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(54) Title: SYSTEM AND METHOD OF PHARMACEUTICAL OPERATIONS FOR POST-ACUTE CARE FACILITIES LONG-TERM CARE FACILITIES

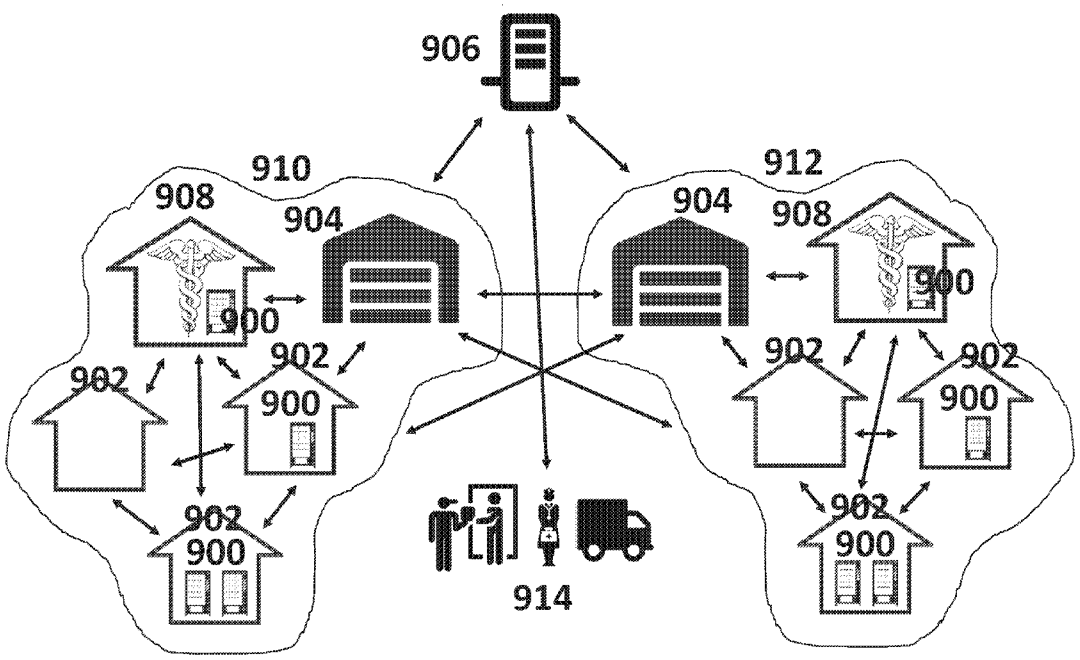

Figure 9a

(57) Abstract: According to an aspect of some embodiments of the present invention there is provided a pharmaceutical dispensing system comprising a pharmaceutical dispensing logistic operational system, comprising at least one pharmaceutical storage and dispensing machine located in at least one facility and at least one supplemental supplier of pharmaceuticals; said operational system in communication with at least one pharmacy management server; at least one pharmacy management server configured to manage and control said pharmaceutical dispensing logistic operational system; said management server further comprises: a computational logistic tracking module, a computational logistic model module, a computational logistic action and a medical pharmaceutical database; wherein said computational logistic action module is configured to provide instructions to said pharmaceutical dispensing logistic operational system based on received information from said at least one pharmaceutical storage and dispensing machine, said computational

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SYSTEM AND METHOD OF PHARMACEUTICAL OPERATIONS FOR POST-ACUTE CARE FACILITIES LONG-TERM CARE FACILITIES

RELATED APPLICATION

This application claims the benefit of priority of U.S. Patent Application No. 16/214,081 filed on 9 December 2018, the contents of which are incorporated herein by reference in their entirety.

This application is a Continuation-in-Part (CIP) of U.S. Patent Application No. 16/214,081 filed on 9 December 2018, the contents of which are incorporated herein by reference in their entirety.

FIELD AND BACKGROUND OF THE INVENTION

The present invention, in some embodiments thereof, relates pharmaceutical dispensing operations to nursing homes, retirement homes, assisted living facilities, and other long-term care industries in general and, more particularly, to providing a reliable pharmaceutical dispensing operations for such long-term care facilities.

Additional background art includes US7698019 which discloses “a system, software and related methods of enhanced pharmaceutical operations in long term care facilities are provided. An embodiment of a system includes a long-term care facility pharmacy group management server, long-term care facility pharmacy management software associated with the long-term care facility pharmacy group management server to manage pharmacological operations in a plurality of long-term care facilities, a plurality of pharmaceutical storage and electronic dispensing carts each positioned in a long-term care facility remote from the long-term care facility pharmacy group management server and in communication therewith, a remote pharmacy group server in communication with the long-term care facility pharmacy group management server, and a plurality of pharmaceutical prescription document processors each positioned in a long-term care facility and in communication with the remote pharmacy group server or the long-term care facility pharmacy group management server”.

SUMMARY OF THE INVENTION

According to an aspect of some embodiments of the present invention there is provided a method of ensuring a pharmaceutical dispensing service to at least one patient in at least one facility following at least one pharmaceutical prescription, comprising: receiving a pharmaceutical dispensing schedule; running, on a processor, at least one model of a

pharmaceutical dispensing process according to said received schedule; wherein when said model indicates that said pharmaceutical dispensing process cannot be achieved by said pharmaceutical dispensing schedule, then automatically activating at least one supplemental pharmaceutical dispensing supplier or moving to a substitute pharmaceutical or an alternative pharmaceutical to ensure said meeting said pharmaceutical dispensing schedule.

According to some embodiments of the invention, when said at least one supplemental pharmaceutical dispensing supplier provides one or more of: the same pharmaceutical, a substitute pharmaceutical and an alternative pharmaceutical.

According to some embodiments of the invention, when moving to said substitute pharmaceutical or an alternative pharmaceutical, if said substitute pharmaceutical or an alternative pharmaceutical has not been previously authorized as such, then said method further comprises requesting approval from authorized personnel of said substitute pharmaceutical or an alternative pharmaceutical.

According to some embodiments of the invention, said moving to a substitute pharmaceutical or an alternative pharmaceutical comprises accessing a medical pharmaceutical database to retrieve information regarding said substitute pharmaceutical or an alternative pharmaceutical.

According to some embodiments of the invention, evaluating of the model utilizes one or more of neural networks, machine learning and simulations.

According to some embodiments of the invention, said receiving a pharmaceutical dispensing schedule comprises a time when the pharmaceuticals need to be ready for dispensing in individual envelopes.

According to some embodiments of the invention, said pharmaceutical dispensing process cannot be achieved comprises at least one pharmaceutical that cannot be dispensed.

According to some embodiments of the invention, said at least one supplemental pharmaceutical dispensing service is located in one or more of: the same location of said facility, a different location in close proximity of said facility, a different location far from said facility.

According to some embodiments of the invention, said authorized personnel is one or more of a physician, a nurse, a pharmacist.

According to some embodiments of the invention, prescriptions delivered to said pharmaceutical dispensing schedule are optimized for pharmaceuticals already present in said at least one facility.

According to some embodiments of the invention, new prescriptions are immediately processed and inserted in said pharmaceutical dispensing schedule.

According to an aspect of some embodiments of the present invention there is provided a pharmaceutical dispensing system comprising: a pharmaceutical dispensing logistic operational system, comprising at least one pharmaceutical storage and dispensing machine located in said at least one facility and at least one supplemental supplier of pharmaceuticals; said pharmaceutical dispensing logistic operational system in communication with at least one pharmacy management server; a pharmacy group management computer being positioned remote from said at least one first facility to manage and control said pharmaceutical dispensing logistic operational system defining a pharmacy management server; said facility pharmacy management server further comprises: a computational logistic tracking module, a computational logistic model module, a computational logistic action and a medical pharmaceutical database; wherein said computational logistic action module is configured to provide instructions to said pharmaceutical dispensing logistic operational system based on received information from said at least one pharmaceutical storage and dispensing machine, said computational logistic tracking module and said computational logistic simulation module.

According to some embodiments of the invention, said at least one pharmaceutical storage and dispensing machine is configured to dispense at least one pharmaceutical in a plurality of envelopes to said at least one patient in said at least one facility at a scheduled time.

According to some embodiments of the invention, said computational logistic tracking module is configured to monitor and record the logistic movements of the pharmaceuticals.

According to some embodiments of the invention, said computational logistic model module is configured to run a virtual pharmaceutical dispensing process based on received information from said at least one pharmaceutical storage and dispensing machine and said computational logistic tracking module.

According to some embodiments of the invention, said medical pharmaceutical database comprises medical information regarding pharmaceuticals, substitute pharmaceuticals and alternative pharmaceuticals when said dispensing will result in not meeting dispensing requirements.

According to some embodiments of the invention, said at least one supplemental supplier of pharmaceuticals is one or more of: another pharmaceutical dispensing machine, a storage and a pharmacy.

According to some embodiments of the invention, said at least one supplemental supplier is located in one or more of: the same location of said facility, a different location in close proximity of said facility, a different location far from said facility.

According to some embodiments of the invention, said computational logistic model module further receives real-time information from external sources.

According to an aspect of some embodiments of the present invention there is provided a method for minimizing the dispense time of a pharmaceutical, comprising: receiving a new prescription; delivering said new description to a pharmaceutical dispensing machine; commanding said pharmaceutical dispensing machine to dispense said pharmaceutical immediately or within the next pharmaceutical dispensing cycle.

According to an aspect of some embodiments of the present invention there is provided a method of optimizing a pharmaceutical dispensing process in a facility, comprising: receiving at least one prescription of at least one pharmaceutical from at least one authorized personnel; comparing said at least one pharmaceutical with an inventory of pharmaceuticals located in said facility; wherein when said at least one pharmaceutical is not present in said inventory of pharmaceuticals located in said facility, then provide a substitute pharmaceutical or an alternative pharmaceutical to said at least one authorized personnel from a medical pharmaceutical database and said substitute pharmaceutical or said alternative pharmaceutical are present in said inventory of pharmaceuticals located in said facility.

