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Automatic notification system

Abstract

Aspects of the disclosure are directed to a notification system. In accordance with one aspect, the notification system, includes a housing configured to receive one or more content, wherein the housing includes a door; a sensing device to produce a sensed signal; a detection device coupled to the sensing device, the detection device configured to detect a transition state of the sensed signal wherein the transition state is based on receipt of the one or more content; and a tampering sensor configured to detect tampering of the housing.

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Background/Summary

CLAIM OF PRIORITY (1) This application is a divisional application of patent application Ser. No. 18/649,554, filed Apr. 29, 2024, titled “Automated Notification System” which is a continuation-in-part application of patent application Ser. No. 18/314,507 filed May 9, 2023, titled “Automated Mail Notification System”, now issued as U.S. Pat. No. 11,998,131, issued on Jun. 4, 2024, the entire contents of the prior application are incorporated herein by reference as if fully set forth below in its entirety and for all applicable purposes.

TECHNICAL FIELD

(1) This disclosure relates generally to the field of notification, and, in particular, to an automatic notification system.

BACKGROUND

(2) Delivery of mail to a user mailbox is a routine activity in contemporary life. However, notification of an actual delivery of mail to the user mailbox requires a user to physically examine the contents of the user mailbox by moving in proximity to the user mailbox and examining its contents, typically outside, without first knowing whether or not delivery has actually occurred. It would be advantageous for the user to be informed automatically of the receipt of mail in the user mailbox prior to physical movement to the location of the user mailbox.

SUMMARY

(3) The following presents a simplified summary of one or more aspects of the present disclosure, in order to provide a basic understanding of such aspects. This summary is not an extensive overview of all contemplated features of the disclosure, and is intended neither to identify key or critical elements of all aspects of the disclosure nor to delineate the scope of any or all aspects of the disclosure. Its sole purpose is to present some concepts of one or more aspects of the disclosure in a simplified form as a prelude to the more detailed description that is presented later.

(4) In one aspect, the disclosure provides an automatic mail notification system. Accordingly, a mail notification system, including an energy emitter device configured to emit energy; a sensing device coupled to the energy emitter device, the sensing device configured to receive the energy from the energy emitter device to produce a sensed signal; a detection device coupled to the sensing device, the detection device configured to detect a transition state of the sensed signal and configured to produce a digital message; and a housing configured to receive one or more mail, wherein the housing houses the energy emitter device, the sensing device, and the detection device.

(5) In one example, the mail notification system further includes a communication device coupled to the detection device, the communication device configured to convey the digital message from a source to a destination. In one example, the mail notification system further includes an energy source configured to provide electrical energy to one or more of the following: the energy emitter, the sensing device, the detection device and the communication device.

(6) In one example, the source is the housing. In one example, the destination is a receiving device. In one example, the destination is a destination section including a receiving device, a processing device and a notification device. In one example, the destination is a home or a business location of a user. In one example, the receiving device is configured to retrieve the digital message.

(7) In one example, the processing device is coupled to the receiving device and the processing device is configured to prepare a notification message based on the digital message. In one example, the notification device is coupled to the processing device and the notification device is configured to notify a user with the notification message, and wherein the notification message conveys a container state of the housing.

(8) Another aspect of the disclosure provides a method for implementing an automatic mail notification, the method including emitting energy from an energy emitter device; receiving the energy from the energy emitter device to produce a sensed signal; detecting a transition state of the sensed signal to produce a digital message; and conveying the digital message from a housing to a destination, wherein the housing is configured to receive one or more mail.

(9) In one example, the energy is an electromagnetic energy with one of the following: visible wavelengths, infrared wavelengths, microwave or radio wavelengths. In one example, the energy is an acoustic energy with one of the following: a sonic frequency band, an ultrasonic frequency band or an infrasonic frequency band. In one example, the energy is emitted by a light emitting diode (LED), an acoustic source, an ultrasonic source or an infrasonic source. In one example, the transition state includes a hysteresis logic.

(10) In one example, the method further includes encoding the digital message into a communication signal, wherein the communication signal is configured to convey the digital message to the destination. In one example, the method further includes transporting the communication signal over a wireless communication link, wherein the wireless communication link conforms with one of the following wireless protocols: Wi-Fi, Bluetooth, near field communication (NFC), Infrared Data Association (IrDA), long-term evolution (LTE), a 3rd Generation Partnership Project (3GPP) wireless protocol.
(11) In one example, the method further includes retrieving the digital message from the communication signal; and preparing a notification message based on the digital message, wherein the notification message conveys a container state of the housing.
(12) Another aspect of the disclosure provides an apparatus implementing an automatic mail notification, the apparatus including means for emitting energy from an energy emitter device; means for receiving the energy from the energy emitter device to produce a sensed signal; means for detecting a transition state of the sensed signal to produce a digital message; means for encoding the digital message into a communication signal; and means for conveying the digital message from a housing to a destination, wherein the housing is configured to receive one or more mail.
(13) In one example, the apparatus further includes means for retrieving the digital message from the communication signal; and means for preparing a notification message based on the digital message, wherein the notification message conveys a container state of the housing.
(14) Another aspect of the disclosure provides a container notification system, including: a housing configured to receive one or more content; a sensing device to produce a sensed signal; a detection device coupled to the sensing device, the detection device configured to detect a transition state of the sensed signal wherein the transition state is based on receipt of the one or more content; and a keep-alive component configured to transmit a diagnostic query and to receive a return health signal, and wherein the housing houses the sensing device, the detection device and the keep-alive component.
(15) In one example, the container further includes a plurality of responsive components, wherein one of the plurality of responsive components is configured to receive the diagnostic query. In one example, at least one of the plurality of responsive components is further configured to transmit the return health signal. In one example, the return health signal indicates whether the one of the plurality of responsive components is functioning appropriately. In one example, the detection device is further configured to generate a digital message based on the transition state.
(16) In one example, the container further includes a communication device coupled to the detection device, the communication device configured to convey the digital message from a source to a destination. In one example, the plurality of responsive components includes one or more of the following: the communication device; the detection device; the sensing device; an energy source; an energy emitter device; a sensor; a tampering sensor; a lock mechanism.
(17) Another aspect of the disclosure provides a container including: a housing configured to receive one or more content; a sensing device to produce a sensed signal; a detection device coupled to the sensing device, the detection device configured to detect a transition state of the sensed signal wherein the transition state is based on receipt of the one or more content based on a comparison of a sensed signal amplitude to a threshold level; and a first camera coupled to the housing, wherein the first camera includes a first sensor to sense motion and the first camera is configured to record activities when the motion is sensed.
(18) In one example, the first camera is mounted on an interior surface of the housing. In one example, the first camera is mounted on an exterior surface of the housing. In one example, the container further includes a second camera mounted on an interior surface of the housing, wherein the second camera includes a second sensor to sense motion inside the housing. In one example, the second camera is configured to record activities when the motion inside the housing is sensed.

