[DESCRIPTION]

TEMPERATURE READER LOGGER EQUIPPED WITH RELAY BRACKET TO MAXIMIZE USABILITY AND MAINTAINABILITY, AND FRESH LOGISTICS SYSTEM INCLUDING THE SAME

BACKGROUND OF INVENTION

Field of the invention

[1] The present disclosure relates to a temperature reader logger, and more particularly, to a temperature reader logger capable of periodically sensing, storing, and transmitting temperature in a low-power method and replacement management without opening a fresh logistics box, and a fresh logistics system including the same.

Related Art

[2] There is a demand for technologies to implement efficient fresh logistics at a low unit price while satisfying battery maintenance of a temperature sensor, cleaning of a logistics box, securing maintainability of internal temperature of the box, securing the accuracy of measuring a room temperature value inside and outside the box, and periodic temperature sensing and management.

[3] [Related Art Document]

[4] [Patent Document]

[5] (Patent Document 0001) Korean Patent Laid-open Publication No. 10-2019-0016817 (February 19, 2019)

[6] (Patent Document 00021) Korean Patent No. 10-1773380 (August 31, 2017)

SUMMARY

[7] The present disclosure provides a temperature reader logger capable of periodically

sensing, storing, and transmitting temperature in a low-power method and replacement management without opening a fresh logistics box, and a fresh logistics system including the same.

[8] However, aspects of the present disclosure are not restricted to those set forth herein. The above and other aspects of the present disclosure will become more apparent to one of ordinary skill in the art to which the present disclosure pertains by referencing the detailed description of the present disclosure given below.

[9] In an aspect, an active reader logger including a reader logger body and a relay bracket on which the reader logger body is detachably mounted is provided.

[10] The relay bracket includes: a guide rail that guides fitting of both side surfaces of the reader logger body so that the reader logger body slides from top to bottom and is coupled to the relay bracket; a locking jaw that supports the reader logger body from below when the reader logger body is completely coupled to the relay bracket; a fixing protrusion that is fitted into a locking groove provided on a rear side portion of the reader logger body so that the reader logger body does not slide upward when the reader logger body is completely coupled to the relay bracket; and a relay antenna that relays communication between the reader logger body and a passive sensor tag installed in a fresh logistics box.

[11] The reader logger body includes: a body part; guide rail grooves that are disposed on both side surfaces of the body part and configured to accommodate the guide rail of the relay bracket; a first wireless communication module that performs communication with a passive sensor tag installed in the fresh logistics box to measure an internal temperature of the fresh logistics box via the relay antenna; a memory that stores a sensing value sensed by the passive sensor tag, a second wireless communication module that performs communication with an external terminal and transmits the sensing value to the external terminal; and a power supply unit that drives the first and second wireless communication modules.

[12] The reader logger body periodically transmits wireless power to the passive sensor tag via the relay antenna of the relay bracket through the first wireless communication module and periodically receives the sensing value from the passive sensor tag.

[13] The first wireless communication module performs short-range wireless communication with the passive sensor tag in a frequency band of 100 kHz to 15 MHz via the relay antenna of the relay bracket, and the second wireless communication module performs short-range wireless communication or mobile communication with the external terminal in a frequency band of 1 GHz to 10 GHz.

[14] According to the embodiments of the present disclosure, by precisely sensing the inside and outside temperature of the box with a passive sensory tag that does not have a separate power supply unit, and at the same time including an active temperature reader logger installed on an outer side portion of the box, it is possible to accurately and periodically sense and manage a fresh logistics temperature.

[15] In addition, it is possible to implement high reliability by monitoring a temperature in the entire process of fresh logistics through tagging of a manager terminal with a passive sensory tag even in the logistics environment, the situation in which the reader logger battery is discharged, and the like.

[16] Furthermore, since the temperature reader logger is fastened in a detachable structure without opening the box, the internal opening of the logistics box is excluded in a series of processes of the collection and re-installation of the temperature reader logger, etc., such as the replacement of the logistics box and the replacement of the battery, so it is possible to stably maintain the fresh temperature and conveniently perform maintenance such as box cleaning.