According to an aspect of some embodiments of the present invention there is provided a method of providing a pharmaceutical dispensing service to at least one facility, comprising: providing at least one first pharmaceutical storage and dispensing machine to said at least one first facility; said at least one first pharmaceutical storage and dispensing machine in communication with at least one facility pharmacy management server; providing a pharmacy group management computer being positioned remote from said at least one first facility to manage and control said at least one first pharmaceutical storage and dispensing machine defining a facility pharmacy management server; providing at least one supplemental supplier of pharmaceuticals; wherein said method further comprises selecting said at least one supplemental supplier of pharmaceuticals so as to ensure dispensing of pharmaceuticals to users according to a predetermined schedule; wherein said at least one supplemental supplier of pharmaceuticals provides one or more of: the same pharmaceutical, a substitute pharmaceutical and an alternative pharmaceutical; wherein dispensing of said substitute pharmaceutical and said alternative pharmaceutical comprises receiving approval from at least one authorized personnel.

According to some embodiments of the invention, further comprising providing at least one second pharmaceutical storage and dispensing machine as supplemental supplier of pharmaceuticals.

According to some embodiments of the invention, said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one second pharmaceutical storage and dispensing machine at the same facility as said at least one first pharmaceutical storage and dispensing machine.

According to some embodiments of the invention, said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one second pharmaceutical storage and dispensing machine at a second facility; said second facility located in the vicinity of said first facility.

According to some embodiments of the invention, said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one second pharmaceutical storage and dispensing machine at a third facility; said third facility located far from said first facility.

According to some embodiments of the invention, further comprising providing communication with at least one pharmacy as supplemental supplier of pharmaceuticals.

According to some embodiments of the invention, said pharmacy comprises a pharmaceutical storage and dispensing machine.

According to some embodiments of the invention, further comprising providing communication with at least one storage unit as supplemental supplier of pharmaceuticals.

According to some embodiments of the invention, information regarding said predetermined schedule is located in said pharmacy group management computer.

According to an aspect of some embodiments of the present invention there is provided a system of pharmaceutical dispensing for at least one first facility, comprising: a data processing and management computer including a first memory to store data therein to manage and control at least one pharmaceutical storage and dispensing machine positioned remote therefrom and to thereby define a facility pharmacy group management server; a facility pharmacy management software stored in said first memory of said facility pharmacy group management server to manage pharmaceutical operations in said at least one facility, to process distribution of pharmaceuticals stored in said at least one pharmaceutical storage and dispensing machine during preselected dispensing time periods; a communications network in communication with said facility pharmacy group management server; at least one pharmaceutical storage and dispensing machine positioned in said at least one facility remote from said facility pharmacy group management server, in communication with said facility pharmacy group management server through said communication network, to store a plurality of pharmaceuticals therein, and to individually retrieve at least one pharmaceutical of said plurality of pharmaceuticals stored in

said pharmaceutical storage and dispensing machine, load said at least one pharmaceutical of the plurality of pharmaceuticals into one of a plurality of disposable individual patient dosing packages, package said at least one pharmaceutical, and dispense said loaded and packaged one of said plurality of individual patient dosing packages into a separate and removable container associated with said machine for use by authorized personnel located at said facility; wherein said system further comprises at least one supplemental supplier of said plurality of pharmaceuticals adapted to dispense said pharmaceuticals to the users at said preselected dispensing time periods; wherein said at least one supplemental supplier of pharmaceuticals provides one or more of: the same pharmaceutical, a substitute pharmaceutical and an alternative pharmaceutical; wherein dispensing of said substitute pharmaceutical and said alternative pharmaceutical comprises receiving approval from at least one authorized personnel.

According to some embodiments of the invention, said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at the same facility.

According to some embodiments of the invention, said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at a second facility; said second facility located near said facility.

According to some embodiments of the invention, said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at a second facility; said second facility located far from said facility.

According to some embodiments of the invention, said at least one supplemental supplier is a pharmacy located near said facility.

According to some embodiments of the invention, said at least one supplemental supplier is a storage unit.

According to an aspect of some embodiments of the present invention there is provided a method of providing a pharmaceutical dispensing service to at least one facility, comprising: providing at least one first pharmaceutical storage and dispensing machine to said at least one first facility; said at least one first pharmaceutical storage and dispensing machine in communication with at least one facility pharmacy management server; providing a pharmacy group management computer being positioned remote from said at least one first facility to manage and control said at least one first pharmaceutical storage and dispensing machine defining a facility pharmacy management server; providing at least one supplemental supplier of pharmaceuticals; wherein said method further comprises selecting said at least one supplemental supplier of pharmaceuticals so as to ensure dispensing of pharmaceuticals to users according to a predetermined schedule.

According to some embodiments of the invention, the method further comprises providing at least one second pharmaceutical storage and dispensing machine as supplemental supplier of pharmaceuticals.

According to some embodiments of the invention, said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one second pharmaceutical storage and dispensing machine at the same facility as said at least one first pharmaceutical storage and dispensing machine.

According to some embodiments of the invention, said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one second pharmaceutical storage and dispensing machine at a second facility; said second facility located in the vicinity of said first facility.

According to some embodiments of the invention, said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one second pharmaceutical storage and dispensing machine at a third facility; said third facility located far from said first facility.

According to some embodiments of the invention, the method further comprises providing communication with at least one pharmacy as supplemental supplier of pharmaceuticals.

According to some embodiments of the invention, said pharmacy comprises a pharmaceutical storage and dispensing machine.

According to some embodiments of the invention, the method further comprises providing communication with at least one storage unit as supplemental supplier of pharmaceuticals.

According to some embodiments of the invention, information regarding said predetermined schedule is located in said pharmacy group management computer.

According to an aspect of some embodiments of the present invention there is provided a system of pharmaceutical dispensing for at least one first facility, comprising: a data processing and management computer including a first memory to store data therein to manage and control at least one pharmaceutical storage and dispensing machine positioned remote therefrom and to thereby define a facility pharmacy group management server; a facility pharmacy management software stored in said first memory of said facility pharmacy group management server to manage pharmaceutical operations in said at least one facility, to process distribution of pharmaceuticals stored in said at least one pharmaceutical storage and dispensing machine during preselected dispensing time periods; a communications network in communication with said

facility pharmacy group management server; at least one pharmaceutical storage and dispensing machine positioned in said at least one facility remote from said facility pharmacy group management server, in communication with said facility pharmacy group management server through said communication network, to store a plurality of pharmaceuticals therein, and to individually retrieve at least one pharmaceutical of said plurality of pharmaceuticals stored in said pharmaceutical storage and dispensing machine, load said at least one pharmaceutical of the plurality of pharmaceuticals into one of a plurality of disposable individual patient dosing packages, package said at least one pharmaceutical, and dispense said loaded and packaged one of said plurality of individual patient dosing packages into a separate and removable container associated with said machine for use by authorized personnel located at said facility; wherein said system further comprises at least one supplemental supplier of said plurality of pharmaceuticals adapted to dispense said pharmaceuticals to the users at said preselected dispensing time periods.

According to some embodiments of the invention, said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at the same facility.

According to some embodiments of the invention, said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at a second facility; said second facility located near said facility.

According to some embodiments of the invention, said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at a second facility; said second facility located far from said facility.

According to some embodiments of the invention, said at least one supplemental supplier is a pharmacy located near said facility.

According to some embodiments of the invention, said at least one supplemental supplier is a storage unit.

According to an aspect of some embodiments of the present invention there is provided a method of storage organization in a pharmaceutical dispensing system, comprising: providing a plurality of storage units in communication with a server of said pharmaceutical dispensing system; collecting pharmaceutical dispensing information of facilities receiving pharmaceuticals from said pharmaceutical dispensing system; collecting information regarding said pharmaceuticals; providing at least one parameter for analysis; analyzing collected information using said at least one parameter; distributing pharmaceuticals between said plurality of storage units according to the result of said analysis.

According to some embodiments of the invention, said at least one parameter is commonly used pharmaceuticals that are not yet prescribed to specific tenants but likely to be required.

According to some embodiments of the invention, said at least one parameter is predicted pharmaceuticals that are not yet prescribed to specific tenants but likely to be required.

According to some embodiments of the invention, a scale of importance is added to said at least one parameter by a system supervisor to enable prioritizing of parameters.

According to some embodiments of the invention, said at least one parameter is at least one selected from the group consisting of: required pharmaceuticals for a current population in said facilities; common prescribed pharmaceuticals; pharmaceuticals dispensed on a regular basis; life expectancy of said pharmaceuticals; a location of use of said pharmaceuticals; frequency of use of said pharmaceuticals; type of said pharmaceuticals; cost of said pharmaceuticals; any combination thereof.

According to some embodiments of the invention, said at least one parameter is required pharmaceuticals for a current population in said facilities.

According to some embodiments of the invention, said at least one parameter is common prescribed pharmaceuticals.

According to some embodiments of the invention, said at least one parameter is pharmaceuticals dispensed on a regular basis.

According to some embodiments of the invention, said at least one parameter is life expectancy of said pharmaceuticals.

According to some embodiments of the invention, said at least one parameter is a location of use of said pharmaceuticals.

According to some embodiments of the invention, said at least one parameter is frequency of use of said pharmaceuticals.

According to some embodiments of the invention, said at least one parameter is type of said pharmaceuticals.

According to some embodiments of the invention, said at least one parameter is cost of said pharmaceuticals.

According to some embodiments of the invention, said at least one parameter is level of automation of a storage facility.

According to some embodiments of the invention, said at least one parameter is distance between said storage units and said facilities.

According to some embodiments of the invention, said pharmaceutical dispensing information is life expectancy of said pharmaceuticals.

According to some embodiments of the invention, said pharmaceutical dispensing information is cost of said pharmaceuticals.

According to some embodiments of the invention, said pharmaceutical dispensing information is expected time of supply from the pharmaceuticals suppliers.

According to some embodiments of the invention, said pharmaceutical dispensing information is type of said pharmaceuticals.

According to some embodiments of the invention, said pharmaceutical dispensing information is form that said pharmaceutical is provided.

According to some embodiments of the invention, said pharmaceutical dispensing information is security requirements for said pharmaceuticals.

According to some embodiments of the invention, said pharmaceutical information is at least one selected from the group consisting of: life expectancy of said pharmaceuticals; cost of said pharmaceuticals; expected time of supply from the pharmaceuticals suppliers; type of said pharmaceuticals; form that said pharmaceutical is provided; security requirements for said pharmaceuticals; any combination thereof.

According to some embodiments of the invention, said pharmaceutical information is life expectancy of said pharmaceuticals.

According to some embodiments of the invention, said pharmaceutical information is cost of said pharmaceuticals.

