

PERSON DETECTION APPARATUS AND METHOD OF DETECTING A
PERSON

Background

5 [0001] The present invention relates to a person
detection technique of detecting a person-position of a
person in a division on a basis of thermographies
detected in the division.

10 [0002] In the past, as an air-conditioning control
system, there is proposed a technique of determining a
division with a person and
controlling an air-conditioning environment to be
comfortable, and stopping air-conditioning and lighting
in a division with no person (for example, see Japanese
15 Patent Application Laid-open No. 2012-057840, Japanese
Patent Application Laid-open No. 2016-070756, and the
like). Such a system employs a technique of detecting a
person in a division as follows. The system detects
thermographies of the division by using a plurality of
20 infrared sensors attached on walls and a ceiling,
extracts a person region indicating a person's skin
temperature from the obtained temperature distribution of
the floor-surface of the division, and thereby detects
the person.

25 [0003] A thermopile array sensor is one of infrared
sensors that detect thermographies. Thermopile array
sensors are arranged on a ceiling, and detects
thermographies. The temperature distribution of the
floor-surface of a division is measured. Then a person,
30 i.e., a heat-generating object, is detected, whose
temperature is higher than the temperature of the floor-

surface. At this time, by using thermopile array sensors having high resolutions, it is possible to obtain person-position information every 10 cm (approximately).

[0004] Thermographies are detected at a certain frame rate, and the temperature distribution of the floor-surface of the division is measured continuously. As a result, it is possible to track a person moving, and detect person-position information in the division in real time.

[0005] In facilities such as an office, in which people use a plurality of divisions, a detection status of people in divisions is useful for a user. Examples of the detection status include a presence status of members in the division, an availability status of shared equipment such as round tables and conference tables in the division, and the like. For example, if a user obtains a presence status of colleagues in an arbitrary different division or an arbitrary division on a different floor, the user can avoid meaningless actions when a colleague is absent, e.g., the user can avoid phone call to the colleague's desk or visit to the colleague's desk. As a result, it is possible to reduce a burden of a user necessary to contact colleagues. For example, if a user obtains an availability status of shared equipment in an arbitrary different division or an arbitrary division on a different floor, the user does not have to go to each shared equipment in order to confirm whether or not the shared equipment is used. As a result, it is possible to reduce a burden of a user necessary to confirm the availability status.

[0006] However, it is an object of the aforementioned

person detection technique of the prior art to control equipment such as air-conditioning equipment and lighting equipment in a division. An obtained person detection result is a person-position including coordinate values in an X-Y coordinate system set in a division. Even if such a person-position is transmitted to a user terminal, it is difficult for a user to easily confirm a presence status or an availability status of a desired division, which is a problem.

[0007] The present invention has been made in view of the aforementioned circumstances, and it is desirable to provide a person detection technique capable of confirming a presence status of members or an availability status of shared equipment easily.

Summary

[0008] In view of the above-mentioned circumstances, according to an embodiment of the present invention, there is provided a person detection apparatus that detects a person-position of a person in a division from thermographies detected by a thermography sensor arranged in the division, the person detection apparatus including: a thermography obtaining unit that obtains thermographies detected by the thermography sensor at regular intervals; a person tracking unit that image-processes the obtained thermographies in time series, tracks a high-temperature part, whose temperature is higher than a floor-surface temperature of the division, and thereby detects the person-position of the person in the division; a memory unit that stores person detection information registered for each seat arranged in the division, the person detection information including a

seat-position of the seat and a person-
detected/undetected status of the seat-position; a person
detection determining unit that compares the person-
position detected by the person tracking unit with the
5 seat-position of each seat registered in the person
detection information, thereby determines a person-
detected/undetected status of the seat-position, and
updates the person-detected/undetected status of the
person detection information; a status data generating
10 unit that generates status data on a basis of the person-
detected/undetected status of each seat in the division,
each seat being registered in the person detection
information, the status data indicating a detection
status of the person in the division; and a transmission
15 processing unit that transmits, in response to a status
request from a user terminal connected via a
communication line, the status data of the division to
the user terminal.

[0009] Further, according to the person detection
20 apparatus of an embodiment of the present invention, the
status data generating unit generates, on a basis of a
person-detected/undetected status of a seat of a member
of the division, the seat being registered in the person
detection information, status data indicating presence or
25 absence as a presence status of the member.

