

A smart door lock, an unlocking system and an unlocking method

5 Field of the invention

The invention is referring to an unlocking technique, especially a smart door lock, an unlocking system and an unlocking method employing short distance communication technology (especially the Bluetooth technology).

10 Background of the Invention

The rapid development of the society and the ongoing expansion of cities have brought about quite a lot unstable elements in cities. In the face of problems concerning how to guard a house against theft, people often choose security doors. Common security doors are opened or closed by tangible metal keys, which need to
15 be carried for the sake of security and convenience. However, keys may be lost or left inside the house daily lives, and keyholes may be blocked by people out of some reasons, which cause rather much inconvenience for the people. Thanks to the development of new technology, people can start to use coded locks, fingerprint locks and remote controlling locks via IOT (Internet of Things), which bring about
20 great convenience on the one hand, and certain problems caused by their own defects on the other hand. For example, the cipher of a coded lock may be decoded or known by others; someone whose fingerprint needed to open a door may be absent, which causes much inconvenience; and regarding the remote controlling lock via IOT which could solve aforementioned problems, its cost is too high to be
25 popularized, or it may not lock or unlock a door with a internet failure, which also brings about inconvenience for people.

Summary of the Invention

Therefore, the invention provides a smart door lock and an unlocking system. The smart door lock can be opened in a simple and feasible way via short distance communication technology.

5 The invention provides a smart door lock, comprising a signal receiving circuit for receiving an unlocking cipher transmitted by smart unlocking device in a short distance communication way;

a central processor for outputting an unlocking instruction upon determining that the unlocking cipher received by the signal receiving circuit satisfies a
10 predetermined unlocking condition;

and an execution part for receiving the unlocking instruction outputted by the central processor and executing unlocking accordingly.

Furthermore, the central processor comprises:

a first comparator for judging whether the unlocking cipher received by the
15 signal receiving circuit is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers;

a second comparator for judging whether the left unlocking times
corresponding to the unlocking cipher received by the signal receiving circuit is zero and/or whether the present time is in the unlocking time period corresponding to the
20 unlocking cipher received by the signal receiving circuit, when the first comparator determines the unlocking cipher received by the signal receiving circuit is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers;

and an output interface for outputting an unlocking instruction when the second
comparator determines that the left unlocking times corresponding to the unlocking
25 cipher received by the signal receiving circuit is not zero and/or the present time is in the unlocking time period corresponding to the unlocking cipher received by the signal receiving circuit.

Further, the signal receiving circuit could be a NFC signal receiving circuit, a Bluetooth receiving circuit or an infrared signal receiving circuit.

30 Further, the executing part comprises a lock-tongue-driven circuit, an electric

machine and a metal lock tongue with rack. The electric machine comprises a spindle and upon it a gear which engages with the rack of the metal lock tongue. And the lock-tongue-driven circuit is used for making the electrical machine rotate in forward direction upon receiving the unlocking instruction from the central processor.

Further, a back-up power source electrically connected with the signal receiving circuit, the central processor and the executing part is also comprised.

Further, a serial communication circuit is also comprised, which is connected with the smart unlocking device through wire. After the smart door lock is mounted on a security door, the serial communication circuit mounted inside the house is used for receiving setting signals of the smart unlocking device for setting the unlocking cipher, its left unlocking times and its unlocking time period.

The invention also provides an unlocking system, including a smart door lock which is mentioned previously and a smart unlocking device which is used for transmitting an unlocking cipher to the smart door lock in a short distance communication way;

Further, the smart unlocking device comprises a signal transmitting circuit which could be a NFC signal transmitting circuit, a Bluetooth transmitting circuit or an infrared signal transmitting circuit, and a processor for transmitting the unlocking cipher received to the smart door lock through the signal transmitting circuit;

The invention also provides an unlocking method, including steps as follows:

a. receiving an unlocking cipher from the smart unlocking device in a short distance communication way;

b. outputting an unlocking instruction once determining that the unlocking cipher received satisfies a predetermined unlocking condition;

c. executing unlocking in accordance with the unlocking instruction outputted.