According to some embodiments of the invention, said pharmaceutical information is expected time of supply from the pharmaceuticals suppliers.

According to some embodiments of the invention, said pharmaceutical information is type of said pharmaceuticals.

According to some embodiments of the invention, said pharmaceutical information is form that said pharmaceutical is provided.

According to some embodiments of the invention, said pharmaceutical information is security requirements for said pharmaceuticals.

According to an aspect of some embodiments of the present invention there is provided a method of tracking users to dispense pharmaceuticals to said users in a pharmaceutical dispensing system, comprising: providing at least one expected location of a user in a facility at at least one time; assessing if said user is at said at least one expected location in said facility at said at least one time; if said user is at said at least one expected location in said facility at said at least one

time, then dispense pharmaceuticals; if said user is not at said at least one expected location in said facility at said at least one time, then: assessing if said user is at a different location within said facility at said at least one time; if said user is at a different location within said facility at said at least one time, then update said different location and dispense pharmaceuticals at said different location; if said user is not at a different location within said facility at said at least one time, then: assessing if said user is at a different facility at said at least one time; if said user is at a different facility at said at least one time, then update location to said different facility location and dispense pharmaceuticals at said different faciltiy location; if said user is not at a different facility at said at least one time, then: assessing if said user is at different address but not in a facility; if said user is at a different address not within a facility at said at least one time, then update said different address location and dispense pharmaceuticals at said different address location; if said user is not at a different address location not within a facility at said at least one time, then: evaluating user status.

Unless otherwise defined, all technical and/or scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of embodiments of the invention, exemplary methods and/or materials are described below. In case of conflict, the patent specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and are not intended to be necessarily limiting.

As will be appreciated by one skilled in the art, some embodiments of the present invention may be embodied as a system, method or computer program product. Accordingly, some embodiments of the present invention may take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code, etc.) or an embodiment combining software and hardware aspects that may all generally be referred to herein as a “circuit,” “module” or “system.” Furthermore, some embodiments of the present invention may take the form of a computer program product embodied in one or more computer readable medium(s) having computer readable program code embodied thereon. Implementation of the method and/or system of some embodiments of the invention can involve performing and/or completing selected tasks manually, automatically, or a combination thereof. Moreover, according to actual instrumentation and equipment of some embodiments of the method and/or system of the invention, several selected tasks could be implemented by hardware, by software or by firmware and/or by a combination thereof, e.g., using an operating system.

For example, hardware for performing selected tasks according to some embodiments of the invention could be implemented as a chip or a circuit. As software, selected tasks according to some embodiments of the invention could be implemented as a plurality of software instructions being executed by a computer using any suitable operating system. In an exemplary embodiment of the invention, one or more tasks according to some exemplary embodiments of method and/or system as described herein are performed by a data processor, such as a computing platform for executing a plurality of instructions. Optionally, the data processor includes a volatile memory for storing instructions and/or data and/or a non-volatile storage, for example, a magnetic hard-disk and/or removable media, for storing instructions and/or data. Optionally, a network connection is provided as well. A display and/or a user input device such as a keyboard or mouse are optionally provided as well.

Any combination of one or more computer readable medium(s) may be utilized for some embodiments of the invention. The computer readable medium may be a computer readable signal medium or a computer readable storage medium. A computer readable storage medium may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific examples (a non-exhaustive list) of the computer readable storage medium would include the following: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing. In the context of this document, a computer readable storage medium may be any tangible medium that can contain, or store a program for use by or in connection with an instruction execution system, apparatus, or device.

A computer readable signal medium may include a propagated data signal with computer readable program code embodied therein, for example, in baseband or as part of a carrier wave. Such a propagated signal may take any of a variety of forms, including, but not limited to, electro-magnetic, optical, or any suitable combination thereof. A computer readable signal medium may be any computer readable medium that is not a computer readable storage medium and that can communicate, propagate, or transport a program for use by or in connection with an instruction execution system, apparatus, or device.

Program code embodied on a computer readable medium and/or data used thereby may be transmitted using any appropriate medium, including but not limited to wireless, wireline, optical fiber cable, RF, etc., or any suitable combination of the foregoing.

Computer program code for carrying out operations for some embodiments of the present invention may be written in any combination of one or more programming languages, including an object oriented programming language such as Java, Smalltalk, C++ or the like and conventional procedural programming languages, such as the "C" programming language or similar programming languages. The program code may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider).

Some embodiments of the present invention may be described below with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems) and computer program products according to embodiments of the invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer program instructions. These computer program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

These computer program instructions may also be stored in a computer readable medium that can direct a computer, other programmable data processing apparatus, or other devices to function in a particular manner, such that the instructions stored in the computer readable medium produce an article of manufacture including instructions which implement the function/act specified in the flowchart and/or block diagram block or blocks.

The computer program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other devices to cause a series of operational steps to be performed on the computer, other programmable apparatus or other devices to produce a computer implemented process such that the instructions which execute on the computer or other

programmable apparatus provide processes for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

Some of the methods described herein are generally designed only for use by a computer, and may not be feasible or practical for performing purely manually, by a human expert. A human expert who wanted to manually perform similar tasks, might be expected to use completely different methods, e.g., making use of expert knowledge and/or the pattern recognition capabilities of the human brain, which would be vastly more efficient than manually going through the steps of the methods described herein.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Some embodiments of the invention are herein described, by way of example only, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of embodiments of the invention. In this regard, the description taken with the drawings makes apparent to those skilled in the art how embodiments of the invention may be practiced.

In the drawings:

Figure 1 is a schematic representation of an exemplary prior art system;

Figure 2 is a schematic diagram showing the basics of the reliability of the pharmaceutical dispensing system, according to some embodiments of the invention;

Figures 3a-b are schematic representations of an exemplary basic pharmaceutical dispensing system, according to some embodiments of the invention;

Figure 4 is a schematic representation of an on-site pharmaceutical dispensing system, according to some embodiments of the invention;

Figure 5 is an exemplary schematic representation of the interaction between a long term facility and a secondary off-site location having a second pharmaceutical dispensing system, according to some embodiments of the invention;

Figure 6 is a schematic representation of an off-site main system and its interaction with a site without a dispensing machine, according to some embodiments of the invention;

Figure 7 is an exemplary schematic representation of the interaction between a long term facility and a secondary distant off-site location having a second pharmaceutical dispensing system, according to some embodiments of the invention;

Figure 8 is an exemplary schematic representation of the interaction between a long term facility and a pharmacy, according to some embodiments of the invention;

Figures 9a-b are schematic representations of the possible interactions in a pharmaceutical dispensing ecosystem, according to some embodiments of the invention;

Figures 10-13 are schematic flowcharts of a method of management and operations performed by an exemplary pharmaceutical dispensing system, according to some embodiments of the invention;

Figures 14-21 are schematic flowcharts of a method of management and operations performed by an exemplary server of the pharmaceutical dispensing system, according to some embodiments of the invention;

Figures 22-24 are schematic flowcharts of an exemplary method of providing alternatives and/or substitutes in an automatic pharmaceutical dispensing process, according to some embodiments of the present invention;

Figure 25 is a schematic representation of a methodology of organizing the storage of pharmaceuticals in a pharmaceutical dispensing system;

Figure 26 is a schematic flowchart of a tracking method performed by an exemplary pharmaceutical dispensing system, according to some embodiments of the invention;

Figure 27 is a schematic representation of the connection and/or interface between the electronic medical record of the facility and the plurality of management softwares, according to some embodiments of the invention;

Figure 28 is a schematic general representation of exemplary logistical movements recorded by the Computational Logistics Tracking Module, according to some embodiments of the invention; and

Figure 29 is a schematic illustration of an exemplary compilation of behavior of part of a logistical process, according to some embodiments of the invention.

DESCRIPTION OF SPECIFIC EMBODIMENTS OF THE INVENTION

The present invention, in some embodiments thereof, relates to pharmaceutical dispensing operations to Long Term Acute Care Hospitals, Skilled Nursing, nursing homes, retirement homes, assisted living facilities, and other long-term care industries in general and, more particularly, to ensuring reliable pharmaceutical operations within nursing homes, retirement homes, assisted living facilities, and other long-term care facilities; also to pharmaceutical operations between nursing homes, retirement homes, assisted living facilities and other long-term care facilities, and a reliable pharmaceutical dispensing system.

Overview

A broad aspect of some embodiments of the invention relates to means and methods of operation in a pharmaceutical dispensing system. In some embodiments, the system comprises units, personnel and users, for example, long-term care facilities, the personnel working at the long-term care facilities, pharmacies, drug-dispensing units, logistic units and the users. In some embodiments, the system further comprises a computerized logistic tracking module and a computerized logistic model module configured to work in parallel with the pharmaceutical dispensing system to enable a high level of reliability to the dispensing process. In some embodiments, both the logistic tracking module and the logistic model module are equipped with deep machine learning algorithms that enables the system to achieve better results over time. In some embodiments, results from the logistic tracking module and the logistic model module are sent to a logistic action module configured to analyze said results with the future actions of said pharmaceutical dispensing process and thereby, if necessary, modify the actions the pharmaceutical dispensing process to ensure the successful completion of the pharmaceutical dispensing process, which is to ensure that the patients receive the medical treatment that they need. In some embodiments, the pharmaceutical dispensing system is global (i.e. the whole world). In some embodiments, the pharmaceutical dispensing system is a defined as a plurality of sub pharmaceutical dispensing systems working in coordination. In some embodiments, each of the sub pharmaceutical dispensing systems is responsible for a specific zone, for example, a country and/or a state and/or a city; and/or responsible for a specific role, for example, distribution and/or storage and/or maintenance and/or support. In some embodiments, a sub pharmaceutical dispensing system interacts with at least one other sub pharmaceutical dispensing system.

An aspect of some embodiments of the invention relates to a reliable pharmaceutical dispensing system comprising a robust logistical operational system, including pharmaceutical dispensing machines located in places of need, a Computational Logistics Tracking Module, a Computational Logistics Model Module and a Computational Logistics Action Module. In some embodiments, the pharmaceutical dispensing system is in communication with a Medical Pharmaceutical Database and/or a Medical Professional Staff; said Medical Pharmaceutical Database configured to include all relevant medical and pharmaceutical information need to achieve an actionable instruction regarding the pharmaceutical dispensing process; said Medical Professional Staff capable of providing said actionable instruction regarding the pharmaceutical dispensing process when the Medical Pharmaceutical Database cannot.

