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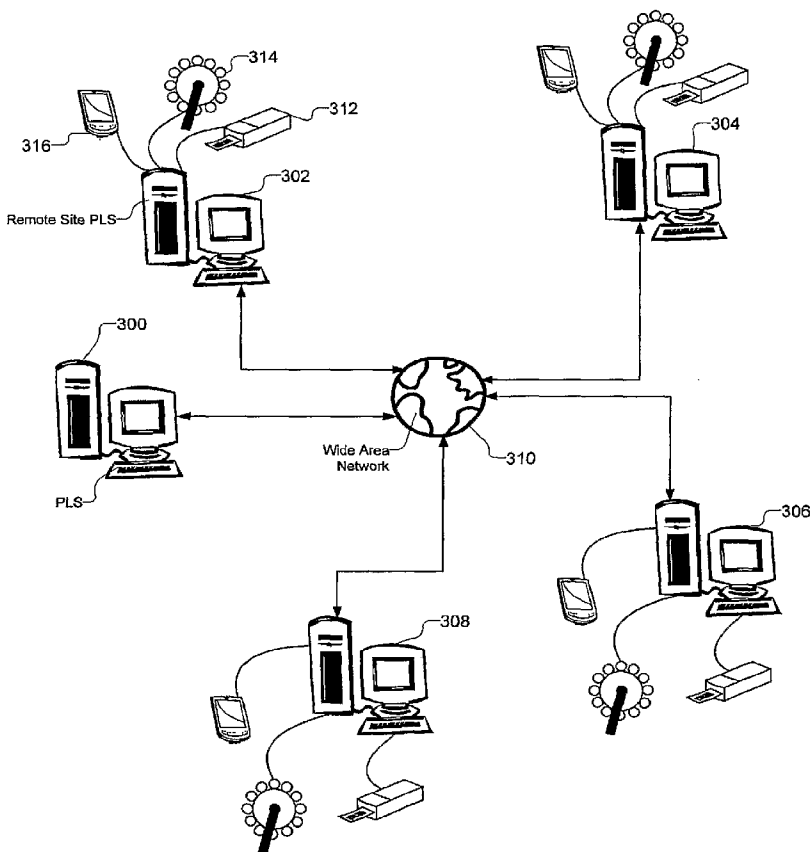
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(54) Title: METHODS AND APPARATUS FOR A PRODUCE LABELING SYSTEM



(57) Abstract: A Produce Labeling System which interfaces with one or more label printers, label applicators, and produce grading devices for the capture and processing of data including but not limited to growers, producers, suppliers, lots, and SKU, among others, creating labels for produce, managing all label printers, label applicators, and produce grading devices utilized in such a system, including but not limited to configuration, troubleshooting, and reporting of such, as well as processing data related to traceability of produce and creating security records and identification for suppliers in the system. The PLS includes processes and/or devices enabling global traceability of produce labeled utilizing the system. The PLS may interleave operations of the connected label printers whereby the PLS and components thereof will continue to operate even if one or more label printers are out of service.

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METHODS AND APPARATUS FOR A PRODUCE LABELING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 60/808,883, filed May 26, 2006, the contents of which are hereby incorporated by reference as if fully stated herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] This invention relates to labeling of produce, more specifically to a produce labeling system which interfaces with one or more label printers, label applicators, and produce grading devices for the capture and processing of data including but not limited to growers, producers, suppliers, lots, grade, and SKU, among others, creating labels for produce, managing all label printers, label applicators, and produce grading devices utilized in such a system, including but not limited to configuration, troubleshooting, and reporting of such, as well as processing data related to traceability of produce and creating security records and identification for suppliers in the system.

Background

[0003] There currently exist various systems and apparatuses for the labeling of produce. These systems and apparatuses include a label printer for generating produce labels, a label applicator for applying a label on produce; and a produce grading device for grading produce.

[0004] Most of these systems and/or apparatuses function in a standalone environment or with a specific device, meaning that, for instance, a computerized system for a label applicator only operates with one or more label applicators. Another example is a produce grading device used to grade produce but not connected to a computerized system. Both examples do not provide connectivity to a host system for data exchange with the other components used in the labeling of produce or with other locations of the same business.

[0005] As more business enterprises such as major retailers expand into the international or global market by way of additional storefront locations, business partnerships, etc., for the import or export of products such as produce, a need exists for the collaboration of worldwide produce supplier data for the retailer to aid in global traceability of harmful produce or tampered produce, among others potentially identified within the retailer's supply chain. This data collaboration requires data beginning with each grower or orchard through all associated produce businesses to the consumer point of sale. This data includes data on growers, subcontractors, brokers, contractors, processors, producers, and wholesalers as well as produce delivery data. Furthermore, regulations set forth in the Bioterrorism Act of 2002 in the United States have warranted a time period not to exceed 24 hours from receipt of an official request for a business such as a retailer to reply to the request. Additionally, depending on the size of the business, records must be retained anywhere from six months to two years.

[0006] This need further necessitates that each produce supplier be verified and authorized as a secured supplier to the retailer. The purpose of this need is to ensure all produce businesses which come into contact with any produce offered by the retailer are a secured source of produce.

DEFINITIONS

[0007] For the purposes of this document the following definitions apply:

[0008] "Host System" – a server, a computer connected to a network, or a stand alone computer which is used for application and data storage, data processing, and file transfers.

[0009] "Label Printer" – a printing device used to print and/or encode a label.

[0010] "Printer Controller" – a device internal or external to a printer which controls print jobs and receives and/or transmits data, among other functions.

[0011] "Labels" – an identifying or descriptive marker that is attached to an object such as fruit.

[0012] "Label Media" – media used in a label printer for printing, reading and/or writing labels such as media with a magnetic stripe, media with a layer of writable and erasable thermally sensitive film, and media containing Radio Frequency active, passive, or both elements, among others.

[0013] “Supplier” – a business entity or individual whose business is to supply a particular service or commodity including, but not limited to, supplies, raw materials, components, intermediate assemblies, or finished products, such as an individual, grower, subcontractor, broker, contractor, processor, producers, and wholesaler, among others.

[0014] “SKU” – acronym for Stock Keeping Unit, a unique code usually consisting of numbers and letters assigned to a produce for identification and inventory control.

SUMMARY OF THE INVENTION

[0015] The invention provides an improved method and apparatus for forming a complete system that interfaces with all components used in produce labeling. The system provides for detecting when a component is added or removed. In addition, the system provides for interfacing with other locations of the same business.

[0016] The invention also provides for global traceability of produce labeled using the system. In addition, the invention provides for electronic records for the mandated record retention as well as secured accessibility to such, among others. Furthermore, the invention provides verification of produce suppliers as well as issuing a secured ID to each authorized produce supplier.

[0017] A Produce Labeling System (herein referred to as “PLS”) interfaces with one or more label printers, label applicators, and produce grading devices for the capture and processing of data including but not limited to growers, producers, suppliers, lots, and SKU, among others. The PLS creates labels for produce, managing all label printers, label applicators, and produce grading devices utilized in such a system, including but not limited to configuration, troubleshooting, and reporting of such, as well as processing data related to traceability of produce and creating security records and identification for suppliers in the system. The PLS includes the ability to globally trace produce labeled utilizing the system. The PLS may interleave operations of the connected label printers whereby the PLS and components thereof will continue to operate even if one or more label printers are out of service.

[0018] In another aspect of the invention, the PLS is coupled to a central controller, one or a plurality of label printers, one or a plurality of label applicators, and one or a plurality of produce grading devices.

[0019] In another aspect of the invention, the PLS includes the processes and/or devices to function as a modular system for printing labels on demand for produce, and applying them to the produce whereby the PLS may include (a) one or more label printers, (b) one or more label applicators, (c) one or more produce real time grading devices, (d) an interface controller to gate grading signaling output by the grading equipment to the label printers, and (e) a central controller connected to the label printer(s), among others.

[0020] In another aspect of the invention, the PLS recognizes when a new label printer goes online wherein the application of the plug-and-play technology within the PLS may be utilized as a link between the central controller and one or a plurality of label printers, allowing one or a plurality of label printers to be added or removed from the PLS without downtime or with minimal downtime.

[0021] In another aspect of the invention, the PLS recognizes when a new label applicator goes online wherein the application of the plug-and-play technology within the PLS may be utilized as a link between the central controller and one or a plurality of label printers, allowing one or a plurality of label applicators to be added or removed from the PLS without downtime or with minimal downtime.

[0022] In another aspect of the invention, the PLS recognizes when a new produce grading device goes online wherein the application of the plug-and-play technology within the PLS may be utilized as a link between the central controller and one or a plurality of label printers, allowing one or a plurality of produce grading devices to be added or removed from the PLS without downtime or with minimal downtime.

[0023] In another aspect of the invention, the preferred application of the plug-and-play technology is Universal Serial Bus (herein referred to as "USB").

[0024] In another aspect of the invention, the PLS includes the processes and/or devices to generate and issue a secured ID. In this aspect, each supplier is given a secured ID for security purposes. The secured ID may be used during delivery of products to verify/authenticate one or more lots. The PLS may include a method to transfer supplier information from a delivery vehicle or transporter of produce to the PLS by way of an electronic device, such as a magnetic stripe card, smart card, memory stick, USB drive stick, etc. The content of such data may contain identification of the supplier, or metrics related to the produce such as: (a) orchard of origin, (b) orchard segment where harvested, (c) delivery

route to the plant, (d) date of harvest, (e) delivery service, and (f) country of origin, among others.

[0025] In another aspect of the invention, the PLS includes the processes and/or devices to track and revoke a previously issued secured ID.

[0026] In another aspect of the invention, a secured ID includes a preferred format of six digits and one alpha character.

[0027] In another aspect of the invention, a central controller, label applicator, interface controller, and label printer may include the processes and/or devices to support two or more label printers operating in an interleaved or simultaneous fashion such that the following modes of operation may be supported: (a) the label media loaded into the label printers may contain pre-printed indicia, there being a plurality of pre-printed indicia label varieties loaded into one or more label printers, one or more label printers may contain specific pre-printed indicia labels activating to print a label which is then applied to a particular piece of produce, all in response to signaling from one or more produce grading devices, the central controller, or both, (b) the ability to interleave operation so as to ensure that labeling continues if one or more of the label printers require servicing, and (c) the ability to label produce with more than one label, among others.

[0028] In another aspect of the invention, the central controller coupled to one or more label printers includes the processes and/or devices for bi-directional communications.