(19) Another aspect of the disclosure provides a container including: a housing configured to receive one or more content, wherein the housing includes a door; a sensing device to produce a sensed signal; a detection device coupled to the sensing device, the detection device configured to detect a transition state of the sensed signal wherein the transition state is based on receipt of the one or more content; and a tampering sensor configured to detect tampering of the housing.
(20) In one example, the tampering sensor is coupled to the door. In one example, the door includes a lock mechanism. In one example, the tampering sensor is electronically coupled to the lock mechanism. In one example, the tampering sensor is configured to detect if the lock mechanism is being tampered with.
(21) In one example, the container further includes a processor and a transmitter, wherein the tampering sensor is electronically coupled to the processor and the transmitter. In one example, the container further includes an alternative lock on the door, an audio alarm coupled to the housing, an external camera coupled to the housing, and an internal camera coupled to an interior surface of the housing. In one example, the tampering sensor causes the processor and the transmitter to perform one or more of the following; send a message with an alert of tampering, activate an alternative lock on the door, turn ON the external camera, turn ON the internal camera, activate an audio alarm.
(22) Another aspect of the disclosure provides a container notification system, including: a sensing device to produce a sensed signal; a detection device coupled to the sensing device, the detection device configured to detect a transition state of the sensed signal wherein the transition state is based on receipt of one or more content; a keep-alive component configured to receive a self-initiated health signal based on a timetable, and the keep-alive component is further configured to transmit a health alert signal if the self-initiated health signal is not received based on the timetable and based on a quantity of missed self-initiated health signal, and a housing configured to receive the one or more content, and wherein the housing houses the sensing device, the detection device and the keep-alive component.
(23) These and other aspects of the present disclosure will become more fully understood upon a review of the detailed description, which follows. Other aspects, features, and implementations of the present disclosure will become apparent to those of ordinary skill in the art, upon reviewing the following description of specific, exemplary implementations of the present invention in conjunction with the accompanying figures. While features of the present invention may be discussed relative to certain implementations and figures below, all implementations of the present invention can include one or more of the advantageous features discussed herein. In other words, while one or more implementations may be discussed as having certain advantageous features, one or more of such features may also be used in accordance with the various implementations of the invention discussed herein. In similar fashion, while exemplary implementations may be discussed below as device, system, or method implementations it should be understood that such exemplary implementations can be implemented in various devices, systems, and methods.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** illustrates an example block diagram of an automatic mail notification system.
(2) FIG. **2** illustrates an example flow diagram for automatic mail notification.
(3) FIG. **3** illustrates an example of an automatic mailbox notification system.
(4) FIG. **4** illustrates an example of a conformal sensor assembly within a container with a plurality of sensor elements.
(5) FIG. **5** illustrates an example of a conformal sensor assembly within a container with a plurality of sensor elements and a reflective surface.

(6) FIG. **6** illustrates an example flow diagram for diagnostic investigations.
(7) FIG. **7** illustrates a first example configuration of electrical connections of the keep-alive component with a plurality of responsive components.
(8) FIG. **8** illustrates a second example configuration of electrical connections of the keep-alive component with a plurality of responsive components.