An aspect of some embodiments of the invention relates to a reliable pharmaceutical dispensing system having a main directive, which is guaranteeing the reliable provision of medical care to the patients. In some embodiments, a medical solution is provided to a logistical problem (i.e. providing an alternative or substitute pharmaceutical instead of the original pharmaceutical that was prescribed).

A broad aspect of the present invention relates to providing a patient with a pharmaceutical by providing a plurality of dispensing options and selecting at least one dispensing option from said plurality of dispensing options, in a pharmaceutical dispensing system.

An aspect of some embodiments of the invention relates to support for pharmaceutical dispensing units of a pharmaceutical dispensing system located in long-term care facilities. In some embodiments, a drug-dispensing unit receives support from another drug-dispensing unit within the same long-term care facility. In some embodiments, a drug-dispensing unit located in a long-term care facility receives support from another drug-dispensing unit located in a different long-term care facility. In some embodiments, a drug-dispensing unit located in a long-term care facility receives support from a pharmaceutical storage unit. In some embodiments, a drug-dispensing unit located in a long-term care facility receives support from a pharmacy. Optionally, the pharmacy comprises a drug-dispensing unit. In some embodiments, the pharmaceutical dispensing system coordinates the support to and between all long-term care facilities.

An aspect of some embodiments of the invention relates to providing a pharmaceutical dispensing service to a location (e.g. long-term care facility) that do not comprises a drug-dispensing unit. In some embodiments, a location that do not comprises a drug-dispensing units means a location that do not comprises a physical machine related to the system. Optionally, a location that do not comprises a drug-dispensing units means a location that requires additional transportation from the place of packaging to the final destination of dispensing. In some embodiments, a pharmaceutical dispensing service means receiving pharmaceuticals from a drug-dispensing machine. In some embodiments, said parameters are time and/or distance from the closest drug dispensing unit. In some embodiments, a drug-dispensing unit located in a long-term care facility provides a pharmaceutical dispensing service to the facility that do not comprises a drug-dispensing unit. In some embodiments, a pharmaceutical storage unit provides a pharmaceutical dispensing service to the facility that do not comprises a drug-dispensing unit. In some embodiments, a pharmacy provides a pharmaceutical dispensing service to the facility

that do not comprises a drug-dispensing unit. Optionally, the pharmacy comprises a drug-dispensing unit.

An aspect of some embodiments of the invention relates to ensuring the dispensing of a pharmaceutical to a patient by providing at least one alternative pharmaceutical dispensing source and/or by providing at least one pharmaceutical substitute to the pharmaceutical and/or by providing at least one pharmaceutical alternative to the pharmaceutical. In some embodiments, providing at least one pharmaceutical substitute includes providing a pharmaceutical substitute comprising the same and/or a similar active ingredient but from a different brand and/or supplier. In some embodiments, providing at least one pharmaceutical alternative includes providing a pharmaceutical alternative comprising the same and/or a similar active ingredient but having a different dose. In some embodiments, providing at least one pharmaceutical substitute to the pharmaceutical and/or by providing at least one pharmaceutical alternative to the pharmaceutical comprises contacting a qualified personnel (i.e. a nurse, a physician, a pharmacist) of the need to provide at least one pharmaceutical substitute and/or at least one pharmaceutical alternative. In some embodiments, a qualified personnel approves providing at least one pharmaceutical substitute and/or at least one pharmaceutical alternative.

An aspect of some embodiments of the invention relates to pharmaceutical tracking dispensing system for users in long-term care facilities in a pharmaceutical dispensing system. In some embodiments, the tracking system uses a personalized schedule of each user in a long-term care facility. In some embodiments, the personalized schedule includes information regarding drug-dispensing schedule and type of drug. In some embodiments, the personalized schedule includes information regarding the physical location of the user. In some embodiments, the tracking system uses the personal electronic devices of the user (i.e. cellphone, tablet, smartwatch). In some embodiments, the dispensing of the drug is coordinated with the location of the user. In some embodiments, the dispensing of the drug comprises choosing a facility that can provide the drug that is the closest to the location of the user.

An aspect of some embodiments of the invention relates to organization of the dispensing of pharmaceuticals to pharmaceutical dispensing units and/or users in long-term care facilities. In some embodiments, the system collects and analyzes information regarding the drug-dispensing behavior of long-term care facilities. In some embodiments, drug-dispensing behavior includes types of pharmaceuticals and/or quantity of pharmaceuticals and/or frequency of dispensing of pharmaceuticals. In some embodiments, the system organizes the geographical allocation of pharmaceuticals in pharmaceutical storage units according to parameters recovered from the analysis of the drug-dispensing behavior. In some embodiments, the system allocates

and/or re-allocates pharmaceuticals according to predictive algorithms using parameters derived from drug-dispensing behavior analysis. In the past, storage of pharmaceuticals was directly decided by the actual location of the users, for example, a long term facility would store the required pharmaceuticals in-house since the users are located in the long term facility. Therefore, it was expected that the storage of pharmaceuticals would be, for example, on the same place as the users. In some embodiments, the actual storage location of the pharmaceuticals is different from the expected storage location of the pharmaceuticals. In some embodiments, the storage placement of the pharmaceuticals is not the same place as the users. In some embodiments, the actual storage placement of the pharmaceuticals is different from the expected storage placement. In some embodiments, the system comprises the information regarding an expected location for pharmaceutical storage. In some embodiments, the system may or may not require the information regarding an expected location for pharmaceutical storage for providing a storage placement for pharmaceuticals.

Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not necessarily limited in its application to the details of construction and the arrangement of the components and/or units and/or methods set forth in the following description and/or illustrated in the drawings and/or the Examples. The invention is capable of other embodiments or of being practiced or carried out in various ways.

Prior art

Over the years, pharmacies have been a backbone in providing prescription drugs and other medications to people and have been a convenience as retail pharmacies have expanded to locations close to most residential areas. Today the primary dispensing method in Long Term Care facilities is through dispensing at a long term care pharmacy. Packing the medication(s) in a traditional blister pack and or otherwise known as punch card and then delivered via a courier service to the facility where the patient resides. Recently, pharmacies also have been placed inside of facilities such as hospitals, physician offices, malls, nursing homes, retirement homes, assisted living facilities, and other locations to make it easier for people to get access to medications and to facilitate interaction with medical personnel.

Referring now to Figure 1, showing a schematic representation of an exemplary prior art system used, for example, in a long term care facility. The system comprises a storage and dispensing machine **100**, which is brought to the long term care facility. There, a nurse **102** collects the pharmaceuticals and brings them to the patients **104**.

It is common, in these prior art systems, that the machine stops working due to, for example, a technical malfunction, maintenance or unscheduled refill of pharmaceuticals. In any of these scenarios, the personnel of the long term care facility is required again to deal directly with the pharmaceuticals until the machine is repaired and/or resupplied.

It is also known, that one of the most problematic issues in pharmaceutical dispensing services to long term facilities is the logistics of transporting the pharmaceuticals from the place of origin (i.e. the warehouse, the pharmacy, the medication cart in the hospital, etc.) into the hand of the patient. While problems in logistics in regular non-medical goods probably will not cause the death of people, logistic problems in medical pharmaceutical goods could potentially cause severe health damage to patients. In order to overcome the downsides of the prior art systems, the present invention presents a highly reliable pharmaceutical dispensing system.

Exemplary Reliable Pharmaceutical Dispensing System

In some embodiments, the exemplary reliable pharmaceutical dispensing system comprises several modules in communication with a robust logistic operational system which enable the reliability of the pharmaceutical dispensing system.

Referring now to Figure 2, a schematic diagram showing that the reliability of the pharmaceutical dispensing system resides in the interaction between 4 parts: the robust logistic operational system **202**, a computational logistic tracking module **204**, a computational logistic model module **206** and a computational logistic action module **208**.

Exemplary Robust Logistic Operational System **202**

In some embodiments, in order to ensure the dispensing of pharmaceuticals to the patients, the system comprises a plurality of logistical instruments. In some embodiments, examples of logistical instruments are pharmaceutical dispensing machines located in the long term facilities, warehouses, delivery trucks, technicians, pharmacies – just to name a few.

In the following paragraphs, detail description of different interactions between the exemplary logistical instruments will be explained.

Exemplary basic system

Referring now to Figure 3a, showing a schematic representation of an exemplary basic pharmaceutical dispensing system, according to some embodiments of the invention. In some embodiments, the minimal requirement of a pharmaceutical dispensing system comprises a dispensing machine **300**, a server **302** and a warehouse **304**. In some embodiments, the

dispensing machine **300** is connected to the central server **302**. In some embodiments, there is an exchange of information between the dispensing machine and the server, for example prescriptions, pharmaceutical inventories and technical status of the machine. In some embodiments, the server is also connected to a warehouse **304**, which, according to instructions from the server, provides pharmaceuticals and/or technical assistance to the dispensing machine.

Referring now to Figure 3b, showing a schematic representation of a variety of pharmaceutical machines (devices) used by the pharmaceutical dispensing system. In some embodiments, the pharmaceutical dispensing system comprises a plurality of devices that can be placed in the relevant locations. In some embodiments, one or more devices are placed in the same location. In some embodiments, a combination of devices are placed in the same location. In some embodiments, the devices are capable of storing and dispensing pharmaceuticals. In some embodiments, the devices only storage pharmaceuticals. In some embodiments, the device is a large dispensing machine **306**. In some embodiments, the device is a small dispensing machine **308**. In some embodiments, the device is a bulk storage cabinet **310**. In some embodiments, the device is a refrigerator **312**. In some embodiments, the device is a nursing cart **314**.

In some embodiments, the large pharmaceutical dispensing machine **306** is adapted to store, package and dispense a large quantity of pharmaceuticals. In some embodiments, the small pharmaceutical dispensing machine **308** comprises the same capabilities of the large machine **306** but with fewer pharmaceuticals in it. In some embodiments, the bulk storage cabinet **310** comprises a variety of pharmaceuticals and medical materials (e.g. liquid drugs, IV, bandages, insulin, and pill storage) in bulk. In some embodiments, the small and/or the large pharmaceutical dispensing machine packages pharmaceuticals as the circumstance arises (also known as PRN - “pro re nata”) and/or first dose pharmaceuticals for a single patient. In some embodiments, adapted and authorized personnel can access the bulk storage cabinet **310** when necessary. In some embodiments, the refrigerator **312** comprises a variety of pharmaceuticals and/or medical materials that require special storage temperatures. In some embodiments, adapted and authorized personnel can access the refrigerator **312** when necessary. In some embodiments, the nursing cart **314** are locked and opened by adapted and authorized personnel.