[0029] In another aspect of the invention, the central controller coupled to one or more label applicators includes the processes and/or devices for bi-directional communications.

[0030] In another aspect of the invention, the central controller coupled to one or more produce grading devices includes the processes and/or devices for bi-directional communications.

[0031] In another aspect of the invention, the central controller of the PLS coupled to one or more label printers includes the processes and/or devices to allow an operator to create labels for download to each label printer, such labels containing information related to a product SKU, and lot trace information, among others. The labels may be created on an auxiliary computer which is connected to the central controller, signaling the central controller with the data to be contained on the printed labels. A label design function may allow real-time produce grading data and information related to the type of produce to be encoded into a barcode which is printed on labels in response to signaling from the grading

device placed on to the label, such information may be overlaid on a fixed portion of the printed indicia on the label providing information related to the lot code, date and other information related to the batch run.

[0032] In another aspect of the invention, the central controller of the PLS connected to a wide area network, such as the internet or intranet, may include the processes and/or devices to monitor: (a) produce label usage, (b) lot code batch sizes, (c) lot code processing date, (d) remote diagnostics of the system, and (e) the ability to enable operation of the label printer to produce a designated amount of labels, among others.

[0033] In another aspect of the invention, the central controller of the PLS connected to a local area network may include the processes and/or devices to monitor: (a) produce label usage, (b) lot code batch sizes, (c) lot code processing date, (d) remote diagnostics of the system, and (e) the ability to enable operation of the label printer to produce a designated amount of labels, among others.

[0034] In another aspect of the invention, the PLS coupled to a central controller includes the processes and/or devices to transmit static and dynamic data downloads to one or a plurality of label printers. The label printer includes the processes and/or devices to receive signaling from a central controller related to data for label images, the ability to hold said label image data in its memory in a dynamic or static fashion, the label printer further having the ability to combine said data with data signaled to it from the central controller, the interface controller, or the grading equipment in a real time fashion, and the ability to combine both data into a composite image which may be printed upon the loaded label media, among others.

[0035] In another aspect of the invention, the PLS includes the processes and/or devices to transmit and receive signals when any malfunction is detected with the system.

[0036] In another aspect of the invention, the PLS includes the processes and/or devices to transmit and receive signals when any malfunction is detected with any label applicator coupled to the PLS.

[0037] In another aspect of the invention, the PLS includes the processes and/or devices to transmit and receive signals when any malfunction is detected with any label printer coupled to the PLS.

[0038] In another aspect of the invention, the PLS includes the processes and/or devices to transmit and receive signals when any malfunction is detected with any produce grading device coupled to the PLS.

[0039] In another aspect of the invention, the PLS includes the processes and/or devices for traceability through a supply chain, from grower or orchard to consumer point of sale wherein traceability may include global traceability.

[0040] In another aspect of the invention, the PLS includes the processes and/or devices to create a configuration file for a label, said configuration file may be based on a SKU generator and may include Sugar, Size, Maturity, Grade, Lot Code, Date, Born on Date, and Barcode, among others.

[0041] In another aspect of the invention, the PLS includes the processes and/or devices to transmit one or a plurality of configuration files to one or a plurality of label printers coupled to the PLS.

[0042] In another aspect of the invention, the PLS includes the processes and/or devices to identify and track labels used, generated, and applied for the purpose of produce traceability, among others.

[0043] In another aspect of the invention, the PLS includes the processes and/or devices to produce or generate security records for traceability through a supply chain, global traceability, or both.

[0044] In another aspect of the invention, the PLS coupled to one or a plurality of label printers includes the processes and/or devices to generate one or a plurality of labels.

[0045] In another aspect of the invention, the PLS coupled to one or a plurality of label applicators includes the processes and/or devices to apply one or a plurality of labels on produce.

[0046] In another aspect of the invention, the PLS coupled to one or a plurality of produce grading devices includes the processes and/or devices to grade produce.

[0047] In another aspect of the invention, a label printer may include one or a plurality of label media, said label media may include varying sizes, said printer may use configuration file to determine which label media to use to generate one or a plurality of labels.

[0048] In another aspect of the invention, the PLS includes the processes and/or devices to download data to one or a plurality of label printers, said data may include static and dynamic data, said label printer storing said data in its memory.

[0049] In another aspect of the invention, the PLS includes the processes and/or devices to collect and disperse data related to each coupled label printer, supplier information, produce information, and label media information, among others.

BRIEF DESCRIPTION OF THE DRAWINGS

[0050] These and other features, aspects, and advantages of the invention will become better understood with regard to the following description and accompanying drawings where:

[0051] FIG. 1 is a diagram of the PLS and components thereof in accordance with an exemplary embodiment of the invention;

[0052] FIG. 2 is a block diagram of the PLS and components thereof in accordance with an exemplary embodiment of the invention;

[0053] FIG. 3 is an illustration of the PLS and components thereof in a wide area network environment in accordance with an exemplary embodiment of the invention;

[0054] FIG. 4 is a process diagram of the real-time monitoring of device connections to the PLS in accordance with an exemplary embodiment of the invention;

[0055] FIG. 5 is a process diagram of the real-time monitoring of device disconnections from the PLS in accordance with an exemplary embodiment of the invention;

[0056] FIG. 6 is a process diagram of the supplier data collection and verification process within the PLS in accordance with an exemplary embodiment of the invention;

[0057] FIG. 7 is a process diagram of printing more than one label on a label printer connected to the PLS in accordance with an exemplary embodiment of the invention;

[0058] FIG. 8 is an illustration depicting how labels may be designed and ultimately applied to produce in accordance with an exemplary embodiment of the invention;

[0059] FIG. 9 is an illustration depicting the traceability of produce from within the PLS in accordance with an exemplary embodiment of the invention; and

[0060] FIG. 10 is an illustration of the data tables in the PLS in accordance with an exemplary embodiment of the invention.

DETAILED DESCRIPTION

[0061] FIG. 1 is a diagram of a PLS and components thereof in accordance with an exemplary embodiment of the invention. Any component may be optional.

[0062] As illustrated, the PLS 100 includes a processor 102, application code 104 executable by the processor stored in a computer-readable storage medium, memory 106, data storage 108, and procedures 110 encoded in the application code and executable by the processor. Exemplary devices for the PLS include a traditional network server, general purpose computer, programmable controller or the like. The PLS 100 further includes one or more interfaces coupled to external devices. These interfaces include an interface to a central controller 112, an interface to or more label printers 114, an interface to one or more produce grading devices 116, an interface to one or more label applicators 118, an administrator link 120 and one or more interfaces to other devices 122.

[0063] In FIG. 1, the processor executing the application code and using memory, storage, and procedures, includes the processes and/or devices to create and maintain one or a plurality of relational databases for storing data related to the following, among others:

- (a) supplier information, then recalling any of that data at any time to create a secured ID card for one or a plurality of suppliers, though a coupled label printer, either directly or through a coupled component such as a gateway or other.
- (b) label usage, then recalling any of that data at any time and transmitting that data to a coupled component or interface, the database further identifying the number of labels or designated labels each coupled label printer may produce or generate.
- (c) security records, then recalling any of that data at any time, for example, to generate a report or statistics regarding supplier information, supply chain traceability, and global traceability, among others.
- (d) printer configuration, then recalling any of that data at any time and transmitting that data to any coupled label printer.

- (e) label design and configuration, then recalling any of that data at any time and transmitting that data to any coupled label printer for the generation of one or a plurality of labels.
- (f) printer diagnostics signaled and transmitted from any coupled label printer to the PLS, then recalling any of that data at any time to, for example, identify and potentially correct a printer malfunction, troubleshoot or maintain a label printer, or report the wrong type of label media in a label printer.
- (g) system diagnostics signaled and transmitted from any component of the PLS such as the application code, then recalling any of that data at any time to, for example, identify and potentially correct a system malfunction, among others.
- (h) label applicator diagnostics signaled and transmitted from any coupled label applicator to the PLS, then recalling any of that data at any time to, for example, identify and potentially correct a label applicator malfunction, among others.
- (i) produce grading device diagnostics signaled and transmitted from any coupled produce grading device to the PLS, then recalling any of that data at any time to, for example, identify and potentially correct a produce grading device malfunction, among others.

[0064] Additionally, the processor executing the application code and using memory, storage, and procedures, includes the processes and/or devices to capture and process data related to the following, among others:

- (a) any additional device connections made to the PLS, the data including a unique identifier for each device as well as device type such as a label printer as later disclosed in FIG. 4.
- (b) any device disconnections from the PLS, the data including a unique identifier for each device as well as device type such as a label printer as later disclosed in FIG. 5.
- (c) rerouting the printing of labels to another coupled label printer should any print jobs exist on a label printer disconnected from the PLS as later disclosed in FIG. 5.
- (d) secured ID issuance, the data may include checks and verifications with external sources such as the Food and Drug Administration (“FDA”), United

States Department of Agriculture (“USDA”), and/or any foreign counterparts as later disclosed in FIG. 6.

- (e) traceability through the supply chain, which may include global traceability, the data may include grower, lot, processor, country of origin, shipping/delivery information, among others.
- (f) the creation of one or a plurality of labels, the data including static and dynamic data.
- (g) the generation of labels by any coupled label printer, the data including static and dynamic data.
- (h) the issuance of labels by any coupled label applicator, the issuance may further include data from a coupled produce grading device.
- (i) the record and log of its activities for statistical and monitoring purposes.
- (j) the transfer of statistical data and activity logs and records to the system administrator or to external sources.
- (k) accept programming through its interface to an administrator as to the procedures, metrics, and other information for example, for the creation of a produce label or plurality of such, system upgrades, remote site information or upgrades, among others.
- (l) request data exchange through the PLS’s interface to a central controller for processing any data previously disclosed and further disclosed in FIG. 10.
- (m) request data exchange through the PLS’s interface with one or a plurality of label printers for label printing, printer configuration, and printer diagnostics, among others, the data previously disclosed and further disclosed in FIG. 10.
- (n) request data exchange through the PLS’s interface with one or a plurality of produce grading devices for produce grading, device diagnostics, and grade determinations, among others, the data previously disclosed and further disclosed in FIG. 10.
- (o) request data exchange through the PLS’s interface with one or a plurality of label applicators for label application, label configuration, number of labels to apply, number of labels applied, and applicator diagnostics, among others, the data previously disclosed and further disclosed in FIG. 10.
- (p) request data exchange through Other(s), which may be any other system, network, or device such as a routing device internal or external to the business for processing data related to, for example, supplier verification, global

traceability, data import, or data export, among others, the data previously disclosed and further disclosed in FIG. 10.

