program in first exercise assistance mode M1. Temperature B and humidity C
5 correspond to the first temperature and the first humidity under the first conditions, respectively.

[0168] User U2 exercises using exercise equipment 203 according to the exercise assistance program in first exercise assistance mode M1. Then, controller 270 acquires an image (second image information) of user U2 during exercise from imaging device 280
10 (step S213).

[0169] Subsequently, controller 270 determines a sweating situation of user U2 based on the first image information and the second image information acquired from imaging device 280, and determines whether user U2 sweats (step S214). That is, controller 270 determines whether user U2 sweats based on the first image information acquired by
15 photographing user U2 with imaging device 280 before exercise starts and the second image information acquired by photographing user U2 with imaging device 280 during the exercise using exercise equipment 203. As a result, when it is determined that user U2 does not sweat (No in step S214), controller 270 maintains blowing conditions of the first air flow from blower 202 without changing the blowing conditions (step S215). Specifically,
20 controller 270 sets the current blowing conditions of the first air flow (wind speed A, temperature B, humidity C) as new blowing conditions of the first air flow (wind speed A, temperature B, humidity C) without change.

[0170] In contrast, when it is determined that user U2 sweats (Yes in step S214), controller 270 changes the blowing conditions of the first air flow from blower 202 (step
25 S216). Specifically, controller 270 increases the wind speed (wind speed A + ΔA), and reduces the temperature (temperature B - ΔB) and the humidity (humidity C - ΔC), with respect to the current blowing conditions of the first air flow (wind speed A, temperature B, humidity C). That is, controller 270 sets the changed blowing conditions of the first air flow (wind speed A + ΔA , temperature B - ΔB , humidity C - ΔC) as new blowing
30 conditions of the first air flow (wind speed A, temperature B, humidity C). Although all of the wind speed, the temperature, and the humidity of the first air flow are changed in the second exemplary embodiment as described above, at least one of the wind speed, the temperature, and the humidity of the first air flow may be changed as described above.

[0171] After step S215 or step S216 ends, controller 270 receives a signal related to an end of the exercise assistance program, or a signal related to a stop of the exercise assistance program, from operation panel 282, and determines whether the exercise assistance program ends (step S217). As a result, when the signal related to the end of the exercise assistance program is not input and the exercise assistance program does not end (No in step S217), controller 270 causes blower 202 to blow the first air flow under the new blowing conditions (step S212). Specifically, controller 270 controls first air conditioner 240a constituting blower 202 to set the conditioned air in first air conditioning space S22a to temperature B and humidity C as new blowing conditions, and controls the pair of air blowers (first air blower 243L1, third air blower 243R1) constituting blower 202 to set the first air flow to be fed to wind speed A.

[0172] In contrast, when the exercise assistance program ends (Yes in step S217), controller 270 causes blower 202 to stop blowing the first air flow (step S218). Specifically, controller 270 controls the pair of air blowers (first air blower 243L1, third air blower 243R1) to stop the blowing operation. Then, first exercise assistance mode M1 ends.

[0173] Exercise assistance unit 201 according to the second exemplary embodiment causes controller 270 to implement at least one of increase in wind speed, decrease in temperature, and decrease in humidity, for the blowing conditions of the first air flow to be blown from blower 202 when it is determined that user U2 sweats in first exercise assistance mode M1. As a result, increase in skin surface temperature of user U2 is suppressed more than before the change of the blowing conditions, so that sweating of user U2 is suppressed.

[0174] As described above, controller 270 in first exercise assistance mode M1 controls the blowing operation of blower 202 to suppress sweating of user U2 during exercise using exercise equipment 203.

[0175] Next, a processing flow in second exercise assistance mode M2 after the processing proceeds to step S220 will be described with reference to Fig. 14.

