VENDING SYSTEMS AND METHODS

Vending systems and methods are described. One example embodiment of the system (10) includes vending machines (12) at a variety of locations (16) and connected to a control center (14). The control center includes an application server (26) that controls access to and collects data relating to vending of products from the vending machines (12). Such data includes the types and quantities of products that have been vended to each employee and a time at which each vending takes place.
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VENDING SYSTEMS AND METHODS

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CROSS REFERENCE TO RELATED APPLICATIONS

[0002] This application claims the benefit of U.S. Provisional Application No. 60/347,155, filed on January 9, 2002, and hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0003] This invention relates generally to product supply and, more particularly, to network methods and systems including methods and systems for vending products.

[0004] Over the course of a workday, and especially within large companies, numerous consumable items are dispensed to employees. Typically, various employee stockrooms and storage areas are located throughout the employer's premises, and employees go to such stockrooms and storage areas when a particular item or groups of items are required. To track employee usage of such items, the employees typically complete a paper worksheet setting forth the quantity and type of items being taken.

[0005] With certain types of items, the employer may have certain policies in place to limit the number of such items that an employee may take over the course of time. For example, an employee may be limited to taking a certain number of types of batteries over the course of one month. Such policies generally are intended to prevent shrinkage and improper use of these items.
With paper based systems, however, tracking how many items and types of items any one particular employee has taken can be a time consuming and tedious task. Further, effectively limiting access to particular items can result in reduced productivity and increased costs.

In addition, and with particular types of items such as safety items, ensuring that such items are available to employees may be required to comply with certain safety or other standards. If such items are stored in a stock room that is only open during certain set working hours, then obtaining such items during other times can be difficult, if not impossible, even though such an item may be legitimately needed at that time.

BRIEF SUMMARY OF THE INVENTION

In one aspect, a vending system is provided. The vending system, in one example embodiment, includes vending machines at a variety of locations and connected to a control center. The control center includes an application server that controls access to and collects data relating to vending of products from the vending machines. Such data includes the types and quantities of products that have been vended to each employee and a time at which each vend takes place.

In the example embodiment, each user is provided with an identification code. An employee desiring to vend an item enters the user identification code and the code for the desired item into a keypad on the vending machine. These entries are then transmitted to the application server which then confirms the correctness/validity of the user identification code, as well as determines whether that particular user is authorized to vend the item requested. If all requirements for authorization are met, the application server transmits a vend command to the machine and the item is vended. The data related to that particular vend is then stored by the application server in a database. For example, the data for each vend could include time, location, user, and item vended.
[0010] Information stored in the database is available to system
administrators/managers via a web site. More particularly, the application server is
coupled to a web server, and authorized individuals can access data stored in the
database via the web server and application server. The data can be formatted into
predesignated report formats so that at any time a manager desires to view vends made
by a particular employee or by a certain item type, the manager can select the report
desired and obtain the desired data. Many other advantages and uses of the system are
possible and contemplated, as described below in more detail.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Figure 1 a schematic diagram of a vending system.

[0012] Figure 2 is a schematic diagram of an alternative embodiment
of a vending system.

[0013] Figure 3 illustrates a vending machine having various items
(e.g., safety gloves) stored therein.

[0014] Figure 4 illustrates a bank of vending machines having
various items stored therein.

[0015] Figure 5 illustrates a close-up view of a vending machine
having batteries stored therein.

[0016] Figure 6 illustrates a user inserting a card into a vending
machine card reader.

[0017] Figure 7 illustrates a vending machine having gloves stored
therein.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Vending systems and methods are described below in the
context of a hosted service. That is, the systems and methods are configured so that a
third party service provider can provide certain services (e.g., business intelligence) to

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a customer. The present systems and methods, however, are not limited to a particular architecture or hosting arrangement. For example, rather than a hosted service, such vending systems and methods can be "customer" hosted (i.e., not hosted by a third party). In addition, and as described below in more detail, certain components and aspects of the systems and methods are not limited to vending applications, and can be used in many other contexts in addition to vending.