[0065] Any or all of the data may be stored locally or transmitted to and from, for example, a central controller.

[0066] The interfaces 112, 114, 116, 118, 120 and 122 include the protocols, messaging logic, hardware, and buffering necessary to exchange data with the processor and application code of the PLS using bi-directional communications and the:

- (a) Central Controller
- (b) Label Printer(s)
- (c) Produce Grading Device(s)
- (d) Label Applicator(s)
- (e) Administrator Link
- (f) Other(s)

[0067] A number of the interfaces for the system may exist on the same physical hardware connection, the attached devices being individually or group-addressable nodes on that connection.

[0068] FIG. 2 is a block diagram of a PLS and components thereof in accordance with an exemplary embodiment of the invention. Any component may be optional.

[0069] As shown, the PLS is coupled to a central controller 202, one or more label printers 202, one or more produce grading devices 204, and one or more label applicators 206.

[0070] The central controller may be used to process any data previously disclosed and as further disclosed in FIG. 10 such as supplier verification data or label configuration data.

[0071] The label printer(s) may be used to generate one or a plurality of labels to be applied to produce. Each label printer may include a processor, memory, firmware, procedures, programming logic, print mechanism, a storage device, a printer controller, and a plurality of communication interfaces such as a communication port or driver. Each label printer also may include label media onto which data is generated by the label printer to create a readable label, either machine readable, human readable, or a combination thereof.

[0072] The label applicator(s) may be used to apply one or a plurality of labels to produce.

[0073] The produce grading device(s) may be used to grade produce. Each produce grading device may include a handheld or mobile device which may be used to signal and transmit data to the PLS, to one or a plurality of label printers, or both.

[0074] FIG. 3 is an illustration of a PLS and components thereof in a wide area network environment in accordance with an exemplary embodiment of the invention.

[0075] As illustrated, the PLS 300 is coupled to multiple remote site PLSs, such as PLSs 302, 304, 306 and 308 using a wide area network 310. The wide area network serves as the bi-directional communication link for the PLS and each remote site PLS. An exemplary wide area network is the Internet.

[0076] The components of the PLS may include any of those previously described in FIG. 1 and FIG. 2. In this embodiment, the PLS is segmented with the PLS functioning as a host system or central controller and each remote site PLS functioning as a point for label generation, grading, and application. With reference to PLS 302, each remote site PLS is coupled to one or a plurality of label printers 312, one or a plurality of label applicators 314, and one or a plurality of produce grading device 316.

[0077] To illustrate, data from the PLS 300 may be transmitted through a wide area network 310 to one or a plurality of remote site PLSs 302, 304, 306 and 308. One example of this data is data related to a secured ID issued to a supplier where the remote site PLS may be a location in proximity to the supplier for delivery of produce. Another example of this data may be a particular label design including static and dynamic data.

[0078] Upon receiving signaling from the PLS 300, a remote site PLS may further transmit the data to any or all of its coupled components, depending on the data received. One or a plurality of label printers may use the transmitted data to generate one or a plurality of labels. Once the labels are generated, a coupled label applicator may be used to apply one or a plurality of labels on produce. Additionally, data from one or a plurality of produce grading devices at a remote site PLS may be used to generate produce grade information which may be generated on a separate label or included with an existing label.

[0079] To further illustrate, data from a remote site PLS may be transmitted back to the PLS 300. One example of this data is diagnostics related to the system, one or a plurality of label printers, one or a plurality of label applicators, and/or one or a plurality of produce grading devices. Another example of this data is a report on the total number of labels produced at a remote site PLS.

[0080] In another embodiment, the PLS and components thereof use a local area network. In yet another embodiment, the PLS and components thereof may use a standalone system.

[0081] In another PLS in accordance with an exemplary embodiment of the invention, a central controller, label applicator, interface controller, and label printer may include the processes and/or devices to support two or more label printers operating in an interleaved or simultaneous fashion such that the following modes of operation may be supported: (a) the label media loaded into the label printers may contain pre-printed indicia, there being a plurality of pre-printed indicia label varieties loaded into one or more label printers, one or more label printers may contain specific pre-printed indicia labels activating to print a label which is then applied to a particular piece of produce, all in response to signaling from one or more produce grading devices, the central controller, or both, (b) the ability to interleave operation so as to ensure that labeling continues if one or more of the label printers require servicing, and (c) the ability to label produce with more than one label, among others.

[0082] In another PLS in accordance with an exemplary embodiment of the invention, the central controller coupled to one or more label printers includes the processes and/or devices for bi-directional communications.

[0083] In another PLS in accordance with an exemplary embodiment of the invention, the central controller coupled to one or more label applicators includes the processes and/or devices for bi-directional communications.

[0084] In another PLS in accordance with an exemplary embodiment of the invention, the central controller coupled to one or more produce grading devices includes the processes and/or devices for bi-directional communications.

[0085] In another PLS in accordance with an exemplary embodiment of the invention, the central controller of the PLS coupled to one or more label printers includes the processes and/or devices to allow an operator to create labels for download to each label printer, such labels containing information related to a product SKU, and lot trace information, among others. The labels may be created on an auxiliary computer which is connected to the central controller, signaling the central controller with the data to be contained on the printed labels. A label design function may allow real-time produce grading data and information related to the type of produce to be encoded into a barcode which is printed on labels in response to signaling from the grading device placed on to the label, such information may be overlaid on

a fixed portion of the printed indicia on the label providing information related to the lot code, date and other information related to the batch run.

[0086] In another PLS in accordance with an exemplary embodiment of the invention, the central controller of the PLS connected to a wide area network, such as the internet or intranet, may include the processes and/or devices to monitor: (a) produce label usage, (b) lot code batch sizes, (c) lot code processing date, (d) remote diagnostics of the system, and (e) the ability to enable operation of the label printer to produce a designated amount of labels, among others.

[0087] In another PLS in accordance with an exemplary embodiment of the invention, the central controller of the PLS connected to a local area network may include the processes and/or devices to monitor: (a) produce label usage, (b) lot code batch sizes, (c) lot code processing date, (d) remote diagnostics of the system, and (e) the ability to enable operation of the label printer to produce a designated amount of labels, among others.

[0088] FIG. 4 is a process diagram of the real-time monitoring of device connections to a PLS in accordance with an exemplary embodiment of the invention.

[0089] In one PLS in accordance with an exemplary embodiment of the invention, the PLS recognizes when a new label printer goes online wherein the application of the plug-and-play technology within the PLS may be utilized as a link between the central controller and one or a plurality of label printers, allowing one or a plurality of label printers to be added or removed from the PLS without downtime or with minimal downtime.

[0090] In another PLS in accordance with an exemplary embodiment of the invention, the PLS recognizes when a new label applicator goes online wherein the application of the plug-and-play technology within the PLS may be utilized as a link between the central controller and one or a plurality of label printers, allowing one or a plurality of label applicators to be added or removed from the PLS without downtime or with minimal downtime.

[0091] In another PLS in accordance with an exemplary embodiment of the invention, the PLS recognizes when a new produce grading device goes online wherein the application of the plug-and-play technology within the PLS may be utilized as a link between the central controller and one or a plurality of label printers, allowing one or a plurality of produce grading devices to be added or removed from the PLS without downtime or with minimal downtime.

[0092] As illustrated, the process begins (400) with real-time monitoring (402) of the PLS system and components thereof. When a device connection is detected (404) by the PLS, for example, a label printer, the PLS is notified and data (408) regarding that device such as an ID, the location, or other data is transmitted to the PLS. If the PLS accepts (410) the device, the PLS and components thereof update (412) to reflect the addition of the device, after which the process returns to the real-time monitoring. Optionally, a configuration file may be transmitted (414) to the device after which the process may return to the real-time monitoring.

[0093] If the PLS does not accept the device for reasons such as a device malfunction or improper device ID, the PLS is notified (416), potentially, with a log being made in the database noting the rejection of a device. After the notification, the process may return to the real-time monitoring.

[0094] This process may repeat for each device connection detected. Examples of a connection made to the PLS includes a USB port, serial port, and parallel port.

[0095] FIG. 5 is a process diagram of the real-time monitoring of device disconnections from the PLS in accordance with an exemplary embodiment of the invention.

[0096] As illustrated, the process begins (500) with real-time monitoring (502) of the system and components thereof. When a device disconnect is detected by the PLS (504), for example, a label printer, the PLS is notified (506). Data 508 regarding that device such as an ID, the location, or other data may be used to determine which device and where it was disconnected. If the process determines (510) job(s) were in progress with the disconnected device, the job(s) are rerouted (512) to other similar devices coupled to the PLS. For example, print jobs may be rerouted to another label printer or label applications may be rerouted to another label applicator. Examples of a job in progress include label printing, label grading, and label application.

[0097] The PLS and components thereof update to reflect the device disconnect after which the process may return to real-time monitoring.

[0098] If there are no job(s) in progress, the process continues with the PLS and components thereof updated to reflect the device disconnect after which the process may return to real-time monitoring.

[0099] This process may repeat for each device disconnect detected.

[00100] In one PLS in accordance with an exemplary embodiment of the invention, the preferred application of the plug-and-play technology is Universal Serial Bus (herein referred to as "USB").

[00101] FIG. 6 is a process diagram of the supplier data collection and verification process within the PLS in accordance with an exemplary embodiment of the invention.

[00102] As illustrated, the process begins (600) with the supplier data collected (602). The supplier data may include any or all of the data later disclosed in FIG. 10 as well as other types of supplier data not disclosed but known to those skilled in the art.

[00103] The supplier data is then processed (604) by the PLS and components thereof. For example, supplier data may be checked (606) against external systems, such as any system in use by the FDA, USDA, police, or other foreign counterpart as well as internal systems, such as a system used to identify disapproved suppliers.

[00104] If the data is verified (608), a secured ID is issued (610) to the supplier. The PLS and components thereof are updated (612) and the process ends (614).

[00105] If the data is not verified, the supplier is notified (616). The PLS and components thereof are updated and the process ends. Optionally, after the supplier is notified, the process may return to the collection of supplier data where the supplier may revise information if needed, depending on the type of rejection received.

