

CLAIMS

1. A method for storing temperature data in a temperature recorder, comprising:
- S11: acquiring starting time data corresponding to a temperature recording time period, and
acquiring actual temperature data corresponding to each time stamp in the temperature
recording time period of the temperature recorder;
- S12: obtaining at least one piece of target compressed data corresponding to the temperature
recording time period by compressing the actual temperature data,
wherein each piece of the target compressed data corresponds to a plurality of pieces of the
actual temperature data; and
- S13: storing the starting time data and the target compressed data corresponding to the
temperature recording time period in a storage space of the temperature recorder.
2. The method for storing temperature data in a temperature recorder according to claim 1,
wherein step S12 further comprises:
- converting the actual temperature data into intermediate temperature data,
wherein the intermediate temperature data is data in a binary format; and
compressing the intermediate temperature data to obtain at least one piece of the target
compressed data,
wherein each piece of the target compressed data corresponds to a set quantity of bits or
bytes.
3. The method for storing temperature data in a temperature recorder according to claim 2,
wherein each piece of the target compressed data corresponds to one bit; and/or
a number of pieces of the actual temperature data corresponding to each piece of the target
compressed data is positively correlated with a temperature change range corresponding to the
temperature recording time period.
4. The method for storing temperature data in a temperature recorder according to claim 1,
wherein the storage space comprises a first storage space and a second storage space;
wherein step S13 further comprises:

determining whether the first storage space is full, if the first storage space is not full, pre-compressing the actual temperature data to obtain first temperature data, and storing the first temperature data into the first storage space;

if the first storage space is full, determining whether the second storage space is full, if the
5 second storage space is not full, compressing all the first temperature data in the first storage space, acquiring the plurality of pieces of target compressed data corresponding to the temperature recording time period, and sequentially storing the target compressed data into the second storage space in a chronological order while deleting all the data in the first storage space;
and

10 if the second storage space is full, generating a message that storage cannot be continued.

5. The method for storing temperature data in a temperature recorder according to claim 4, wherein the storage space further comprises a third storage space;

and the method further comprises:

when the temperature recorder is bound during a binding process to an application in a data
15 collection device, storing a public key and a private key generated in the binding process into the third storage space;

when an occurrence of the first storage space being full and the second storage space not being full occurs for a first time, decompressing all the pre-compressed first temperature data in the first storage space to acquire the corresponding actual temperature data; and

20 performing a hash calculation on the actual temperature data and the private key to obtain a first signature value;

when the occurrence of the first storage space being full and the second storage space being not full occurs for an Nth time, performing a hash calculation on the actual temperature data, the private key, and the first signature value to obtain a new first signature value, where $N \geq 2$ and N
25 is an integer; and

when the temperature recorder finishes recording temperature data, if there is no data in the first storage space, using the first signature value as a target signature value; and/or

when the temperature recorder finishes recording temperature data, if the first storage space is not full and the second storage space is not full, performing a hash calculation on the actual temperature data, the private key, and the previously corresponding first signature value to obtain a target signature value; and

5 storing the target signature value into the third storage space.

6. A method for collecting temperature data, wherein the collection method is implemented based on the method for storing temperature data in a temperature recorder according to any one of claims 1 to 5,

and the collection method comprises:

10 S21: sending, by an application in a data collection device, a temperature collection request to the temperature recorder;

S22: sending, by the temperature recorder, the plurality of pieces of target compressed data corresponding to the temperature recording time period to the application according to the temperature collection request; and

15 S23: decompressing, by the application, the target compressed data to acquire the actual temperature data corresponding to each time stamp in the temperature recording time period.

7. The method for collecting temperature data according to claim 6, wherein before step S21, the method further comprises:

acquiring a name, a version number, and an identification number of the application;

20 performing a hash calculation according to the name, the version number, and the identification number of the application to obtain a first hash value;

uplinking the first hash value to a blockchain server;

acquiring first identification data of the temperature recorder and second identification data of the application;

25 performing a hash calculation on the first identification data and the second identification data to obtain a public key; and

uplinking the public key to the blockchain server, and performing a hash calculation in the blockchain server according to the public key to obtain a private key,

wherein both the public key and the private key are stored in the temperature recorder;

and before step S21, the method further comprises:

5 acquiring a first name, a first version number, and a first identification number of the application;

performing a hash calculation according to the first name, the first version number, and the first identification number of the application to obtain a second hash value; and

10 determining whether the second hash value and the first hash value are consistent, and if they are consistent, determining that the application is valid, otherwise, determining that the application is invalid.

8. The method for collecting temperature data according to claim 7, wherein step S22 further comprises:

15 sending, by the temperature recorder, a target signature value to the application according to the temperature collection request;

and after step S23, the method further comprises:

S24: sending, by the application, the target signature value and the actual temperature data to the blockchain server;

20 S25: performing, by the blockchain server, a hash calculation according to the private key and the actual temperature data to obtain a second signature value; and

S26: determining whether the second signature value and the target signature value are consistent, and if they are consistent, determining that the actual temperature data is not tampered with.