The step b further includes:

b1. judging whether the unlocking cipher received is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers;

b2. judging whether the left unlocking times corresponding to the unlocking

cipher received is zero and/or whether the present time is in the unlocking time period corresponding to the unlocking cipher received, when the step b1 determines that the unlocking cipher received is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers;

5 b3. outputting the unlocking instruction when the step b2 determines that the left unlocking times corresponding to the unlocking cipher received is not zero and/or the present time is in the unlocking time period corresponding to the unlocking cipher received.

10 Further, the short distance communication way could be any one or multiple kinds of the near field communication, the Bluetooth communication and the infrared communication.

Further, the method also includes:

d. receiving setting signal(s) of the smart unlocking device for setting the unlocking cipher, its left unlocking times or its unlocking time period.

15 e. setting the unlocking cipher, its left unlocking times or its unlocking time period of the smart door lock accordingly.

Benefits of the Invention

20 The smart door lock receives an unlocking cipher from the smart unlocking device in a short distance communication way, then executes unlocking when determining that the unlocking cipher received by the signal receiving circuit satisfies a predetermined unlocking condition. Hence smart unlocking can be realized through short distance communication, and the smart door lock can be opened in a simple and feasible way, different from the traditional coded lock, the
25 fingerprint lock and the lock operated through IOT.

30 In addition, according to the invention, the smart door also judges whether the left unlocking times corresponding to the unlocking cipher is zero and/or whether the present time is in the unlocking time period corresponding to the unlocking cipher after receiving the right unlocking cipher, then executes unlocking only if it determines that the left unlocking times is not zero and/or the present time is in the

unlocking time period corresponding to the unlocking cipher. In other words, the concepts of the left unlocking times and /or the unlocking time period corresponding to the unlocking cipher are also introduced in the invention so as to enrich the scope of application of the smart door lock. For example, A would be expected to provide
5 housekeeping service in B's house between 1 and 2 pm on Sunday, when there would be nobody in. And it would be inappropriate to leave a key to A in advance. Under such circumstances, the smart door lock of the invention could be applied. After predetermining the unlocking cipher such as "123456", the left unlocking times such as "once" and the unlocking time period such as "1 to 2pm on Sunday",
10 B could give the unlocking cipher to A who could provide housekeeping service later with only one chance to unlock the door (i.e. A could not enter B's house repeatedly).

Description of the Drawings

15 Here is further description of the invention with drawings and embodiments.

Figure 1 is a structure diagram of one embodiment of the unlocking system in accordance with the invention.

Figure 2 is a structure diagram of one embodiment of the central processor in Figure 1.

20 Figure 3 is a structure diagram of one embodiment of the executing part in Figure 1.

Figure 4 is a structure diagram of another embodiment of the smart door lock in Figure 1.

25 Figure 5 is a flow diagram of the first embodiment of the unlocking method in accordance with the invention.

Figure 6 is a flow diagram of an embodiment of the step S12 in Figure 5.

Figure 7 is a flow diagram of the second embodiment of the unlocking method in accordance with the invention.

30 Figure 8 is a flow diagram of an embodiment of the unlocking and locking methods in accordance with the invention.

Embodiments

The unlocking system comprises a smart unlocking device 1 and a smart door lock 2, referring to Fig. 1, a structure diagram of an embodiment of the unlocking system in accordance with the invention.

Herein the smart unlocking device 1 such as the smart phone, the tablet or PDA (Personal Digital Assistant) is used for transmitting the unlocking cipher to the smart door lock 2 in a short distance communication way, which could be NFC (Near Field Communication), Bluetooth communication or infrared communication.

Further, the smart unlocking device 1 could comprise a processor 11 and a signal transmitting circuit 12. Herein the processor 11, which could be CPU, is used for coding the received unlocking cipher into NFC signal, Bluetooth signal and infrared signal. The unlocking cipher received by the processor 11 could be inputted by users, or saved in the memory of the unlocking device 1 where the cipher could be extracted directly when the processor 11 receives an unlocking triggering command. The signal transmitting circuit 12 could be NFC signal transmitting circuit, Bluetooth signal transmitting circuit or infrared signal transmitting circuit, for transmitting NFC signal, Bluetooth signal or infrared signal generated by the processor 11 to the smart door lock 2. In other words, the unlocking cipher would be transmitted in the form of NFC signal, Bluetooth signal or infrared signal to the smart door lock 2.

