Description

Title of the Invention

SUPPORTING DEVICE FOR SUPPORTING USER TAKING NAP OR RESTING IN UPRIGHT POSITION, AND PROGRAM

Technical Field

[0001]

This application claims (1) priority based on Japanese Patent Application No. 2023-026812, filed 23 February, 2023, (2) priority based on Japanese Patent Application No. 2023-175610, filed 10 October, 2023, and (3) priority based on Japanese Patent Application No. 2023-215180, filed 20 December, 2023. These applications are incorporated by reference in their entirety into this application.

[0002]

The present invention relates to a support device that supports a user who is taking nap or resting, in a standing position, and a program therefor.

Background technology

[0003]

As shown in FIG. 3 of Patent Document 1, a structure for accommodating a human body (sleeping enclosure) is disclosed that has a storage space for accommodating a human body and is configured to support the human body stored in the storage space in an upright position.

This sleeping enclosure includes: (1) a first support portion that supports the buttocks of the human body stored in the storage space so as to support at least a portion of the weight of the human body from below; (2) a second support portion that supports the upper body of the human body stored in the storage space so as to prevent the upper body from moving horizontally; and (3) a third support portion that supports the knees of the human body stored in the storage space so as to prevent the knees from moving forward.

According to Patent Document 1, this sleeping enclosure can support the human body in a standing position without requiring a large horizontal space, by including the components (1) to (3) described above.

[0004]

Paragraph "0039" of Patent Document 1 states that the front support portion, which constitutes part of the second support portion of this sleep casing, "a protruding member has a triangular cross section when viewed

from the side. By employing a protruding member of this shape, the space below the front support portion 21A can be made larger, allowing a person to rest or sleep more comfortably." Therefore, this sleep casing is intended for use by a user, with the user's upper body supported from below by the front support portion and with parts of the user's body positioned in the space below the front support portion and above the third support portion. This sleep casing can be said to be used by a user with the user's upper body aligned vertically and the user's upper limbs supported by the front support portion.

Prior art documents

Patent documents

[0005]

[Patent Document 1] JP 2020-99444 A

Summary of the Invention

Problem to be solved by the invention

[0006]

The sleeping casing disclosed in Patent Document 1 can certainly support a human body in a standing position. However, since the relative distance between the (2) second support portion and the (3) third support portion in the up and down direction is constant in this sleeping casing, there is a risk that this relative distance may not be appropriate for some users among multiple users with different leg lengths.

[0007]

An object of the present invention is to provide a support mechanism that can adjust the support position of a human body in accordance with the different leg lengths of multiple users.

Means for solving the problem

[0008]

A support device of the first aspect, supporting a user who is taking a nap or resting in a standing position, includes:

a first support unit having an inclined surface facing upward in the up and down direction and contacting one or both of the knee and the lower leg of the human body from a front side of the human body to support the human body from below;

a second support unit that is disposed at a position different from that of the first support unit when viewed from the up and down direction and that contacts one or both of the buttocks and the upper thighs of the human body from a rear side of the human body to support the human body from below;

a third support unit that is disposed at a position higher than the first support unit and the second support unit, and that contacts at least one of the upper limbs, the head, and the upper body of the human body so that the upper limbs and the head of the human body are disposed within a predetermined range in the front and rear direction, thereby supporting the human body from at least one side in the front and rear direction;

a fourth support unit that is disposed below the first support unit and the second support unit and that is closer to the second support unit in the front and rear direction than the first support unit when viewed from the up and down direction, and that contacts the soles of the feet of the human body to support the human body from below so that the feet of the human body are inclined with respect to the up and down direction;

a moving mechanism that moves one or two of the first support unit, the second support unit, and the fourth support unit in the up and down direction relative to the one or one other than the two of the first support unit, the second support unit, and the fourth support unit; and

a control unit that controls the movement mechanism.

[0009]

The support device of the second aspect is,

in the support device of the first aspect, wherein

the third support unit includes: (1) an upper limb support unit that is disposed above the first support unit in the up and down direction and supports the upper limbs of the human body from below; and, (2) a head support unit that is disposed above the upper limb support unit in the up and down direction and contacts the forehead of the human body to support the head from the front in the front and rear direction.

[0010]

The support device of the third aspect is,

in the support device of the second aspect, wherein

the moving mechanism moves the head support unit relative to the upper limb support unit in the up and down direction and the front and rear direction.

[0011]

The support device of the fourth aspect is,

in the support device of any one of the first to third aspects, wherein

a swinging mechanism controlled by the control unit, which swings the first support unit and the second support unit relative to the third support unit around an axis set between the first support unit and the second support unit when viewed from the up and down direction.

[0012]

The support device of the fifth aspect is,

in the support device of any one of the first to fourth aspects, wherein

the control unit has a timer that counts a usage time used by the user, and

the control unit controls the moving mechanism so that, when the usage time has elapsed after a predetermined time, the second support unit, the upper limb support unit, and the head support unit move relative to the first support unit in the up and down direction with the same waveform and phase.

[0013]

The support device of the sixth aspect is,

in the support device of the fourth aspect, wherein

the control unit has a timer that counts a usage time used by the user, and

the control unit controls the swinging mechanism so that the first support unit, the second support unit, and the fourth support unit swing around the axis relative to the third support unit during a period until the usage time has elapsed.

[0014]

The support device of the seventh aspect is,

in the support device of the fourth aspect, whrein

the control unit has a timer that counts a usage time used by the user, and

the control unit controls the swinging mechanism so that the first support unit, the second support unit, and the fourth support unit swing around the axis relative to the third support unit when the usage time has elapsed a predetermined time.

[0015]

The support device of the eighth aspect is,

in the support device of any one of the first to seventh aspects,

further including multiple sensors are communicatively connected to the control unit; attached respectively to the first support unit, the second support unit, and the third support unit; and each measure the load or pressure received from a human body in contact therewith, wherein

the control unit controls the moving mechanism so that a ratio of the measurement values of the multiple sensors falls within a predetermined ratio range.

[0016]

The support device of the ninth aspect is,

in the support device of the eighth aspect,

further including a user interface communicatively connected to the control unit and configured to transmit a request from a user to the control unit; wherein

when a request to start use is transmitted from the user via the user interface, the control unit controls the movement mechanism so that a ratio of the measurement values of the multiple sensors falls within the range of the determined ratio.

[0017]

The support device of the tenth aspect is,

in the support device of the ninth aspect, wherein

the control unit controls the movement mechanism when a usage time request is transmitted from the user via the user interface and the usage time has elapsed, so that a ratio of the measurement values of the multiple sensors that is within the range of the defined ratio goes out of the range of the defined ratio.

[0018]

The support device of the eleventh aspect is,

in the support device of the eighth aspect, wherein

the control unit controls the movement mechanism so that a ratio of the measurement values of the multiple sensors varies within the determined ratio range during a period from when the usage time request is transmitted from the user via the user interface until the usage time has elapsed.

[0019]

The support device of the twelfth aspect is,

in the support device of any one of the first to fourth aspects, wherein

the second support unit has a seat that contacts one or both of the buttocks and the upper legs of the human body and a link mechanism that connects the seat and the moving mechanism, wherein

the seat is moved upward by the moving mechanism so as to change its posture so as to widen an angle formed between the seat and the link along the up and down direction.

[0020]

A program of the first aspect is,

In the program for controlling the support device according to claims 1 to 3,

causing the control unit to execute:

a measurement function that causes the multiple sensors to measure the load or pressure received from a human body;

a movement function that controls the movement mechanism to move the second support unit relative to the first support unit in the up and down direction so that a ratio of the measurement values of the multiple sensors is within a predetermined ratio range; and

a swinging function that controls the swinging mechanism to swinging one or both of the first support unit, the second support unit, and the fourth support unit, and the third support unit around the axis so that the first support unit, the second support unit, and the fourth support unit swinging relative to the third support unit.

[0021]

The program of the second aspect is,

in the program for controlling the support device of a fourth aspect,

causing the control unit to execute:

a measurement function that causes the multiple sensors to measure the load or pressure received from a human body;

a movement function that controls the movement mechanism to move the second support unit relative to the first support unit in the up and down direction so that the ratio of the measurement values of the multiple sensors is within a predetermined ratio range;

a swinging function that controls the swinging mechanism to swing one or both of the first support unit, the second support unit, and the fourth support unit, or the third support unit, around the axis so that the first support unit, the second support unit, and the fourth support unit swinging relative to the third support unit.

Effects of the Invention

[0022]

According to the support devices of the first and third aspects, the support position of a human body can be adjusted in accordance with the different leg lengths of multiple users.

[0023]

According to the support device of the second aspect, compared to a configuration in which the third support unit is composed only of an upper limb support part, it is possible to provide a user with a more satisfying nap or rest when taking a nap or rest with the lower body bent.

[0024]

According to the support device of the fourth aspect, when taking a nap or resting with the lower body bent, the user can swing the upper body relative to the lower body.

[0025]

According to the support device of the fifth aspect, the movement mechanism that more appropriately adjusts the support position of the human body can be used to notify the user of the passage of usage time through a bodily sensation.

