Title: MOVABLE CONTAINER, ASSOCIATED ELECTRONIC DEVICE AND ASSOCIATED METHOD

Abstract: A movable container (10) includes: a driving mechanism (W_1-W_4, 211-214, 215), a sensing device (310), and a control circuit (320). The driving mechanism (W_1-W_4, 211-214, 215) is arranged to provide a momentum to the movable container (10). The sensing device (310) is arranged to sense a motion feature in accordance with the momentum provided by the driving mechanism (W_1-W_4, 211-214, 215). The control circuit (320) is coupled to the sensing device (310) and the driving mechanism (W_1-W_4, 211-214, 215), and arranged to calculate a calculated mass of the movable container (10) in accordance with the motion feature sensed by the sensing device (310). The control circuit (320) is coordinated with the driving mechanism (W_1-W_4, 211-214, 215) and the sensing device (310) via a user input. An electronic device (20) communicating with the movable container (10). A method for calculating the weight of the movable container (10).

FIG. 1

WO 2019/072056 A1

[Continued on next page]
Declarations under Rule 4.17:
— as to the identity of the inventor (Rule 4.17(i))
— as to applicant’s entitlement to apply for and be granted a patent (Rule 4.17(H))
— as to the applicant’s entitlement to claim the priority of the earlier application (Rule 4.17(m))
— of inventorship (Rule 4.17(iv))

Published:
— with international search report (Art. 21(3))
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
MOVABLE CONTAINER, ASSOCIATED ELECTRONIC DEVICE AND
ASSOCIATED METHOD

BACKGROUND

[0001] Traditionally, when a user needs to weigh a suitcase or other piece of luggage, a scale is required. Such scale, however, is not always accurate and easy to acquire, which might cause an inconvenient user experience. Therefore, a new device is desired.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] Aspects of the present disclosure are best understood from the following detailed description when read with the accompanying figures. It is noted that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

[0003] FIG. 1 is a diagram illustrating a movable container and an electronic device connected thereto according to an embodiment of the present disclosure.

[0004] FIG. 2 is a diagram illustrating circuits installed in the movable container according to an embodiment of the present disclosure.

[0005] FIG. 3 is a diagram illustrating a driving mechanism according to an embodiment of the present disclosure.

[0006] FIG. 4 is a diagram illustrating a location of a sensing device installed on the movable container according to an embodiment of the present disclosure.
FIG. 5 is a diagram illustrating a sensing device including an ultrasonic sensor and an infrared sensor sensing the obstacles according to an embodiment of the present disclosure.

FIG. 6 is a flowchart illustrating the method applied to a movable container according to an embodiment of the present disclosure.

FIG. 7 is a diagram illustrating the steps of executing the setting operation according to an embodiment of the present disclosure.

FIG. 8 is a flowchart illustrating execution of the setting operation according to an embodiment of the present disclosure.

FIG. 9 is a diagram illustrating the steps of executing the calibration operation according to an embodiment of the present disclosure.

FIG. 10 is a flowchart illustrating execution of the calibration operation according to an embodiment of the present disclosure.

FIG. 11 is a diagram illustrating the user actively executing a setting operation, a calibration operation and a calculation operation via a user interface according to an embodiment of the present disclosure.

FIG. 12 is a diagram illustrating a control signal provided to the user comprising an alert message according to an embodiment of the present disclosure.

FIG. 13 is a diagram illustrating a control signal provided to the user comprising an alert message according to another embodiment of the present disclosure.
DETAILED DESCRIPTION

[00016] The following disclosure provides many different embodiments, or examples, for implementing different features of the disclosure. Specific examples of components and arrangements are described below to simplify the present disclosure. These are, of course, merely examples and are not intended to be limiting. For example, the formation of a first feature over or on a second feature in the description that follows may include embodiments in which the first and second features are formed in direct contact, and may also include embodiments in which additional features may be formed between the first and second features, such that the first and second features may not be in direct contact. In addition, the present disclosure may repeat reference numerals and/or letters in the various examples. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various embodiments and/or configurations discussed.

[00017] Further, spatially relative terms, such as "beneath," "below," "lower," "above," "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. The spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. The apparatus may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein may likewise be interpreted accordingly.

