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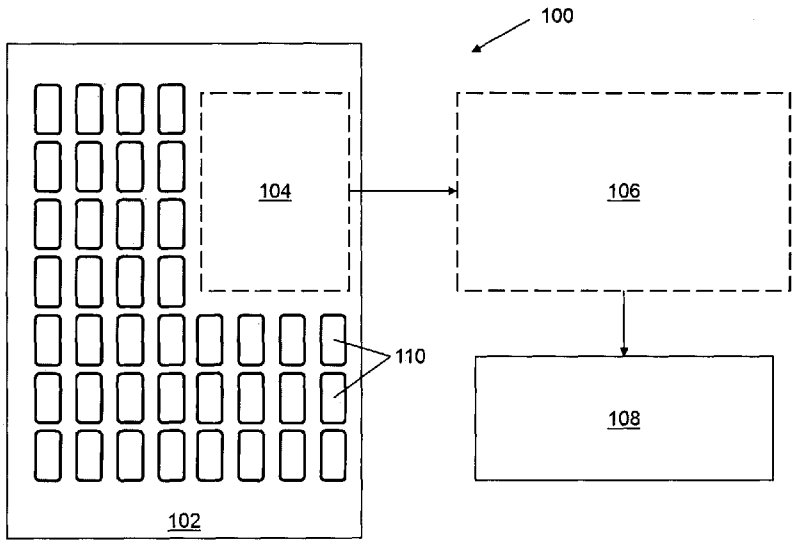

Figure 1

(57) Abstract: The present invention provides a system and apparatus for managing a product storage device. The system includes a product storage device, an on-board monitoring device connected to the product storage device, and an off-board processing device. The on-board monitoring device includes one or more monitoring modules to monitor one or more parameters associated with the product storage device. The one or more parameters include location, power outages, functioning characteristics of the product storage device, vibrations, type of the plurality of products, quantity of the plurality of products, and temperature of the product storage device. The off-board processing device determines whether the one or more parameters are within a desired range and communicates the one or more parameters to an entity when at least one of the one or more parameters is not within a desired range.

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SYSTEM AND APPARATUS FOR MANAGING PRODUCT STORAGE DEVICES

RELATED APPLICATION

Benefit is claimed to India Provisional Application No. 463/CHE/2012 titled "An Asset Monitoring and Tracking System" filed by Logica Private Limited on 07th February 2012, which is herein incorporated in its entirety by reference for all purposes.

FIELD OF THE INVENTION

The present invention generally relates to the field of electronics, and more specifically relates to a system and apparatus for managing product storage devices.

BACKGROUND OF THE INVENTION

It is known in the art that certain manufacturers provide users with assets such as refrigerators, coolers or any other storage device to store exclusively their products. It is noticed that users of the asset misplace products of a different manufacturer in the provided assets. Further, quantities of products that are to be placed in the asset are often exceeded. In the current system, an entity needs to personally monitor the parameters of the plurality of products contained in the asset. The entity can be any person or a user interested in monitoring the assets. For example, quantities of the plurality of products, type of products among the plurality of products etc. are some of the parameters that the entity can monitor using the system.

Certain known technologies used for monitoring an asset are Radio Frequency Identification (RFID) technologies, Barcode, Quick Response (QR) codes, wireless scanners, etc. However, the currently known technologies did not

provides results on real time basis such as type of products present in the asset, location, health condition of the asset etc. to the entity interested in tracking and monitoring the asset.

Further, it is known from experience that users tend to move or relocate the asset without the knowledge of the manufacturers who sponsor the asset for storing exclusively products of their brand. In such cases, it is also vital to know whether an intended user has moved the asset or it is a theft.

Furthermore, users or a service provider often fail to recognize the failure or breakdown of certain critical components in the assets (e.g. compressor in case of the asset being the refrigerator). There is a requirement of systems including devices that are required for monitoring operating conditions of the asset. Operating conditions of the asset include various parameters such as voltage, power outage monitoring, power consumption of components, usage level of the asset and so on.

SUMMARY OF THE INVENTION

The present invention provides a system and apparatus for managing product storage devices. In one aspect, a system includes a product storage device having a plurality of products, and an on-board monitoring device connected to the product storage device and configured to monitor one or more parameters associated with the product storage device. The one or more parameters include at least one of location, power outage, functioning characteristics of the product storage device, vibrations, type of the plurality of products, quantity of the plurality of products, and temperature of the product storage device. The system also includes an off-board processing device connected to the on-board monitoring device and configured to determine whether the one or more parameters are within a desired range and to communicate the one or more parameters to the entity when at least one of the one or more parameters is not within the desired range.

In another aspect, a method of monitoring a product storage device includes collecting one or more parameters associated with the product storage device using an on-board monitoring device, where the one or more parameters include at least one of location, power outages, attempt to tamper the product storage device, functioning characteristics of the product storage device, vibrations, type and quantity of plurality of products stored in the product storage device, and temperature of the product storage device. The method further includes processing the one or more parameters as received from the on-board monitoring device at an off-board processing device, and communicating the one or more parameters to an entity when at least one of the one or more parameters is not within a desired range.