Herein the smart door lock 2 comprises a signal receiving circuit 21, a central processor 22 and an executing part 23. The signal receiving circuit 21 is used for receiving the unlocking cipher transmitted by the smart unlocking device 1 (e.g. the signal transmitting circuit 12 thereof) in such a short distance communication way as NFC, Bluetooth communication or infrared communication.

The processor 22 is used for judging whether the unlocking cipher received by the signal receiving circuit 21 satisfies the unlocking condition, and then outputting the unlocking command to the executing part 23 if it does, or refusing the unlocking request from the smart unlocking device 1 if it doesn't. The executing ways of

refusing the unlocking request could be responding nothing, responding rejection to the smart unlocking device 1 and so on. Herein the unlocking condition is predetermined in the smart door lock 2, e.g. the memory thereof. After getting the unlocking cipher received by the signal receiving circuit 21, the central processor 22
5 extracts the unlocking condition from the memory and compares it with the unlocking cipher to judge whether the cipher satisfies the unlocking condition.

The unlocking condition generally includes that the unlocking cipher received by the signal receiving circuit 21 should be the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers. Herein multiple predetermined
10 unlocking ciphers are aimed at sending different unlocking ciphers to different users for the sake of managing those users.

Based on what is said above, the unlocking condition further includes: when the unlocking cipher received by the signal receiving circuit 21 is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers, the left
15 unlocking times corresponding to the unlocking cipher received by the signal receiving circuit 21 is not zero; or the present time is in the unlocking time period corresponding to the unlocking cipher received by the signal receiving circuit 21; or the left unlocking times corresponding to the unlocking cipher received by the signal receiving circuit 21 is not zero and the present time is in the unlocking time period
20 corresponding to the unlocking cipher received by the signal receiving circuit 21.

The unlocking condition above could be kept in the form of chart, like Chart 1 to Chart 3:

Chart 1

Cipher	Left Unlocking Times
1254*89	unlimited
5789@125	14 times
335489	once

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Chart 2

Cipher	Unlocking Time Period
1254*89	unlimited
5789@125	12: 00—13:00 and 18: 00—19: 00 every day
335489	13: 00—14: 00 on Sunday

Chart 3

Cipher	Left Unlocking Times	Unlocking Time Period
1254*89	unlimited	unlimited
5789@125	14 times	12: 00—13:00 and 18: 00—19: 00 every day
335489	once	13: 00—14: 00 on Sunday

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Unless unlimited, the left unlocking times in Chart 1 and Chart 3 will be subtracted one from the total if a successful unlocking execution with the corresponding cipher is recorded, then the result will be recorded in Chart 1, until the total is zero. For example, after the cipher of 335489 is used successfully to
10 unlock the door once, the corresponding left unlocking time will be changed from 1 to zero.

Further referring Figure 3, a structure diagram of an embodiment of the central processor 22 in Figure 1, the central processor 22 which could be realized by CPU or microcontroller comprises a first comparator 221, a second comparator 222 and an
15 output interface 223.

The first comparator is used for judging whether the unlocking cipher received by the signal receiving circuit 21 is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers.

For example, if the unlocking cipher is predetermined as {1254*89, 5789@125,

335489}, when the signal receiving circuit 21 receives 1254*89 or 5789@125 or 335489, the first comparator 221 will output a judgment of yes.

The second comparator 222 is used for further judging whether the left unlocking times corresponding to the unlocking cipher received by the signal receiving circuit 21 is zero and/or whether the present time is in the unlocking time period corresponding to the unlocking cipher received by the signal receiving circuit 21, when the first comparator 221 determines the unlocking cipher received by the signal receiving circuit 21 is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers;

For example, the unlocking condition as shown in Chart 3 is that the unlocking cipher received by the signal receiving circuit 21 is 335489. Then the second comparator 222 will output a judgment of yes only if the unlocking cipher of 335489 is used for the first time between 13:00 and 14:00 on Sunday.

By introducing in the left unlocking times and/or the unlocking time period, the door opening times and the unlocking time can be limited under some special use circumstances. For example, a housekeeping worker could not provide the housekeeping service once a week because he/she could not open the door when the owner of the house is not in. To solve this problem, certain unlocking cipher which is predetermined for unlocking once a week could be given to him/her.