DETAILED DESCRIPTION

(9) The detailed description set forth below in connection with the appended drawings is intended as a description of various configurations and is not intended to represent the only configurations in which the concepts described herein may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of various concepts. However, it will be apparent to those skilled in the art that these concepts may be practiced without these specific details. In some instances, well known structures and components are shown in block diagram form in order to avoid obscuring such concepts.
(10) While for purposes of simplicity of explanation, the methodologies are shown and described as a series of acts, it is to be understood and appreciated that the methodologies are not limited by the order of acts, as some acts may, in accordance with one or more aspects, occur in different orders and/or concurrently with other acts from that shown and described herein. For example, those skilled in the art will understand and appreciate that a methodology could alternatively be represented as a series of interrelated states or events, such as in a state diagram. Moreover, not all illustrated acts may be required to implement a methodology in accordance with one or more aspects.
(11) FIG. **1** illustrates an example block diagram of an automatic mail notification system **100**. The example automatic mail notification system **100** includes a source section **101**, where sensing is performed and a notification is generated, and a destination section **102**, where the notification may be received. In one example, the source section **101** is a physical mailbox for receiving mail. In one example, mail is one or more letters and/or packages, for example, delivered by a postal carrier or a private delivery personnel. The source section **101** of the automatic mail notification system **100** may have a plurality of source devices such as an energy emitter device **110**, a sensing device **120**, a detection device **130**, a communication device **140** and an energy source **150**. The destination section **102** of the automatic mail notification system **100** may have a plurality of destination devices such as a receiving device **160**, a processing device **170** and a notification device **180**. One skilled in the art would understand that the example components disclosed herein for either the source section **101** or the destination section **102** are not exclusive and that other components may be included within the spirit and scope of the present disclosure. Additionally, in one example, not all the components disclosed herein for the source section **101** are mandatory. Similarly, in one example, not all the components disclosed herein for the destination section **102** are mandatory.
(12) In one example, the energy emitter device **110** may be a visible light source or an infrared light source. In one example, the energy emitter device **110** emits energy to a sensing device **120**. In one example, the energy is a sensing signal **115** which is sent to the sensing device **120**. For example, the energy emitter device **110** may be a light emitting diode (LED). In one example, the energy emitter device **110** may be an acoustic source. For example, the energy emitter device **110** may be an ultrasonic source (i.e., a source which produces high frequency inaudible sound waves).
(13) In one example, the sensing device **120** receives energy from the sensing signal **115** which is generated by the energy emitter device **110** and produces a sensed signal which depends on the energy level of the sensing signal **115**. In one example, the sensed signal is produced by converting the received energy received from the energy emitter device **110** into a sensed electrical signal. The sensed electrical signal, for example, may include a sensed signal amplitude. For example, the sensed signal amplitude is monotonically related to the received energy. That is, as the received energy increases, the sensed signal amplitude increases. That is, as the received energy decreases, the sensed signal amplitude decreases.

(14) In one example, the sensed signal changes amplitude state when the sensed signal amplitude transitions between two discrete states when an obstruction causes the energy level of the sensing signal to change by at least a minimum energy differential. For example, the minimum energy differential is equivalent to when the energy level of the sensing signal changes by an amplitude transition greater than a predefined amplitude threshold. That is, a changed sensed signal is a sensed signal from the sensing device **120** with an energy level change with an amplitude transition greater than the predefined amplitude threshold. In one example, the predefined amplitude threshold may be defined as greater than 50% change from a nominal amplitude level. One skilled in the art would understand that the percentage of change may be a value other than 50%. For example, the percentage of change may be set by a user and/or may be dependent one or more factors, such as the sensitivity of one or more component of the source section **101**.
(15) In one example, the sensing device **120** may be a light sensor. For example, the sensing device **120** may be sensitive to visible wavelengths (e.g., between 400 nm and 700 nm wavelengths) generated by the energy emitter device **110**. For example, the sensing device **120** may be sensitive to infrared wavelengths (e.g., greater than 700 nm wavelength) generated by the energy emitter device **110**. In one example, the light sensor is a photodetector. For example, the light sensor may be sensitive to visible wavelengths. For example, the light sensor may be sensitive to infrared (IR) wavelengths. In one example, the sensing device **120** may be an acoustic sensor for example, a sonic sensor, an ultrasonic sensor, etc. In one example, the sensing device **120** is matched to the energy emitter device **110**. That is, if the energy emitter device **110** generates electromagnetic energy within a spectral band, then the sensing device **120** is sensitive to electromagnetic energy in that spectral band. If the energy emitter device **110** generates acoustic energy within an acoustic frequency band, then the sensing device **120** is sensitive to acoustic energy within that acoustic frequency band.
(16) In one example, the sensing device **120** is vibration-tolerant. For example, a vibration-tolerant sensing device does not produce a changed sensed signal when a mechanical vibration occurs at the sensing device **120**.
(17) In one example, the sensing device **120** may be a photodiode. In one example, the photodiode is a light sensitive detector which absorbs incident photons and produces a photodiode electrical current which depends on the photon rate or input power level. In one example, the light sensitive detector may be sensitive to a spectral band (e.g., visible, ultraviolet, infrared, etc.). For example, the photon rate may be expressed in photons/see or in watts. For example, the electrical current may be expressed in amperes (A), milliamperes (mA), microamperes (μA), etc. In one example, the photodiode electrical current may be proportional to the photon rate or input power level. For example, a ratio of photodiode electrical current over input power level may be denoted as responsivity R in units of amperes per watt (A/W).
(18) In one example, the detection device **130** detects a transition state from the sensed signal from the sensing device **120** to produce a digital message. In one example, the detection device **130** compares the sensed signal from the sensing device **120** to a threshold level. For example, the detection device **130** compares the sensed signal amplitude to the threshold level. For example, the detection device **130** may be coupled to the sensing device **120** to determine whether or not the sensed signal (e.g., the sensed signal amplitude) has changed state and to indicate a transition state. In one example, the transition state may be represented by the digital message. The digital message may be generated by the detection device **130**. For example, the digital message may be a binary indication of whether the transition state indicates a change from an empty state to a non-empty state. For example, the transition state may be an indication of a change from an empty container to a non-empty container. For example, the container may be a user mailbox which is a repository for received mail. In one example, the container may be a locker and the container state is an indication of an empty locker or a non-empty locker in which the content may include mail, clothing, books, boxes, etc. In one example, the container may be a house or a dwelling and the

container state is an indication of an empty house or a non-empty house in which the container state may include whether or not a person or an animal has entered the house.

(19) In one example, the detection device **130** may include hysteresis logic. For example, hysteresis logic includes a logical dependence on its state history. That is, the detection of the transition state depends not only on the comparison of the sensed signal amplitude to the threshold level, but also on the state history of the sensed signal. For example, the state history may include a finite time duration of the sensed signal prior to a present time.

(20) In one example, the communication device **140** encodes the digital message from the detection device **130** into a communication signal **145** which conveys the digital message from a source to a destination. For example, the communication signal **145** may be transmitted from a user mailbox to a receiver in a home. For example, the communication signal **145** may be transported over a wireless communication link **146** which conforms with a wireless protocol. In another example, the communication signal **145** may be transported over a wired link (not shown).

