

[DESCRIPTION]

[Title of Invention] ENVIRONMENTAL CONTROL SYSTEM,
ENVIRONMENTAL CONTROL METHOD, AND PROGRAM

[Technical Field]

5 [0001]

The present invention relates to an environmental control system, an environmental control method, and a program.

[Background Art]

[0002]

10 Patent Literature (PTL) 1 discloses an audio illumination apparatus. The audio illumination apparatus includes an illumination unit, an audio output unit, a setting unit, and a control unit. The setting unit sets a parameter of at least one of illumination of the illumination unit or audio output of the audio
15 output unit in accordance with a recognized user who is in a neighborhood. The control unit controls the at least one of the illumination of the illumination unit or the audio output of the audio output unit in accordance with the parameter set by the setting unit.

[Citation List]

20 [Patent Literature]

[0003]

[PTL 1] Japanese Unexamined Patent Application Publication No. 2014-093204

[Summary of Invention]

25 [Technical Problem]

[0004]

The present invention relates to an environmental control system, an environmental control method, and a program that easily increase user satisfaction.

30 [Solution to Problem]

[0005]

An environmental control system according to an aspect of the present invention includes a lighting controller and a sound controller. The lighting controller controls one or more lighting devices of each
35 of a plurality of groups. The sound controller controls one or more

sound devices of each of the plurality of groups. The plurality of groups include a first group and a second group. The lighting controller causes the one or more lighting devices of the first group to emit illumination light having a color temperature greater than a reference color temperature, and causes the one or more lighting devices of the second group to emit illumination light having a color temperature less than the reference color temperature. The sound controller causes the one or more sound devices of the first group to play a specific sound.

10 [0006]

An environmental control method according to an aspect of the present invention includes controlling one or more lighting devices and controlling one or more sound devices. The controlling of the one or more lighting devices includes controlling one or more lighting devices of each of a plurality of groups. The controlling of the one or more sound devices includes controlling one or more sound devices of each of the plurality of groups. Among the plurality of groups, two or more groups include a first group and a second group. The controlling of the one or more lighting devices includes causing the one or more lighting devices of the first group to emit illumination light having a color temperature greater than a reference color temperature, and causing the one or more lighting devices of the second group to emit illumination light having a color temperature less than the reference color temperature. The controlling of the one or more sound devices includes causing the one or more sound devices of the first group to play a specific sound.

[0007]

A program according to an aspect of the present invention causes one or more processors to execute the above-described environmental control method.

[Advantageous Effects of Invention]

[0008]

An environmental control system, an environmental control method, and a program according to the present invention have the advantageous effect of easily increasing user satisfaction.

[Brief Description of Drawings]

[0009]

[FIG. 1]

FIG. 1 is a diagram illustrating a schema of an office for which
5 an environmental control system according to an embodiment is
used.

[FIG. 2]

FIG. 2 is a block diagram illustrating a functional configuration
of the environmental control system according to the embodiment.

10 [FIG. 3]

FIG. 3 is a graph illustrating a result of an experiment for
evaluating lighting control and sound control.

[FIG. 4]

FIG. 4 is a flowchart illustrating an operation example of the
15 environmental control system according to the embodiment.

[FIG. 5]

FIG. 5 is a block diagram illustrating a functional configuration
of an environmental control system according to Variation 1 of the
embodiment.

20 [FIG. 6]

FIG. 6 is a block diagram illustrating a functional configuration
of an environmental control system according to Variation 2 of the
embodiment.

[Description of Embodiments]

25 [0010]

Hereinafter, an embodiment will be described in detail with
reference to the Drawings. It should be noted that the embodiment
described below shows a general or specific example of the present
invention. The numerical values, shapes, materials, constituent
30 elements, the arrangement and connection of the constituent
elements, steps, the processing order of the steps etc. shown in the
embodiment below are mere examples, and therefore do not limit the
scope of the present invention. Moreover, among the constituent
elements in the embodiment below, constituent elements not recited
35 in any one of the independent claims are described as arbitrary

constituent elements.

[0011]

It should be noted that the Drawings are schematic drawings, and are not necessarily exact depictions. Moreover, elements that are essentially the same share the same reference signs in the respective Drawings, and overlapping explanations thereof may be omitted or simplified.

[0012]

[Embodiment]

10 [Configuration]

First, a configuration of environmental control system 100 according to an embodiment will be described. FIG. 1 is a plan view illustrating a schema of an office for which environmental control system 100 according to the present embodiment is used. FIG. 2 is a block diagram illustrating a functional configuration of environmental control system 100 according to the present embodiment.

[0013]

Environmental control system 100 according to the present embodiment is a system that is used in an environment, such as an office, in which people may freely choose a work place according to their own work, for example, and is used for controlling such an environment. In the present embodiment, environmental control system 100 is assumed to be used for an Activity Based Working (ABW) style office. Here, "ABW" means a kind of working style that allows users (e.g., employees) to choose a work place, a desk, or the like, according to their own work. In such an ABW style office, when a user takes on a task requiring concentration, the user can choose a relatively quiet place; moreover, when a user holds a meeting, the user can choose a relaxing place such as a sofa.

[0014]

It should be noted that the use of environmental control system 100 is not limited to an ABW style office. Environmental control system 100 may be used for a non-territorial office (free-address office) or other environments as long as users can

freely choose a work place according to their own work. For example, environmental control system 100 may be used for an educational facility such as an elementary school, a junior high school, a high school, or a university; a public facility such as a public hall or a library; or a store or a commercial facility.

[0015]

As illustrated in FIG. 2, environmental control system 100 includes lighting controller 11, sound controller 12, and storage 13. It should be noted that it is sufficient for environmental control system 100 to include at least lighting controller 11 and sound controller 12, and environmental control system 100 does not necessarily include storage 13.

[0016]

Moreover, as illustrated in FIG. 1, lighting devices 1 and sound devices 2 are provided in an environment (here, ABW style office 3) for which environmental control system 100 is used. Environmental control system 100 may be provided in office 3 or in a remote location away from office 3.

[0017]

Each lighting device 1 is located on a ceiling in office 3. Needless to say, each lighting device 1 may be located on a wall, a floor, or a desk in office 3, other than the ceiling. In the present embodiment, as an example, each lighting device 1 is a light for general lighting as ambient lighting that uniformly illuminates a target space, and includes a light source including a solid light-emitting element such as a light-emitting diode (LED). Moreover, the light source of each lighting device 1 is configured to be controlled by lighting controller 11 to enable either one or both of dimming and color-change of light.