[17] In addition, according to the multi-channel passive sensory tag driven by receiving power by the temperature reader logger of the present disclosure, it is possible to accurately

measure the inside and outside temperature of the box at low cost, thereby enabling setting and maintaining the optimal temperature conditions of the fresh logistics for each environment.

[18] The effects of the present disclosure are not limited to the above-mentioned effects, and other effects that are not mentioned may be obviously understood by those skilled in the art from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[19] FIG. 1 is a perspective view schematically illustrating a reader logger body according to some embodiments of the present disclosure.

[20] FIG. 2 is a diagram schematically illustrating a front part of the reader logger body according to some embodiments of the present disclosure.

[21] FIG. 3 is a diagram schematically illustrating a rear part of the reader logger body according to some embodiments of the present disclosure.

[22] FIG. 4 is a view illustrating how the reader logger body according to some embodiments of the present disclosure is fastened to a fitting type relay bracket.

[23] FIG. 5 is a diagram illustrating an appearance in which the reader logger body according to some embodiments of the present disclosure is fastened to a hanging type relay bracket.

[24] FIG. 6 is a diagram exemplarily illustrating an appearance in which the temperature reader logger according to some embodiments of the present disclosure is mounted in a fresh logistics box.

[25] FIG. 7 is a diagram for describing an arrangement relationship of a first wireless communication antenna provided in the reader logger body, a relay antenna provided in a relay bracket, and an antenna of a passive sensory tag provided in a box according to the

present disclosure.

[26] FIGS. 8 and 9 are diagrams for describing a fresh logistics system including a temperature reader logger according to some embodiments of the present disclosure.

[27] FIG. 10 is a diagram conceptually illustrating a configuration of a sensor tag according to some embodiments of the present disclosure.

[28] FIG. 11 is a diagram for describing a method of sensing and managing temperature information for each channel in a temperature management system according to some embodiments of the present disclosure.

[29] FIG. 12 is a diagram for describing a method of sensing and managing temperature information for each channel in a temperature management system according to some other embodiments of the present disclosure.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[30] Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. Advantages and features of the present disclosure and methods for accomplishing these advantages and features will become apparent from embodiments to be described later in detail with reference to the accompanying drawings. However, the present disclosure is not limited to embodiments to be described below, but may be implemented in various different forms, these embodiments will be provided only in order to make the present disclosure complete and allow those skilled in the art to completely recognize the scope of the present disclosure, and the present disclosure will be defined by the scope of the claims. Throughout the specification, the same components will be denoted by the same reference numerals.

[31] Unless defined otherwise, all the terms (including technical and scientific terms) used herein have the same meaning as meanings commonly understood by one of ordinary skill in

the art to which the present disclosure pertains. In addition, the terms defined in generally used dictionaries are not ideally or excessively interpreted unless they are specifically defined clearly.

[32] In addition, unless otherwise stated, a singular form includes a plural form in the present specification. Components, steps, operations, and/or elements mentioned by the terms “comprise” and/or “comprising” used herein do not exclude the existence or addition of one or more other components, steps, operations, and/or elements.

[33] A sensor tag of the present disclosure is a passive type sensor tag not equipped with its own power supply unit (for example, a battery), and a single sensor tag may perform a role of sensing and transmitting two or more sensing values to a reader. For example, the sensor tag may be implemented to include a plurality of temperature sensors for measuring temperatures of two or more different spaces, respectively.

[34] FIG. 1 is a perspective view schematically illustrating a reader logger body according to some embodiments of the present disclosure, FIG. 2 is a diagram schematically illustrating a front part of the reader logger body according to some embodiments of the present disclosure, FIG. 3 is a diagram schematically illustrating a rear part of the reader logger body according to some embodiments of the present disclosure, FIG. 4 is a view illustrating how the reader logger body according to some embodiments of the present disclosure is fastened to a fitting type relay bracket, FIG. 5 is a diagram illustrating an appearance in which the reader logger body according to some embodiments of the present disclosure is fastened to a hanging type relay bracket, FIG. 6 is a diagram exemplarily illustrating an appearance in which the temperature reader logger according to some embodiments of the present disclosure is mounted in a fresh logistics box, FIG. 7 is a diagram for describing an arrangement relationship of a first wireless communication antenna provided in the reader logger body, a relay antenna provided in a relay bracket, and an antenna of a passive sensory

tag provided in a box according to the present disclosure, and FIGS. 8 and 9 are diagrams for describing a fresh logistics system including a temperature reader logger according to some embodiments of the present disclosure.

