



[12] Published Patent Application



[10] Publication No.: CN 105425665 A

[43] Publication Date: March 23, 2016

[21] Application No.: 201510765468.4

[22] Filing Date: November 10, 2015

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[51] Int. Cl.

G05B 19/042(2006.01)

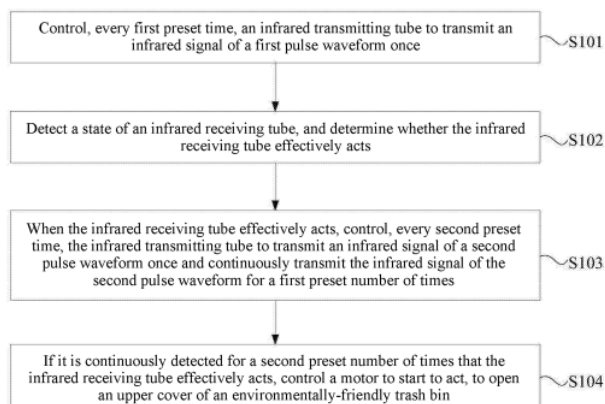
Claims: 2 pages; specification: 9 pages; drawings: 2 pages

[54] Title of Invention

SMART ENVIRONMENTALLY-FRIENDLY
TRASH BIN CONTROL METHOD AND APPARATUS,
AND SMART ENVIRONMENTALLY-FRIENDLY
TRASH BIN

[57] Abstract

The present invention discloses a smart environmentally-friendly trash bin control method and apparatus, and a smart environmentally-friendly trash bin. The method includes: controlling, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once; detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts; when the infrared receiving tube effectively acts, controlling, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times; and if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, controlling a motor to start to act, to open an upper cover of an environmentally-friendly trash bin. According to the technical solutions provided by the present invention, the upper cover can be automatically opened when a person carrying garbage walks up to the smart environmentally-friendly trash bin, which facilitates people to directly throw garbage into the trash bin. The smart environmentally-friendly trash bin is convenient.



What is claimed is:

1. A smart environmentally-friendly trash bin control method, comprising:
 - controlling, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the first pulse waveform comprising a first preset quantity of continuous sub-waveforms with a first preset frequency, the sub-waveforms being waveforms of a period;
 - detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts;
 - when the infrared receiving tube effectively acts, controlling, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times, the second pulse waveform comprising a second preset quantity of continuous sub-waveforms with a second preset frequency, the sub-waveforms being waveforms of a period; and
 - if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, controlling a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.
2. The method according to claim 1, wherein each time before the controlling an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the method further comprises:
 - controlling the infrared receiving tube to be powered on in advance third preset time, and maintaining the infrared receiving tube being powered on for fourth preset time.
3. The method according to claim 1, wherein the detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts comprises:
 - respectively detecting output levels of the infrared receiving tube before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once; and
 - if the output levels of the infrared receiving tube are respectively a high level and a low level before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, determining that the infrared receiving tube effectively acts.
4. The method according to claim 1, wherein the detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts comprises:
 - when the infrared transmitting tube starts to transmit the infrared signal of the first pulse waveform once, detecting output levels of the infrared receiving tube for continuously four times every fourth preset time; and
 - if the output levels of the infrared receiving tube are respectively a high level, a low level, a low level, and a high level in sequence, determining that the infrared receiving tube effectively acts.
5. The method according to claim 1, further comprising:
 - if it is detected within fifth preset time that a number of effective actions of the infrared receiving tube does not reach the second preset number of times, entering a standby state, and continuing to control, every the first preset time, the infrared transmitting tube to transmit the first pulse waveform once.
6. A smart environmentally-friendly trash bin control apparatus, comprising:
 - a first control module, configured to control, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the first pulse waveform comprising a first preset quantity of continuous sub-waveforms with a first preset frequency, the sub-waveforms being waveforms of a period; and
 - a detection module, configured to: detect a state of an infrared receiving tube, and determine whether the infrared receiving tube effectively acts;
 - a second control module, configured to: when the infrared receiving tube effectively acts, control, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times, the second pulse waveform comprising a second preset quantity of continuous sub-waveforms with a second preset frequency, the sub-waveforms being waveforms of a period; and
 - a third control module, configured to: if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, control a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.
7. The apparatus according to claim 6, further comprising:

a fourth control module, configured to: at third preset time before the first control module each time controls the infrared transmitting tube to transmit the infrared signal of the first pulse waveform once, control the infrared receiving tube to be powered on, and maintain the infrared receiving tube being powered on for fourth preset time.

8. The apparatus according to claim 6, the detection module comprises:

a first detection unit, configured to respectively detect output levels of the infrared receiving tube before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once; and

a first determining unit, configured to: if the output levels of the infrared receiving tube are respectively a high level and a low level before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, determine that the infrared receiving tube effectively acts.

