A system and method for packaging and delivering a temperature-sensitive item includes an insulated package having a substantially rigid container for containing the item, and a vacuum-sealed outer shell surrounding said container, and an insulated drop box having a first transceiver, for storing the insulated package.
FIG. 5
INPUT DELIVERY ADDRESS TO A COMPUTER SYSTEM TO DETERMINE optimum delivery route

PLACING PACKAGES IN CONTAINERS HAVING ELECTRONIC TAGS

PLACING CONTAINERS IN LOCATIONS ON A TRANSPORT VEHICLE

ACTIVATING A SIGNALING DEVICE ON A PARTICULAR ELECTRONIC TAG WHEN TRANSPORT VEHICLE ARRIVES AT A DESTINATION OF A PACKAGE CONTAINED WITHIN THE PARTICULAR ELECTRONIC TAG

FIG. 8

FIG. 9A
START

PACKAGE THE ITEM IN AN INSULATIVE VACUUM-SEALED PACKAGE

ASSOCIATE THE PACKAGE WITH AN ELECTRONIC TAG

TRANSPORT THE PACKAGE TO A DESTINATION HAVING A TEMPERATURE-CONTROLLED DROP BOX

DEPOSIT THE PACKAGE IN THE DROP BOX

END

FIG. 13
SYSTEM AND METHOD FOR PACKAGING AND DELIVERING A TEMPERATURE-SENSITIVE ITEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This Application claims the benefit of U.S. Provisional Application No. 60/299,727 which was filed on Jun. 22, 2001 by Grant Leung, and assigned to the present assignee, and which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a system and method for packaging and delivering an item, and in particular, a system and method for packaging and delivering a temperature-sensitive item.

[0004] 2. Description of the Related Art

[0005] Temperature-sensitive items, such as chilled and even frozen items, are typically stored, for example, by vendors at low temperatures. For example, a grocer may maintain a frozen food display at a temperature of about -20° C. When purchased by the purchaser, these temperature-sensitive items are typically placed in a plastic or paper bag by the vendor, and transported to the home of the purchaser. Of course, the items are not in a temperature-controlled environment so that while the items are being transported home, the temperature of the items increases which can cause the quality of the items to deteriorate.

[0006] Indeed, in more temperate climates where temperatures are typically high, if the transport period is long the quality of the item can be seriously and irreversibly deteriorated. In fact, if the frozen item is, for example, a frozen food, the thaw during the transport period may even pose a health risk to a consumer.

[0007] Other temperature-sensitive items, on the other hand, may require a warm temperature (e.g., warmer than an ambient temperature). In this case, a vendor may store the items, for example, in an oven. During the transport period the items are not in a temperature-controlled environment so that the temperature of the items steadily decreases. Again, if the transport period is long, the quality of the items can be seriously and irreversibly deteriorated.

[0008] Similar issues are encountered with respect to a delivery of temperature-sensitive items, for example, items purchased by mail order or via the Internet. Most temperature-sensitive items sold, for example, in a retail store have bright colorful packages that make the item desirable to the purchaser. However, temperature-sensitive items sold by mail-order or via the Internet, do not need to be so visually pleasing and can, therefore, be more practical and cost effective.

[0009] However, temperature-sensitive items sold by mail-order or via the Internet must be delivered to the purchaser via a delivery truck directly from a warehouse or via a courier. In case of direct delivery, the transport vehicle (e.g., a delivery truck) must have some means of keeping the items within a desirable temperature range during a transport period (e.g., a refrigerated truck), which can severely increase the vendor's cost of the transport vehicle. Moreover, the delivery person and the purchaser must coordinate a delivery time so the purchaser can place the items, for example, in a refrigerator, freezer or oven or may, in the case of food, consume it before the quality of the item is deteriorated by a change in temperature. This coordination of the delivery also results in additional vendor expense and inconvenience to both the vendor and the purchaser.

[0010] Where the temperature-sensitive items are frozen or chilled items, one solution has been to pack the items in dry ice during the transport period. However, this is very inconvenient and costly to the vendor. Moreover, it does not address the needs of items needing to be maintained at a warm temperature.

SUMMARY OF THE INVENTION

[0011] In view of the foregoing and other problems, disadvantages, and drawbacks of the conventional methods and structures, an object of the present invention is to provide a system and method for packaging and delivering a temperature-sensitive item.

[0012] The present invention includes an insulated package including a substantially rigid container for containing a temperature-sensitive item, and a vacuum-sealed outer shell surrounding the container. Further, a vacuum may be formed between the container and the outer shell to improve insulative qualities of the package. For example, the container may include a polystyrene box and the outer shell may include a polyethylene bag.

[0013] For instance, the insulated package may more than double a time it takes to increase a surface temperature of the item from -25° C. to -1° C. Specifically, the insulated package may prevent an increase in a surface temperature of said item from -25° C. to -1° C. for about 20 hours.

[0014] Further, the outer shell may include a reflective coating formed on an inside surface or outside surface of the outer shell. In addition, the substantially rigid container may include polystyrene, polyethylene or polypropylene. Further, the thickness of a wall of the substantially rigid container may be, for example, in a range of 0.5 and 0.33 inches. Furthermore, a pressure inside the package may be substantially less than 760 torr.

