[DESCRIPTION]

[Title of Invention] HEAT-ILLNESS RISK ASSESSMENT METHOD AND HEAT-ILLNESS RISK ASSESSMENT SYSTEM

[Technical Field]

[0001]

The present invention relates to a heat-illness risk assessment method and a heat-illness risk assessment system for assessment of the risk of heat illness in a plurality of activity performers engaging in activities in a plurality of activity areas.

[Background Art]

[0002]

A conventional method and system for determining the risk of the onset of heat illness is a heat-illness prevention system for determining the risk of the onset of heat illness of a living body on the basis of its activity amount and environmental information; the activity amount is obtained by measuring the activity performed by the living body, the environmental information is information such as the ambient temperature (see, for example, PTL 1). In this heat-illness prevention system, a housing to be attached to a living body includes: an activity amount measurement unit that measures the activity performed by the living body; and an environmental information acquisition unit that acquires environmental information including the ambient temperature of the living body.

[Citation List]

[Patent Literature]

[0003]

[PTL 1] Japanese Patent Application Publication No. 2012-210233

[Technical Problem]

[0004]

In the conventional heat-illness prevention system described above, since the environmental information acquisition unit is provided in the housing to be attached to a living body, there is a risk that accurate environmental information cannot be obtained depending on the posture of the living body (an activity performer) or depending on the position of the activity performer relative to the sun, ground, and so forth. For example, even when the activity performer is performing an activity in hot and sunny

weather, if the environmental information acquisition unit is positioned behind the activity performer, it is impossible to obtain accurate environmental information on the surroundings of the activity performer. Accordingly, there is a problem that an accurate determination result cannot be obtained due to determining of the risk of the onset of heat illness based on the inaccurate environmental information and the amount of activity.

[0005]

The present invention has been made in view of the above circumstance, and an aspect of the present invention is to provide a heat-illness risk assessment method and a heat-illness risk assessment system that provide accurate assessment of the risk of heat illness.

[Solution to Problem]

[0006]

A main aspect of the present invention for achieving the above-described aspect is a heat-illness risk assessment method for assessment of a risk of heat illness when a plurality of activity performers engage in an activity in a plurality of activity areas,

the heat-illness risk assessment method including:

an activity-performer information-data transmission step of transmitting activity-performer information data of a target activity performer by an activity sensor,

the target activity performer being an activity performer to be assessed for the risk of heat illness, among the plurality of activity performer,

the activity sensor being a sensor that is worn by the target activity performer and that measures an activity state of the target activity performer,

the activity-performer information data including activity data and an activity-performer ID of the target activity performer,

the activity data indicating the activity state measured by the activity sensor,

the activity-performer ID being an ID assigned to the target activity performer,

the activity-performer ID being stored in the activity sensor;

an activity-area information-data transmission step of receiving the activity-performer information data and transmitting activity-area information data by an activity area device,

the activity area device being arranged in each of the activity areas,

the activity area device storing an activity area ID identifying the activity area in which the activity area device is arranged,

the activity-performer information data transmitted by the activity sensor that is located in the activity area in which the activity area device is arranged,

the activity-area information data including the activity area ID and the activity-performer information data received by the activity area device;

an environmental information-data transmission step of transmitting environmental information data by an environmental sensor,

the environmental sensor being a sensor that is arranged in each of the activity areas and that measures an environmental condition of the activity area in which the environmental sensor is arranged,

the environmental sensor storing the activity area ID identifying the activity area in which the environmental sensor is arranged,

the environmental information data including environmental data and the activity area ID,

the environmental data indicating the environmental condition measured by the environmental sensor; and

a risk assessment step executed by a management terminal

in which the activity-area information data and the environmental information data are received and

in which the risk of heat illness is assessed individually for the target activity performer,

the target activity performer being identified by the activity-performer ID,

the assessing being performed based on the activity data and the environmental data that are associated with each other using the activity area ID,

the management terminal together with the activity sensor, the

activity area device, and the environmental sensor being connected to a network.

[0007]

According to the heat-illness risk assessment method, the activity state of the target activity performer is measured using the activity sensor worn by the target activity performer. This makes it possible to determine a more accurate activity state. The environmental condition of each activity area is measured using the environmental sensor arranged in the activity area. This makes it possible to determine more accurate environmental conditions.

[0008]

In addition, the activity data indicating the activity state measured using the activity sensor is received together with the activity-performer ID by the activity area device located in the activity area in which the target activity performer is performing an activity. The activity data and the activity-performer ID are transmitted together with the activity area ID of the activity area in which the activity area device is arranged. Accordingly, if the target activity performer moves to a different activity area, the activity area device arranged in the different activity area to which the target activity performer has moved transmits the activity data and the activity-performer ID of the target activity performer, together with the activity area ID indicating the different activity area. Accordingly, even if the target activity performer has moved to a different activity area, it is possible to accurately detect the activity area in which the target activity performer is performing an activity.

[0009]

The risk of heat illness in each target activity performer is assessed for the target activity performer identified by the activity-performer ID, on the basis of the activity data and the environmental data that are associated with each other using the activity area ID. This makes it possible to more reliably identify the activity area in which the target activity performer is performing an activity, and also makes it possible to more accurately assess the risk of heat illness of each target activity performer based on more accurate activity data and environmental data.

[0010]

A heat-illness risk assessment method for assessment of a risk of heat illness when a plurality of activity performers engage in an activity in a plurality of activity areas,

the heat-illness risk assessment method including:

an activity-performer information-data transmission step of transmitting activity-performer information data of a target activity performer by an activity sensor,

the target activity performer being an activity performer to be assessed for the risk of heat illness, among the plurality of activity performer,

the activity sensor being a sensor that is worn by the target activity performer and that measures an activity state of the target activity performer,

the activity-performer information data including activity data and an activity-performer ID of the target activity performer,

the activity data indicating the activity state measured by the activity sensor,

the activity-performer ID being an ID assigned to the target activity performer,

the activity-performer ID being stored in the activity sensor;

an environmental information-data transmission step of transmitting environmental information data by an environmental sensor,

the environmental sensor being a sensor that is arranged in each of the activity areas and that measures an environmental condition of the activity area in which the environmental sensor is arranged,

the environmental information data including environmental data,

the environmental data indicating the environmental condition measured by the environmental sensor;

an activity-area information-data transmission step of receiving the activity-performer information data and the environmental data and transmitting activity-area information data by an activity area device,

the activity area device being arranged in each of the activity areas,

the activity area device storing an activity area ID identifying the activity area in which the activity area device is arranged,

the activity-area information data including the activity-performer information data, the environmental information data, and the activity area ID,

the activity-performer information data transmitted by the activity sensor that is located in the activity area in which the activity area device is arranged,

the environmental data transmitted by the environmental sensor that is located in the activity area in which the activity area device is arranged; and

a risk assessment step executed by a management terminal,

in which the activity-area information data is received, and

in which the risk of heat illness is assessed for the target activity performer,

the target activity performer being identified by the activity-performer ID,

the assessing being performed based on the activity data and the environmental data that are associated with each other using the activity area ID,

the management terminal together with the activity sensor and the activity area device being connected to a network.