[0176] As illustrated in Fig. 14, controller 270 in second exercise assistance mode M2 receives a signal related to a start of the exercise assistance program (start switch on) from operation panel 282, and then determines whether the exercise assistance program is started (step S221). As a result, when the signal related to the start of the exercise assistance program is not input and the exercise assistance program is not started (No in

step S221), controller 270 continues to wait for input of the signal related to the start of the exercise assistance program (step S221). In contrast, when the signal related to the start of the motion support program is input and the exercise assistance program is started (Yes in step S221), controller 270 causes blower 202 to blow the second air flow (step S222).

5 Specifically, controller 270 causes blower 202 to blow the second air flow under conditions such as wind speed D [m/s], temperature E [°C], and humidity F [%] based on the exercise assistance program in second exercise assistance mode M2. Temperature E and humidity F correspond to the second temperature and the second humidity under the second conditions, respectively.

10 **[0177]** User U2 exercises using exercise equipment 203 according to the exercise assistance program in second exercise assistance mode M2. Then, controller 270 acquires an image (second image information) of user U2 during exercise from imaging device 280 (step S223).

[0178] Subsequently, controller 270 determines a sweating situation of user U2 based on
15 the first image information and the second image information acquired from imaging device 280, and determines whether user U2 sweats (step S224). As a result, when it is determined that user U2 does not sweat (No in step S224), controller 270 changes the blowing conditions of the second air flow from blower 202 (step S225). Specifically, controller 270 reduces the wind speed (wind speed $D - \Delta D$), and increases the temperature (temperature $E + \Delta E$) and the humidity (humidity $F + \Delta F$), with respect to the current
20 blowing conditions of the second air flow (wind speed D, temperature E, humidity F). That is, controller 270 sets the changed blowing conditions of the second air flow (wind speed $D - \Delta D$, temperature $E + \Delta E$, humidity $F + \Delta F$) as new blowing conditions of the second air flow (wind speed D, temperature E, humidity F). Although all of the wind speed, the
25 temperature, and the humidity of the second air flow are changed in the second exemplary embodiment as described above, at least one of the wind speed, the temperature, and the humidity of the second air flow may be changed as described above.

[0179] In contrast, when it is determined that user U2 sweats (Yes in step S224), controller 270 further determines whether user U2 is in an excessive sweating situation
30 (step S226). As a result, when it is determined that user U2 is not in the excessively sweating situation (No in step S226), controller 270 maintains blowing conditions of the second air flow from blower 202 without changing the blowing conditions (step S227). Specifically, controller 270 sets the current blowing conditions of the second air flow

(wind speed D, temperature E, humidity F) as new blowing conditions of the first air flow (wind speed D, temperature E, humidity F) without change.

[0180] In contrast, when it is determined that user U2 is in the excessive sweating situation (Yes in step S226), controller 270 changes the blowing conditions of the second air flow from blower 202 (step S228). Specifically, controller 270 increases the wind speed (wind speed $D + \Delta D$), and reduces the temperature (temperature $E - \Delta E$) and the humidity (humidity $F - \Delta F$), with respect to the current blowing conditions of the second air flow (wind speed D, temperature E, humidity F). That is, controller 270 sets the changed blowing conditions of the second air flow (wind speed $D + \Delta D$, temperature $E - \Delta E$, humidity $F - \Delta F$) as new blowing conditions of the second air flow (wind speed D, temperature E, humidity F). Although all of the wind speed, the temperature, and the humidity of the second air flow are changed in the second exemplary embodiment as described above, at least one of the wind speed, the temperature, and the humidity of the second air flow may be changed as described above.

[0181] After each step (step S225, step S227, or step S228) ends, controller 270 receives a signal related to the end of the exercise assistance program, or a signal related to the stop of the exercise assistance program, from operation panel 282, and determines whether the exercise assistance program ends (step S229). As a result, when the signal related to the end of the exercise assistance program is not input and the exercise assistance program does not end (No in step S229), controller 270 causes blower 202 to blow the second air flow under the new blowing conditions (step S222). Specifically, controller 270 controls second air conditioner 240b constituting blower 202 to set the conditioned air in second air conditioning space S22b to temperature E and humidity F as new blowing conditions, and controls the pair of air blowers (second air blower 243L2, fourth air blower 243R2) constituting blower 202 to set the second air flow to be fed to wind speed D.