[0015] The present invention also includes a system for packaging and delivering a temperature-sensitive item. The inventive system includes an insulated package including a substantially rigid container for containing the item, and a vacuum-sealed outer shell surrounding the container. The system also includes an insulated drop box having a first transceiver, for storing the insulated package.

[0016] The system may also include an electronic tag associated with the insulated package, the tag having a second transceiver for wirelessly communicating with the first transceiver on the drop box. For example, the electronic tag may be affixed directly on the insulated package.

[0017] The inventive system may also include an access card, having a third transceiver, for wirelessly communicating with the first transceiver to allow access to the drop box. The system may further include a dock to serve as a base for the drop box, and a lock mechanism for securing the drop box to the dock. Further, the dock may include a temperature control unit for controlling a temperature inside the drop box.
box. For instance, the drop box may include a port for connecting to the temperature control unit.

[0018] The system may also include a transport container (e.g., an insulated transport container), for transporting the package. In this case, the electronic tag may be affixed on the transport container. For instance, the insulated transport container and the insulated drop box may be interchangeable.

[0019] In addition, the drop box may further include a signaling device. Thus, the second transceiver may wirelessly communicate with the first transceiver causing the signaling device to be activated when the package is within a predetermined distance of the drop box.

[0020] The inventive system may also include a transport vehicle having a computer system with a fourth transceiver for wirelessly communicating with the electronic tag, and a loop antenna connected to the fourth transceiver. The system may also include a global positioning system for navigating the transport vehicle to a destination.

[0021] The present invention also includes a method for packaging and delivering a temperature-sensitive item. The inventive method includes packaging the item in an insulative vacuum-sealed package, associating the package with an electronic tag, transporting the package to a destination having a temperature-controlled drop box, and depositing the package in the drop box.

[0022] The present invention also includes a programable storage medium tangibly embodying a program of machine-readable instructions executable by a digital processing apparatus to perform the inventive method for packaging and delivering a temperature-sensitive item.

[0023] With its unique and novel aspects, the present invention provides a system and method for packaging and delivering a temperature-sensitive item which makes unattended home delivery possible at a very low cost. In addition, the present invention keeps warm items warm and cold items cold and eliminates the need for temperature-controlled (e.g., refrigerated) transport vehicles, and makes it possible to use a drop box at the consumer’s home or office for unattended delivery. Further, it can be used by a vendor to prepare a temperature-sensitive item to be transported by a purchaser from the vendor’s place of business to the home or office of the purchaser.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The foregoing and other purposes, aspects and advantages will be better understood from the following detailed description of a preferred embodiment of the invention with reference to the drawings, in which:

[0025] FIG. 1 illustrates an inventive package 10 for packaging a temperature-sensitive item according to the present invention;

[0026] FIG. 2 illustrates a system 100 for packaging and delivering a temperature-sensitive item according to the present invention;

[0027] FIG. 3 illustrates a transport container for holding an insulated package to be delivered, according to the present invention;

[0028] FIG. 4 illustrates an electronic tag used in the inventive system according to the present invention;

[0029] FIG. 5 illustrates the circuitry of the electronic tag used in the inventive system according to the present invention;

[0030] FIG. 6 is a flow chart of the inventive system according to the present invention;

[0031] FIG. 7 illustrates an electronic tag temporarily affixed to a package as used in the inventive system according to the present invention;

[0032] FIG. 8 is a flow chart illustrating an inventive method for delivering a temperature-sensitive item according to the present invention;

[0033] FIGS. 9A and 9B illustrate a drop box used in the inventive system and method according to the present invention;

[0034] FIG. 10 illustrates an electronic access card used in the inventive system and method according to the present invention;

[0035] FIG. 11A illustrates a switch and FIG. 11B illustrates a keypad which may be used on a drop box in the inventive system according to the present invention;

[0036] FIG. 12 illustrates an insulated container and dock used in the inventive system according to the present invention; and

[0037] FIG. 13 is a flow chart illustrating the inventive method for packaging and delivering a temperature-sensitive item according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0038] Referring now to the drawings, FIG. 1 illustrates an inventive package 10 for packaging a temperature-sensitive item 50 according to the present invention.

[0039] It should be noted that the term “temperature-sensitive item” as used herein should be understood to mean an item (e.g., a food item) which has a preferred storage temperature. For instance, such an item may be adversely affected by any deviation (above or below) from the preferred storage temperature. For example, such an item may have a preferred storage temperature of 25°C and may be adversely affected by any deviation from this temperature.

[0040] Generally, the inventors have developed an insulated package 10 (e.g., a frozen food package) that can be used to extend the time that a temperature-sensitive item can be out of a temperature-controlled environment, for example, during a transport to the home of the purchaser. For instance, for cold items, the present invention may allow the item to remain out of the refrigerator or freezer for about 20 hours or more while preventing a surface temperature of the item to go no higher than about −1°C. Moreover, this claimed packaging and delivery system may have a lower cost to the vendor and may have a visually pleasing appearance making the item desirable to a purchaser.

[0041] Similarly, the present invention may allow the item to remain out of a temperature-maintained environment for a long duration while preventing a surface temperature of the item to go no lower than a certain (e.g., preferred)
temperature. This may be helpful, for example, in a cold climate where it is preferred that the item not go below a certain temperature (e.g., room temperature).