[00018] Notwithstanding that the numerical ranges and parameters setting forth the broad scope of the disclosure are approximations, the numerical
values set forth in the specific examples are reported as precisely as possible. Any numerical value, however, inherently contains certain errors necessarily resulting from the standard deviation found in the respective testing measurements. Also, as used herein, the term "about" generally means within 10%, 5%, 1%, or 0.5% of a given value or range. Alternatively, the term "about" means within an acceptable standard error of the mean when considered by one of ordinary skill in the art. Other than in the operating/working examples, or unless otherwise expressly specified, all of the numerical ranges, amounts, values and percentages such as those for quantities of materials, durations of times, temperatures, operating conditions, ratios of amounts, and the likes thereof disclosed herein should be understood as modified in all instances by the term "about." Accordingly, unless indicated to the contrary, the numerical parameters set forth in the present disclosure and attached claims are approximations that can vary as desired. At the very least, each numerical parameter should at least be construed in light of the number of reported significant digits and by applying ordinary rounding techniques. Ranges can be expressed herein as from one endpoint to another endpoint or between two endpoints. All ranges disclosed herein are inclusive of the endpoints, unless specified otherwise.

[00019] The embodiments of the present disclosure propose a movable container, an associated electronic device connected thereto and an associated method applied thereby to solve the aforementioned problems. In some embodiments, the movable container may be, but is not limited to, a suitcase. Any other container which can move manually or automatically shall fall within the scope of the present disclosure.
FIG. 1 is a diagram illustrating a movable container 10 and an electronic device 20 electronically connected thereto according to an embodiment of the present disclosure. It should be noted that the electronic device 20 may be a portable electronic device such as a mobile phone, a laptop or a personal digital assistant (PDS), or a non-portable electronic device such as a desktop computer, a server, or a computer terminal, which is not a limitation. In addition, the electronic device 20 may connect to the movable container 10 wirelessly, in a wired arrangement, or directly. For example, the electronic device 20 may be a mobile phone, and may connect to the movable container 10 via a wireless communication method such as Bluetooth or Wi-Fi. For another example, the electronic device 20 may be a laptop, and may connect to the movable container 10 via any kind of transmission line such as a Universal Serial Bus (USB) line, or a High Definition Multimedia Interface (HDMI). For yet another example, the electronic device 20 may be directly embedded in the movable container 10.

As shown in FIG. 1, the movable container 10 includes wheels W_1 to W_4 for facilitating the motion of the movable container 10 toward any direction. It should be noted that the number of wheels, size of wheels and the location of wheels installed on the movable container 10 shown in FIG. 1 are only for illustrative purpose, and do not comprise a limitation of the present invention. Similarly, the tool for the motion of the movable container 10 is not limited to wheels as shown in FIG. 1. In other embodiments, the movable container 10 may include a belt or roller, or any kind of tool for facilitating the motion of the movable container 10. The movable container 10 may include more elements than those shown in FIG. 1. For example, a handle may
be included for carrying the movable container 10. However, only those elements pertinent to the present disclosure are illustrated in FIG. 1 for brevity.

[00022] As shown in FIG. 1, the electronic device 20 includes a transceiver circuit 210 and a user interface 220, wherein the transceiver circuit 210 is arranged to transmit and receive signals from the movable container 10, and the user interface 220 is arranged to interact with a user of the electronic device 20 according to a user input issued by the user for communicating with the movable container 10 or via signals received from the movable container 10. For example, but not limited to, the user interface 220 may include a touch display screen. The user input is issued by the user by touching the screen, and the signals received from the movable container 10 are displayed on the screen for notifying the user. It should be noted that the size and the location of the transceiver circuit 210 and the user interface 220 shown in FIG. 1 are only for illustrative purpose.