[0011]

According to the heat-illness risk assessment method, the activity state of the target activity performer is measured using the activity sensor worn by the target activity performer. This makes it possible to determine a more accurate activity state. The environmental condition of each activity area is measured using the environmental sensor arranged in the activity area. This makes it possible to determine more accurate environmental conditions.

[0012]

In addition, the activity data indicating the activity state measured using the activity sensor is received together with the activity-performer ID by the activity area device located in the activity area in which the target activity performer is performing an activity. The activity data and the activity-performer ID are transmitted together with the activity area ID of the activity area in which the activity area device is arranged.

Accordingly, if the target activity performer moves to a different activity area, the activity area device arranged in the different activity area to which the target activity performer has moved transmits the activity data and the activity-performer ID of the target activity performer, together with the activity area ID indicating the different activity area. Accordingly, even if the target activity performer has moved to a different activity area, it is possible to accurately detect the activity area in which the target activity performer is performing an activity.

[0013]

Furthermore, the environmental data which indicates the environmental condition of the activity area and which is measured using the environmental sensor is also transmitted together with the activity area ID by the activity area device. Thus, the risk of heat illness of each target activity performer is assessed for the target activity performer based on the activity data of the target activity performer and the environmental data of the activity area where the target activity performer is performing an activity. This makes it possible to more reliably identify the activity area where the target activity performer is performing an activity, and also makes it possible to more accurately assess the risk of heat illness of each target activity performer based on more accurate activity data and environmental data.

[0014]

In such a heat-illness risk assessment method,

a plurality of the activity area devices are arranged in each of the activity areas, and

each of the plurality of activity area devices is capable of receiving the activity-performer information data that is sent by the activity sensor and in a predetermined range smaller than the activity area in which the activity area device is arranged.

[0015]

According to the heat-illness risk assessment method, the activity area device arranged in each activity area is capable of receiving the activity-performer information data that is sent by the activity sensor in a predetermined range smaller than the activity area in which the activity area device is arranged. This makes it possible to reduce the output of

the activity sensor. This also makes it possible to reduce the power consumption of the activity sensor and the size of the activity sensor. Due to the reduced size, the activity sensor does not interfere in the activity performed by the target activity performer, enabling the target activity performer to easily perform an activity. Also, it is possible to identify the position of the target activity performer in the activity area within a smaller range.

[0016]

In such a heat-illness risk assessment method,

the activity area device receives a beacon signal.

[0017]

According to the heat-illness risk assessment method, the activity area in which the target activity performer is performing an activity can be detected using the beacon signal. This also makes it possible to reduce the power consumption of the activity sensor, and to reduce easily the size of the activity sensor.

[0018]

In addition, the environmental data generated by the environmental sensor is transmitted with included in the beacon signal, and the beacon signal is received by the activity area device. In this case, it is possible to reduce the power consumption of the environmental sensor, and it is also possible to easily reduce the size of the environmental sensor.

[0019]

In such a heat-illness risk assessment method,

the network comprises a cloud system.

[0020]

According to the heat-illness risk assessment method, the network is a cloud system. This enables on a mobile terminal to perform assessment and to recognize the state of the target activity performer. Thus, it is possible to achieve highly-flexible and low-cost assessment of the risk of heat illness in the target activity performer engaging in an activity, in a wider activity area.

[0021]

Further, a heat-illness risk assessment system for assessment of a risk of heat illness when a plurality of activity performers engage in an

activity in a plurality of activity areas,

the heat-illness risk assessment system including:

an activity sensor configured to measure an activity state of a target activity performer who wears the activity sensor and to transmit activity-performer information data,

the target activity performer being an activity performers to be assessed for the risk of heat illness, among the plurality of activity performers,

the activity-performer information data including activity data and an activity-performer ID of the target activity performer,

the activity data indicating the activity state of the target activity performer measured by the activity sensor,

the activity-performer ID being an ID assigned to the target activity performer,

the activity-performer ID being stored in the activity sensor;

an activity area device arranged in each of the activity areas,

the activity area device configured to store an activity area ID identifying the activity area in which the activity area device is arranged,

the activity area device configured to receive the activity-performer information data transmitted by the activity sensor that is located in the activity area in which the activity area device is arranged,

the activity area device configured to transmit activity-area information data,

the activity-area information data including the activity area ID and the activity-performer information data received by the activity area device;

an environmental sensor arranged in each of the activity areas,

the environmental sensor configured to store the activity area ID identifying the activity area in which the environmental sensor is arranged,

the environmental sensor configured to measure an environmental condition of the activity area in which the environmental sensor is arranged,

the environmental sensor configured to transmit environmental information data,

the environmental information data including environmental data

and the activity area ID,

the environmental data indicating the environmental condition measured by the environmental sensor; and

a management terminal configured to be connected to a network together with the activity area device and the environmental sensor,

the management terminal configured to receive the activity-area information data and the environmental information data,

the management terminal configured to assess the risk of heat illness individually for the target activity performer,

the target activity performer being identified by the activity-performer ID,

the assessing being performed based on the activity data and the environmental data that are associated with each other using the activity area ID.

[0022]

According to the heat-illness risk assessment system, it is possible to more accurately detect the activity area where the target activity performer is performing an activity, using the activity area device that has received activity-performer information data from the activity sensor. Also, it is possible to more accurately assess the risk of heat illness in each target activity performer based on the followings: more accurate activity data which is measured by the activity sensor worn by the target activity performer and which is transmitted from the activity area device; and more accurate environmental data measured by the environmental sensor arranged in each activity area.

[0023]

Further, a heat-illness risk assessment system for assessment of a risk of heat illness when a plurality of activity performers engage in an activity in a plurality of activity areas,

the heat-illness risk assessment system including:

an activity sensor configured to measure an activity state of a target activity performer who wears the activity sensor and to transmit activity-performer information data,

the target activity performer being an activity performers to be assessed for the risk of heat illness, among the plurality of activity

performers,

the activity-performer information data including activity data and an activity-performer ID of the target activity performer,

the activity data indicating the activity state of the target activity performer measured by the activity sensor,

the activity-performer ID being an ID assigned to the target activity performer,

the activity-performer ID being stored in the activity sensor;

an environmental sensor arranged in each of the activity areas,

the environmental sensor configured to measure an environmental condition of the activity area in which the environmental sensor is arranged,

the environmental sensor configured to transmit environmental data measured by the environmental sensor,

the environmental data indicating the environmental condition;

an activity area device arranged in each of the activity areas,

the activity area device configured to store an activity area ID identifying the activity area in which the activity area device is arranged,

the activity area device configured to receive the activity-performer information data and the environmental data,

the activity-performer information data being transmitted by the activity sensor that is located in the activity area in which the activity area device is arranged,

the environmental data being transmitted by the environmental sensor that is located in the activity area in which the activity area device is arranged,

the activity area device configured to transmit activity-area information data,

the activity-area information data including the activity area ID, the activity-performer information data and the environmental data that have been received by the activity area device; and

a management terminal configured to be connected to a network together with the activity area device,

the management terminal configured to receive the activity-area information data,

the management terminal configured to assess the risk of heat illness individually for the target activity performer,

the target activity performer being identified by the activity-performer ID,

the assessing being performed based on the activity data and the environmental data of the received activity-area information data.