In some embodiments, any of the above dispensing machines and/or storage units assists in the pharmaceutical dispensing service. In some embodiments, different devices of the system are used in combination to provide the pharmaceuticals in the pharmaceutical dispensing service. In some embodiments, each of the abovementioned devices is monitored and controlled by the system.

In some embodiments, any of the above dispensing machines and/or storage units comprise a plurality of pharmaceuticals according to their physical capacities, for example, certain dispensing machine may comprise 30 different pharmaceuticals, while other may comprise 100 or 300 or any quantity of different pharmaceuticals.

In some embodiments, the pharmaceutical dispensing machines comprise identical double modules configured to replace one another and/or to work in parallel to one another. In some embodiments, this increases the reliability of the pharmaceutical dispensing system from mechanical failures of the machines. In some embodiments, modules of the pharmaceutical dispensing machines are configured to be extracted from the machine without affecting the dispensing process of the machine or disturbing the functioning of the parallel module. In some embodiments, when a physician provides a new prescription for a medicine to a patient, the system checks if the medicine is currently available in the pharmaceutical dispensing machine. If the medicine is not part of the current inventory, the system then provides alternatives based on the current inventory of the pharmaceutical dispensing machine, which enables a swift and easy insertion of the new prescription into the next pharmaceutical dispensing cycle. In some embodiments, this also enables a minimal time from the moment a physician writes a prescription until the patient receives the medicine, since, in some embodiments, the pharmaceutical dispensing machine is configured to dispense a single envelope on request, besides the preparation of the dose in the next dispensing cycle.

In some embodiments, from a legal point of view, the custody of the pharmaceuticals remains at the pharmaceutical dispensing system until the moment is delivered to a dedicated personnel in the facility (i.e. a nurse, a physician). In some embodiments, at this moment, the custody of the pharmaceutical is transferred to the authorized personnel until is delivered directly to the patient.

Exemplary logistical interactions in a pharmaceutical dispensing system

In some embodiments, the pharmaceutical dispensing system coordinates the interactions between the pharmaceutical dispensing system and other machines and/or systems and/or facilities. In some embodiments, a specific pharmaceutical dispensing system (e.g. a dispensing machine) may require support (i.e. technical assistance and/or refilling and/or emergency supply). In some embodiments, support is provided from another pharmaceutical dispensing system (e.g. another dispensing machine).

In some embodiments, units of the pharmaceutical dispensing system are also defined by a relative physical distance and/or a relative period of time between them. In some embodiments,

the relative physical distance is from about 0 kilometers to about 500 kilometers. Optionally, the relative physical distance is from about 50 kilometers to about 300 kilometers. Optionally, the relative physical distance is from about 100 kilometers to about 200 kilometers. In some embodiments, the relative period of time required to move from one pharmaceutical dispensing system to another is from about 0 minutes to about 48 hours. Optionally, the relative period of time required to move from one pharmaceutical dispensing system to another is from about 30 minutes to about 24 hours. Optionally, the relative period of time required to move from one pharmaceutical dispensing system to another is from about 2 hours to about 12 hours.

In some embodiments, depending on the nature of the problem (e.g. technical malfunction, refilling) and the level of urgency, the system activates a unit in the pharmaceutical dispensing system (e.g. a dispensing machine) according to the distance and/or the time required to reach the dispensing machine in trouble. In some embodiments, the time of preparation of the pharmaceuticals before the dispensing and/or the time of the dispensing itself are also taken under consideration when choosing which unit to activate. For example, a dispensing machine stopped working and the next scheduled round of dispensing pharmaceuticals is in 3 hours. At this point, the system activates the closest dispensing machine that is equipped to provide the required pharmaceuticals. Another example, if the next scheduled round of dispensing pharmaceuticals is in 10 hours, but the time for a technician to arrive is 3 hours, the system will activate the technician instead of requesting pharmaceuticals from a different dispensing machine.

In some embodiments, the parameter that guides which unit is activated is the assurance that the patients will receive the pharmaceuticals on time. In some embodiments, the parameter that guides which unit is activated is the request from a single and/or multiple dispensing machines to the potential provider of pharmaceuticals and/or technical assistance.

Exemplary different interactions will be described in the following paragraphs.

Exemplary on-site second system (on-site interaction layer)

In some embodiments, the pharmaceutical dispensing system comprises at least two dispensing machines located in the same site (e.g. long term care facility). Referring now to Figure 4, showing a schematic representation of an on-site pharmaceutical dispensing system. In some embodiments, the on-site system comprises at least two dispensing machines **400-402**, in communication with each other by conventional means (e.g. wire, wireless) and in communication with the server **302** (not shown). In some embodiments, the personnel **404** of the long term care facility may access each dispensing machine and provide pharmaceuticals to the patients **406**.

In some embodiments, the dispensing machines located at the same site are identical to each other in their capabilities to store and dispense pharmaceuticals. In some embodiments, the dispensing machines located at the same site are different to each other in their capabilities to store and dispense pharmaceuticals. In some embodiments, one of the dispensing machines is a main dispensing machine, comprising the necessary pharmaceuticals required for the long term facility, while the other dispensing machine is a secondary dispensing machine comprising some of the necessary pharmaceuticals required for the long term facility. In some embodiments, if one of the two dispensing machines is unable to fulfill its purpose, then the second dispensing machine "covers" for the purpose of both dispensing machines until the first dispensing machine is returned to normal function. This enables a continue cover of the pharmaceutical dispensing requirements of the long term facility almost without the necessity to involve the long term facility personnel.

For example, a facility comprises a large dispensing machine **306** and a small dispensing machine **308**. In some embodiments, the two machines work in coordination with each other to provide pharmaceutical dispensing service to the facility. Optionally, any combination of two machines (large dispensing machine **306**, a small dispensing machine **308**, bulk storage cabinet **310**, a refrigerator **312** and/or a nursing cart **314**) apply to this example. In some embodiments, if either of the machines cannot provide the dispensing service, the second machine fulfills the required service for both machines.

Exemplary off-site second system (off-site interaction layer – second system)

Referring now to Figure 5, showing an exemplary schematic representation of the interaction between a long term facility **500** and a secondary off-site location **502** having a second pharmaceutical dispensing system **506**. In some embodiments, if the dispensing machine **504** located at the long term facility **500** requires assistance, for example due to a malfunction and/or lack of inventory (or any other reason) and cannot supply, either partially or completely, the required pharmaceuticals, the dispensing machine **504** contacts the server (not shown) and makes an automatic request. In some embodiments, the server activates a second dispensing machine **506** located at another site **502**, which is capable of supplying the required, either all or partially, pharmaceuticals without affecting the performance requirements of its own site. In some embodiments, the movement of pharmaceuticals from one site to the other is performed by dedicated transportation units **508** sent by the system. In some embodiments, the movement of pharmaceuticals from one site to the other is performed by the personnel **510** of either facility. In

some embodiments, the secondary dispensing device will provide assistance as long as is necessary.

In some embodiments, the secondary off-site location **502** is located in close proximity of the long term facility **500**. In some embodiments, close proximity is defined as travel time to the long term facility from about 0 minutes to about 20 hours. Optionally from about 2 hours from about 12 hours. Optionally from about 4 hours to about 8 hours. In some embodiments, close proximity is defined as travel distance to the long term facility from to about 0 kilometers to about 1000 kilometers. Optionally, from about 50 kilometers to about 500 kilometers. Optionally from about 100 kilometers to about 300 kilometers.

Exemplary off-site main system (off-site interaction layer – main system)

Referring now to Figure 6, showing a schematic representation of an off-site main system and its interaction with a site without a dispensing machine. In some embodiments, a first location **600** may not comprise a dispensing machine of their own. In some embodiments, storage, preparation of pharmaceuticals and dispensing is performed in an off-site location **602** having a pharmaceutical dispensing system and dispensing machine **604** and delivered **606** to the personnel **608** at the first location **600**. In some embodiments, the first location **600** comprises a dedicated user interface unit (i.e. a dedicated online website view from a regular computer or a dedicated interface unit) from which the necessary communications with the system, through a server, are performed.

Exemplary off-site distant second system (off-site interaction layer – distant second system)

Referring now to Figure 7, showing an exemplary schematic representation of the interaction between a long term facility **700** and a secondary distant off-site location **702** (e.g. in another state) having a second pharmaceutical dispensing system. In some embodiments, if the dispensing machine located at the long term facility **700** requires assistance, for example due to a malfunction and/or lack of inventory (or any other reason), the dispensing machine located at the long term facility **700** contacts the server and performs an automatic request. In some embodiments, the server will analyze the request and activate a second dispensing machine located at another site **702** is capable of supplying the required pharmaceuticals without affecting the performance requirements of its own site. In some embodiments, the movement of pharmaceuticals from one site to the other is performed by dedicated transportation units **704** sent by the system. In some embodiments, the movement of pharmaceuticals from one site to the other

is performed by the personnel (not shown) of either facility. In some embodiments, the secondary dispensing device will provide assistance as long as is necessary.

In some embodiments, the secondary distant off-site location **700** is not located in close proximity of the long term facility **702**. In some embodiments, assistance from distant long term facilities and/or dispensing machines is activated only when there is no other facility closer to the one that requires assistance, and/or when the assistance is not urgent and a delayed arrival of assistance will not incur a miss in the dispensing of the pharmaceuticals to the patients. In some embodiments, not in close proximity is defined as travel time to the long term facility of about 24 hours or more. In some embodiments, not in close proximity is defined as travel distance to the long term facility of about 1000 kilometers or more.