In yet another aspect, a system includes an on-board monitoring device connected to a product storage device. The on-board monitoring device is configured to monitor one or more parameters associated with the product storage device, wher e the one or more parameters include at least one of location, power outage, attempt to tamper the product storage device, functioning characteristics of the product storage device, vibrations, type of the plurality of products, quantity of the plurality of products, and temperature of the product storage device. The system further includes an off-board processing device connected to the on-board monitoring device, where the off-board processing device is configured to communicate the one or more parameters to the entity when at least one of the one or more parameters received from the on¬board device is not within a desired range. Furthermore, the system includes one or more interfaces connected to the off-board device, where the one or more interfaces are configured to facilitate communication to the entity.

In further another aspect, an apparatus includes an on-board monitoring device connected to a product storage device storing a plurality of products and configured to monitor one or more parameters. The on-board monitoring device includes an image capturing module configured to capture images of the plurality of products in the product storage device to determine the type and the quantity of the plurality of products present in the product storage device, a location determining module configured to determine location of the product storage

device, and a current sensing module configured to monitor one of the functioning characteristics, and magnitude of current consumed by the product storage device. The on-board monitoring device also includes a usage monitoring module configured to monitor usage of the product storage device and a data transfer module configured to transfer the one or more parameters from the on-board monitoring device to an off-board processing device.

Other features of the embodiments will be apparent from the accompanying drawings and from the detailed description that follows.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Figure 1 illustrates a block diagram of a system for managing a product storage device, in accordance with an embodiment;

Figure 2 illustrates various components of an on-board monitoring device such as those shown in **Figure 1,** in accordance with an embodiment;

Figure 3 illustrates various components of an off-board processing device, in accordance with an embodiment; and

Figure 4 is a process flowchart illustrating an exemplary method of monitoring a product storage device, in accordance with an embodiment.

The drawings described herein are for illustration purposes only and are not intended to limit the scope of the present disclosure in any way.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a system and apparatus for managing product storage devices. In the following detailed description of the embodiments of the invention disclosure, reference is made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration specific embodiments in which the invention may be practiced. These embodiments are

described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that changes may be made without departing from the scope of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

Figure 1 illustrates a block diagram of a system 100 for managing product storage device, in accordance with an embodiment. The system 100 includes a product storage device 102, an on-board monitoring device 104, an off-board processing device 106, and a user interface 108.

The product storage device 102 may be a cooling device such as refrigerator and the like capable of storing a plurality of products 110. Further, the term 'the product storage device 102' can encompass a container, an electronic equipment, a shelf, a rack, and the like that can be used to store articles or objects. The on-board monitoring device 104 is connected to the product storage device 102. In one exemplary implementation, the on-board monitoring device 104 may be deployed in the product storage device 102. The on-board monitoring device 104 is configured to monitor one or more parameters associated with the product storage device 102. In an embodiment, the one or more parameters include location, functioning characteristics of the product storage device 102, vibrations, type of the plurality of products 110, quantity of the plurality of products 110, and temperature of the product storage device 102. The on-board monitoring device 104 is wirelessly connected to the off-board processing device 106. In an embodiment, the off-board processing device and the on-board monitoring device are connected through a wireless means such as the Internet, Wi-Fi or the like. The on-board monitoring device 104 transfers the monitored one or more parameters to the off-board processing device 106 via the wireless means. The off-board processing device 106 is configured to determine whether the one or more parameters are within a desired range and communicate the one or more parameters to the entity through the user interface 108. The user interface 108 assists the entity in viewing the one or more

parameters monitored by the on-board monitoring device 104. In an embodiment, the user interface 108 is a web interface that can be accessed by the entity.

Figure 2 illustrates various components of the on-board monitoring device 104, in accordance with an embodiment. The on-board monitoring device 104 includes monitoring modules 202, a control device 204, a power control module 206, a data transfer module 208, a memory unit 210, an on-board energy storage device 212, and a time and date recording device 214.

The on-board monitoring device 104 connected to the product storage device 102 is configured to monitor the one or more parameters associated with the product storage device 102. The monitoring modules 202 is a combination of one or more modules, each of the monitoring modules 202 assist in monitoring the at least one of the one or more parameters.

The monitoring modules 202 includes an image capturing module 216, a current sensing module 218, a location determining module 220, a usage monitoring module 222, a vibration sensing module 224, a temperature sensing module 226, and an anti-tampering module 228. The control device 204 is configured to collect the one or more parameters from the monitoring modules 202 and the power control module 206. In an embodiment, the control device 204 includes a microcontroller. The power control module 206 is connected to the control device 204 and is configured to control the power supplied to the product storage device 102. In an exemplary embodiment, the power control module 206 includes a relay unit (not shown in the figure). The relay unit is configured to assist in monitoring power outages associated with the product storage device 102. The power control module 206 is further configured to provide signals to the control device 204 indicating whether power supply is provided to the product storage device 102 or not.