[0024]

According to the heat-illness risk assessment system, it is possible to more accurately detect the activity area where the target activity performer is performing an activity, using the activity area device that has received activity-performer information data from the activity sensor. Also, it is possible to more accurately assess the risk of heat illness in each target activity performer based on the followings: more accurate activity data which is measured by the activity sensor worn by the target activity performer and which is transmitted from the activity area device; and more accurate environmental data measured by the environmental sensor arranged in each activity area.

[Advantageous Effects of Invention]

[0025]

According to the present invention, it is possible to provide a heat-illness risk assessment method and a heat-illness risk assessment system that provide accurate assessment of the risk of heat illness.

[Brief Description of the Drawings]

[0026]

[FIG. 1] FIG. 1 is a schematic top view of a work site where a heat-illness risk assessment system that performs a heat-illness risk assessment method according to the present embodiment is implemented.

[FIG. 2] FIG. 2 is a diagram illustrating an example of a configuration of the heat-illness risk assessment system.

[FIG. 3] FIG. 3 illustrates an example of a worker ID table.

[FIG. 4] FIG. 4 illustrates an example of a WBGT reference value table.

[FIG. 5] FIG. 5 illustrates an example of a heart-rate reference value table.

[FIG. 6] FIG. 6 is a flowchart illustrating the heat-illness risk assessment method according to the present embodiment.

[FIG. 7] FIG. 7 is a diagram illustrating a modified example of the configuration of the heat-illness risk assessment system.

[FIG. 8] FIG. 8 is a flowchart illustrating a modified example of the heat-illness risk assessment method.

[Description of Embodiments]

[0027]

Embodiment

A heat-illness risk assessment method according to the present embodiment is performed using a heat-illness risk assessment system.

[0028]

Heat-illness risk Assessment System

As illustrated in FIG. 1, a heat-illness risk assessment system 1 is implemented for individual target workers Mt (Mt1, Mt2,...) to be assessed, when a plurality of workers M are engaged in work in any of a plurality of work areas A (A1, A2, and A3) having different environmental conditions. Here, the work areas A (A1, A2, and A3) correspond to activity areas, the work corresponds to an activity, the workers M (M1, M2,...) correspond to activity performers, and the target workers Mt (Mt1, Mt2,...) correspond to target activity performers. In FIG. 1, the workers M and the target workers Mt are each represented by a black circle.

[0029]

In the illustrated example, as the plurality of work areas A having different environmental conditions, as illustrated in FIG. 1, the following three work areas A are illustrated by way of example: a sunny area A1 located outdoors and exposed to direct sunlight; a sunshade area A2 located outdoors beneath a sunshade; and an indoor area A3 located inside a building under construction at a construction site. However, the present invention is not limited thereto. For example, as a plurality of work areas having different environmental conditions, there may be used different floors of a building above ground, or there may be used a floor(s) above ground and a floor(s) below ground. Alternatively, there may be used zones having different planar positions on the same floor of a building. Also, in an outdoor area, there may be used zones into which the area is divided depending on whether ventilation is good or bad, for example.

[0030]

The target workers Mt to be assessed for the risk of heat illness may be determined as follows. The target workers Mt may include all of the workers M, or may include, among all the workers M, only some selected workers M who satisfies a predetermined condition as described below.

[0031]

As illustrated in FIG. 1, the heat-illness risk assessment system 1 includes: environmental sensors 3 (31, 32, and 33) each of which is arranged in one of the work areas A1, A2, and A3; activity sensors 4 (41, 42, 43, and 44) each of which is attached to one of the target workers Mt (Mt1, Mt2,...); relays 5 (51 to 56) arranged at desired positions in the work areas A (A1, A2, and A3); and a cloud system 10 that performs heat-illness risk assessment. The relays 5 (51 to 56) correspond to activity area devices.

[0032]

Each of the environmental sensors 3 measures the environmental condition of one of the work areas A1, A2, and A3 in which that environmental sensor 3 is arranged, and the environmental sensor 3 transmits environmental condition data at all times or at appropriate intervals. In the illustrated example, each of the environmental sensors 3 measures a thermal index (hereinafter also referred to as WBGT) as the environmental condition and outputs WBGT data (corresponding to thermal index data) including the thermal index. WBGT stands for "wet-bulb globe temperature", which is an index of heat stress. WBGT is derived from Eq. 1 for indoors and Eq. 2 for outdoors using wet-bulb temperature, black globe temperature, and dry-bulb temperature.

[0033]

WBGT = 0.7 × wet-bulb temperature + 0.3 × black globe temperature ... Eq. 1

WBGT = 0.7 × wet-bulb temperature + 0.2 × black globe temperature + 0.1 × dry-bulb temperature ... Eq. 2

Accordingly, each of the environmental sensors 3 includes, for example, but is not limited to, a wet-bulb thermometer for measuring wet-bulb temperature, a black globe thermometer for measuring black globe temperature, and a dry-bulb thermometer for measuring dry-bulb temperature.

That is, sensors having any other configuration may be used as the environmental sensors 3 so long as it is possible to calculate WBGT.

[0034]

In the illustrated example, among the three work areas A1, A2, and A3 in FIG. 1, the environmental sensors 31 and 32 placed in outdoor sites, namely the sunny area A1 and the sunshade area A2, compute WBGT using Eq. 2 for outdoor sites. Whereas the environmental sensor 33 placed in the indoor area A3 inside a building computes WBGT using Eq. 1 for indoors.

[0035]

As illustrated in FIG. 2, the respective environmental sensors 3 placed in the three work areas A (A1, A2, and A3) each includes a communication unit connectable to the cloud system 10, and a storage unit. In each of the environmental sensors 3, the storage unit stores a work-area ID for identifying one of the work areas A1, A2, and A3 where the environmental sensor 3 is arranged.

[0036]

Each of the environmental sensors 3 transmits WBGT data to the cloud system 10. At this time, each of the environmental sensors 3 also transmits the work-area ID stored in the storage unit together with the WBGT data. Here, WBGT data and a work-area ID that are sent from each of the environmental sensors 3 correspond to environmental information data.