[0019] Further, the systems and methods are sometimes described herein the context of an employer having employees who vend items from the vending machines. The present systems and methods, however, are not limited to use by employers and employees, and can be used in many other contexts. The term employees, therefore, should be understood to refer to users of the vending machines. The term employer should be understood to refer to the person or entity that desires to control and monitor vends. For example, vending machines could be located at a work site having many different individuals performing work. All such individuals may use the vending machines, even though such individuals may not be employees of any single employer.

[0020] Figure 1 is a schematic diagram of an example embodiment of a vending system 10. System 10 includes a plurality of vending machines 12 coupled to a control center 14. In the example embodiment, control center 14 is hosted in that a third party service provider can operate center 14 and provide various services (e.g., reporting services) to a customer (e.g., a company in which employees of the company have access to vending machines 12). As explained above, however, control center 14 need not be hosted by a third party and can be internally operated by an enterprise. In addition, the various functions and operations performed by control center 14 can be distributed across an organization and need not be performed in a centralized manner as described herein.

[0021] In the embodiment illustrated in Figure 1, machines 12 are coupled to center 14 via terminal servers 16 that communicate across a TCP/IP infrastructure 18 to a socket server 20. TCP/IP infrastructure can be any communications medium (e.g., a network) that enables communications between
vending machines 12 and control center 14. For example, TCP/IP infrastructure 18 can be a public wide area network (e.g., the public Internet), a private wide area network (e.g., private TCP networks), local area network(s), frame relay, and any combinations thereof. In addition, system 10 includes a plurality of web user computers 22 coupled to center 14 via infrastructure 18. Specifically, computers 22 communicate with a web server 24 at control center 14.

[0022] Vending machines 12 may be located at remote locations (i.e., not immediately adjacent) with respect to control center 14. For example, vending machines may be at various locations within a building, or within numerous buildings located throughout the world. Machines 12 also can be located outdoor at construction sites or near other work (e.g., a rail yard). Communications between vending machines 12 and control center 14 is “always on” since such communications occur via infrastructure 18. In one specific example, terminal servers 16 are single port terminal servers such as terminal servers commercially available from Patton Electronics Company (7622 Rickenbacker Drive, Gaithersburg, MD), Model No. 2120. Each terminal server establishes an outbound connection and such connection is maintained open (i.e., “always on”), which enables monitoring and control. Use of such terminal servers avoids a need for use of more expensive private LANs or other expensive networks between the vending machines and an application server 26. In addition, each terminal server 16 can be located within one of respective vending machines 12. Further, terminal servers 16 need not be uniquely addressable by application server 26 and therefore avoids the complexity of having to manage unique terminal server addresses at control center 14.

[0023] The “always on” status of vending machines 12 allows vending machines 12 to connect to control center 14 by initiation of socket communications from the vending machines. Each vending machine 12, via respective terminal server 16, initiates this socket communication on a user defined outbound connection. This allows vending machines 12 to be placed anywhere within a network, and allows vending machines 12 to be firewall friendly. Specifically, most firewalls are configured to allow unlimited outbound access. By having each vending
machine 12, via respective terminal server 16, initiate and establish the outbound connection to control center 14, the port being used for the communication is not exposed to inbound connections. Configured this way, firewall 54 is not forced to accept an inbound connection, which facilitates minimizing the risk to the network. Furthermore, because the outbound connection is initiated by vending machine 12, unfriendly parties can not spoof messages to look like messages from control center 14, and can not initiate denial of service attacks. Once the connection is initiated, the communications protocol ensures the “always on” state of the connection with the use of a “heart beat” request reply initiated by control center socket server 20.

[0024] Terminal servers 16 can be used in connection with applications other than vending to provide a simple and low cost manner in which to establish communications between equipment to be monitored/controlled and a controller (e.g., an application server). For example, a terminal server can be coupled to an automated teller machine (ATM) to enable low cost remote monitoring and control of such machine. Numerous other applications of such terminal servers in the context of communicating across a TCP/IP infrastructure with an application server are possible.