[00106] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to generate and issue a secured ID. In this aspect, each supplier is given a secured ID for security purposes. The secured ID may be used during delivery of products to verify/authenticate one or more lots. The PLS may include a method to transfer supplier information from a delivery vehicle or transporter of produce to the PLS by way of an electronic device, such as a magnetic stripe card, smart card, memory stick, USB drive stick, etc. The content of such data may contain identification of the supplier, or metrics related to the produce such as: (a) orchard of origin, (b) orchard segment where harvested, (c) delivery route to the plant, (d) date of harvest, (e) delivery service, and (f) country of origin, among others.

[00107] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to track and revoke a previously issued secured ID.

[00108] In another PLS in accordance with an exemplary embodiment of the invention, a secured ID includes a preferred format of six digits and one alpha character.

[00109] FIG. 7 is a process diagram of printing more than one label on a label printer connected to the PLS in accordance with an exemplary embodiment of the invention.

[00110] As illustrated, the process begins (700) with the number of labels identified (702). Once determined, the print job(s) are transmitted (704) to one or a plurality of label printers to generate the specified number of labels for each piece of produce. Each print job may contain data (706) such as static data, dynamic data, one or a plurality of barcodes, and other types of data. During this portion of the process, data and information regarding print jobs and number of labels used in printing, among others may be transmitted to and from the PLS for real-time monitoring (708) of the process.

[00111] Each label (such as labels 709) is then printed (710) and applied to each piece of produce. During this portion of the process, data and information regarding the printing and application of each label, among others may be transmitted to and from the PLS for real-time monitoring (708) of the process. For example, in one embodiment a label printer may print two labels, label A and label B. Label A may be printed using one size label while label B may be printed using another size label. After the label printer generates both labels, a label may be used to apply (712) label A and label B to each piece of produce. Any error or malfunction in printing or application of a label may be reported by the real time monitoring (708) to the PLS and logged in a database.

[00112] FIG. 8 is an illustration depicting how labels may be designed and ultimately applied to produce in accordance with an exemplary embodiment of the invention.

[00113] As illustrated, one or more labels (800) are designed using the PLS (802) after which a configuration file 804 which may contain the contents of the label design is transmitted to a coupled label printer 806. Grading data 808 from a produce grading device 810 also may be transmitted to the label printer, the grading data may be included on the same label or a separate label. The label printer then generates each necessary label. When done, the labels are placed on a label applicator 812 and ultimately placed on produce 814.

[00114] Additionally, data for each label printer 816, data for each produce grading device 818, and data for each label applicator 820 may be transmitted to and from the PLS. These types of data may be useful in determining the number of labels produced, the types of labels

produced, the number of labels applied, and any errors or malfunctions with any label printer, produce grading device, or label applicator, among other types of data.

[00115] In one PLS in accordance with an exemplary embodiment of the invention, the central controller of the PLS coupled to one or more label printers includes the processes and/or devices to allow an operator to create labels for download to each label printer, such labels containing information related to a product SKU, and lot trace information, among others. The labels may be created on an auxiliary computer which is connected to the central controller, signaling the central controller with the data to be contained on the printed labels. A label design function may allow real-time produce grading data and information related to the type of produce to be encoded into a barcode which is printed on labels in response to signaling from the grading device placed on to the label, such information may be overlaid on a fixed portion of the printed indicia on the label providing information related to the lot code, date and other information related to the batch run.

[00116] In one PLS in accordance with an exemplary embodiment of the invention, the central controller of the PLS connected to a wide area network, such as the internet or intranet, may include the processes and/or devices to monitor: (a) produce label usage, (b) lot code batch sizes, (c) lot code processing date, (d) remote diagnostics of the system, and (e) the ability to enable operation of the label printer to produce a designated amount of labels, among others.

[00117] In one PLS in accordance with an exemplary embodiment of the invention, the central controller of the PLS connected to a local area network may include the processes and/or devices to monitor: (a) produce label usage, (b) lot code batch sizes, (c) lot code processing date, (d) remote diagnostics of the system, and (e) the ability to enable operation of the label printer to produce a designated amount of labels, among others.

[00118] In one PLS in accordance with an exemplary embodiment of the invention, the PLS coupled to a central controller includes the processes and/or devices to transmit static and dynamic data downloads to one or a plurality of label printers. The label printer includes the processes and/or devices to receive signaling from a central controller related to data for label images, the ability to hold said label image data in its memory in a dynamic or static fashion, the label printer further having the ability to combine said data with data signaled to it from the central controller, the interface controller, or the grading equipment in a real time

fashion, and the ability to combine both data into a composite image which may be printed upon the loaded label media, among others.

[00119] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to transmit and receive signals when any malfunction is detected with the system.

[00120] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to transmit and receive signals when any malfunction is detected with any label applicator coupled to the PLS.

[00121] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to transmit and receive signals when any malfunction is detected with any label printer coupled to the PLS.

[00122] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to transmit and receive signals when any malfunction is detected with any produce grading device coupled to the PLS.

[00123] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to create a configuration file for a label, said configuration file may be based on a SKU generator and may include Sugar, Size, Maturity, Grade, Lot Code, Date, Born on Date, and Barcode, among others.

[00124] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to transmit one or a plurality of configuration files to one or a plurality of label printers coupled to the PLS.

[00125] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to identify and track labels used, generated, and applied for the purpose of produce traceability, among others.

[00126] In one PLS in accordance with an exemplary embodiment of the invention, a label printer may include one or a plurality of label media, said label media may include varying sizes, said printer may use configuration file to determine which label media to use to generate one or a plurality of labels.

[00127] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to download data to one or a plurality of label

printers, the data may include static and dynamic data, said label printer storing said data in its memory.

[00128] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to collect and disperse data related to each coupled label printer, supplier information, produce information, and label media information, among others.

[00129] FIG. 9 is an illustration depicting the traceability of produce from within a PLS in accordance with an exemplary embodiment of the invention.

[00130] As illustrated, the PLS 900 transmits a request, such as request 902 to each remote site PLS, such as remote site PLS 904, for produce traceability using a wide area network 905. A transmitted request may be based on a lot code, for example.

[00131] The remote site PLS, in turn transmits the request to each supplier, such as supplier 906, involved with that lot code, from the orchard 908, the delivery company 910, etc. For example, a request 912 may be transmitted to the orchard, a producer, and supplier. Data is collected from such and returned to the remote site PLS 904 for processing after which the remote site PLS transmits the collected data through the wide area network to the PLS 900.

[00132] A variation to this is the PLS functioning as both the PLS and remote site PLS. Another variation would be the use of a local area network. Another variation would be using the PLS on a standalone host system.

[00133] Optionally, traceability data may be transmitted to and from one or a plurality of external organizations, such as government agencies, among others.

[00134] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices to produce or generate security records for traceability through a supply chain, global traceability, or both.

[00135] In one PLS in accordance with an exemplary embodiment of the invention, the PLS includes the processes and/or devices for traceability through a supply chain, from grower or orchard to consumer point of sale wherein traceability may include global traceability.

[00136] FIG. 10 is an illustration of the data tables in the PLS in accordance with an exemplary embodiment of the invention.

[00137] As illustrated, the PLS 100 includes a plurality of data tables: such as a data table for label printers 1002, a data table for label applicators 1004, a data table for produce grading devices 1006, a data table for suppliers 1008, a data table for security records 1010, a data table for configuration files 1012, a data table for label usage 1014, a data table for system maintenance 1016, and others 1018, among others not shown.

[00138] The label printers data table may be utilized to capture and store data related to each label printer coupled to the PLS. This data may include any or all of the following attributes defined in Table I as follows:

TABLE I

Attribute	Description
Printer ID	A unique identifier for each label printer used in the PLS. This ID may be utilized when a label printer is connected to or disconnected from the PLS.
Printer Location	A unique identifier for each location of a label printer. An example would be an IP address.
Printer Activity	A log used to potentially determine the life remaining on a print head of a label printer or track the usage of a label printer, among others.
Printer Error	The types of errors which may occur with a label printer as well as the date the error occurred. Examples include a paper low error, paper out error, wrong paper size error, and non-responsive printer error, among others.
Printer Configuration	The configuration set for each label printer such as number of print heads in the printer, static data, and dynamic data, among others.

[00139] The label applicators data table may be utilized to capture and store data related to each label applicator coupled to the PLS. This data may include any or all of the following attributes defined in Table II as follows:

TABLE II

Attribute	Description
Applicator ID	A unique identifier for each label applicator coupled to the PLS. This ID may be utilized when a label applicator is connected to or disconnected from the PLS.
Applicator Location	A unique identifier for each location of a label applicator. An example would be an IP address.
Applicator Activity	A log used to potentially determine the life remaining on a label applicator or track the usage of a label applicator, among others.

Applicator Error	The types of errors which may occur with a label applicator as well as the date the error occurred. Examples include paper low error, paper out error, wrong paper size error, and non-responsive label applicator, among others.
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The produce grading devices data table may be utilized to capture and store data related to each produce grading device coupled to the PLS. This data may include any or all of the following attributes defined in Table III as follows:

TABLE III

Attribute	Description
Grading Device ID	A unique identifier for each produce grading device coupled to the PLS. This ID may be utilized when a produce grading device is connected to or disconnected from the PLS.
Grading Device Location	A unique identifier for each location of a produce grading device. An example would be an IP address.
Grading Device Activity	A log used to potentially track the usage of a produce grading device, among others.
Grading Device Error	The types of errors which may occur with a produce grading device as well as the date the error occurred. Examples include non-responsive produce grading device, and communication interface error, among others.

[00140] The suppliers data table may be utilized to capture and store data related to each supplier. This data may include any or all of the following attributes defined in Table IV as follows:

TABLE IV

Attribute	Description
Supplier ID	A unique identifier assigned to each supplier identified in the PLS.
Supplier Name	The name of the business or organization.
Supplier Certification	All certifications issued and verified as being issued to the supplier.
Supplier Contact Person	The name of the business owner or the name of an authorized person of the business.
Supplier Address	The full address of the supplier.
Supplier Country	The country where the supplier's business is located.
Type of Supplier	The type of supplier. Examples include growers, subcontractors, contractors, brokers, processors, producers, and wholesalers, among others.
Relationship with other Suppliers	The relationship of one supplier to another. For example, a grower working with a subcontractor where both the grower and subcontractor are defined as suppliers in the PLS.
Orchard of Origin	The orchard where the produce originated.

