DESCRIPTION

Title of Invention:

ENVIRONMENTAL INFORMATION MANAGEMENT SYSTEM

Technical Field

[0001] The present invention relates to a technique for managing environmental information.

Background Art

[0002] In Zero Energy Building (ZEB), it is required to save energy while maintaining a quality of indoor environment. In order to achieve both energy conservation and the quality of indoor environment, it is necessary to grasp the indoor environment in detail and perform maximum energy conservation within a range that does not impair the comfort.

[0003] Generally, to grasp the indoor environment, a method of measuring the indoor environment with various types of sensors (such as a thermometer and an illuminance meter) is used.

However, if a number of sensors is excessively small for a size of a room, the indoor environment cannot be accurately grasped. If the number of sensors is excessively large, the cost increases. Further, if the sensor becomes a hindrance, convenience in the room is degraded.

To cope with this situation, environmental information at a position where no sensor is arranged is estimated by an interpolation process based on a measurement value of a sensor.

For example, Non-Patent Literature 1 discloses a method in which a temperature at a

A sensor coordinate value of the environmental information data 182 expresses a virtual point coordinate value (1, 1, 0).

An information type of the environmental information data 182 is the same as the information type of the environmental information data 181.

A sensor value "22.2" of the environmental information data 182 is an average of three sensor values "22.0", "23.0", and "21.5" included in three pieces of environmental information data 181.

A time stamp of the environmental information data 182 is the same as the time stamp of the environmental information data 181.

[0049] Getting back to Fig. 3, the description will continue from step S115.

In step S115, the management unit 113 checks whether an unselected virtual point exists. Specifically, the management unit 113 checks whether unselected virtual point data exists.

If an unselected virtual point exists, the processing proceeds to step S111.

If an unselected virtual point does not exist, the processing proceeds to step S121.

[0050] In step S121, the visualization unit 114 acquires a plurality of pieces of accumulated environmental information data (including environmental information data of a virtual point) from the accumulation unit 180.

Then, the visualization unit 114 visualizes an environment of the monitored space 209 based on the acquired plurality of pieces of environmental information data. Specifically, the visualization unit 114 generates a graph expressing the environment of the monitored space 209, and displays the generated graph to a display.

[0051] *** Effect of Embodiment 1 ***

According to Embodiment 1, the interpolated environmental information (a

unit 112 finds a sensor value at a virtual point.

Each time a sensor value at the virtual point is found, the management unit 113 accumulates environmental information data including the sensor value at the virtual point, in the accumulation unit 180.

[0068] A periodical collection process in the environmental information management method will be described with referring to Fig. 12.

The periodical collection process is executed periodically. That is, the periodical collection process is executed each time a predetermined period of time passes.

[0069] In step S301, the collection unit 111 collects a plurality of pieces of measurement data from a plurality of sensors 201.

Step S301 is the same as step S101 in Embodiment 1.

[0070] In step S302, the collection unit 111 accumulates a plurality of pieces of environmental information data in the accumulation unit 180 based on a plurality of pieces of measurement data.

Step S302 is the same as step S102 in Embodiment 1.

[0071] In step S303, a management unit 113 detects a measurement point where the sensor value has changed, based on a plurality of pieces of environmental information data of the last time and a plurality of pieces of environmental information data of this time.

For example, the collection unit 111 detects a measurement point where a difference between a sensor value of the last time and a sensor value of this time is larger than an error threshold.

[0072] In step S304, the management unit 113 decides one virtual point or more where the sensor value is to be updated, based on a position of the measurement point

information data of the measurement point.

Then, the collection unit 111 accumulates the new environmental information data in the accumulation unit 180.

[0130] In step S825, the interpolation unit 112 finds a sensor value at the designated point based on the one piece of environmental information data or more (excluding the environmental information data that has passed the valid reference time) acquired in step S821 and the new environmental information data generated in step S824.

A method of finding a sensor value at the designated point is the same as a method of finding a sensor value at a virtual point.

[0131] Getting back to Fig. 20, step S831 and beyond will be described.

Step S831 is the same as step S612 in Embodiment 6.

Step S832 is the same as step S613 in Embodiment 6.

Step S841 is the same as step S621 in Embodiment 6.

Step S842 is the same as step S622 in Embodiment 6.

[0132] *** Effect of Embodiment 8 ***

According to Embodiment 8, new environmental information to replace environmental information that has passed a certain period of time or more is obtained. Therefore, it is possible to always respond to a request of application software with the latest environmental information.

[0133] *** Other Configurations ***

In Embodiment 8, a virtual sensor at an additional point may be provided as in Embodiment 7.

In a case where a valid reference time has passed for environmental information data which is referred to for obtaining a sensor value at an additional point, the processing is the same as processing of a case where a valid reference time has

passed for environmental information data which is referred to for obtaining a sensor value at a designated point. In other words, the interpolation unit 112 finds a sensor value at the additional point based on new environmental information data.

[0134] Embodiment 9.

A mode for reducing a capacity necessary for accumulating environmental information data of a virtual point will be described with referring to Figs. 23 to 25, mainly regarding its differences from Embodiments 5 to 8.