[0018]

Lighting devices 1 are grouped into groups G1. In the example illustrated in FIG. 1 and FIG. 2, lighting devices 1 are grouped into three groups G1. Of course, the number of groups G1 is not limited to three, and may be two, four, or more. Here, one or more lighting devices 1 in the same group G1 are located close to one

another. Then, one or more lighting devices 1 in the same group G1 illuminate a space corresponding to the same group G1 in office 3.
[0019]

For example, three groups G1 are assumed to be group A,
5 group B, and group C. In this case, one or more lighting devices 1 in group A illuminate space α corresponding to group A in office 3, one or more lighting devices 1 in group B illuminate space β corresponding to group B in office 3, and one or more lighting devices 1 in group C illuminate space γ corresponding to group C in office 3.

10 [0020]

For example, a manager of environmental control system 100 carries out grouping of lighting devices 1 into groups G1 beforehand. The manager carries out the grouping by using an information terminal with which parameters of environmental control system 100
15 can be set, for example. Examples of the information terminal may include a smartphone, a tablet device, and a personal computer.

[0021]

It should be noted that, in office 3, adjacent spaces may be, but is not necessarily, partitioned. In the present embodiment,
20 office 3 is assumed to be composed of one large room in which no other room is created by partitioning with a wall or equipment. Such office 3 is preferred since an enhanced view and improved design is provided.

[0022]

Moreover, in the present embodiment, light emitted from one
25 or more lighting devices 1 provided in one of adjacent two spaces needs not precisely illuminate only the one of the adjacent two spaces and is allowed to partially reach the other of the adjacent two spaces. In other words, it is sufficient that light emitted from one or
30 more lighting devices 1 corresponding to an arbitrary space mainly illuminate the arbitrary space. Even if light from an other space partially reaches the arbitrary space, such light is allowable as long as the light from the other space has almost no influence on the arbitrary space. This is because the light from the other space that
35 is different from the arbitrary space has only a small influence on the

view of a user using the arbitrary space or a work environment of the user.

[0023]

Each sound device 2 is located on a ceiling in office 3.
5 Needless to say, each sound device 2 may be located on a wall, a floor, or a desk in office 3, other than the ceiling. In the embodiment, each sound device 2 is an omnidirectional loudspeaker as an example, and plays content transmitted from sound controller 12. It should be noted that each sound device 2 may be a directional loudspeaker
10 such as a parametric loudspeaker, a loudspeaker using ultrasonic waves, or a loudspeaker including an enclosure having a horn-like structure. A directional loudspeaker is preferred because a degree to which a portion of sound from the directional loudspeaker is audible in the outside of a space corresponding to the directional
15 loudspeaker can be easily reduced when the directional loudspeaker is used.

[0024]

Sound devices 2 are grouped into groups G1, similar to lighting devices 1. In the example illustrated in FIG. 1 and FIG. 2,
20 sound devices 2 are grouped into three groups G1. Here, one or more sound devices 2 in the same group G1 are located close to one another. Then, one or more sound devices 2 in the same group G1 output sound to a space corresponding to the same group G1 in office 3.

25 [0025]

For example, three groups G1 are assumed to be group A, group B, and group C. In this case, one or more sound devices 2 in group A output sound to space α corresponding to group A in office 3, one or more sound devices 2 in group B output sound to space β
30 corresponding to group B in office 3, and one or more sound devices 2 in group C output sound to space γ corresponding to group C in office 3.

[0026]

Similar to lighting devices 1, a manager of environmental
35 control system 100 carries out grouping of sound devices 2 into

groups G1 beforehand using an information terminal.

[0027]

In the embodiment, it should be noted that sound outputted from one or more sound devices 2 that is provided in one of adjacent two spaces needs not be outputted to only the one of the adjacent two spaces, and is allowed to be partially audible in the other of the adjacent two spaces. In other words, it is sufficient that sound outputted from one or more sound devices 2 corresponding to an arbitrary space be mainly audible in the arbitrary space. Even if sound from another space is partially audible in the arbitrary space, such sound is allowable as long as the sound has almost no influence on the arbitrary space.

[0028]

Lighting controller 11 can communicate with each lighting device 1 and controls either one or both of dimming and color-change of light of each lighting device 1 by transmitting a lighting control signal to each lighting device 1. In other words, lighting controller 11 controls one or more lighting device 1 of each of plurality of groups G1. In the present embodiment, lighting controller 11 transmits identical lighting control signals to one or more lighting devices 1 in the same group G1. In other words, lighting controller 11 controls one or more lighting devices 1 by each group G1. The communication between lighting controller 11 and each lighting device 1 may be wired or wireless communication, and communication standards are not particularly limited. Moreover, the identical lighting control signals need not be transmitted at the exactly same time. A transmission time difference among the identical lighting control signals is preferably 60 minutes or less, more preferably 30 minutes or less, and further more preferably one minute or less. The transmission time difference is preferably 60 minutes or less because it is more laborsaving compared to when an environment of a space is changed by moving equipment or furniture with manpower.

[0029]

Furthermore, the identical lighting control signals transmitted

from lighting controller 11 to one or more lighting devices 1 in the same group G1 need not be exactly identical. A slight difference in the content of control among the identical lighting control signals is allowable as long as the slight difference has only a small influence on the corresponding space. For example, the tolerance of a color temperature is ± 500 K and the tolerance of a dimming rate is ± 20 %.

[0030]

Sound controller 12 can communicate with each sound device 2 and causes each sound device 2 to play content by transmitting a sound control signal (including the content to be played) to each sound device 2. In other words, sound controller 12 controls one or more sound devices 2 of each of plurality of groups G1. In the embodiment, sound controller 12 transmits identical sound control signals to one or more sound devices 2 in the same group G1. In other words, sound controller 12 controls each sound device 2 by each group G1. The communication between sound controller 12 and each sound device 2 may be wired or wireless communication, and communication standards are not particularly limited.

[0031]

Moreover, the content may be stored in sound controller 12, each sound device 2, or storage 13. The content is stored in an electronic data medium in a WAV format or mp3 format, for example; however, the present invention is not limited to this example. For example, the content may be stored in a compact disc (CD) or the like by any well-known method.

[0032]

Storage 13 is a storage device in which information (computer program and so on) necessary for lighting controller 11 and sound controller 12 to perform control is stored. For example, storage 13 is implemented by a hard disk drive (HDD); however, storage 13 is not limited to this example and may be implemented by a semiconductor memory or other well-known electronic information storage means. Storage 13 stores information regarding a lighting schedule to be referred to by lighting controller 11 and information regarding a sound schedule to be referred to by sound controller 12.

[0033]

Lighting controller 11, sound controller 12, and storage 13 may be mounted on a single substrate or accommodated in a single case. The above-described substrate or case may be provided to
5 equipment or furniture, such as a ceiling, a wall, a floor, or a desk, in office 3. In such a case, environmental control system 100 is made small and is therefore preferred.