[0025] Control center 14 includes socket server 20 and web server 24 coupled to application server 26 through a firewall 28. The term “application server” as used herein generally refers to any programmable processor capable of performing the monitoring and control functions as described herein. An application server can be, for example, a general purpose computer programmed to perform specific functions, which functions are described below in detail. Application servers generally are well known in the art. Application server 26 is coupled to a database 30 (e.g., an Oracle database).

[0026] System administrators designated by the employer authorize users who vend items. Specifically, the administrators have access, via computers 22, to user information stored in database 30 via computers 22, allowing them to make updates and perform maintenance to data. Database 30 is a “real-time” accessible database of all employees and the information relative to their authorization to vend.
Initial setup can be done, for example, as a batch upload from a human resources system.

[0027] In addition to basic employee information, a dollar level of spending authorization, training identifiers on specified items, and a cost center identifier for tracking purposes are stored in database 30. Additional restrictions for vend authorization can be added if the market demands new or different variables. Information can be viewed and sorted by employee, dollar limit, budget amount used and budget amount remaining, and other variables. Administrative users are able to edit for some missing information such as cost centers. Business intelligence tools, such as the business intelligence software commercially available from Business Objects Americas, Inc., 3030 Orchard Parkway, San Jose, CA, or from Cognos Corporation, 67 South Bedford Street, Burlington, MA, can be used to perform analysis and reporting using the information stored in database 30. Such software can, for example, be loaded into application server 26 and used to generate reports accessible at computers 22 via web server 24. The business intelligence software can be used, for example, to determine patterns of usage and exceptions.

[0028] Prior to operation, an employer collects inventory and employee information, authorization levels and cost center data. This information is stored in database 30, and application server 26 is programmed to use this information in processes defined by the employer. For example, the employer designates, by authorized employee, the authorization levels, limits, and cost centers, as well as any other information the employer desires to use to control a vend. This information sometimes is referred to as the vend rules and procedures.

[0029] Vending machines are set up as they are added to the network, recording location, telecom information and basic data such as make and model. The machine’s product layout map is entered in database 30 and this layout can be updated periodically as changes are made, e.g., different products are added for vending. The layouts and transactions recorded by a particular machine can be viewed by a user at one of computers 22.
Further, a record of the items that can be placed in a vending machine is maintained in database 30. The employer sets up item specifications, including description, manufacturer, cost, and training restrictions. Using one of computers 22, a user can view all transactions for an item, and sorts can be made by person, location, cost and time period, and other variables.

To initiate a vend, an employee uses the vending machine keypad to input identification and item selection. The terminal server for the vending machine sends the information to the application server, which then executes the rules in accordance with the defined process. Specifically, and in one example, the application server verifies employment and vend authority (budget, training) based on the entered information. A vend command is then sent back to the vending machine if the vend is authorized, and the controller commands the appropriate machine motor to vend the designated item. The database is then updated with the vend information, and this data is immediately available for inquiry at computers 22. For example, summary reports can be run at any time.

In Figure 1, the dotted lines represent a vending machine session, and the solid lines represent a TCP/IP infrastructure session. The vending machine session is used to initiate and execute authorization and vend approval processes. The web browser session is used to initiate and execute remote administration, query, and report generation processes.

Via computers 22, as explained above, an administrator can view all transactions, sorted by date, person, item, cost, machine location, and other variables. Clients can manually add transactions to cover any manual dispensing or unusual events. In addition, a list of all unusual events such as batch uploads and error corrections is stored in database 30. These events can be sorted by entry source, employee, machine, and item, and other variables.