The image capturing module 216 is configured to capture images of the product storage device 102. In an embodiment, the images are used to determine type of

the plurality of products 110, and quantity of the plurality of products 110. For example, the images captured by the image capturing module 216 may include a plurality of edges. By using an edge detecting algorithm and based on the plurality of edges, the type and quantity of the plurality of products 110 can be determined. The image capturing module 216 transfers the captured images to the control device 204. In an embodiment, the image capturing module 216 includes an electro-optical device such as a camera.

The current sensing module 218 is configured to detect magnitude of current or power consumed by the product storage device 102. In an embodiment, the current sensing module 218 includes a Hall Effect sensor. The current sensing module 218 is deployed in between the power control module 206 and the product storage device 102 for continuously determining real time power or current consumption by the product storage device 102.

The location determining module 220 is configured to determine the location of the product storage device 102. The location determining module 220 transfers location information associated with the product storage device 102 to the control device 204. In an embodiment, the location determining module 220 includes a Global Positioning System (GPS).

The usage monitoring module 222 connected to the control device 204 is configured to monitor usage of the product storage device 102. In an embodiment, the usage monitoring module 222 monitors the usage of the product storage device 102 through determining number of times the door of the product storage device 102 is opened and closed. In an embodiment, the usage monitoring module 222 includes a magnetic switch (not shown in the figure) attached to a door (not shown in the figure) of the product storage device 102. When the door of the product storage device 102 is opened or closed, the magnetic switch is activated or deactivated. Thus, the magnetic switch assists in monitoring number of times the door of the product storage device 102 is opened and closed. The usage monitoring module 222 transfers data to the control device 204.

The vibration sensing module 224 is connected to the control device 204. The vibration sensing module 224 is configured to detect vibrations associated with the product storage device 102. In an embodiment, the vibrations detected using the vibration sensing module 224 is used to identify movement or relocation of the product storage device 102. For instance, vibrations detected at the product storage device 102 beyond a threshold time limit may imply a relocation of the product storage device 102. Further, the vibration sensing module 224 transfers the detected vibrations to the control device 204.

The temperature sensing module 226 is connected to the control device 204. The temperature sensing module 226 is configured to detect temperature of the product storage device 102. In an embodiment, the temperature sensing module 226 detects temperature of the product storage device 102 (both internal and proximal temperature). Further, the temperature sensing module 226 transfers the measured temperature to the control device 204.

The anti-tampering module 228 is connected to the control device 204. The anti-tampering module 228 is configured to determine whether any attempt is made to tamper the on-board monitoring device 104. For example, when at least one module of the monitoring modules 202 is non-functional, disconnected or fails to measure at least one of the one or more parameters, a signal is produced by the anti-tampering module 228 and transferred to the control device 204.

The control device 204 is further connected to the memory unit 210 and the time and date recording device 214. The memory unit 210 is configured to store the one or more parameters received and collected by the control device 204. The time and date recording device 214 is configured to assist in recording time and date associated with the one or more parameters.

Further, the on-board monitoring device 104 includes the on-board energy storage device 212 connected to the monitoring modules 202, the control device 204, the data transfer module 208 and the memory unit 210. The on-board

energy storage device 212 is configured to provide required energy to the connected components of the on-board monitoring device 104.

The data transfer module 208 is connected to the control device 204. The data transfer module 208 is configured to transfer data received from the control device 204 to the off-board processing device 106. In an embodiment, the data transfer module 208 includes a General Packet Radio Service (GPRS) module (not shown in the figure).

Figure 3 illustrates various components of the off-board processing device 106, in accordance with an embodiment. The off-board processing device 106 receives data from the on-board monitoring device 104, more specifically from the data transfer module 208. In an embodiment, the off-board processing device 106 includes a data recognizing module 302 configured to recognize the one or more parameters received from the on-board monitoring device 104, and a processing module 304 connected to the data recognizing module 302. The processing module 304 is configured to process the one or more parameters and communicate one or more outputs to the entity. The data recognizing module 302 includes a data collating module 308 configured to receive and collate data from the on-board monitoring device 104, an image processing module 310 connected to the data collating module 308, and a pattern recognizing module 312 connected to the processing module 304 and the data collating module 308. The image processing module 310 is configured to process the one or more parameters when at least one of the one or more parameters is an image. The pattern recognizing module 312 is configured to compare the one or more parameters received from the data collating module 308 with the existing one or more parameters in a database 314. In an embodiment, the database 314 includes previously recognized and stored one or more parameters.

In an embodiment, the off-board processing device 106 is configured to determine whether the one or more parameters received from the on-board monitoring device 104 is within a desired range or not. It should be noted that each of the one or more parameters have a respective desired range. For

instance, when the at least one of the one or more parameters received by the off-board processing device 106 is an image associated with the product storage device 102, the image is processed by the image processing module 310 and transferred to the pattern recognizing module 312. Accordingly, the pattern recognizing module 312 determines the quantity and type of the plurality of products 110 by comparing images captured by the image capturing module 216 with existing images stored in the database 314. More specifically, edges present in the received images are compared with the edges present in the existing images stored in the database 314 by using an edge detecting algorithm. This would provide information on some of the one or more parameters including the quantity and type of the plurality of products 110. Consequently, when quantity and type of products are out of the desired range, the entity is informed with the one or more outputs.