[0034]

[Control in First Group and Second Group]

10 Here, in the present embodiment, groups G1 include first group G11 and second group G12. The number of first groups G11 may be one, two, or more. Similarly, the number of second groups G12 may be one, two, or more. For example, first group G11 and
15 second group G12 may be determined by a manager of environmental control system 100, using an information terminal; may be determined according to a schedule as described below; or may be determined based on information obtained by obtainer 14 (a first obtainer, a second obtainer, or a third obtainer) as described below. Lighting controller 11 controls one or more lighting devices
20 1 in first group G11 and one or more lighting devices 1 in second group G12 as below.

[0035]

Specifically, lighting controller 11 causes one or more lighting devices 1 of first group G11 to emit illumination light having a color
25 temperature greater than a reference color temperature. Moreover, lighting controller 11 causes one or more lighting devices 1 of second group G12 to emit illumination light having a color temperature less than the reference color temperature. Thus, the color temperature of light to be emitted to a space corresponding to first group G11 is
30 differentiated from the color temperature of light to be emitted to a space corresponding to second group G12; therefore, a so-called zoning effect can be expected.

[0036]

In the example illustrated in FIG. 1, among three groups G1,
35 group G1 at the lower left of office 3 is determined as first group G11

and group G1 at the upper right of office 3 is determined as second group G12. Accordingly, a space corresponding to first group G11 at the lower left of office 3 is a space in which the color temperature of the illumination light is greater than the reference color temperature, and a space corresponding to second group G12 at the upper right of office 3 is a space in which the color temperature of the illumination light is less than the reference color temperature. In FIG. 1, a density of dots in each of dot-hatched areas represents a color temperature level. The dot-hatched area having a lower density of dots represents a higher color temperature, and the dot-hatched area having a higher density of dots represents a lower color temperature.

[0037]

It should be noted that, in the present embodiment, lighting controller 11 causes one or more lighting devices 1 of group G1 that is not determined as either first group G11 or second group G12 to emit illumination light having the reference color temperature. Accordingly, in the example illustrated in FIG. 1, the color temperature of the illumination light in a space at the lower right of office 3 is the reference color temperature.

[0038]

Here, for example, the zoning effect means perceivable division of a space into spaces and may include an effect of enabling a user to easily perceive that the spaces are different from one another in appearance. Moreover, the zoning effect may include an effect of easily prompting a user to change, as intended by zoning, the user's behavior or movement according to the user's perception. For example, it is assumed that zoning is performed with the intention of making an arbitrary space suitable for a user to take on a task requiring concentration. In such a case, it can be said that the zoning effect is exerted when a user who has seen the arbitrary space comes to use the arbitrary space mainly for the purpose of taking on a task requiring concentration.

[0039]

Moreover, the zoning effect may include an effect of causing a

user to have a tendency to feel: a user's subjective effect or feeling according to the purpose of zoning; or a physiological, psychological, or physical effect according to the purpose of zoning, when the user actually uses a space resulting from zoning. For example, it is assumed that zoning is performed for the purpose of making an arbitrary space suitable for a user to take on a task requiring concentration, and the arbitrary space is used by a user. In such a case, it can be said that the zoning effect is exerted when the user feels that the user has successfully concentrated on the user's task by using the arbitrary space or when an index or data regarding a psychological or physical effect indicating that the user has concentrated on the user's task is obtained.

[0040]

By performing lighting control as described above, a space can be zoned into spaces without using equipment or furniture. Therefore, the design of the spaces can be easily improved; moreover, the layout of office 3 can be changed immediately by lighting control such as dimming or color-change of light, that is, so-called active zoning is made possible. In other words, when zoning is performed by the above-described lighting control, a change of control parameters for dimming or color-change of light in each of the spaces will be completed in a few seconds, for example. In such a case, consequently, it is possible to change the layout of office 3 in a few seconds. Here, when the layout of office 3 is changed by moving equipment or furniture with manpower, it may take 60 minutes, a few hours, one day, or in some cases, several days. In view of the above, zoning by the above-described lighting control may exert a significant effect.

[0041]

By active zoning, the layout of office 3 can be changed in a short cycle, such as every hour, every day, or every month, compared to a conventional way in which the layout of office 3 is changed by rearranging equipment or furniture.

[0042]

In the present embodiment, the reference color temperature is

3500 K. Accordingly, lighting controller 11 causes one or more lighting devices 1 of first group G11 to emit illumination light having a color temperature greater than 3500 K, that is, a cool color temperature, in the space corresponding to first group G11. As an example, the color temperature of the illumination light in the space corresponding to first group G11 is preferably 5000 K to 7000 K. In contrast, lighting controller 11 causes one or more lighting devices 1 of second group G12 to emit illumination light having a color temperature less than 3500 K, that is, a warm color temperature, in the space corresponding to second group G12. As an example, the color temperature of the illumination light in the space corresponding to second group G12 is preferably 2500 K to less than 3500 K.

[0043]

Such control can provide a space in which a user can relatively easily concentrate, in the space corresponding to first group G11. Moreover, a space in which a user can relatively easily relax can be provided in the space corresponding to second group G12.

[0044]

In order to enhance the zoning effect, it is preferred that a significant difference exist between the color temperature of the illumination light in the space corresponding to first group G11 and the color temperature of the illumination light in the space corresponding to second group G12, to the extent that a user can visually or subconsciously perceive the significant difference. For example, a difference between the color temperature of the illumination light in the space corresponding to first group G11 and the color temperature of the illumination light in the space corresponding to second group G12 is preferably 1000 K or more, and more preferably 2000 K or more.

[0045]

In the present embodiment, in order to further enhance the above-described zoning effect, sound controller 12 causes one or more sound devices 2 of first group G11 to play a specific sound. In other words, sound controller 12 causes one or more sound devices 2 of first group G11 to play, in the space corresponding to first group

G11, a specific sound at a sound volume at which a user in the space corresponding to first group G11 can perceive the specific sound.

[0046]

The specific sound is preferably a sound that can be expected to provide a zoning effect similar to the zoning effect that is expected to result from illumination light. It is because such a sound is likely to exhibit an effect that is superior to the mere sum of the zoning effect expected to result from sound and the zoning effect expected to result from illumination light, and therefore an unpredictable but preferred synergistic effect is likely to be achieved. The details will be described in [Verification of Zoning Effect] below.

[0047]

For example, the specific sound is a sound that is likely to stimulate the parasympathetic nervous system of a user. In the present embodiment, the specific sound is a white noise, as an example. Here, the "white noise" means a sound having a sound pressure of a certain level or more in a wide frequency range. Moreover, the specific sound is a natural environmental sound, as an example. Here, the "natural environmental sound" means a voice and a sound, which is other than music, in a daily environment in nature, such as a sound of wind, a sound of waves, a sound of thunder, a sound of an animal, or a sound of an insect. In the present embodiment, the natural environmental sound is preferably a bird chirping sound or a water flowing sound. Additionally, the specific sound may include a sound other than the white noise and the natural environmental sound. For example, the specific sound may be a sound of hustle and bustle in an urban area or a shop (such as a coffeehouse). The zoning effect resulting from the specific sound will be described in details in [Verification of Zoning Effect] below.