[35] Referring to FIGS. 1 to 9, a reader logger body 100 includes a body part 110, a display unit 120 provided on a front surface of the body part 110, a user input unit 130 provided on an upper or lower surface of the body part 110, and guide rail groove parts 151 and 152 for attaching and detaching to and from a relay bracket 200.

[36] In addition, although not illustrated, the reader logger body 100 may include a first wireless communication module (here, the first wireless communication module perform communication with the passive sensory tag 1000 via a relay antenna of a relay bracket to be described later) that communicates with a passive sensory tag 1000 installed in a fresh logistics box to measure an internal temperature of the fresh logistics box, a memory that stores a sensing value sensed by the passive sensory tag 1000, a second wireless communication module that performs communication with an external terminal and transmits the sensing value to the external terminal, and a power supply unit that drives the first and second wireless communication modules.

[37] The reader logger body 100 periodically transmits wireless power to the passive sensory tag 1000 through the first wireless communication module (specifically, through a first wireless communication antenna 100AT of the first wireless communication module) via the relay antenna, and periodically receives the sensing value from the passive sensory tag 1000 via the relay antenna. That is, the relay antenna of the relay bracket may serve as a coupling antenna in wireless power transmission and wireless communication between the reader logger body 100 and the passive sensory tag 1000.

[38] Here, the first wireless communication module performs short-range wireless communication with the passive sensor tag 1000 in a frequency band of 100 kHz to 15 MHz,

and the second wireless communication module performs short-range wireless communication or mobile communication with the external terminal in a frequency band of 1 GHz to 10 GHz.

[39] For a more specific example, one reader logger body 100 is mounted on a box to match one passive sensory tag 1000 1:1, and the first wireless communication module of the reader logger body 100 may supply wireless power to the passive sensory tag 1000 through a passive short-range wireless communication (e.g., NFC or RFID communication), and thus, receive the internal and external temperature value of the fresh logistics box which is sensed by the passive sensory tag 1000.

[40] That is, the first wireless communication module may be a module that serves as a reader module (e.g., NFC reader module) that supplies wireless power to the passive sensory tag 1000 and receives the sensing value when the reader logger body 100 performs the passive short-range wireless communication with the passive sensory tag 1000.

[41] The second wireless communication module may be, for example, an active short-range wireless communication module (e.g., a Bluetooth low energy (BLE) module) or a mobile communication module, and the reader logger body 100 may include both an active short-range wireless communication module and a mobile communication module as needed.

[42] That is, the second wireless communication module may be a module for performing communication with a delivery manager terminal, a manager terminal, a management server, etc., without a user's tagging operation.

[43] As illustrated in FIG. 8, when the second wireless communication module is a BLE module, at least one reader logger body 100 may be paired with an external terminal (e.g., a smartphone or the like of a delivery driver delivering logistics boxes). That is, the box temperature information collected by the reader logger body 100 provided in each of the plurality of boxes may be collected and managed by an external terminal 6 (for example, a

delivery manager or manager terminal).

[44] The reader logger body 100 may transmit a temperature value to the external terminal 6 whenever a temperature value is received from the sensor, or may store temperature values for each cycle in the memory and transmit the temperature values for a plurality of cycles at once.

[45] The external terminal 6 may collect the temperature value transmitted from the reader logger body 100, and collect the external terminal itself information (e.g., time information matching individual temperature values, GPS information, etc.) other than the temperature and other management information (e.g., product information, transportation information, etc.) and transmit the collected information to the management server or the like.