The output interface 223 is used for outputting an unlocking instruction when the second comparator 222 determines that the left unlocking times corresponding to the unlocking cipher received by the signal receiving circuit 21 is not zero and/or the present time is in the unlocking time period corresponding to the unlocking cipher received by the signal receiving circuit 21. Otherwise it would refuse an unlocking request.

The executing part 23 is used for receiving the unlocking instruction outputted by the central processor 22 and executing unlocking operation as instructed. Specifically, the executing part 23 shown in Figure 3 comprises a lock-tongue-driven circuit 231, an electric machine 232 and a metal lock tongue with rack 233. Herein the electric machine 232 comprises a spindle and upon it a gear which engages with

the rack of the metal lock tongue 233. And the lock-tongue-driven circuit 231 is used for making the electrical machine 232 and the rack accordingly rotate in forward direction upon receiving the unlocking instruction from the central processor 22, thus controlling the metal lock tongue 233 to finish an unlocking operation.

5 Additionally, the locking process of the smart door lock 1 could apply a similar but much easier method as that of the unlocking process. For example, when it tests that the locking cipher transmitted to the smart door lock 2 by the smart unlocking device 2 is the same with the predetermined one, the central processor 22 will transmit a locking instruction to the lock-tongue-driven circuit 231, which will control the
10 electrical machine 232 and the rack accordingly to rotate in backward direction, thus controlling the metal lock tongue 233 to finish a locking operation.

In the embodiment, the smart door lock receives the unlocking cipher from the smart unlocking device in a short distance communication way, and then executes unlocking operation when determining that the unlocking cipher received by the
15 signal receiving circuit satisfies the unlocking condition. Hence smart unlocking can be realized through short distance communication, and the smart door lock can be opened in a simple and feasible way, different from the traditional coded lock, the fingerprint lock and the lock operated through IOT.

According to the invention, the smart door also judges whether the left
20 unlocking times corresponding to the unlocking cipher is zero and/or whether the present time is in the unlocking time period corresponding to the unlocking cipher after receiving the right unlocking cipher, then executes unlocking operation only if it determines that the left unlocking times is not zero and/or the present time is in the unlocking time period corresponding to the unlocking cipher. In other words, the
25 concepts of the left unlocking times and /or the unlocking time period corresponding to the unlocking cipher are also introduced in the invention so as to enrich the scope of application of the smart door lock on many occasions when unlocking times and unlocking time need to be controlled.

Figure 4 is a structure diagram of another embodiment of the smart door lock
30 part in Figure 1.

Compared with that of the embodiment in Figure 1, the smart door lock 2 of the embodiment in Figure 4 further comprises a back-up power source 25 and/or a serial communication circuit 24. Herein the back-up power source 25 electrically connected with the signal receiving circuit 21, the central processor 22 and the
5 executing part 23 (mainly the lock-tongue-driven circuit 231 and the electric machine 232) is used for guaranteeing normal unlocking or locking operations of the smart door lock 2 when there is a power cut. The back-up power source 25 could adopt a rechargeable battery pack to guarantee replenishment of electric energy after its consumption.

10 The serial communication circuit 24 is used for receiving setting signals of the smart unlocking device 1 for setting unlocking cipher, locking cipher, left unlocking times or unlocking time period. Herein the serial communication circuit 24 is only connected with the smart unlocking device 1 through wire, and is mounted inside the house when the smart door lock 2 is mounted on a security door or likeness to avoid
15 malicious reset of unlocking cipher, locking cipher, left unlocking times or unlocking time period of the smart door lock 2. After the serial communication circuit 24 receives setting signals of the smart unlocking device 1 for setting unlocking cipher, locking cipher, left unlocking times or unlocking time period, according unlocking cipher the central processor sets locking cipher, left unlocking
20 times or unlocking time period of the smart door lock 2.

Figure 5 is a flow diagram of the first embodiment of the unlocking method according to the invention. Herein the method which could be executed by the aforementioned smart door lock 2 includes following steps:

Step S11: receiving the unlocking cipher transmitted by the smart unlocking
25 device in a short distance communication way.