[0026]

According to the support device of the sixth aspect, the user can swing the upper body relative to the lower body while taking a nap or resting with the lower body bent.

[0027]

According to the support device of the seventh aspect, after taking a nap or resting with the lower body bent, the user can swing the upper body relative to the lower body.

[0028]

According to the support device of the eighth aspect, the support position of the human body can be adjusted more appropriately compared to an aspect in which the load or pressure received from the human body is not measured by a plurality of sensors.

[0029]

According to the support device of the ninth aspect, compared to an aspect in which the ratio of the measurement values of the multiple sensors remains constant, the areas where the user receives reaction force from the support device can be dispersed during the period from immediately after use begins until the usage time has elapsed.

[0030]

According to the support devices of the tenth and eleventh aspects, the movement mechanism that more appropriately adjusts the support position of the human body can be used to notify the user of the passage of usage time through a bodily sensation.

[0031]

According to the support device of the twelfth aspect, the support position of the human body can be more appropriately adjusted to suit the different leg lengths of multiple users, compared to an aspect in which the posture of the seat is not changed to align in the up and down direction as the seat moves upward.

[0032]

According to the programs of the first and second aspects, the support position of the human body can be adjusted in accordance with different leg lengths of multiple users.

Brief explanation of the drawings

[0033]

FIG. 1A is a front view of a nap box of this embodiment with the door closed.

FIG. 1B is a front view of the nap box of this embodiment with the door open.

FIG. 1C is a front view of the nap box of this embodiment with the door open.

FIG. 1D is a diagram illustrating a state in which a user is using the nap box of this embodiment.

FIG. 1E is a top view of a third support unit provided in the nap box of this embodiment.

FIG. 2 is a block diagram of a control system for the nap box according to this embodiment.

FIG. 3 is a flow chart showing the control flow of the nap box of this embodiment.

FIG. 4 is a schematic diagram for explaining the initial operation when the nap box of this embodiment is first used.

FIG. 5 is a schematic diagram for explaining the operation of a nap box according to a fourth modification.

FIG. 6 is a flow chart showing the control flow of a nap box according to a fifth modification.

FIG. 7 is a flow chart showing the control flow of a nap box according to a sixth modification.

FIG. 8 is a flow chart showing the control flow of a nap box according to a seventh modification.

FIG. 9A is a block diagram of a control system of a nap box according to an eighth modification.

FIG. 9B is a flow chart showing the control flow of a nap box of an eighth modification.

FIG. 10 is a flow chart showing the control flow of a nap box according to a ninth modification.

FIG. 11 is a flow chart showing the control flow of a nap box of a tenth modification.

FIG. 12 is a block diagram of a control system of a nap box according to an eleventh modification.

FIG. 13A is a block diagram of the control system of a nap box of a twelfth modification.

FIG. 13B is a schematic diagram of an AI model of the twelfth modification.

FIG. 13C is a flow chart showing a control flow of the nap box of the twelfth modification.

FIG. 14A is a schematic diagram illustrating a swinging mechanism provided in the nap box of a thirteenth modification.

FIG. 14B is a schematic diagram for explaining the operation of the swinging mechanism provided in the nap box of the thirteenth modification.

DETAILED DESCRIPTION OF THE INVENTION

[0034]

Overview

The following describes a nap box 10 (an example of a support device; see FIGS. 1A, 1B, 1C, etc.) of this embodiment. Next, several modifications will be described. It should be noted that in this specification, components having similar functions are designated by the same or similar reference numerals in each of the drawings referred to in the several modifications described below.

[0035]

This Embodiment

First, the structures and functions of the nap box 10 of this embodiment will be described, followed by a description of the operation of the nap box 10. Next, the effects of the nap box 10 will be described.

[0036]

Structure and Functions of the Nap Box

FIG. 1A is a front view of the nap box 10 of this embodiment with a door 442 of a housing 40 closed. FIGS. 1B and 1C are front views of the nap box 10 with the door 442 open. FIG. 1D is a diagram illustrating the state in which the nap box 10 is being used by a user. FIG. 1E is a top view of the third support portion 230 of the nap box 10. FIG. 2 is a block diagram of the control system CS of the nap box 10.

[0037]

The nap box 10 of this embodiment includes, as shown in FIGS. 1B and 1C, a support mechanism 20, multiple sensors 30, a housing 40, a control unit 50, and a user interface 60 (hereinafter referred to as UI 60). The nap box 10 is a device used to support a user U (see FIG. 1D) in a standing position and allow the user U to take a nap or rest.

[0038]

Here, if the user U is to take a nap or rest, it may seem appropriate to have the user U lie on his/her side using a bed or the like rather than standing. However, allowing the user U to take a nap or rest in a standing position, as in the nap box 10 of this embodiment, has two technical significances: (1) it requires a smaller installation area than a bed or the like, and (2) it allows user U to take a nap or rest at levels 1 and 2, which are the shallower of the four levels (levels 1 to 4) of deep sleep in non-REM sleep.

[0039]

Support Mechanism, Multiple Sensors, and Housing

The support mechanism 20 is a major part of the hardware of the nap box 10 and has a function of supporting the user U in a standing position. As shown in FIGS. 1B and 1C, the support mechanism 20 has a first support unit 210, a second support unit 220, a third support unit 230, a fourth support nit 240, a movement mechanism 250, and multiple pillars 260 (four pillars in this embodiment, as an example).

The first support unit 210, the second support unit 220, the third support unit 230, the fourth support unit 240 and the moving mechanism 250 are the main components of the nap box 10 of this embodiment and will be described later.

[0040]

Multiple sensors 30 (four sensors in this embodiment, for example) are configured to measure load or pressure and include a first sensor 32, a second sensor 34, a third sensor 36, and a fourth sensor 38. The multiple sensors 30 are attached to the first support unit 210, the second support unit 220, the third support unit 230, and the fourth support unit 240, respectively (see FIGS. 1B and 1C), and are communicatively connected to the control unit 50 (see FIG. 2). The first sensor 32, the second sensor 34, the third sensor 36, and the fourth sensor 38 each have a function of measuring the load or pressure received from the body of the user U that they come into contact with, and transmitting the measurement data to the control unit 50.

The first sensor 32, the second sensor 34, the third sensor 36, and the fourth sensor 38 are the main components of the nap box 10 of this embodiment and will be described later.

[0041]

The housing 40 is the exterior of the nap box 10 and functions to house the support mechanism 20, the multiple sensors 30, the control unit 50, and the UI 60 therein. In other words, the housing 40 surrounds the support mechanism 20. As shown in FIG. 1A, the housing 40 has a ceiling wall 42, a peripheral wall 44, a bottom wall 46, and a base 48. As shown in FIG. 1A, the housing 40 has a substantially bilaterally symmetrical shape when viewed from the front side of the nap box 10. Here, the dashed dotted line CL in the FIGS. indicates the center line of the nap box 10.

The ceiling wall 42 and the bottom wall 46 are each formed in a polygonal shape, for example, by diamond-cutting the outer surface of a hemisphere.

The peripheral wall 44 is a tube connecting the lower end of the ceiling wall 42 and the upper end of the bottom wall 46, and has a regular polygonal shape when viewed from the top-to-bottom direction. The peripheral wall 44 is made up of multiple long plates arranged in the circumferential direction, and the door 442 that allows the user U to enter and exit is attached by hollowing out a portion of the peripheral wall 44. As an example, the door 442 is a double-door type.

The base 48 supports the ceiling wall 42, the peripheral wall 44 and the bottom wall 46 from below.

[0042]

As shown in FIGS. 1B and 1C, when viewed from the door 442 side (viewed from the front side of the nap box 10), the multiple pillars 260 are arranged in pairs along the up and down direction on the front and rear sides of both sides of the bottom wall 46, and both ends of each are fixed to the bottom wall 46 and the ceiling wall 42. In this specification, when viewed from the front side of the nap box 10, the left side is the front side and the right side is the rear side, and the straight line connecting these is the front and rear direction.

[0043]

Major Components

The main components of this embodiment will be described below.

[0044]

First Support Unit and First Sensor

The first support unit 210 has a function of contacting one or both of the knees and lower legs of the user U from the front side of the body, thereby supporting the body from below (see FIG. 1D).

As shown in FIGS. 1B and 1C, the first support portion 210 includes, for example, a base 212 and a cushion 214.

The base 212 is, for example, flat and rectangular when viewed in its thickness direction. As shown in FIGS. 1B and 1C, the base 212 is located on the left side when viewed from the front of the nap box 10, and is tilted so that its upper surface faces upward and toward the center line CL (inward). Therefore, the upper surface forms a slope. The tilt angle of the base 212 is, for example, set to 20° to 60°. The base 212 is fixed to the cylinder of a second actuator 254 (described later) provided in the movement mechanism 250.

The cushion 214 is, for example, in the shape of a flat plate, and when viewed in the thickness direction, is formed in a rectangular shape that is slightly smaller than the base 212. The cushion 214 is fixed to the upper surface of the base 212.

[0045]

The first sensor 32 is, as shown FIGS. 1B and 1C, disposed between the base 212 and the cushion 214. The first sensor 32 measures the load or pressure applied from one or both of the knee and the lower leg of the user U's body that is in contact with the cushion 214, and transmits the measurement data to the control unit 50.

