

[DESCRIPTION]

[Title of Invention] SOUND ZONING SYSTEM

[Technical Field]

[0001]

5 The present invention relates to a sound zoning system.

[Background Art]

[0002]

10 Patent Literature (PTL) 1 discloses an illumination control device capable of determining whether each of sectional regions obtained by sectionalizing an illumination area is a staying region where a person stays or a non-staying region where no person stays to perform different illumination control for each of the determined regions.

[Citation List]

15 [Patent Literature]

[0003]

[PTL 1] Japanese Unexamined Patent Application Publication No. 2013-109876

[Summary of Invention]

20 [Technical Problem]

[0004]

25 Zoning that divides a space into a plurality of zones based on a plurality of sound contents has a problem of how to synchronize the playback time of a sound content that is to be played back by a plurality of loudspeaker devices.

[0005]

 The present invention provides a sound zoning system that can synchronize the playback time of a sound content that is to be played back by a plurality of loudspeaker devices used for zoning.

30 [Solution to Problem]

[0006]

35 A sound zoning system according to one aspect of the present invention is a sound zoning system that divides a space into a plurality of zones according to types of sound content audible in the space, the sound zoning system includes: a plurality of loudspeaker devices that

belong to a first group for creating a first zone among the plurality of zones; and a control device that transmits first playback start time information to each of the plurality of loudspeaker devices via wireless communication while the plurality of loudspeaker devices are playing back sound content A, the first playback start time information indicating a playback start time of sound content B that is to be played back following the sound content A.

[Advantageous Effects of Invention]

[0007]

A sound zoning system according to one aspect of the present invention can synchronize the playback time of a sound content that is to be played back by a plurality of loudspeaker devices used for zoning.

[Brief Description of Drawings]

[0008]

[FIG. 1]

FIG. 1 is a diagram illustrating an overview of a sound zoning system according to an embodiment.

[FIG. 2]

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

[FIG. 3]

FIG. 3 is a sequence diagram illustrating operation example 1 showing operation performed by the sound zoning system according to the embodiment.

[FIG. 4]

FIG. 4 is a sequence diagram illustrating operation example 2 showing operation performed by the sound zoning system according to the embodiment.

[FIG. 5]

FIG. 5 is a sequence diagram illustrating operation example 3 showing operation performed by the sound zoning system according to the embodiment.

[Description of Embodiments]

[0009]

Hereinafter, embodiments will be described with reference to the drawings. Note that the embodiments below each describe a general or specific example. The numerical values, shapes, materials, structural elements, the arrangement and connection of the structural elements, steps, and orders of the steps, etc. presented in the embodiments below are mere examples, and therefore do not intend to limit the present invention. Furthermore, among the structural elements in the embodiments below, those not recited in any one of the independent claims will be described as optional structural elements.

[0010]

Note that the drawings are schematic diagrams, and do not necessarily provide strictly accurate illustration. Throughout the drawings, the same numeral is given to substantially the same structural element, and redundant descriptions may be omitted or simplified.

[0011]

[Embodiment]

[Configuration]

Hereinafter, a sound zoning system according to an embodiment will be described. FIG. 1 is a diagram illustrating an overview of a sound zoning system according to the embodiment. FIG. 2 is a block diagram illustrating a functional configuration of the sound zoning system according to the embodiment.

[0012]

Sound zoning system 10 creates a plurality of zones in space 50 by unifying, for each zone, a genre of audible sounds. For example, out of the four loudspeaker devices 40 provided on the ceiling in (a) in FIG. 1, the two loudspeaker devices 40 on the left side play back jazz (more specifically, a sound content classified as jazz) and the two loudspeaker devices 40 on the right side play back natural environmental sounds (more specifically, a sound content classified as natural environmental sounds). As a result, first zone 51 in which jazz is audible and second zone 52 in which natural environmental sounds are audible are created in space 50. Natural

environmental sounds are, for example, wild bird chirping sounds and water flowing sounds. Note that the dashed lines in FIG. 1 each indicate an imaginary boundary line between zones.

[0013]

5 For example, when the number of second zone 52 users increases, control device 20 causes loudspeaker device 40 located second from the left to play back natural environmental sounds instead of jazz. As a result, as illustrated in (b) in FIG. 1, first zone 51 in which jazz is audible is reduced, and second zone 52 in which
10 natural environmental sounds are audible is increased.

[0014]

 Sound zoning system 10 as described above is used in an activity based working (ABW)-type office, a free address-type office, and the like. ABW is a work style that enables workers (e.g.,
15 employees) to select a desk or a place to work according to their tasks. Sound zoning system 10 enhances mobility of workers in an office to seek facilitation of communication in an organization using the office and to seek improvement in innovation creation.