[46] Alternatively, when the second wireless communication module is a mobile communication module as illustrated in FIG. 9, the reader logger body 100 may periodically transmit sensing temperature value information or the like to the management server 3 or the like through the information communication network 5.

[47] The relay bracket 200 illustrated in FIGS. 4 and 5 includes a guide rail 250 that guides fitting of both side surfaces of the reader logger body so that the reader logger body 100 slides from top to bottom and is coupled to the relay bracket, a locking jaw 210 that supports the reader logger body from below when the reader logger body is completely coupled to the relay bracket, a fixing protrusion 260 that is fitted into a locking groove provided on a rear side portion of the reader logger body so that the reader logger body slides upward and does not escape when the reader logger body is completely coupled to the relay bracket, and a relay antenna 200AT (see FIG. 7) that relays communication between the reader logger body and a passive sensory tag installed in a fresh logistics box.

[48] The relay bracket 200 may be coupled to the fresh logistics box in a variety of ways. For example, as in the relay bracket 200 illustrated in FIG. 4, fitting protrusions 270 disposed

on both side surfaces of the relay bracket may be fitted into the fresh logistics box, or as in a relay bracket 200' illustrated in FIG. 5, a hook member 270' provided on an upper portion of the housing of the relay bracket may be fixed to a hook groove or the like provided in the fresh logistics box, but is not limited thereto.

[49] Meanwhile, FIG. 7 illustrates an arrangement relationship between the first wireless communication antenna 100AT provided in the reader logger body 100, the relay antenna 200AT provided in the relay bracket 200, and an antenna 1000AT of the passive sensory tag 1000 provided in the box.

[50] All the antennas 100AT, 200AT, and 1000AT have a loop antenna shape, and a width 100ATw of the first wireless communication antenna 100AT is configured to be smaller than a width 200ATw of the relay antenna 200AT, and a width 200ATw of the relay antenna 200AT is configured to be smaller than a width 1000ATw of the sensor tag antenna 1000AT. Here, center points (geometric centers) of the first wireless communication antenna 100AT and the relay antenna 200AT may be disposed to overlap each other.

[51] As a result, it is possible to further miniature the reader logger body 100 and the relay bracket 200, and further reduce the probability of communication failure due to misalignment (i.e., the situation in which the center point of the sensor tag antenna 1000AT and the central point of the first wireless communication antenna 100AT or the relay antenna 200AT do not exactly overlap) with the sensor tag 1000.

[52] FIG. 10 is a diagram conceptually illustrating a configuration of a sensor tag according to some embodiments of the present disclosure, FIG. 11 is a diagram for describing a method of sensing and managing temperature information for each channel in a temperature management system according to some embodiments of the present disclosure, and FIG. 12 is a diagram for describing a method of sensing and managing temperature information for each channel in a temperature management system according to some other embodiments of the

present disclosure.

[53] An internal configuration of a sensor tag 1 illustrated in FIG. 10 is conceptually illustrated for convenience of explanation, but is not limited thereto. In addition, it goes without saying that the sensor tag 1 may include other additional components (excluding a battery) other than a sensing circuit unit, a micro controller unit (MCU), and an antenna unit to be described later. Furthermore, the shapes and arrangement of the sensing circuit unit, the MCU, and the antenna blocks are briefly shown. For example, variable resistors Th1, Th2, and Th3 illustrated in FIGS. 1 and 6 may be branched and arranged at a position physically separated from the sensor tag body.

[54] Meanwhile, the MCU 20 employed in the sensor tags 1, 1', and 1" of the present disclosure is an MCU having a short-range wireless communication interface such as RFID or NFC, and the MCU 20 is an MCU that includes at least one operational amplifier (OP-AMP) and at least one analog-digital converter (ADC) input port 220, which will be described later.

[55] The passive 2-channel multi-channel sensor tag 1 may be configured to include a sensing circuit unit 10 that is driven by power received from an external reader and measures two sensing values, the MCU 20 that receives two sensing values, and the antenna unit 1000AT that receives power and signals from the external reader and transmits two sensed values to the external reader.