[0135] *** Description of Configuration ***

A configuration of an environmental information management device 100 is the same as a corresponding configuration in Embodiment 5 (see Fig. 13).

[0136] *** Description of Operations ***

An outline of an environmental information management method will be described.

When a delete suspension time has passed since environmental information data of a virtual point including a sensor value at the virtual point is sent as a response, a management unit 113 deletes the environmental information data, which has been sent as a response, of the virtual point from an accumulation unit 180. The delete suspension time is predetermined time duration.

[0137] A presentation process in the environmental information management method will be described with referring to Fig. 23.

Step S901 to step S903 are the same as step S501 to step S503, respectively, in Embodiment 5.

[0138] In step S904, a presentation unit 115 searches a sensor information list 191 to find a sensor information data group that matches with a search condition.

Then, per sensor information data that matches with the search condition, the

CLAIMS

[Claim 1] An environmental information management system comprising:

a collection unit to collect a plurality of sensor values at a plurality of measurement points from a plurality of sensors provided to the plurality of measurement points, and per measurement point, to accumulate environmental information data including a sensor value, in an accumulation unit;

a management unit to decide a plurality of virtual points based on the plurality of measurement points, so that the plurality of measurement points and the plurality of virtual points are arranged at a plurality of intersecting points of a grid; and

an interpolation unit to find, per virtual point, a sensor value at a virtual point based on one sensor value or more obtained by one sensor or more,

wherein the management unit accumulates, per virtual point, environmental information data including the sensor value at the virtual point, in the accumulation unit.

[Claim 2] An environmental information management system comprising:

a collection unit to collect a plurality of sensor values at a plurality of measurement points periodically from a plurality of sensors provided to the plurality of measurement points, and per collection and per measurement point, to accumulate environmental information data including a sensor value, in an accumulation unit;

an interpolation unit to find a sensor value at a virtual point, each time a sensor value at a measurement point changes, based on one sensor value or more obtained by one sensor or more; and

a management unit to accumulate, each time a sensor value at the virtual point is found, environmental information data including the sensor value at the virtual point, in the accumulation unit.

[Claim 3] An environmental information management system comprising:

a collection unit to collect a plurality of sensor values at a plurality of measurement points from a plurality of sensors provided to the plurality of measurement points, and per measurement point, to accumulate environmental information data including a sensor value, in an accumulation unit;

an interpolation unit to find a sensor value at a virtual point based on one sensor value or more obtained by one sensor or more;

a management unit to accumulate environmental information data including the sensor value at the virtual point, in the accumulation unit; and

a presentation unit to accept an information request requesting one piece of environmental information data or more, to acquire the one piece of environmental information data or more from the accumulation unit, and to respond with the one piece of environmental information data or more,

wherein the information request indicates a designated point,

wherein when environmental information data including a sensor value at the designated point is not accumulated in the accumulation unit, the interpolation unit finds a sensor value at the designated point based on the one piece of environmental information data or more accumulated in the accumulation unit,

wherein when environmental information data including a sensor value at the designated point is not accumulated in the accumulation unit, the management unit decides an additional point based on the designated point, and accumulates environmental information data including a sensor value at the designated point, in the accumulation unit,

wherein the presentation unit responds with environmental information data including a sensor value at the designated point.,

wherein the interpolation unit finds a sensor value at the additional point based

on the one piece of environmental information data or more accumulated in the accumulation unit, and

wherein the management unit accumulates environmental information data including a sensor value at the additional point, in the accumulation unit.

[Claim 4] An environmental information management system comprising:

a collection unit to collect a plurality of sensor values at a plurality of measurement points from a plurality of sensors provided to the plurality of measurement points, and per measurement point, to accumulate environmental information data including a sensor value, in an accumulation unit;

an interpolation unit to find a sensor value at a virtual point based on one sensor value or more obtained by one sensor or more;

a management unit to accumulate environmental information data including the sensor value at the virtual point, in the accumulation unit; and

a presentation unit to accept an information request requesting one piece of environmental information data or more, to acquire the one piece of environmental information data or more from the accumulation unit, to add accuracy information to each of the one piece of environmental information data or more, and to respond with the one piece of environmental information data or more.

[Claim 5] An environmental information management system comprising:

a collection unit to collect a plurality of sensor values at a plurality of measurement points from a plurality of sensors provided to the plurality of measurement points, and per measurement point, to accumulate environmental information data including a sensor value, in an accumulation unit;

an interpolation unit to find a sensor value at a virtual point based on one sensor value or more obtained by one sensor or more; and

a management unit to accumulate environmental information data including the sensor value at the virtual point, in the accumulation unit, and to add sensor information data of a virtual sensor at the virtual point to a sensor information list containing a plurality of pieces of sensor information data of the plurality of sensors,

wherein the sensor information data of the virtual sensor indicates a reference sensor from which a sensor value to be referred to for finding a sensor value at the virtual point is obtained, and

wherein the management unit accepts variation data indicating variations in the plurality of sensors, and updates the reference sensor to be indicated in the sensor information data of the virtual sensor, based on the variation data.