[0015]

20 Here, a zoning effect that can be achieved by sound zoning system 10 will be described. The zoning effect means, for example, creation of perceptible, imaginary sections in a space, and may include an effect that a user can readily recognize a plurality of spaces as different spaces. Moreover, the zoning effect may include, with
25 the user's recognition, an effect of facilitating a change in an action or mobility of the user as intended by zoning. For example, suppose that zoning of an optionally selected space is performed with the intention of creating the space to be a space in which a user can readily carry out a task requiring concentration. In this case, if a
30 user who saw the space uses the space to carry out the task requiring concentration as their main purpose, it can be said that the zoning effect is exerted.

[0016]

 In addition, the zoning effect may include an effect that (i) a
35 subjective effect and/or a real feeling experienced by a user or (ii) a

physiological effect, a psychological effect, and/or a biological effect experienced by the user indicate a tendency according to an intention of zoning, when the user actually uses a space on which the zoning has been performed. For example, suppose that zoning of an optionally selected space is performed with an intention of creating the space to be a space in which a user can readily carry out a task requiring concentration, and that a user uses the space. In this case, if the user experiences a real feeling that the use of the space enabled them to concentrate, or if an indicator and/or data suggesting user's concentration as a psychological effect and/or a biological effect is obtained, it can be said that the zoning effect is exerted.

[0017]

As has been described above, sound zoning system 10 can perform zoning of a space without the use of fittings and pieces of furniture. For this reason, the design of a space can be readily improved, and an office layout can be instantly changed under the control of control device 20. For example, the zoning enables changes of sound contents in spaces to complete in, for example, a few seconds. As a result, an office layout can be changed in a few seconds. When the office layout is changed by moving fittings or pieces of furniture using man power, it takes 60 minutes, a few hours, or a whole day, and in some cases, a few days. From this point, zoning performed under the control of the above-described control device 20 can produce an extremely remarkable effect.

[0018]

Moreover, as compared to the conventional office layout changes made by changing the arrangement of fittings and pieces of furniture, the zoning enables a change in an office layout in a shorter period, such as every hour, every day, or every month.

[0019]

Specifically, sound zoning system 10 includes control device 20, wireless communication device 30, and a plurality of loudspeaker devices 40 as illustrated in FIG. 2. Hereinafter, each of these devices will be described.

[0020]

First, control device 20 will be described. Control device 20 wirelessly communicates with each of the plurality of loudspeaker devices 40 to control the plurality of loudspeaker devices 40. Control device 20 includes communicator 21, controller 22, and storage 23.

5 Note that control device 20 may include a playback controller and a loudspeaker body like loudspeaker device 40.

[0021]

Communicator 21 is a communication circuit for control device 20 to wirelessly communicate with each of the plurality of loudspeaker devices 40 via wireless communication device 30. Specifically, communicator 21 is a wireless communication circuit that is compliant with a communication standard such as a wireless local area network (LAN).

[0022]

15 Controller 22 performs information processing for controlling the plurality of loudspeaker devices 40. Specifically, controller 22 is implemented by a microcomputer or a processor. A function of controller 22 is implemented by the microcomputer or the processor, which is controller 22, executing a computer program stored in storage 23, for example.

[0023]

Storage 23 is a storage device that stores the above-described computer program and information (e.g., management information indicating which group each of the plurality of loudspeaker devices 40 belongs to) necessary for performing the above-described information processing. Storage 23 may be implemented by, for example, a semiconductor memory.

[0024]

Next, wireless communication device 30 will be described. Wireless communication device 30 is a relay device used for wireless communication between control device 20 and the plurality of loudspeaker devices 40. Specifically, wireless communication device 30 is a wireless local area network (LAN) router. Control device 20 can wirelessly communicate with the plurality of loudspeaker devices 40 via wireless communication device 30. Note that a description of

the usage of wireless communication device 30 when control device 20 wirelessly communicates with the plurality of loudspeaker devices 40 will be hereinafter omitted from the embodiment as appropriate.

[0025]

5 Next, loudspeaker device 40 will be described. Loudspeaker device 40 is provided on the ceiling of space 50, and plays back a sound content. Loudspeaker device 40 includes loudspeaker body 41, communicator 42, playback controller 43, and storage 44.

[0026]

10 Loudspeaker body 41 is a transducer that converts a sound content (sound signals of an MP3 file or an advanced audio coding (AAC) file) stored in storage 44 into playback sounds (sound waves) of the sound content, and outputs the playback sounds. In other words, loudspeaker body 41 plays back sound contents.
15 Loudspeaker body 41 is, for example, a directional loudspeaker, but may be a typical loudspeaker. In other words, loudspeaker device 40 may be a directional loudspeaker or may be a typical loudspeaker. When loudspeaker device 40 is a directional loudspeaker, it is possible to achieve an advantageous effect of readily exerting the above-
20 described zoning effect.