[0037]

Since WBGT data and a work-area ID are transmitted by each of the environmental sensors 3, the cloud system 10 can promptly identify which work area the environmental condition indicated by the received WBGT data belongs to, based on the work-area ID attached to the received WBGT data. The installation of the environmental sensors 3 at a construction site is made at an appropriate time before the assessment of the risk of heat illness begins, such as before the construction begins.

[0038]

In the illustrated example, the storage unit of each of the environmental sensors 3 stores a work-area ID, but the invention is not limited thereto. For example, assuming that each of the environmental sensors 3 is individually assigned, without redundancy, an environmental-sensor ID for identifying the environmental sensor 3, and that a storage unit in the

cloud system 10 stores an environmental-sensor ID table that associates the environmental-sensor ID of each of the environmental sensors 3 with the work area A in which the environmental sensor 3 is arranged. In this case, the following configuration is also acceptable: each of the environmental sensors 3 transmits WBGT data and its environmental-sensor ID, which is stored therein; and, upon receipt of the WBGT data and the environmental-sensor ID, the cloud system 10 identifies which work area the environmental condition indicated by the received WBGT data belongs to, based on the received environmental-sensor ID and the environmental-sensor ID table.

[0039]

Each of the activity sensors 4 is capable of measuring the heart rate (corresponding to an activity state) of the target worker Mt who wears the sensor 4. Each of the activity sensors 4 measures the heart rate of that target worker Mt, and transmits heart rate data (corresponding to activity data) at all times or at appropriate intervals. In the illustrated example, bracelet-type activity sensors 4 are used, and each of the activity sensors 4 is attached to a wrist of each target workers Mt so as to be in direct contact with the body of the target worker Mt during use.

[0040]

As illustrated in FIG. 2, each of the activity sensors 4 includes a communication unit capable of communicating with the relays 5, a notification unit such as a speaker, and a storage unit. The storage unit of each of the activity sensors 4 stores a worker ID for identifying the target worker Mt wearing the activity sensor 4.

[0041]

The heart rate data transmitted from the activity sensors 4 is received by the relays 5 and is transmitted to the cloud system 10 via the relays 5. The communication unit of each of the activity sensors 4 successively generates low-power-consumption beacon signals (Bluetooth Low Energy), transmits the beacon signals including heart rate data and the corresponding worker ID. Here, the heart rate data and the worker ID correspond to activity-performer information data. The beacon signals will be described in detail below.

[0042]

Since each of the activity sensors 4 transmits heart rate data and the

corresponding worker ID together, the cloud system 10 can promptly identify which target worker Mt the activity state indicated by the received heart rate data belongs to, based on the worker ID attached to the received heart rate data and the worker ID table stored in the cloud system 10.

[0043]

Two of the relays 5 (51 to 56) are arranged in each of the sunny area A1, the sunshade area A2, and the indoor area A3, in such a manner that the two relays are spaced apart from each other.

[0044]

Each of the relays 5 includes a first communication unit capable of receiving a beacon signal, a second communication unit connectable to the cloud system 10, and a storage unit. The storage unit stores a work-area ID capable of identifying the work area A in which the relay 5 is arranged.

[0045]

Each of the relays 5 transmits the received heart rate data and worker ID together with the work-area ID stored in the storage unit to the cloud system 10, at all times or at appropriate intervals.

[0046]

Each of the activity sensors 4 successively generates a plurality of kinds of beacon signals having different coverable ranges in such a manner that the beacon signals include information indicating heart rate data and the corresponding worker ID. For example, each of the activity sensors 4 generates three kinds of beacon signals having different coverable ranges: a beacon signal whose coverable range is short (hereinafter referred to as short-range beacon signal); a beacon signal whose coverable range is medium (hereinafter referred to as medium-range beacon signal); and a beacon signal whose coverable range is long (hereinafter referred to as long-range beacon signal). In FIG. 1, each of the ranges covered by a plurality of kinds of beacon signals having different coverable ranges (a predetermined range smaller than each of the work areas A) is indicated by a three-dot chain line.

[0047]

The relays 5 (51 to 56) are arranged such that any relay 5 arranged in the work areas A can receive at least a long-range beacon signal sent from any position in each of the work areas A1, A2, and A3. That is, the relays

5 are arranged in such a manner that a beacon signal sent from any position in each of the work areas A can be received by at least any one of the relays 5.

[0048]

Accordingly, a beacon signal sent from each of the activity sensors 4 is received by any relay 5 located within the range covered by the beacon signal. For example, in FIG. 1, among the beacon signals sent from the activity sensor 41 worn by the target worker Mt1, the long-range beacon signal is received by only the relay 52 out of the two relays 51 and 52 arranged in the sunny area A1. From the relay 52 that has received that beacon signal, activity-performer information data including the heart rate data of the target worker Mt1 wearing the activity sensor 41 and the worker ID of the target worker Mt1 is transmitted together with the work-area ID of the sunny area A1. Here, activity-performer information data and a work-area ID correspond to activity-area information data.

[0049]

Upon receipt of the signal from the relay 52, the cloud system 10 specifies that the target worker Mt1 is working in the sunny area A1.

[0050]

In FIG. 1, furthermore, among the beacon signals sent from the activity sensor 43 worn by the target worker Mt3, the long-range beacon signal is received by the relay 52 arranged in the sunny area A1 and the relay 53 arranged in the sunshade area A2, and the medium-range beacon signal sent from the activity sensor 43 is received by the relay 54 arranged in the sunshade area A2. From each of the relays 52, 53, and 54 that have received the beacon signals, a beacon signal which includes activity-area information data, the heart rate data of the target worker Mt3 wearing the activity sensor 43 and the worker ID of the target worker Mt3, is transmitted together with the work-area ID of the sunny area A1 or the work-area ID of the sunshade area A2.

[0051]

Upon receipt of the signals from the relays 52, 53, and 54, the cloud system 10 identifies, based on the received beacon signals, the relay 54 that has sent a signal including the beacon signal having the shortest coverable range among the received signals. The cloud system 10 identifies

the sunshade area A2 where the identified relay 54 is arranged as the work area A in which the target worker Mt3 is working.

[0052]

As illustrated in FIG. 2, the environmental sensors 3 and the relays 5 are connected to the cloud system 10, and the cloud system 10 is also accessible externally, such as via a supervisor computer 11 in a construction management office 2 or via a tablet. In the present embodiment, the cloud system 10 corresponds to a network and a management terminal. The environmental sensors 3 and the relays 5 do not have to be connected to a cloud system. Also, a management terminal that performs heat-illness risk assessment may be connected to a network over which communication can take place.