[0010] Further, according to the person detection
apparatus of an embodiment of the present invention, the
transmission processing unit receives an alert-condition
from the user terminal, the alert-condition specifying
30 alert-information of a target seat, the target seat
indicating an arbitrary seat in the division, the alert-

information indicating presence or absence at the target seat, stores the alert-condition in the memory unit, confirms, where the status data is newly generated, the presence status at the target seat specified in the alert-condition stored in the memory unit, and transmits, where the presence status is changed and coincides with the presence or absence specified in the alert-information, alert data indicating the alert-information to a user terminal specified in the alert-condition.

[0011] Further, according to the person detection apparatus of an embodiment of the present invention, the status data generating unit generates, on a basis of a person-detected/undetected status of a seat of shared equipment in the division, the seat being registered in the person detection information, status data indicating availability or unavailability as an availability status of the shared equipment.

[0012] Further, according to the person detection apparatus of an embodiment of the present invention, the transmission processing unit receives an alert-condition from the user terminal, the alert-condition specifying alert-information of target shared equipment, the target shared equipment indicating arbitrary shared equipment in the division, the alert-information indicating availability or unavailability of the target shared equipment, stores the alert-condition in the memory unit, confirms, where the status data is newly generated, the availability status of the target shared equipment specified in the alert-condition stored in the memory unit, and transmits, where the availability status is changed and coincides with the availability or

unavailability specified in the alert-information, alert data indicating the alert-information to a user terminal specified in the alert-condition.

[0013] Further, according to an embodiment, there is provided a method of detecting a person, the method being used by a person detection apparatus that detects a person-position of a person in a division from thermographies detected by a thermography sensor arranged in the division, the method including: by a thermography obtaining unit, obtaining thermographies detected by the thermography sensor at regular intervals; by a person tracking unit, image-processing the obtained thermographies in time series, tracking a high-temperature part, whose temperature is higher than a floor-surface temperature of the division, and thereby detecting the person-position of the person in the division; by a memory unit, storing person detection information registered for each seat arranged in the division, the person detection information including a seat-position of the seat and a person-detected/undetected status of the seat-position; by a person detection determining unit, comparing the person-position detected by the person tracking unit with the seat-position of each seat registered in the person detection information, thereby determining a person-detected/undetected status of the seat-position, and updating the person-detected/undetected status of the person detection information; by a status data generating unit, generating status data on a basis of the person-detected/undetected status of each seat in the division, each seat being registered in the person detection

information, the status data indicating a detection status of the person in the division; and by a transmission processing unit, transmitting, in response to a status request from a user terminal connected via a communication line, the status data of the division to the user terminal.

[0014] According to the present invention, a user can easily confirm a presence status of members and an availability status of shared equipment in an arbitrary different division or an arbitrary division on a different floor. Therefore, if a user obtains a presence status of members, the user can avoid meaningless actions when a colleague is absent, e.g., the user can avoid phone call to the colleague's desk or visit to the colleague's desk. Further, if a user obtains an availability status of shared equipment, the user does not have to go to each shared equipment in order to confirm whether or not the shared equipment is used. As a result, it is possible to reduce a burden of a user necessary to confirm the availability status.

These and other objects, features and advantages of the present disclosure will become more apparent in light of the following detailed description of best mode embodiments thereof, as illustrated in the accompanying drawings.

Brief Description of Drawings

[0015] Fig. 1 is a block diagram showing a configuration of a person detection system of the first embodiment;

Fig. 2 shows an arrangement example of seats of the first embodiment;

Fig. 3 shows an example of data structure of person detection information of the first embodiment;

Fig. 4 is a sequence diagram showing a status data generation behavior and a status data transmission behavior of the first embodiment;

Fig. 5 is an example of the status data (presence status) displayed on the screen;

Fig. 6 shows an arrangement example of seats of the second embodiment;

Fig. 7 shows an example of data structure of person detection information of the second embodiment;

Fig. 8 is an example of the status data (availability status) displayed on the screen;

Fig. 9 shows an example of data structure of alert-conditions;

Fig. 10 is a sequence diagram showing an alert data transmission behavior of the third embodiment; and

Fig. 11 shows examples of alert data displayed on a screen.

Detailed Description of Embodiments

[0016] Hereinafter, embodiments of the present technology will be described with reference to the drawings.