[0048]

In the space corresponding to first group G11, such control can provide a space in which an effect of further improving user's concentration can be expected, as compared with the case where only illumination light from one or more lighting devices 1 is

provided.

[0049]

[Control According to Schedule]

Here, in the present embodiment, each of lighting controller 11 and sound controller 12 performs control according to a predetermined schedule unless there is a real-time instruction from a manager of environmental control system 100. Specifically, lighting controller 11 controls one or more lighting devices 1 of each of groups, according to a predetermined lighting schedule. Moreover, sound controller 12 controls one or more sound devices 2 of each of the groups, according to a predetermined sound schedule. The lighting schedule and the sound schedule are set by the manager of environmental control system 100, for example.

[0050]

For example, the lighting schedule is a schedule from the start time to the end time of working hours on an arbitrary day, and is divided into time periods. In each of the time periods, among two or more groups G1 of the plurality of groups G1, at least one group G1 is determined as first group G11 and at least remaining one group G1 is determined as second group G12.

[0051]

Similar to the lighting schedule, for example, the sound schedule is a schedule from the start time to the end time of working hours on an arbitrary day, and is divided into time periods. In each of the time periods, among two or more groups G1 of the plurality of groups G1, at least one group G1 is determined as first group G11 and at least remaining one group G1 is determined as second group G12.

[0052]

For example, lighting controller 11 and sound controller 12 perform control so that the proportion of the number of first groups G11 in the total number of groups G1 becomes higher than the proportion of the number of second groups G12 in the total number of groups G1 in the morning, according to the lighting schedule and the sound schedule. Moreover, lighting controller 11 and sound

controller 12 perform control so that the proportion of the number of first groups G11 in the total number of groups G1 becomes lower than the proportion of the number of second groups G12 in the total number of groups G1 in the afternoon, according to the lighting schedule and the sound schedule. Such control can provide, in the morning, a greater number of spaces in which a user can easily concentrate, that is, work efficiency of a user can be easily improved, and can also provide, in the afternoon, a greater number of spaces in which a user can easily relax, that is, a user can easily communicate with other users.

[0053]

Such control according to the schedule can provide a user with a space in which a zoning effect as desired by a manager of environmental control system 100 can be expected, without a real-time instruction from the manager.

[0054]

It should be noted that when control is performed according to the schedule, first group G11 and second group G12 need not exist simultaneously during a predetermined time period, for example. In other words, first group G11 and second group G12 need not exist simultaneously during all the time periods. As an example, all of groups G1 may be determined as second groups G12 during a time period that is close to the end time of working hours. In this case, since a user is likely to be exposed to a warm color illumination environment, the user can easily notice, in a direct or subconscious manner, that the end time of working hours is approaching. Consequently, the user is likely to be prompted to go home and an effect of reducing overtime can be expected.

[0055]

[Verification of Zoning Effect]

The inventors or the like of the present application carried out an experiment for verifying a zoning effect resulting from the combination of a color temperature and a specific sound, as below. Specifically, a plurality of (here, ten) subjects were assembled in an experimental space (here, a room in an office), and asked to perform

a predetermined task (here, typing using a personal computer for one minute) under various conditions for the experimental space. Then, each of the subjects responded to a questionnaire that asked the subject about the subject's impression of the experimental space for each of the conditions.

[0056]

The experimental space was provided with desks. Each of the subjects performed typing using a personal computer (here, a laptop computer) on any one of the desks. Moreover, lights for general lighting that uniformly illuminate the entire experimental space were provided on a ceiling of the experimental space. Furthermore, a spotlight that locally illuminates a corresponding desk was provided on each of the desks.

[0057]

Each of the conditions for the experimental space was a combination of one of four illumination conditions regarding illumination and one of four sound conditions regarding sound. Namely, the experiment was carried out under 16 conditions in total.

[0058]

The four illumination conditions are following (A1) to (A4). (A1) is controlling each of the lights for general lighting to cause the color temperature of the illumination light to be 3000 K and the illuminance of the experimental space to be 800 lx. (A2) is controlling each of the lights for general lighting to cause the color temperature of the illumination light to be 3500 K and the illuminance of the experimental space to be 800 lx. (A3) is controlling each of the lights for general lighting to cause the color temperature of the illumination light to be 5000 K and the illuminance of the experimental space to be 800 lx. (A4) is controlling each of the spotlights to cause the color temperature of the illumination light to be 3500 K and the illuminance of the central part of each of the desks to be 1200 lx.

[0059]

The four sound conditions are following (B1) to (B4). (B1) is not playing any sound, that is, no sound being played in the

experimental space. (B2) is playing a natural environmental sound such as a murmur of a stream in the experimental space. (B3) is playing jazz in the experimental space. (B4) is playing music for meditation in the experimental space. The music for meditation is music that is played in a practice of meditation or yoga and is so-called healing music.

[0060]

In the questionnaire to each of the subjects, a degree of user preference for the experimental space, that is, user dependence on the experimental space was asked. Specifically, each of the subjects was asked about the degree of user preference for the experimental space, using a seven-level grading scale: (a) extremely like, (b) quite like, (c) slightly like, (d) neither like nor dislike, (e) slightly dislike, (f) quite dislike, and (g) extremely dislike.

[0061]

Then, the inventors or the like of the present application quantitatively evaluated the conditions for the experimental space, based on the result of the questionnaire to each of the subjects. Specifically, the seven-level grading scale was treated as an interval scale, and scalar values of 7 to 1 were given to the above-described (g) to (a), respectively, in the response obtained by the questionnaire. Then, an evaluation function for evaluating the experimental space was defined as equation (1) below, and a score $V(m)$ was determined for each of the conditions for the experimental space by equation (2) using the evaluation function.

[0062]

In equations (1) and (2) below, " $f(n,m)$ " denotes the evaluation function and " v " denotes the scalar value. Moreover, in equations (1) and (2) below, " n " denotes a number assigned to each of the subjects, " N " denotes the total number of subjects, and " m " denotes a number assigned to each of the combinations of the illumination conditions and the sound conditions. Here, since the total number of the subjects was ten, " N " is 10 and " n " may be a natural number of 1 to 10. Moreover, here, since there were 16 combinations of the illumination conditions and the sound conditions

in total, “m” may be a natural number of 1 to 16.