[0182] In contrast, when the exercise assistance program ends (Yes in step S229), controller 270 causes blower 202 to stop blowing the second air flow (step S230). Specifically, controller 270 controls the pair of air blowers (second air blower 243L2, fourth air blower 243R2) to stop the blowing operation. Then, second exercise assistance mode M2 ends.

[0183] Exercise assistance unit 201 according to the second exemplary embodiment causes controller 270 to implement at least one of decrease in wind speed, increase in temperature, and increase in humidity, for the blowing conditions of the second air flow

when it is determined that user U2 sweats in second exercise assistance mode M2. As a result, increase in skin surface temperature of user U2 is promoted more than before the change of the blowing conditions, so that the body temperature of user U2 increases to promote sweating of user U2. When it is determined that user U2 is in an excessive sweating situation, controller 270 implements at least one of increase in wind speed, decrease in temperature, and decrease in humidity, for the blowing conditions of the second air flow even after it is determined that user U2 sweats. As a result, increase in skin surface temperature of user U2 is suppressed more than before the change of the blowing conditions, so that sweating of user U2 is suppressed. Thus, a state of excessive exercise load on user U2 can be suppressed.

[0184] As described above, controller 270 in second exercise assistance mode M2 controls the blowing operation of blower 202 to promote sweating of user U2 during exercise using exercise equipment 203.

[0185] As described above, exercise assistance unit 201 in each exercise assistance mode implements the exercise assistance for user U2 to suppress or promote the sweating of user U2 based on the information on the sweating of user U2 while user U2 exercises using exercise equipment 203.

[0186] As described above, exercise assistance unit 201 including blower 202, according to the second exemplary embodiment, enables enjoying effects below.

[0187] (1) Exercise assistance unit 201 in each exercise assistance mode (first exercise assistance mode M1, second exercise assistance mode M2) is configured to control at least one of wind speed, temperature, and humidity of an air flow (the first air flow or the second air flow) to be blown from blower 202 based on information on sweating of user U2 to suppress or promote the sweating of user U2.

[0188] This configuration controls not only a conventional exercise load caused by the exercise equipment, but also the air flow to be blown from blower 202 toward user U2. That is, when user U2 uses exercise equipment 203, the air flow to be blown toward user U2 can be controlled to cause user U2 to have intended exercise intensity. Thus, exercise assistance (training) based on the exercise intensity (exercise without sweating or exercise with sweating) intended by user U2 can be implemented with higher quality.

[0189] (2) Exercise assistance unit 201 enables first exercise assistance mode M1 and second exercise assistance mode M2 to be performed by switching between the modes when it is determined that user U2 sweats based on the information on sweating of user

U2. Here, first exercise assistance mode M1 is configured to suppress sweating of user U2 by implementing at least one of increase in wind speed, decrease in temperature, and decrease in humidity for the first air flow to be blown from blower 202. Second exercise assistance mode M2 is configured to promote sweating of user U2 by implementing at least one of decrease in wind speed, increase in temperature, and increase in humidity for the second air flow to be blown from blower 202 when it is determined that user U2 sweats based on the information on sweating of user U2.

[0190] This configuration enables exercise assistance unit 201 to switch between first exercise assistance mode M1 of suppressing sweating of user U2 while maintaining body temperature of user U2 and second exercise assistance mode M2 of increasing the body temperature of user U2 to promote the sweating. Thus, exercise assistance unit 201 can reliably implement exercise assistance (training) reflecting an intention of user U2.