Of course, many alternative architectures can be used in connection with performing vend control operations as described herein. Figure 2, for example, is a schematic diagram of an alternative embodiment of a vending system.
50. Components in Figure 2 that are the same as the components in Figure 1 are identified in Figure 2 using the same reference numerals as used in Figure 2. In Figure 2, vending machines 12 and computers 22 are coupled via a local area network/wide area network 52, and communications via the Internet 18 are performed through a firewall 54. In addition, center 14 includes a firewall 56. The architecture illustrated in Figure 2 facilitates, for example, interconnection of all vending machines 12 across an enterprise with many different business locations, with one center 14.

[0035] The above described systems alleviate a need for either a separate "dumb" terminal or card management, which facilitates avoiding certain cost and space requirements. Specifically, a user simply enters a user identification number (and possibly also a password) into the keypad, along with an identification of the item desired for vending, and awaits authorization.

[0036] The embodiments described herein provide that vending machines 12 are connected by "always on" telecommunications to center 14. Response time is rapid, so the user is not waiting for an extended period of time at any one of machines 12 for approval provided that the user is authorized to receive the item. Center 14 also provides web access to vending and inventory information. Specifically, a user can obtain up-to-the minute information via one of computers 22. Customized reports can be defined within application server 26 so that an employer can obtain the desired information in the desired format. Reports are available in real-time to provide a variety of information. Typical data in a report includes the number of vends for a given item, employee, or month, dollar value of items vended, and similar information. Employee usage patterns can therefore be monitored to spot abuse, document potential litigation situations and provide overall inventory and expense control.

[0037] At a site where safety equipment is needed to perform a job, the system enables a person to key in (on a machine-mounted keypad) their user ID and a password in order to request a "vend". If that particular person is authorized to receive that piece of equipment, the vend is completed. Authorization and record
updates are accomplished in real time between the vending machine and the control center.

[0038] As one specific example, a controlled and monitored vending machine stocked with safety equipment for construction could be located at a construction site. Each of the participating contractors could enroll his employees and distribute authentication credentials (e.g., username and password or strong authentication such as a smartcard or secure ID or even biometric authentication). The machine may be completely unused during the course of construction but would provide value by satisfying the safety requirements for all of the participating enterprises. If supplies are issued, the charges generated could feed an appropriate financial system.

[0039] Similarly, and as another specific example, a vending machine could be stocked with office supplies and located in a shared office building, providing tight inventory control (no shrinkage due to theft or misplacement) and convenient distribution with chargeback.

[0040] In another specific example, a vending machine could be stocked with medical supplies at a health care provider. The dispensation of supplies to authorized and trained staff could be based on a combination of authentication of the health care provider and identification of the patient. Such vending could be used even for multiple health care providers sharing a facility.

[0041] Figure 3 illustrates vending machine 12 having various items (e.g., safety gloves) stored therein. Machine 12 includes a keypad 60 and a card reader 62 having a card slot 64 and a display 66. A user can enter user identification information and item identification information into keypad 60. Alternatively, the user can insert a card (e.g., having the employee identification information stored thereon) into card reader slot 64.

[0042] Many different items can be stored in vending machine 12, such as gloves, batteries, and safety equipment. Generally, if a user desires to vend a
particular item stored in machine 12, the user enters a user identification number into keypad 60 or inserts the user card into slot 64. The user also enters a product identification number into keypad indicating which item is desired for the vend. This information is then transmitted (e.g., via the terminal server to the application server) for validating the user and if validated, authorizing the vend. A command is then transmitted to vending machine 12 for executing the vend (e.g., energizing a motor to drive the appropriate coil in which the desired product is stored).

[0043] Figure 4 illustrates a bank 70 of vending machines 12 having various items stored therein. As shown in Figure 4, each vending machine 12 has a keypad 60 and card reader 62. Alternatively, and for vending machine bank 70, the machines can be networked and coupled to one keypad and card reader 62.