Herein Step S11 could be executed by the signal receiving circuit 21 in Figure 1. The short distance communication includes the near field communication, the Bluetooth communication and the infrared communication. The unlocking cipher received in Step S11 could be transmitted by the smart unlocking device 1 in Figure

30 1.

Step S12: outputting the unlocking instruction when determining that the received unlocking cipher satisfies the predetermined unlocking condition.

Herein Step S12 could be executed by the central processor 22 in figure 1. As shown in Figure 6, step S12 could further includes:

5 Step S121: judging whether the unlocking cipher received in Step S11 is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers.

10 Step S122: further judging whether the left unlocking times corresponding to the unlocking cipher received in Step S11 is zero and/or whether the present time is in the unlocking time period corresponding to the unlocking cipher received in Step S11, when the step S121 determines that the unlocking cipher received in Step S11 is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers.

15 Step S123: outputting the unlocking instruction when the Step S122 determines that the left unlocking times corresponding to the unlocking cipher received in Step S11 is not zero and/or the present time is in the unlocking time period corresponding to the unlocking cipher received in Step S11.

Step S121 to Step S123 above could be executed respectively by the first comparator 221, the second comparator 222 and the output interface 223 in Figure 2.

20 Step S13: executing unlocking operation according to the outputted unlocking instruction.

Herein Step S13 could be executed by aforementioned executing part 23 which has a structure as shown in Figure 3.

25 Figure 7 is a flow diagram of the second embodiment of the unlocking method according to the invention. Unlike that in Figure 5, the embodiment in Figure 7 further includes:

Step S14: receiving the setting signals of the smart unlocking device for setting the unlocking cipher, its left unlocking times or its unlocking time period.

30 Step S15: setting the unlocking cipher, its left unlocking times or its unlocking time period of the smart door lock according to the setting signals.

Herein Step S14 and Step S15 could be executed respectively by the serial communication circuit 24 and the central processor 22 in Figure 4. In addition, Step S14 and Step 15 don't need to be executed after Step S13. They could be executed before Step S11 since there is no limit in the embodiment.

5 What needs to be illustrated is that the structure embodiments in Figure 1 to 4 has illustrated details and process of corresponding method, thus aforementioned process will not be described in detail.

Figure 8 is a flow diagram of a specific embodiment of the unlocking and locking methods according to the invention. In the embodiment, the smart unlocking
10 device which might be a cell phone and the smart door lock are communicated by Bluetooth in following steps:

Step S20: the cell phone transmits unlocking or locking instruction by Bluetooth to the smart door lock.

Step S21: the smart door lock receives unlocking or locking instruction by
15 Bluetooth from the cell phone.

Step S22: the smart door lock judges whether what is received is an unlocking instruction or a locking instruction, then executes Step 23 if it is an unlocking instruction, or executes Step 28 if it is a locking instruction. Herein the unlocking instruction and the locking instruction carry respectively the unlocking cipher and
20 the locking cipher, thus Step S22 also needs to judge whether the unlocking cipher and locking cipher are right, and executes following steps only if they are right.

Step S23: judging whether the left unlocking times of unlocking cipher in the unlocking instruction is zero, then terminating the process directly if they are, or executing Step S24 if not.

25 Step S24: judging whether the present time is in the unlocking time period corresponding to the unlocking cipher, then terminating if it's not, or executing Step S25 if it is.

Step S25: subtracting one from the left unlocking times corresponding to the unlocking cipher. What needs to be illustrated is that if the left unlocking times
30 corresponding to the unlocking cipher are unlimited, the times decreased by 1 are

still unlimited.

Step S26: generating the unlocking instruction and transmitting it to the lock-tongue-driven circuit.

5 Step S27: the lock-tongue-driven circuit makes the electric machine rotate in forward direction and the process is over.

Step 28: transmitting the locking instruction to the lock-tongue-driven circuit.

Step S29: the lock-tongue-driven circuit makes the electrical machine rotate in backward direction and the process is over.

10 It should be noted that the present invention is not limited to the particular embodiments; the person skilled in the art should know that various modifications or equivalents can be done without departing from the spirit and range thereof and should be included in the claims of the present invention.