[0046]

Second Support Unit and Second Sensor

The second support unit 220 is positioned at a different position from the first support unit 210 when viewed from the top-to-bottom direction (in this embodiment, at a position behind the first support unit 210 in the front-to-back direction) (see FIGS. 1B and 1C), and has a function of contacting one or both of the buttocks and upper thighs of the user U from the rear side of the body, thereby supporting the body from below (see FIG. 1D).

As shown in FIGS. 1B and 1C, the second support portion 220 includes, for example, a seat 222 and a link mechanism 224.

[0047]

The seat 222 includes, for example, a base 222 A and a cushion 222 B. The seat 222 is a portion that comes into contact with one or both of the buttocks and upper thighs of the user U's body.

As an example, the base 222A is flat and rectangular when viewed in its thickness direction. As shown in FIGS. 1B and 1C, the base 222A is located on the right side (rear side in the front and rear direction) when viewed from the front side of the nap box 10, and is tilted so that its upper surface faces upward and

toward the center line CL (inward). Therefore, the upper surface forms a slope. The upper end portion of the back surface of the base 222A is attached to the upper end of a first actuator 252 (described later) provided in the movement mechanism 250 so as to be able to swing.

The cushion 222B is, for example, in the shape of a flat plate, and when viewed in the thickness direction, is formed in a rectangular shape that is slightly smaller than the base 222A. The cushion 222B is fixed to the upper surface of the base 222A.

[0048]

As shown in FIGS. 1B and 1C, the link mechanism 224 has a function of connecting the seat 222 and the first actuator 252. The link mechanism 224 has a link 224A and two joints 224B fitted into through holes at both ends of the link 224A. One end of the link 224A is attached to a lower end portion of the base 222A by the joint 224B, and the other end is attached to two adjacent pillars of multiple pillars 260 by the two joints 224B.

With the above structures, the seat 222 is configured to change its posture so that the angle formed with the link 224A increases in the up and down direction as the seat 222 is moved upward by the first actuator 252 (see FIG. 4). The amount and range of extension of the first actuator 252 are preset. In this embodiment, the tilt angle of the seat 222 is set to, for example, 45° at its lowest position and 80° at its highest position.

[0049]

As shown in FIGS. 1B and 1C, the second sensor 34 is disposed between the base 222A and the cushion 222B. The second sensor 34 measures the load or pressure applied from one or both of the buttocks and upper thighs of the user U's body that are in contact with the cushion 222B, and transmits the measurement data to the control unit 50.

[0050]

Third Support Unit and Third Sensor

As shown in FIGS. 1B and 1C, the third support unit 230 is disposed at a position higher than the first support unit 210 and the second support unit 220. The third support unit 230 has a function of contacting the upper limbs and head of the user U so that the upper limbs and head of the human body are positioned within a predetermined range in the front and rear direction, and supporting the human body from at least one side in the front and rear direction.

As shown in FIGS. 1C and 1E, the third support unit 230 has a mounting portion 232, an upper limb support portion 234, a connecting portion 236, and a head support portion 238.

As shown in FIGS. 1B and 1C, the third support unit 230 is attached to the upper end of the second actuator 254. Therefore, the third support unit 230 is movable within a preset range in the up and down direction in accordance with the operation of the second actuator 254.

[0051]

The mounting portion 232 is attached to the second actuator 254.

The upper limb support portion 234 is pivotally attached to the mounting portion 232 by a hinge HG (see FIG. 1E). As shown in FIG. 1D, the upper limb support portion 234 functions to support the upper limbs of the user U from below. As shown in FIG. 1E, the upper limb support portion 234 is C-shaped when viewed from above. The upper limb support portion 234 includes a base 234A and a cushion 234B fixed to the upper surface of the base 234A. As an example, the base 234A and the cushion 234B are formed into substantially the same C-shape. The upper limb support portion 234 is designed to be positioned perpendicular to the mounting portion 232 when not in use, and to be tilted approximately 90° by the user U when in use, so that the opening faces the user U's chest. The user U places their upper limbs on the upper limb support portion 234 when in use.

[0052]

As shown in FIGS. 1C and 1D, the head support portion 238 is disposed above the mounting portion 232 and the upper limb support portion 234 in the up and down direction, and functions to contact the forehead of the user U and support the head from the front in the front-to-back direction. The head support portion 238 has a base plate 238A and a cushion 238B. The base plate 238A has a rectangular shape and is disposed with its thickness aligned with the front-to-back direction and its short side aligned with the up and down direction. As an example, the cushion 238B is formed in a rectangular shape substantially the same as the base plate 238A, and is fixed to the surface of the base plate 238A (the surface facing rearward in the front-to-back direction).

One end of the connecting portion 236 is fixed to the rear surface of the base plate 238A, and the other end of the connecting portion 236 is fixed to the mounting portion 232. In other words, the head support portion 238 is positioned relative to the mounting portion 232 via the connecting portion 236.

As an example, the connecting portion 236 is configured to be extendable. Therefore, for example, when the user U extends or retracts the connecting portion 236, the head support portion 238 is configured to

be able to change its position in the up and down direction relative to the upper limb support portion 234. In addition, an extendable and retractable member (not shown) is disposed between the connecting portion 236 and the base plate 238A of the head support portion 238. Therefore, for example, when the user U moves the head support portion 238 in the front and rear direction, the extendable member extends or retracts, and the head support portion 238 is configured to be able to change its position in the front and rear direction relative to the connecting portion 236.

[0053]

As shown in FIG. 1C, the third sensor 36 is disposed between the substrate 238A and the cushion 238B. The third sensor 36 measures the load or pressure exerted by the head (for example, the forehead) of the user U's body that is in contact with the cushion 238B, and transmits the measurement data to the control unit 50.

[0054]

Fourth Support Unit and Fourth Sensor

As shown in FIGS. 1B and 1C, the fourth support unit 240 is disposed in a position lower than the first support unit 210 and the second support unit 220 and closer to the second support unit 220 in the front and rear direction than the first support unit 210 when viewed from the up and down direction (a position substantially directly below the second support unit 220 when viewed from the up and down direction). As shown in FIG. 1D, the fourth support unit 240 contacts the soles of the feet of the user U and supports the body from below so that the feet of the user U are inclined relative to the up and down direction.

The fourth support unit 240 is a V-shaped member when viewed from the front side of the nap box 10, and is composed of two long plates (a fixed plate and an inclined plate) that run from the front to the rear side and form an angle of approximately 45°, for example. One of the long plates (fixed plate) is fixed to the upper surface (floor surface) of the bottom wall 46.

[0055]

As shown in FIGS. 1B and 1C, the fourth sensor 38 is disposed on the inclined plate of the fourth support unit 240. The fourth sensor 38 measures the load or pressure applied by the foot of the user U's body that is in contact with the inclined plate, and transmits the measurement data to the control unit 50.

[0056]

Moving Mechanism

As shown in FIGS. 1B and 1C, the movement mechanism 250 includes a first actuator 252 and a second actuator 254.

As described above, the first actuator 252 has an upper end to which the seat 222 of the second support unit 220 is attached so as to be able to swing. The first actuator 252 utilizes the fact that the link 224A of the link mechanism 224 is attached to two adjacent pillars of multiple pillars 260, and has a function of changing the vertical position and tilt angle (or posture) of the seat 222 by moving the rod upward. Here, in this embodiment, the first support unit 210 and the fourth support unit 240 are configured not to move in the up and down direction. Therefore, it can be said that the first actuator 252 has a function of moving one of the first support unit 210, the second support unit 220, and the fourth support unit 240 (for example, the second support unit 220) in the up and down direction relative to the other one of the first support unit 210, the second support unit 220, and the fourth support unit 240 (the first support unit 210 or the fourth support unit 240).

As described above, the second actuator 254 has the mounting portion 232 of the third support unit 230 attached to its upper end. The second actuator 254 has a function of changing the vertical position of the third support unit 230 (including the upper limb support portion 234 and the head support portion 238) by moving its rod in the up and down direction.

[0057]

Control Unit

The control unit 50 has a function of controlling the moving mechanism 250 based on commands sent from a UI 60 (described later) and a program PG stored in its own storage device 54.

As shown in FIG. 2, the control unit 50 is communicatively connected to the UI 60, the moving mechanism 250, and the multiple sensors 30 via an I/O port (input/output port). The control unit 50 also has an arithmetic device 52, a storage device 54, and a timer 56.

[0058]

The arithmetic device 52 is a so-called central processing unit, and executes the program PG stored in a first storage section 542 of the storage device 54. The contents of the program PG will be explained later in the description of the operation of the nap box 10.

As shown in FIG. 2, the storage device 54 has the first storage section 542 and a second storage section 544. The first storage section 542 is, for example, a read-only memory (ROM (=Read Only Memory)). The first storage section 542 stores a program PG for operating the movement mechanism 250. The second storage

section 544 is, for example, a readable and writable memory (RAM (=Random Access Memory)). The second storage section 544 temporarily stores data on the operation of the movement mechanism 250 while the nap box 10 is in use, etc.