9. The apparatus according to claim 6, the detection module comprises:

a second detection unit, configured to: when the infrared transmitting tube starts to transmit the infrared signal of the first pulse waveform once, detect output levels of the infrared receiving tube for continuously four times every fourth preset time; and

a second determining unit, configured to: if the output levels of the infrared receiving tube are respectively a high level, a low level, a low level, and a high level in sequence, determine that the infrared receiving tube effectively acts.

10. The apparatus according to claim 6, further comprising:

a fifth control module, configured to: if it is detected within fifth preset time that a number of effective actions of the infrared receiving tube does not reach the second preset number of times, enter a standby state, and continue to control, every the first preset time, the infrared transmitting tube to transmit the first pulse waveform once.

11. A smart environmentally-friendly trash bin, comprising:

a microcontroller unit, an infrared transmitting tube connected to the microcontroller unit, an infrared receiving tube connected to the microcontroller unit, a motor connected to the microcontroller unit, and an environmentally-friendly trash bin with an upper cover,

wherein operations of the microcontroller unit comprise:

controlling, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the first pulse waveform comprising a first preset quantity of continuous sub-waveforms with a first preset frequency, the sub-waveforms being waveforms of a period; and

detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts;

when the infrared receiving tube effectively acts, controlling, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times, the second pulse waveform comprising a second preset quantity of continuous sub-waveforms with a second preset frequency, the sub-waveforms being waveforms of a period; and

if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, controlling a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.

SMART ENVIRONMENTALLY-FRIENDLY TRASH BIN CONTROL METHOD AND APPARATUS, AND SMART ENVIRONMENTALLY-FRIENDLY TRASH BIN

TECHNICAL FIELD

[0001] The present invention relates to the field of control technologies, and in particular, to a smart environmentally-friendly trash bin control method and apparatus, and a smart environmentally-friendly trash bin.

BACKGROUND

[0002] An environmentally-friendly trash bin, also referred to as a trash bin, is configured to store garbage, so that garbage is effectively stored and is not thrown at a will to affect an environment. In production and life, various types of trash bins are widely used. At present, most trash bins are designed with openings, so that people can directly throw garbage into the trash bins. However, garbage inside the opened trash bins gives off various bad or pungent odors directly to surrounding environments outside the trash bins, polluting the environments. Therefore, there are also trash bins with upper covers. The upper covers of the trash bins are closed at ordinary times, to avoid odors of garbage from escaping. To throw garbage, people have to first open the upper covers and then throw the garbage into the trash bins. Specific ways to open an upper cover are: opening the upper cover by treading on a pedal or manually opening the upper cover. These ways are mechanically designed.

[0003] That is, at present, for these trash bins provided the upper covers, the upper covers of the trash bins need to be opened by users. However, it can be understood that sometimes, it may be inconvenient for people to open the upper cover of the trash bin, and it may be hard to throw garbage into the trash bin. Therefore, the current trash bins sometimes cause inconvenience to people.

SUMMARY

[0004] In view of this, the present invention provides a smart environmentally-friendly trash bin control method and apparatus, and a smart environmentally-friendly trash bin. An upper cover can be automatically opened when a person carrying garbage walks up to the smart environmentally-friendly trash bin, which facilitates people to directly throw garbage into the trash bin. The smart environmentally-friendly trash bin is convenient.

[0005] In order to achieve the above objective, the present invention provides the following technical solutions:

[0006] A smart environmentally-friendly trash bin control method includes:

[0007] controlling, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the first pulse waveform including a first preset quantity of continuous sub-waveforms with a first preset frequency, the sub-waveforms being waveforms of a period; and

[0008] detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts;

[0009] when the infrared receiving tube effectively acts, controlling, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times, the second pulse waveform including a second preset quantity of continuous sub-waveforms with a second preset frequency, the sub-waveforms being waveforms of a period; and

[0010] if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, controlling a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.

[0011] Preferably, each time before the controlling an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the method further includes:

[0012] controlling the infrared receiving tube to be powered on in advance third preset time, and maintaining the infrared receiving tube being powered on for fourth preset time.

[0013] Preferably, the detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts includes:

[0014] respectively detecting output levels of the infrared receiving tube before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once; and

[0015] if the output levels of the infrared receiving tube are respectively a high level and a low level before and

after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, determining that the infrared receiving tube effectively acts.

[0016] Preferably, the detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts includes:

[0017] when the infrared transmitting tube starts to transmit the infrared signal of the first pulse waveform once, detecting output levels of the infrared receiving tube for continuously four times every fourth preset time; and

[0018] if the output levels of the infrared receiving tube are respectively a high level, a low level, a low level, and a high level in sequence, determining that the infrared receiving tube effectively acts.

[0019] Preferably, the method further includes:

[0020] if it is detected within fifth preset time that a number of effective actions of the infrared receiving tube does not reach the second preset number of times, entering a standby state, and continuing to control, every the first preset time, the infrared transmitting tube to transmit the first pulse waveform once.