[0027]

 Communicator 42 is a communication circuit for loudspeaker device 40 to wirelessly communicate with control device 20 or with other loudspeaker devices 40 via wireless communication device 30.
25 Specifically, communicator 42 is a wireless communication circuit that is compliant with a communication standard such as a wireless LAN.

[0028]

 Playback controller 43 performs information processing relating to the playback of sound contents. Specifically, playback controller
30 43 is implemented by a microcomputer or a processor. A function of playback controller 43 is implemented by the microcomputer or the processor, which is playback controller 43, executing a computer program stored in storage 44, for example.

[0029]

35 Storage 44 is a storage device that stores the above-described

computer program and the like. Storage 44 is implemented by, for example, a semiconductor memory.

[0030]

5 Note that storage 44 prestores a plurality of first sound contents (jazz in the example shown in FIG. 1) which are to be played back for creating first zone 51, a first playlist indicating the playback order of the plurality of first sound contents, a plurality of second sound contents (natural environmental sounds in the example shown in FIG. 1) which are to be played back for creating second zone 52, 10 and a second playlist indicating the playback order of the plurality of second sound contents. With this, loudspeaker device 40 can play back both of the first sound contents for creating first zone 51 and the second sound contents for creating second zone 52. Note that storage 23 of control device 20 may store the first playlist and the 15 second playlist.

[0031]

As has been described above, sound zoning system 10 adopts wireless communication for communication between control device 20 and the plurality of loudspeaker devices 40. With this, it is possible 20 to implement more flexible equipment change (e.g., an addition of loudspeaker device 40) as compared to the case where wired communication is adopted for communication between control device 20 and the plurality of loudspeaker devices 40.

[0032]

25 Here, prevention of choppiness in playback sounds resulting from radio wave interference, etc. is a problem to be addressed when wireless communication is adopted for communication between control device 20 and the plurality of loudspeaker devices 40. For example, in an office, there are many other office automation 30 appliances that use wireless signals in the same frequency band. Moreover, in shops such as a restaurant, there are appliances, such as a microwave oven, that tend to interrupt wireless communication.

[0033]

In view of the above, in sound zoning system 10, storage 44 of 35 loudspeaker device 40 prestores a plurality of sound contents.

Accordingly, only a cue signal for a playback instruction or a pause instruction is transmitted from control device 20 to the plurality of loudspeaker devices 40. With this, sound zoning system 10 can further reduce choppiness in playback sounds as compared to a system in which a sound content itself is transmitted from control device 20 to a plurality of loudspeaker devices 40. The reason is that the cue signal is a discretely transmitted signal, and thus is extremely resistant to radio wave interference as compared to continuous transmission of sound contents in the form of radio signals. Moreover, the case where only cue signals are transmitted has an advantage in that a retry using a retransmission process is readily possible even if the process is interrupted due to radio wave interference, etc.

[0034]

Loudspeaker device 40 may have a configuration to be provided on the ceiling. In this case the above-described zoning effect is readily exerted. Furthermore, loudspeaker device 40 may have a configuration to be secured to a wiring duct rail provided on the ceiling. This enables easy installation and easy rearrangement of loudspeakers.

[0035]

[Operation example 1]

A way of achieving synchronous playback of a sound content is a problem to be addressed by sound zoning system 10. As described with reference to FIG. 1, the plurality of loudspeaker devices 40 that belong to the first group creating first zone 51 may be instructed to change from the first group to a second group while the plurality of loudspeaker devices 40 are playing back a first sound content (jazz in the example shown in FIG. 1) exclusive to the first group. The second group creates second zone 52. Loudspeaker device 40 instructed to change a group is required to play back, in synchronization with loudspeaker devices 40 that belong to the second group, a second sound content (natural environmental sounds in the example shown in FIG. 1) exclusive to the second group. Hereinafter, operation example 1 showing operation for achieving the above-described synchronous playback will be described. FIG. 3 is a

sequence diagram illustrating operation example 1 showing operation performed by the sound zoning system. The illustration of wireless communication device 30 is omitted from FIG. 3.

[0036]

5 Note that, before the operation shown in FIG. 3 is performed, it is assumed that: (i) each of control device 20 and the plurality of loudspeaker devices 40 has obtained time information to be used as a reference from, for example, wireless communication device 30 (not illustrated in FIG. 3), and (ii) the time is synchronized within sound
10 zoning system 10. Note that, as the time information to be used as a reference, time information measured by control device 20 may be adopted instead of time information measured by wireless communication device 30. Moreover, time information measured by one of the plurality of loudspeaker devices 40 may be adopted instead
15 of time information measured by wireless communication device 30. In addition, time information measured by a server device, which is not illustrated, may be adopted.