For instance, when the one or more parameters received by the off-board processing device 106 is magnitude of current as detected by the current sensing module 208, the current magnitude is compared with the desired range. The pattern recognizing module 312 determines whether the current magnitude is within the desired range and communicates to the processing module 304. On determining the current magnitude to be not within the desired range, the processing module 304 communicates to the entity through the user interface 108. For example, the product storage device 102 can be a refrigerator or any other cooling device and typically consumes a power of approximately 2200 W or 10 ampere current. When the current sensing module 208 detects the current well below the desired range (e.g., approximately 500W or 2 ampere), it may denote that one of the components of the refrigerator or any cooling device is not functioning properly, thereby assisting in monitoring health condition of the components of the product storage device 102.

In another instance, the one or more parameters received by the off-board processing device 106 may be location related data of the product storage device 102. The location related data is monitored by the location determining module 220. The pattern recognizing module 312 present in the data recognizing

module 302 compares the data received from the on-board processing device 104 with previously stored data in the database 314. Thereafter, the pattern recognizing module 312 communicates the same with the processing module 304. On determining the location of the product storage device 102 to be not within the desired range, the processing module 304 communicates the location related data to the entity through the user interface 108.

In yet another instance, the one or more parameters received by the off-board processing device 106 may be related to usage of the product storage device 102. The usage of the product storage device 102 may imply number of times the door (not shown in the figure) is opened or closed (operated). The usage related information of the product storage device 102 is monitored by the usage monitoring module 222. In an embodiment, the usage monitoring module 222 may comprise at least one magnetic switch, the at least one magnetic switch gets activated upon detecting continuous movement of the door of the product storage device 102. In an exemplary embodiment, the number of times the door opened or closed (operated) is compared with the quantity of the plurality of products 110. In another exemplary embodiment, the pattern recognizing module 312 computes the difference between the number of times the door operated and the quantity of the plurality of products 110. The pattern recognizing module 312 communicates to the processing module 304. When the difference exceeds the desired range, the entity is informed through the user interface 108.

As an example in accordance with the present disclosure, the one or more parameters received by the off-board processing device 106 may be vibrations experienced by the product storage device 102. The off-board processing device 106 the one or more parameters related to vibrations is detected by the vibration sensing module 224. The pattern recognizing module 312 determines whether the vibrations detected by the vibration sensing module 224 are within the desired range by comparing the detected vibrations with previously recorded information present in the database 314. For example, the pattern recognizing module 312 records information related to time or period of existence of vibrations in the product storage device 102. When the detected vibrations last

or exist more than a threshold time which is stored as the desired range, it is determined that the product storage device 102 is being relocated or transported or moved. When the vibrations exceed the desired range, the processing module 304 communicates to the entity through the user interface 108.

As another example in accordance with the present disclosure, when the one or more parameters received by the off-board processing device 106 is temperature as recorded by the temperature sensing module 226, the pattern recognizing module 312 determines if the internal and proximal temperature of the product storage device 102 is within the desired range. The temperature received is compared with previously stored data in the database 314 and communicated to the processing module 304. When the temperature is not within the desired range, the entity is communicated of the temperature being not within the desired range. For example, the communication is facilitated through the user interface 108.

As yet another example, the one or more parameters received by the off-board processing device 106 may be related to attempts made to tamper the on-board monitoring device 104. The anti-tampering module 228 is configured to monitor if any attempt is made to tamper the on-board monitoring device 104. For example, when at least one module of the monitoring modules 202 are out of functioning or disconnected or fail to produce at least one of the one or more parameters, the signal is produced by the anti-tampering module 228 that the at least one of the monitoring modules 202 is out of communication with the product storage device 102. Thereafter, a status of functioning is detected for all the modules of the monitoring modules 202. When all the modules are out of communication with the products storage device 102, it is determined that a tampering attempt is made. The off-board processing device 106 receives the signal. For example, the pattern recognizing module 312 verifies the signal and transfers to the processing module 304. The processing module 304 communicates to the entity through the user interface 108.

The off-board processing device 106 also includes an alert generating module 306 connected to the processing module 304 and configured to send an alert to the entity on receiving the one or more outputs from the processing module 304. The one or more outputs can be sent to the entity through the user interface 108. In accordance with an embodiment, the entity may have a means to connect with the on-board monitoring device 104, where the entity may be enabled to provide at least one instruction to the on-board monitoring device 104. For example, the at least one instruction may be to disconnect power supply to the product storage device 102 based on the alert using the power control module 206. For another example, the entity may be allowed to control the power supply to the product storage device 102 based on the alert.