The timer 56 mainly counts the execution time of the program PG.

[0059]

User Interface

As shown in FIG. 2, the UI 60 is communicatively connected to the control unit 50 via an I/O port. The UI 60 has a function of transmitting requests from the user U to the control unit 50. As an example, the UI 60 is in the form of either a touch panel or a voice-based interactive format, or a combination of these. Specific requests input to the UI 60 will be described later in the description of the operation of the nap box 10.

[0060]

The above is a description of the structures and functions of the nap box 10 of this embodiment.

[0061]

Operation of Nap Box

Next, the operation of the nap box 10 of this embodiment will be described mainly with reference to FIGS. 3 and 4. FIG. 3 is a flow diagram showing the control flow of the nap box 10 (algorithm of the program PG).

[0062]

First, the user U using the nap box 10 opens the door 442 (see FIGS. 1A and 1B) of the housing 40, moves into the nap box 10, and closes the door 442. The user U then faces forward in the front-to-back direction and places both feet on the fourth support unit 240.

[0063]

Next, when the user U operates the UI 60 to input the usage time (the time for taking a nap) into the UI 60, the UI 60 transmits the information to the control unit 50 (S10 in the control flow of FIG. 3). Accordingly, the control unit 50 starts operation based on the program PG stored in the first storage section 542. The transmitted usage time information is temporarily stored in the second storage section 544.

[0064]

Next, the control unit 50 confirms that the user U is standing in a fixed position via the UI 60. Specifically, the UI 60 inquires the user U on a screen (not shown) or by voice, asking, "Are you standing with

both feet on the fourth support unit 240?", and when the user U inputs or speaks an affirmative answer (S20 in the control flow of FIG. 3), the control unit 50 starts the next operation (S30 in the control flow of FIG. 3) which involves a determination step.

[0065]

At this time, the UI 60 also suggests to the user U by displaying on the screen (not shown) or by voice that the user (1) tilt the upper limb support portion 234 of the third support unit 230 (see FIG. 1C) and place both arms on the upper limb support portion 234, and (2) place their forehead in contact with the head support portion 238. Upon receiving this suggestion, the user U can move the head support portion 238 in the up-to-down and front-to-back directions. Here, the diagram shown in FIG. 4 as the initial state is a simplified diagram including the first support unit 210, the second support unit 220, the third support unit 230, and the fourth support unit 240 arranged in the positional relationship prior to the start of use.

[0066]

Next, the control unit 50 first receives each measurement data from the multiple sensors 30 in the initial state and determines (1) whether the head support portion 238 of the third support unit 230 is receiving a load or pressure from the user U's body (head) that is greater than a predetermined value, and (2) whether the ratio of the load or pressure received from the user U's body that each support unit (the first support unit 210, the second support unit 220, and the fourth support unit 240) comes into contact with is within the predetermined ratio range (S30 in the control flow of FIG. 3).

Here, (1) the load or pressure that the head support portion 238 receives that is equal to or greater than the predetermined value is, for example, as follows.

Load that is equal to or greater than the predetermined value : Load of 1.0 kgf or more

Pressure that is equal to or greater than the predetermined value : Pressure of 100 kgf/ m^2

Furthermore, (2) the range of the specified ratio of the load or pressure received by each support nit (first support unit 210, second support unit 220, and fourth support unit 240) is, for example, as shown in the following relational expression (hereinafter referred to as the specified ratio relational expression):

	The first support unit 210	: The second support unit 220	: The fourth support unit 240
=	45% to less than 55%	: 25% to less than 35%	: 15% to less than 25%

(However, the total ratio of all support units is 100%)

If the control unit 50 makes a positive determination in S30, it performs the next operation (S40). In contrast, if the control unit 50 makes a negative determination in S30, it performs S32 without starting S40. In S32 , the control unit 50 controls the first actuator 252 to raise the second support unit 220 by a predetermined height (e.g., 1cm), and then performs the determination in S30 again. This subroutine of S30 and S32 is performed until the control unit 50 makes a positive determination in S30 (see adjustment state 1 and adjustment state 2 in FIG. 4).

Here, information on the load or pressure received by each support unit relative to the height of the second support unit 220 is stored in the second storage section 544 each time a measurement is taken. If the control unit 50 makes a determination in S30 while raising the height of the second support unit 220 by 1 cm at a time over the entire movable range of the first actuator 252 and does not make a positive determination in S30, the control unit 50 operates the first actuator 252 to move the second support unit 220 to a height that is close to the relationship defined by the above-mentioned relational expression, and performs the subroutines of S30 and S32 while moving the second support unit 220 at intervals shorter than 1 cm. This can be achieved because the results of the subroutines of S30 and S32 are sequentially stored in the second storage section 544.

Note that, as an example, the adjustment of the vertical position of the third support unit 230 by the second actuator 254 is also performed in conjunction with the operation of S30.

[0067]

Next, in S40, the timer 56 starts counting.

[0068]

Next, in a determination step S50, when the count number of the timer 56 reaches or exceeds the usage time stored in the second storage section 544 (when the control unit 50 makes a positive determination in S50), the UI 60 notifies the user U in S60 that the usage time has expired. The notification in S60 is performed, for example, by sound or by turning on the lights inside the housing 40 that were turned off during use.

[0069]

Next, when the user U wakes up from a nap and operates the UI 60 to acknowledge that the usage time has elapsed, the control unit 50 controls the first actuator 252 to return the second support unit 220 to its initial position (see FIG. 4), thereby completing the operation of the nap box 10 of this embodiment.

[0070]

The above is a description of the operation of the nap box 10 of this embodiment.

[0071]

Effects of Nap Box

Next, the effects of the nap box 10 of this embodiment will be described.

[0072]

First Effect

As shown in FIGS.1C, 1D, etc., the support mechanism 20 of this embodiment includes the first support unit 210, the second support unit 220, and the third support unit 230. The third support unit 230 also includes a head support portion 238.

Incidentally, in a configuration in which the support mechanism 20 does not include only the head support portion 238 (not shown, hereinafter referred to as the comparative configuration), the user U uses a nap box equipped with a support mechanism of the comparative configuration by contacting both arms from above with the upper surface of the upper limb support portion 234 and then resting their head on both arms. Therefore, even when the same user U uses the nap box, the reaction forces and the ratio of the reaction forces that the user U receives from each of the first support unit 210 and the second support unit 220 will vary depending on where the user U's arms and head are located in the front-to-back direction of the user U's body on the upper limb support portion 234.

However, in this embodiment, the third support unit 230 has the head support portion 238. When the user U places their head in contact with the head support portion 238, their upper body tilts forward in the up and down direction (see FIG. 1D). By using the nap box 10 in this position, the positions of the user U's head, shoulders, etc. are always uniform. Thus, the reaction forces and the ratio of these reaction forces that the user U receives from the first support unit 210 and the second support unit 220 are less likely to vary.

Therefore, the support mechanism 20 and the nap box 10 of this embodiment can provide the user U with a highly satisfying nap or rest when taking a nap or rest with the lower body bent.

[0073]

Second Effect

The support mechanism 20 of this embodiment moves the second support unit 220, of the first support unit 210, the second support unit 220, the third support unit 230, and the fourth support unit 240, in the up and

down direction relative to the first support unit 210, the third support unit 230, or the fourth support unit 240 (see FIG. 4).

Therefore, the support mechanism 20 and the nap box 10 of this embodiment can adjust the support position of each human body for each of multiple users U, each with a different leg length.

Particularly, in the case of this embodiment, as shown in S30 of the control flow of FIG. 3, the relative positioning operation of the first support unit 210 and the second support unit 220 is performed by (1) satisfying that the head support portion 238 of the third support unit 230 is receiving a load or pressure of a predetermined value or more from the user U's body (head), and (2) determining whether the ratio of the load or pressure received from the user U's body at each support portion (the first support unit 210, the second support unit 220, and the fourth support unit 240) is within a predetermined ratio range.

Therefore, this embodiment is advantageous in that it is possible to provide a more optimal support position for the human body for each user U compared to the comparative example described above.

[0074]

Third Effect

In this embodiment, the nap box 10 includes the multiple support units (the first support unit 210, the second support unit 220, the third support unit 230, and the fourth support unit 240) each equipped with a sensor (the first sensor 32, the second sensor 34, the third sensor 36, and the fourth sensor 38), which are configured to measure the load or pressure exerted by the user U's body at each support unit (see FIGS. 1C and 2). Furthermore, in this embodiment, the control unit 50 operates the first actuator 252 while acquiring measurement data from each sensor (the first sensor 32, the second sensor 34, and the fourth sensor 38) based on the program PG, thereby adjusting the relative positions of the multiple support units (the first support unit 210, the second support unit 220, and the fourth support unit 240) so that the values of each sensor satisfy the predetermined ratio (see S30 and S32 in FIG. 3).

Therefore, compared to a configuration that does not use multiple sensors to measure the load or pressure applied by the human body, the nap box 10 of this embodiment can appropriately adjust the support position of each human body for multiple users U with different leg lengths. Accordingly, by using the program PG of this embodiment, the support position of the human body can be adjusted according to the different leg lengths of multiple users U.