[0191] (3) Exercise assistance unit 201 is configured to determine whether user U2 sweats based on the first image information acquired by photographing user U2 with imaging device 280 before exercise starts and the second image information acquired by photographing user U2 with imaging device 280 during the exercise using exercise equipment 203. This configuration enables exercise assistance unit 201 to easily determine sweating of user U2 in a non-contact manner.

[0192] (4) Exercise assistance unit 201 is configured to perform determination and control of an air flow as described below based on the second image information acquired by photographing user U2 during exercise using exercise equipment 203 after the determination that user U2 sweats in second exercise assistance mode M2. That is, exercise assistance unit 201 is configured to implement at least one of increase in wind speed, decrease in temperature, and decrease in humidity for the second air flow to suppress sweating of user U2 when a flow of sweat on the head of user U2 or a motion of wiping the sweat on the head of user U2 is determined. This configuration enables exercise assistance unit 201 to suppress a state of excessive exercise load on user U2, so that exercise assistance intended by user U2 can be continued for a long time in second exercise assistance mode M2.

[0193] (5) Exercise assistance unit 201 is configured to control wind speed, temperature, and humidity of an air flow to be fed toward user U2 based on contents of an image displayed on display device 204, so that exercise assistance unit 201 can improve bodily sensation (realistic feeling) of user U2 who receives the air flow.

[0194] Although the present disclosure is described above based on the second exemplary embodiment, the present disclosure is not limited to the second exemplary embodiment at all, and it can be easily inferred that various modifications and variations can be made without departing from the gist of the present disclosure. For example, the numerical
5 values mentioned in the second exemplary embodiment are merely examples, and other numerical values can be naturally used.

[0195] Although exercise assistance unit 201 according to the second exemplary embodiment is configured such that controller 270 determines the sweating situation of user U2 using the information from imaging device 280 as the information on sweating of
10 user U2, and determines whether user U2 sweats, exercise assistance unit 201 may be modified as follows. For example, an exercise assistance unit according to this modification includes a thermo camera, which is a device for measuring infrared radiation emitted from a body surface and converting the infrared radiation into temperature, instead of imaging device 280. In this case, controller 270 determines that user U2 sweats when a
15 temperature difference (variation) between a face surface temperature of user U2 before exercise starts and a face surface temperature of user U2 while user U2 exercises using exercise equipment 203 is larger than or equal to a predetermined value.

[0196] Although exercise assistance unit 201 according to the second exemplary embodiment is configured such that controller 270 determines whether there is a state
20 change in a part such as the forehead, the temple, the cheek, and the nose based on difference information between the first image information and the second image information on the head (or face) of user U2, and determines the sweating situation of user U2, exercise assistance unit 201 may be modified as follows. For example, an exercise assistance unit according to a first modification of the second exemplary embodiment
25 determines the sweating situation of user U2 using at least one of information items below in addition to the state change. That is, the information items include a variation of impedance measured by an electrode installed on a handle or the like of exercise equipment 203 (change in the amount of body moisture before and after exercise starts), a variation of an opening degree of the mouth of user U2 determined from difference
30 information between the first image information and the second image information on the mouth of user U2, a variation of a respiratory rate of user U2, and the like. This configuration enables the exercise assistance unit according to the first modification of the second exemplary embodiment to improve determination accuracy of the sweating

situation of user U2.

[0197] Although exercise assistance unit 201 according to the second exemplary embodiment is configured to end the exercise assistance program only in second exercise assistance mode M2, exercise assistance unit 201 may be modified as follows. For

5 example, an exercise assistance unit according to a second modification of the second exemplary embodiment implements third exercise assistance mode M3 of blowing a third air flow (e.g., the same air flow as the first air flow in first exercise assistance mode M1) controlled to promote evaporation of sweat of user U2 after second exercise assistance mode M2 ends. In this way, the exercise assistance unit according to the second
10 modification of the second exemplary embodiment promotes evaporation of sweat of user U2 in third exercise assistance mode M3, so that the body temperature of user U2 raised in second exercise assistance mode M2 can be effectively cooled down.