[00023] FIG. 2 is a diagram illustrating a driving mechanism of the movable container 10 according to an embodiment of the present disclosure. The driving mechanism is arranged to provide a momentum to the movable container 10, wherein the driving mechanism includes wheels W_1 to W_4, motors 211 to 214, and a battery 215. Each of the motors 211 to 214 corresponds to one of the wheels W_1 to W_4. In some embodiments, each motor is a hub motor included within the corresponding wheel. The battery 215 is arranged to provide driving currents DC1 to DC4 to each of the motors 211 to 214, respectively, to drive the motors. When the motors 211 to 214 receive the driving currents DC1 to DC4, the motors 211 to 214 provide the
momentum by cooperating with the corresponding wheels. It should be noted that the connection between the battery 215 and each of the motors 211 to 214, and the connection between the motors 211 to 214 and the corresponding wheels W_1 to W_4, are not a limitation of the present disclosure. In other words, the driving currents DC1 to DC4 may be provided to the motors 211 to 214 through a variety of ways, and the motors 211 to 214 may coordinate with the corresponding wheels through different ways. For example, the driving current might be provided to the motor with a cable, and the motor might coordinate with the corresponding wheel through gears or a belt. In some embodiments, the battery 215 is detachable. In an example, when the user needs to check in the movable container 10 at an airport, the battery 215 installed in the movable container 10 can be removed. In some embodiments, the battery 215 is rechargeable. It should be noted that the size, the locations, the number and the type of the motors and the battery are not a limitation of the present disclosure.

[00024] FIG. 3 is a diagram illustrating a sensing device 310 and a control circuit 320 coupled to the driving mechanism including the motors 211 to 214 and the battery 215 of the movable container 10 according to an embodiment of the present disclosure. The control circuit 320 is arranged to receive an enable signal EN converted from the user input via the transceiver circuit 210 to activate a calculation operation, wherein the calculation operation is arranged to calculate a calculated mass MASS_cal of the movable container 10. The control circuit 320 is further arranged to issue a command COM to the driving mechanism (e.g., the battery 215 or a control unit in the driving mechanism not shown in FIG. 2). When the command COM is received by the
driving mechanism, the momentum is provided to the movable container 10. The sensing device 310 is arranged to sense a motion feature MF of the movable container 10 while the momentum is being provided. In some embodiments, the motion feature MF may be acceleration, velocity, a moving distance, or a length of time of the movable container 10 being moved. The control circuit 320 calculates the calculated mass MASS_cal of the movable container 10 according to the motion feature MF provided by the sensing device 310, and transmits the calculated mass MASS_cal via the user interface 220 to inform the user. For example, the calculated mass MASS_cal is displayed on a screen of the user interface 220 to inform the user. It should be noted that the connection between the control circuit 320 and the driving mechanism (i.e., the battery 215 or the control unit in the driving mechanism) and the connection between the control circuit 320 and the sensing device 310 are not limited by the above embodiment. For example, the connections may be implemented by a wireless method such as Bluetooth, Wi-Fi, or through a cable. The detailed description of calculating the calculated mass MASS_cal according to the motion feature MF will be discussed in the following paragraphs.

More specifically, when the motors 211 to 214 provide the momentums precisely, the movable container 10 is moving and driven by a force $F_{\text{drive}}$. In one embodiment, the sensing device 310 includes an accelerometer, and when the movable container 10 is driven by the force $F_{\text{drive}}$, the accelerometer detects an acceleration $A_{cc}$ as the motion feature MF. In some embodiments, the accelerometer may be included in an inertial measurement unit. Based on the physical law $F_{\text{drive}} = \text{MASS}_{\text{cal}} \times A_{cc}$, the
control circuit 320 can easily calculate the calculated mass \( \text{MASS\_cal} \) according to the motion \( MF \) (i.e., the acceleration \( A_{cc} \)). In another embodiment, the sensing device 310 includes an image sensor and a timer, and when the movable container 10 is driven by the force \( F_{\text{drive}} \), the image sensor and the timer sense a moving distance \( X_{\text{sense}} \) and a length of time \( t_{\text{sense}} \) for which the movable container 10 is driven by the force \( F_{\text{drive}} \). According to the moving distance \( X_{\text{sense}} \) and the length of time \( t_{\text{sense}} \), the control circuit 320 can calculate the velocity \( V_{\text{sense}} \) based on the physical law \( V^2_{\text{sense}} = V^2_0 + 2A_{cc}X_{\text{sense}} \), and the control circuit 320 can calculate the acceleration \( A_{cc} \) and further obtain the calculated mass \( \text{MASS\_cal} \) based on physical law \( F_{\text{drive}} = \text{MASS\_cal} \times A_{cc} \). It should be noted that the generation of the moving distance \( X_{\text{sense}} \) and the length of time \( t_{\text{sense}} \) are not limited to be implemented by the image sensor and the timer. Those skilled in the art should readily understand the existence of alternative methods to obtain the moving distance \( X_{\text{sense}} \) and the length of time \( t_{\text{sense}} \). For example, the sensing device 310 may include an odometer or wheel speedometer to sense the moving distance \( X_{\text{sense}} \).