[0053]

A program for executing an assessment process for the risk of heat illness is stored in advance in the cloud system 10. Also, tables indicating WBGT reference values and heart-rate reference values described below, which are used for the assessment process, are recorded in advance in the cloud system 10. Further, a worker ID table illustrated in FIG. 3 is stored in the cloud system 10, and in a worker ID table, the name and age of each of the target workers Mt are associated with the worker ID assigned to the target worker Mt. The cloud system 10 executes the program described above, executing the assessment process described above. The assessment process will be described below.

[0054]

The WBGT reference values are reference values for individually assessing the risk of heat illness in each of the work areas A1, A2, and A3 on the basis of WBGT data transmitted from the environmental sensors 3. That is, the storage unit has a WBGT reference value table, illustrated in FIG. 4, in which WBGT reference values are recorded. In the WBGT reference value table, the WBGT reference value unique to each of the three work areas A1, A2, and A3 is stored in association with the corresponding work-area ID.

[0055]

The cloud system 10 refers to the WBGT reference value table by using as a key a work-area ID which has been transmitted from each of the environmental sensors 3 together with WBGT data. Then the cloud system 10

acquires the WBGT reference value corresponding to the work-area ID. Thus, the cloud system 10 is able to determine, for each of the work areas A1, A2, and A3, whether there is a risk of heat illness, on the basis of the acquired WBGT reference value and the WBGT data transmitted from each of the environmental sensors 3.

[0056]

The respective WBGT reference values for the work areas A1, A2, and A3 are set at an appropriate time before the assessment system starts operation, in consideration of work conditions in each of the work areas A1, A2, and A3. In addition, the WBGT reference values are updated sequentially in line with the construction progress.

[0057]

Examples of the work conditions to be taken into consideration include "work intensity", "wearing clothes", "airflow", and "acclimatization to heat". Here, "work intensity" refers to metabolic rate, with the work intensity being low for light manual work or deskwork and being high for heavy-lifting work and the like. For "wearing clothes", considered are the types of clothes worn at work (for example, work uniforms, coveralls made from SMS polypropylene fabric, etc.). For "airflow", considered is whether there is a flow of air. For "acclimatization to heat", considered is whether there is acclimatization to heat.

[0058]

The heart-rate reference values are reference values for individually assessing the risk of heat illness in each of the work areas A1, A2, and A3 on the basis of heart rate data transmitted from the activity sensors 4. That is, the storage unit has a heart-rate reference value table, illustrated in FIG. 5, in which heart-rate reference values are recorded. In the heart-rate reference value table, heart-rate reference values, which are associated with workers' ages, are stored in association with work-area IDs.

[0059]

The cloud system 10 refers to the heart-rate reference value table by using as a key a worker ID which has been transmitted from each of the activity sensors 4 via any of the relays 5 together with heart rate data. Then the cloud system 10 acquires the heart-rate reference value

corresponding to the age of the target worker Mt associated with the worker ID. Thus, the cloud system 10 is able to determine, based on the acquired heart-rate reference values and the heart rate data transmitted from the activity sensors 4, whether there is a risk of heat illness in the target workers Mt working in the work areas A1, A2, and A3.

[0060]

Heat-illness risk Assessment Method

Next, a heat-illness risk assessment method using the heat-illness risk assessment system described above will be described.

[0061]

First, each worker who is to work at a work site having a plurality of work areas (in the present embodiment, three work areas A1, A2, and A3) visits the construction management office 2 before starting work on the work day. As for each of the workers M1, M2,... who have visited the construction management office 2, the supervisor determines whether the worker is a target worker (Mt1, Mt2, ...) described above, that is, a target worker (Mt1, Mt2, ...) to be assessed for the risk of heat illness. The workers M1, M2,... are determined to be the target workers Mt1, Mt2,..., for example, when the ages of the workers M1, M2,... are within a predetermined age range prone to heat illness, or when their job falls into a category that involves wearing a non-air permeable work uniform such as dustproof clothes, or when the number of years of working experience in this work is few, or when the value of blood pressure measured in the morning is higher than a predetermined value.

[0062]

When the workers M1, M2,... are determined to be the target workers Mt1, Mt2,..., the supervisor accesses the cloud system 10 and inputs to the cloud system 10 the name of each of the target workers Mt1, Mt2,... and a worker ID to which the target worker is assigned in association with each other. For example, the name of the target worker Mt1 is Ichiro XXX, and the target worker Mt1 is assigned the worker ID "M00001". In this case, the worker name "Ichiro XXX" and the worker ID of Ichiro XXX, "M00001", are input in association with each other. The data of the target workers Mt1, Mt2,... is input to the cloud system 10, and a worker ID table is stored in the cloud system 10 accordingly. It is not necessarily that the

information of workers input before the start of work on the work day, and it is acceptable to register it in a batch prior to the work day.

[0063]

Simultaneously with or after the above process of inputting the data of the target workers Mt1, Mt2,..., the supervisor prepares one of the activity sensors 4 for each of the target workers Mt1, Mt2,... and passes the activity sensors 4 to the target workers Mt1, Mt2,.... Each of the activity sensors 4 is exclusively used by the corresponding one of the target workers Mt1, Mt2,..., for example, and the storage unit of each of the activity sensors 4 has recorded therein in advance the worker ID of the corresponding one of the target workers Mt1, Mt2,... For example, Ichiro XXX is assigned the worker ID "M00001", and the storage unit of the activity sensor 41 prepared for Ichiro XXX has recorded therein the worker ID "M00001".

[0064]

Each of the prepared activity sensors 4 is worn on the wrist of the corresponding one of the target workers Mt before they start work at the work site. While the target workers Mt are working, as illustrated in FIG. 6, the activity sensors 4 worn by the target workers Mt transmit activity-performer information data with being included in three kinds of beacon signals having different coverable ranges; the activity-performer information data includes heart rate data indicating the measured heart rate of each of the target workers Mt1, Mt2,... and the corresponding worker ID (activity-performer information-data transmission step S1).

[0065]

The activity-performer information data transmitted from the activity sensors 4 is received by the relays 5 arranged in the coverable ranges of the beacon signals. Accordingly, the recipient relays 5 differ depending on the position at which the target worker Mt is working. The activity-performer information data transmitted from each of the activity sensors 4 is received by all of the relays 5 positioned in the coverable ranges of the beacon signals. Each of the relays 5 that have received the activity-performer information data transmits to the cloud system 10 activity-area information data; the activity-area information data includes the received activity-performer information data and the work-area ID stored in the

storage unit of the relay 5 (activity-area information-data transmission step S2).

[0066]

On the other hand, each of the environmental sensors 3 in the work areas A1, A2, and A3 transmits to the cloud system 10 environmental information data including the WBGT data of the corresponding work area and the work-area ID stored in the storage unit of the environmental sensor 3 (environmental information-data transmission step S3).

[0067]

While the target workers Mt are working, the risk of heat illness is assessed for each of the target workers Mt in the following way.