[0198] Exercise assistance unit 201 according to the second exemplary embodiment may be modified as follows. An exercise assistance unit according to a third modification of the
15 second exemplary embodiment implements first exercise assistance mode M1 before second exercise assistance mode M2 starts. In this way, the exercise assistance unit according to the third modification of the second exemplary embodiment can warm up user U2 in first exercise assistance mode M1 while sweating of user U2 is suppressed, so that the exercise assistance in second exercise assistance mode M2 can be performed more
20 effectively.

[0199] Exercise assistance unit 201 according to the second exemplary embodiment stores conditioned air under the first conditions (first temperature and first humidity) in first air conditioning space S22a in advance and feeds the conditioned air with air blower 243L. Exercise assistance unit 201 also stores conditioned air under the second conditions
25 (second temperature and second humidity) in second air conditioning space S22b in advance and feeds the conditioned air with air blower 243R. Thus, when first exercise assistance mode M1 to third exercise assistance mode M3 are combined as in the exercise assistance unit according to the second modification of the second exemplary embodiment described above, conditions (particularly, temperature and humidity conditions) of an air
30 flow to be blown out from blower 202 can be switched between the first conditions and the second conditions without delay.

[0200] Although exercise assistance unit 201 according to the second exemplary embodiment is configured to store conditioned air under the first conditions (first

temperature and first humidity) to be used in first exercise assistance mode M1 and conditioned air under the second conditions (second temperature, second humidity) to be used in second exercise assistance mode M2 in air conditioning spaces (S22a, S22b), respectively, exercise assistance unit 201 may be modified as follows. For example, an

5 exercise assistance unit according to a fourth modification of the second exemplary embodiment is configured to prepare conditioned air under one condition corresponding to one of the exercise assistance modes by using one air conditioning space. This configuration enables downsizing of the exercise assistance unit according to the fourth modification of the second exemplary embodiment.

10 **[0201]** Exercise assistance unit 201 according to the second exemplary embodiment also may be modified to store and learn information on user U2 (user setting information, second image information at the time of sweating, conditions of the second air flow, and the like) when user U2 uses the exercise assistance program, as personal history information. This configuration enables the exercise assistance unit according to this

15 modification to improve determination accuracy of the sweating situation of user U2.

[0202] Exercise assistance unit 201 according to the second exemplary embodiment may be modified in cooperation with contents of an image displayed on display device 204 by further installing various facilities such as a lighting facility, an acoustic facility, a ventilation facility, an air purification facility, a fragrance generation facility, and a space

20 sterilization and deodorization facility in exercise assistance unit 201. This configuration enables the exercise assistance unit according to this modification to improve bodily sensation of an air flow when the air flow is fed from blower 202 toward user U2.

[0203] The exercise assistance unit according to the present disclosure is useful as an exercise assistance unit that assists exercise of a user using exercise equipment.

25

INDUSTRIAL APPLICABILITY

[0204] The exercise assistance unit according to the present disclosure is useful as an exercise assistance unit that assists exercise of a user using exercise equipment.

30 REFERENCE MARKS IN THE DRAWINGS

[0205] 101 exercise assistance unit
102 blower
103 exercise equipment

	104	display device
	105	door
	130L	first blow-out air flow
	130L1	conditioned air
5	130L2	conditioned air
	130R	second blow-out air flow
	130R1	conditioned air
	130R2	conditioned air
	140	air conditioner
10	140a	first air conditioner
	140b	second air conditioner
	141	air conditioning device
	141a	first air conditioning device
	141b	second air conditioning device
15	142	humidity controller
	142a	first humidity controller
	142b	second humidity controller
	143L	air blower
	143L1	first air blower
20	143L2	second air blower
	143R	air blower
	143R1	third air blower
	143R2	fourth air blower
	144L	first switching unit
25	144L1	first damper
	144L2	second damper
	144R	second switching unit
	144R1	third damper
	144R2	fourth damper
30	160L	first blowing unit
	160R	second blowing unit
	170	controller
	170a	input unit