FIG. 4 is a diagram illustrating the location of the sensing device 310 installed on the movable container 10 according to an embodiment of the present disclosure. As shown in FIG. 4, the sensing device 310 includes an accelerometer 410, an image sensor 420 and a timer 430. In this embodiment, the image sensor 420 may be a camera for capturing images. It should be noted that the number and the location of the sensors (e.g., the accelerometer 410, the image sensor 420 and the timer 430) are not a limitation of the present disclosure. For example, in this embodiment, the image sensor 420 is installed on the top of a surface (e.g., the front surface of the movable container 10) for easily capturing the images. However, the image sensor 420 might be installed...
at a different location of the movable container 10 as long as it can easily capture the required images, at the handle or upper part of the pull rods for example.

[00026] In some embodiments, the sensing device 310 includes other sensors. For example, the sensing device 310 includes a proximity sensor for sensing and avoiding obstacles. With such configuration, when the user executes the calculation operation, the control circuit 320 can transmit a command to the sensing device 310 to search for a moving path via the ultrasonic sensor or the infrared sensor. The searched moving path allows the movable container 10 to move without encountering any obstacle, and facilitates the control circuit 320 to calculate the calculated mass MASS_cal easily. FIG. 5 is a diagram illustrating the sensing device 310 including the proximity sensor 501 for sensing the obstacles OBI to OB4 according to an embodiment of the present disclosure. As shown in FIG. 5, the proximity sensor 501 may be installed on the front surface of the movable container 10 to sense the obstacles OBI to OB4, but the disclosure is not limited thereto. Next, the proximity sensor 501 may find a moving path that includes fewer obstacles to allow the control circuit 320 to calculate the calculated mass MASS_cal. For the calculation of the control circuit 320, the moving path is usually longer than a predetermined value, so the sensing device 310, and more particularly, the image sensor 420 included in the sensing device 310, can easily obtain the moving distance Xsense. However, the moving path is not limited to a straight line. In other embodiments, the moving path may be a curved line, and the control circuit 320 may calculate the calculated mass MASS_cal according to the angular velocity sensed by the sensing device 310. In this embodiment, the proximity
sensor 501 may be an ultrasonic sensor, an infrared sensor, a laser scanner, a light detection and ranging (LiDAR), or a stereo camera. The type of the proximity sensor 501 should not be limited by the present disclosure. In addition, in other embodiments, the proximity sensor 501 may be further arranged to sense the moving distance $X_{sense}$ and calculate the velocity $V_{sense}$. The function of the proximity sensor 501 should not be limited by the present disclosure either.

[00027] FIG. 6 is a flowchart illustrating the method 600 applied by the movable container 10 according to an embodiment of the present disclosure. Provided that the results are substantially the same, the steps shown in FIG. 6 are not required to be executed in the exact order described, and other orders may be followed. The method 600 is summarized as follows.

[00028] In Step 602, momentum is provided to the movable container 10.

[00029] In Step 604, the motion feature MF is sensed in accordance with the momentum.

[00030] In Step 606, the calculated mass MASS_cal of the movable container 10 is calculated at least in accordance with the motion feature MF.

[00031] Those skilled in the art should readily understand the method 600 after reading the paragraphs above. The detailed description is omitted herein for brevity.

[00032] It should be noted that, in practice, the momentum provided by the motors 211 to 214 may not be precise under certain circumstances. The force driving the movable container 10 might not be accurate enough, and may
introduce a deviation of the calculated mass MASS_cal. Therefore, the control circuit 320 may transmit a setting signal SET to instruct the user to execute a setting operation first to increase the accuracy of calculated mass MASS_cal.

[00033] FIG. 7 is a diagram illustrating the steps of instructing the setting operation according to an embodiment of the present disclosure. When the user issues the user input (in this embodiment, by touching the user interface 220) via the transceiver 210 to activate the calculation operation, the control circuit 320 receives the enable signal EN, and transmits a setting signal SET instructing the user to empty the movable container 10 back to the user interface 220 to inform the user. For example, the setting signal SET might be shown on the screen of the user interface 220.