[0037]

20 Note that the time information is information indicating a time obtained for the purpose of improving the accuracy of synchronous playback within sound zoning system 10. Accordingly, a time indicated in the time information need not match with the time shared in the general public such as Japan standard time. For example, when it is 7:00 in Japan standard time, the time in sound zoning
25 system 10 indicated in the time information may be 7:01.

[0038]

30 First, controller 22 of control device 20 causes communicator 21 to transmit a playback start instruction (S11). Communicator 21 transmits the playback start instruction to each of the plurality of loudspeaker devices 40. The playback start instruction includes information indicating the playback start time of sound content A which is at the top of the first playlist. Sound content A is one example of the first sound contents.

[0039]

35 Each of the plurality of loudspeaker devices 40 that belong to

the first group receives the playback start instruction. Specifically, the playback start instruction is received by communicators 42. Based on information indicating the playback start time included in the received playback start instruction, playback controllers 43 of the plurality of loudspeaker devices 40 start playing back sound content A stored in storages 44 when the playback start time comes (S12). Specifically, playback controllers 43 cause loudspeaker bodies 41 to output playback sounds of sound content A.

[0040]

Thereafter, playback controller 43 of one loudspeaker device 40 among the plurality of loudspeaker devices 40 causes communicator 42 to transmit a request for the playback start time of sound content B whose playback order is decided to be the second in the first playlist (S13). Communicator 42 transmits the request for the playback start time to control device 20. The request for the playback start time includes information indicating the playback stop time of sound content A. Sound content B is another example of the first sound contents.

[0041]

Note that in step S13, although the plurality of loudspeaker devices 40 each may transmit the request for a playback start time to control device 20, a single loudspeaker device 40 among the plurality of loudspeaker devices 40 may transmit the request for a playback start time on behalf of other loudspeaker devices 40. In this case, an advantageous effect of preventing an increase in communication traffic can be achieved. Which loudspeaker device 40 is to transmit the request for a playback start time is determined using a predetermined algorithm at a time at which the plurality of loudspeaker devices 40 are divided into groups for each zone, for example.

[0042]

Communicator 21 of control device 20 receives the request for the playback start time. Controller 22 determines the playback start time of sound content B based on the received request (S14). In other words, controller 22 determines the playback start time of

sound content B while the plurality of loudspeaker devices 40 are playing back sound content A. Specifically, based on the information indicating the playback stop time of sound content A which is included in the received request for the playback start time, controller 22
5 determines the playback start time of sound content B to be a time later than the playback stop time of sound content A. For example, controller 22 determines the playback start time of sound content B to be a predetermined time after (e.g., five seconds after) the playback stop time of sound content A.

10 [0043]

Next, controller 22 causes communicator 21 to transmit first playback start time information indicating the determined playback start time (S15). Communicator 21 transmits the first playback start time information to each of the plurality of loudspeaker devices 40
15 via wireless communication.

[0044]

Each of the plurality of loudspeaker devices 40 that belong to the first group receives the first playback start time information. Specifically, the first playback start time information is received by
20 communicators 42. When the playback start time indicated in the received first playback start time information comes, playback controllers 43 of the plurality of loudspeaker devices 40 start playing back sound content B stored in storages 44 (S16). Specifically, playback controllers 43 cause loudspeaker bodies 41 to output
25 playback sounds of sound content B.

[0045]

As has been described above, the playback start time of sound content B is notified while sound content A is being played back in sound zoning system 10. According to the configuration as has been
30 described above, loudspeaker device 40 instructed to change a group can play back a sound content exclusive to a group to which loudspeaker device 40 is instructed to change in synchronization with other loudspeaker devices 40 that belong to the group to which loudspeaker device 40 is instructed to change after a time
35 corresponding with one sound content has elapsed at the most.

Hereinafter, the foregoing point will be described in detail with reference to operation examples 2 and 3.

[0046]

Note that in operation example 1, control device 20 transmits the first playback start time information to each of the plurality of loudspeaker devices 40 in response to a request from at least one loudspeaker device 40 among the plurality of loudspeaker devices 40. However, control device 20 may voluntarily transmit the first playback start time information to each of the plurality of loudspeaker devices 40 without receiving the request from loudspeaker device 40. For example, if storage 23 of control device 20 stores information indicating a time length of each of the plurality of first sound contents and the first playlist, control device 20 can identify the playback stop time of sound content A. Accordingly, control device 20 can voluntarily transmit the first playback start time information to each of the plurality of loudspeaker devices 40.