[First embodiment]

Firstly, with reference to Fig. 1, the person detection system 1 of a first embodiment of the present invention will be described. Fig. 1 is a block diagram showing a configuration of a person detection system of the first embodiment.

The person detection system 1 is provided in facilities such as an office, in which people use a

plurality of divisions. The person detection system 1 provides a person detection result, which is based on thermographies obtained in the respective divisions, to a user. In the present embodiment described here, a presence status of members in each division is generated on a basis of the person detection result, and is transmitted to a user.

[0017] The person detection system 1 includes the plurality of thermography sensors T and the person detection apparatus 10.

The thermography sensors T are typical thermography sensors such as thermopile sensors. The thermography sensors T are sensor terminals arranged on the ceiling S or walls (not shown) of the division D, and detects thermographies of the floor-surface of the division D. In this case, for example, the thermography sensors T are arranged in a matrix on the ceiling of the division D at certain intervals such that the imaging areas of the thermography sensors T overlap with each other.

Note that, if there are a plurality of divisions D, in each of which the thermography sensors T are arranged, the plurality of divisions D are treated as detection targets of the person detection system 1.

[0018] The person detection apparatus 10 as a whole is an information processing apparatus such as a server apparatus. The person detection apparatus 10 image-processes thermographies obtained from the thermography sensors T via the communication line L1, generates a presence status on a basis of the obtained person detection result, and transmits the presence status to the user terminals 20 via the communication line L2.

The user terminal 20 is an information processing terminal connected to the person detection apparatus 10 via the communication line L2 such as a PC, a tablet, and a smartphone. For example, the user terminal 20 has functions of accessing the person detection apparatus 10 in response to an operation input in a browser by a user, thereby obtaining a presence status of an arbitrary division D, and displaying the presence status on a screen.

[0019] [Person detection apparatus]

The person detection apparatus 10 mainly includes, as functional units, the sensor I/F unit 11, the communication I/F unit 12, the memory unit 13, the thermography obtaining unit 14, the person tracking unit 15, the person detection determining unit 16, the status data generating unit 17, and the transmission processing unit 18. A central processing unit (CPU) executes programs to realize the thermography obtaining unit 14, the person tracking unit 15, the person detection determining unit 16, the status data generating unit 17, and the transmission processing unit 18 out of those functional units.

[0020] The sensor I/F unit 11 has a function of sending and receiving data to and from the thermography sensors T arranged in the division D via the communication line L1.

The communication I/F unit 18 has a function of sending and receiving data to and from the user terminal 20 via the communication line L2.

[0021] The memory unit 13 includes memory devices such as a hard disk and a semiconductor memory. The memory

unit 13 has a function of storing various information-to-be-processed and programs used for a person detection process of the person detection apparatus 10.

Examples of such information-to-be-processed mainly include thermographies obtained from the thermography sensors T, and person detection information indicating a person detection result of each seat arranged in the division D.

[0022] Fig. 2 shows an arrangement example of seats of the first embodiment. Fig. 3 shows an example of data structure of person detection information of the first embodiment. Person detection information is registered for each seat ID identifying a seat, the person detection information including a name, a seat-position (X coordinate value, Y coordinate value), and a person-detected/undetected status. The X, Y coordinate values indicating a seat-position are coordinate values in a preset X-Y coordinate system in the division D based on an origin O.

[0023] For example, the name of the member "AAA", who uses this seat as his/her own seat, is registered as the name for the seat "P11". The seat-position of this seat is "X11", "Y11". "Detected", which means that a person is detected at this seat-position, is registered as the person-detected/undetected status. It means that the member "AAA" is present at the seat "P11".

Further, the name of the member "CCC", who uses this seat as his/her own seat, is registered as the name for the seat "P21". The seat-position of this seat is "X21", "Y21". "Undetected", which means that a person is undetected at this seat-position, is registered as the

person-detected/undetected status. It means that the member "CCC" is not present at, i.e., absent from, the seat "P21".

[0024] The thermography obtaining unit 14 has functions of obtaining thermographies detected by the thermography sensors T at regular intervals via the sensor I/F unit 11 and the communication line L1, and storing the thermographies in the memory unit 13.