[0063]

In equation (2) below, “4” is subtracted in order to establish “score $V(m) = 0$ ” when the subjects do not particularly have a good or bad impression of the experimental space, that is, when the above-described degree of user preference is (d). Accordingly, the maximum value of a score $V(m)$ is “3” and the minimum value of a score $V(m)$ is “-3”. For example, a score $V(m)$ being the maximum value means that all of the subjects have an impression that they “extremely like” the experimental space. In contrast, a score $V(m)$ being the minimum value means that all of the subjects have an impression that they “extremely dislike” the experimental space.

[0064]

[Math. 1]

$$f(n, m) = v \quad \dots (1)$$

$$V(m) = \frac{\sum_{n=1}^N f(n, m)}{N} - 4 \quad \dots (2)$$

[0065]

The results of the above-described experiment will be described with reference to FIG. 3. FIG. 3 is a graph illustrating some of the results of the experiment for evaluating lighting control and sound control. In FIG. 3, the vertical axis represents score $V(m)$ for the experimental space. Moreover, in FIG. 3, the horizontal axis represents the condition for the experimental space. Specifically, on the horizontal axis in FIG. 3, “5000 K” represents the illumination condition of (A3) and “3500 K” represents the illumination condition of (A2). Moreover, on the horizontal axis in FIG. 3, “no sound” represents the sound condition of (B1) and “natural environmental sound” represents the sound condition of (B2).

[0066]

In FIG. 3, the combination of “no sound” and “3500 K” shows the score $V(m)$ of “+0.6” and the combination of “no sound” and

"5000 K" shows the score $V(m)$ of "+0.6". In other words, no increase in the score $V(m)$ was found when the color temperature of the illumination light in the experimental space was increased. Moreover, the combination of "natural environmental sound" and "3500 K" shows the score $V(m)$ of "+0.4". In other words, no increase in the score $V(m)$ was found when the natural environmental sound was played in the experimental space.

[0067]

In contrast, in FIG. 3, the combination of "natural environmental sound" and "5000 K" shows the score $V(m)$ of "+1.4", whereas the combination of "no sound" and "3500 K" shows the score $V(m)$ of "+0.6". In view of the above-described results of the experiment, it was assumed that no increase in the score $V(m)$ would be found even when the latter combination was used. However, despite the assumption, a significant increase in the score $V(m)$ was found by increasing the color temperature of the illumination light and playing the natural environmental sound in the experimental space, as compared with the case where only the color temperature was changed.

[0068]

According to the results of the above-described experiment, the inventors or the like of the present application acquired the knowledge that, by causing the color temperature of the illumination light to be greater than the reference color temperature and playing a specific sound such as a natural environmental sound, an effect superior to the mere sum of the zoning effect expected to result from sound and the zoning effect expected to result from illumination light is likely to be exhibited, and therefore an effect of easily achieving an unpredictable but preferred synergistic effect can be expected, as compared with the case where only the color temperature of the illumination light is changed.

[0069]

[Operation]

Hereinafter, an example of the operation of environmental control system 100 according to the embodiment will be described.

FIG. 4 is a flowchart illustrating an operation example of environmental control system 100 according to the embodiment. Hereinafter, it is assumed that a lighting schedule and a sound schedule have been set in advance. Moreover, hereinafter, it is assumed that until control timing according to the lighting schedule and the sound schedule, lighting controller 11 causes each lighting device 1 of all groups G1 to emit illumination light having a reference color temperature and sound controller 12 does not perform any control in particular. In other words, it is assumed that neither first group G11 nor second group G12 exists until the control timing.

[0070]

First, when the control timing comes (S1: Yes), lighting controller 11 controls each lighting device 1 of first group G11 and each lighting device 1 of second group G12, according to the lighting schedule (S2). Accordingly, the color temperature of the illumination light in a space corresponding to first group G11 becomes greater than the reference color temperature, and the color temperature of the illumination light in a space corresponding to second group G12 becomes lower than the reference color temperature. Process S2 and process S5, which is to be described later, correspond to controlling ST1 of one or more lighting devices in an environmental control method. Moreover, sound controller 12 controls each sound device 2 of first group G11 according to the sound schedule (S3). Accordingly, a specific sound is played in the space corresponding to first group G11. Process S3 and process S6, which is to be described later, correspond to controlling ST2 of one or more sound devices in the environmental control method.

[0071]

When an instruction is given by, for example, a manager of environmental control system 100 in the middle of the lighting schedule and the sound schedule (S4: Yes), lighting controller 11 controls each lighting device 1 of first group G11 and each lighting device 1 of second group G12, according to the instruction, regardless of the lighting schedule (S5). Moreover, sound controller 12 controls each sound device 2 of first group G11 according to the

instruction, regardless of the sound schedule (S6).

[0072]

The above-described series of processes is repeated until the lighting schedule and the sound schedule are complete (S7: Yes).

5 [0073]

[Advantageous Effects]

Hereinafter, advantageous effects of environmental control system 100 according to the embodiment will be described.

Environmental control system 100 according to the embodiment can
10 concurrently provide a user with two or more spaces which are controlled to have mutually different environments, such as a space corresponding to first group G11 and a space corresponding to second group G12. In other words, environmental control system 100 according to the embodiment can concurrently provide a user
15 with two or more spaces which are controlled to exhibit mutually different zoning effects. Specifically, an environment in which a user can easily concentrate is provided in the space corresponding to first group G11 and an environment in which a user can easily relax is provided in the space corresponding to second group G12.
20 Moreover, by playing a specific sound, an environment in which a user can further easily concentrate is provided in the space corresponding to first group G11, as compared with the case where the specific sound is not played. Accordingly, a user can easily recognize a difference between the space corresponding to first
25 group G11 and the space corresponding to second group G12.

[0074]

Therefore, for example, when a user takes on a task in a relaxed state or would like to communicate with other users, the user moves to the space corresponding to second group G12. Moreover,
30 for example, when a user would like to concentrate on a task or would like to prevent communication with other users, the user moves to the space corresponding to first group G11. As described above, environmental control system 100 according to the embodiment has the advantageous effect that since a user can select and use an
35 environment from two or more spaces which are controlled to have

mutually different environments, the user can easily stay in the environment desired by the user and the user satisfaction can be easily increased.

[0075]

5 [Variations]

Although the embodiment is described as above, the present invention is not limited to the above-described embodiment. Hereinafter, variations of the embodiment will be described. The variations described below can be combined appropriately.

10 [0076]

[Variation 1 of Embodiment]

As illustrated in FIG. 5, environmental control system 100 according to Variation 1 of the embodiment is different from environmental control system 100 according to the embodiment in that environmental control system 100 according to Variation 1 includes obtainer 14. FIG. 5 is a block diagram illustrating a functional configuration of environmental control system 100 according to Variation 1 of the embodiment.