[0047]

For example, if storage 23 of control device 20 stores information indicating a time length of each of the plurality of first sound contents and the first playlist as described above, controller 22 can predetermine playback stop times of the plurality of first sound contents. In other words, it is not necessary that the playback start time of sound content B is to be determined while the plurality of loudspeaker devices 40 are playing back sound content A as presented in operation example 1.

[0048]

[Operation example 2]

Next, based on operation example 1, an operation example presenting the case where one loudspeaker device 40 that belongs to the first group joining the second group will be described as operation example 2. FIG. 4 is a sequence diagram illustrating operation example 2 as described above. In the following description of operation example 2, loudspeaker device 40 that belongs to the first group is indicated as loudspeaker device 40a, loudspeaker device 40 that initially belongs to the first group but will be changed to belong

to the second group in the middle of a sequence is indicated as loudspeaker device 40b, and loudspeaker device 40 that belongs to the second group is indicated as loudspeaker device 40c.

[0049]

5 Initially, playback controllers 43 of loudspeaker device 40a and loudspeaker device 40b which belong to the first group are playing back sound content A (e.g., jazz) (S21), and playback controller 43 of loudspeaker device 40c that belongs to the second group is playing back sound content X (e.g., natural environmental sounds) (S22).
10 Sound content X is one example of the second sound contents.

[0050]

 Controller 22 of control device 20 causes communicator 21 to transmit a group change instruction (S23). Communicator 21 transmits the group change instruction to loudspeaker device 40b.
15 This group change instruction is information for instructing a loudspeaker device to change from the first group to the second group.

[0051]

 Communicator 42 of loudspeaker device 40b receives the group change instruction. Upon reception of the group change instruction, playback controller 43 of loudspeaker device 40b stops playing back sound content A (S24).
20

[0052]

 Thereafter, playback controller 43 of loudspeaker device 40c that belongs to the second group causes communicator 42 to transmit a request for the playback start time of sound content Y whose playback order is decided to be after sound content X in the second playlist (S25). Communicator 42 transmits the request for the playback start time to control device 20. The request for the playback start time includes information indicating the playback stop time of sound content X. Sound content Y is another example of the second sound contents.
25
30

[0053]

 Communicator 21 of control device 20 receives the request for the playback start time. Controller 22 determines the playback start time of sound content Y based on the received request (S26).
35

Specifically, controller 22 determines the playback start time of sound content Y to be a time later than the playback stop time of sound content X, based on the information indicating the playback stop time of sound content X which is included in the received request for the
5 playback start time. For example, controller 22 determines the playback start time of sound content Y to be a predetermined time after (e.g., five seconds after) the playback stop time of sound content X.

[0054]

10 Next, controller 22 causes communicator 21 to transmit second playback start time information indicating the determined playback start time (S27). Communicator 21 transmits the second playback start time information to each of loudspeaker device 40b and loudspeaker device 40c (i.e., a plurality of loudspeaker devices 40
15 that belong to the second group) via wireless communication.

[0055]

Each of loudspeaker device 40b and loudspeaker device 40c receives the second playback start time information. Specifically, the second playback start time information is received by communicators
20 42. When the playback start time indicated in the received second playback start time information comes, playback controllers 43 of loudspeaker device 40b and loudspeaker device 40c start playing back sound content Y (S28).

[0056]

25 As has been described above, loudspeaker device 40b instructed to change a group can play back, in synchronization with loudspeaker device 40c that originally belongs to the second group, sound content Y exclusive to the second group to which loudspeaker device 40b has been changed by being put on standby only until the
30 playback of sound content X terminates. Conventionally, all of loudspeakers in a target group needed to be temporarily stopped for maintenance work to be performed when a group change takes place. However, sound zoning system 10 can achieve an advantageous effect that such work is less likely to occur.

35 [0057]

Loudspeaker device 40b has stopped playing back sound content A immediately after receiving the group change instruction. However, note that even if the group change instruction is received, loudspeaker device 40b may continue playing back sound content A until the second playback start time information is received, and loudspeaker device 40b may stop playing back sound content A upon reception of the second playback start time information. Moreover, if the second playback start time information is to be received after the playback stop time of sound content A comes, loudspeaker device 40b may play back sound content A to the end, and thereafter, may be put on standby without playing back a sound content until the second playback start time information is received. In addition, when loudspeaker device 40b stops playing back sound content A, a playback sound fade-out process may be performed.