Produce Supplied	The types of produce supplied. Examples include apples, oranges, and mangos, among others.
Orchard Segment where Harvested	The part of an orchard where the produce was harvested.
Harvest Date	The date of the harvest of the produce.
Produce Delivery Date	The date the produce was delivered.
Delivery Service/Company Used	The name and full details of the company used to delivery the produce.
Delivery Method	The method or means used to deliver produce. Examples include truck and train, among others.
Delivery Route	The route used in the delivery of produce.

[00141] The security records data table may be utilized to capture and store data related to security records. This data may include any or all of the following attributes defined in Table V as follows:

TABLE V

Attribute	Description
Security Record ID	A unique identifier for each security record.
Security Record Type	The type of security record. Examples include a supplier security record, a secured ID,
Security Record Details	All data related to the details or purpose of the security record.
Security Record Date	The date a security record was created.
Supplier Information	Any data from supplier data table to build a security record, depending on the type of security record needed.

[00142] The configuration files data table may be utilized to capture and store data related to the configuration of each label designed in the PLS. This data may include any or all of the following attributes defined in Table VI as follows:

TABLE VI

Attribute	Description
Config ID	A unique identifier for the configuration file associated with each label design. Each configuration file may be transmitted to and from one or a plurality of label printers as previously disclosed in FIG. 8.
SKU	The Stock Keeping Unit code assigned to each produce. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from the PLS.
Sugar	The sugar content of each produce. This attribute may be based on signaling from a produce grading device.
Size	The size of each produce. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from a produce grading device.

Maturity	The maturity of each produce.
Grade	The grade of each produce. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from a produce grading device.
Lot Code	A code associated with a production or run of a produce. Ideally, this would be the supplier's lot code. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from the PLS.
Born on Date	The date the produce was packaged.
Barcode	A machine readable format comprising any data set by the system user. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from the PLS.
Weight	The weight of the produce. May be the minimum acceptable weight for a particular grade or a range of weights for a particular grade. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from the PLS.
Color	The color of the produce. May be the minimum acceptable color for a particular grade or a range of colors for a particular grade. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from the PLS.

[00143] The label usage data table may be utilized to capture and store data related to label usage. This data may include any or all of the following attributes defined in Table VII as follows:

TABLE VII

Attribute	Description
Label ID	A unique identifier assigned to each label designed in the PLS.
Label Purpose	The reason why a label was designed and potentially generated.
Lot Code Batch Size	The size of the batch per lot code. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from the PLS.
Lot Code Processing Date	The date the lot code was processed. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from the PLS.
Where labels were printed	The location within the PLS such as a remote site PLS where each label, series of labels, or lots of labels where printed. This attribute may be used as static data being defined in the PLS or dynamic data based on signaling from the PLS.

[00144] The system data table may be utilized to capture and store data related to system maintenance and activities of the PLS. This data may include any or all of the following attributes defined in Table VIII as follows:

TABLE VIII

Attribute	Description
System Users	All data related to the users of the PLS, including but not limited to, PLS user name, real name, location, unique identifier, password, secured password, and electronic signature, among others.
Time Stamps	A date and/or time in hours, minutes, and seconds used to log all activities within the PLS. Each time stamp may include the PLS user name of each system user.
Data Import	The type of data imported into the PLS as well as the date of the import, the source of the imported data, where the imported data resides such as host system, central controller, or remote site PLS, purpose of the import, user requesting data import, and if the data import was successful, among others.
Data Export	The type of data exported from the PLS as well as the date of the export, the source of the exported data such as host system, central controller, or remote site PLS, purpose of the export, where the exported data went such as an external link for example to the FDA or USDA, purpose of the export, user requesting data export, and if the data export was successful, among others.
System Updates	All updates made to the PLS including code updates, and all remote site PLS updates, if any, among others.
Statistical Information	All data for reports, requests, etc. used to generate statistical records for use with the business using the PLS or for use with an external entity such as a government agency.

[00145] The others data table may be utilized to capture and store data related to other data. This data may include any or all of the following attributes defined in Table IX as follows:

TABLE IX

Attribute	Description
Recall ID	A unique identifier assigned to each recall of produce or traceability request received in the PLS.
Recall Date	The date of a recall or traceability request.
Recall Problem	The problem or list of problems associated with a recall or traceability request.
External Links	Each organization external to the PLS involved in the recall or traceability request.

Internal Links	Links to other systems in use with the business which utilizes the PLS. An example is a human resources system.
Recall Product Info	Data related to the recall product, such as product name and description of the product, among others.
Recall Codes	Codes used with a recall of a product, such as a lot code or unit number, among others.
Recall Details	Complete details on the recall of a product, such as volume of recall, health hazards, and distribution, among others.
Traceability Request	All data related to a request for traceability, either locally or globally. Examples of this data include a request date, request time, requesting agency, and purpose of request, among others.
Traceability Report	All data related to the result of a traceability request. Examples of this data include report date, report time, reporting business, and all traceability request data, among others.

[00146] Additionally, data from any data table may be used to build a relationship to data in another data table. For example, data from the suppliers data table, such as Supplier Name, Relationship with other Suppliers, and Supplier Country may be used to gather data in the others data table for a traceability request, which results in a traceability report. In another example, data from the suppliers data table such as Produce Supplied may be used with the system data table to produce records for a Data Export.

[00147] Although this invention has been described in certain specific embodiments, many additional modifications and variations would be apparent to those skilled in the art. It is therefore to be understood that this invention may be practiced otherwise than as specifically described. Thus, the present embodiments of the invention should be considered in all respects as illustrative and not restrictive.

WHAT IS CLAIMED IS:

1. A method of operating a produce labeling system, the produce labeling system coupled to one or more label printers and one or more label applicators, the method comprising:
 - generating a label by a label printer of the one or more label printers;
 - applying the label to a piece of produce by a label applicator of the one or more label applicators; and
 - storing by the produce labeling system produce data of the labeled produce.
2. The method of Claim 1, wherein the produce labeling system further comprises one or more produce grading devices and wherein the produce data includes grading data for the labeled produce collected by a grading device of the one or more grading devices.
3. The method of Claim 1, wherein the produce labeling system is further coupled to a central controller, the method further comprising reporting by the produce labeling system to the central controller the produce data.
4. The method of Claim 1, further comprising storing by the produce labeling system error data collected from the label printer.
5. The method of Claim 1, further comprising storing by the produce labeling system error data collected from the label applicator.
6. The method of Claim 1, further comprising:
 - transmission of label information by the produce labeling system to the label printer,
 - wherein the label printer uses the label information to generate the label.
7. The method of Claim 1, further comprising detecting by the produce labeling system when the label printer is disconnected from the produce labeling system.

8. The method of Claim 1, further comprising detecting by the produce labeling system when the label applicator is disconnected from the produce labeling system.
9. The method of Claim 1, further comprising detecting by the produce labeling system when a new label printer is connected to the produce labeling system.
10. The method of Claim 1, further comprising detecting by the produce labeling system when a new label applicator is connected to the produce labeling system.
11. A produce labeling system, the produce labeling system coupled to one or more label printers and one or more label applicators, comprising:
- means for generating a label by a label printer of the one or more label printers;
 - means for applying the label to a piece of produce by a label applicator of the one or more label applicators; and
 - means for storing by the produce labeling system produce data of the labeled produce.
12. The produce labeling system of Claim 11, wherein the produce labeling system further comprises one or more produce grading devices and wherein the produce data includes grading data for the labeled produce collected by a grading device of the one or more grading devices.
13. The produce labeling system of Claim 11, wherein the produce labeling system is further coupled to a central controller, the produce labeling system further comprising means for reporting by the produce labeling system to the central controller the produce data.

14. The produce labeling system of Claim 1, further comprising means for storing by the produce labeling system error data collected from the label printer.

15. The produce labeling system of Claim 1, further comprising means for storing by the produce labeling system error data collected from the label applicator.

16. The produce labeling system of Claim 1, further comprising:
means for transmission of label information by the produce labeling system to the label printer,
wherein the label printer uses the label information to generate the label.

17. The produce labeling system of Claim 11, further comprising means for detecting by the produce labeling system when the label printer is disconnected from the produce labeling system.

18. The produce labeling system of Claim 11, further comprising means for detecting by the produce labeling system when the label applicator is disconnected from the produce labeling system.

19. The produce labeling system of Claim 11, further comprising means for detecting by the produce labeling system when a new label printer is connected to the produce labeling system.

20. The produce labeling system of Claim 11, further comprising means for detecting by the produce labeling system when a new label applicator is connected to the produce labeling system.