[0021] A smart environmentally-friendly trash bin control apparatus includes:

[0022] a first control module, configured to control, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the first pulse waveform including a first preset quantity of continuous sub-waveforms with a first preset frequency, the sub-waveforms being waveforms of a period; and

[0023] a detection module, configured to: detect a state of an infrared receiving tube, and determine whether the infrared receiving tube effectively acts;

[0024] a second control module, configured to: when the infrared receiving tube effectively acts, control, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times, the second pulse waveform including a second preset quantity of continuous sub-waveforms with a second preset frequency, the sub-waveforms being waveforms of a period; and

[0025] a third control module, configured to: if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, control a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.

[0026] Preferably, the apparatus further includes:

[0027] a fourth control module, configured to: at third preset time before the first control module each time controls the infrared transmitting tube to transmit the infrared signal of the first pulse waveform once, control the infrared receiving tube to be powered on, and maintain the infrared receiving tube being powered on for fourth preset time.

[0028] Preferably, the detection module includes:

[0029] a first detection unit, configured to respectively detect output levels of the infrared receiving tube before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once; and

[0030] a first determining unit, configured to: if the output levels of the infrared receiving tube are respectively a high level and a low level before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, determine that the infrared receiving tube effectively acts.

[0031] Preferably, the detection module includes:

[0032] a second detection unit, configured to: when the infrared transmitting tube starts to transmit the infrared signal of the first pulse waveform once, detect output levels of the infrared receiving tube for continuously four times every fourth preset time; and

[0033] a second determining unit, configured to: if the output levels of the infrared receiving tube are respectively a high level, a low level, a low level, and a high level in sequence, determine that the infrared receiving tube effectively acts.

[0034] Preferably, the apparatus further includes:

[0035] a fifth control module, configured to: if it is detected within fifth preset time that a number of effective actions of the infrared receiving tube does not reach the second preset number of times, enter a standby state, and continue to control, every the first preset time, the infrared transmitting tube to transmit the first pulse waveform once.

[0036] A smart environmentally-friendly trash bin includes:

[0037] a microcontroller unit, an infrared transmitting tube connected to the microcontroller unit, an infrared receiving tube connected to the microcontroller unit, a motor connected to the microcontroller unit, and an environmentally-friendly trash bin with an upper cover,

[0038] where operations of the microcontroller unit include:

[0039] controlling, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the first pulse waveform including a first preset quantity of continuous sub-waveforms with a first preset frequency, the sub-waveforms being waveforms of a period; and

[0040] detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts;

[0041] when the infrared receiving tube effectively acts, controlling, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times, the second pulse waveform including a second preset quantity of continuous sub-waveforms with a second preset frequency, the sub-waveforms being waveforms of a period; and

[0042] if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, controlling a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.

[0043] It can be learned from the foregoing technical solutions that compared with the related art, the present invention provides a smart environmentally-friendly trash bin control method and apparatus, and a smart environmentally-friendly trash bin. According to the technical solutions provided in the present invention, the infrared transmitting tube is controlled, every the first preset time, to transmit the infrared signal of the first pulse waveform once. If a person or an object blocks the infrared signal, the infrared signal may be transmitted. In this case, the infrared receiving tube may receive the reflected infrared signal. Therefore, whether the infrared receiving tube effectively acts is determined by detecting the state of the infrared receiving tube. When the infrared receiving tube effectively acts, it can be determined that a person or an object passes by the smart environmentally-friendly trash bin. In this case, the infrared transmitting tube is controlled, every the second preset time, to transmit the infrared signal of the second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for the first preset number of times. If it is continuously detected for the second preset number of times that the infrared receiving tube effectively acts, it indicates that the infrared receiving tube has detected the infrared signal continuously for the second preset number of times, that is, a person or an object keeps blocking the infrared signal transmitted by the infrared transmitting tube. Therefore, it can be determined that a person walks up to the smart environmentally-friendly trash bin. In this case, the motor is automatically controlled to start to act, to open the upper cover of the environmentally-friendly trash bin, so that it is convenient for people to directly throw garbage into the smart environmentally-friendly trash bin. Therefore, according to the technical solutions provided in the present invention, the smart environmentally-friendly trash bin can automatically open the upper cover when a person carrying garbage walks up to the smart environmentally-friendly trash bin, which facilitates people to directly throw garbage into the trash bin. This is convenient, which avoids the inconvenience in the related art that a user has to open the upper cover when throwing garbage. In this way, the following problem can be avoided: A user throws garbage around the trash bin at a will because it is inconvenient to open the upper cover, which can further ensure cleanness and tidiness of an environment around the trash bin.