9. The method for collecting temperature data according to claim 8, wherein when the first storage space of the temperature recorder is full and a corresponding number of pieces of temperature data is a first set quantity, the step of performing, by the blockchain server, a hash

calculation according to the private key and the actual temperature data to obtain a second signature value comprises:

when a number of pieces of temperature data corresponding to the temperature recording time period is less than or equal to the first set quantity, performing a hash calculation according to the private key and the actual temperature data to obtain the second signature value; and

when the number of pieces of temperature data corresponding to the temperature recording time period is greater than the first set quantity, performing a hash calculation on the private key and a first group of the first set quantity of actual temperature data in a chronological order to obtain a fourth signature value;

continuing to perform a hash calculation on the private key, an Mth group of the first set quantity of actual temperature data, and the fourth signature value corresponding to a previous group to obtain a fifth signature value, where $M \geq 2$ and M is an integer;

when a number of remaining pieces of temperature data in the temperature recording time period is less than or equal to the first set quantity, performing hash calculation according to the private key, the remaining actual temperature data, and the fifth signature value corresponding to the previous group to obtain the second signature value; and/or

before step S24, the method further comprises:

sending, by the temperature recorder, a total number of pieces of first temperature data stored in the temperature recorder to the application according to the temperature collection request;

calculating, by the application, a total number of pieces of second temperature data corresponding to the actual temperature data; and

determining whether the total number of pieces of first temperature data and the total number of pieces of second temperature data are consistent, and if they are consistent, determining to perform step S24.

10. A system for storing temperature data in a temperature recorder, comprising a time data acquisition module, a temperature data acquisition module, a compressed data acquisition module, and a storage module, wherein

the time data acquisition module is configured to acquire starting time data corresponding to
5 a temperature recording time period;

the temperature data acquisition module is configured to acquire actual temperature data corresponding to each time stamp in the temperature recording time period of the temperature recorder;

the compressed data acquisition module is configured to obtain at least one piece of target
10 compressed data corresponding to the temperature recording time period by compressing the actual temperature data,

wherein each piece of the target compressed data corresponds to a plurality of pieces of the actual temperature data; and

the storage module is configured to store the starting time data and the target compressed
15 data corresponding to the temperature recording time period into a storage space of the temperature recorder.

11. The system for storing temperature data in a temperature recorder according to claim 10, wherein the compressed data acquisition module comprises a data conversion unit and a compression unit;

20 the data conversion unit is configured to convert the actual temperature data into intermediate temperature data,

wherein the intermediate temperature data is data in a binary format; and

the compression unit is configured to compress the intermediate temperature data to obtain at least piece one of the target compressed data,

25 wherein each piece of the target compressed data corresponds to a set quantity of bits or bytes.

12. The system for storing temperature data in a temperature recorder according to claim 11, wherein each piece of the target compressed data corresponds to one bit; and/or

a number of pieces of the actual temperature data corresponding to each piece of the target compressed data is positively correlated with a temperature change range corresponding to the temperature recording time period.

13. The system for storing temperature data in a temperature recorder according to claim 10, wherein the storage space comprises a first storage space and a second storage space;

the storage module is configured to determine whether the first storage space is full, if the first storage space is not full, pre-compress the actual temperature data to obtain first temperature data, and store the first temperature data into the first storage space;

if the first storage space is full, determine whether the second storage space is full, if the second storage space is not full, compress all the first temperature data in the first storage space, acquire the plurality of pieces of target compressed data corresponding to the temperature recording time period, and sequentially store the target compressed data into the second storage space in a chronological order while deleting all the data in the first storage space; and

if the second storage space is full, generate a message that storage cannot be continued.

14. The system for storing temperature data in a temperature recorder according to claim 13, wherein the storage space further comprises a third storage space;

and the storage module is further configured to: store, when the temperature recorder is bound to an application in a data collection device during a binding process, a public key and a private key generated in the binding process into the third storage space;

when an occurrence of the first storage space being full and the second storage space being not full appears in the temperature recorder for a first time, decompress all the pre-compressed first temperature data in the first storage space to acquire the corresponding actual temperature data; and

perform a hash calculation on the actual temperature data and the private key to obtain a first signature value;

when an occurrence of the first storage space being full and the second storage space being not full appears for an Nth time, perform a hash calculation on the actual temperature data, the private key, and the first signature value, and when the temperature recorder finishes recording temperature data, acquire a corresponding target signature value to obtain a new first signature value, where $N \geq 2$ and N is an integer; and

when the temperature recorder finishes recording temperature data, if there is no data in the first storage space, use the first signature value as a target signature value; and/or

when the temperature recorder finishes recording temperature data, if the first storage space is not full and the second storage space is not full, perform a hash calculation on the actual temperature data, the private key, and the previously corresponding first signature value to obtain a target signature value; and

store the target signature value into the third storage space.