[56] The sensing circuit unit 10 includes at least six or more non-variable/variable resistor sets connected in series from a driving voltage node Vdd to a ground terminal.

[57] Specifically, as illustrated in FIG. 1, the sensing circuit unit may include a first non-variable resistor R1 having one end connected to the driving voltage node Vdd, a second non-variable resistor R2 having one end connected to the driving voltage node Vdd and connected in parallel with the first non-variable resistor R1, a first variable resistor Th1 having one end

connected in series to the other end of the first non-variable resistor R1 and the other end being grounded, a second variable resistor Th2 having one end connected in series to the other end of the second non-variable resistor R2 and the other end being grounded, a first measurement voltage node V^-_{in} located at a contact point of the other end of the first non-variable resistor R1 and one end of the first variable resistor Th1 but connected to an (-) input terminal of an amplifier (i.e., OP-AMP 210), and a first measurement voltage node V^+_{in} located at a contact point of the other end of the second non-variable resistor R2 and one end of the second variable resistor Th2 but connected to the (+) input terminal of the OP-AMP 210.

[58] In some embodiments, each of the first variable resistor Th1 and the second variable resistor Th2 may be a thermistor whose resistance characteristics change according to the temperature. For example, each of the first variable resistor Th1 and the second variable resistor Th2 may be a negative temperature coefficient thermistor (NTC), a positive temperature coefficient thermistor (PTC), a critical temperature resistor (CTR), or the like.

[59] In this case, the antenna unit 1000AT of the sensor tag 1 may transmit voltage values (more precisely, voltage values digitized within the MCU after the measurement) measured at each of the first measurement voltage node V^-_{in} and the second measurement voltage node V^+_{in} to the external reader, and the external reader or the management server capable of communicating with the external reader may calculate a first temperature value and a second temperature value in a space where a first thermistor is disposed from each of the first and second sensing voltage values based on a preset voltage-temperature conversion table.

[60] Meanwhile, in the case of a 3-channel sensor tag 1’ illustrated in FIG. 10, as illustrated, the sensing circuit unit 10’ may further include a third non-variable resistor R3 having one end connected to the driving voltage node Vdd and connected in parallel with the first non-variable resistor R1 and the second non-variable resistor R2, a third variable resistor

Th3 having one end connected in series to the other end of the third non-variable resistor R3 and the other end being grounded, and a third measurement voltage node V^{ADC}_{in} located at a contact point of the other end of the third non-variable resistor R3 and one end of the third variable resistor Th3 but connected to the ADC input port 220. The third variable resistor Th3 may also be a thermistor similarly to the first and second variable resistors, and for example, the third variable resistor Th3 may be an the NTC, the PTC, the CTR, or the like.

[61] In this case, the antenna unit 1000AT of the sensor tag may transmit voltage values measured at each of the first measurement voltage node V^{-}_{in}, the second measurement voltage node V^{+}_{in}, and the third measurement voltage node V^{ADC}_{in} to the external reader, and the external reader or the management server capable of communicating with the external reader may calculate a first temperature value in the space (e.g., the space outside the logistics box) where the first thermistor is disposed, a second temperature in the space (eg, the upper space inside the logistics box) where a second thermistor is disposed, and a third temperature value in a space (e.g., the lower space inside the logistics box) where a third thermistor is disposed from each of the first sensing voltage value, the second sensing voltage value, and the third sensing voltage value based on the preset voltage-temperature conversion table.

[62] Meanwhile, regardless of the number of channels described above, a series of processes in which the multi-channel sensor tag of the present disclosure receives power from the external reader, measures the sensing value, and then transmits the measured value to the external reader is performed the state in which the OP-AMP 210 included in the MCU 20 of the multi-channel sensor tag is turned off. Here, the turn off of the OP-AMP 210 may mean that the supply of power to the OP-AMP or the power consumption by the OP-AMP is not substantially made, and the OP-AMP does not perform an operation amplification (e.g., $V_{out}=A*(V^{+}_{in}-V^{-}_{in})$ etc.) function based on input values V^{-}_{in} and V^{+}_{in}.