The person tracking unit 15 has functions of image-processing the thermographies stored in the memory unit 13 in time series, tracking a high-temperature part, whose temperature is higher than a floor-surface temperature of the thermographies, and thereby detecting the person-position of the person in the division D. A known tracking method disclosed in Japanese Patent Application Laid-open No. 2016-070756 or the like, for example, may be used.

[0025] The person detection determining unit 16 has functions of comparing the person-position detected by the person tracking unit 15 with the seat-position of each seat registered in the person detection information stored in the memory unit 13, thereby determining a person-detected/undetected status, which indicates whether or not a person is detected at each seat-position, and updating the person-detected/undetected status of the person detection information stored in the memory unit 13 on a basis of the obtained detection result.

For example, a person-detected/undetected status of each seat-position may be determined as follows. The person detection determining unit 16 compares the person-position obtained by the person tracking unit 15 with the

seat-position of each seat registered as the person detection information. The person detection determining unit 16 determines, where the difference between the person-position and the seat-position is within an acceptable range, that a person is detected at the seat-position.

[0026] In this example, a threshold may be provided for a time period, in which the difference between the person-position and the seat-position is within the acceptable range. The person detection determining unit 16 may determine that a person is detected, only if the difference is within the acceptable range without interruption for a time period equal to or larger than the threshold. As a result, if a person moves to somewhere and the difference is within the acceptable range only in a short time, the person detection determining unit 16 does not determine that a person is detected. As a result, the person detection determining unit 16 can determine the person-detected/undetected status accurately.

[0027] The status data generating unit 17 has a function of generating status data on a basis of the person-detected/undetected status of each seat in the division D registered in the person detection information stored in the memory unit 13, the status data indicating a detection status of the person in the division D. Specifically, the status data indicates a presence status of each member in the division D. The status data generating unit 17 has a function of storing the status data in the memory unit 13. If the person-detected/undetected status of an arbitrary seat is

"detected", then it means that the presence status of the member of this seat is present. If the person-detected/undetected status is "undetected", then it means that the presence status is absent.

5 [0028] The transmission processing unit 18 has a function of obtaining, in response to a status request received from the user terminal 20 via the communication line L2 and the communication I/F unit 12, the status data of the division D from the memory unit 13. The
10 transmission processing unit 18 has a function of transmitting the status data to the user terminal 20 via the communication I/F unit 12 and the communication line L2. The status data may be transmitted to the user terminal 20 by a Web screen, which is created by using a
15 description language such as HTML, via an email, or via a message.

[0029] [Behavior of first embodiment]

Next, with reference to Fig. 4, a behavior of the person detection apparatus 10 of the present embodiment
20 will be described. Fig. 4 is a sequence diagram showing a status data generation behavior and a status data transmission behavior of the first embodiment. In an example described below, the status data indicates a presence status of a member.

25 [0030] [Status data generation behavior]

Firstly, a behavior of generating a presence status will be described.

When it reaches the thermography sending timing (Step 100), the thermography sensor T detects a
30 thermography of the division D (Step 101), and sends the detected thermography to the person detection apparatus

10 (Step 102).

At this time, the thermography sensor T may, in response to a request obtained from the person detection apparatus 10, return the detected thermography to the person detection apparatus 10.

[0031] The thermography obtaining unit 14 receives thermographies autonomously sent from the thermography sensors T. The thermography obtaining unit 14 thus obtains the thermographies of the division D, and stores the thermographies in the memory unit 13 (Step 103).

The person tracking unit 15 executes a person tracking process, in which the person tracking unit 15 image-processes thermographies stored in the memory unit 13 in time series, tracks a high-temperature part, whose temperature is higher than a floor-surface temperature, as a person, and thereby detects the person-position of the person in the division D (Step 104).

[0032] Next, the person detection determining unit 16 compares the person-position detected by the person tracking unit 15 with the seat-position of each seat registered in the person detection information stored in the memory unit 13, thereby determines a person-detected/undetected status of the seat-position, which indicates whether or not a person is detected at each seat-position, and updates the person-detected/undetected status of the person detection information stored in the memory unit 13 on a basis of the obtained detection result (Step 105).

[0033] After that, the status data generating unit 17 generates status data on a basis of the person-detected/undetected status of each seat in the division D

registered in the person detection information stored in the memory unit 13, the status data indicating a presence status of the members in the division D, and stores the status data in the memory unit 13 (Step 106). A series of the status data generation behavior is finished.

[0034] [Status data transmission behavior]

Next, the status data transmission behavior will be described.