Exemplary off-site outside the system (off-site interaction layer – outside the system)

Referring now to Figure 8, showing an exemplary schematic representation of the interaction between a long term facility **800** and a pharmacy **802**. The pharmacy **802** is an entity outside the pharmaceutical dispensing system. In some embodiments, the pharmacy **802** may include a dispensing machine **804** which belongs to the pharmaceutical dispensing system. In some embodiments, the pharmacy does not include a dispensing machine. In some embodiments, when a dispensing machine located at the long term facility **800** requires assistance, for example due to a malfunction and/or lack of inventory (or any other reason), the dispensing machine located at the long term facility **800** communicated with the server and performs an automatic request. In some embodiments, the server activates a pharmacy **802**, which either includes a dispensing machine **804** or not, and which is capable of supplying the required pharmaceuticals without affecting the performance requirements of its own site. In some embodiments, the movement of pharmaceuticals from the pharmacy **802** to the long term facility **800** is performed by dedicated transportation units **806** sent by the system. In some embodiments, the movement of pharmaceuticals from one site to the other is performed by the personnel of either facility. In some embodiments, the pharmacy will provide assistance as long as is necessary.

In some embodiments, the activation of a pharmacy to supply assistance is done when no other dispensing machine is in close proximity and when the urgency of the delivery is high (i.e. providing pharmaceuticals to the patients on time).

Exemplary Pharmaceutical Dispensing Ecosystem

The general use of the word ecosystem means “a complex network or interconnected system”. Referring now to Figure 9a, showing a schematic representation of the possible

interactions in a pharmaceutical dispensing ecosystem. In some embodiments, interactions between the dispensing machines **900**, the facilities **902**, the storage units **904**, the server **906**, the pharmacies **908**, the different regions **910-912**, are all part of the pharmaceutical dispensing ecosystem. Also shown in Figure 8a is the possible activation of dedicated delivery services **914** used together with the tracking system. Referring now to Figure 9b showing a schematic representation of an exemplary cascade of interactions. In some embodiments, the interaction begins with a first degree interaction between two dispensing machines within the same facility **916**. In some embodiments, the interaction continues with a second degree interaction between facilities **918** in the vicinity to each other (as represented by circle **920**). In some embodiments, the interaction continues with a third degree interaction between facilities **922** that are not in the vicinity of each other (as represented by circle **924**). In some embodiments, the interaction continues with a fourth degree interaction between facilities and other units (i.e. pharmacies, storage units) **926**, which can cover all distances (as represented by circle **928**). In some embodiments, the order of the degrees of interactions depends on the distance between dispensing units. In some embodiments, the order of the degrees of interaction depends on the quickest response time. In some embodiments, the order of the degrees of interaction depends on the availability of the pharmaceuticals. In some embodiments, the order of the degrees of interaction depends on a combination of all of the above.

Exemplary Logistical Pharmaceutical Dispensing methods

Referring now to Figure 10, showing a schematic flowchart of one exemplary method of management and operations performed by the pharmaceutical dispensing system. In some embodiments, the dispensing machine runs a self-diagnostic program **1002** on its software, hardware and inventory. In some embodiments, the dispensing machine might detect an issue **1004** during the self-diagnostic program. In some embodiments, issues revealed by the self-diagnostic program might be, for example, a technical issue **1006**, an inventory issue **1008** a security issue **1010**, a consumable issue **1012** and/or an unknown issue **1014**. In some embodiments, a cascade of inquiries is activated in each of the scenarios in order to assess the situation and proceed accordingly, as will be explain in the following paragraph. In some embodiments, the dispensing machine continues the diagnostic program **1012** until either it receives an "all ok" response or until an issue is detected and identified. In some embodiments, if the issue is a technical issue **1006** and/or an inventory issue **1008** and/or an unknown issue **1014**, then (Flowchart continues following the letters A, B and E to Figure 11), the system assesses if there is a second dispensing machine on-site **1102**. In some embodiments, if there is, the system

assesses if the second dispensing machine comprises the necessary pharmaceuticals for the correct dispensing in the long term facility **1104**. In some embodiments, if the second dispensing machine comprises the necessary pharmaceuticals, the system changes the primary dispensing machine to the back-up dispensing machine **1106**, and contacts the server to communicate the issue **1108**. In some embodiments, if the second dispensing machine does not comprise the necessary pharmaceuticals, the system contacts the server to communicate the issue **1108**. In some embodiments, if there is not a second dispensing machine on-site, the system contacts the server to communicate the issue **1108**.

In some embodiments, if the issue is a security issue **1010**, then (Flowchart continues following the letter C to Figure 12), then the system commences two independent actions. In some embodiments, the system locks the machine **1202** and assesses if there are sensitive drugs in the dispensing machine **1204**. In some embodiments, if there are sensitive drugs, then the system contact the authorities (i.e. police) **1206** and contact the server to communicate the issue **1208**. In some embodiments, the second action is to assess if there is a second dispensing machine on-site **1210**. In some embodiments, there is, the system assesses if the second dispensing machine comprises the necessary pharmaceuticals for the correct dispensing in the long term facility **1212**. In some embodiments, if the second dispensing machine comprises the necessary pharmaceuticals, the system changes the primary dispensing machine to the back-up dispensing machine **1214**, and contacts the server to communicate the issue **1216**. In some embodiments, if the second dispensing machine does not comprise the necessary pharmaceuticals, the system contacts the server to communicate the issue **1216**. In some embodiments, if there is not a second dispensing machine on-site, the system contacts the server to communicate the issue **1216.**

In some embodiments, if the issue is a consumable issue **1012**, then (Flowchart continues following the letter D to Figure 13), then the system assesses if the consumable is replaceable by the personnel in-site (i.e. nurse) **1302**. In some embodiments, if the answer is yes, the system notifies the personnel **1304** that a consumable needs to be replaced and/or refilled, and then system contacts the server to communicate the issue **1306.** In some embodiments, if the consumable is not replaceable by the personnel, then the system assesses if there is a second dispensing machine on-site **1308**. In some embodiments, there is, the system assesses if the second dispensing machine comprises the necessary pharmaceuticals for the correct dispensing in the long term facility **1310**. In some embodiments, if the second dispensing machine comprises the necessary pharmaceuticals, the system changes the primary dispensing machine to the back-up dispensing machine **1312**, and contacts the server to communicate the issue **1314**. In some

embodiments, if the second dispensing machine does not comprise the necessary pharmaceuticals, the system contacts the server to communicate the issue **1314**. In some embodiments, if there is not a second dispensing machine on-site, the system contacts the server to communicate the issue **1314.**

In some embodiments, issues may be detected by the personnel of the long term facility. In some embodiments, the personnel of the long term facility may communicate the issues directly to the server by entering the relevant information, either through the control panel of the dispensing machine or through a dedicated website using a regular computer and/or smartphone and/or tablet.

Referring now to Figure 14, showing a schematic flowchart of a method performed by an exemplary server of the pharmaceutical dispensing system. In some embodiments, the server is contacted by a dispensing machine reporting an issue **1402**. In some embodiments, the server assesses what kind of issue is reported by the dispensing machine, for example, a technical issue **1404**, an inventory issue **1406,** a security issue **1408**, a consumable issue **1410** and/or an unknown issue **1412**. In some embodiments, a cascade of inquiries is activated in each of the scenarios in order to assess the situation and proceed accordingly, as will be explain in the following paragraph. In some embodiments, if the issues are related to technical issues **1404**, inventory issues **1406** and/or an unknown issue **1412**, then (Flowchart continues following the letters F, G and J to Figure 15) the servers first assesses if there is a second dispensing machine on-site **1502**. In some embodiments, if the answer is yes, then the server assesses if the second dispensing machine comprises the necessary pharmaceuticals for the correct dispensing in the long term facility **1504**. In some embodiments, if the second dispensing machine comprises the necessary pharmaceuticals, the system changes the primary dispensing machine to the second dispensing machine as the primary dispensing machine of the long term facility **1506**, and dispatches a technician and/or dispatches pharmaceuticals supplies to the long term facility to assess and repair the issue and/or to resupply the missing pharmaceuticals **1508**. In some embodiments, if there is not a second on-site dispensing machine, then (Flowchart continues following the letter K to Figure 16) the server assesses if there is a second dispensing machine off-site **1602** in the vicinity of the long term facility. In some embodiments, if the answer is yes, then the server assesses if the second off-site dispensing machine comprises the necessary pharmaceuticals for the correct dispensing in the long term facility **1604**. In some embodiments, if the second off-site dispensing machine comprises the necessary pharmaceuticals, the system changes the primary dispensing machine to the second off-site dispensing machine as the primary dispensing machine of the long term facility **1606**, and dispatches a technician and/or dispatches

pharmaceuticals supplies to the long term facility to assess and repair the issue and/or to resupply the missing pharmaceuticals **1608**. In some embodiments, if there is not a second dispensing machine off-site in the vicinity of the long term facility or the second dispensing machine off-site in the vicinity of the long term facility does not comprise the required pharmaceuticals (Flowchart continues following the letter L to Figure 17), the server assesses if there is a pharmacy (or other relevant HMO) in the vicinity of the long term facility **1702**. In some embodiments, if the answer is yes and there is a pharmacy nearby, the server assesses if the pharmacy has a dispensing machine from the pharmaceutical dispensing system **1704**. In some embodiments, if the answer is yes and the pharmacy has a dispensing machine, then the server changes the primary dispensing machine to the machine as the primary dispensing machine of the long term facility **1706**, and dispatches a technician and/or dispatches pharmaceuticals supplies to the long term facility to assess and repair the issue and/or to resupply the missing pharmaceuticals **1708**. In some embodiments, if the answer is no and the pharmacy does not have a dispensing machine, then the server activates the pharmacy by requesting the necessary pharmaceuticals, which will be provided as soon as possible to the long term facility **1710**, and dispatches a technician to the long term facility to assess and repair the issue **1708**.