[0077]

20 Obtainer 14 obtains user-related information. Hereinafter, an example of the user-related information obtained by obtainer 14 and an example of control based on the information obtained will be described. It should be noted that it is sufficient for environmental control system 100 to operate according to at least one of the first to third examples described below and environmental control system 25 100 may operate according to any combination of the first to third examples.

[0078]

In the first example, obtainer 14 obtains user position information. Obtainer 14 of the first example is also referred to as a "first obtainer". Here, it is sufficient that the user position information indicate a position of a user in a space (here, office 3) that is a target to be controlled by environmental control system 100, and the user position information needs not include information 35 indicating a position of the user outside of the space.

[0079]

For example, obtainer 14 can obtain user position information by obtaining a detection result transmitted from a motion detector, such as an infrared sensor, provided in office 3. In other words, when receiving, from a motion detector, a detection result indicating the presence of a person in a detection range, obtainer 14 can obtain user position information in office 3, based on the position and the detection range of the motion detector.

[0080]

Moreover, for example, obtainer 14 can obtain user position information in office 3 by obtaining a detection result from an indoor positional information detection system using Bluetooth (registered trademark) Low Energy (BLE) or the like that is employed in office 3.

[0081]

Furthermore, for example, obtainer 14 can obtain user position information in office 3 by obtaining an image of office 3 captured by a camera provided in office 3 and then appropriately performing image analysis processing on the image captured.

[0082]

As another example, obtainer 14 can obtain user position information in office 3 by obtaining, from a tag reader provided in office 3, a reading result of a wireless IC tag carried around by a user.

[0083]

Then, in the first example, first group G11 and second group G12 are determined based on the user position information obtained by obtainer 14. For example, it is assumed that a space corresponding to first group G11 is more crowded than a space corresponding to second group G12 at an arbitrary time. In this case, first group G11 and second group G12 are determined by lighting controller 11 and sound controller 12 so that the number of first groups G11 is increased. Accordingly, a floor area of the space corresponding to first group G11 is increased and thus the crowdedness in the space corresponding to first group G11 can be reduced.

[0084]

As described above, in the first example, since first group G11 and second group G12 are determined based on user position information, the proportion of the number of first groups G11 in the total number of groups G1 and the proportion of the number of second groups G12 in the total number of all groups G1 can be adjusted according to the position of a user. The first example is favorable for an owner of office 3 since an office environment that brings high user satisfaction with a relatively small area can be easily provided.

[0085]

In the second example, obtainer 14 obtains user schedule information. Obtainer 14 of the second example is also referred to as a "second obtainer". Here, it is sufficient that the user schedule information indicate that a user is scheduled to stay in a space (here, office 3) that is a target to be controlled by environmental control system 100, and the user schedule information needs not include information indicating that the user is scheduled to stay outside the space. For example, the user schedule information includes the start time and the end time of user's working hours.

[0086]

For example, user schedule information is inputted by a user through an information terminal and thus transmitted to and stored in a database that manages the user schedule information. Obtainer 14 can obtain the user schedule information from the database.

[0087]

Then, in the second example, first group G11 and second group G12 are determined based on the user schedule information obtained by obtainer 14. For example, it is assumed that the number of users whose start time of working hours is 9 am is less than the number of users whose start time of working hours is 10 am. In this case, first group G11 and second group G12 are determined by lighting controller 11 and sound controller 12 so that the number of first groups G11 is decreased during 9 am to 10 am and the number of first groups G11 is increased after 10 am. Accordingly,

the space corresponding to first group G11 in which a user can easily take on a task requiring concentration can be appropriately provided to the user in the morning during which the user can efficiently perform the task.

5 [0088]

As described above, in the second example, since first group G11 and second group G12 are determined based on user schedule information, the proportion of the number of first groups G11 in the total number of groups G1 and the proportion of the number of second groups G12 in the total number of groups G1 can be adjusted according to a schedule of a user. The second example is favorable for an owner of office 3 since an office environment that brings high user satisfaction with a relatively small area can be easily provided.

10 [0089]

15 In the third example, obtainer 14 obtains user preference information. Obtainer 14 of the third example is also referred to as a "third obtainer". For example, the user preference information includes a degree of user preference for a space. Specifically, the user preference information includes, for example, information indicating that a user prefers the space corresponding to first group G11, information indicating that a user prefers the space corresponding to second group G12, or information indicating that a user prefers neither the space corresponding to first group G11 nor the space corresponding to second group G12.

20

25 [0090]

For example, user preference information is inputted by a user through an information terminal and thus transmitted to and stored in a database that manages the user preference information. Obtainer 14 can obtain the user preference information from the database.

30

[0091]

Moreover, obtainer 14 can obtain user preference information by analyzing, through appropriate processing, in which of spaces a user has a tendency to stay, based on user position information. In this case, the user needs not input the user preference information.

35

[0092]

Then, in the third example, first group G11 and second group G12 are determined based on the user preference information obtained by obtainer 14. For example, it is assumed that the number of users who prefer the space corresponding to first group G11 is greater than the number of users who prefer the space corresponding to second group G12. In this case, first group G11 and second group G12 are determined by lighting controller 11 and sound controller 12 so that the proportion of the number of spaces corresponding to first groups G11 in the total number of spaces corresponding to all groups G1 becomes higher than the proportion of the number of spaces corresponding to second groups G12 in the total number of the spaces corresponding to all groups G1. Accordingly, crowdedness can be avoided in a space that is preferred by more users.

[0093]

As described above, in the third example, since first group G11 and second group G12 are determined based on user preference information, the proportion of the number of first groups G11 in the total number of groups G1 and the proportion of the number of second groups G12 in the total number of groups G1 can be adjusted according to a user preference. The third example is favorable for an owner of office 3 since an office environment that brings high user satisfaction with a relatively small area can be easily provided.

[0094]

[Variation 2 of Embodiment]

As illustrated in FIG. 6, environmental control system 100 according to Variation 2 of the embodiment is different from environmental control system 100 according to the embodiment in that environmental control system 100 according to Variation 2 includes notifier 15. FIG. 6 is a block diagram illustrating a functional configuration of environmental control system 100 according to Variation 2 of the embodiment.

[0095]

Notifier 15 notifies a user of at least a state of first group G11

and a state of second group G12. For example, notifier 15 generates a map that is a plan view of office 3 and indicates that which of all groups G1 are each first group G11, second group G12, or group G1 that is neither first group G11 nor second group G12.

5 Then, notifier 15 transmits the map generated to an information terminal used by the user. Accordingly, the user can know where the space corresponding to first group G11 (space in which the user can easily relax) is and where the space corresponding to second group G12 (space in which the user can easily concentrate) is, in office 3,
10 by checking the map received by the information terminal.