[0068]

The cloud system 10 receives WBGT data from each of the environmental sensors 31, 32, and 33 in the work areas A1, A2, and A3, and receives heart rate data transmitted from each of the activity sensors 4 (41 to 44) individually worn by the target workers Mt1, Mt2,... via any of the relays 5 (51 to 56). At this time, the WBGT data is accompanied by the corresponding work-area ID, and the heart rate data is accompanied by the corresponding worker ID and work-area ID.

[0069]

At this time, as described above, in some cases, a plurality of pieces of heart rate data to which the same worker ID is attached may be received. The cloud system 10 checks information indicating the coverable ranges of the beacon signals which include the plurality of pieces of heart rate data to which the same worker ID is attached, and detects data including a beacon signal having a shorter coverable range. That is, it is determined that the corresponding target worker Mt is working at a location close to the relay 5 that has received the beacon signal having a shorter coverable range. Accordingly, based on the heart rate data and work-area ID transmitted by the relay 5 that has received the beacon signal having a shorter coverable range, the cloud system 10 identifies the heart rate and work area of the corresponding target worker Mt.

[0070]

The cloud system 10 assesses the risk of heat illness in each of the target workers Mt on the basis of the identified heart rate data of the

target worker Mt, the worker ID of the target worker Mt, and the stored heart-rate reference value table (risk assessment step S4).

[0071]

At this time, the cloud system 10 assesses the risk of heat illness in the work area A in which target workers Mt are working, based on the followings: a work-area ID transmitted from any relay 5 of the work area A where it is determined that the target workers Mt are working; WBGT data whose work-area ID is the same as the transmitted work-area ID; and the WBGT reference value table stored in the cloud system 10 (risk assessment step S4).

[0072]

If the result of heat-illness risk assessment using the heart rate data and the result of heat-illness risk assessment using the WBGT data indicate that "there is no risk of heat illness", the work and the assessment are continued. On the other hand, if the results indicate that "there is a risk of heat illness", the cloud system 10 transmits warning data indicating that there is a risk of heat illness, to the activity sensor 41 of the target worker Mt1 assigned the worker ID "M00001". Then, the notification unit of the activity sensor 41 of the target worker Mt1 provides a warning to the target worker Mt1, "Ichiro XXX". The configuration is also possible in which when both the result of heat-illness risk assessment using the heart rate data and the result of heat-illness risk assessment using the WBGT data indicate that "there is a risk of heat illness", warning data indicating that there is a risk of heat illness is transmitted to the activity sensor 41 of the target worker Mt1.

[0073]

According to the heat-illness risk assessment method according to the present embodiment, the working conditions of the target workers Mt are measured using the activity sensors 4 worn by the target workers Mt. This makes it possible to determine more accurate working conditions. The environmental conditions of the work areas A1, A2, and A3 are measured using the respective environmental sensors 3 arranged in the work areas A1, A2, and A3. This makes it possible to determine more accurate environmental conditions.

[0074]

In addition, activity data indicating the working conditions measured using the activity sensors 4 is received together with the respective worker IDs by the relays 5 located in any of the work areas A1, A2, and A3 in which the target workers Mt are working. The activity data is transmitted by the relays 5, accompanying with the work-area IDs of the corresponding work area (A1, A2 or A3) in which the relays 5 are arranged. This provides accurate detection of the work area (A1, A2 or A3) in which the target workers Mt are working. If any of the target workers Mt moves to a different work area (A1, A2 or A3), relays 5 arranged in the work area (A1, A2 or A3) to which the target worker Mt has moved transmit the work data and worker ID of the target worker Mt, together with the work-area ID of the work area (A1, A2 or A3). Accordingly, even if any of the target workers Mt moves to a different work area (A1, A2 or A3), it is possible to accurately detect the work area (A1, A2 or A3) where the target worker Mt is working.

[0075]

The assessment of the risk of heat illness in the individual target workers Mt is performed based on the work-area ID, WBGT data, and heart rate data; the WBGT data is data indicating the environmental conditions of the corresponding work areas (A1, A2, or A3) and is measured using the environmental sensors 3; the WBGT data and heart rate data are associated with each other using the work-area ID; and the work-area ID has been transmitted together with the worker IDs and heart rate data measured using the activity sensors 4. This makes it possible to more reliably identify the work area (A1, A2, or A3) in which each target worker Mt is working, and makes it possible to more accurately assess the risk of heat illness in each target worker Mt based on more accurate WBGT data and heart rate data.

[0076]

Furthermore, a plurality of relays 5 that receive data transmitted from the activity sensors 4 are arranged in each predetermined zone in the work areas A1, A2, and A3. This makes it possible to reduce the output of the activity sensors 4. This also makes it possible to reduce the power consumption of the activity sensors 4 and the size of the activity sensors 4.

[0077]

Furthermore, the work area (A1, A2, or A3) of each target worker Mt is detected using beacon signals. This also makes it possible to reduce the power consumption of the activity sensors 4 and to reduce easily the size of the activity sensors 4. Due to the reduced size, the activity sensors 4 are less likely to interfere in the work of the target workers Mt, making it possible to ensure high work efficiency of the target workers Mt. This makes it possible to identify the position of each of the target workers Mt in the work area (A1, A2, or A3) within a smaller range.

[0078]

Furthermore, the risk assessment step S4 is executed by the cloud system 10 to which the relays 51 and the environmental sensors 31 are connected. This enables on a mobile terminal or any other suitable device to perform assessment and to recognize the state of each of the target workers Mt. Accordingly, it is possible to achieve highly-flexible and low-cost assessment of the risk of heat illness in target workers working in wider work areas.

[0079]

In the embodiment described above, described is an example in which the environmental sensors 3 are connected to the cloud system and transmit WBGT data to the cloud system 10. However, the present invention is not limited thereto. For example, as illustrated in FIG. 7, like the activity sensors 41, the environmental sensors 3 may be connected to the cloud system 10 via the relays 5.

[0080]

In this case, as illustrated in FIG. 8, the activity sensors 4 transmit activity-performer information data (activity-performer information-data transmission step S11). The environmental sensors 3 transmit environmental data (environmental information-data transmission step S12), and the transmitted environmental data is received by the relays 5. The received environmental data and activity-performer information data are combined with the work-area ID of each of the relays 5, and the resulting data is transmitted by the relays 5 (activity-area information-data transmission step S13). Then, the cloud system 10 assesses the risk of heat illness in each of the target workers Mt (risk assessment step S14).

[0081]

At this time, the cloud system 10 assesses the risk of heat illness in the work area A in which target workers Mt are working, based on the followings: a work-area ID transmitted from any relay 5 of the work area A where it is determined that the target workers Mt are working; WBGT data whose work-area ID is the same as the transmitted work-area ID; and the WBGT reference value table stored in the cloud system 10 (risk assessment step S4). Here, environmental data, activity-performer information data, and a work-area ID correspond to activity-area information data.