(21) In one example, the wireless communication link **146** may be based on a short-range wireless system which conforms with a wireless protocol such as Wi-Fi, Bluetooth, near field communication (NFC), Infrared Data Association (IrDA), etc. or on a long-range wireless system which conforms with a wireless protocol such as, long-term evolution (LTE), a 3rd Generation Partnership Project (3GPP) wireless protocol (e.g., 5G, 6G, etc). For example, a short-range wireless system may be used for propagation distances much less than 100 m, i.e., within a home, small business, local environment, etc. For example, a long-range wireless system may be used for propagation distances much greater than 100 m, i.e., over a neighborhood, town, city, etc.

(22) In one example, a Wi-Fi system conforms with an IEEE 802.11 wireless protocol which uses microwave frequency bands (e.g., 2.4 GHz, 5 GHZ, etc.) to cover short ranges (e.g., <100 m propagation distance). For example, there are a plurality of Wi-Fi versions which use different modulation types and formats.

(23) In one example, a Bluetooth system conforms with a Bluetooth wireless protocol which uses microwave frequency bands (e.g., 2.4 GHz) to cover very short ranges (e.g., <10 m propagation distance).

(24) In one example, an IrDA system conforms with an IrDA wireless protocol which uses near-IR frequency bands (e.g., 300-400 THz) to cover very short ranges (e.g., <10 m propagation distance).

(25) In one example, the energy source **150** may be a battery (e.g., a chargeable battery or a non-chargeable battery), a solar cell, etc. For example, the energy source **150** may be used to provide electrical energy for the plurality of devices (e.g., one or more of: an energy emitter device **110**, a sensing device **120**, a detection device **130**, a communication device **140** and/or an energy source **150**) in the automatic mail notification system **100**.

(26) In one example, the receiving device **160** retrieves the digital message from the communication signal **145** using a receiver. In one example, the receiving device **160** is in a home or a business location. In one example, the receiving device **160** decodes the communication signal **145** to retrieve the digital message created by the detection device **130**.

(27) In one example, the processing device **170** accepts the retrieved digital message from the receiving device **160** and prepares a notification message to be presented to the user. In one example, the notification message may be a binary message which indicates a container state (e.g., user mailbox state). For example, the container state may indicate a change from an empty state to a non-empty state.

(28) In one example, the notification device **180** accepts the notification message from the processing device **170** and notifies the user of the container state. In one example, the user notification may be a visual display (e.g., graphical icons) which indicates the container state. In one example, the user notification may be a text message or an electronic mail (email) message sent to the user. In one example, the user notification may be an audio indication which indicates the container state.

(29) FIG. **2** illustrates an example flow diagram **200** for automatic mail notification. In block **210**, emit energy from an energy emitter device. That is, an energy emitter device emits energy. In one example, the energy may include a sensing signal. In one example, the—energy is electromagnetic energy. For example, the electromagnetic energy may include visible wavelengths. For example, the electromagnetic energy may include infrared wavelengths. For example, the electromagnetic energy may include microwave or radio wavelengths. In one example, the energy is acoustic energy. For example, the acoustic energy may include a sonic frequency band. For example, the acoustic energy may include an ultrasonic frequency band. For example, the acoustic energy may include an infrasonic frequency band. In one example, the energy may include a sensing signal. For example, the energy may be generated by a light emitting diode (LED). For example, the energy may be generated by an acoustic source. For example, the energy may be generated by an ultrasonic source. For example, the energy may be generated by an infrasonic source.
(30) In block **220**, receive the energy from the energy emitter device to produce a sensed signal using a sensing device. That is, a sensing device receives the energy from the energy emitter device to produce a sensed signal. In one example, the received energy is the sensing signal generated by the energy emitter device. In one example, the received energy is used to produce a sensed signal which depends on the energy level of the sensing signal. In one example, the sensing device is a light sensor. For example, the light sensor is a photodiode. In one example, the sensing device is an acoustic sensor. For example, the acoustic sensor is a sonic sensor, an ultrasonic sensor, an infrasonic sensor, etc.
(31) In block **230**, detect a transition state of the sensed signal using a detection device to produce a digital message. That is, a detection device detects a transition state of the sensed signal and produces a digital message. In one example, detecting the transition state determines whether or not the sensed signal has changed state. In one example, the transition state may be represented by the digital message. In one example, detecting a transition state from the sensed signal may include hysteresis logic. For example, hysteresis logic may detect the transition state in accordance with its state history. That is, the detection of the transition state depends not only on the comparison of the sensed signal amplitude to the threshold level, but also on the state history of the sensed signal.
(32) In block **240**, convey the digital message from a source to a destination using a communication device. That is, a communication device conveys the digital message from a source to a destination. In one example, the source is a transmitter. For example, the transmitter is within a container, e.g., a user mailbox or a mailbox for housing (e.g., receiving) one or more letters and/or packages. In one example, a physical mailbox is a housing for containing one or more devices of the source section **101** illustrated in FIG. **1**. In one example, the devices of the source section **101** include an energy emitter device **110**, a sensing device **120**, a detection device **130**, a communication device **140** and an energy source **150**. In one example, the destination is a receiving device. For example, the receiving device is within a home or a business location. In another example, the destination is the destination section **102** illustrated in FIG. **1**, wherein the destination section includes one or more of a receiving device **160**, a processing device **170** and a notification device **180**. In one example, the destination is a house or a business location of a user.
(33) In one example, the communication device encodes the digital message into a communication signal which conveys the digital message from a source to a destination. For example, the communication signal may be transported over a wireless communication link which conforms with a wireless protocol. In one example, the wireless communication link may be based on a short-range wireless system which conforms with a wireless protocol such as Wi-Fi, Bluetooth, near field communication (NFC), Infrared Data Association (IrDA), etc. or on a long-range wireless system which conforms with a wireless protocol such as LTE, 5G, 6G, etc. In another example, the communication signal may be transported directly from a source to a destination over a direct wired link.
(34) In block **250**, retrieve the digital message using a receiving device. That is, a receiving device

retrieves the digital message. In one example, retrieve the digital message from the communication signal using a receiving device. That is, a receiving device retrieves the digital message from a communication signal since the communication device encodes the digital message into the communication signal. In one example, the receiving device retrieves the digital message from the communication signal using a receiver. In one example, the receiving device is in a home (e.g., house) or a business location of a user. In one example, the receiving device decodes the communication signal to retrieve the digital message created by the detection device.