[0042] More specifically, as shown in FIG. 1, the insulated package 10 includes a container 20 which may be fabricated of high density polymer (e.g., a high density polyethylene, polypropylene) with a temperature-sensitive item 50 (e.g., a plurality of temperature-sensitive items). The walls of the container 20 may be, for example, in a range of about ½ inch to ¾ inch thick. For example, an item which has been maintained in a temperature-controlled environment (e.g., in a freezer or on a warehouse maintained at room temperature (e.g., about 25°C)), can be placed in the container 20 and, for example, returned to the temperature-controlled environment.

[0043] For example, a frozen item can be stored in the container 20 in a freezer. When the container is removed from the freezer, the container 20 may be used to maintain a temperature of a temperature-sensitive item below a certain temperature for many hours. For example, using the container 20, a frozen item may be removed safely from a -25°C freezer and stored at room temperature for approximately 8 hours, and never attain a surface temperature over about -1°C.

[0044] Moreover, as shown in FIG. 1, the package 10 may also include a vacuum-sealed outer shell 30 to reduce a pressure inside said package to sub-atmospheric pressure (e.g., less than 760 torr) and further enhance the insulative qualities of the package 10. The outer shell 30 may be formed, for example, of a thermoplastic material (e.g., polyethylene or polypropylene).

[0045] For instance, the container 20 (e.g., a polystyrene box) including the temperature-sensitive item 50 (e.g., a frozen food) may be placed in the outer shell 30 (e.g., a polyethylene bag). The container 20 may be airtight so that a vacuum may be pulled inside the outer shell 30 holding both the container 20 and the item, for example, forming a vacuum between the outer shell 30 and the container 20. The package 10 can thereby be made to have the insulative qualities of, for example, a high-quality vacuum thermos.

[0046] Alternatively, the container 20 may be not airtight so that the vacuum is pulled inside the container as well. Further, the vacuum may be pulled on the outer shell 30 by any conventional vacuum processing devices. Further, the package 10 may be inexpensive and can be safely recycled after use.

[0047] For example, the outer shell 30 may include a preformed port (e.g., a circular port) for easily inserting and removing a vacuum hose. Thus, after a vacuum is pulled inside the outer shell 30, the vacuum hose can be removed and the port easily sealed (e.g., by a thermal-seal, screw-tight seal, etc.).

[0048] Specifically, the package may have the design of a cylinder, square or other design. In addition, the range of volumes inside the package may be unlimited. For instance, the package may have a volume of 8 ft³ for an application requiring that amount of volume. In other words, a business may keep on hand packages 10 having various dimensions for use in particular applications. Further, the inventive package 10 can be made to be disposable, so that a customer after opening the package can merely recycle the package.

[0049] Moreover, the insulated package 10 can substantially extend the amount of time during which a temperature-sensitive item can remain outside of a temperature-controlled environment. For example, the invention package 10 can more than double the time it takes for a surface temperature of a frozen item to reach -1°C. For instance, experimentation has shown that a frozen item can be stored in the insulated package 10 outside of a freezer for about 20 hours before attaining a surface temperature of about -1°C.

[0050] Further, the outer shell 30 may include a reflective coating formed on the inside and/or on the outside of the outer shell 30. This reflective coating can further enhance the insulative qualities of the inventive package 10. For instance, the reflective coating may include a metallized (e.g., aluminized) surface coating bonded to the surface of the outer shell 30. Alternatively, the outer shell 30 may be formed of a material having a reflective property.

[0051] Referring again to the drawings, FIG. 2 illustrates an inventive system 100 for packaging and delivering temperature-sensitive items according to the present invention. The inventive system 100 is fully integrated and may facilitate sales (e.g., Internet sales) of temperature-sensitive items which may require delivery (e.g., unattended) of such items.

[0052] Further, as shown in FIG. 2, the inventive system 100 may also include an ordering device 105 (e.g., an Internet-based ordering device). Consumers may, for example, use such an ordering device 105 (e.g., a personal computer connected to the Internet) to place orders quickly. For example, with an Internet-based ordering device, a customer may view an image of the temperature-sensitive item on a business website (e.g., a website of a retailer, distributor, or manufacturer), and place an order for the item directly over the Internet. Such orders from the ordering device 105 may be received, for example, at a distribution center 107 which distributes the items to fill the orders.

[0053] In addition, the inventive system 100 may select an optimum route for the driver, identify the correct items to be delivered at each destination, and verify that the items were actually delivered. As shown in FIG. 2, in the inventive system 100, the transport vehicle 150 used to deliver the items may include a computer system 130 which wirelessly communicates with a base station 120 to optimize a delivery route. The transport vehicle may also include a loop antenna 140 to facilitate a two-way communication with the base station 120. Further, the computer system 130 may include a global positioning system (GPS), to verify the location of the transport vehicle.

[0054] The inventive system 100 may further include transport containers 200 (e.g., insulated bags or totes) for containing the temperature-sensitive items in the insulated package 10 while being transported to a destination. As shown in more detail in FIG. 3, the transport containers 200 may be made from materials such as canvas or nylon, and may include a support device 210 (e.g., a support strap) attached to the transport container 200 (e.g., at the top of the transport container) for easily handling the transport container 200.