The user terminal 20 receives a status request operation, which requests for status data of the division D, via a browser, for example (Step 110). Then the user terminal 20 sends a status request to the person detection apparatus 10 via the communication line L2 (Step 111).

[0035] The transmission processing unit 18 of the person detection apparatus 10 receives the status request from the user terminal 20 via the communication I/F unit 12. Then the transmission processing unit 18 obtains the status data of the specified division D from the memory unit 13 (Step 112), and transmits the obtained status data to the user terminal 20, which sent the request (Step 113).

The user terminal 20 receives presence data transmitted from the person detection apparatus 10. Then the user terminal 20 displays the received status data on the screen by using the browser (Step 114). A series of the status data transmission behavior is finished.

[0036] Fig. 5 is an example of the status data (presence status) displayed on the screen. In this example, the arrangement of the seats in the division D is displayed with the graphic symbols showing chairs,

desks, and tables. The colors and patterns of the graphic symbols identify and display presence/absence (occupied/vacant). With this display, a user can confirm the presence status, i.e., the presence/absence status, of each member in the division D very easily.

[0037] Note that the status data may not always be displayed on the Web screen using the graphic symbols of Fig. 5. For example, a presence list indicating presence/absence including each member's name in person detection information on a basis of the corresponding person-detected/undetected status may be generated. The presence list may be displayed on a Web screen.

Alternatively, the presence list of a text format may be generated and transmitted via an email or a message.

[0038] [Effects of first embodiment]

As described above, according to the present embodiment, the person tracking unit 15 image-processes the obtained thermographies in time series, tracks a high-temperature part, and thereby detects the person-position of the person in the division. The person detection determining unit 16 compares the detected person-position with the seat-position of each seat registered in the person detection information, and thereby determines a person-detected/undetected status of the seat-position. The status data generating unit 17 generates status data on a basis of the person-detected/undetected status of each seat, the status data indicating a detection status of the person in the division D. The transmission processing unit 18 transmits the status data to the user terminal 20.

[0039] More specifically, the status data generating

unit 17 generates, on a basis of a person-detected/undetected status of a seat of a member of the division D registered in the person detection information, status data indicating presence or absence as a presence status of the member.

[0040] As a result, a person-detected/undetected status at each seat-position is determined on a basis of a person-position detected in the thermographies of the division D. The status data indicating a detection status of a person in the division D is generated on a basis of the person-detected/undetected status. The status data is transmitted to the user terminal 20 and displayed on a screen. As a result, even if a user cannot confirm a different floor or division with the eyes, the user can confirm the detection status of persons in the division D, specifically, the presence status of the members, by using the user terminal 20 that the user owns, remotely and easily. As a result, the user can avoid meaningless actions when a colleague is absent, e.g., the user can avoid phone call to the colleague's desk or visit to the colleague's desk.

[0041] [Second embodiment]

Next, the person detection apparatus 10 of a second embodiment of the present invention will be described.

In the example described in the first embodiment, the person detection apparatus 10 transmits the status data indicating the presence status of members as the detection status of the division D. In the present embodiment described below, as the detection status of the division D, status data indicating the availability status of shared equipment in the division D such as

round tables and conference tables is transmitted instead of the presence status.

[0042] The status data generating unit 17 has functions of generating status data on a basis of the person-detected/undetected status of each seat in the division D registered in the person detection information stored in the memory unit 13, the status data indicating an availability status of shared equipment in the division D, and storing the status data in the memory unit 13. The configuration of the person detection apparatus 10 of the present embodiment is similar to that of Fig. 1, and will not be described in detail.

[0043] Fig. 6 shows an arrangement example of seats of the second embodiment. Fig. 7 shows an example of data structure of person detection information of the second embodiment. Person detection information is registered for each seat ID identifying a seat, the person detection information including a name, an X coordinate value, a Y coordinate value, and a person-detected/undetected status. The X, Y coordinate values are coordinate values in a preset X-Y coordinate system in the division D based on an origin O.

[0044] For example, the shared equipment "round table A" of the seat "P41" is registered as the name for the seat "P41". The seat-position of this seat is "X41", "Y41". "Undetected", which means that a person is undetected at this seat-position, is registered as the person-detected/undetected status. At this time, "undetected" is registered as the person-detected/undetected status of the other seat "P42" of the shared equipment "round table A", too. It means that the

shared equipment "round table A" is unused and available.