Figure 4 is a process flowchart illustrating an exemplary method 400 of managing a product storage device, in accordance with an embodiment. The method 400 starts at the step 402. At 404, the one or more parameters associated with the product storage device 102 (refer to **Figure 1)** are monitored using the monitoring modules 202 and the power control module 206. The one or more parameters include at least one of location, power outages, attempt to tamper the product storage device, functioning characteristics of the product storage device, vibrations, type and quantity of plurality of products present in the product storage device, and temperature of the product storage device. At step 406, the one or more parameters are collected at the on-board processing device 104. At 408, the one or more parameters are processed at the off-board processing device 106 using the data recognizing module 302 and the processing module 304 (refer to FIGURE 3). At step 410, it is determined whether the one or more parameters associated with the product storage device 102 are within the desired range. When the one or more parameters are not within the desired range, the entity is notified of the status of the one or more parameters.

The invention disclosure with various embodiments is explained by using product storage devices to be primary application area. It should be noted that the product storage devices are used throughout the invention for the convenience

of better understanding on usage. However, the invention can be used in variety of appliances, electronic equipment, and the like.

The present embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the various embodiments. Furthermore, the various devices, modules, and the like described herein may be enabled and operated using hardware circuitry, for example, complementary metal oxide semiconductor based logic circuitry, firmware, software and/or any combination of hardware, firmware, and/or software embodied in a machine readable medium. For example, the various electrical structure and methods may be embodied using transistors, logic gates, and electrical circuits, such as application specific integrated circuit.

We Claim:

1. A system comprising:

a product storage device comprising a plurality of products;

an on-board monitoring device connected to the product storage device and configured to monitor one or more parameters associated with the product storage device, wherein the one or more parameters include at least one of location, power outages, attempt to tamper the product storage device, functioning characteristics of the product storage device, vibrations, type of the plurality of products, quantity of the plurality of products, and temperature of the product storage device; and

an off-board processing device connected to the on-board monitoring device and configured to determine whether the one or more parameters is within a desired range and to communicate the one or more parameters to an entity when at least one of the one or more parameters is not within the desired range.

2. The system as recited in claim 1, wherein the on-board monitoring device comprises:

an image capturing module configured to capture images of the plurality of products in the product storage device to determine the type and the quantity of the plurality of products present in the product storage device;

a vibration sensing module configured to detect vibrations occurring in the product storage device;

a location determining module configured to determine location of the product storage device;

a temperature determining module configured to determine temperature of the product storage device; and

an anti-tampering module configured to determine an attempt made to tamper the on-board monitoring device.

3. The system as recited in claim 2, wherein the image capturing module comprises an electro-optical device to capture the images.

4. The system as recited in claim 2, wherein the location determining module comprises a Global Positioning System.

5. The system as recited in claim 2, wherein the on-board monitoring device further comprises:

a current sensing module configured to monitor one of the functioning characteristics, magnitude of current consumed by the product storage device; and

a usage monitoring module configured to monitor usage of the product storage device.

6. The system as recited in claim 6, wherein the current sensing module comprises a Hall Effect sensor.

7. The system as recited in claim 6, wherein the usage monitoring module comprises a magnetic switch attached to a door of the product storage device, wherein the magnetic switch is configured to detect opening and closing of the product storage device.

8. The system as recited in claim 1, wherein the on-board monitoring device further comprises a power control module configured to control the power supplied to the product storage device and to monitor power outage experienced by the product storage device.

9. The system as recited in claim 9, wherein the power control module comprises at least one relay unit.

10. The system as recited in claim 1, wherein the on-board monitoring device further comprises:

a control device configured to collect the one or more parameters associated with the product storage device;

a time and date recording device connected to the control device and configured to assist in recording time and date associated with the one or more parameters; and

a memory unit connected to the control device and configured to store the one or more parameters collected by the control device.

11. The system as recited in claim 1, wherein the on-board monitoring device further comprises a data transfer module configured to transfer data from the on-board monitoring device to the off-board processing device.

12. The system as recited in claim 1, wherein the off-board processing device comprises:

a data recognizing module configured to recognize the one or more parameters received from the on-board monitoring device; and

a processing module connected to the data recognizing module, wherein the processing module is configured to process the one or more parameters and to communicate one or more outputs to the entity.

13. The system as recited in claim 13, wherein the data recognizing module comprises:

a data collating module configured to receive and collate data from the on-board monitoring device;

an image processing module connected to the data collating module and configured to process the one or more parameters when at least one of the one or more parameters is an image; and

a pattern recognizing module connected to the processing module and the data collating module, wherein the pattern recognizing module is configured to compare the one or more parameters received from the data collating module with the desired range stored in a database.

14. The system as recited in claim 13, wherein the off-board processing device further comprises an alert generating module connected to the processing

module, wherein the alert generating module is configured to send an alert to the entity on receiving the one or more outputs from the processing module.

15. A method for monitoring a product storage device comprising:

collecting one or more parameters associated with the product storage device using an on-board monitoring device, wherein the one or more parameters include at least one of location, power outages, attempt to tamper the product storage device, functioning characteristics of the product storage device, vibrations, type and quantity of plurality of products present in the product storage device, and temperature of the product storage device;

processing the one or more parameters as received from the on-board monitoring device at an off-board processing device; and

communicating to an entity, when at least one of the one or more parameters is not within a desired range.