[0055] In the inventive system 100, the transport container 200 may be loaded with an insulated package 10 (e.g., a plurality of insulated packages), for example, at the distri-
The packages may then be transferred onto the transport vehicle 150 where the packages 10 are sorted, for example, on shelves in the transport vehicle 150. The packages 10 may be placed on the transport vehicle at a specific location or may be placed randomly on the transport vehicle. Further, the location of a package 10 (e.g., location code) may be determined so as to minimize driver time.

For example, the package's location on the transport vehicle may be determined based upon the route the transport vehicle must take to deliver all the packages 10. For example, the packages 10 can be placed from left to right, front to back, upper to lower or lower to upper or in any other order, according to such factors as the destination of the package 10 or the anticipated time of delivery. Further, packages 10 with the earliest delivery (i.e., closest destinations) may be located on the lower left side of the transport vehicle. The packages 10 may then proceed up and right along the wall of the transport vehicle so that packages 10 having the latest deliveries (i.e., closest destinations) would be located on the lower right side of the transport vehicle. Therefore, the driver may make a delivery knowing, for example, a package 10 located at a particular location on the transport vehicle is to be delivered to a particular destination. On the other hand, as explained below, the insulated packages 10 or transport container 200 in which the packages 10 are contained, may include an electronic tag which generates a signal (e.g., a light or audible signal) to alert the delivery person to the correct package 10 or transport container 200 he is to deliver.

Further, as shown in FIG. 4, the inventive system 100 may further utilize small electronic tags 210 (e.g., electronic modules). The electronic tag 210 may be located, for example, in a small translucent pocket 220 on the transport container 200 or on the package 10. The tag may include a signaling device (e.g., plurality of signaling devices) such as a red or green light emitting diodes 320, a liquid crystal display 330 (LCD) for alphanumeric display, and switches 340 (e.g., buttons) for controlling the electronic tag 210.

The electronic tag 210 may be used, for example, to help direct the placement of insulated packages 10 on the transport vehicle. For example, a package's proper location on the transport vehicle may be shown on the LCD 330 so that it may be easily viewed, for example, by package handlers at the distribution center 107.

FIG. 5 provides a more detailed description of the electronic tag 210. As shown in FIG. 5, the electronic tag 210 additionally may include an inexpensive processor 320 (e.g., a low powered four bit microprocessor), a memory device 330 (e.g., a random access memory (RAM)) or other nonvolatile memory device for storing a unique identification number. The identification number may be permanent, so that it can be changed only with a special program and transmitter.

The electronic tag 210 may also contain a transceiver 350 (e.g., a two-way communication chip) for allowing the electronic tag 210 to communicate with the base station 120. The two-way communications chip may be, for example, a low-cost CMOS analog digital chip. The two-way communications chip may be connected to orthogonal ferrite antennas 360 that are able to transmit and receive using low frequencies to the loop antenna which is wirelessly connected to the base station.

Further, the electronic tag 210 may wirelessly communicate with the base station via a bi-directional wireless link. The wireless link may include, for example, a low frequency conductive loop requiring minimal power and allowing communication within a small area. Further, the LCD 330 may be programmed to display both numeric as well as alphanumeric information transmitted to the module via the base station 120. The circuitry may be solar powered or powered, for example, by a battery 370 or other power source. Battery life using conventional alkaline batteries is likely to exceed five years, and with AAA batteries the life may be longer.

Further, the inventive system 100 may include several hardware and software components. As shown in FIG. 6, routing software 510 may be used to calculate an optimal route based on the GPS coordinates of the address is where items are to be delivered. A global positioning system 520 (GPS), may detect the location of a transport vehicle in real-time. A mapping guidance system 530 may also be used to direct the driver to the correct address. This is particularly important if the system is used for nighttime delivery when addresses and street signs are not normally visible.

A database 540 holding the correct transport container 200 and the ID for the tag attached to the container plus the GPS address may also be stored (e.g., in a database) on the computer system 130 (as shown in FIG. 2). The computer system 130 may also include, for example, a display 545 (e.g., a laptop computer with a flat-panel display) which is temporarily located near the delivery driver in the transport vehicle. The computer system 130 may include a transceiver 550 connected to the loop antenna 140 for wirelessly communicating with the base station 120.

The base station 120 similarly may include a transceiver allowing it to wirelessly communicate (e.g., through the loop antenna 140) with all of the electronic tags 210 in the inventive system 100 by the unique ID number of the tags. Thus, the inventive system 100 can activate a signaling device (e.g., an LED) on a particular transport container 200 or insulated package 10 when the delivery driver arrives at the destination for that particular insulated package 10.

In addition, the base station 120 may poll all of the electronic tags 210 in the inventive system 210 (e.g., using the loop antenna 140) in search of a particular electronic tag 210 and in communicate only with that particular tag. Thus, the base station 120 is capable of placing specific information on the display 330, activating/deactivating the signaling device (e.g., flashing the light emitting diodes 320), selectively activating each electronic tag 210 included on a package 10 or on a transport container 200 (e.g., on the transport vehicle).