[0082]

The environmental data sent from the environmental sensors 3 is received by the relays 5, making it possible to reduce the output of the environmental sensors 3. This makes it possible to reduce the power consumption of the environmental sensors 3, and also to reduce the size of the environmental sensors 3. In this case, the activity-performer information data and the environmental data are transmitted with included in beacon signals, by the activity sensors 4 and the environmental sensors 3, making it possible to easily reduce the power consumption of the environmental sensors 3 and to reduce the size of the environmental sensors 3.

[0083]

According to the heat-illness risk assessment system 1 of the present embodiment, it is possible to more accurately detect the work area (A1, A2, or A3) of a target worker Mt, using the relays 5 that have received activity-performer information data from the activity sensors 4. Also, it is possible to more accurately assess the risk of heat illness in each of the target workers Mt, based on the followings: more accurate activity data which is measured by the activity sensors 4 worn by each target worker Mt and which is transmitted from the relays 5; and more accurate environmental data measured by the environmental sensors 3 arranged in the work areas A1, A2, and A3.

[0084]

Furthermore, it is possible to more accurately detect the work area (A1, A2, or A3) of a target worker Mt, using the relays 5 that have received activity-performer information data from the activity sensors 4. Also, it is possible to more accurately assess the risk of heat illness in each of

the target workers Mt, based on the followings: more accurate activity data which is measured by the activity sensors 4 worn by each target worker Mt and which is transmitted from the relays 5; and more accurate environmental data measured by the environmental sensors 3 arranged in the work areas A1, A2, and A3.

[0085]

In the embodiment described above, described is an example in which, if the result of heat-illness risk assessment using heart rate data and the result of heat-illness risk assessment using WBGT data indicate that "there is a risk of heat illness", warning information indicating that there is a risk of heat illness is transmitted to the activity sensors 4 of the target workers Mt. However, the present invention is not limited thereto. For example, the warning information may be transmitted not only to the activity sensors 4 of the target workers Mt, but also to a mobile terminal 6 carried by a construction supervisor at the work site where the target workers Mt are working.

[0086]

Further, in the construction site illustrated in FIG. 1, the state of the work areas A1, A2, and A3 changes in line with the construction progress. Specifically, there may be cases in which the number of work areas having different conditions from the work areas A1, A2, and A3 increase, and cases in which the work areas A1, A2, and A3 are expanded or contracted. In such cases, the appropriate arrangement of environmental sensors and relays in accordance with the changes in each work area enables more accurate assessment of the risk of heat illness in each of the target workers Mt.

[0087]

In the embodiment described above, described is an example in which heart-rate reference values used for heat-illness risk assessment are stored in a cloud system in form of heart-rate reference value table. However, the present invention is not limited thereto. For example, a heart-rate reference value may be calculated using a predetermined formula stored in the cloud system on the basis of input information or the like on each target worker.

[0088]

Other embodiments

Although the embodiment of the present disclosure has been described hereinabove, the above embodiment of the present disclosure is simply to facilitate understanding of the present disclosure and are not in any way to be construed as limiting the present disclosure. The present disclosure may variously be changed or altered without departing from its gist and encompass equivalents thereof. For example, modified example which will be described below is possible.

[0089]

In the embodiment described above, "work" is exemplified as an example of an "activity", and, accordingly, a worker is exemplified as an example of an activity performer. In addition, a target worker is exemplified as an example of a target activity performer, and a work area is exemplified as an example of an activity area. The present invention is not limited thereto. That is, the concept of an activity includes work. That is, the concept of an activity is broader than the concept of work and means operation, for example.

[0090]

In the embodiment described above, heart rate is exemplified as an example of an "activity state", and, accordingly, heart rate data, which is an example of activity data, is output from each of the activity sensors 4. The present invention is not limited thereto. For example, each of the activity sensors 4 may include a speed sensor, a pedometer, or the like. That is, activity data may be data indicating the speed of an activity performer, data indicating the acceleration of an activity performer, data indicating the number of steps taken, or the like. Furthermore, "activity state" may denote a physiological state such as body temperature, the value of blood pressure, the volume of blood flow, and the amount of perspiration. In this case, measurement data obtained by measuring at least one of the foregoings is used as activity data, and a sensor capable of outputting the measurement data is used as an activity sensor.

[0091]

In the embodiment described above, a construction site is exemplified as an example of a location having the plurality of work areas A1, A2, and A3. The present invention is not limited thereto. The location may be a factory, an elderly care center, or the like, for example, or may be any

other location.

[0092]

In the embodiment described above, WBGT data is exemplified as an example of environmental condition data. The present invention is not limited thereto. For example, only data of the temperature measured in the work areas A1, A2, and A3 may be used as environmental condition data, or only data of the humidity measured in the work areas A1, A2, and A3 may be used as environmental condition data. Alternatively, data of any other index indicating the environmental conditions of the work areas A1, A2, and A3 may be used as environmental condition data.

[Reference Signs List]

[0093]

1 heat-illness risk assessment system, 2 construction management office,
3 (31 to 33) environmental sensor,
4 (41 to 44) activity sensor,
5 (51 to 56) relay (activity area device),
6 mobile terminal, 10 cloud system (network, management terminal),
11 supervisor computer,
A1 sunny area (work area, activity area)
A2 sunshade area (work area, activity area)
A3 indoor area (work area, activity area)
M worker (activity performer)
Mt (Mt1 to Mt4) target worker (target activity performer)

[Name of Document] CLAIMS

[Claim 1]

A heat-illness risk assessment method for assessment of a risk of heat illness when a plurality of activity performers engage in an activity in a plurality of activity areas,

the heat-illness risk assessment method comprising:

an activity-performer information-data transmission step of transmitting activity-performer information data of a target activity performer by an activity sensor,

the target activity performer being an activity performer to be assessed for the risk of heat illness, among the plurality of activity performer,

the activity sensor being a sensor that is worn by the target activity performer and that measures an activity state of the target activity performer,

the activity-performer information data including activity data and an activity-performer ID of the target activity performer,

the activity data indicating the activity state measured by the activity sensor,

the activity-performer ID being an ID assigned to the target activity performer,

the activity-performer ID being stored in the activity sensor;

an activity-area information-data transmission step of receiving the activity-performer information data and transmitting activity-area information data by an activity area device,

the activity area device being arranged in each of the activity areas,

the activity area device storing an activity area ID identifying the activity area in which the activity area device is arranged,

the activity-performer information data transmitted by the activity sensor that is located in the activity area in which the activity area device is arranged,

the activity-area information data including the activity area ID and the activity-performer information data received by the activity area

device;

an environmental information-data transmission step of transmitting environmental information data by an environmental sensor,

the environmental sensor being a sensor that is arranged in each of the activity areas and that measures an environmental condition of the activity area in which the environmental sensor is arranged,

the environmental sensor storing the activity area ID identifying the activity area in which the environmental sensor is arranged,

the environmental information data including environmental data and the activity area ID,

the environmental data indicating the environmental condition measured by the environmental sensor; and

a risk assessment step executed by a management terminal

in which the activity-area information data and the environmental information data are received and

in which the risk of heat illness is assessed individually for the target activity performer,

the target activity performer being identified by the activity-performer ID,

the assessing being performed based on the activity data and the environmental data that are associated with each other using the activity area ID,

the management terminal together with the activity sensor, the activity area device, and the environmental sensor being connected to a network.