[0058]

[Operation example 3]

Next, based on operation example 1, an operation example presenting the case where one loudspeaker device 40 that belongs to the second group joining the first group will be described as operation example 3. FIG. 5 is a sequence diagram illustrating operation example 3 as described above. In the following description of operation example 3, loudspeaker devices 40 that belong to the first group are indicated as loudspeaker device 40a and loudspeaker device 40b, and loudspeaker device 40 that initially belongs to the second group but will be changed to belong to the first group in the middle of a sequence is indicated as loudspeaker device 40c.

[0059]

Initially, playback controllers 43 of loudspeaker device 40a and loudspeaker device 40b which belong to the first group are playing back sound content A (e.g., jazz) (S31), and playback controller 43 of loudspeaker device 40c that belongs to the second group is playing back sound content X (e.g., natural environmental sounds) (S32).

[0060]

Controller 22 of control device 20 causes communicator 21 to transmit a group change instruction (S33). Communicator 21

transmits the group change instruction to loudspeaker device 40c. This group change instruction is information for instructing a loudspeaker device to change from the second group to the first group. [0061]

5 Communicator 42 of loudspeaker device 40c receives the group change instruction. Upon reception of the group change instruction, playback controller 43 of loudspeaker device 40c stops playing back sound content X (S34).

[0062]

10 Thereafter, playback controller 43 of loudspeaker device 40a that belongs to the first group causes communicator 42 to transmit a request for the playback start time of sound content B whose playback order is decided to be after sound content A in the first playlist (S35). Communicator 42 transmits the request for the playback start time to
15 control device 20. The request for the playback start time includes information indicating the playback stop time of sound content A.

[0063]

 Communicator 21 of control device 20 receives the request for the playback start time. Controller 22 determines the playback start
20 time of sound content B based on the received request (S36). Specifically, controller 22 determines the playback start time of sound content B to be a time later than the playback stop time of sound content A, based on the information indicating the playback stop time of sound content A which is included in the received request for the
25 playback start time. For example, controller 22 determines the playback start time of sound content B to be a predetermined time after (e.g., five seconds after) the playback stop time of sound content A.

[0064]

30 Next, controller 22 causes communicator 21 to transmit first playback start time information indicating the determined playback start time (S37). Communicator 21 transmits the first playback start time information to each of loudspeaker device 40a, loudspeaker device 40b, and loudspeaker device 40c (i.e., a plurality of
35 loudspeaker devices 40 that belong to the first group) via wireless

communication.

[0065]

Each of loudspeaker device 40a, loudspeaker device 40b, and loudspeaker device 40c receives the first playback start time information. Specifically, the first playback start time information is received by communicators 42. When the playback start time indicated in the received first playback start time information comes, playback controllers 43 of loudspeaker device 40a, loudspeaker device 40b, and loudspeaker device 40c start playing back sound content B (S38).

[0066]

As has been described above, loudspeaker device 40c instructed to change a group can play back, in synchronization with loudspeaker device 40a and loudspeaker device 40b which originally belong to the first group, sound content B exclusive to the first group to which loudspeaker device 40c has been changed by being put on standby only until the playback of sound content A terminates.

[0067]

Loudspeaker device 40c has stopped playing back sound content X immediately after receiving the group change instruction. However, note that even if the group change instruction is received, loudspeaker device 40c may continue playing back sound content X until the first playback start time information is received, and loudspeaker device 40c may stop playing back sound content X upon reception of the first playback start time information. Moreover, if the first playback start time information is to be received after the playback stop time of sound content X comes, loudspeaker device 40c may play back sound content X to the end, and thereafter, may be put on standby without playing back a sound content until the first playback start time information is received. In addition, when loudspeaker device 40c stops playing back sound content X, a playback sound fade-out process may be performed.

[0068]

[Variation]

In the above-described embodiment, a local communication

network between control device 20 and the plurality of loudspeaker devices 40 is built via wireless communication device 30. However, wireless communication device 30 can be omitted when a local communication network between control device 20 and the plurality of loudspeaker devices 40 is built based on Bluetooth (registered trademark) mesh.

[0069]

Moreover, the above-described embodiment describes control device 20 as a local controller provided within or in the vicinity of space 50, but control device 20 may be provided at a distant location from space 50. For example, a cloud server may be used as control device 20. In addition, control device 20 may have a function as loudspeaker device 40. In other words, one of the plurality of loudspeaker devices 40 may have a function as control device 20.

[0070]

Moreover, the above-described embodiment has described sound zoning system 10 as being used in space 50 such as an office. However, sound zoning system 10 may be used in space 50 such as a restaurant, a school, a nursing home, or an amusement facility.

[0071]

[Advantageous effect, etc.]