[0044] Figure 5 illustrates a close-up view of vending machine 12 having batteries stored therein. Many different types of products can be vended from machines 12, and the products selected for vending via the vending system can vary and be selected for many different reasons. For example, batteries may be selected for vending via the vending system since batteries may easily be taken and used by employees for unauthorized purposes, e.g., the batteries may be taken home and used for non-employment related purposes. By vending the batteries via the system, the number of batteries vended to each employee can be tracked and limited to a pre-designated quantity. If an employee has reached the pre-authorized number of batteries that can be vended but still needs additional batteries, the employee can then contact the appropriate manager and request authorization.

[0045] In addition, batteries may be needed for certain safety equipment. Since batteries are subject to shrinkage and improper use, batteries typically are locked in a store room or cabinet that most employees do not have access to other than during normal working hours. If the batteries are needed for an emergency at a time other than during normal working hours, the vending system allows employees to obtain such batteries in such situations.
[0046] Figure 6 illustrates a user inserting a card into a vending machine card reader 62. The user simply inserts the card into slot 64 and reader 62 then reads the card to obtain user information (e.g., a user identification number). The user then selects an item to be vended via the keypad, and the authorization process is initiated, as described above.

[0047] Figure 7 illustrates a portion of vending machine 12 having gloves stored therein. As explained above, many different items can be stored for vending in machines 12, and gloves are just one additional example of the types of items that can be vended.

[0048] The above described vending system facilitates improving current supply chain practice. Companies currently distribute equipment and other supplies, and experience costs and inefficiencies in the process. The above described system, however, brings real-time authorization and visibility, delivering value in terms of access control, usage reduction, liability control, and enhanced information. The system also facilitates reduction of supply usage.

[0049] Further, the system enables full-time and real-time access control for safety equipment or other items dispensed from its vending machines. The system is “always on”, so an employee does not have to wait for a human to be available to dispense supplies. Access is controlled by the “real-time” accessible database of authorized individuals. Employees can be added, budgets changed or training authority updated in real-time. Employees desiring to vend an item will receive immediate approval or denial from the system. The system actually controls rather than passively monitors usage.

[0050] More particularly, the system collects data by employee, vending machine, and item vended. Transactions also receive a date/time stamp. The information is available on a real-time basis. Analysis of this information can be conducted at any time from anywhere using the system web interface. Information is available by machine, employee, item, and date, for any specified time period. Also,
customized or standard reports can also be provided using the data stored in the database.

[0051] The system provides a wide variety of benefits as a result of the real-time visibility of inventory usage information and real-time decision making capability concerning the dispensing of supplies. Specifically, and with respect to access control and inventory usage tracking, only authorized individuals may vend a given item. Employees can be immediately added or removed from authorization lists. In addition, authorization can be based on matters such as training and budget levels. Such access control and the documentation of who uses what item also facilitates reducing unnecessary use and pilferage of consumables. Access control also documents availability and usage of safety supplies for liability records. Further, accurate usage data also facilitates proper departmental billing.

[0052] With respect to cost savings, companies can reduce the total use of consumable supplies and eliminate the need for humans to monitor supply bins. The ability to place machines in various locations around a plant also facilitates increasing productivity by putting supplies close to where they are needed and eliminating excessive “walking around”. Benefits can also be achieved in the area of centralized purchasing, which can be facilitated with collection of the vending machine data.

[0053] With respect to inventory efficiency, an employer can reduce amount of safety supply inventory needed on hand, and can document usage patterns to facilitate restocking. The system also facilitates supplier access to the system and on-hand inventory quantity monitoring.

[0054] Further, and with respect to safety, safety supply equipment availability facilitates proper equipment usage. The system also facilitates documenting the training authority to use such items, the availability of safety supplies, and an employee vending history.
[0055] In addition, the above described system can be modified so that information about each vending machine, inventories, received cash, temperature, on/off status, and other variables could be transferred to database 30, increasing an ability to manage the vending machines and inventory. The combination of active, real-time control of inventory over the TCP/IP infrastructure with record keeping facilitates locating inventory of supplies where needed (health, safety, regulatory compliance) or where wanted (convenience), and dispensed to authorized users in a secure manner.