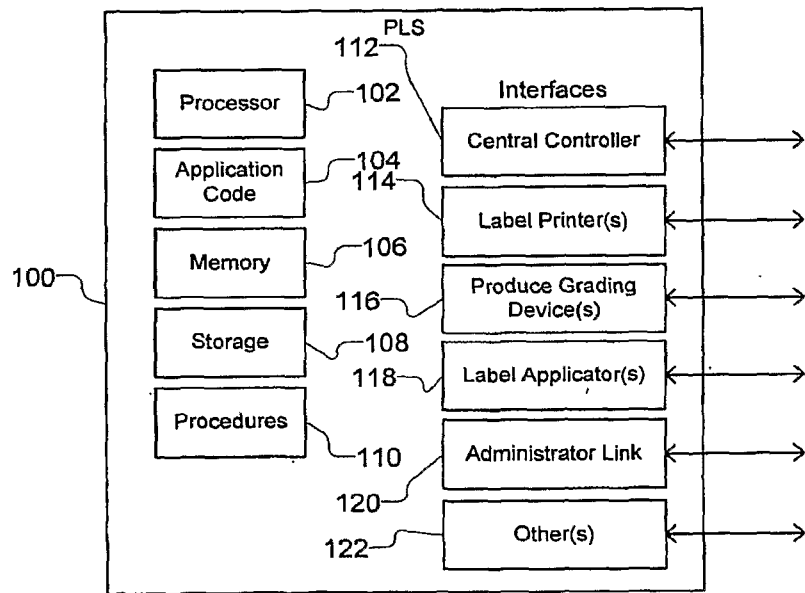


FIG. 1

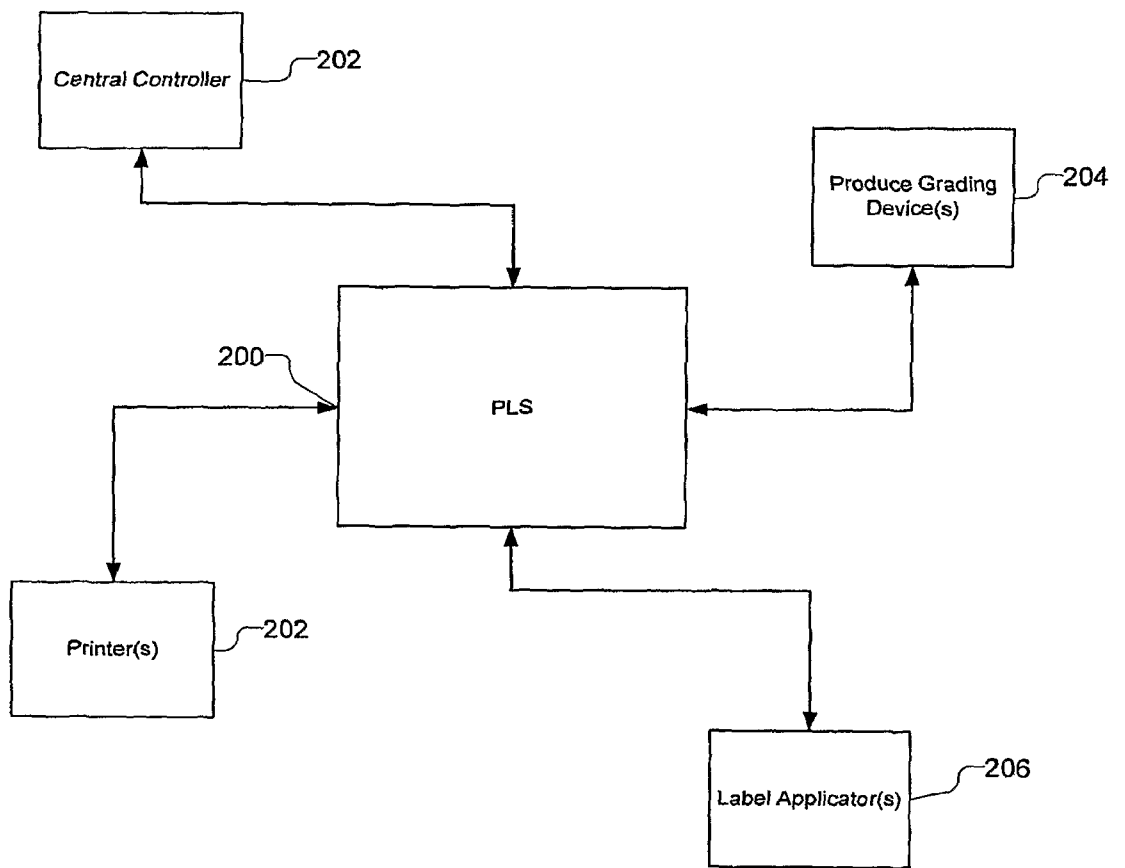


FIG. 2

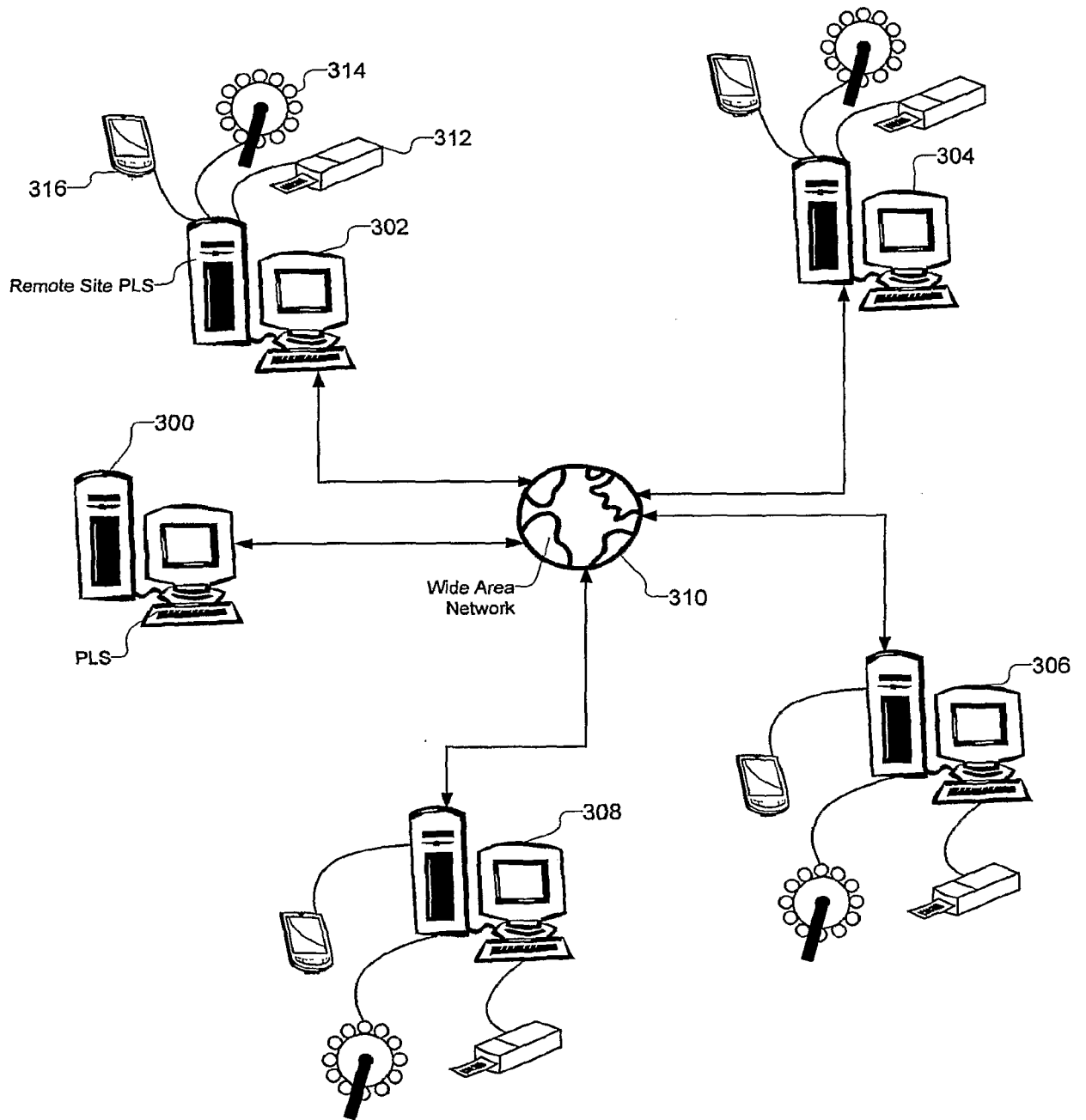


FIG. 3

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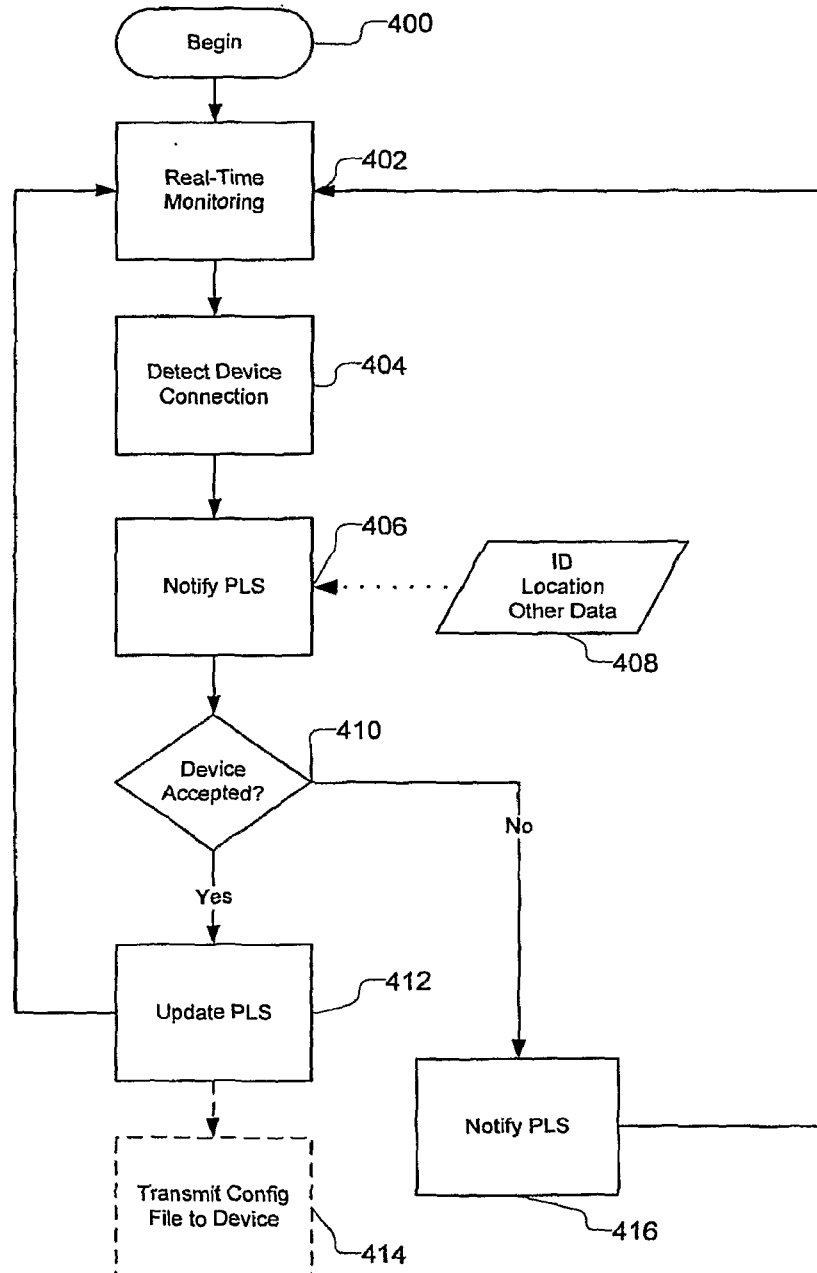