BRIEF DESCRIPTION OF DRAWINGS

[0044] To describe the technical solutions in the embodiments of the present invention or in the related art more clearly, the following briefly introduces the accompanying drawings for describing the embodiments or the related art. Apparently, the accompanying drawings in the following description show merely the embodiments of the present invention, and a person of ordinary skill in the art may still derive other drawings from the provided accompanying drawings without creative efforts.

[0045] FIG. 1 is a flowchart of a smart environmentally-friendly trash bin control method according to an embodiment of the present invention.

[0046] FIG. 2 is a structural diagram of a smart environmentally-friendly trash bin control apparatus according to an embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0047] The following clearly and completely describes the technical solutions in the embodiments of the present invention with reference to the accompanying drawings in the embodiments of the present invention. Apparently, the described embodiments are some of the embodiments of the present invention rather than all of the embodiments. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of present invention without making creative efforts shall fall within the protection scope of present invention.

[0048] In order to make the above objectives, features, and advantages of the present invention more comprehensible, the present invention will be further described in detail below in combination with the accompanying drawings and specific implementations.

[0049] Embodiments

[0050] Referring to FIG. 1, FIG. 1 is a flowchart of a smart environmentally-friendly trash bin control method according to an embodiment of the present invention. As shown in FIG. 1, the method includes:

[0051] Step S101: Control, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once.

[0052] Specifically, the first pulse waveform includes a first preset quantity of continuous sub-waveforms with a first preset frequency, and the sub-waveforms are waveforms of a period. Optionally, the first preset time is 200 milliseconds. The first preset quantity is 20. The first preset frequency is 38 KHZ. A duty cycle is 1/3. In this way, time required by the infrared transmitting tube to transmit the infrared signal of the first pulse waveform once is $T = 20 \times 1/38 = 0.526$ milliseconds.

[0053] Step S102: Detect a state of an infrared receiving tube, and determine whether the infrared receiving tube effectively acts.

[0054] Specifically, the infrared transmitting tube and the infrared receiving tube that are arranged on a smart environmentally-friendly trash bin face the same direction, and are located close to each other, so that after an infrared signal transmitted by the infrared transmitting tube is blocked by a person or an object, a reflected infrared signal may be received by the infrared receiving tube. Specifically, if the infrared signal transmitted by the infrared transmitting tube is the infrared signal of reference data shown in step S101, when a person or an object blocks infrared light, and the infrared receiving tube receives reflected infrared light of a quantity of 38 KHZ waveforms, the receiving tube may automatically output a low-level pulse (optionally, a low level is approximately maintained for time of 0.8 T to 1 T. It is found through an experiment that when the infrared transmitting tube transmits tenth to twelfth waveforms, the infrared receiving tube generates a low-level pulse.

[0055] Optionally, step S102 includes:

[0056] respectively detecting output levels of the infrared receiving tube before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once; and

[0057] if the output levels of the infrared receiving tube are respectively a high level and a low level before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, determining that the infrared receiving tube effectively acts. That is, if the output level of the infrared receiving tube is a high level before the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, and the output level of the infrared receiving tube is a low level after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, it is determined that the infrared receiving tube effectively acts.

[0058] Step S103: When the infrared receiving tube effectively acts, control, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times.

[0059] Specifically, the second preset time is less than the first preset time, and optionally, does not exceed 0.2 times the first preset time. That is, when the infrared receiving tube effectively acts, a frequency of controlling the infrared transmitting tube to transmit the infrared signal increases. Optionally, the second preset time is 25 milliseconds, and the first preset number of times is 20. That is, fast transmission time is 500 milliseconds. Specifically, when the infrared receiving tube effectively acts, the infrared transmitting tube is controlled, every 25 milliseconds, to transmit the infrared signal of the second pulse waveform once, which means a small transmission frequency. It totally takes 500 milliseconds to continuously transmit the infrared signal of the second pulse waveform for 20 times, which means short transmission time and a small transmission frequency. Therefore, the

receiving accuracy of the infrared receiving tube is high. The short transmission time and a small number of times of transmission of the infrared signal can reduce energy consumption.

[0060] Specifically, the second pulse waveform includes a second preset quantity of continuous sub-waveforms with a second preset frequency, and the sub-waveforms are waveforms of a period. Optionally, the second preset quantity is 20. The second preset frequency is 38 KHZ A duty cycle is 1/3. In this way, time required by the infrared transmitting tube to transmit the infrared signal of the second pulse waveform once is: $T=20*1/38=0.526$ milliseconds. That is, optionally, the second pulse waveform is the same as the first pulse waveform.

[0061] Step S104: If it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, control a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.

[0062] Optionally, the second preset number of times is 5.