[0056] While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.
WHAT IS CLAIMED IS:

1. A vending system comprising:
   at least one vending machine;
   a central control remote from and coupled to said vending machine, said
   central control configured to control vending of items from said vending machine.

2. A vending system according to Claim 1 wherein said vending machine
   comprises at least one of a keypad and a card reader.

3. A vending system according to Claim 1 further comprising a terminal
   server coupled to said vending machine, said terminal server configured to
   communicate with said central control.

4. A vending system according to Claim 1 wherein said central control
   comprises an application server programmed to control access to products contained
   within said vending machines and to record identification of products that have been
   vended, an identification of the person to whom the products have been vended, and a
   time at which the products are vended.

5. A vending system according to Claim 1 wherein said central control
   comprises an application server programmed to execute vend rules and processes, and
   a database coupled to said application server, said database having user information
   stored therein.

6. A vending system according to Claim 5 wherein said database has
   stored therein a dollar level of spending authorization, training identifiers on specified
   items, and a cost center identifier.

7. A vending system according to Claim 5 further comprising at least one
   computer coupled to said central control, said computer operable to view information
stored in said database, said information sortable by at least one of user, dollar limit, budget amount used and budget amount remaining.

8. A vending system according to Claim 1 wherein said central control comprises a database, and a product map of said vending machine is stored in said database, said product map identifying the items and item locations in said vending machine.

9. A method for controlling a vend from a vending machine, the vending machine coupled to a central control, said method comprising the steps of:
   receiving a user identification and request for a vend at the vending machine;
   transmitting the user identification and vend request to the central control;
   determining, at the central control, whether the user is authorized for the requested vend; and
   if the user is authorized for the requested vend, then authorizing the vend.

10. A method according to Claim 9 wherein the user identification is received via a keypad at the vending machine.

11. A method according to Claim 9 wherein the user identification is received via a card reader at the vending machine.

12. A method according to Claim 9 wherein the user identification is transmitted from the vending machine to the control center via TCP/IP infrastructure.

13. A method according to Claim 9 wherein the user identification comprises a username and a password.

14. A method according to Claim 9 wherein the user identification comprises at least one of a username, a password, a secure id, and a biometric indicator.
15. A method according to Claim 9 wherein the user identification is transmitted from the vending machine to the control center via at least one of a wide area network and a local area network.

16. A method according to Claim 9 wherein determining, at the central control, whether the user is authorized for the requested vend comprises the step of executing pre-defined vend rules.

17. A method according to Claim 16 wherein the pre-defined vend rules comprise at least one of by authorized user, authorization levels, limits, and cost centers.

18. A database for a vending system, said database configured to store records relating to vendings therein, said database further having data regarding individual authorized to perform a vend stored therein.

19. A database according to Claim 18 further comprising at least one of, by user, a dollar level of spending authorization, training identifiers on specified items, and a cost center identifier.

20. A database according to Claim 18 wherein data stored therein can be sorted by at least one of user, dollar limit, and budget amount used and budget amount remaining.

21. Apparatus comprising:
   a device to be monitored;
   a terminal server coupled to said device; and
   a central control remote from and coupled to said terminal server, said central control configured to monitor said device via said terminal server.
22. Apparatus according to Claim 21 wherein said terminal server comprises a single port terminal server.

23. Apparatus according to Claim 21 wherein said terminal server communicates with said central control via a TCP/IP infrastructure.

24. Apparatus according to Claim 21 wherein said central control comprises a socket server.

25. Apparatus according to Claim 21 wherein said terminal server establishes an outbound connection with said central control, and said outbound connection is maintained by a request reply initiated by said central control.
INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/00271

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G07F 11/00; G06F 17/00
US CL : 221/7; 700/241
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)
U.S. : 221/7, 9, 13, 75, 131, 124; 700/231, 241, 244

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>A</td>
<td>US 5,307,941 A (SIEGAL) 03 May 1994 (03.05.1994), see entire document.</td>
<td>1-25</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

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