FIG. 4

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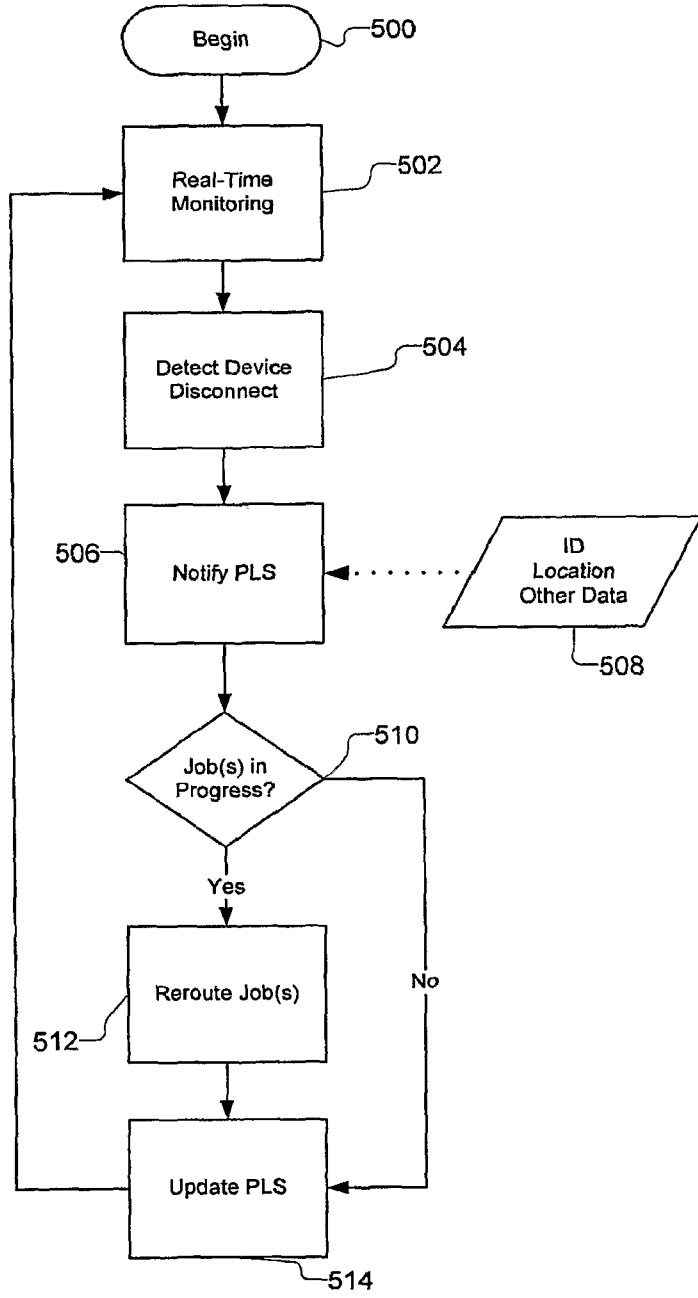