[0063] According to the technical solutions provided in the embodiments of the present invention, the infrared transmitting tube is controlled, every the first preset time, to transmit the infrared signal of the first pulse waveform once. If a person or an object blocks the infrared signal, the infrared signal may be transmitted. In this case, the infrared receiving tube may receive the reflected infrared signal. Therefore, whether the infrared receiving tube effectively acts is determined by detecting the state of the infrared receiving tube. When the infrared receiving tube effectively acts, it can be determined that a person or an object passes by the smart environmentally-friendly trash bin. In this case, the infrared transmitting tube is controlled, every the second preset time, to transmit the infrared signal of the second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for the first preset number of times. If it is continuously detected for the second preset number of times that the infrared receiving tube effectively acts, it indicates that the infrared receiving tube has detected the infrared signal continuously for the second preset number of times, that is, a person or an object keeps blocking the infrared signal transmitted by the infrared transmitting tube. Therefore, it can be determined that a person walks up to the smart environmentally-friendly trash bin. In this case, the motor is automatically controlled to start to act, to open the upper cover of the environmentally-friendly trash bin, so that it is convenient for people to directly throw garbage into the smart environmentally-friendly trash bin. Therefore, according to the technical solutions provided in the present invention, the smart environmentally-friendly trash bin can automatically open the upper cover when a person carrying garbage walks up to the smart environmentally-friendly trash bin, which facilitates people to directly throw garbage into the trash bin. This is convenient, which avoids the inconvenience in the related art that a user has to open the upper cover when throwing garbage. In this way, the following problem can be avoided: A user throws garbage around the trash bin at a will because it is inconvenient to open the upper cover, which can further ensure cleanness and tidiness of an environment around the trash bin.

[0064] Optionally, according to a technical solution provided in another embodiment of the present invention, before step S101 of each time controlling an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the method further includes:

[0065] controlling the infrared receiving tube to be powered on in advance third preset time, and maintaining the infrared receiving tube being powered on for fourth preset time.

[0066] Specifically, the infrared receiving tube is controlled to be periodically turned on, and is turned off after being turned on for a period of time, instead of being turned on all the time. Therefore, energy consumption can be reduced. Optionally, the third preset time is 2T, namely, 1.502 milliseconds, and the fourth preset time is 4T, namely, 2.104 milliseconds.

[0067] Optionally, according to a technical solution provided in another embodiment of the present invention, step S102 includes:

[0068] when the infrared transmitting tube starts to transmit the infrared signal of the first pulse waveform once, detecting output levels of the infrared receiving tube for continuously four times every fourth preset time;

[0069] optionally, the fourth preset time is 0.4T, namely, 0.2104 milliseconds; and

[0070] if the output levels of the infrared receiving tube are respectively a high level, a low level, a low level, and a high level in sequence, determining that the infrared receiving tube effectively acts.

[0071] Specifically, in a normal case, when the infrared receiving tube starts to output a low level at 0.5T to 0.6T, and low-level maintenance time is 0.8T to 1.0T. Therefore, if the infrared receiving tube outputs a high level at 0.4T, outputs a low level at 0.8T, outputs a low level at 1.2T, and outputs a high level at 1.6T, that is, if it is detected

continuously for four times that the output levels of the infrared receiving tube are respectively a high level, a low level, a low level, and a high level, it is determined that the infrared receiving tube effectively acts.

[0072] In the foregoing method for detecting the output levels of the infrared receiving tube by four points (i.e., continuously detecting the output levels for four times), interference, such as interference from a transparent plastic bag, ambient light, and a remote object, can be better excluded, thereby preventing a misoperation.

[0073] Optionally, according to a technical solution provided in another embodiment of the present invention, after step S104, the method further includes:

[0074] if it is detected within fifth preset time that a number of effective actions of the infrared receiving tube does not reach the second preset number of times, entering a standby state, and continuing to control, every the first preset time, the infrared transmitting tube to transmit the first pulse waveform once.

[0075] Optionally, the fifth preset time is 500 milliseconds, which is time required by the infrared transmitting tube to transmit the infrared signal every 25 milliseconds for 20 consecutive times. Optionally, the second preset number of times is 5. That is, if a number of times that the infrared receiving tube effectively acts within 500 milliseconds does not reach 5, it can be determined that no user walks up to the trash bin to throw garbage, but there is interference. In this case, the interference is cleared, and the standby state is implemented, so that a misoperation (namely, opening the cover of the smart environmentally-friendly trash bin) of the motor can be effectively prevented, and accuracy is high.

[0076] To describe the technical solutions provided in the present invention more comprehensively, the present invention discloses a smart environmentally-friendly trash bin control apparatus corresponding to the smart environmentally-friendly trash bin control method provided in the embodiments of the present invention.