[00034] When the movable container 10 is empty, the user executes the calculation via the user interface 220. As mentioned in the embodiments of FIGS. 3 and 4, the control circuit 320 can calculate a reference mass MASS_ref of the movable container 10 accordingly, wherein the reference mass MASS_ref represents the mass of the empty movable container 10. Next, the user can load the movable container 10 and execute the calculation operation again. At such time, the control circuit 320 may obtain the calculated mass MASS_cal of the loaded movable container 10 based on the equation MASS_ref*A_{ref}=MASS_cal*A_{cc}, wherein the acceleration A_{ref} and the acceleration A_{cc} can be obtained by the methods mentioned above.

[00035] FIG. 8 is a flowchart illustrating the setting operation 800 executed prior to the method 600 according to an embodiment of the present disclosure. Provided that the results are substantially the same, the steps shown in FIG. 8
are not required to be executed in the exact order described. The setting operation 800 is summarized as follows.

[00036] In Step 802, the user is instructed to empty the movable container 10.

[00037] In Step 804, the reference mass MASS_ref is calculated.

[00038] Those skilled in the art should readily understand the setting operation 800 after reading the paragraphs above. The detailed description is omitted herein for brevity.

[00039] In practice, when the mechanical structures or the electronic structures of the movable container 10 become worn, the deviation of the calculated mass MASS_cal might increase. Therefore, a calibration mechanism is desired for the movable container 10. For example, if the user, by chance, is able to weigh the movable container 10 with an accurate scale such as a scale at the airport to obtain a scaled mass MASS_sca of the movable container 10, the control circuit 320 can instruct the user to execute the calibration operation.

[00040] FIG. 9 is a diagram illustrating the steps of instructing the calibration operation according to an embodiment of the present disclosure. After the calculated mass MASS_cal is calculated by the method 600, the control circuit 320 transmits a calibration signal CAL to the user interface 220 to instruct the user to execute the calibration operation. For example, the calibration signal CAL may be shown on the screen of the user interface 220 to instruct the user to input the scaled mass MASS_sca via the user input (in this embodiment, by touching the screen of the user interface 220). When the control circuit 320
receives a calibration enable signal CAL_EN converted from the user input via the transceiver circuit 210, the control circuit 320 compares the calculated mass MASS_cal which is calculated before and the scaled mass MASS_sca, and stores the difference of the calculated mass MASS_cal and the scaled mass MASS_sca. Accordingly, when next time the enable signal EN is received by the control circuit 320, the control circuit 320 may refer to the difference of the calculated mass MASS_cal and the scaled mass MASS_sca to generate a calibrated mass MASS_clb, and inform the user of the calibrated mass MASS_elb as the calculated mass MASS_cal. For example, when the original calculated mass MASS_cal is 2kg heavier than the scaled mass MASS_sca, the control circuit 320 may reduce 2kg from the original calculated mass MASS_cal as the calibrated mass MASS_elb, and inform the user of the calibrated mass MASS_elb to better provide the exact mass of the movable container 10. Preferably, the control circuit 320 may utilize interpolation method to execute the calibration operation. The method utilized by the control circuit 320 should not be limited by the present disclosure.

[00041] FIG. 10 is a flowchart illustrating the calibration operation 1000 executed after the method 600 according to an embodiment of the present disclosure. Provided that the results are substantially the same, the steps shown in FIG. 10 are not required to be executed in the exact order described. The calibration operation 1000 is summarized as follows.

[00042] In Step 1002, the user is instructed to input the scaled mass MASS_sca.
In Step 1004, the scaled mass `MASS_sca` is referred to generate a calculated mass `MASS_clb` as the calculated mass `MASS_cal` are compared.

In Step 1006, the calculated mass `MASS_cal` of the container is informed to the user.

Those skilled in the art should readily understand the calibration operation 1000 after reading the paragraphs above. The detailed description is omitted herein for brevity.

It should be noted that, in the abovementioned embodiments, the control circuit 320 instructs the user to execute the setting operation or the calibration operation. However, this is not a limitation of the present disclosure. In some embodiments, the user actively executes the setting operation, the calibration operation or the calculation operation via the user interface 220. FIG. 11 is a diagram illustrating the user actively executing the setting operation, the calibration operation and the calculation operation via the user interface 220 according to an embodiment of the present disclosure. As shown in FIG. 11, the user interface 220 displays options such as setting operation, calibration operation, and calculation operation. Therefore, the user can actively execute the setting operation, the calibration operation, and the calculation operation by touching the screen of the user interface 220.