16. The method in accordance with claim 16, wherein collecting the one or more parameters comprises monitoring the one or more parameters associated with the product storage device using one or more monitoring modules.

17. A system for managing a product storage device by an entity, the system comprising:

an on-board monitoring device connected to the product storage device, the on-board monitoring device is configured to monitor one or more parameters associated with the product storage device, the one or more parameters include at least one of location, power outages, attempt to tamper the product storage device, functioning characteristics of the product storage device, vibrations, type of the plurality of products, quantity of the plurality of products, and temperature of the product storage device;

an off-board processing device connected to the on-board monitoring device, wherein the off-board processing device is configured to communicate to the entity when the one or more parameters received from the on-board device is not in a desired range; and

one or more interfaces connected to the off-board device, the one or more interfaces configured to facilitate communication to the entity.

18. The system as recited in claim 1, wherein the on-board monitoring device comprise one or more modules to assist in monitoring the one or more parameters, the one or more modules includes:

an image capturing module configured to capture images of the plurality of products in the product storage device to determine the type and the quantity of the plurality of products present in the product storage device;

a vibration sensing module configured to detect vibrations occurring in the product storage device;

a location determining module configured to determine location of the product storage device;

a temperature determining module configured to determine temperature of the product storage device;

an anti-tampering module configured to determine an attempt made to tamper the on-board monitoring device;

a current sensing module configured to monitor one of the functioning characteristics, magnitude of current consumed by the product storage device;

a usage monitoring module configured to monitor usage of the product storage device;

a power control module configured to control the power supplied to the product storage device and to monitor power outage experienced by the product storage device;

a control device configured to collect the one or more parameters associated with the product storage device;

a time and date recording device connected to the control device and configured to assist in recording time and date associated with the one or more parameters;

a memory unit connected to the control device and configured to store the one or more parameters collected by the control device; and

a data transfer module configured to transfer data from the on-board monitoring device to the off-board processing device.

19. An apparatus comprising:

an image capturing module configured to capture images of a plurality of products in a product storage device to determine the type and the quantity of the plurality of products present in the product storage device;

a location determining module configured to determine location of the product storage device;

a current sensing module configured to monitor one of functioning characteristics, and magnitude of current consumed by the product storage device;

a usage monitoring module configured to monitor usage of the product storage device; and

a vibration sensing module configured to detect vibrations occurring in the product storage device;

a temperature determining module configured to determine temperature of the product storage device;

an anti-tampering module configured to determine an attempt made to tamper the on-board monitoring device; and

a data transfer module configured to transfer the one or more parameters from the on-board monitoring device.

20. The apparatus as recited in claim 1, wherein the on-board monitoring device further comprises:

a power control module configured to control the power supplied to the product storage device and to monitor power outage experienced by the product storage device;

a control device configured to collect the one or more parameters associated with the product storage device;

a time and date recording device connected to the control device and configured to assist in recording time and date associated with the one or more parameters; and

a memory unit connected to the control device and configured to store the one or more parameters collected by the control device.