[0077] Referring to FIG. 2, FIG. 2 is a structural diagram of a smart environmentally-friendly trash bin control apparatus according to an embodiment of the present invention. As shown in FIG. 2, the apparatus includes:

[0078] a first control module 201, configured to control, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the first pulse waveform including a first preset quantity of continuous sub-waveforms with a first preset frequency, the sub-waveforms being waveforms of a period;

[0079] a detection module 202, configured to: detect a state of an infrared receiving tube, and determine whether the infrared receiving tube effectively acts,

[0080] optionally, the detection module 202 including:

[0081] a first detection unit, configured to respectively detect output levels of the infrared receiving tube before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once; and

[0082] a first determining unit, configured to: if the output levels of the infrared receiving tube are respectively a high level and a low level before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, determine that the infrared receiving tube effectively acts;

[0083] a second control module 203, configured to: when the infrared receiving tube effectively acts, control, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times, the second pulse waveform including a second preset quantity of continuous sub-waveforms with a second preset frequency, the sub-waveforms being waveforms of a period; and

[0084] a third control module 204, configured to: if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, control a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.

[0085] Optionally, the smart environmentally-friendly trash bin control apparatus according to another embodiment of the present invention further includes:

[0086] a fourth control module, configured to: at third preset time before the first control module each time controls the infrared transmitting tube to transmit the infrared signal of the first pulse waveform once, control the infrared receiving tube to be powered on, and maintain the infrared receiving tube being powered on for fourth preset time.

[0087] Optionally, according to the smart environmentally-friendly trash bin control apparatus provided in another embodiment of the present invention, the detection module 202 includes:

[0088] a second detection unit, configured to: when the infrared transmitting tube starts to transmit the infrared

signal of the first pulse waveform once, detect output levels of the infrared receiving tube for continuously four times every fourth preset time; and

[0089] a second determining unit, configured to: if the output levels of the infrared receiving tube are respectively a high level, a low level, a low level, and a high level in sequence, determine that the infrared receiving tube effectively acts.

[0090] Optionally, the smart environmentally-friendly trash bin control apparatus according to another embodiment of the present invention further includes:

[0091] a fifth control module, configured to: if it is detected within fifth preset time that a number of effective actions of the infrared receiving tube does not reach the second preset number of times, enter a standby state, and continue to control, every the first preset time, the infrared transmitting tube to transmit the first pulse waveform once.

[0092] According to the smart environmentally-friendly trash bin control apparatus provided in the embodiments of the present invention, the smart environmentally-friendly trash bin can automatically open the upper cover when a person carrying garbage walks up to the smart environmentally-friendly trash bin, which facilitates people to directly throw garbage into the trash bin. This is very convenient, which avoids the inconvenience in the related art that a user has to open the upper cover when throwing garbage. In this way, the following problem can be avoided: A user throws garbage around the trash bin at a will because it is inconvenient to open the upper cover, which can further ensure cleanness and tidiness of an environment around the trash bin.

[0093] To describe the technical solutions provided in the present invention more comprehensively, the present invention discloses a smart environmentally-friendly trash bin corresponding to the smart environmentally-friendly trash bin control method provided in the embodiments of the present invention.

[0094] The smart environmentally-friendly trash bin provided in the embodiments of the present invention includes:

[0095] a microcontroller unit, an infrared transmitting tube connected to the microcontroller unit, an infrared receiving tube connected to the microcontroller unit, a motor connected to the microcontroller unit, and an environmentally-friendly trash bin with an upper cover,

[0096] where operations of the microcontroller unit include:

[0097] controlling, every first preset time, an infrared transmitting tube to transmit an infrared signal of a first pulse waveform once, the first pulse waveform including a first preset quantity of continuous sub-waveforms with a first preset frequency, the sub-waveforms being waveforms of a period;

[0098] detecting a state of an infrared receiving tube, and determining whether the infrared receiving tube effectively acts;

[0099] when the infrared receiving tube effectively acts, controlling, every second preset time, the infrared transmitting tube to transmit an infrared signal of a second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for a first preset number of times, the second pulse waveform including a second preset quantity of continuous sub-waveforms with a second preset frequency, the sub-waveforms being waveforms of a period; and

[0100] if it is continuously detected for a second preset number of times that the infrared receiving tube effectively acts, controlling a motor to start to act, to open an upper cover of an environmentally-friendly trash bin.

[0101] Optionally, according to the smart environmentally-friendly trash bin provided in another embodiment of the present invention, the operations of the microcontroller unit further include:

[0102] each time before the controlling the infrared transmitting tube to transmit the infrared signal of the first pulse waveform once, controlling the infrared receiving tube to be powered on in advance third preset time, and maintaining the infrared receiving tube being powered on for fourth preset time.

[0103] Specifically, the infrared transmitting tube and the infrared receiving tube that are arranged on a smart environmentally-friendly trash bin face the same direction, and are located close to each other, so that after an infrared signal transmitted by the infrared transmitting tube is blocked by a person or an object, a reflected infrared signal may be received by the infrared receiving tube.

[0104] Optionally, the motor is connected to the upper cover through a gear. The motor rotates clockwise to open the upper cover, and rotates counterclockwise to close the upper cover.