(35) In block **260**, prepare a notification message based on the digital message using a processing device. That is, a processing device prepares a notification message based on the digital message. In one example, accept the digital message from the receiving device. In one example, the notification message may be a binary message which indicates the container state (e.g., user mailbox state). For example, the notification message indicates whether there is or is not mail inside a user's mailbox. In one example, the mailbox is a housing for one or more of the devices (e.g., an energy emitter device **110**, a sensing device **120**, a detection device **130**, a communication device **140** and/or an energy source **150**) of the source section **101** in FIG. **1**. In one example, the mailbox is a physical mailbox.

(36) In block **270**, notify a user with the notification message which conveys the container state using a notification device. That is, a notification device notifies a user with a notification message which conveys the container state. In one example, a notification device accepts the notification message from the processing device. In one example, the user notification may be a visual display (e.g., graphical icons) which indicates the container state. In one example, the user notification may be a text message or an electronic mail (email) message sent to the user. In one example, the user notification may be an audio indication which indicates the container state.

(37) FIG. **3** illustrates an example of an automatic mailbox notification system **300**. In one example, a user mailbox **303** is a repository for mail delivered by a mail carrier. In an initial state, the user mailbox **303** is empty and the purpose of the automatic mailbox notification system is to notify a user of receipt of mail upon delivery. For example, the user may be notified of receipt of mail on a mobile device **302**, for example, a mobile phone. The user notification may be executed by a software application (e.g., an app) on the mobile device **302** as text message, email, graphical icon, audio indication, etc. In one example, the mobile device **302** is a destination section (e.g., destination section **102** shown in FIG. **1**) for the automatic mailbox notification system **300**.

(38) In one example, a source section **301** of the automatic mailbox notification system **300** may be retrofitted into an existing user mailbox where the source section **301** is added onto an already manufactured existing user mailbox. In one example, the source section **301** of the automatic mailbox notification system **300** may be integrated into an user mailbox where the source section **301** is manufactured along with the rest of the user mailbox. For example, the source section **301** may have a plurality of source devices such as an energy emitter device **310**, a sensing device **320**, a detection device **330**, a communication device **340** and an energy source **350**. For example, a communication signal between the communication device **340** and the mobile phone **320** may be transported over a wireless communication link **345** which conforms with a wireless protocol. One skilled in the art would understand that the example components disclosed herein for the source section **301** are not exclusive and that other components may be included within the spirit and scope of the present disclosure. Additionally, in one example, not all the components disclosed herein for the source section **301** are mandatory.

(39) In one example, the sensing device **320** may be a conformal sensor assembly. In one example, the conformal sensor assembly is a geometric arrangement of a plurality of sensor elements which conforms (i.e., follows) to a predefined shape. In one example, the conformal sensor assembly in a user mailbox may conform to a non-planar surface area by a congruent geometric shape.

(40) In one example, the automatic mailbox notification system **300** includes an external camera **360** mounted on an external surface of the user mailbox **303**. The external camera may be

configured to record when motion is detected, wherein the external camera incudes a motion detector (not shown). Once turned ON, the external camera may be programed to stay ON to record for a preset time period or the external camera may be programed to stay ON to record until motion is no longer detected. In another example, the external camera may be configured to record when turned ON by a user, either through a remote control via a wireless signal or manually by the user. In one example, once the external camera **360** is turned ON, it may be turned OFF either by the user or it may be turned OFF after a preset time period or until motion is no longer detected. In one example, the time duration the external camera **360** stays turned ON may be preset or it may be programmable.

(41) In one example, the automatic mailbox notification system **300** includes an internal camera **365** mounted on an internal surface of the user mailbox **303**. In one example, the internal camera **365** is coupled to a light **367**. In one example, the internal camera **365** includes a motion detector (not shown). The internal camera **365** may be triggered to turn ON in one or more of the following ways: turned ON manually by a user, turned ON by a user through a remote control via a wireless signal, turned ON with an opening motion of the user mailbox **303**, turned ON when there's motion within the user mailbox **303**, such as the deposit of a content (e.g., letter, package, etc.) to within the user mailbox **303**. In one example, the time duration that the internal camera **365** stays turned ON may be preset (i.e., a preset time period) or may be programmable. In one example, the internal camera **365** may stay turned ON as long as motion is detected by its motion detector.

(42) In one example, the light **367** is turned ON when the internal camera **365** is turned ON. In one example, the light **367** turns ON when motion is detected by the motion detector. In one example, the light **367** turns ON when motion is detected by the motion detector, even if the internal camera **365** is OFF. In one example, the light **367** may be turned ON manually. The time duration of the light **367** staying ON may be preset, pre-programmed or it may stay ON as long as the internal camera **365** is ON or as long as motion is detected. In one example, the light **367** may be preprogramed to stay ON for a quantity of time following a specified event, such as but not limited to: internal camera turning OFF, ceased of motion within the user mailbox **303**, closing of a door of the user mailbox **303**, etc. One skilled in the art would understand that other conditions (not specified herein) for keeping the light **367** ON or turning OFF the light **367** may be within the scope and spirit of the present disclosure.