	170b	storage unit
	170c	timer
	170d	processor
	170e	output unit
5	180	heart rate sensor
	181	temperature and humidity sensor
	182	operation panel
	201	exercise assistance unit
	202	blower
10	203	exercise equipment
	204	display device
	205	door
	230L	first blow-out air flow
	230L1	conditioned air
15	230L2	conditioned air
	230R	second blow-out air flow
	230R1	conditioned air
	230R2	conditioned air
	240	air conditioner
20	240a	first air conditioner
	240b	second air conditioner
	241	air conditioning device
	241a	first air conditioning device
	241b	second air conditioning device
25	242	humidity controller
	242a	first humidity controller
	242b	second humidity controller
	243L	air blower
	243L1	first air blower
30	243L2	second air blower
	243R	air blower
	243R1	third air blower
	243R2	fourth air blower

	244L	first switching unit
	244L1	first damper
	244L2	second damper
	244R	second switching unit
5	244R1	third damper
	244R2	fourth damper
	260L	first blowing unit
	260R	second blowing unit
	270	controller
10	270a	input unit
	270b	storage unit
	270c	timer
	270d	processor
	270e	output unit
15	280	imaging device
	281	temperature and humidity sensor
	282	operation panel
	S11	exercise space
	S12	air conditioning space
20	S12a	first air conditioning space
	S12b	second air conditioning space
	S21	exercise space
	S22	air conditioning space
	S22a	first air conditioning space
25	S22b	second air conditioning space
	U1	user
	U2	user

CLAIMS

1. An exercise assistance unit comprising:
exercise equipment used by a user to exercise;
5 a blowing unit that blows an air flow toward the user; and
a controller that acquires information on a heart rate of the user and controls at
least one of wind speed, temperature, and humidity of the air flow to be blown from the
blowing unit based on the acquired information on the heart rate to cause the user during
exercise using the exercise equipment to have a heart rate within a predetermined range
10 suitable for exercise intensity intended by the user.
2. The exercise assistance unit according to Claim 1, wherein
the information on the heart rate includes a first heart rate set based on a
maximum heart rate and exercise intensity which are suitable for the user, and a second
15 heart rate of the user during exercise using the exercise equipment, the second heart rate
being transmitted from a heart rate sensor that measures the heart rate of the user, and
the controller performs the control by switching between (i) a first exercise
assistance mode in which the controller controls at least one of wind speed, temperature,
and humidity of a first air flow to be blown from the blowing unit to cause the second heart
20 rate to be less than or equal to the first heart rate and (ii) a second exercise assistance mode
in which the controller controls at least one of wind speed, temperature, and humidity of a
second air flow to be blown from the blowing unit to cause the second heart rate to exceed
the first heart rate.
- 25 3. The exercise assistance unit according to Claim 2, wherein the controller
implements at least one of increase in the wind speed, decrease in the temperature, and
decrease in the humidity of the first air flow to cause the second heart rate to be less than
or equal to the first heart rate in the first exercise assistance mode, and implements at least
one of decrease in the wind speed, increase in the temperature, and increase in the
30 humidity of the second air flow to cause the second heart rate to exceed the first heart rate
in the second exercise assistance mode.
4. The exercise assistance unit according to Claim 2, wherein the controller

implements at least one of the wind speed, the temperature, and the humidity of the second air flow to be blown from the blowing unit to cause the second heart rate to be less than or equal to the maximum heart rate in the second exercise assistance mode.

- 5 5. The exercise assistance unit according to any one of Claims 2 to 4, wherein after the second exercise assistance mode ends, the controller performs a third exercise assistance mode of implementing at least one of wind speed, temperature, and humidity of a third air flow to be blown from the blowing unit to cause the second heart rate to be less than or equal to the first heart rate.