The inventive system 100 may also determine an optimal route for the transport vehicle. An optimal route may be used, for example, to minimize time or distances traveled by the transport vehicle. The optimal route may be determined, for example, using a GPS system and the coordinates or addresses of each package's destination. The optimal route may be, for example, input into the computer system...
which may also be located on the transport vehicle. The ID numbers of the electronic tags 210 can also be loaded into the computer system 130. The GPS system can also be used to guide the transport vehicle to a package’s destination via a map, or other conventional routing software.

[0067] Thus, when the transport vehicle arrives at a package destination, the computer system 130 can alert the driver, for example, audibly or by displaying a text message on the computer system display 545. The message to the driver may include, for example, the destination address, the number of packages 10 to be delivered, and the package’s location on the transport vehicle. In addition, the computer system 130 may cause the electronic tag 210, for example, on the transport container 200 in which the insulated package is located, to be activated (e.g., using the loop antenna 140) so as to facilitate locating the insulated package 10 by the driver. For example, the signaling devices (e.g., light emitting diodes) on the electronic tag 210 may be activated so that the driver can easily locate the package 10.

[0068] Therefore, the driver need only locate the package or container emitting a signal (e.g., a flashing light) from an electronic tag, remove the package 10 (e.g., from the container 200) and deliver it to its destination. The driver may also activate the switch 340 (e.g., a button) on the electronic tag 210 to indicate that the package has been properly delivered to its destination. In addition, if for some reason the package 10 could not be delivered, the driver may place the package 10 back in the transport vehicle 150 (e.g., in the transport container 200) and activate a switch (e.g., on the electronic tag 210) to indicate that delivery was attempted but unsuccessful.

[0069] Further, additional information can be displayed on the LCD 330 of the electronic tag 210 at different times. For example, after the transport container 200 is loaded on the transport vehicle, the number of packages 10 contained in the transport container 200 can be displayed so the driver can periodically check the contents of each transport container 200.

[0070] Furthermore, when the transport container 200 is empty, the driver may deactivate the electronic tag 210 using an activation switch 340 (e.g., a button) on the electronic tag 210. The electronic tag 210 may also be automatically deactivated, for example, by placing the transport container 200 and/or the electronic tag 210 at a particular location on the transport vehicle. In addition, the computer system 130 may wirelessly communicate with the electronic tag 210 in order to detect that the transport container 200 is no longer in use.

[0071] The container 200 used by the inventive system may include, for example, a tote. In this case, the electronic tag may be located, for example, on the front of the tote. In addition, a simple, inexpensive electronic tag may contain a single LED to facilitate locating the package (e.g., insulated package) by the delivery driver.

[0072] Further, as shown in FIG. 7, a small electronic tag 601 may be placed, for example, not on the transport container 200 but instead, directly on the insulated package 10. In this case, the driver may remove the tag 601 as the insulated package 10 is delivered to its destination, and place it in a special bin located, for example, in the transport vehicle. Further, the electronic tag 601 may be placed on the package using an adhesive pouch 610 having a plastic window. The tag 601 might be very flat like a credit card with only a single lighting diode 620, and a small switch 630 (e.g., button) and in all other respects is the same as the electronic tag 210 in FIGS. 4 and 5. The switch 630 may be used for confirming delivery of the package to its destination or alternatively to allow the tag 601 to be used as an access card to open an electronic drop box (e.g., an insulated drop box) at the package’s destination.

[0073] For example, the driver may activate the switch 630 (e.g., push a button) on the tag to gain access to a drop box located at the package’s destination (as discussed below). The tag 210 on the package wirelessly communicates with the drop box causing the drop box to open. After the driver places the insulated package 10 in the drop box, the tag 210 may be removed and placed in a bin located, for example, on the transport vehicle. In addition, the driver may deactivate the tag 210 to indicate that the tag 210 is no longer in use and/or that the package 605 was properly delivered, using the switch 630 on the electronic tag 210. Further, the tag may include a memory which records, for example, the date and time that the tag was used to open the drop box.

[0074] For example, FIG. 8 is a flow diagram illustrating a method 700 for delivering a package according to one aspect of the present invention. As shown in FIG. 8, the method 700 may include inputting (710) a delivery address to the computer system to determine an optimum delivery route, placing (720) a package (e.g., insulated package) in a container having an electronic tag, placing (730) the container on a transport vehicle, and activating (740) a signaling device on the electronic tag associated with a package (e.g., the electronic tag on the container holding the package) when the transport vehicle arrives at the package’s destination.

[0075] In addition, as shown in FIG. 9A, the inventive system 100 may include an insulated drop box 800. The space inside the insulated drop box may range, for example, from between about 1 cubic foot to 30 cubic feet. The temperature inside the box 800 may be controlled to between about 35 and 85 degrees Fahrenheit. As shown in FIG. 9A, the insulated drop box may be formed of a variety of materials, such as plastic or metal, and should have good insulative properties. The lid of the box should have a tight seal. In particular, the insulative properties should be sufficient to ensure little energy is required to maintain a temperature inside the insulated drop box 800 within a desirable range. For example, the walls may be formed of a single layer of a conventional insulative material having a sufficient thickness and density to provide the desired insulative features. Alternatively, the box 800 may be double-walled and have insulative material (e.g., a conventional insulative material) therebetween.