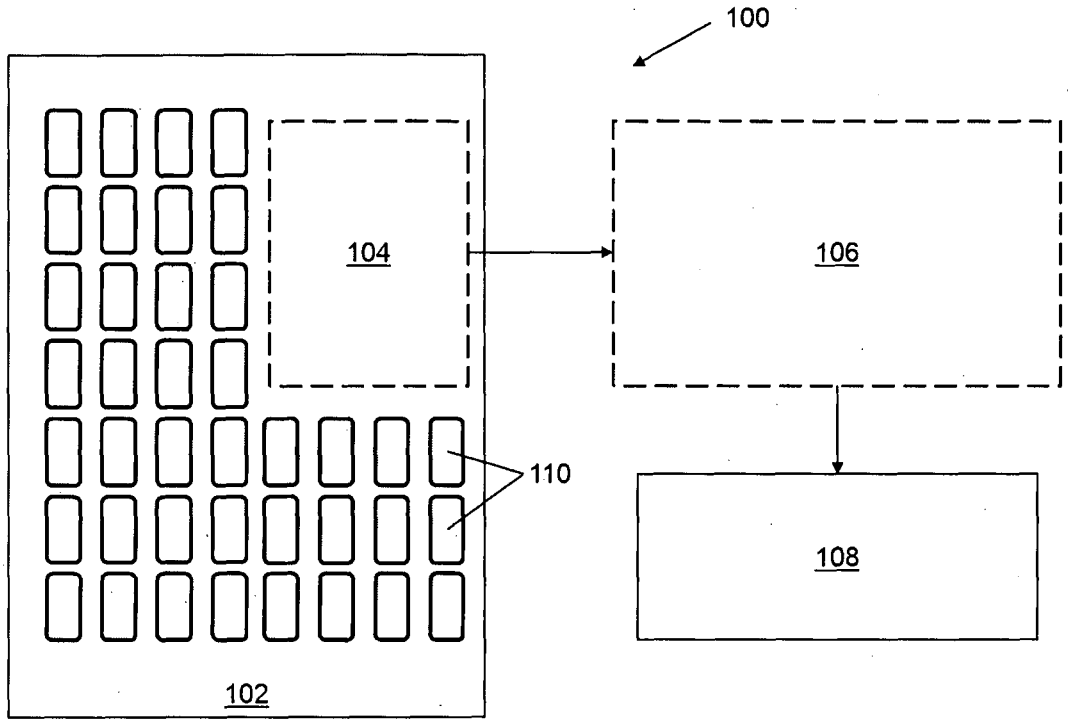

Figure 1

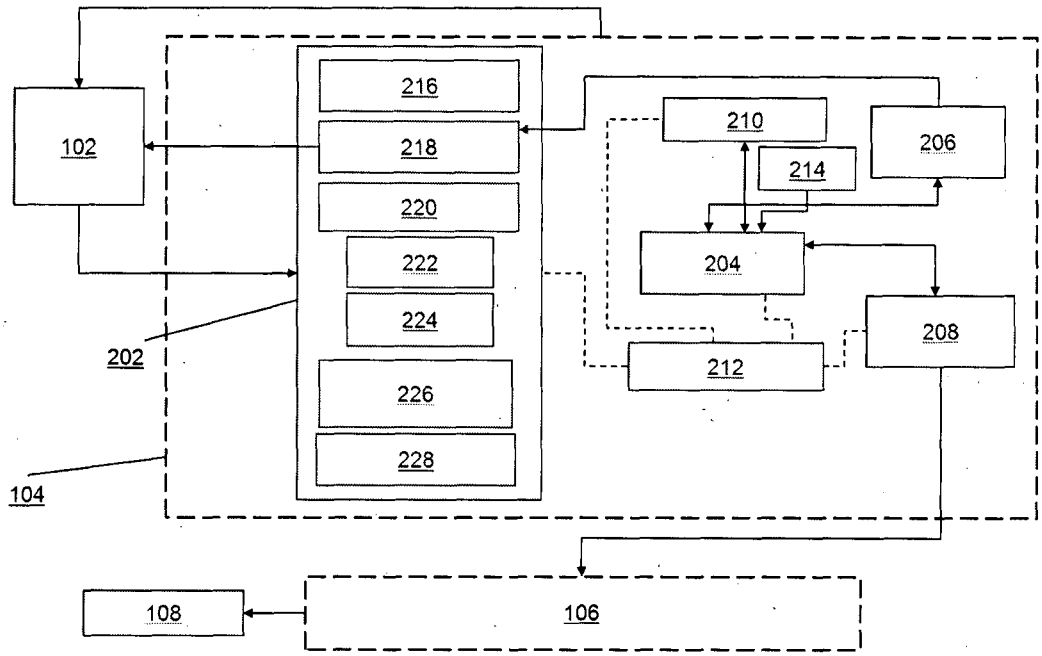
102
216
218
220
222
224
226
228
202
104
210
214
206
204
208
212
108
106