15. A system for collecting temperature data, wherein the collection system is implemented based on the system for storing temperature data in a temperature recorder according to any one of claims 10 to 14, and

the collection system comprises a request sending module, a data feedback module, and a decompression module, wherein

an application sends a temperature collection request to the temperature recorder according to the request sending module;

the temperature recorder uses the data feedback module to send the plurality of pieces of target compressed data corresponding to the temperature recording time period to the application according to the temperature collection request; and

the application decompresses the target compressed data according to the decompression module to acquire the actual temperature data corresponding to each time stamp in the temperature recording time period.

16. The system for collecting temperature data according to claim 15, further comprising a program data acquisition module, a first hash value acquisition module, an uplinking module, a

first determination module, an identification data acquisition module, a second hash calculation module, and a private key calculation module, wherein

the program data acquisition module is configured to acquire a name, a version number, and an identification number of the application;

5 the first hash calculation module is configured to perform hash calculation according to the name, the version number, and the identification number of the application to obtain a first hash value;

the uplinking module is configured to uplink the first hash value to a blockchain server;

the identification data acquisition module is configured to acquire first identification data of
10 the temperature recorder and second identification data of the application;

the second hash calculation module is configured to perform hash calculation on the first identification data and the second identification data to obtain a public key;

the private key calculation module is configured to uplink the public key to the blockchain server, and perform hash calculation in the blockchain server according to the public key to
15 obtain a private key,

wherein both the public key and the private key are stored in the temperature recorder;

the program data acquisition module is configured to acquire a first name, a first version number, and a first identification number of the application;

the first hash calculation module is configured to perform hash calculation according to the
20 first name, the first version number, and the first identification number of the application to obtain a second hash value; and

the first determination module is configured to determine whether the second hash value and the first hash value are consistent, and if they are consistent, determine that the application is valid, otherwise, determine that the application is invalid.

25 17. The system for collecting temperature data according to claim 16, wherein the temperature recorder uses the data feedback module to send a target signature value

corresponding to the target compressed data to the application according to the temperature collection request;

the collection system further comprises a data sending module, a signature value calculation module, and a second determination module;

5 the application uses the data sending module to send the target signature value and the actual temperature data to the blockchain server;

the blockchain server uses the signature value calculation module to perform hash calculation according to the private key and the actual temperature data to obtain a second signature value; and

10 the second determination module is configured to determine whether the second signature value and the target signature value are consistent, and if they are consistent, determine that the actual temperature data is not tampered with.

18. The system for collecting temperature data according to claim 17, wherein when the first storage space of the temperature recorder is full and a corresponding number of pieces of temperature data is a first set quantity, the signature value calculation module is configured to: perform, when a number of pieces of temperature data corresponding to the temperature recording time period is less than or equal to the first set quantity, hash calculation according to the private key and the actual temperature data to obtain the second signature value;

perform, when the number of pieces of temperature data corresponding to the temperature recording time period is greater than the first set quantity, hash calculation on the private key and a first group of a first set quantity of actual temperature data in a chronological order to obtain a fourth signature value;

continue to perform hash calculation on the private key, a Mth group of the first set quantity of actual temperature data, and the fourth signature value corresponding to a previous group to obtain a fifth signature value, where $M \geq 2$ and M is an integer;

perform, when a number of remaining pieces of temperature data in the temperature recording time period is less than or equal to the first set quantity, hash calculation according to

the private key, the remaining actual temperature data, and the fifth signature value corresponding to the previous group to obtain the second signature value; and/or

the collection system further comprises a temperature quantity acquisition module, a temperature quantity calculation module, and a third determination module;

5 the temperature recorder uses the temperature quantity acquisition module to send a total number of pieces of first temperature data stored in the temperature recorder to the application according to the temperature collection request;

the application uses the temperature quantity calculation module to calculate a total number of pieces of second temperature data corresponding to the actual temperature data; and

10 the third determination module is configured to determine whether the total number of pieces of first temperature data and the total number of pieces of second temperature data are consistent, and if they are consistent, call the data sending module.

19. An electronic device, comprising a memory, a processor, and a computer program stored on the memory and runnable on the processor, wherein when executing the computer program,
15 the processor implements the method for storing temperature data in a temperature recorder according to any one of claims 1 to 5, and/or implements the method for collecting temperature data according to any one of claims 6 to 9.

20. A computer-readable storage medium having a computer program stored thereon, wherein the computer program, when executed by a processor, implements steps of the method
20 for storing temperature data in a temperature recorder according to any one of claims 1 to 5, and/or implements the method for collecting temperature data according to any one of claims 6 to 9.