[0076] In addition, the insulated drop box 800 could include a humidity control feature to regulate the amount of moisture inside the box 800. For example, the humidity inside the box 800 may be controlled so as to remain below 50% relative humidity. To regulate humidity, the box 800 may include a conventional humidity measuring device (e.g., a hygrometer) and a dessicant material (e.g., a conventional dessicant) to remove moisture from the air inside the box 800. Alternatively, the box 800 may include a more
extensive humidity control device which may involve air exchanges such as with conventional heating, ventilation and air conditioning (HVAC) systems. Such air exchanges may be desirable, for example, to inhibit the growth of mold or mildew inside the box 800.

[0077] In addition, the box 800 may include a switch to activate and deactivate the temperature control and/or humidity control features. Further, the box 800 may have an switch to regulate the temperature and humidity inside the box 800 within desirable ranges. Such switches may be located, for example, on an inside wall of the box. The switches may also be remotely located inside a home or business such as, for example, a home or business which is serviced by the insulated drop box 800.

[0078] In addition, as shown in FIG. 9B, the drop box 800 may include, for example, a processor 825 (e.g., a fixed programmed four bit microprocessor), a memory device 830 (e.g., random access memory (RAM)) and a power source 835 (e.g., a lithium battery). The drop box 800 may also include a transceiver 840 (e.g., a custom two-way communication analog chip) and an antenna 845 to transmit and receive data over a short range link. As mentioned above, the power source 835 (e.g., battery) should have a long service life (e.g., over five years) over many (e.g., several thousand) transactions.

[0079] Further, the insulated drop box 800 may also optionally include a signaling device 855 (e.g., light-emitting device(s) such as one or two light emitting diodes) that can be optionally used to identify a correct package when a delivery driver arrives (e.g., when a package is located within a certain distance of the drop box). In addition, as shown in FIG. 9B, the antenna 845 in the drop box 800 may include a larger loop antenna for improved two-way communication.

[0080] The drop box 800 may further include a lock mechanism 860 having, for example, a low powered motor and a screw that can move a rod forward to lock the lid of the box 800 and backward to unlock the box 800. Obviously, as would be known by one of ordinary skill in the art taking the present application as a whole, other lid-locking mechanisms could be employed. The box 800 may also have a switch 870 (e.g., a button) to control an operation of the box 800. Further, when the lid is closed, the processor in the drop box 800 may automatically cause the lock mechanism 860 to lock to prevent an entry to the box 800.

[0081] As explained above, orders may be transmitted to a distribution center 107 where temperature-sensitive items are loaded onto a transport vehicle. The transport vehicles, for example, may deliver the orders to the specially designed insulated drop-box 800 between about 10:00 pm and 6:00 am when traffic is minimal. Each transport vehicle may be equipped with Global Positioning System guidance that guides the vehicle to the boxes using an optimal route, as well as a wireless communication system that activates a signaling device (e.g., a light emitting diode) on the transport container 200 which contains the correct order as the driver approaches the destination. The navigation system tells the driver where to stop. The driver may then select the corresponding transport container 200 or package 10 on which the signaling device is activated and deliver the container 200 or the insulated package 10 to the insulated drop box 800.

[0082] In addition, as shown in FIG. 9A, the insulated drop box 800 may include a signaling device 805 (e.g., an LED) which may be activated to signal to the driver where the package 10 is to be delivered. The box 800 may also include a switch 815 (e.g., a button) located, for example, on the outside of the box to activate and deactivate the security features of the box 800. The box 800 may also be secured to a dock 850 which may be used, for example, to lock the box 800 in a stationary position and provide other features to the box 800 as explained below.

[0083] The driver may open the lid 820 of box 800, remove the temperature-sensitive goods (i.e., the items ordered) from the container (e.g., insulated container 200 and place them in the insulated drop box 800. The insulated packaging and/or the environment control devices (e.g., temperature and humidity control devices) on the insulated drop box 800 may help to ensure that regardless of the environmental conditions outside the box 800, the contents of the drop box 800 are stored at a temperature which will maintain a desirable temperature of said temperature-sensitive item for a predetermined period of time.

[0084] As shown in FIG. 10, the inventive system 100 may also include an access card 900 for accessing the drop box 800. For instance, instead of using the electronic tag 210 on the package 10 or container 200 to access the drop box, the delivery person may use the access card 900. Similarly, after the item has been delivered the drop box 800, the customer (e.g., home or business owner) may open the drop box 800 and remove the package using the access card 900.

[0085] It is important to note that the database in the transport vehicle and the route may be based upon the GPS coordinates of the insulated drop box 800. This makes it possible for the driver to locate the box 800 via a route based system even during the night when it is not possible to see addresses or street signs. This combination of a lockable insulated drop box 800 and GPS coordinates of the box 800 used as the destination makes it possible to do night time deliveries to the box 800 and further reduce costs. Costs are reduced because of reduced traffic and the ability to park almost anywhere, with the added advantage of not requiring signatures or human interaction to successfully make a delivery. Thus, it is possible to do three to four times the number of deliveries using this system than with conventional delivery systems.