FIG. 12 is a diagram illustrating the control signal providing the user with an alert message according to an embodiment of the present disclosure. In this embodiment, when the calculated mass `MASS_cal` calculated by the control circuit 320 is greater than a predetermined value, the control circuit
transmits the alert message ALE to inform the user that the movable container 10 is too heavy. For example, the alert message may be shown on the screen of the user interface 220 to inform the user.

[00048] FIG. 13 is a diagram illustrating the control signal providing the user with an alert message according to another embodiment of the present disclosure. In this embodiment, when the control circuit 320 learns that an amount of charge in the battery is lower than a predetermined value, the control circuit 320 transmits the alert message ALE to inform the user that the battery 215 needs to be charged or replaced. For example, the alert message may be shown on the screen of the user interface 220 to inform the user.

[00049] In some embodiments, a movable container is disclosed. The movable container includes: a driving mechanism, a sensing device, and a control circuit. The driving mechanism is arranged to provide a momentum to the movable container. The sensing device is arranged to sense a motion feature in accordance with the momentum provided by the driving mechanism. The control circuit is coupled to the sensing device and the driving mechanism and arranged to calculate a calculated mass of the movable container in accordance with the motion feature sensed by the sensing device, and the control circuit is coordinated with the driving mechanism and the sensing device via a user input.

[00050] In some embodiments, an electronic device is disclosed. The electronic device includes: a transceiver circuit, and a user interface. The transceiver circuit is arranged to transmit and receive signals from a movable container. The user interface is arranged to receive the user input and inform a
user of the electronic device of the calculated mass of the container. When the user input indicates a calculation operation, the transceiver circuit transmits a command to activate the driving mechanism of the movable container to provide the momentum for calculating the calculated mass of the container.

[00051] In some embodiments, a method of a movable container is disclosed. The method includes: providing a momentum to the movable container; sensing a motion feature in accordance with the momentum; and calculating a calculated mass of the movable container at least in accordance with the motion feature.

[00052] The foregoing outlines features of several embodiments so that those skilled in the art may better understand the aspects of the present disclosure. Those skilled in the art should appreciate that they may readily use the present disclosure as a basis for designing or modifying other processes and structures for carrying out the same purposes and/or achieving the same advantages of the embodiments introduced herein. Those skilled in the art should also realize that such equivalent constructions do not depart from the spirit and scope of the present disclosure, and that they may make various changes, substitutions, and alterations herein without departing from the spirit and scope of the present disclosure.
WHAT IS CLAIMED IS:

1. A movable container, comprising:

   a driving mechanism, arranged to provide a momentum to the movable container;

   a sensing device, arranged to sense a motion feature in accordance with the momentum provided by the driving mechanism; and

   a control circuit, coupled to the sensing device and the driving mechanism, wherein the control circuit is arranged to calculate a calculated mass of the movable container in accordance with the motion feature sensed by the sensing device, and the control circuit is coordinated with the driving mechanism and the sensing device via a user input.

2. The movable container of Claim 1, wherein the momentum is provided based on a driving current.

3. The movable container of Claim 1, wherein the sensing device comprises an accelerometer, the motion feature is an acceleration sensed by the accelerometer, and the control circuit calculates the calculated mass of the container in accordance with the acceleration and the momentum.

4. The movable container of Claim 1, wherein the sensing device comprises an image sensor, the motion feature is a moving distance of the container sensed by the image sensor while the momentum is provided, and the control circuit calculates the calculated mass of the container in accordance with the moving distance of the container while the momentum is provided, a time of the container being moved, and the momentum.
5. The movable container of Claim 4, wherein the sensing device comprises an ultrasonic sensor or an infrared sensor, the sensing device is further arranged to search for a moving path for the container, and the moving path is not shorter than the moving distance of the container.

6. The movable container of Claim 1, wherein the driving mechanism comprises a motor and a battery, and the momentum is generated by the motor.

7. The movable container of Claim 1, wherein the sensing device comprises a laser scanner or a light detection and ranging (LiDAR) installed on the movable container, and further comprises an odometer.