[0045] Further, the shared equipment "conference table C" of the seat "P51" is registered as the name for the seat "P51". The seat-position of this seat is "X51",

5 "Y51". "Detected", which means that a person is detected at this seat-position, is registered as the person-detected/undetected status. It means that the shared equipment "conference table C" is used and unavailable.

[0046] Typically, if no person is detected at all the
10 seats of shared equipment, then it means that nobody uses the shared equipment. Therefore the status data generating unit 17 determines that the shared equipment is available. Further, if a person is detected at any one seat of shared equipment, then it means that somebody
15 uses the shared equipment. Therefore the status data generating unit 17 determines that the shared equipment is unavailable.

[0047] Fig. 8 is an example of the status data (availability status) displayed on the screen. In this
20 example, the arrangement of the seats in the division D is displayed with the graphic symbols showing chairs, desks, and tables. The colors and patterns of the graphic symbols identify and display presence/absence (occupied/vacant). With this display, a user can confirm
25 the availability status, i.e., the availability/unavailability status, of each shared equipment in the division D very easily.

[0048] Note that the availability status may not
30 always be displayed on the Web screen using the graphic symbols of Fig. 8. For example, an availability/unavailability list indicating

availability/unavailability including each shared equipment's name in person detection information on a basis of the corresponding availability/unavailability status may be generated. The availability/unavailability list may be displayed on a Web screen. Alternatively, the availability/unavailability list of a text format may be generated and transmitted via an email or a message.

[0049] [Effects of second embodiment]

As described above, according to the present embodiment, the person tracking unit 15 image-processes the obtained thermographies in time series, tracks a high-temperature part, and thereby detects the person-position of the person in the division. The person detection determining unit 16 compares the detected person-position with the seat-position of each seat registered in the person detection information, and thereby determines a person-detected/undetected status of the seat-position. The status data generating unit 17 generates status data on a basis of the person-detected/undetected status of each seat, the status data indicating an availability status of each shared equipment in the division D. The transmission processing unit 18 transmits the status data to the user terminal 20.

[0050] As a result, a person-detected/undetected status at each seat-position is determined on a basis of a person-position detected in the thermographies of the division D. The status data indicating an availability status of each shared equipment in the division D is generated on a basis of the person-detected/undetected status. The status data is transmitted to the user terminal 20 and displayed on a screen. As a result, even

if a user cannot confirm a different floor or division with the eyes, the user can confirm the availability status of each shared equipment easily. As a result, since a user obtains the availability status of each shared equipment, the user does not have to go to each shared equipment in order to confirm whether or not the shared equipment is used. As a result, it is possible to reduce a burden of a user necessary to confirm the availability status.

[0051] [Third embodiment]

Next, the person detection apparatus 10 of a third embodiment of the present invention will be described.

In the examples of the aforementioned first and second embodiments, in response to a status request of the user terminal 20, the person detection apparatus 10 transmits status data indicating a presence status or an availability status of the division D. In the present embodiment described below, where an alert-condition of a preset presence status or availability status is satisfied, the person detection apparatus 10 transmits alert data indicating a specified presence status or availability status to the user terminal 20.

[0052] Fig. 9 shows an example of data structure of alert-conditions. In the data structure, for each condition ID identifying an alert-condition, a seat ID or shared equipment ID indicating a detection target, alert-information, and alert-destination are registered.

For example, for the condition "J01", the seat "P11" i.e., the member "AAA", is registered as the detection target. To alert "presence", i.e., that the member "AAA" has returned to his/her own seat, is registered as the

alert-information. As the alert-destination, information identifying a user, e.g., an email address or the IP address of the user terminal 20, is registered.

[0053] Further, for the condition "J02", the conference table "C" is registered as the detection target. To alert "availability" is registered as the alert-information. Further, as the alert-destination, information identifying a user, e.g., an email address or the IP address of the user terminal 20, is registered.

[0054] The transmission processing unit 18 has functions of receiving an alert-condition from the user terminal 20, storing the alert-condition in the memory unit 13, at a time when a presence status or an availability status stored in the memory unit 13 is updated, confirming whether or not the alert-condition stored in the memory unit 13 is satisfied, and where the alert-condition is satisfied, transmitting alert data indicating the alert-information to the user terminal 20 specified in the alert-condition, the alert-information including the specified presence status or availability status. The alert data may be transmitted via an email or a message.