[0105] Optionally, according to the smart environmentally-friendly trash bin provided in the embodiments of the present invention, the performing, by the microcontroller unit, the operation of detecting a state of the infrared receiving tube and determining whether the infrared receiving tube effectively acts specifically includes:

[0106] respectively detecting output levels of the infrared receiving tube before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once; and

[0107] if the output levels of the infrared receiving tube are respectively a high level and a low level before and after the infrared transmitting tube transmits the infrared signal of the first pulse waveform once, determining that the infrared receiving tube effectively acts.

[0108] It should be noted that, according to the smart environmentally-friendly trash bin provided in the embodiments of the present invention, the performing, by the microcontroller unit, the operation of detecting a state of the infrared receiving tube and determining whether the infrared receiving tube effectively acts may alternatively be implemented in another manner, specifically include:

[0109] when the infrared transmitting tube starts to transmit the infrared signal of the first pulse waveform once, detecting output levels of the infrared receiving tube for continuously four times every fourth preset time;

[0110] if the output levels of the infrared receiving tube are respectively a high level, a low level, a low level, and a high level in sequence, determining that the infrared receiving tube effectively acts.

[0111] Optionally, according to the smart environmentally-friendly trash bin provided in another embodiment of the present invention, the operations of the microcontroller unit further include:

[0112] if it is detected within fifth preset time that a number of effective actions of the infrared receiving tube does not reach the second preset number of times, entering a standby state, and continuing to control, every the first preset time, the infrared transmitting tube to transmit the first pulse waveform once.

[0113] Optionally, according to the smart environmentally-friendly trash bin provided in another embodiment of the present invention, the microcontroller unit automatically enters a dormancy mode when the infrared transmitting tube and the infrared receiving tube do not work, thereby saving more power.

[0114] It can be learned from the foregoing technical solutions that compared with the related art, the present invention provides a smart environmentally-friendly trash bin control method and apparatus, and a smart environmentally-friendly trash bin. According to the technical solutions provided in the present invention, the infrared transmitting tube is controlled, every the first preset time, to transmit the infrared signal of the first pulse waveform once. If a person or an object blocks the infrared signal, the infrared signal may be transmitted. In this case, the infrared receiving tube may receive the reflected infrared signal. Therefore, whether the infrared receiving tube effectively acts is determined by detecting the state of the infrared receiving tube. When the infrared receiving tube effectively acts, it can be determined that a person or an object passes by the smart environmentally-friendly trash bin. In this case, the infrared transmitting tube is controlled, every the second preset time, to transmit the infrared signal of the second pulse waveform once and continuously transmit the infrared signal of the second pulse waveform for the first preset number of times. If it is continuously detected for the second preset number of times that the infrared receiving tube effectively acts, it indicates that the infrared receiving tube has detected the infrared signal continuously for the second preset number of times, that is, a person or an object keeps blocking the infrared signal transmitted by the infrared transmitting tube. Therefore, it can be determined that a person walks up to the smart environmentally-friendly trash bin. In this case, the motor is automatically controlled to start to act, to open the upper cover of the environmentally-friendly trash bin, so that it is convenient for people to directly throw garbage into the smart environmentally-friendly trash bin. Therefore, according to the technical solutions provided in the present invention, the smart environmentally-friendly trash bin can automatically open the upper cover when a person carrying garbage walks up to the smart environmentally-friendly trash bin, which facilitates people to directly throw garbage into the trash bin. This is convenient, which avoids the inconvenience in the related art that a user has to open the upper cover when throwing garbage. In this way, the following problem can be avoided: A user throws garbage around the trash bin at a will because it is inconvenient to open the upper cover, which can further ensure cleanness and tidiness of an environment around the trash bin.

[0115] It should be finally noted that, in this document, relationship terms such as first and second are used solely to distinguish one entity or operation from another entity or operation without necessarily requiring or implying any actual such relationship or order between such entities or operations. Moreover, the terms "include," "comprise,"

and any variation thereof are intended to cover a non-exclusive inclusion. Therefore, in the context of a process, a method, an object, or a device that includes a series of elements, the process, method, object, or device not only includes such elements, but also includes other elements not specified expressly, or may include inherent elements of the process, method, object, or device. Without further limitation, an element defined by the phrase "including a/an..." does not exclude the presence of another identical elements in the process, method, article or device that includes the element.

[0116] The various embodiments in this specification are described in a progressive manner, and each embodiment focuses on differences from other embodiments. The same or similar parts between all the embodiments can be referred to each other. Since the apparatus and the smart environmentally-friendly trash bin that are disclosed in the embodiments correspond to the method disclosed in the embodiments, the apparatus and the smart environmentally-friendly trash bin are described simply, and related parts are found in some of the explanations of the method.