Figure 2

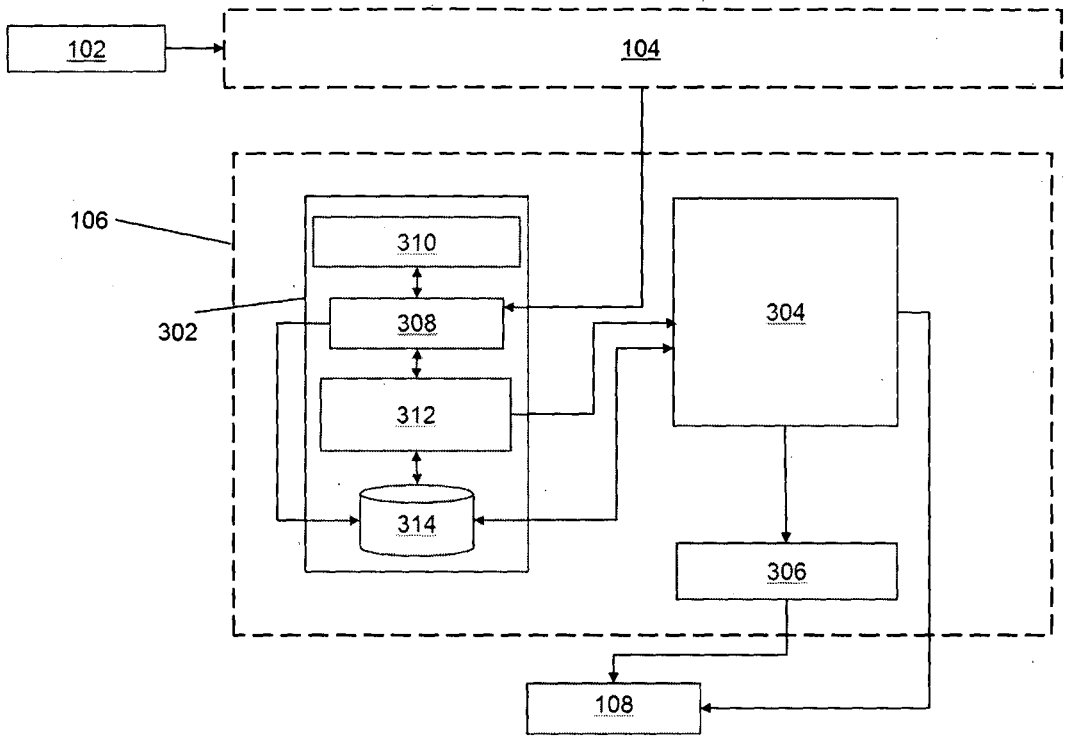

Figure 3

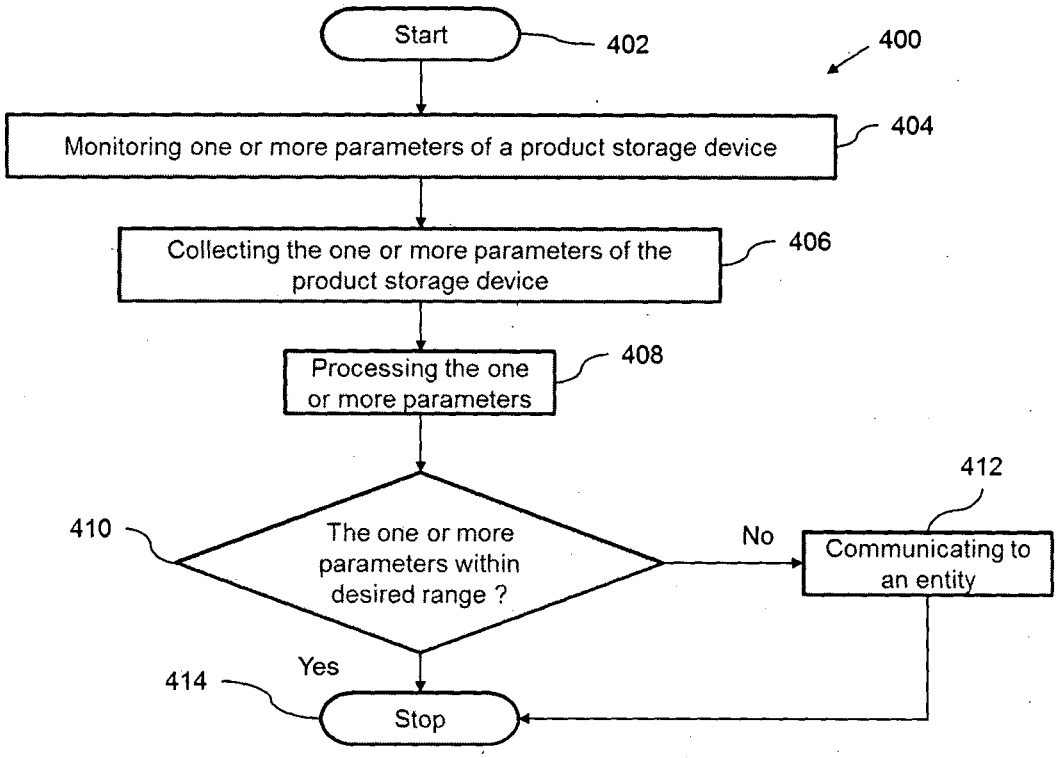
Start
402
400
Monitoring one or more parameters of a product storage device
404
Collecting the one or more parameters of the product storage device
406
Processing the one or more parameters
408
412
410
The one or more parameters within desired range ?
No
Communicating to an entity
Yes
414
Stop

Figure 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN201 2/000240

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 11/30 (201 2.01)
USPC - 62/1 29
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)
IPC(8) - H04L 12/28; F25B 5/00; G06F 11/30, 11/32, 11/34, 1/28 (2012.01)
USPC - 62/125, 129; 165/1 1.1, 11.2, 200, 201; 340/146.2, 501, 515, 517, 526, 528; 700/276; 702/130

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)
PatBase, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/0179703 A1 (SINGH et al) 15 June 2010 (15.06.2010) entire document	1, 8-12, 15-17
Y		2-7, 13-14, 18-20
Y	US 2007/0236357 A1 (GLIELMO et al) 11 October 2007 (11.10.2007) entire document	2-7, 18-20
Y	US 2005/0194437 A1 (DEARING et al) 08 September 2005 (08.09.2005) entire document	2-7, 18-20
Y	US 201 1/0202194 A1 (KOBRAEI et al) 18 August 2011 (18.08.201 1) entire document	6-7
Y	US 2012/0023971 A1 (MIN et al) 02 February 2012 (02.02.2012) entire document	13-14

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search
19 September 2012

Date of mailing of the international search report
0 2 OCT 2012

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Form PCT/ISA/210 (second sheet) (July 2009)