8. An electronic device for communicating with the movable container of Claim 1, comprising:

   a transceiver circuit, arranged to transmit and receive signals from the movable container; and

   a user interface, arranged to receive the user input and inform a user of the electronic device of the calculated mass of the container;

wherein when the user input indicates a calculation operation, the transceiver circuit transmits an enable signal to activate the driving mechanism of the movable container to provide the momentum for calculating the calculated mass of the container.
9. The electronic device of Claim 8, wherein the electronic device is wirelessly, in a wired manner, or directly connected to the movable container.

10. The electronic device of Claim 8, wherein the electronic device is a mobile phone, a personal computer, or a personal digital assistant (PDA), and the user interface is a touch display screen, a keyboard, or a microphone to receive the user input.

11. A method of a movable container, comprising:

   providing a momentum to the movable container;

   sensing a motion feature in accordance with the momentum; and

   calculating a calculated mass of the movable container at least in accordance with the motion feature.

12. The method of Claim 11, further comprising:

   receiving a user input instructing a calculation operation via an electronic device before providing the momentum.

13. The method of Claim 11, further comprising:

   informing a user of the calculated mass of the container via an electronic device.

14. The method of Claim 11, further comprising:

   instructing the user to input a scaled mass of the container via an electronic device to execute a calibration operation.
15. The method of Claim 14, wherein the calibration operation comprises:

referring to the scaled mass to generate a calibrated mass as the calculated mass; and

informing a user of the calculated mass of the container.

16. The method of Claim 11, further comprising:

instructing the user to execute a setting operation via an electronic device before the calculated mass of the container is calculated.

17. The method of Claim 16, wherein the setting operation comprises:

calculating a reference mass of the container when the container is empty;

and steps of calculating the calculated mass of the movable container comprise:

calculating the calculated mass of the movable container by referring to the reference mass of the container.

18. The method of Claim 11, further comprising:

rotating the container to find a moving path, wherein a length of the moving path is greater than a predetermined value;

wherein rotating the container to find the moving path comprising:

utilizing a proximity sensor to find the moving path.
19. The method of Claim 11, wherein the movable container comprises a battery, and the method further comprises:

providing the user with an alert message when the calculated mass of the container is greater than a predetermined value.

20. The method of Claim 11, wherein the momentum is provided by a driving current.
FIG. 6

600

Provide the momentum to the movable container 10

602

sense the motion feature MF in accordance with the momentum

604

calculate the calculated mass MASS_cal of the movable container 10 at least in accordance with the motion feature MF

606
Please empty the movable container 10.
Instruct the user to empty the movable container 10

Calculate the reference mass MASS_ref
FIG. 10

Instruct the user to input the scaled mass MASS_ sca.

Refer to the scaled mass MASS_ sca to generate a calibrated mass as the calculated mass MASS_ cal.

Inform the user of the calculated mass of the container.
FIG. 12

Control circuit

warning! The movable container 10 is too heavy.
FIG. 13

320

Control circuit

ALE

20 220

warning! The battery is low
A. CLASSIFICATION OF SUBJECT MATTER

G01G 19/03(2006.01)i; A45C 13/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G01G; A45C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS,CNTXT,VEN,USTXT,CNKI:luggage, suitcase, container, baggage, bag, box, weigh, weight, mass, load, scale, acceleration, volecity, distance, displacement,smart, move, actuate, motor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>E</td>
<td>CN 10872021 I A (LINGDONG TECHNOLOGYBEIJING CO.LTD) 02 November 2018; claims 1-20; description paragraphs [0021]-[0062]; figures 1-7</td>
<td>1-20</td>
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<td>PX</td>
<td>CN 107830922 A (LINGDONG TECHNOLOGYBEIJING CO.LTD) 23 March 2018; description paragraphs [0057]-[01 10]; figure 1</td>
<td>1-4, 11, 13-17, 19</td>
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<td>PY</td>
<td>CN 107830922 A (LINGDONG TECHNOLOGYBEIJING CO.LTD) 23 March 2018; description paragraphs [0057]-[01 10]; figure 1</td>
<td>5-10, 12, 18, 20</td>
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<td>Y</td>
<td>US 2017220040 A1 (LONDON JUSTIN) 03 August 2017 (2017-08-03); description paragraphs [0013]-[0062]; figure 1</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

Date of the actual completion of the international search

27 November 2018

Date of mailing of the international search report

06 March 2019

Name and mailing address of the ISA/CN

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Telephone No. 5744
### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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