As has been described above, sound zoning system 10 is a sound zoning system that divides space 50 into a plurality of zones according to types of sound content audible in space 50. Sound zoning system 10 includes: a plurality of loudspeaker devices 40 that belong to a first group for creating a first zone among the plurality of zones; and control device 20 that transmits first playback start time information to each of the plurality of loudspeaker devices 40 via wireless communication while the plurality of loudspeaker devices 40 are playing back sound content A. The first playback start time information indicates a playback start time of sound content B that is to be played back following the sound content A.

[0072]

Sound zoning system 10 as described above can synchronize the playback time of a sound content that is to be played back by the

plurality of loudspeaker devices 40.

[0073]

In addition, for example, control device 20 determines the playback start time while the plurality of loudspeaker devices 40 are playing back the sound content A.

[0074]

Sound zoning system 10 as described above can determine the playback start time of a next sound content to be played back while a certain sound content is being played back.

10 [0075]

Moreover, for example, control device 20 transmits the first playback start time information to each of the plurality of loudspeaker devices 40 in response to a request from at least one of the plurality of loudspeaker devices 40.

15 [0076]

Sound zoning system 10 as described above can transmit first playback start time information to the plurality of loudspeaker devices 40 in response to a request from at least one of the plurality of loudspeaker devices 40.

20 [0077]

In addition, for example, control device 20 and at least one of the plurality of loudspeaker devices 40 obtain time information to be used as a reference via wireless communication.

[0078]

25 Sound zoning system 10 as described above can synchronize the time of control device 20 and the plurality of loudspeaker devices 40.

[0079]

Moreover, in operation example 3 (see FIG. 5), when an additional loudspeaker device 40c is added to the first group while loudspeaker device 40a and loudspeaker device 40b are playing back sound content A, control device 20 transmits the first playback start time information to each of loudspeaker device 40a, loudspeaker device 40b, and the additional loudspeaker device 40c.

35 [0080]

Sound zoning system 10 as described above can synchronize the playback time of a sound content that is to be played back by loudspeaker device 40a, loudspeaker device 40b, and the additional loudspeaker device 40c.

5 [0081]

In addition, in operation example 2 (see FIG. 4), when one loudspeaker device 40b out of loudspeaker device 40a and loudspeaker device 40b receives a group change instruction to change to a second group while playing back sound content A, the one
10 loudspeaker device 40b stops playing back sound content A and is put on standby until second playback start time information is received. The second group creates a second zone different from the first zone among the plurality of zones. The second playback start time information is transmitted to loudspeaker device 40 (e.g.,
15 loudspeaker device 40c) that belongs to the second group.

[0082]

Sound zoning system 10 as described above can synchronize the playback time of a sound content that is to be played back by loudspeaker device 40b and loudspeaker device 40c.

20 [0083]

Moreover, for example, each of the plurality of loudspeaker devices 40 includes: storage 44 that prestores sound content A and sound content B; communicator 42 that receives the first playback start time information; and playback controller 43 that starts playing
25 back sound content B at the playback start time indicated in the first playback start time information received.

[0084]

Sound zoning system 10 as described above can further reduce choppiness in playback sounds as compared to a system that
30 transmits a sound content itself from control device 20 to the plurality of loudspeaker devices 40.

[0085]

In addition, for example, the plurality of loudspeaker devices 40 are secured to the ceiling of space 50.

35 [0086]

Sound zoning system 10 as described above can synchronize the playback time of a sound content that is to be played back by the plurality of loudspeaker devices 40 secured to the ceiling of space 50.
[0087]

5 Moreover, for example, each of the plurality of loudspeaker devices 40 is a directional loudspeaker.
[0088]

10 Sound zoning system 10 as described above can synchronize the playback time of a sound content that is to be played back by the plurality of loudspeaker devices 40 having directionality.
[0089]

15 In addition, for example, sound zoning system 10 is used in an office, a restaurant, a school, a nursing home, or an amusement facility.
[0090]

20 Sound zoning system 10 as described above can synchronize the playback time of a sound content that is to be played back by the plurality of loudspeaker devices 40 in space 50, such as an office, a restaurant, a school, a nursing home, or an amusement facility.
[0091]
[Other embodiments]

25 The embodiments have been hereinbefore described, yet the present invention is not limited to the above-described embodiments.
[0092]

30 For example, the sound zoning system in the above-described embodiments is implemented by a plurality of devices, but may be implemented as a single device. For example, the sound zoning system may be implemented as a single device corresponding to a control device or a loudspeaker device. When the sound zoning system is implemented by a plurality of devices, structural elements (particularly, functional structural elements) included in the sound zoning system may be assigned to the plurality of devices in any way.
[0093]

35 Moreover, information transmission paths presented in the above-described embodiments are mere examples, and thus are not

particularly limited to the above-described paths. When two devices are to communicate with each other for transmission and reception of information in the above-described embodiments, a relay device, which is not illustrated, may be interposed between these two devices.