[0086] Further, as shown in FIG. 10, the access card 900 which allows access to the insulated drop box 800 may include a short range wireless link to control a lock mechanism (e.g., a battery operated lock mechanism) contained in the drop box 800. The access card 900 may include an inexpensive processor 920 (e.g., a low powered four bit microprocessor), a memory device 930 (e.g., a random access memory (RAM)) or other nonvolatile memory device for storing a unique identification number. The identification number may be permanent, so that it can be changed only with a special program and transmitter. The access card 900 may also contain a switch 975 (e.g., a button) to control an operation of the access card 900.

[0087] The access card 900 may also contain a transceiver 950 (e.g., a two-way communication chip) for allowing the access card 900 to communicate with the drop box 800 and other devices in the inventive system 100 (e.g., the base station 120). The two-way communications chip may be, for
example, a low-cost CMOS analog digital chip. The two-way communications chip may be connected to orthogonal ferrite antennas 960 that are able to transmit and receive using low frequencies to the loop antenna connected to the base station. Further, the access card 900 may wirelessly communicate with other devices via a bi-directional wireless link. The wireless link may include, for example, a low frequency conductive loop requiring minimal power and allowing communication within a small area.

[0088] Further, the access card may include a display device 970 (e.g., a light emitting diode (LED) display) which may be programmed to display both numeric as well as alphanumeric information transmitted to the access card 900. The circuitry may be solar powered or powered, for example, by a battery 980 or other power source. Battery life using conventional alkaline batteries is likely to exceed five years, and with AAA batteries the life may longer.

[0089] As mentioned above, a record of opening and closing times can be kept in the memory device included in the drop box 800 so that when the driver opens the box 800 to place an order he can “harvest” this information. Further, as shown in FIG. 11A, the drop box 800 or the access card 900 may include a single button 975 and one or two display devices 970 (e.g., light emitting diodes) to indicate the status of the box 800.

[0090] Alternatively, as shown in FIG. 11B, the box 800 or access card 900 may have a small keypad 1000 to enter in a Personal Identification Number (PIN). The keypad 1000 would allow the driver to program the security level of the access to the box 800 when placing an order using the keypad on either the access card 900 or drop box 800. For instance, if it is a high security item, the box 800 could open only with a one time use PIN. For lower security, a standard PIN known by the customer may be used, and for low security items the driver may not enter a PIN. The access card 900 having a keypad 1000 could also be used by third party couriers, so that each driver might have a PIN. This would make it possible to change the program of the box 800 to disallow the use of a particular PIN, for example, if a driver left the delivery company. In addition, the PIN and keypad 1000 may be used to monitor who accesses the drop box 800.

[0091] As mentioned above, the inventive system 100 can be used to effectively package and deliver items such as temperature-sensitive items. Further, as shown in FIG. 12, the container 200 (e.g., transport container) can be made to have a design similar to the insulated drop box 800. In addition, as explained above, the insulated transport container 200 may have a electronic tag 210 and packed directly on the transport vehicle, then removed from the transport vehicle left the delivery 1120 located at the package’s destination. This may further help to eliminate the need for a refrigerated truck.

[0092] Specifically, the transport container 200 may be placed, for example, on the dock 1120 which may have the same features as the dock on which the insulated drop box 800 may be stored. Further, the container 200 may be designed to interface with the dock 1120 in the same manner as the drop box 800 so that the insulated drop box 800 and the transport container 200 may be considered interchangeable. Further, the dock 1120 may be fabricated of heavy concrete and have a locking mechanism 1130 that makes it easy to place the transport container 200 or box 800 on the dock 1120 securely.

[0093] Therefore, the delivery person may deliver the insulated packages 10 to the destination and remove the packages 10 from the transport container 200 and place the packages 10 in the insulated drop box 800. Alternatively, when there exists a dock but not a drop box 800 at a destination address, the driver may simply deliver the transport container 200 to the destination address and secure it to the dock 1120.

[0094] I Like the insulated drop box 800, the customer may open the insulated transport container 200 with an access card similar to that described above and remove the delivered goods. The driver may return at a later date, open the box with his access card 900 and unlock the insulated transport container 200 from the dock by releasing the lock mechanism 1130 from inside the insulated transport container 200.

[0095] Further, the lock mechanism 1130 on the dock 1120 may interact with the lock mechanism 860 on the drop box 800 as explained above, to secure the drop box 800 or transport container 200 to the dock. For instance, the lock mechanism 1130 might have a design similar to a hydraulic quick release coupling used to connect hydraulic lines on heavy equipment. For instance, the lock mechanism 1130 on the dock may include a male portion of the coupling, and the lock mechanism 860 in the drop box 800 or transport container 200 may include the female portion of the coupling (or vice versa).

[0096] Thus, when the box 800 or transport container 200 is positioned on the dock 1120 and engaged (e.g., pushed down) both lock mechanisms 860, 1130 may be activated. The user may, for example, open the box 800 or transport container 200 and pull back the collar on the coupling to thereby release the drop box or container from the dock.