[0096]

Moreover, notifier 15 may transmit the map generated to a projector provided in office 3. In this case, the projector projects the map received on a screen. Accordingly, the user can know
15 where the space corresponding to first group G11 is and where the space corresponding to second group G12 is, in office 3, by checking the map projected on the screen. It should be noted that the projector may project the map on a wall or a ceiling in office 3, instead of the screen.

20 [0097]

For another example, notifier 15 may give a notification to a user by a message or audio content that indicates a state of first group G11 and a state of second group G12, instead of transmitting the map. Of course, notifier 15 may give a notification to a user by
25 an appropriate combination of the map, the message, and the audio content.

[0098]

Since the state of first group G11 and the state of second group G12 are notified to a user as described above, the user can
30 know the state of first group G11 and the state of second group G12.

[0099]

[Other Variations]

Although one or more sound devices 2 in second group G12 do not play any sound in the embodiment, one or more sound devices 2
35 in second group G12 may play a sound. In this case, the type of a

sound to be played is preferably a sound that is different from a specific sound to be played by one or more sound devices 2 in first group G11, for example. In other words, in this case, one or more sound devices 2 in second group G12 preferably play a sound that causes a user to recognize a difference between first group G11 and second group G12.

[0100]

Although each of lighting devices 1 includes a light for general lighting as ambient lighting in the embodiment, the present invention is not limited to this example. For example, any of lighting devices 1 may include a spotlight as local lighting. In other words, it is sufficient for each of lighting devices 1 to emit light to the extent that a user can at least recognize that the space corresponding to first group G11 and the space corresponding to second group G12 are mutually different.

[0101]

Although each of all groups G1 includes one or more sound devices 2 in the embodiment, the present invention is not limited to this example. For example, it is sufficient that at least group G1 that can be determined as first group G11 include one or more sound devices 2. Group G1 that cannot be determined as first group G11 needs not include sound device 2.

[0102]

Although lighting device 1 and sound device 2 are separately formed in the embodiment, the present invention is not limited to this example. For example, lighting device 1 and sound device 2 may be integrally formed by incorporating sound device 2 into lighting device 1.

[0103]

Although office 3 is composed of one large room in which no other room exists in the embodiment, the present invention is not limited to this example. For example, office 3 may be composed of a large room including one or more rooms or may be composed of a plurality of floors.

[0104]

Although environmental control system 100 is used for single office 3 in the embodiment, the present invention is not limited to this example. For example, environmental control system 100 may be used for a plurality of offices 3 and may control each of lighting devices 1 and each of sound devices 2 for each office 3.

[0105]

Although lighting device 1 and sound device 2 are not included in the constituent elements of environmental control system 100 in the embodiment, at least one of lighting device 1 or sound device 2 may be included in the constituent elements of environmental control system 100.

[0106]

Moreover, for example, although environmental control system 100 is implemented by a plurality of devices in the above-described embodiment, environmental control system 100 may be implemented as a single device. For example, environmental control system 100 may be implemented as a single device equivalent to a server device. When environmental control system 100 is implemented by a plurality of devices, the constituent elements included in environmental control system 100 can be assigned to any of the plurality of devices. For example, the constituent elements included in the server device in the above-described embodiment may be included in an information terminal provided in a closed space. In other words, the present invention may be implemented by cloud computing or edge computing.

[0107]

For example, a method for communication between the devices in the above-described embodiment is not particularly limited. Moreover, a relay device, which is not illustrated in the Drawings, may be used for the communication between the devices.

[0108]

Furthermore, in the above-described embodiment, each of the constituent elements may be implemented by executing a software program suitable for each of the constituent elements. Each of the

constituent elements may be implemented by a program execution unit, such as a CPU or a processor, to retrieve and execute a software program stored in a recording medium such as a hard disk drive or a semiconductor memory.

5 [0109]

Moreover, each of the constituent elements may be implemented by hardware. For example, each of the constituent elements may be a circuit (or an integrated circuit). These circuits may form a single circuit as a whole, or may each form an individual circuit. Moreover, these circuits may be general-purpose circuits or may be dedicated circuits.

[0110]

Moreover, general or specific aspects of the present invention may be realized as a system, a device, a method, an integrated circuit, a computer program, or a computer-readable recording medium such as a CD-ROM. Furthermore, general or specific aspects of the present invention may be realized as an arbitrary combination of a system, a device, a method, an integrated circuit, a computer program, and a recording medium.

20 [0111]

For example, the present invention may be realized as an environmental control method that is executed by a computer such as environmental control system 100, as a program for causing a computer to execute the environmental control method, or as a non-transitory computer-readable recording medium in which the program is stored.

[0112]

For other examples, forms obtained by making various modifications to the above-described embodiments that can be conceived by a person skilled in the art, as well as other forms realized by arbitrarily combining some constituent elements and functions in the above-described embodiments, without departing from the essence of the present invention, are included in the scope of the present invention.

35 [0113]

[Conclusion]

As described above, environmental control system 100 includes lighting controller 11 that controls one or more lighting devices 1 of each of a plurality of groups G1 and sound controller 12 that controls one or more sound devices 2 of each of the plurality of groups G1. Here, the plurality of groups G1 include first group G11 and second group G12. Lighting controller 11 causes one or more lighting devices 1 of first group G11 to emit illumination light having a color temperature greater than a reference color temperature, and causes one or more lighting devices 1 of second group G12 to emit illumination light having a color temperature less than the reference color temperature. Sound controller 12 causes one or more sound devices 2 of first group G11 to play a specific sound.

[0114]

Accordingly, environmental control system 100 has the advantageous effect that since a user can be provided with two or more spaces which are controlled to have mutually different environments, the user can easily stay in the environment desired by the user and the user satisfaction can be easily increased.

[0115]

Moreover, for example, in environmental control system 100, the reference color temperature may be 3500 K.

[0116]

Accordingly, environmental control system 100 can provide a space in which a user can relatively easily concentrate, in a space corresponding to first group G11. Moreover, environmental control system 100 can provide a space in which a user can relatively easily relax, in a space corresponding to second group G12.

[0117]

Moreover, for example, in environmental control system 100, the specific sound may be a white noise.

[0118]

Accordingly, environmental control system 100 can provide, in the space corresponding to first group G11, a space in which an effect of further improving user's concentration can be expected, as

compared with the case where only illumination light from one or more lighting devices 1 is provided.

[0119]

Moreover, for example, in environmental control system 100,
5 the specific sound may be a natural environmental sound.

[0120]

Accordingly, environmental control system 100 can provide, in the space corresponding to first group G11, a space in which an effect of further improving user's concentration can be expected, as
10 compared with the case where only illumination light from one or more lighting devices 1 is provided.