[63] In order to secure sufficient measurement voltage/conversion temperature resolution

in the turn-off state of the OP-AMP and at the same time perform sufficient operation with only the wirelessly transmitted power without self-power, the sensor tag MCU of the present disclosure is preferably an MCU capable of digitally converting each analog value sensed for each channel with a resolution of 8 bits to 50 bits. In this case, even in a low power environment, sufficiently precise temperature measurement is possible without using a difference value amplification method of the V^{+}_{in} and V^{-}_{in} of the OP-AMP.

[64] The reason why the OP-AMP 210 is turned off is that the amplifier inside the OP-AMP consumes a lot of power, so the voltage values themselves are transmitted to a server through wireless communication such as NFC (via a reader such as a smartphone) without operation amplification (the transmitted voltage values are converted into the temperature values by table matching in the server as described above).

[65] In addition, even though the OP-AMP amplification is unnecessary, the reason why the MCU including the OP-AMP are employed is that the need for development/production management for a separate MCU for implementing multi-channel tags may be eliminated.

[66] That is, by unifying the MCU used in the conventional single-channel sensor tag and the MCU of the multi-channel sensor tag in the present disclosure, development and production management costs for single-channel/multi-channel sensor tags can be drastically reduced.

[67] Accordingly, the present disclosure measures and transmits sensing values for each channel having a high resolution of 8 bits to 50 bits through low power of 1 mW to 37 mW received at a sufficient tagging distance of 5 mm to 30 mm, thereby realizing a passive multi-channel sensor tag with low power consumption and high reliability.

[68] FIG. 11 is a diagram for describing a method of sensing and managing temperature information for each channel in a temperature management system according to some embodiments of the present disclosure, and FIG. 12 is a diagram for describing a method of

sensing and managing temperature information for each channel in a temperature management system according to some other embodiments of the present disclosure.

[69] Referring to FIGS. 11 and 12, the temperature management system may include at least one passive multi-channel sensor tags 1, 1', and 1", at least one active reader logger 2, a management server 3, and a manager interface 4. In addition, a separate user interface for tagging for sensing, confirmation of sensing, management of sensing value, and the like may be provided in the active reader logger 2.

[70] At least one of the active reader logger 2, the management server 3, and the manager interface 4 may perform data communication with each other in real time through the information communication network 5. The information communication network 5 may be implemented as all types of wireless networks such as a wired network or mobile radio communication network such as a local area network (LAN), a wide area network (WAN), or a value added network (VAN), a satellite communication network, Bluetooth, wireless broadband Internet (Wibro), and high speed downlink packet access (HSPDA).

[71] As the management server 3, a server device that stores and processes information input from the active reader logger 2 and/or the manager interface 4, and includes a high-performance processor for processing the corresponding procedure without delay in response to a request of each terminal, a workstation having a large storage space, and the like may be used.

[72] A consumer interface and a manager interface 4 of the active reader logger 2 may be implemented in various smart devices such as smart phones, smart notes, tablet PCs, smart cameras, smart TVs, and wearable computers, all types of handheld-based wireless communication devices such as a personal communication system (PCS), global system for mobile communications (GSM), personal digital cellular (PDC), a personal handyphone system (PHS), personal digital assistant (PDA), international mobile telecommunication

(IMT)-2000, code division multiple access (CDMA)-2000, W-code division multiple access (W-CDMA), and a wireless broadband Internet (Wibro) terminal, and may be implemented in a desktop, a note book, a laptop, etc., equipped with a web browser.

[73] Each terminal physically implementing the consumer interface and the manager interface 4 may be equipped with a recording medium capable of being read and written by a computing device recorded with an application program that displays a communication unit performing communication with the management server 3 and each function through a user interface in order to implement the above functions.

[74] Each of the passive multi-channel sensor tags 1, 1', and 1" in the temperature management system may have various numbers of sensors depending on the purpose and environment. For example, it may include two sensors 11 and 12 like the first sensor tag 1 illustrated in FIG. 8 or three sensors 11, 12, and 13 like the second and third sensor tags 1' and 1". Also, some of the sensors may be sensors branched from a tag body, and some other sensors may be sensors disposed inside the tag body.