[0075]

Fourth Effect

In the nap box 10 of this embodiment, the second support unit 220, whose vertical height is adjusted by the first actuator 252, has the sheet 222 and the link mechanism 224 (see FIGS. 1B and 1C). The sheet 222 is configured to change its position so that the angle formed with the link 224A increases as the sheet 222 is moved upward by the first actuator 252 (see FIG. 4).

With this structures, the nap box 10 of this embodiment is arranged so that the height of the seat 222 is higher for users U with longer legs, and the inclination angle of the seat 222 is adjusted so that each support unit (the first support unit 210, the second support unit 220, and the fourth support unit 240) makes appropriate surface contact with each user U even when used by multiple users U with different leg lengths.

Therefore, compared to a configuration in which the inclination angle of the seat 222 cannot be adjusted, the nap box 10 of this embodiment can appropriately adjust the support position of each human body for each user U according to multiple users U each having different leg lengths.

[0076]

The above is a description of the effects of the nap box 10 of this embodiment. The above is a description of the nap box 10 of this embodiment.

[0077]

Variations

Next, several modifications (see Table 1 below) will be described. The changes in Table 1 refer to changes from the previously described embodiment. For each modification, only the differences from the previously described embodiment will be described.

[0078]

Table 1

Modification's name	Changes	Reference FIG.
The 1st Modification	Including no multiple sensors.	none
The 2nd Modification	Support units moved by a moving mechanism are different.	none
The 3rd Modification	A structure of the third support unit is different.	none
The 4th Modification	A structure of the second support member is different.	FIG. 5
The 5th Modification	Notification method at the end of a usage time is different.	FIG. 6

The 6th Modification	Notification method at the end of a usage time is different (2).	FIG. 7
The 7th Modification	The relative position of each support unit changes during the usage time.	FIG. 8
The 8th Modification	Capable of connecting to a mobile device (1).	FIG. 9A and B
The 9th Modification	Capable of connecting to a mobile device (2).	FIG. 10
The 10th Modification	Capable of connecting to a mobile device (3).	FIG. 11
The 11th Modification	Performing personal authentication using a UI.	FIG. 12
The 12th Modification	Using of AI technology.	FIG. 13A-C
The 13th Modification	Including a swinging mechanism.	FIG. 14A and B

[0079]

First Modification

Changes: Including no multiple sensors

The nap box 10 of the above-described embodiment has sensors (the first sensor 32, the second sensor 34, the third sensor 36, and the fourth sensor 38) arranged on each of the multiple support units (the first support unit 210, the second support unit 220, the third support unit 230, and the fourth support unit 240) of the support mechanism 20, and is configured so that the load or pressure received from the user U's body can be measured at each support part (see FIGS. 1C and 2).

However, some or all these sensors may be omitted (the first modification (not shown)).

In the case of this modification, the third effect of the above-described embodiment is not achieved, but the first, second and fourth effects are achieved.

[0080]

Second Modification

Changes: Support units moved by a moving mechanism are different.

In the nap box 10 of the above-described embodiment, the second support unit 220 attached to the first actuator 252 of the moving mechanism 250 moves in the up and down direction, causing the second support unit 220 to move relative to the first support unit 210, the third support unit 230, and the fourth support unit 240 (see FIG. 4).

However, as an example, if the moving mechanism 250 can move one or two of the first support unit 210, the second support unit 220, the third support unit 230, and the fourth support unit 240 relative to one other than the one or two in the up and down direction, it may be in a form different from that of the above-mentioned embodiment (the second modification (not shown)).

For example, in the second modification, the first support unit 210, the second support unit 220, and the fourth support unit 240 may each be attached to a different movement mechanism (not shown) so that they can move relative to one another. Alternatively, for example, the second support unit 220 may be configured so as not to move vertically, and the first support unit 210 and the fourth support unit 240 may be configured so as to move vertically together with the floor by a movement mechanism (not shown). Alternatively, for example, the second support unit 220 and the fourth support unit 240 may be configured so as not to move vertically, and the first support unit 210 may be configured so as to move vertically by the second actuator 254. Furthermore, in this case, the first support portion 210, which is composed of the base 212 and the cushion 214, may be configured with an additional link mechanism (a link mechanism attached to the base 212 (not shown)), like the second support unit 220, so that the tilt angle of the first support unit changes as the first support unit moves vertically.

Even in the case of these second modifications, the first and second effects described above or effects equivalent to these effects are achieved compared to the configuration in which the first support unit 210, the second support unit 220, the third support unit 230 and the fourth support unit 240 cannot move relative to each other.

[0081]

Third Modification

Changes: A structure of the third support unit is different.

In the nap box 10 of the above-described embodiment, the third support unit 230 is attached to the upper end of the second actuator 254 and is movable in a predetermined range in the up and down direction in response to the operation of the second actuator 254 (see FIGS. 1B and 1C). In this configuration, for example, the mechanism for moving the third support part 230 in the up and down direction may be manual.

In addition, in the nap box 10 of the above-mentioned embodiment, the third support unit 230 has the mounting portion 232 attached to the second actuator 254, the upper limb support portion 234 that supports both arms of the user U from below, and the head support portion 238 (see FIGS. 1C and 1D).

However, the third support unit 230 only needs to be in contact with one or both of the upper limbs and head of the user U so that the upper limbs and head are positioned within the predetermined range in the front and rear direction, thereby fulfilling the function of supporting the user U from at least one side in the front and rear direction. The third support unit 230 may have a different form (the third modification (not shown)) from that of the above-described embodiment, as long as it is configured to fulfill this function. A variant of the third support unit may be a string-like member or other member that supports the bases of both arms and/or the chin from the ceiling or the rear side in the front and rear direction to prevent the upper body of the user U from falling over. Furthermore, instead of the upper limb support portion 234, a configuration that supports the front side of the upper body of the user U (e.g., the chest) may also be used (not shown).

[0082]

Fourth Modification

Changes: A structure of the second support member is different.

FIG. 5 is a schematic diagram of the main parts of a nap box 10A according to the fourth modification.

In the nap box 10 of the above-described embodiment, the second support unit 220 includes the seat 222 and the link mechanism 224 (see FIGS. 1B and 1C). The seat 222 is configured to change its position so that the angle formed between the seat 222 and the link 224A increases as the seat 222 is moved upward by the first actuator 252 (see FIG. 4).

However, the second support unit may have a different configuration from that of this embodiment as long as it is moved in the up and down direction by the moving mechanism 250. For example, like the second support unit 220A of the nap box 10A of the fourth modification shown in Fig. 5, it may be composed of a shaft 220A1 arranged in a direction perpendicular to the up and down direction and the front and rear direction, a cylindrical member 220A2 that covers the outer periphery of the shaft 220A1, part of the outer periphery being a flat surface, and that can be positioned by rotating around the shaft 220A1, and a cushion 220A3 attached to the flat surface.

In the case of the fourth modification, the posture of the second support unit 220A does not change with the movement in the up and down direction, but the user U can adjust the inclination angle of the cushion 220A3 by changing the inclination angle of the cushion 220A3 himself/herself. Therefore, this modification is also effective in that it easily fits the body of users U with different leg lengths.

[0083]

Fifth Modification

Changes: Notification method at the end of a usage time is different.

FIG. 6 is a flow chart showing the control flow of the nap box 10B of the fifth modification.

In the operation of the nap box 10 in the above-described embodiment (see the control flow in FIG. 3), if the control unit 50 makes a positive determination in S50, the UI 60 notifies the user U in S60 that the time for use has arrived. The notification in S60 is performed, for example, by sound or by turning on the lights in the housing 40 that were off during use. Therefore, in the above-described embodiment, the UI 60 requires a component that generates sound (a speaker, for example).

However, as long as it is possible to notify the user U that the usage time has elapsed, the notification method may be different from that in the above-described embodiment. For example, as in the control flow of a fifth modification shown in FIG. 6 , S60 in the above-described embodiment (see the control flow of FIG. 3) may be replaced with S60B, and the control unit 50 may control the movement mechanism 250 so that the ratio of the measurement values of the multiple sensors 30, which is within a predetermined ratio range, becomes a ratio outside the predetermined ratio range. In this case, to notify the user U that the usage time has elapsed, the movement mechanism 250 may, for example, move the second support unit 220 up and down multiple times so that the relative positional relationship of the support units 220, 230, etc. becomes a positional relationship corresponding to a position within and outside the predetermined ratio range.

This operation notifies the user U who has been napping that the scheduled usage time has elapsed, as the posture of the user's body is changed due to a change in the support position from each of the support units 210, 220, etc. When the user U, who has been notified, inputs into the UI 60 that he or she agrees to end the operation, the control unit 50 returns each of the support units 210, 220, etc. to their initial positions, and the operation of this modification ends.

Unlike the above-described embodiment, this modification is effective in that notification can be achieved by utilizing the support units 210, 220 and the movement mechanism 250. In other words, according to this modification, the movement mechanism 250, which more appropriately adjusts the support position of the human body, can be used to notify the user U of the passage of usage time through a bodily sensation.

[0084]

Sixth Modification

Changes: Notification method at the end of a usage time is different (2).

FIG. 7 is a flow chart showing the control flow of a nap box 10C according to the sixth modification.