FIG. 5

6/10

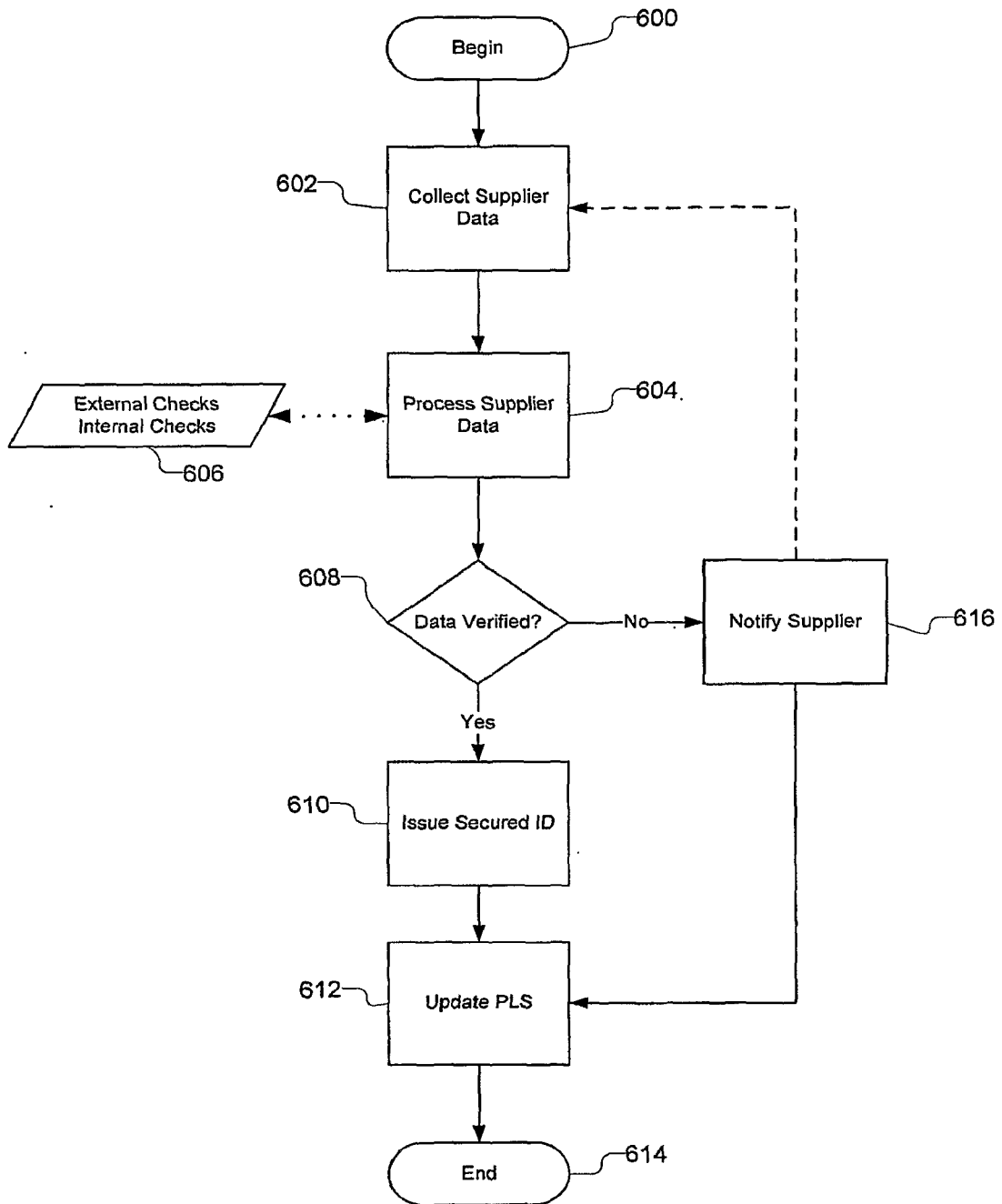


FIG. 6

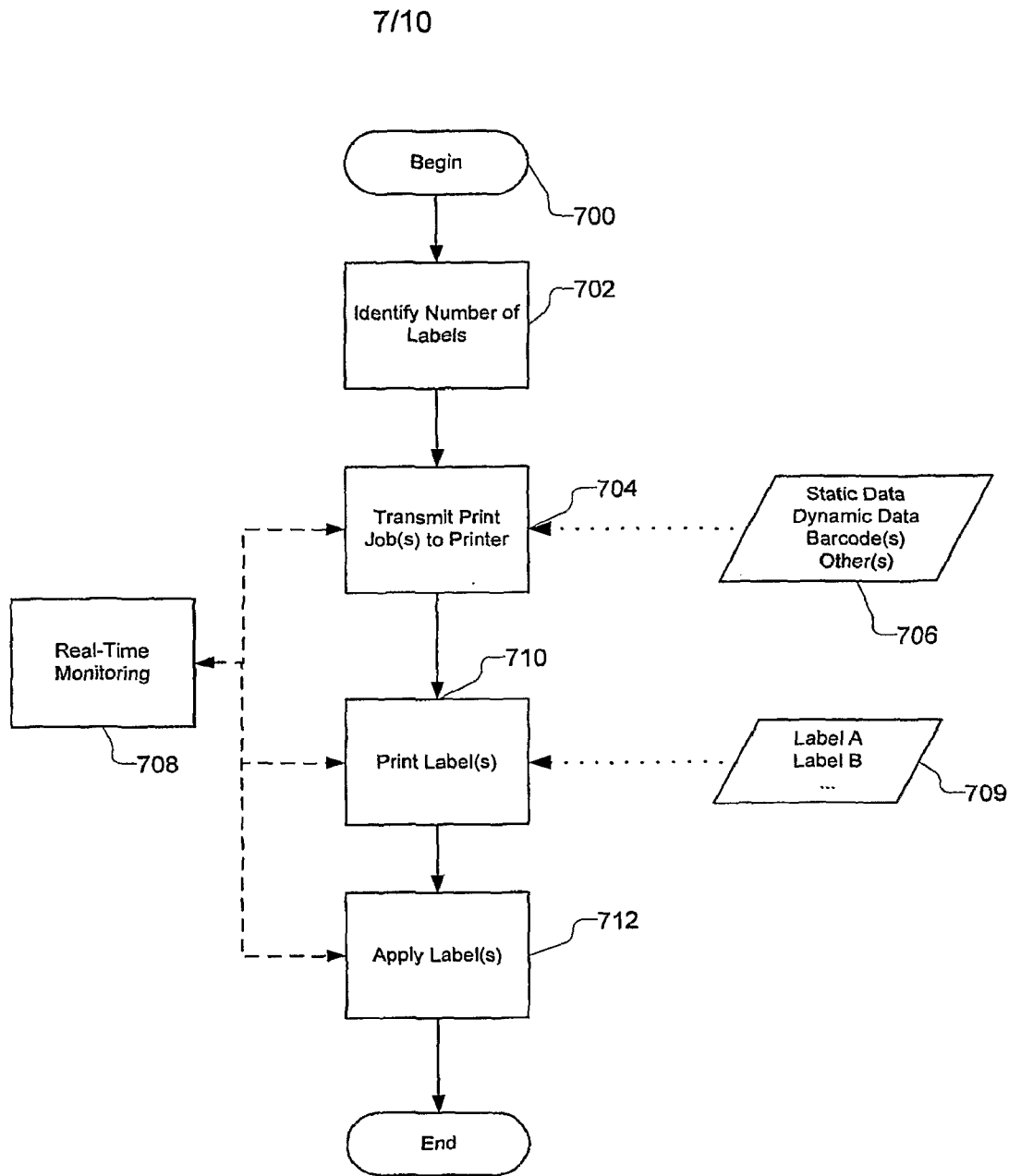


FIG. 7

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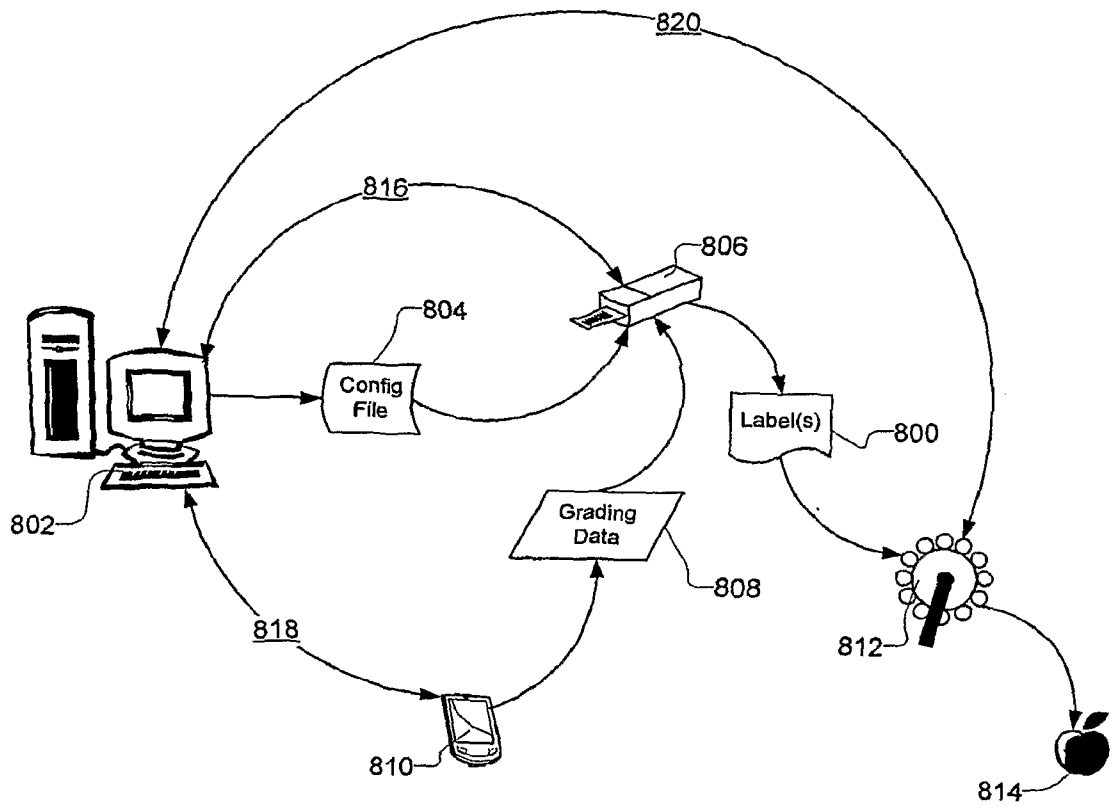


FIG. 8

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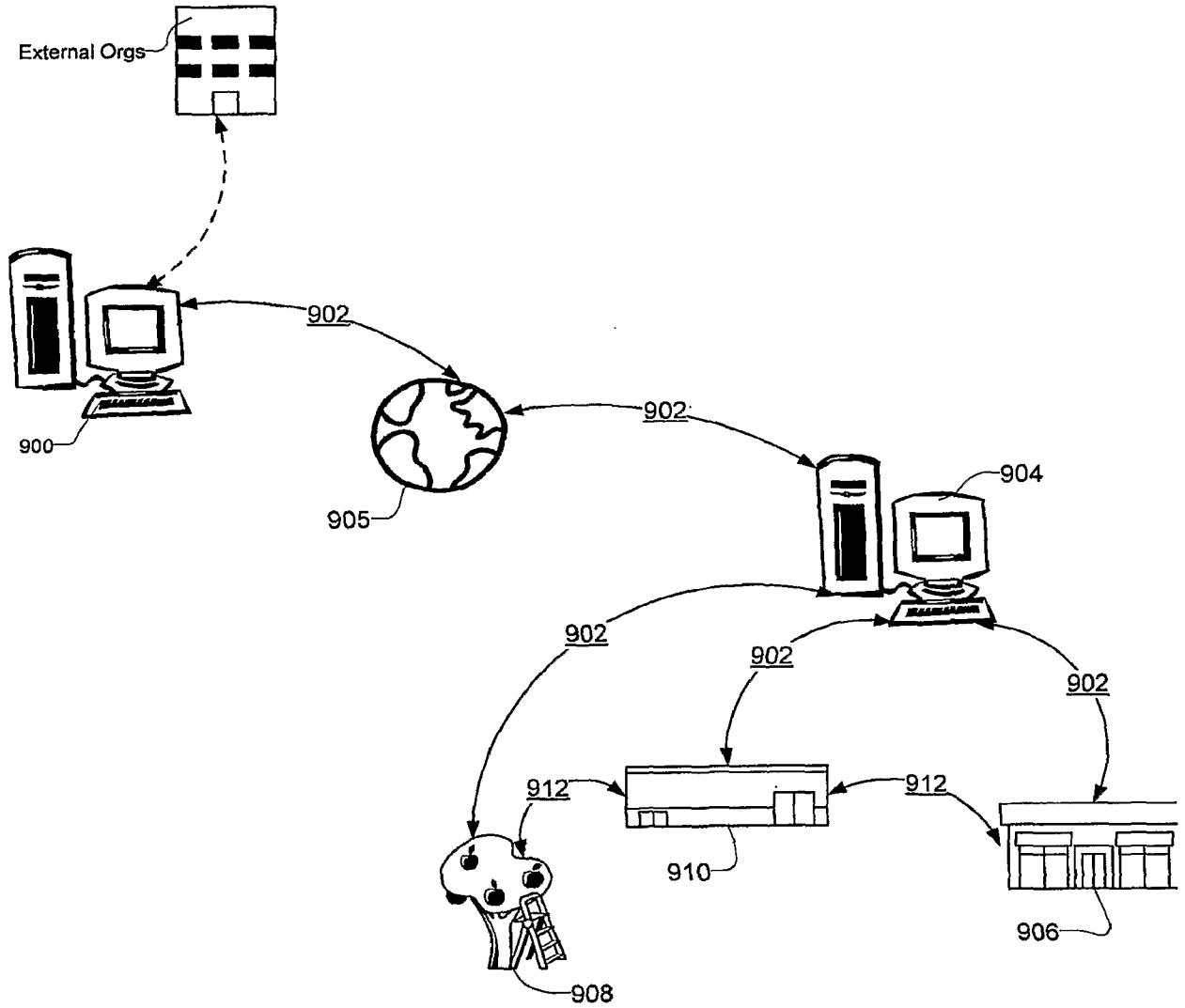


FIG. 9

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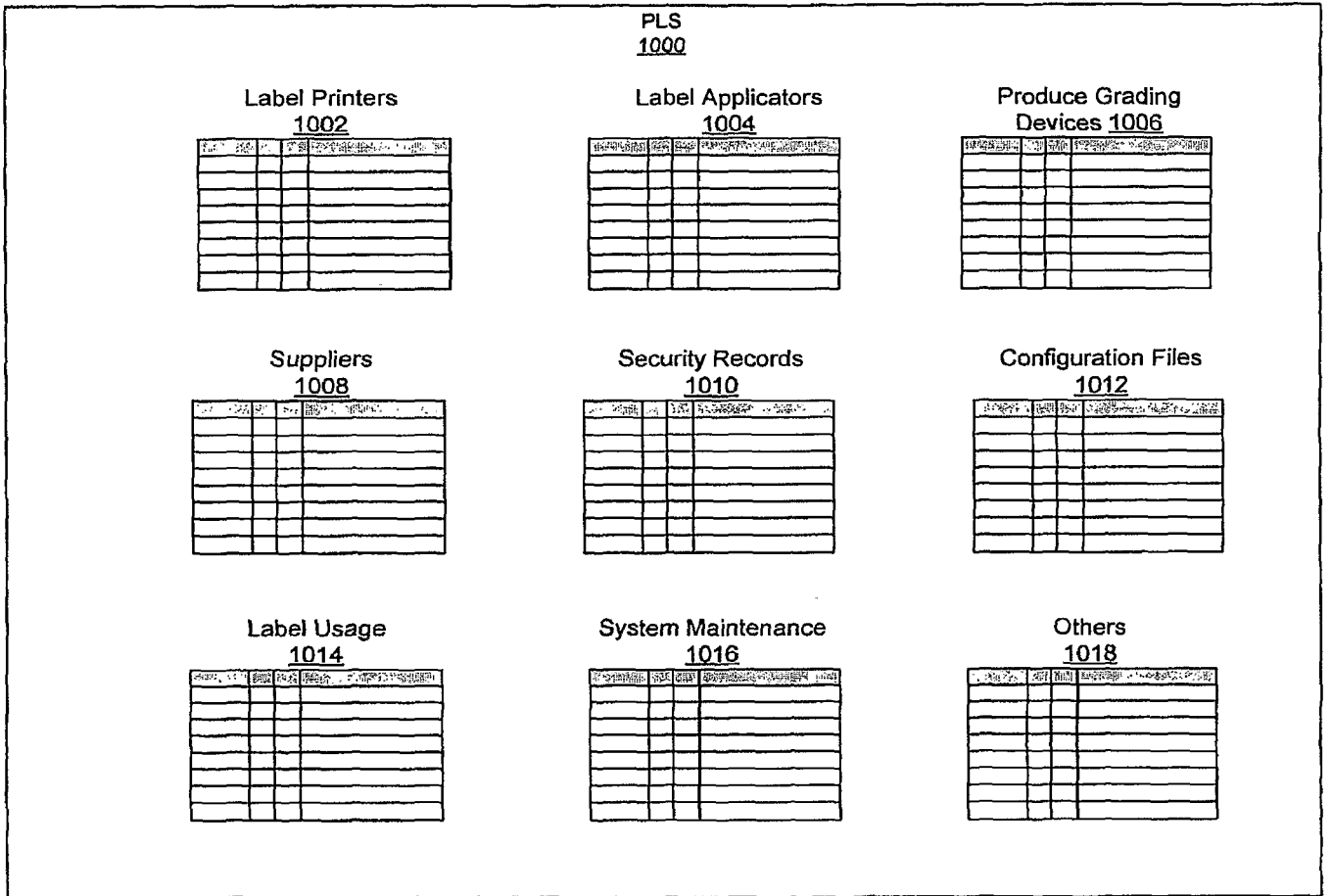


FIG. 10