[0121]

Moreover, for example, in environmental control system 100, the specific sound may be a bird chirping sound or a water flowing
15 sound.

[0122]

Accordingly, environmental control system 100 can provide, in the space corresponding to first group G11, a space in which an effect of further improving user's concentration can be expected, as
20 compared with the case where only illumination light from one or more lighting devices 1 is provided.

[0123]

Moreover, for example, in environmental control system 100, lighting controller 11 may control one or more lighting devices 1 of
25 each of the plurality of groups G1 according to a predetermined lighting schedule. Furthermore, sound controller 12 may control one or more sound devices 2 of each of the plurality of groups G1 according to a predetermined sound schedule.

[0124]

30 Accordingly, environmental control system 100 can provide a user with a space in which a zoning effect as desired by a manager of environmental control system 100 can be expected, without a real-time instruction from the manager.

[0125]

35 Moreover, for example, environmental control system 100 may

further include obtainer (first obtainer) 14 that obtains user position information. Then, first group G11 and second group G12 may be determined based on the user position information obtained by obtainer (first obtainer) 14.

5 [0126]

Accordingly, environmental control system 100 can adjust the proportion of the number of first groups G11 in the total number of groups G1 and the proportion of the number of second groups G12 in the total number of groups G1, according to the position of a user.

10 [0127]

Moreover, for example, environmental control system 100 may further include obtainer (second obtainer) 14 that obtains user schedule information. Then, first group G11 and second group G12 may be determined based on the user schedule information obtained

15 by obtainer (second obtainer) 14.

[0128]

Accordingly, environmental control system 100 can adjust the proportion of the number of first groups G11 in the total number of groups G1 and the proportion of the number of second groups G12 in the total number of groups G1, according to a schedule of a user.

20 [0129]

Moreover, for example, environmental control system 100 may further include obtainer (third obtainer) 14 that obtains user preference information. Then, first group G11 and second group

25 G12 may be determined based on the user preference information obtained by obtainer (third obtainer) 14.

[0130]

Accordingly, environmental control system 100 can adjust the proportion of the number of first groups G11 in the total number of groups G1 and the proportion of the number of second groups G12 in the total number of groups G1, according to a user preference.

30 [0131]

Moreover, for example, environmental control system 100 may further include notifier 15 that notifies a user of at least a state of first group G11 and a state of second group G12.

35

[0132]

Accordingly, environmental control system 100 enables a user to know a state of first group G11 and a state of second group G12.

[0133]

5 Moreover, an environmental control method includes controlling ST1 of one or more lighting devices 1 of each of a plurality of groups G1 and controlling ST2 of one or more sound devices 2 of each of the plurality of groups G1. The plurality of groups G1 include first group G11 and second group G12. Controlling ST1 of
10 one or more lighting devices 1 includes causing one or more lighting devices 1 of first group G11 to emit illumination light having a color temperature greater than a reference color temperature, and causing one or more lighting devices 1 of second group G12 to emit illumination light having a color temperature less than the reference
15 color temperature. Controlling ST2 of one or more sound devices 2 includes causing one or more sound devices 2 of first group G11 to play a specific sound.

[0134]

20 Accordingly, the environmental control method has the advantageous effect that since a user can be provided with two or more spaces which are controlled to have mutually different environments, the user can easily stay in the environment desired by the user and the user satisfaction can be easily increased.

[0135]

25 Moreover, for example, a program causes one or more processors to execute the above-described environmental control method.

[0136]

30 Accordingly, the program has the advantageous effect that since a user can be provided with two or more spaces which are controlled to have mutually different environments, the user can easily stay in the environment desired by the user and the user satisfaction can be easily increased.

[Reference Signs List]

35 [0137]

	100	environmental control system
	11	lighting controller
	12	sound controller
	14	obtainer
5	15	notifier
	1	lighting device
	2	sound device
	G1	group
	G11	first group
10	G12	second group
	ST1	controlling of one or more lighting devices
	ST2	controlling of one or more sound devices

[CLAIMS]

[Claim 1]

An environmental control system comprising:

5 a lighting controller that controls one or more lighting devices
of each of a plurality of groups; and

a sound controller that controls one or more sound devices of
each of the plurality of groups,

wherein the plurality of groups include a first group and a
second group,

10 the lighting controller causes the one or more lighting devices
of the first group to emit illumination light having a color
temperature greater than a reference color temperature, and causes
the one or more lighting devices of the second group to emit
illumination light having a color temperature less than the reference
15 color temperature, and

the sound controller causes the one or more sound devices of
the first group to play a specific sound.

[Claim 2]

20 The environmental control system according to claim 1,
wherein the reference color temperature is 3500 kelvin (K).

[Claim 3]

25 The environmental control system according to claim 1 or 2,
wherein the specific sound is a white noise.

[Claim 4]

30 The environmental control system according to claim 1 or 2,
wherein the specific sound is a natural environmental sound.

[Claim 5]

35 The environmental control system according to claim 4,
wherein the natural environmental sound is a bird chirping
sound or a water flowing sound.

[Claim 6]

The environmental control system according to any one of claims 1 to 5,

5 wherein the lighting controller controls the one or more lighting devices of each of the plurality of groups according to a predetermined lighting schedule, and

the sound controller controls the one or more sound devices of each of the plurality of groups according to a predetermined sound schedule.

10

[Claim 7]

The environmental control system according to any one of claims 1 to 6, further comprising:

a first obtainer that obtains user position information,

15 wherein the first group and the second group are determined based on the user position information obtained by the first obtainer.

[Claim 8]

20 The environmental control system according to any one of claims 1 to 7, further comprising:

a second obtainer that obtains user schedule information,

wherein the first group and the second group are determined based on the user schedule information obtained by the second obtainer.

25

[Claim 9]

The environmental control system according to any one of claims 1 to 8, further comprising:

a third obtainer that obtains user preference information,

30 wherein the first group and the second group are determined based on the user preference information obtained by the third obtainer.

[Claim 10]

35 The environmental control system according to any one of

claims 1 to 9, further comprising:

a notifier that notifies a user of at least a state of the first group and a state of the second group.

5 [Claim 11]

An environmental control method comprising:

controlling one or more lighting devices of each of a plurality of groups; and

10 controlling one or more sound devices of each of the plurality of groups,

wherein, among the plurality of groups, two or more groups include a first group and a second group,

the controlling of the one or more lighting devices includes causing the one or more lighting devices of the first group to emit
15 illumination light having a color temperature greater than a reference color temperature, and causing the one or more lighting devices of the second group to emit illumination light having a color temperature less than the reference color temperature, and

the controlling of the one or more sound devices includes
20 causing the one or more sound devices of the first group to play a specific sound.

[Claim 12]

A program for causing one or more processors to execute the
25 environmental control method according to claim 11.