In this modification, S60B in the fifth modification (see FIG. 6) is changed to S60C.

Specifically, in this modification, when the usage time for the user U has elapsed a predetermined time (end), the control unit 50 controls the moving mechanism 250 so that the second support unit 220, the upper limb support portion 234, and the head support portion 238 (the third support unit 230) move vertically relative to the first support unit 210 with the same waveform and phase as each other, i.e., while maintaining the same relative positional relationship.

According to this modification, when the user U has finished using the device, the user U is notified by the lower body contracting and expanding while keeping the upper body in the same position as when using the device, i.e., maintaining the neck angle. Therefore, the neck angle does not suddenly change during a nap. Other effects of this modification are the same as those of the fifth modification.

[0085]

Seventh Modification

Changes: The relative position of each support unit changes during the usage time.

FIG. 8 is a flow chart showing the control flow of a nap box 10D according to the seventh modification.

In the operation of the nap box 10 of the above-described embodiment (see the control flow in FIG. 3), the relative positions of the support units 210, 220, etc. do not change from the start to the end of use by the user U.

However, if the user U can take a nap or rest during the use period, the relative positions of the support units 210, 220, etc. may be changed during the use period. Specifically, the control flow of the seventh modification shown in FIG. 8 may be used. The details of the control flow of the seventh modification are as follows.

In S30D, the moving mechanism 250 (the first actuator 252 thereof) is intentionally operated over a wide range, and the control unit 50 determines a combination for the user U in which the ratio of the measurement values of the multiple sensors 30 is a predetermined ratio. Information about this combination is temporarily stored in the second storage section 544 of the storage device 54 (see FIG. 2).

Next, in S40D, the control unit 50 operates the moving mechanism 250 to set each of the support units 210, 220, etc. within the range of the above combination, and starts the timer 56 to count.

Next, in S50D and S52D, the control unit 50 changes the relative positions of each support unit 210, 220, etc. using the moving mechanism 250 so that, when 1/3 of the usage time has elapsed since use began, the relative positions of each support unit 210, 220, etc. are different from those immediately before and become one of the combinations grasped in S30C.

Next, in S54D and S56D, the control unit 50 changes the relative positions of the support units 220, 230, etc., using the movement mechanism 250, so that when two-thirds of the usage time has elapsed since the start of use, the relative positions of the support units 220, 230, etc. are different from those immediately before and become one of the combinations grasped in S30D.

Next, in S58D, the control unit 50 changes the relative positions of the support units 210, 220, etc., using the movement mechanism 250, so that the relative positions of the support units 210, 220, etc. become a combination other than the combination determined in S30D when a predetermined time has elapsed since the start of use (see S60B in FIG. 8). As a result, the user U, who was napping, is notified that the scheduled usage time has elapsed because the support positions from the support units 210, 220, etc. have changed, which in turn changes the posture of the user's body. Then, when the user U inputs to the UI 60 that he or she agrees to end the operation, the control unit 50 returns the support units 210, 220, etc. to their initial positions, and the operation of this modification ends.

In this modification, the relative positions of the support units 210, 220, etc. change during use in accordance with the combination determined in S30A. Thus, according to this modification, the parts of the user U's body that receive reaction forces from the support units 210, 220, etc. can be changed during use.

Therefore, according to this modification, the areas where the reaction force is received by the user U's body from the support mechanism 20 can be dispersed during the period from the start of use until the elapse of usage time, compared to when the ratio of the measurement values of the multiple sensors 30 remains constant.

In this modification, the relative positions of the support units 210, 220, etc. are changed at 1/3 and 2/3 of the usage time, but they may also be changed at integer fractions such as 1/4 or 1/5 of the usage time, or the period until the change may be shortened each time the usage time elapses.

[0086]

Eighth Modification

Changes: Capable of connecting to a mobile device (1).

Fig. 9A is a block diagram of a control system CSE of a nap box 10E of the eighth modification, and Fig. 9B is a flow diagram showing the control flow of the nap box of this modification.

The nap box 10 of the above-described embodiment employs a configuration in which the user U transmits a request (such as the usage time) to the nap box 10 via the UI 60 (see FIG. 3).

However, for example, a mobile device 70 (a mobile device 70 refers to a smartphone, smart watch, mobile phone, or other portable information terminal) owned by a user U may be connected to the control unit 50 of the nap box 10 using a wireless communication line such as Wi-Fi or BLUETOOTH (Registered Trademark) (see the control system CSE of the eighth modification in FIG. 9A).

In this case, the mobile device 70 uses dedicated application software for connecting to the nap box 10 as a user interface for communication, and transmits a profile (body type information) related to the user U's body type, such as height and weight, entered through the application software. From another perspective, the control unit 50 receives the body type information and usage time information from the mobile device 70 (S10 in FIG. 9B).

Next, the control unit 50 confirms via the UI 60 that the user U is standing in a fixed position (S20 in FIG. 9B), similar to the case of S20 in the above-described embodiment (see FIG. 3).

Next, the control unit 50 adjusts the relative positions of the support units 210, 220, etc. corresponding to the user U stored in the program PG based on the received body type information using the movement mechanism 250 (S30D in FIG. 9B).

The subsequent control flow is, as shown in FIG. 9B, performed in the same manner as in the seventh modification (see FIG. 8), for example.

In this way, when the user U uses the device, it is possible to omit the adjustment of the relative positions of the support units 210, 220, etc. using the moving mechanism 250 (see, for example, S30 and S32 in FIG. 3), which is performed in the initial operation of the above-mentioned embodiment.

In this modification, the control flow from S40D onwards may be the control flow from S40 onwards in the above-described embodiment (see FIGS. 3, 6 and 7).

[0087]

Ninth Modification

Changes: Capable of connecting to a mobile device (2).

FIG. 10 is a flow chart showing the control flow of the nap box 10F of the ninth modification.

This modification is a further modification of the eighth modification. In the eighth modification, S40D is performed after S30D (see FIG. 9B). In this modification, the following steps are performed between S30D and S40. Specifically, after S30D, in S70, the UI 60 asks the user U whether to fine-tune the relative positions of the support units 210, 220, etc. If the user U wishes to fine-tune the automatically adjusted relative positions of the support units 210, 220, etc. (i.e., if the user U responds yes), the user U inputs this into the UI 60. After a period of use, the UI 60 then asks the user U whether the support positions were optimal. If the user U responds yes, information associating the connected mobile device 70 with the optimal support position may be written to, for example, the first storage section 542 or an external server 80 connected to the mobile device 70 or the nap box 10 via the Internet (S62).

In this way, the optimal support position can be reproduced the next time the user U uses the nap box 10. Particularly, if this information is written to the storage device of the mobile device 70 or the external server 80, it is effective in that the optimal support position can be reproduced even when using the nap box 10 that is available in another location.

[0088]

Tenth Modification

Changes: Capable of connecting to a mobile device (3).

FIG. 11 is a flow chart showing the control flow of a nap box 10G according to the tenth modification.

This modification is a further modification of the ninth modification. In the ninth modification, a subroutine (S50) for measuring the usage time is performed between S40 and S60B (see FIG. 10). However, in this modification, if a negative determination is made in S50, the following steps are performed. Specifically, in S80, it is determined whether the heart rate is equal to or greater than a predetermined heart rate. If the mobile device 70 is, for example, a smartwatch capable of measuring the heart rate, this can be achieved by enabling the smartwatch to communicate with the control unit 50. Here, the predetermined heart rate refers to the upper limit of the heart rate at which the user U is determined to be napping (in REM sleep). If a positive determination is made in S80, i.e., if it is determined that the user U is not napping, the relative positions of the support units 210, 220, etc. are adjusted in S82, i.e., the support positions are fine-tuned.

According to this modification, the support position can be adjusted more appropriately by using information from the mobile device 70 that can measure the heart rate.

[0089]

Eleventh Modification

Changes: Performing personal authentication using a UI.

FIG. 12 is a block diagram of the control system CSH of a nap box 10H according to the eleventh modification.

As shown in FIG.12, in this modification, a UI 60H with a personal authentication function capable of personal authentication is employed instead of the UI 60. Here, personal authentication is, for example, authentication based on face authentication, fingerprint authentication, vocal cord authentication, or a combination of these.

In this modification, when a user U uses the nap box for the second or subsequent time, information about the support position that suited the user at the time of previous use is stored in the storage device 54 or the external server 80 along with the authentication information of user U. Therefore, when user U uses the nap box for the second or subsequent time, this information is retrieved from the storage device 54 or the external server 80 and used.

According to this modification, when using the device for the second time or later, it is not necessary to adjust the support positions of the support units 210, 220, etc., as in the case of the above-described embodiment (see FIG. 3).

[0090]

Twelfth Modification

Changes: Using of AI technology.

FIG. 13A is a block diagram of the control system CSI of the nap box 10I of the twelfth modification.

FIG. 13B is a schematic diagram of the AI model of this modification. FIG. 13C is a flow diagram showing the control flow of the nap box of this modification.

A control unit 50I of this modification is modified by adding a model generating unit 58 to the control unit 50 (see FIG. 9A) of the control system CSE of the eighth modification.