[0055] For example, an alert-condition specifying alert-information is set, the alert-information indicating presence or absence of a target seat. In this case, at a time when the status data indicating the detection status is updated, the presence status at the target seat specified in the alert-condition is changed, and coincides with the presence or absence specified in the alert-information to satisfy the alert-condition, the transmission processing unit 18 transmits alert data

indicating the alert-information to the user terminal 20 specified in the alert-condition.

[0056] Further, an alert-condition specifying alert-information is set, the alert-information indicating availability or unavailability of target shared equipment. In this case, at a time when the status data indicating the availability status is updated, the availability status of the target seat specified in the alert-condition is changed, and coincides with the availability or unavailability specified in the alert-information to satisfy the alert-condition, the transmission processing unit 18 transmits alert data indicating the alert-information to the user terminal 20 specified in the alert-condition.

[0057] At this time, where the detection target registered in the alert-condition is shared equipment, the transmission processing unit 18 may determine whether or not the alert-condition is satisfied in a similar way to the method of determining the availability/unavailability status of the second embodiment. In short, the transmission processing unit 18 may determine availability if no person is detected at all the seats of shared equipment. The transmission processing unit 18 may determine unavailability if a person is detected at any one seat of shared equipment.

[0058] [Behavior of third embodiment]

Next, with reference to Fig. 10, a behavior of the person detection apparatus 10 of the present embodiment will be described. Fig. 10 is a sequence diagram showing an alert data transmission behavior of the third embodiment.

In an example described below, an alert data transmission behavior will be described. Note that the status data generation behavior and the availability status generation behavior are similar to the
5 aforementioned behaviors with reference to Fig. 4, and will not be described in detail.

[0059] [Alert data transmission behavior]

Where the status data generating unit 17 newly generates status data, the transmission processing unit
10 18 of the person detection apparatus 10 obtains the status data from the memory unit 13 (Step 300), and obtains the alert-condition from the memory unit 13 (Step 301).

[0060] Next, the transmission processing unit 18
15 confirms whether or not each condition registered in the alert-condition is satisfied on a basis of the status data (Step 302). The transmission processing unit 18 transmits alert data indicating alert-information registered for the satisfied condition to the user
20 terminal 20 registered as the alert-destination specified in the condition (Step 303).

The user terminal 20 receives the alert-information transmitted from the person detection apparatus 10. Then the user terminal 20 displays the received alert-
25 information on a screen (Step 304). A series of the alert data transmission behavior is finished.

[0061] Fig. 11 shows examples of alert data displayed on a screen. (a) of Fig. 11 shows an example of an alert where the condition "J01" of Fig. 9 is satisfied. The
30 alert includes the alert data as follows. The alert data indicates that the member "AAA" of the seat "P11", i.e.,

the detection target, is present, i.e., has returned to his/her own seat. Further, (b) of Fig. 11 shows an example of an alert where the condition "J02" of Fig. 9 is satisfied. The alert includes the alert data as follows. The alert data indicates that shared equipment "conference table C", i.e., the detection target, is available.

[0062] [Effects of third embodiment]

As described above, according to the present embodiment, the transmission processing unit 18 receives an alert-condition from the user terminal 20, the alert-condition specifying alert-information of a detection target, the detection target indicating an arbitrary seat or shared equipment in the division, the alert-information indicating presence/absence or availability/unavailability of the detection target, and stores the alert-condition in the memory unit 13. The transmission processing unit 18, where the status data is updated and where the detection status of the target seat or the availability status of the target shared equipment as the detection target specified in the alert-condition of the memory unit 13 is the presence/absence or availability/unavailability specified in the alert-information, transmits alert data indicating the alert-information to the user terminal 20 specified in the alert-condition.

[0063] As a result, without sending a status request for a detection status or an availability status from the user terminal 20, information of presence/absence or availability/unavailability of an arbitrary detection target is automatically transmitted to the user terminal

20. As a result, it is possible to reduce a burden of a user's operation necessary to confirm the detection status or availability status.

[0064] Further, the person detection apparatus 10 may be in cooperation with a booking system, which manages booking of shared equipment. If the person detection apparatus 10 detects start of using shared equipment, then the booking system may automatically book use of the shared equipment. If the person detection apparatus 10 detects end of using shared equipment, then the booking system may automatically cancel booking of the shared equipment. As a result, it is possible to reduce a burden of a user's booking operation into the booking system.