In some embodiments, the answer to the inquiry regarding the availability of a pharmacy nearby is no. In some embodiments, at this point (Flowchart continues following the letter M to Figure 18), the server assesses if there is a second dispensing machine in an off-site **1802** location distant from the long term facility. In some embodiments, if the answer is yes, then the server assesses if the second dispensing machine in the off-site, which is far from the long term facility, comprises the necessary pharmaceuticals for the correct dispensing in the long term facility **1804**. In some embodiments, if the second dispensing machine in the off-site far from the long term facility comprises the necessary pharmaceuticals, the system changes the primary dispensing machine to the second dispensing machine in the far off-site as the primary dispensing machine of the long term facility **1806**, and dispatches a technician and/or dispatches pharmaceuticals supplies to the long term facility to assess and repair the issue and/or to resupply the missing pharmaceuticals **1808**. In some embodiments, if there is not a second dispensing machine in an off-site location distant from the long term facility or the second dispensing machine in the off-site far from the long term facility does not comprise the required pharmaceuticals (Flowchart continues following the letter **N** to Figure 19), the server assesses if there is a storage unit in the vicinity of the long term facility **1902**. In some embodiments, if the answer is yes and there is a storage unit nearby, the server assesses if the storage unit has a dispensing machine from the pharmaceutical dispensing system **1904**. In some embodiments, if the answer is yes and the

storage unit has a dispensing machine, then the server changes the primary dispensing machine to the dispensing machine of the storage unit as the primary dispensing machine of the long term facility **1906**, dispatches a technician and/or dispatches pharmaceuticals supplies to the long term facility to assess and repair the issue and/or to resupply the missing pharmaceuticals **1908**. In some embodiments, if the answer is no and the storage unit does not have a dispensing machine, then the server activates the storage unit by requesting the necessary pharmaceuticals, which will be provided as soon as possible to the long term facility **1910**, and dispatches a technician and/or dispatches pharmaceuticals supplies to the long term facility to assess and repair the issue and/or to resupply the missing pharmaceuticals **1908**. In some embodiments, if there is no storage unit in the near vicinity of the long term facility, the server contacts a human supervisor **1912** to notify him of the issue.

Returning to Figure 14, if the issue is a consumable issue **1410**, then (Flowchart continues following the letter I to Figure 20), then the system assesses if the consumable is replaceable by the personnel in-site (i.e. nurse) **2002**. In some embodiments, if the answer is yes, the system notifies the personnel **2004** that a consumable needs to be replaced and/or refilled, and then system dispatches consumables and/or a technician **2006**. In some embodiments, if the consumable is not replaceable by the personnel, then the system assesses if there is a second dispensing machine on-site **2008**. In some embodiments, if there is, the system assesses if the second dispensing machine comprises the necessary pharmaceuticals for the correct dispensing in the long term facility **2010**. In some embodiments, if the second dispensing machine comprises the necessary pharmaceuticals, the system changes the primary dispensing machine to the back-up dispensing machine **2012**, and dispatches consumables and/or a technician **2014**. In some embodiments, if the second dispensing machine does not comprise the necessary pharmaceuticals and/or if there is not a second dispensing machine on-site, then (Flowchart continues following the letter K back to Figure 16) the server assesses if there is a second dispensing machine off-site **1602** in the vicinity of the long term facility. The next actions following this assessment are the same as disclosed above, with the difference that consumables are dispatched instead of pharmaceuticals.

Returning to Figure 14, if the issue is a security issue **1408**, then (Flowchart continues following the letter H to Figure 21), then the system commences two independent actions. In some embodiments, the system activates the locking mechanism of the dispensing machine **2102** and assesses if there are sensitive drugs in the dispensing machine **2104**. In some embodiments, if there are sensitive drugs, then the system contacts the authorities (i.e. police) **2106** and dispatches relevant personnel (i.e. technician, supervisor) **2108**. In some embodiments, the second action is

to assess if there is a second dispensing machine on-site **2110**. In some embodiments, there is, the system assesses if the second dispensing machine comprises the necessary pharmaceuticals for the correct dispensing in the long term facility **2112**. In some embodiments, if the second dispensing machine comprises the necessary pharmaceuticals, the system changes the primary dispensing machine to the back-up dispensing machine **2114**. In some embodiments, if the second dispensing machine does not comprise the necessary pharmaceuticals and/or if there is not a second dispensing machine on-site, then (Flowchart continues following the letter K back to Figure 16) the server assesses if there is a second dispensing machine off-site **1602** in the vicinity of the long term facility. The next actions following this assessment are the same as disclosed above.

Exemplary Quantitative and Qualitative Pharmaceutical Supplementary Dispensing

As mentioned above, in some embodiments, the pharmaceutical dispensing system comprises a plurality of sources from which the system can choose in order to ensure providing the pharmaceutical to the user at the scheduled time. In some embodiments, ensuring the arrival of a pharmaceutical to a destination on time includes providing a determined pharmaceutical from another location, for example: from another pharmaceutical dispensing machine in the same building, from a pharmaceutical dispensing machine in another location (either in close proximity to the dispensing location or far from the dispensing location) or from a pharmacy. In some embodiments, this is called "Quantitative Supplemental Dispensing" since the system ensures the arrival of a pharmaceutical to the destination at the set time by providing the exact same pharmaceutical that was scheduled to be dispensed (quantity missing = quantity dispensed).

In some embodiments, when the exact same pharmaceutical is not available and/or cannot arrive at the scheduled time – and therefore the dispensing of the pharmaceutical to the user at the specified schedule cannot be ensured, the system activates what, in some embodiments, is called "Qualitative Supplemental Dispensing", which means that the system searches for either at least one substitute pharmaceutical or at least one alternative pharmaceutical to be provided to the patient at the scheduled time.

In some embodiments, for example, substitute pharmaceuticals are pharmaceuticals comprising the same active ingredient but it is supplied by a different supplier, for example in the case for pharmaceuticals that are sold under a known brand and pharmaceuticals that comprise the same active principle but are sold under a generic brand.

In some embodiments, for example, alternative pharmaceuticals are pharmaceuticals comprising a different active ingredient but the act similarly, or same pharmaceutical but with higher/lower concentration of active ingredient.

In some embodiments, the use of substitute pharmaceuticals and/or alternative pharmaceuticals require contacting and the approval of a qualified personnel (i.e. a nurse, a physician, a pharmacist). In some embodiments, the approval and type of alternatives and/or substitutes are inserted in the system with the insertion of the original pharmaceutical prescription. In some embodiments, this enables the system to operate automatically without the need to contact the qualified personnel in case of a problem. In some embodiments, when there are no alternatives and/or substitutes in the system, the system contacts in real time a dedicated personnel to receive input on alternatives and/or substitutes.

In some embodiments, alternatives and/or substitutes are provided as one time solution. In some embodiments, alternatives and/or substitutes are provided multiple times. In some embodiments, due to the provision of alternatives and/or substitutes, the pharmaceutical dispensing plan is changed to said alternatives and/or substitutes.

Referring now to Figure 22, showing a schematic flowchart of an exemplary method of providing alternatives and/or substitutes in an automatic pharmaceutical dispensing process, according to some embodiments of the present invention.

In some embodiments, the dispensing machine runs a self-diagnostic program **2202** on its software, hardware and inventory. In some embodiments, the dispensing machine might detect an issue **2204** during the self-diagnostic program. In some embodiments, issues revealed by the self-diagnostic program might be, for example, a technical issue, an inventory issue, a security issue, a consumable issue **2204** and/or an unknown issue. In some embodiments, when the system detects an inventory issue, the system assesses if the issue interferes with the dispensing of pharmaceuticals in the next dispensing cycle. In some embodiments, if the issue does not interfere with the dispensing of pharmaceuticals of the next dispensing cycle, the system continues with the dispensing process and contacts the server **2206** to resolve the inventory issue before the relevant dispensing cycle. In some embodiments, if the issue does interfere with the dispensing of pharmaceuticals of the next dispensing cycle, the system contacts the server in order to search for a supplementary pharmaceutical dispensing source of the exact same pharmaceutical that needs to be dispensed in the next dispensing cycle and that can arrive to meet the scheduled dispensing time **2208**. In some embodiments, the system actively assesses if the server provided a supplementary pharmaceutical dispensing source of the exact same pharmaceutical to be dispensed and that can arrive to meet the scheduled dispensing time **2210**.

In some embodiments, if the answer is yes, then the system continues with the dispensing process and contacts the server to update the status of the dispensing process **2212**. In some embodiments, if the answer is no, meaning the server has not provided a supplementary pharmaceutical dispensing source of the exact same pharmaceutical to be dispensed and that can arrive to meet the scheduled dispensing time, either because, for example, there is no exact match in the database or because there is a problem with the server, (continues following the letter "O" to Figure 23) the system assesses if there is on file an approved substitute and/or an alternative pharmaceutical for the original pharmaceutical to be dispensed **2302**. In some embodiments, if there is on file an approved substitute and/or an alternative pharmaceutical for the original pharmaceutical to be dispensed, then the system contacts the server **2304** to search for a supplementary pharmaceutical dispensing source of the substitute and/or the alternative pharmaceutical for the original pharmaceutical to be dispensed so it will arrive at the scheduled time of dispensing. In some embodiments, the system actively assesses if the server provided a supplementary pharmaceutical dispensing source for the substitute and/or the alternative pharmaceutical for the original pharmaceutical to be dispensed so it will arrive at the scheduled time of dispensing **2306**. In some embodiments, if the answer is yes, then the system continues with the dispensing process **2308**. In some embodiments, if the answer is no, then the system contacts a human supervisor and notifies him of the issue **2310**. Returning to **2302**, when the system assesses if there is on file an approved substitute and/or an alternative pharmaceutical for the original pharmaceutical to be dispensed, in some embodiments, if the answer is no, then (continues following the letter "P" to Figure 24) the system contacts a qualified personnel and requests for an approved substitute and/or an alternative pharmaceutical for the original pharmaceutical to be dispensed **2402**. In some embodiments, the system assesses if an input from the qualified personnel was received **2404**. In some embodiments, if the answer is no, then the system contacts a human supervisor and notifies him of the issue **2406**. In some embodiments, if the answer is yes, then the system contacts the server and requests to search for a supplementary pharmaceutical dispensing source of the substitute and/or the alternative pharmaceutical for the original pharmaceutical to be dispensed so it will arrive at the scheduled time of dispensing **2408**. In some embodiments, (continues following the letter "Q" back to Figure 23), the system then assesses if the server provided a supplementary pharmaceutical dispensing source for the substitute and/or the alternative pharmaceutical for the original pharmaceutical to be dispensed so it will arrive at the scheduled time of dispensing **2306**, and the loop of the process is closed until a positive solution is found or a human supervisor is contacted.

Exemplary Pharmaceutical Dispensing Storage system

In some embodiments, a plurality of storage units are part of the pharmaceutical dispensing system. In some embodiments, the storage units comprise a plurality of pharmaceuticals according to the requirements of the long term facilities having pharmaceutical dispensing machines, which are located in the vicinity of the storage unit. In some embodiments, the server monitors the requirements of the different long term facilities and distributes accordingly the pharmaceuticals in the storage units.