[0091]

Hereinafter, the features of the AI function in this modification will be described with reference to FIG. 13B.

(Training Data)

The training data in this modification includes (1) the heights of multiple users U, each with a different height (leg length), (2) the support posture of each user U when using the nap box (the relative positions of each support units 210, 220, etc.), and (3) information regarding the heart rate obtained by each user U from a mobile device 70 that can measure heart rate, such as a smart watch, which is the actual measured heart rate value after a certain time (for example, 5 minutes) has elapsed since the nap box began to be used.

The actual height measurements are input to the UI 60 by each user U, uploaded from a mobile device 70, or obtained from a height gauge (for example, a non-contact ultrasonic type) attached to the nap box. This information is stored, for example, in the storage device 54 as training data.

(Model Generation Section)

The model generation section 58 generates an estimation model by machine learning, which estimates what supporting posture is optimal for napping for a user U of a certain height, from the accumulated training data, i.e., data on the correlation between height, heart rate, and supporting posture. The program for generating the estimation model is stored in the first storage section 542 as the program PGI in which an AI program including a program for generating the estimation model is added to a program PG for controlling the moving mechanism 250 (see FIG. 13A).

(Control unit 50I (an example of a reception unit and a processing unit))

The control unit 50I receives as input the height and heart rate of the user U from the UI 60 or the mobile device 70. Then, the control unit 50I uses the above-described estimation model to output the optimal supporting posture of the user U from the input received by the control unit 50I from the UI 60 or the mobile device 70.

The above is an explanation of the features of the AI function of this modification.

An invention having the AI characteristics of this modification (for example, an estimation system) can be expressed as follows, as an example.

==========

An estimation system including:

a model generation unit that generates an estimation model by machine learning to estimate a user's posture from his/her height and heart rate using his/her height, the user's posture for that height, and actual measurements of the heart rate obtained from the mobile device as training data;

a reception unit that receives the height and heart rate of the user as input; and

a processing unit that outputs a supporting posture of the user from the input received by the receiving unit using the estimation model.

==========

[0092]

Next, the operation of the nap box of this modification will be described with reference to FIG. 13C.

The initial steps S10D and S20 are the same as those in the eighth modification (see FIG. 9B) and the ninth modification (see FIG. 10).

Next, in S30D, the relative positions of the support units 210, 220, etc. are adjusted by the movement mechanism 250 based on, for example, body type information received from the mobile device 70. In this case, in this modification, a trained model (an estimated model) derived by the AI function described above is used. Here, while the above-mentioned estimation model uses the height and heart rate of the user U as input, in this step, the height and a heart rate corresponding to REM sleep (i.e., a heart rate that has not actually been measured) are used as input. As a result, the optimal support posture (relative positions of the support units 210, 220, etc.) for the user U of that height is derived as output. Based on this result, the control unit 50I operates the movement mechanism 250.

Next, in S40, the timer 56 starts counting.

Next, in S70, the UI 60 asks the user U whether the user U is using the mobile device 70 and whether, if so, the heart rate can be measured. When the user U inputs a positive result to the UI 60, the UI 60 transmits the result to the control unit 50A. Thereafter, in S74I, the control unit 50I starts recording the heart rate while communicating with the mobile device 70 and continues counting the usage time (see S50). The heart rate data transmitted from the mobile device 70 is stored in the storage device 54. The recorded result is used by the model generation unit 58 as new training data to update the estimation model.

In contrast, if the user U inputs a negative result (that is, that the mobile device 70 capable of measuring heart rate is not being used) into the UI 60 in S70, the counting of the usage time continues (see S50).

Then, when the usage time has elapsed, S60B is carried out and the operation of this modification ends.

The above is a description of the operation of this modification.

[0093]

According to this modification, when using the device for the second time or later, it is not necessary to adjust the support positions of the support portions 210, 220, etc., as in the case of the above-described embodiment (see FIG. 3).

In addition, the nap box operating in this modification may be the nap box 10 of the above-mentioned embodiment, and it is also effective in that a more appropriate support posture can be output for support parts other than the second support unit 220, such as the first support unit 210 and the third support unit 230, if the vertical position and tilt angle can be changed (not shown).

[0094]

Thirteenth Modification

(overview)

Changes: Including a swinging mechanism.

Fig. 14A is a schematic diagram illustrating a swinging mechanism 90 included in a nap box 10J according to a thirteenth modification. Fig. 14B is a schematic diagram illustrating the operation of the swinging mechanism 90 included in the nap box 10J.

[0095]

(Configuration, functions and basic operations)

The nap box 10J of this modification further includes the swinging mechanism 90 in addition to the nap box 10 of the above-described embodiment or the nap boxes 10A, 10B, etc. of the modifications.

The swinging mechanism 90 has a function of swinging the first support unit 210, the second support unit 220 and the fourth support unit 240 around the axis CL set between the first support unit 210 and the second support unit 220 relative to the third support unit 230, with the axis CL as the center when viewed from the up and down direction.

[0096]

As shown in FIG.14A, the swinging mechanism 90 has a gear 92 and a power source 94. In this modification, the disk-shaped bottom wall 46 of the above embodiment is changed to a bottom wall 46J. As shown in FIG.14B, an arc-shaped notch NTC is formed in the outer periphery of the bottom wall 46J along the circumferential direction thereof. The outer diameter of the bottom wall 46J is set to be smaller than the outer diameter of the bottom wall 46.

As shown in FIG.14A, the gear 92 is disposed between the base 48 and the bottom wall 46J. As an example, the axis of the gear 92 is set to coincide with the center line CL of the nap box 10. The gear 92 is fixed to the bottom wall 46J and is positioned so as to be rotatable about its axis relative to the base 48.

The power source 94 has a motor 94A and a gear 94B fixed to the shaft of the motor 94A. The gear 94B is disposed in a position where it meshes with the gear 92.

The configuration of the swinging mechanism 90 described above is just one example, and is not limited to the above example, as long as it can achieve the function of swinging the first support unit 210, the second support unit 220, and the fourth support unit 240 around the axis CL set between the first support unit 210 and the second support unit 220 relative to the third support unit 230, with the axis CL as the center when viewed from the up and down direction.

[0097]

In this modification, unlike the previously described embodiment (see FIG. 1C, etc.), the first support unit 210 is fixed to the bottom wall 46 by a shaft 216. Also, unlike the previously described embodiment, the second actuator 254 passes through a notch NTC in the bottom wall 46J and is fixed to the base 48. The first actuator 252 is fixed to the bottom wall 46J, as in the previously described embodiment.

Unlike the previous embodiment, the multiple pillars 260 are fixed to the base 48 (not shown).

[0098]

With the above configuration, the nap box 10J of this modification is configured so that when the power source 94 drives the motor 94A and rotates the gear 94B, the driving force transmitted from the gear 94B rotates the gear 92, which in turn rotates the bottom wall 46J. However, the diameter of the gear 94B is set, for example, to a fraction of the diameter of the gear 92, so that after several rotations of the gear 94B, the gear 92 swings only a set angle (for example, about 25°).

[0099]

(Specific operation and their effects)

Next, a description will be given of the specific operation and effect of the swinging mechanism 90 of this modification. The power source 94 of the swinging mechanism 90 operates under the control of the control unit 50.

[0100]

"First Example"

For example, after the user U starts using the nap box 10J, the control unit 50 rotates the power source 94 several times in both the forward and reverse directions at predetermined timings during the period until the usage time (the usage time counted by the timer 56 stored in the second storage section 544) has elapsed. Accordingly, the first support unit 210, the second support unit 220, and the fourth support unit 240 swing about the axis CL relative to the third support unit 230. As a result, the upper half of the sleeping user U swings relative to the lower half of the sleeping user U. This allows the user U to take a nap while being stretched.

[0101]

"Second Example"

For example, when the user U's usage time of the nap box 10J (the usage time counted by the timer 56 stored in the second storage section 544) has elapsed, the control unit 50 rotates the power source 94 several times in both the forward and reverse directions at a predetermined timing. Accordingly, the first support unit 210, the second support unit 220, and the fourth support unit 240 swing around the axis CL relative to the third support unit 230. As a result, the upper body of the user U who is napping swings relative to the lower body. This allows the user U to stretch after taking a nap in a predetermined position.

The second example is the same as the sixth modification (see FIG. 7), except that S60C is a swinging operation.

[0102]

(Further modification of the thirteenth modification)

In addition to or instead of controlling the relative positions of the support sections 210, 220, 230, and 240 by the movement mechanism 250 in the above-described modifications, a swinging operation by the swinging mechanism 90 may be performed.

In this case, the swinging operation may be performed simultaneously with the relative position control operation, or may be performed at different timings.

Furthermore, a questionnaire regarding the comfort of the swinging action (swinging speed, timing, swinging angle, etc.) is conducted for the ninth modification (see FIG. 9) and the tenth modification (see FIG. 10), and if the user U answers that it is optimal, information relating the connected mobile device 70 to the optimal support position may be written, for example, to the first storage section 542, or to an external server 80 connected to the mobile device 70 or the nap box 10 via the Internet (S62, S62D).

[0103]

The above is a description of several modifications.