[0117] The steps of the method or algorithm described in conjunction with the embodiments disclosed herein can be implemented directly using hardware, software modules executed by the processor, or a combination thereof. The software module may be placed in a random access memory (RAM), a memory, a read-only memory (ROM), an electrically programmable ROM (EPROM), an electrically erasable programmable ROM (EEPROM), a register, a hard disk, a removable magnetic disk, a compact disc-read-only memory (CD-ROM), or any storage medium of other forms well-known in the technical field.

[0118] The above explanations of the disclosed embodiments enable those skilled in the art to implement or use the present invention. The various modifications to these embodiments will be apparent to those skilled in the art, and the general principles defined herein can be implemented in other embodiments without departing from the spirit or scope of the present invention. Thus, the present invention is not limited to these embodiments shown herein, but accords with the broadest scope consistent with the principles and novel features disclosed herein.

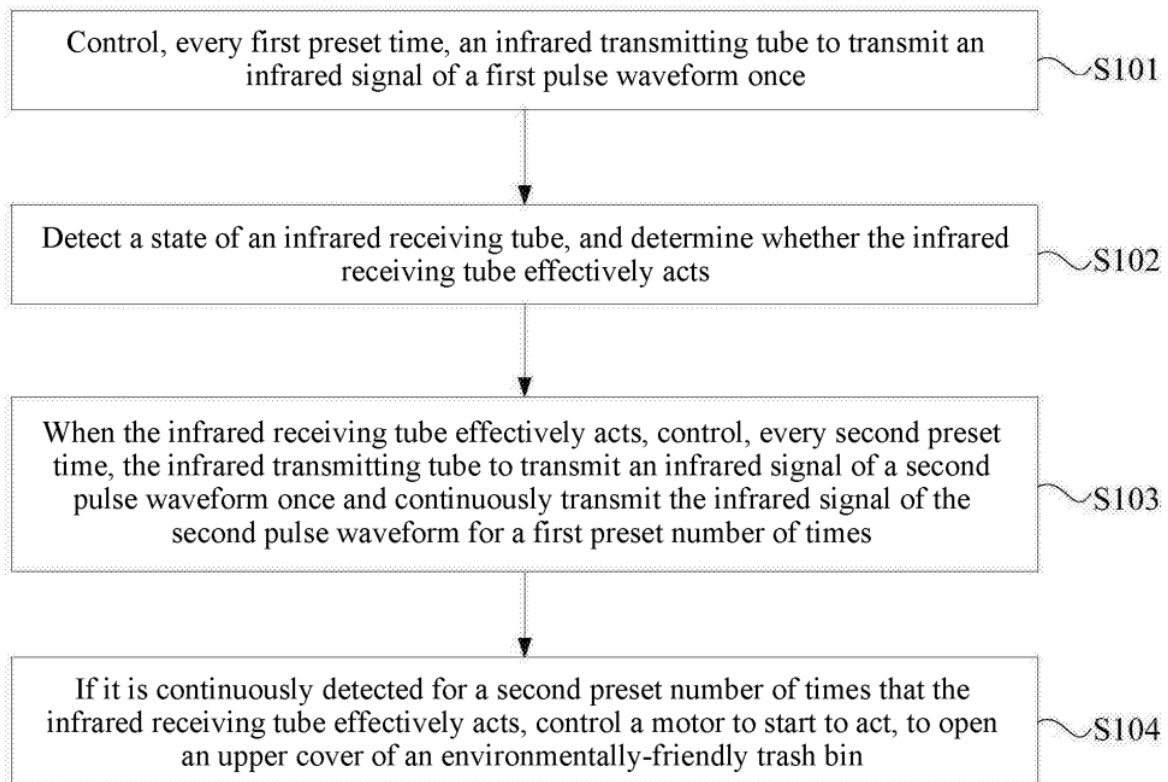
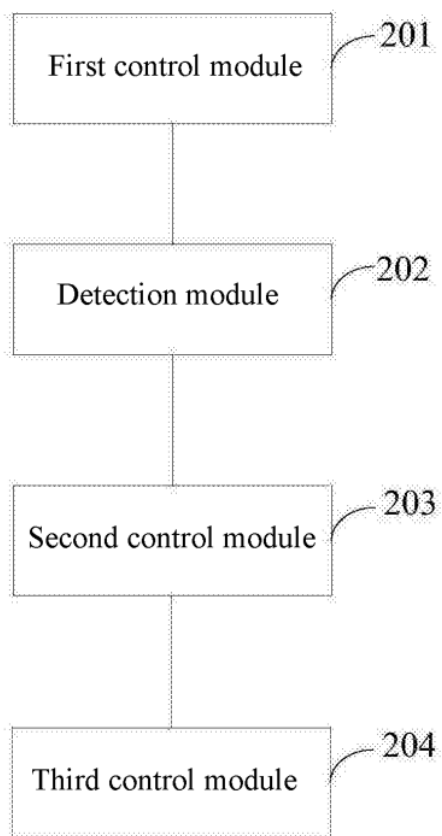


FIG. 1

**FIG. 2**



Certification of Accuracy

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