(43) In one example, recording data captured by either the external camera **360** or the internal camera **365**, or both, may be stored for a time duration at a remote memory unit, for example, via Internet cloud storage. In another example, storage of camera information may be done by a memory unit coupled to the external camera **360** and/or internal camera **365**. In one example, the memory unit (not shown) may be a component of the user mailbox **303**.

(44) FIG. **4** illustrates an example of a conformal sensor assembly **400** within a container **401** (e.g., a user mailbox) with a plurality of sensor elements **420**. In one example, the plurality of sensor elements **420** may be light sensors (e.g., visible light sensor, infrared light sensor, etc.) such as photodetectors, photodiodes, etc. In one example, the plurality of sensor elements **420** receives energy directly from an energy emitter device **410**. In addition, the container **401** includes a detection device (e.g., detection device **130** of FIG. **1**), a communication device (e.g., communication device **140** of FIG. **1**), an energy source (e.g., an energy source **150** of FIG. **1**), etc.

(45) The container **401** includes a door **440**. In one example, one of the plurality of sensor elements is a tampering sensor **424** and is configured to detect tampering of the container **401**. In one example, the tampering sensor **424** is further configured to detect tampering of the door **440**. In one example, the container **401** is the user mailbox **303**. In one example, the tampering sensor **424** is coupled electronically to the door **440**, particularly to a lock mechanism **441** of the door **440**.

(46) In one example, the tampering sensor **424** is electronically coupled to a processor and a transmitter. In one example, the transmitter is a communication device (e.g., the communication device **140** of FIG. **1**). In the event the tampering sensor **424** senses that the lock mechanism **441** is

being tampered with, the tampering sensor **424** may cause the processor and the transmitter to perform one or more of the following: send a message with an alert of tampering, activate a second lock (not shown) on the door **440**, turn ON the external camera **360**, and/or turn ON the internal camera **365**, activate an alarm (not shown) with audio (i.e., audio alarm). In one example, the second lock is an alternative lock which has not been tampered with.

(47) In one example, the message with the alert of tampering may be sent to a preset designation, such as a mobile phone or computer of the user of the container **401**. In one example, the alarm with audio is a component coupled to the container **401**.

(48) In one example, the energy from the energy emitter device **410** is radiated directly towards the plurality of sensor elements **420**. For example, if the container **401** is empty (i.e., no mail has been delivered), the plurality of sensor elements **420** will receive an energy level greater than a predefined threshold. For example, if the container **401** is not empty (i.e., mail has been delivered), the plurality of sensor elements **420** will receive an energy level less than the predefined threshold. In one example, the container **401** is a housing.

(49) FIG. **5** illustrates an example of a conformal sensor assembly **500** within a container **501** (e.g., a user mailbox, a safe deposit box, a locker, etc.) with a plurality of sensor elements **520** and a reflective surface **521**. In one example, the plurality of sensor elements **520** may be light sensors (e.g., visible light sensor, infrared light sensor, etc.) such as photodetectors, photodiodes, etc. In one example, the plurality of sensor elements **520** receives energy indirectly from an energy emitter device **510** by receiving reflected energy off the reflective surface **521**. Although the reflective surface **521** is shown in FIG. **5** as lining the entire curved portion **530** of container **501**, one skilled in the art would understand that the reflective surface **521** may also line just portions of the curved portion **530** (i.e., not the entire curved portion **530**) of the container **501** within the spirit and scope of the present disclosure. In addition, the container **501** includes a detection device (e.g., detection device **130** of FIG. **1**), a communication device (e.g., communication device **140** of FIG. **1**), an energy source (e.g., an energy source **150** of FIG. **1**), etc. In one example, the container **501** is a housing.

(50) In one example, the energy from the energy emitter device **510** is radiated toward the reflective surface **521** which reflects the energy towards the plurality of sensor elements **520**. For example, if the container **501** is empty (i.e., no mail has been delivered), the plurality of sensor elements **520** will receive an energy level greater than a predefined threshold. For example, if the container **501** is not empty (i.e., mail has been delivered), the plurality of sensor elements **520** will receive an energy level less than the predefined threshold.

(51) In one example, the user mailbox **303** (of FIG. **3**), the container **401** (of FIG. **4**) or the container **501** (of FIG. **5**) includes a keep-alive function. In one example, the keep-alive function is provided by a keep-alive component. In one example, the keep-alive component is coupled to one or more of the sensors of the plurality of sensors **420**, **520** or to the sensing device **320**. The keep-alive component uses one or more sensors to monitor the various components of the user mailbox **303** or the containers **401**, **501**. For example, notification(s) may be sent, in any of the following: either of the external camera or the internal camera is not working, energy level is less than a predefined threshold, memory unit or cloud storage is full or nearing a threshold, the light **367** is not working, the energy emitter device **110**, **310**, **410**, **510** is malfunctioning, the communication device **340** is malfunctioning, any sensor that's malfunctioning, etc. In one example, the notification(s) is sent to a mobile device (e.g., mobile device **302**) or a computer of a user of the user mailbox **303** or the container **401**, **501**.