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Claims

1. A smart door lock comprising:

a signal receiving circuit for receiving an unlocking cipher transmitted by
5 smart unlocking device in a short distance communication way;

a central processor for outputting an unlocking instruction upon determining
that the unlocking cipher received by the signal receiving circuit satisfies a
predetermined unlocking condition;

and an executing part for receiving the unlocking instruction outputted by the
10 central processor and executing unlocking accordingly.

2. The smart door lock in accordance with Claim 1 wherein the central
processor comprises:

a first comparator for judging whether the unlocking cipher received by the
15 signal receiving circuit is the sole predetermined unlocking cipher or one of multiple
predetermined unlocking ciphers;

a second comparator for judging whether the left unlocking times
corresponding to the unlocking cipher received by the signal receiving circuit is zero
and/or whether the present time is in the unlocking time period corresponding to the
20 unlocking cipher received by the signal receiving circuit, when the first comparator
determines the unlocking cipher received by the signal receiving circuit is the sole
predetermined unlocking cipher or one of multiple predetermined unlocking ciphers;

and an output interface for outputting an unlocking instruction when the second
comparator determines that the left unlocking times corresponding to the unlocking
25 cipher received by the signal receiving circuit is not zero and/or the present time is in
the unlocking time period corresponding to the unlocking cipher received by the
signal receiving circuit.

3. The smart door lock in accordance with Claim 1 or Claim 2 wherein the signal receiving circuit could be a NFC signal receiving circuit, a Bluetooth receiving circuit or an infrared signal receiving circuit;

or the executing part comprises a lock-tongue-driven circuit, an electric machine and a metal lock tongue with rack, wherein the electric machine comprises a spindle and upon it a gear which engages with the rack of the metal lock tongue, and the lock-tongue-driven circuit is used for making the electrical machine rotate in forward direction upon the unlocking instruction received from the central processor.

4. The smart door lock in accordance with Claim 1 or Claim 2 further comprises a serial communication circuit and a back-up power source electrically connected with the signal receiving circuit, the central processor and the executing part, wherein the serial communication circuit, connected with the smart unlocking device through wire and mounted inside the house after the smart door lock is mounted on a security door, is used for receiving setting signals of the smart unlocking device for setting the unlocking cipher, its left unlocking times and its unlocking time period.

5. An unlocking system comprising a smart unlocking device and a smart door lock, wherein the smart unlocking device is used for transmitting an unlocking cipher to the smart door lock in a short distance communication way;

and the smart door is any one of smart door lock in accordance with Claim 1 to Claim 4.

6. The unlocking system in accordance with Claim 5 wherein the smart unlocking device comprises

a signal transmitting circuit which could be a NFC signal transmitting circuit, a Bluetooth transmitting circuit or an infrared signal transmitting circuit,

and a processor for transmitting the unlocking cipher received to the smart door lock through the signal transmitting circuit.

7. An unlocking method including following steps:

a. receiving an unlocking cipher from a smart unlocking device in a short distance communication way;

5 b. outputting an unlocking instruction once determining that the unlocking cipher received satisfies the predetermined unlocking condition;

c. executing unlocking in accordance with the unlocking instruction outputted.

10 8. The unlocking method in accordance with Claim 7 wherein the step b includes:

b1. judging whether the unlocking cipher received is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers;

15 b2. judging whether the left unlocking times corresponding to the unlocking cipher received is zero and/or whether the present time is in the unlocking time period corresponding to the unlocking cipher received, when the step b1 determines the unlocking cipher received is the sole predetermined unlocking cipher or one of multiple predetermined unlocking ciphers;

20 b3. outputting the unlocking instruction when the step b2 determines that the left unlocking times corresponding to the unlocking cipher received is not zero and/or the present time is in the unlocking time period corresponding to the unlocking cipher received.

25 9. The unlocking method in accordance with Claim 7 or Claim 8 wherein the short distance communication way means any one or multiple ways of the near field communication, the Bluetooth communication and the infrared communication.

10. The method in accordance with Claim 7 or Claim 8 further comprising:

d. receiving setting signals of the smart unlocking device for setting the unlocking cipher, its left unlocking times or its unlocking time period;

5 e. setting the unlocking cipher, its left unlocking times or its unlocking time period of the smart door lock according to the setting signals.