[0065] [Extension of embodiments]

It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

What is claimed is:

1. A person detection apparatus that detects a person-position of a person in a division from thermographies detected by a thermography sensor arranged in the division, the person detection apparatus comprising:

a thermography obtaining unit that obtains thermographies detected by the thermography sensor at regular intervals;

a person tracking unit that image-processes the obtained thermographies in time series,

tracks a high-temperature part, whose temperature is higher than a floor-surface temperature of the division, and thereby

detects the person-position of the person in the division;

a memory unit that stores person detection information registered for each seat arranged in the division, the person detection information including a seat-position of the seat and a person-detected/undetected status of the seat-position;

a person detection determining unit that compares the person-position detected by the person tracking unit with the seat-position of each seat registered in the person detection information, thereby determines a person-detected/undetected status of the seat-position, and

updates the person-detected/undetected status of the person detection information;

a status data generating unit that generates status data on a basis of the person-detected/undetected status

of each seat in the division, each seat being registered in the person detection information, the status data indicating a detection status of the person in the division; and

5 a transmission processing unit that transmits, in response to a status request from a user terminal connected via a communication line, the status data of the division to the user terminal.

2. The person detection apparatus according to claim 1,
10 wherein

 the status data generating unit generates, on a basis of a person-detected/undetected status of a seat of a member of the division, the seat being registered in the person detection information, status data indicating
15 presence or absence as a presence status of the member.

3. The person detection apparatus according to claim 2, wherein

 the transmission processing unit
 receives an alert-condition from the user
20 terminal, the alert-condition specifying alert-information of a target seat, the target seat indicating an arbitrary seat in the division, the alert-information indicating presence or absence at the target seat,

 stores the alert-condition in the memory unit,
25 confirms, where the status data is newly generated, the presence status at the target seat specified in the alert-condition stored in the memory unit, and

 transmits, where the presence status is changed
30 and coincides with the presence or absence specified in the alert-information, alert data indicating the alert-

information to a user terminal specified in the alert-condition.

4. The person detection apparatus according to any one of claim 1 to claim 3, wherein

5 the status data generating unit generates, on a basis of a person-detected/undetected status of a seat of shared equipment in the division, the seat being registered in the person detection information, status data indicating availability or unavailability as an
10 availability status of the shared equipment.

5. The person detection apparatus according to claim 4, wherein

 the transmission processing unit
 receives an alert-condition from the user
15 terminal, the alert-condition specifying alert-information of target shared equipment, the target shared equipment indicating arbitrary shared equipment in the division, the alert-information indicating availability or unavailability of the target shared equipment,

20 stores the alert-condition in the memory unit, confirms, where the status data is newly generated, the availability status of the target shared equipment specified in the alert-condition stored in the memory unit, and

25 transmits, where the availability status is changed and coincides with the availability or unavailability specified in the alert-information, alert data indicating the alert-information to a user terminal specified in the alert-condition.

30 6. A method of detecting a person, the method being used by a person detection apparatus that detects a

person-position of a person in a division from
thermographies detected by a thermography sensor arranged
in the division, the method comprising:

by a thermography obtaining unit, obtaining
5 thermographies detected by the thermography sensor at
regular intervals;

by a person tracking unit,
image-processing the obtained thermographies in
time series,

10 tracking a high-temperature part, whose
temperature is higher than a floor-surface temperature of
the division, and thereby

detecting the person-position of the person in
the division;

15 by a memory unit, storing person detection
information registered for each seat arranged in the
division, the person detection information including a
seat-position of the seat and a person-
detected/undetected status of the seat-position;

20 by a person detection determining unit,
comparing the person-position detected by the
person tracking unit with the seat-position of each seat
registered in the person detection information, thereby
determining a person-detected/undetected status
25 of the seat-position, and

updating the person-detected/undetected status
of the person detection information;

by a status data generating unit, generating status
data on a basis of the person-detected/undetected status
30 of each seat in the division, each seat being registered
in the person detection information, the status data

indicating a detection status of the person in the
division; and

by a transmission processing unit, transmitting, in
response to a status request from a user terminal
5 connected via a communication line, the status data of
the division to the user terminal.