(52) In one example, the keep-alive component provides periodic diagnostic investigations of any responsive components of the user mailbox **303** or the container **401**, **501**. The periodic diagnostic investigations may be preprogrammed or may be operated manually. And, in one example, selective responsive components may be diagnosed. And, which responsive component is diagnosed and when may be preprogrammed. That is, the diagnostic investigations are

programmable, for example, by a user, using a processor within a mobile device (e.g., mobile device **302**) or a computer. In one example, each responsive component includes a capability to receive a diagnostic query and to respond to the diagnostic query with a return health signal.
(53) Examples of responsive components include communication device **340**; detection device **330**; sensing device **320**; energy source **350**; energy emitter device **310**, **410**, **510**; sensors **420**, **520**; tampering sensor **424**; lock mechanism **441**, etc. In one example, each sensor of the plurality of sensors **420**, **520** includes a communication receiver to receive diagnostic queries and a transmitter to transmit a return health signal.
(54) FIG. **6** illustrates an example flow diagram **600** for diagnostic investigations. In one example, the diagnostic investigations is performed by the keep-alive component. In block **610**, determine if it is time to transmit a set of diagnostic queries. In one example, the set of diagnostic queries is transmitted via hardwire. In one example, some of the set of diagnostic queries are transmitted wirelessly. In one example, the set has a quantity of one.
(55) In block **620**, determine a list of responsive components to be diagnosed. In one example, each responsive component includes a time schedule for diagnostic investigation which may be preset. In one example, the determination of whether an responsive component is diagnosed or not is based on a previous diagnosis of that responsive component. For example, if the previous diagnosis indicates that the responsive component may be near malfunctioning, the time schedule for a future diagnosis may be accelerated. In another example, if the previous diagnosis indicates that the responsive component is functioning near 100%, the next diagnosis may be skipped. Or, if a large quantity of previous diagnosis indicates that the responsive component is functioning near 100%, the next diagnosis may be skipped.
(56) In block **630**, transmit the set of diagnostic queries to the list of responsive components, wherein each of the list of responsive components receives one of the set of diagnostic queries.
(57) In block **640**, receive one or more return health signals from the list of responsive components. In one example, each return health signal includes a unique identification to indicate that it corresponds to a particular responsive component.
(58) In block **650**, determine if the one or more return health signals equals in quantity to the set of diagnostic queries. If yes, proceed to block **670**. If no, proceed to block **660**.
(59) In block **660**, analyze the one or more return health signals to determine which of the list of responsive components did not transmit a return health signal. Following block **660**, proceed to block **670**.
(60) In block **670**, analyze the one or more return health signals to determine which of the one or more return health signals indicates that its corresponding responsive component is not functioning appropriately.
(61) In block **680**, transmit a health alert signal to a user's communication device to indicate that an responsive component is not functioning appropriately. In one example, the user's communication device may be a mobile device or a computer. In one example, the health alert signal may be a text message or an email message, for example, to the user.
(62) In one example, each responsive component includes sending a self-initiated health signal to the keep-alive component without receiving a diagnostic query. In one example, each responsive component is programed with a timetable of when to send a self-initiated health signal. The timetable of each responsive component is also known to the keep-alive component, and when a responsive component fails to send its self-initiated health signal to the keep-alive component per its timetable, the keep-alive component will in turn send a health alert signal to a user's communication device to indicate that the responsive component, which did not send a self-initiated health signal, is not functioning appropriately. In one example, the user may program the keep-alive component to send the health alert signal only after more than one self-initiated health signal is missed from a particular responsive component, for example, the exact quantity of consecutively missed self-initiated health signals may be determined by the user or by what the

responsive component is. For example, for a responsive component whose function is only moderately critical to the functionality of the container, the exact quantity of consecutively missed self-initiated health signals may be set lower than if the responsive component's function is highly critical to the functionality of the container. In one example, the timetable of each responsive component may be programmable and may depend on the criticality of the responsive component's function.

(63) FIG. **7** illustrates a first example configuration **700** of electrical connections of the keep-alive component **705** with a plurality of responsive components **710**, **720**, **730**, **740**, **750**, **760**, **770**, **780**. The first example configuration **700** illustrates that the keep-alive component is electrically coupled to each responsive component via a databus **790**.

(64) FIG. **8** illustrates a second example configuration **800** of electrical connections of the keep-alive component **805** with a plurality of responsive components **810**, **820**, **830**, **840**, **850**, **860**, **870**, **880**. The second example configuration **800** illustrates that the keep-alive component **805** is serially (e.g., independently) coupled to each responsive component.

(65) In a first example, the keep-alive component is housed within the user mailbox **303** or containers **401**, **501**. Communication between the keep-alive component and the responsive components may be achieved either through a wired connection as illustrated in either the examples of FIG. **7** or FIG. **8**. Additionally, the keep-alive component may communicate wirelessly (e.g., via Bluetooth, WiFi, etc.) with the responsive components.

(66) In another example, the keep-alive component is physically separated from the user mailbox **303** or containers **401**, **501**. Wired connections between the keep-alive component and the responsive components may be achieved through either the examples of FIG. **7** or FIG. **8**. Or, the keep-alive component may communicate wirelessly (e.g., via Bluetooth, WiFi, etc.) with the responsive components.

(67) In one example, the user mailbox **303** (of FIG. **3**), the container **401** (of FIG. **4**) or the container **501** (of FIG. **5**) is a physical object that can be used to hold or transport something. In one example, a purpose of the user mailbox **303** or the containers **401**, **501** is for depositing one or more physical content. For example, the physical content may be letters, documents, packages, notebooks, clothes, shoes, jewelries, bags, briefcases, or any physical item that can fit within the container. For example, the user mailbox **303** or the containers **401**, **501** may be a safe deposit box or a locker. In one aspect, the various features disclosed for the user mailbox **303** may apply to the containers **401**, **501**. In one aspect, the various features disclosed for the container **401** may apply to the user mailbox **303** or the container **501**. In one aspect, the various features disclosed for the container **501** may apply to the user mailbox **303** or the container **401**.