[Claim 2]

A heat-illness risk assessment method for assessment of a risk of heat illness when a plurality of activity performers engage in an activity in a plurality of activity areas,

the heat-illness risk assessment method comprising:

an activity-performer information-data transmission step of transmitting activity-performer information data of a target activity performer by an activity sensor,

the target activity performer being an activity performer to be

assessed for the risk of heat illness, among the plurality of activity performer,

the activity sensor being a sensor that is worn by the target activity performer and that measures an activity state of the target activity performer,

the activity-performer information data including activity data and an activity-performer ID of the target activity performer,

the activity data indicating the activity state measured by the activity sensor,

the activity-performer ID being an ID assigned to the target activity performer,

the activity-performer ID being stored in the activity sensor;

an environmental information-data transmission step of transmitting environmental information data by an environmental sensor,

the environmental sensor being a sensor that is arranged in each of the activity areas and that measures an environmental condition of the activity area in which the environmental sensor is arranged,

the environmental information data including environmental data,

the environmental data indicating the environmental condition measured by the environmental sensor;

an activity-area information-data transmission step of receiving the activity-performer information data and the environmental data and transmitting activity-area information data by an activity area device,

the activity area device being arranged in each of the activity areas,

the activity area device storing an activity area ID identifying the activity area in which the activity area device is arranged,

the activity-area information data including the activity-performer information data, the environmental information data, and the activity area ID,

the activity-performer information data transmitted by the activity sensor that is located in the activity area in which the activity area device is arranged,

the environmental data transmitted by the environmental sensor that is located in the activity area in which the activity area device is

arranged; and

a risk assessment step executed by a management terminal,

in which the activity-area information data is received, and

in which the risk of heat illness is assessed for the target activity performer,

the target activity performer being identified by the activity-performer ID,

the assessing being performed based on the activity data and the environmental data that are associated with each other using the activity area ID,

the management terminal together with the activity sensor and the activity area device being connected to a network.

[Claim 3]

The heat-illness risk assessment method according to Claim 1 or 2, wherein

a plurality of the activity area devices are arranged in each of the activity areas, and

each of the plurality of activity area devices is capable of receiving the activity-performer information data that is sent by the activity sensor and in a predetermined range smaller than the activity area in which the activity area device is arranged.

[Claim 4]

The heat-illness risk assessment method according to any of Claims 1 to 3, wherein

the activity area device receives a beacon signal.

[Claim 5]

The heat-illness risk assessment method according to any of Claims 1 to 4, wherein

the network comprises a cloud system.

[Claim 6]

A heat-illness risk assessment system for assessment of a risk of heat

illness when a plurality of activity performers engage in an activity in a plurality of activity areas,

the heat-illness risk assessment system comprising:

an activity sensor configured to measure an activity state of a target activity performer who wears the activity sensor and to transmit activity-performer information data,

the target activity performer being an activity performers to be assessed for the risk of heat illness, among the plurality of activity performers,

the activity-performer information data including activity data and an activity-performer ID of the target activity performer,

the activity data indicating the activity state of the target activity performer measured by the activity sensor,

the activity-performer ID being an ID assigned to the target activity performer,

the activity-performer ID being stored in the activity sensor;

an activity area device arranged in each of the activity areas,

the activity area device configured to store an activity area ID identifying the activity area in which the activity area device is arranged,

the activity area device configured to receive the activity-performer information data transmitted by the activity sensor that is located in the activity area in which the activity area device is arranged,

the activity area device configured to transmit activity-area information data,

the activity-area information data including the activity area ID and the activity-performer information data received by the activity area device;

an environmental sensor arranged in each of the activity areas,

the environmental sensor configured to store the activity area ID identifying the activity area in which the environmental sensor is arranged,

the environmental sensor configured to measure an environmental condition of the activity area in which the environmental sensor is arranged,

the environmental sensor configured to transmit environmental information data,

the environmental information data including environmental data and the activity area ID,

the environmental data indicating the environmental condition measured by the environmental sensor; and

a management terminal configured to be connected to a network together with the activity area device and the environmental sensor,

the management terminal configured to receive the activity-area information data and the environmental information data,

the management terminal configured to assess the risk of heat illness individually for the target activity performer,

the target activity performer being identified by the activity-performer ID,

the assessing being performed based on the activity data and the environmental data that are associated with each other using the activity area ID.

[Claim 7]

A heat-illness risk assessment system for assessment of a risk of heat illness when a plurality of activity performers engage in an activity in a plurality of activity areas,

the heat-illness risk assessment system comprising:

an activity sensor configured to measure an activity state of a target activity performer who wears the activity sensor and to transmit activity-performer information data,

the target activity performer being an activity performers to be assessed for the risk of heat illness, among the plurality of activity performers,

the activity-performer information data including activity data and an activity-performer ID of the target activity performer,

the activity data indicating the activity state of the target activity performer measured by the activity sensor,

the activity-performer ID being an ID assigned to the target activity performer,

the activity-performer ID being stored in the activity sensor;

an environmental sensor arranged in each of the activity areas,

the environmental sensor configured to measure an environmental condition of the activity area in which the environmental sensor is arranged,

the environmental sensor configured to transmit environmental data measured by the environmental sensor,

the environmental data indicating the environmental condition;

an activity area device arranged in each of the activity areas,

the activity area device configured to store an activity area ID identifying the activity area in which the activity area device is arranged,

the activity area device configured to receive the activity-performer information data and the environmental data,

the activity-performer information data being transmitted by the activity sensor that is located in the activity area in which the activity area device is arranged,

the environmental data being transmitted by the environmental sensor that is located in the activity area in which the activity area device is arranged,

the activity area device configured to transmit activity-area information data,

the activity-area information data including the activity area ID, the activity-performer information data and the environmental data that have been received by the activity area device; and

a management terminal configured to be connected to a network together with the activity area device,

the management terminal configured to receive the activity-area information data,

the management terminal configured to assess the risk of heat illness individually for the target activity performer,

the target activity performer being identified by the activity-performer ID,

the assessing being performed based on the activity data and the environmental data of the received activity-area information data.