[75] When the active reader logger 2 is tagged on the sensor tag 1, the sensor tag 1 may acquire power to drive the sensor tag 1 through the RF field energy generated from the antenna of the active reader logger 2.

[76] The sensor unit of the sensor tag 1 may acquire sensing values for each channel using the acquired power, and the MCU may transmit the acquired sensing values for each channel to the NFC interface without parsing and transmit unparsed sensing values for each channel transmitted through the antenna to the active reader logger 2. That is, the sensor tag 1 does not convert voltage values measured at each of the first measurement voltage node V^{-}_{in}, the second measurement voltage node V^{+}_{in}, and the third measurement voltage node V^{ADC}_{in} illustrated in FIG. 6 into temperature values, and transmits the voltage values to the active reader logger 2.

[77] In some embodiments, as illustrated in FIG. 9, the active reader logger 2 may transmit sensing values (i.e., measured voltage values) for each channel to the management server 3, and the management server 3 may parse the sensing values for each channel based on a preset voltage-temperature conversion table to calculate temperature information for each sensor tag/each channel of the sensor tag, and may transmit the calculated temperature information for each channel to the active reader logger 2 and/or the manager interface 4. The transmitted temperature information for each channel may be displayed through the user interface of the active reader logger 2 or the manager interface 4.

[78] In some other embodiments, as illustrated in FIG. 10, the reader logger 2 may calculate the temperature information for each sensor tag/each channel of the sensor tag by parsing the sensing values for each channel transmitted from the sensor tag 1 based on the preset voltage-temperature conversion table, and may display the calculated temperature information for each channel through the GUI or the like of the active reader logger 2. The calculated temperature information for each channel may be collected by the management server 3 and converted into big data through the manager interface 4 or the like.

[79] It will be understood by those skilled in the art to which the present disclosure pertains that the present disclosure may be implemented in a modified form without departing from essential characteristics of the present disclosure. Therefore, methods disclosed herein should be considered in an illustrative aspect rather than a restrictive aspect. The scope of the present disclosure should be defined by the claims rather than the above-mentioned description, and equivalents to the claims should be interpreted to fall within the present disclosure.

What is claimed is:

1. An active reader logger, comprising:

a reader logger body and a relay bracket on which the reader logger body is detachably mounted,

wherein the relay bracket includes:

a guide rail that guides fitting of both side surfaces of the reader logger body so that the reader logger body slides from top to bottom and is coupled to the relay bracket;

a locking jaw that supports the reader logger body from below when the reader logger body is completely coupled to the relay bracket;

a fixing protrusion that is fitted into a locking groove provided on a rear side portion of the reader logger body so that the reader logger body does not slide upward when the reader logger body is completely coupled to the relay bracket; and

a relay antenna that relays communication between the reader logger body and a passive sensory tag installed in a fresh logistics box, and

the reader logger body includes:

a body part;

guide rail groove parts that are disposed on both side surfaces of the body part and configured to accommodate the guide rail of the relay bracket;

a first wireless communication module that performs communication with a passive sensory tag installed in the fresh logistics box to measure an internal temperature of the fresh logistics box via the relay antenna;

a memory that stores a sensing value sensed by the passive sensory tag;

a second wireless communication module that performs communication with an external terminal and transmits the sensing value to the external terminal; and

a power supply unit that drives the first and second wireless communication modules.

2. The active reader logger of claim 1, wherein the reader logger body periodically transmits wireless power to the passive sensory tag via the relay antenna of the relay bracket through the first wireless communication module and periodically receives the sensing value from the passive sensory tag,

the first wireless communication module performs short-range wireless communication with the passive sensory tag in a frequency band of 100 kHz to 15 MHz via the relay antenna of the relay bracket, and

the second wireless communication module performs short-range wireless communication or mobile communication with the external terminal in a frequency band of 1 GHz to 10 GHz.