[0104]

As described above, the present invention has been described using the above-described embodiment and several modifications as an example of the present invention, but aspects included in the technical scope of the present invention are not limited to the above-described embodiment and several modifications. The technical scope of the present invention also includes the following aspects.

For example, some components, control methods, etc. of one embodiment or one of the modifications may be replaced with parts of another embodiment. Furthermore, some components, control methods, etc. of another embodiment may be added to one embodiment or one of the modifications. That is, the embodiments and modifications may be combined or interchanged with each other. Specifically, a configuration (not shown) may be formed by combining the nap box 10A of the fourth modification (see FIG. 5) with the first modification (a configuration without the multiple sensors 30).

[0105]

In the above-described embodiment, the third support unit 230 supports the user U from the front in the front and rear direction by contacting one or both of the user U's upper limbs and head so that the upper limbs and head are positioned in a predetermined range in front of the user U in the front and rear direction (see FIG. 1D). However, the third support unit 230 may have a function of supporting the user U from at least one side in the front and rear direction by contacting one or both of the user U's upper limbs and head so that the upper limbs and head are positioned in a predetermined range in the front and rear direction. For example, the third support unit may support the user U from at least the rear in the front and rear direction by contacting at least the back of the head or neck so that the upper half of the user U's body is positioned in a predetermined range behind the user U in the front and rear direction.

Furthermore, the third support unit 230 may be arranged at a position higher than the first support unit 210 and the second support unit 220, and may be in contact with at least one of the upper limbs, head, and upper body of the human body so that the upper limbs and head of the human body are positioned within a predetermined range in the front and rear direction, thereby supporting the human body from at least one side in the front and rear direction. For example, the third support unit 230 may not include the head support portion 238 and may be composed of only the upper limb support portion 234.

[0106]

Furthermore, in the above description of the thirteenth modification, the first actuator 252 is fixed to the bottom wall 46J, and the second actuator 254 and the multiple pillars 260 are fixed to the base 48, so that the first support portion 210, the second support portion 220, and the fourth support portion 240 swing about the axis CL relative to the third support portion 230. However, the second actuator 254 and the multiple pillars 260 may be fixed to the bottom wall 46J, and the first actuator 252 may be fixed to the base 48.

Explanation of symbols

[0107]

10	nap box (an example of a support device)
10A	nap box (an example of a support device)
10B	nap box (an example of a support device)
10C	nap box (an example of a support device)
10D	nap box (an example of a support device)
10E	nap box (an example of a support device)
10F	nap box (an example of a support device)
10G	nap box (an example of a support device)
10H	nap box (an example of a support device)
10I	nap box (an example of a support device)
10J	nap box (an example of a support device)
20	support mechanism
210	first support unit
212	base
214	cushion
220	second support unit
220A	second support unit
220A1	shaft
220A2	cylindrical member
220A3	cushion
222	seat
222A	base

222B	cushion
224	link mechanism
224A	link
224B	joint
230	third support unit
232	mounting portion
234	upper limb support portion
234A	base
234B	cushion
236	connecting portion
238	head support portion
238A	board
238B	cushion
240	fourth support unit
250	movement mechanism
252	first actuator
254	second actuator
260	pillars
30	multiple sensors
32	first sensor
34	second Sensor
36	third Sensor
38	fourth sensor
40	housing
42	ceiling wall
44	surrounding walls
442	door
46	bottom wall
46J	bottom wall

48	base
50	control unit
50I	control unit
52	arithmetic device
54	storage device
542	first storage section
544	second storage section
56	timer
58	model generation unit
60	user interface (UI)
60A	UI with personal authentication function
70	mobile device
80	external server
90	swinging mechanism
92	gear
94	power source
94A	motor
94B	gear
CL	center line
CS	control system
CSE	control system
CSH	control system
CSI	control system
HG	hinge
NTC	notch
PG	program
PGI	program
U	User

Claims

1. A support device that supports a user who is taking a nap or resting in a standing position, the support device comprising:

a first support unit having an inclined surface facing upward in the up and down direction and contacting one or both of the knee and the lower leg of the human body from a front side of the human body to support the human body from below;

a second support unit that is disposed at a position different from that of the first support unit when viewed from the up and down direction and that contacts one or both of the buttocks and the upper thighs of the human body from a rear side of the human body to support the human body from below;

a third support unit that is disposed at a position higher than the first support unit and the second support unit, and that contacts at least one of the upper limbs, the head, and the upper body of the human body so that the upper limbs and the head of the human body are disposed within a predetermined range in the front and rear direction, thereby supporting the human body from at least one side in the front and rear direction;

a fourth support unit that is disposed below the first support unit and the second support unit and that is closer to the second support unit in the front and rear direction than the first support unit when viewed from the up and down direction, and that contacts the soles of the feet of the human body to support the human body from below so that the feet of the human body are inclined with respect to the up and down direction;

a moving mechanism that moves one or two of the first support unit, the second support unit, and the fourth support unit in the up and down direction relative to the one or one other than the two of the first support unit, the second support unit, and the fourth support unit; and

a control unit that controls the movement mechanism.

2. The support device of claim 1, wherein

the third support unit includes: (1) an upper limb support unit that is disposed above the first support unit in the up and down direction and supports the upper limbs of the human body from below; and, (2) a head support unit that is disposed above the upper limb support unit in the up and down direction and contacts the forehead of the human body to support the head from the front in the front and rear direction.

3. The support device of claim 2, wherein

the moving mechanism moves the head support unit relative to the upper limb support unit in the up and down direction and the front and rear direction.

4. The support device according to any one of claims 1 to 3, the support device further comprising:

a swinging mechanism controlled by the control unit, which swings the first support unit and the second support unit relative to the third support unit around an axis set between the first support unit and the second support unit when viewed from the up and down direction.

5. The support device according to any one of claims 1 to 4, wherein

the control unit has a timer that counts a usage time used by the user, and

the control unit controls the moving mechanism so that, when the usage time has elapsed after a predetermined time, the second support unit, the upper limb support unit, and the head support unit move relative to the first support unit in the up and down direction with the same waveform and phase.

6. The support device of claim 4, wherein

the control unit has a timer that counts a usage time used by the user, and

the control unit controls the swinging mechanism so that the first support unit, the second support unit, and the fourth support unit swing around the axis relative to the third support unit during a period until the usage time has elapsed.

7. The support device of claim 4, wherein

the control unit has a timer that counts a usage time used by the user, and

the control unit controls the swinging mechanism so that the first support unit, the second support unit, and the fourth support unit swing around the axis relative to the third support unit when the usage time has elapsed a predetermined time.

8. The support device according to any one of claims 1 to 7, the support device further comprising:

multiple sensors are communicatively connected to the control unit; attached respectively to the first support unit, the second support unit, and the third support unit; and each measure the load or pressure received from a human body in contact therewith, wherein

the control unit controls the moving mechanism so that a ratio of the measurement values of the multiple sensors falls within a predetermined ratio range.

9. The support device of claim 8, the support device further comprising:

a user interface communicatively connected to the control unit and configured to transmit a request from a user to the control unit, wherein

wherein when a request to start use is transmitted from the user via the user interface, the control unit controls the movement mechanism so that a ratio of the measurement values of the multiple sensors falls within the range of the determined ratio.

10. The support device of claim 9, wherein

the control unit controls the movement mechanism when a usage time request is transmitted from the user via the user interface and the usage time has elapsed, so that a ratio of the measurement values of the multiple sensors that is within the range of the defined ratio goes out of the range of the defined ratio.

11. The support device of claim 8, wherein

the control unit controls the movement mechanism so that a ratio of the measurement values of the multiple sensors varies within the determined ratio range during a period from when the usage time request is transmitted from the user via the user interface until the usage time has elapsed.

12. The support device according to any one of claims 1 to 4, wherein

the second support unit has a seat that contacts one or both of the buttocks and the upper legs of the human body and a link mechanism that connects the seat and the moving mechanism, wherein

the seat is moved upward by the moving mechanism so as to change its posture so as to widen an angle formed between the seat and the link along the up and down direction.

13. A program for controlling the support device according to any one of claims 1 to 3, which causes the control unit to execute:

a measurement function that causes the multiple sensors to measure the load or pressure received from a human body;

a movement function that controls the movement mechanism to move the second support unit relative to the first support unit in the up and down direction so that a ratio of the measurement values of the multiple sensors is within a predetermined ratio range; and

a swinging function that controls the swinging mechanism to swinging one or both of the first support unit, the second support unit, and the fourth support unit, and the third support unit around the axis so that the first support unit, the second support unit, and the fourth support unit swinging relative to the third support unit.

14. A program for controlling the support device according to claim 4, which causes the control unit to execute:

a measurement function that causes the multiple sensors to measure the load or pressure received from a human body;

a movement function that controls the movement mechanism to move the second support unit relative to the first support unit in the up and down direction so that the ratio of the measurement values of the multiple sensors is within a predetermined ratio range;

a swinging function that controls the swinging mechanism to swing one or both of the first support unit, the second support unit, and the fourth support unit, or the third support unit, around the axis so that the first support unit, the second support unit, and the fourth support unit swinging relative to the third support unit.