5 [0094]

Furthermore, a process performed by a particular processor may be performed by another processor in the above-described embodiments. In addition, the order of a plurality of processes may be changed, and the plurality of processes may be performed in parallel.

10 [0095]

Moreover, each of structural elements may be implemented by executing a software program suitable for the structural element in the above-described embodiments. Each structural element may be implemented as a result of a program execution unit, such as a central processing unit (CPU), processor or the like, loading and executing a software program stored in a storage medium such as a hard disk or a semiconductor memory.

15 [0096]

In addition, each structural element may be implemented by a hardware product. For example, each structural element may be a circuit (or an integrated circuit). These circuits may be individual circuits or may constitute a single circuit as a whole. Moreover, these circuits may be general-purpose circuits or dedicated circuits.

20 [0097]

Note that general or specific aspects of the present invention may be implemented by a system, a device, a method, an integrated circuit, a computer program, or a computer-readable recording medium such as a CD-ROM. Note that general or specific aspects of the present invention may be implemented by an optional combination of a system, a device, a method, an integrated circuit, a computer program, and a recording medium.

25 [0098]

For example, the present invention may be implemented as a method to be executed by a computer such as the sound zoning

system or a program for causing a computer to execute such a method. The present invention may be implemented as a non-transitory computer-readable recording medium on which such a program is recorded.

5 [0099]

The present invention also encompasses: embodiments achieved by applying various modifications conceivable to those skilled in the art to each embodiment; and embodiments achieved by optionally combining the structural elements and the functions of each embodiment without departing from the essence of the present invention.

[Reference Signs List]

[0100]

- 10 10 sound zoning system
- 15 20 control device
- 30 wireless communication device
- 40, 40a, 40b, 40c loudspeaker device
- 42 communicator
- 43 playback controller
- 20 44 storage
- 50 space

[CLAIMS]

[Claim 1]

A sound zoning system that divides a space into a plurality of zones according to types of sound content audible in the space, the
5 sound zoning system comprising:

a plurality of loudspeaker devices that belong to a first group for creating a first zone among the plurality of zones; and

a control device that transmits first playback start time information to each of the plurality of loudspeaker devices via wireless
10 communication while the plurality of loudspeaker devices are playing back sound content A, the first playback start time information indicating a playback start time of sound content B that is to be played back following the sound content A.

15 [Claim 2]

The sound zoning system according to claim 1, wherein the control device determines the playback start time while the plurality of loudspeaker devices are playing back the sound content A.

20

[Claim 3]

The sound zoning system according to claim 1 or 2, wherein the control device transmits the first playback start time information to each of the plurality of loudspeaker devices in response
25 to a request from at least one of the plurality of loudspeaker devices.

[Claim 4]

The sound zoning system according to any one of claims 1 to 3, wherein

30 the control device and at least one of the plurality of loudspeaker devices obtain time information to be used as a reference via wireless communication.

[Claim 5]

35 The sound zoning system according to any one of claims 1 to

4, wherein

when an additional loudspeaker device is added to the first group while the plurality of loudspeaker devices are playing back the sound content A, the control device transmits the first playback start time information to each of the plurality of loudspeaker devices and the additional loudspeaker device.

[Claim 6]

The sound zoning system according to any one of claims 1 to 5, wherein

when one loudspeaker device among the plurality of loudspeaker devices receives a group change instruction to change to a second group while playing back the sound content A, the one loudspeaker device stops playing back the sound content A and is put on standby until second playback start time information is received, the second group creating a second zone different from the first zone among the plurality of zones, the second playback start time information being transmitted to a loudspeaker device that belongs to the second group.

[Claim 7]

The sound zoning system according to any one of claims 1 to 6, wherein

each of the plurality of loudspeaker devices includes:

a storage that prestores the sound content A and the sound content B;

a communicator that receives the first playback start time information; and

a playback controller that starts playing back the sound content B at the playback start time indicated in the first playback start time information received.

[Claim 8]

The sound zoning system according to any one of claims 1 to 7, wherein

the plurality of loudspeaker devices are secured to a ceiling of the space.

[Claim 9]

5 The sound zoning system according to any one of claims 1 to 8, wherein

 each of the plurality of loudspeaker devices is a directional loudspeaker.

10 [Claim 10]

 The sound zoning system according to any one of claims 1 to 9, wherein

 the sound zoning system is used in an office, a restaurant, a school, a nursing home, or an amusement facility.