[0097] In addition, the dock 1120 may also be used to house devices for providing the temperature and humidity control features discussed above. In other words, the insulated drop box 800 or transport container 200 may be devoid of any active temperature or humidity control devices, but may include ports or ducts which interface securely to the dock 1120 when the box 800 or transport container 200 is secured to the dock. This would allow, for example, heated, chilled or conditioned air to be generated outside the box 800 or transport container 200 and fed into the box 800 or transport container 200, for example, through a valve (e.g., control valve) to help maintain a desirable temperature and/or humidity. This conditioned air could be generated, for example, using a peltrie device contained in the dock or alternatively be remotely generated by a system in a house or business and attached to the dock 1120, for example, via an insulated conduit (e.g., hose).

[0098] In addition, as shown in FIG. 12, the present invention includes an inventive method 1200 for packaging and delivering a temperature-sensitive item. As shown in FIG. 12, the inventive method 1200 includes packaging (1210) the temperature-sensitive item in an insulative vacuum-sealed package and associating (1220) the package with an electronic tag. In addition, the method 1200 includes transporting (1230) the item to a destination having an
insulated drop box and depositing (1240) the package in the insulated drop box. The inventive method 1200 may also include placing the insulated package in a transport container having an electronic tag.

[0099] With its unique and novel aspects, the present invention provides a system and method for packaging and delivering a temperature-sensitive item which makes unattended home delivery possible at a very low cost. In addition, the present invention keeps warm items warm and cold items cold and eliminates the need for temperature controlled (e.g., refrigerated) transport vehicles, and makes it possible to use a drop box at the consumer’s home or office for unattended delivery. Further, it can be used by a vendor to prepare a temperature-sensitive item to be transported by a purchaser from the vendor’s place of business to the home or office of the purchaser.

[0100] While a preferred embodiment of the present invention has been described above, it should be understood that it has been provided as an example only. Thus, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the appended claims.

What we claim is:
1. An insulated package, comprising:
   a substantially rigid container for containing a temperature-sensitive item; and
   a vacuum-sealed outer shell surrounding said container.

2. The insulated package according to claim 1, wherein a vacuum is formed between said container and said outer shell.

3. The insulated package according to claim 1, wherein said container comprises a polystyrene box, and wherein said outer shell comprises a polyethylene bag.

4. The insulated package according to claim 1, wherein said insulated package more than doubles a time it takes to increase a surface temperature of said item from −25°C to −1°C.

5. The insulated package according to claim 1, wherein said insulated package prevents an increase in a surface temperature of said item from −25°C to −1°C for about 20 hours.

6. The insulated package according to claim 1, wherein said outer shell comprises a reflective coating formed on one of an inside surface and outside surface of the outer shell.

7. A system for packaging and delivering a temperature-sensitive item comprising:
   an insulated package, comprising:
   a substantially rigid container for containing said item; and
   a vacuum-sealed outer shell surrounding said container; and
   an insulated drop box comprising a first transceiver, for storing said insulated package.

8. The system according to claim 7, further comprising:
   an electronic tag associated with said insulated package, said tag comprising a second transceiver for wirelessly communicating with said first transceiver.

9. The system according to claim 7, further comprising:
   an access card, comprising a third transceiver, for wirelessly communicating with said first transceiver to access said drop box.

10. The system according to claim 7, further comprising:
    a dock to serve as a base for said drop box.

11. The system according to claim 8, further comprising:
    a transport container for transporting said package, wherein said electronic tag is affixed on said transport container.

12. The system according to claim 11, wherein said transport container comprises an insulated transport container.

13. The system according to claim 8, wherein said electronic tag is affixed on said insulated package.

14. The system according to claim 10, further comprising:
    a lock mechanism for securing said drop box to said dock.

15. The system according to claim 12, wherein said insulated transport container and said insulated drop box are interchangeable.

16. The system according to claim 11, wherein said drop box further comprises a signaling device and wherein said second transceiver wirelessly communicates with said first transceiver causing said signaling device to be activated when said package is within a predetermined distance of said drop box.

17. The system according to claim 4, further comprising:
    a transport vehicle comprising:
    a computer system comprising a fourth transceiver for wirelessly communicating with said electronic tag; and
    a loop antenna connected to said fourth transceiver.

18. The system according to claim 17, further comprising:
    a global positioning system for navigating said transport vehicle to a destination.

19. The system according to claim 10, wherein said dock comprises a temperature control unit for controlling a temperature inside said drop box, and
    wherein said drop box comprises a port for connecting to said temperature control unit.

20. A method for packaging and delivering a temperature-sensitive item comprising:
    packaging said item in an insulative vacuum-sealed package;
    associating said package with an electronic tag;
    transporting said package to a destination having a temperature-controlled drop box; and
    depositing said package in said drop box.

21. The insulated package according to claim 1, wherein said substantially rigid container comprises one of polystyrene, polyethylene and polypropylene.

22. The insulated package according to claim 1, wherein a thickness of a wall of said substantially rigid container is in a range of ½ and ¾ inches.

23. The insulated package according to claim 1, wherein a pressure inside said package is substantially less than 760 torr.
24. A programmable storage medium tangibly embodying a program of machine-readable instructions executable by a digital processing apparatus to perform a method for packaging and delivering a temperature-sensitive item, said method comprising:

- packaging said item in an insulative vacuum-sealed package;

- associating said package with an electronic tag;
- transporting said package to a destination having a temperature-controlled drop box; and
- depositing said package in said drop box.

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