(68) In one aspect, one or more of the steps for providing an automatic mail notification system in FIG. **2** may be executed by one or more processors which may include hardware, software, firmware, etc. The one or more processors, for example, may be used to execute software or firmware needed to perform the steps in the flow diagram of FIG. **2**. Software shall be construed broadly to mean instructions, instruction sets, code, code segments, program code, programs, subprograms, software modules, applications, software applications, software packages, routines, subroutines, objects, executables, threads of execution, procedures, functions, etc., whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise.

(69) The software may reside on a computer-readable medium. The computer-readable medium may be a non-transitory computer-readable medium. A non-transitory computer-readable medium includes, by way of example, a magnetic storage device (e.g., hard disk, floppy disk, magnetic strip), an optical disk (e.g., a compact disc (CD) or a digital versatile disc (DVD)), a smart card, a flash memory device (e.g., a card, a stick, or a key drive), a random access memory (RAM), a read only memory (ROM), a programmable ROM (PROM), an erasable PROM (EPROM), an electrically erasable PROM (EEPROM), a register, a removable disk, and any other suitable medium for storing software and/or instructions that may be accessed and read by a computer. The

computer-readable medium may also include, by way of example, a carrier wave, a transmission line, and any other suitable medium for transmitting software and/or instructions that may be accessed and read by a computer. The computer-readable medium may reside in a processing system, external to the processing system, or distributed across multiple entities including the processing system. The computer-readable medium may be embodied in a computer program product. By way of example, a computer program product may include a computer-readable medium in packaging materials. The computer-readable medium may include software or firmware. Those skilled in the art will recognize how best to implement the described functionality presented throughout this disclosure depending on the particular application and the overall design constraints imposed on the overall system.

(70) Any circuitry included in the processor(s) is merely provided as an example, and other means for carrying out the described functions may be included within various aspects of the present disclosure, including but not limited to the instructions stored in the computer-readable medium, or any other suitable apparatus or means described herein, and utilizing, for example, the processes and/or algorithms described herein in relation to the example flow diagram.

(71) Within the present disclosure, the word “exemplary” is used to mean “serving as an example, instance, or illustration.” Any implementation or aspect described herein as “exemplary” is not necessarily to be construed as preferred or advantageous over other aspects of the disclosure. Likewise, the term “aspects” does not require that all aspects of the disclosure include the discussed feature, advantage or mode of operation. The term “coupled” is used herein to refer to the direct or indirect coupling between two objects. For example, if object A physically touches object B, and object B touches object C, then objects A and C may still be considered coupled to one another-even if they do not directly physically touch each other. The terms “circuit” and “circuitry” are used broadly, and intended to include both hardware implementations of electrical devices and conductors that, when connected and configured, enable the performance of the functions described in the present disclosure, without limitation as to the type of electronic circuits, as well as software implementations of information and instructions that, when executed by a processor, enable the performance of the functions described in the present disclosure.

(72) One or more of the components, steps, features and/or functions illustrated in the figures may be rearranged and/or combined into a single component, step, feature or function or embodied in several components, steps, or functions. Additional elements, components, steps, and/or functions may also be added without departing from novel features disclosed herein. The apparatus, devices, and/or components illustrated in the figures may be configured to perform one or more of the methods, features, or steps described herein. The novel algorithms described herein may also be efficiently implemented in software and/or embedded in hardware.

(73) It is to be understood that the specific order or hierarchy of steps in the methods disclosed is an illustration of exemplary processes. Based upon design preferences, it is understood that the specific order or hierarchy of steps in the methods may be rearranged. The accompanying method claims present elements of the various steps in a sample order, and are not meant to be limited to the specific order or hierarchy presented unless specifically recited therein.

(74) The previous description is provided to enable any person skilled in the art to practice the various aspects described herein. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects. Thus, the claims are not intended to be limited to the aspects shown herein, but are to be accorded the full scope consistent with the language of the claims, wherein reference to an element in the singular is not intended to mean “one and only one” unless specifically so stated, but rather “one or more.” Unless specifically stated otherwise, the term “some” refers to one or more. A phrase referring to “at least one of” a list of items refers to any combination of those items, including single members. As an example, “at least one of: a, b, or c” is intended to cover: a; b; c; a and b; a and c; b and c; and a, b and c. All structural and functional equivalents to the elements of the

various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. No claim element is to be construed under the provisions of 35 U.S.C. § 112, sixth paragraph, unless the element is expressly recited using the phrase “means for” or, in the case of a method claim, the element is recited using the phrase “step for.”
(75) One skilled in the art would understand that various features of different embodiments may be combined or modified and still be within the spirit and scope of the present disclosure.

Claims

1. A container comprising: a housing configured to receive one or more content, wherein the housing includes a door; a light sensor configured to receive an energy directly from an energy emitter and to produce a sensed signal from the energy; a detection device coupled to the light sensor, the detection device configured to detect a transition state of the sensed signal wherein the transition state is based on receipt of the one or more content received by the housing; a tampering sensor configured to detect a tampering of the housing; and a processor coupled to the tampering sensor, the processor configured to activate a second lock mechanism in the event the tampering is detected; wherein the tampering sensor is coupled to the door; wherein the door includes a first lock mechanism, and wherein the tampering sensor is electronically coupled to the first lock mechanism; and wherein the tampering sensor is configured to detect if the first lock mechanism is being tampered with.
2. The container of claim 1, further comprising a transmitter, wherein the tampering sensor is electronically coupled to the processor and the transmitter.
3. The container of claim 2, further comprising an audio alarm coupled to the housing, an external camera coupled to the housing, and an internal camera coupled to an interior surface of the housing.
4. The container of claim 3, wherein the tampering sensor causes the processor and the transmitter to perform one or more of the following; send a message with an alert of tampering turn ON the external camera, turn ON the internal camera, activate an audio alarm.