In some embodiments, the server comprises a dedicated software that monitors the requirements of a specific area, collects the information in dedicated databases and performs analysis on the information. In some embodiments, based on the information, the server is capable to anticipate the needs of different zones and activate the timely delivery of supplies according to their expected needs. In some embodiments, the information includes, for example, the pharmaceuticals shelf life, the pharmaceuticals costs (for example, ordering pharmaceuticals having similar active ingredients but cost less), the expected time of supply from the pharmaceuticals suppliers, the type of pharmaceuticals needed in the region, the time of year (for example, expecting more cases of flu during the winter), pharmaceuticals that need special handling requirements (e.g. refrigeration, exposure to light), pharmaceuticals that need to be under lock, the form that the pharmaceutical is provided (i.e. liquid, powder, pill, IV).

In some embodiments, a single storage unit can supply pharmaceuticals to a variety of long term facilities in the same region. In some embodiments, a single storage unit can supply pharmaceuticals to adjacent regions, each region comprising a variety of long term facilities.

In some embodiments, the software is adapted to monitor and match the National Drug Code (NDC) of the pharmaceuticals. In some embodiments, monitoring and matching of the pharmaceuticals by their NDC is performed at any time that any pharmaceutical is moved, for example, when being loaded into envelopes and/or when being loaded into dispensing machines. In some embodiments, monitoring and matching of the pharmaceuticals by their NDC may reduce incidents where an incorrect pharmaceutical is being loaded and/or dispensed.

In some embodiments, the system comprises a dedicated algorithm responsible for the storage organization of the pharmaceuticals. In some embodiments, the storage organization is dictated by a plurality of parameters. Exemplary parameters are:

Required pharmaceuticals for the current population in the facilities, and between them: common prescribed pharmaceuticals, pharmaceuticals that need to be dispensed on a regular basis, predicted and commonly used pharmaceuticals that are not yet prescribed to specific tenants but likely to be required.

Life expectancy of the pharmaceuticals, for example, not to keep pharmaceuticals that are likely to expire unless consumed regularly by the current tenants.

Storage pharmaceuticals between the different storage devices (in case more than one dispensing machine is in the site) based on, for example, location of use, frequency of use, type of drug (i.e. bulk, liquid, powder).

Storage pharmaceuticals based on multiple facilities, for example, for rare drugs use facility to store rare drugs for another facility in close proximity.

Consolidate and storage same drug from different makers.

Storage pharmaceuticals based on costs, for example, batch production vs one at a time, expiration time, special storage requirements (e.g. refrigeration), consistency of drugs (e.g. liquid, powder, pills).

Storage pharmaceuticals based on costs of buying the pharmaceuticals from the providers (e.g. same drug can be bought at different prices at different locations).

Storage pharmaceuticals based on the level of automation of the storage facility, for example, manual storage lockers, fully computerized storage facility.

In the past, storage of pharmaceuticals was directly decided by the actual location of the users, for example, a long term facility would store the required pharmaceuticals in-house since the users are located in the long term facility. Therefore, it was expected that the storage of pharmaceuticals would be, for example, on the same place as the users. Different cases might provide different expected storage locations. In some embodiments, the actual storage location of the pharmaceuticals is different from the expected storage location of the pharmaceuticals. In some embodiments, the storage placement of the pharmaceuticals is not the same place as the users. Referring now to Figure 25, showing a schematic representation of a methodology of organizing the storage of pharmaceuticals in a pharmaceutical dispensing system. In some embodiments, the system comprises the information regarding an expected location for pharmaceutical storage **2502**. In some embodiments, the system analyzes the data regarding each pharmaceutical according to defined parameters **2504**. In some embodiments, the actual storage placement of the pharmaceuticals is different from the expected storage placement **2506**. In some embodiments, the system does not require the information regarding an expected location for pharmaceutical storage **2502** for providing a storage placement for pharmaceuticals.

Exemplary Pharmaceutical Dispensing System – user tracking system

One of the downsides of the prior art system is that the system is not updated with the location of the patients in real-time. For example, a patient in a hospital is required to take a

medicine at a certain time. So it happens, that at that same time the patient was transferred to another department inside the hospital, for example physiotherapy. The nurse, or any other personnel responsible for giving the medicine to the patient, is now required to look for the patient, find him and ensure that the patient will get the medicine on time. This causes a waste of time and resources. A worse scenario, is the possibility that the patient might get a double dose, one at the physiotherapy department and another once he is back. This might endanger the health of the patient. Another example, a patient in a long term facility decides to spend the holidays with his family. If the system is not updated with the location of the patient, the dispensing machine will keep dispensing his medicine even if he is not located in the long term facility. This, again, causes a waste of resources.

In some embodiments, the pharmaceutical dispensing system comprises a personalized tracking system, adapted to include real-time information on the location of each patient.

In some embodiments, the tracking system comprises a daily schedule for each patient. In some embodiments, the schedule is updated by the user and/or the medical personnel of the facility. In some embodiments, the schedule comprises all the information regarding all the hours of the day, all the days of the year, and more.

In some embodiments, the server activates dedicated delivery services (e.g. special delivery services like UPS® or FEDEX®, a nurse, a pharmacy) using the information from the tracking system in order to dispense pharmaceuticals at the real-time location of the patient. In some embodiments, the patient can access a local pharmacy where the pharmaceuticals will be waiting for him.

In some embodiments, the location of the patient is updated manually by the long term facility personnel. In some embodiments, the location of the patient is tracked using an electronic tag, which is in communication with the system and provides real-time updates on the location of the patient. In some embodiments, the location of the patient is tracked using the personal electronic devices of the patient, for example, cellphone, tablet, smartwatch. In some embodiments, the location of the patient is tracked using a dedicated device provided to the patient.

Referring now to Figure 26, showing a schematic flowchart of a tracking method performed by an exemplary server of the pharmaceutical dispensing system. In some embodiments, the system inquiries if the patient will be at his regular location **2602**. Optionally, the system inquiries if the patient is currently at his regular location. If the answer is yes, then the system continues with the dispensing regularly **2604**. If the answer is no, them the system inquiries if the patient is at other location inside the facility **2606**. If the answer is yes, then the

system updates the location, as a temporary location of the patient in the facility **2608**. If the answer is no, then the system inquiries if the patient is at other facility **2610**. If the answer is yes, then the system updates the address of the other facility as temporary location, and transfers the drug prescriptions to the other facility **2612**. If the answer is no, then the system inquiries if the patient is at other address but not in a facility **2614**. If the answer is yes, then a personal drug package is prepared and sent to the new temporary address **2616**. If the answer is no, then the system evaluates the patient status **2618**, for example, deceased, not sick anymore, permanently moved to another facility.

Exemplary connection and or interface between the electronic medical record of the facility and management software

Referring now to Figure 27 showing a schematic representation of the connection and/or interface between the electronic medical record of the facility and the plurality of management softwares, according to some embodiments of the rpesent invention.

In some embodiments, each region (or facility, or plurality of facilities in a specified area) comprises a regional server **2702** (also called regional environment) adapted to hold the relevant database functionalities and relevant services from the management system software **2704** (DxAgent). In some embodiments, this server is connected to the outside real live residents **2706** data coming from the framework **2708** (electronic medical record) of the facilities. In some embodiments, there can be a finite number N of region servers/enviroments **2710**.

In som eembodiments, the plurality of region servers/enviroments are connected to a root server/enviroment **2712**, which contains major data and management services for all the APS **2714** (Advances Pharmaceutical Solutions – e.g. large dispensing machine **306**, small dispensing machine **308**, bulk storage cabinet **310**, a refrigerator **312**, a nursing cart **314**) units located in the same area. In some embodiments, where there is a server-client infrastructure the live data is kept on the server with duplication on the local unit in order to allow continuous activity in case of disconnection between the single machines and the servers. In some embodiments, the APS units comprise several APS-mini **2716**, which can be secondary machines that are directly connected (master-slave mode) in order to provide dispensing services to the same population. In some embodiments, the root server/enviroment **2712** is connected and updates the warehouse systems with the necessary data **2718**.

Optional components of an exemplary system

It should be understood that the devices (e.g. dispensing machines) and methods disclosed thereof, include the use of known and disclosed methods performed by the server, said server having a dedicated database including the necessary information required for the correct functioning of the pharmaceutical dispensing system; and performed by the warehouse, said warehouse comprising the necessary pharmaceuticals required by the dispensing machines. While not explicitly mentioned in each embodiment, it should be understood that they optionally include the servers and the warehouses as integral parts of the pharmaceutical dispensing system, unless mentioned otherwise.

Exemplary Computational Logistics Tracking Module

In some embodiments, the system comprises a computational logistic tracking module which is configured to monitor and record all the logistic movements of the pharmaceuticals, starting from the original suppliers of the pharmaceuticals (i.e. Pfizer®, Abbot®, Bayer®, etc.) until it arrives at the patient, at the end of the dispensing process.

In some embodiments, the source of the logistics movements of the pharmaceuticals are divided into external sources and internal sources. In some embodiments, external sources are those who do not belong to the pharmaceutical dispensing system as disclosed above, for example the suppliers of the pharmaceuticals, the pharmacies, etc. In some embodiments, internal sources are those who belong to the pharmaceutical dispensing system as disclosed above, for example the warehouses, the pharmaceutical dispensing machines, the technicians, the dedicated personnel, etc.

Referring now to Figure 28, showing a schematic general representation of exemplary logistical movements recorded by the module. In some embodiments, pharmaceuticals leave from an external source (the "external" attribute is depicted by the dashed line) **2802** (i.e. a warehouse of a supplier) to a warehouse **2804** managed by the pharmaceutical dispensing system by means of, for example, a truck **2806**. Optionally and additionally, the pharmaceuticals can be delivered directly to the long term care facility **2808** by means of, for example, a truck **2806**. In some embodiments, from the warehouse **2804** managed by the pharmaceutical dispensing system, the pharmaceuticals are delivered directly to the long term care facility **2808** by means of, for example, a truck **2806**. In some embodiments, once arrived at the long term care facility **2808**, the pharmaceuticals are delivered, for example, to a pharmaceutical dispensing machine **2810** by authorized personnel **2812**. In some embodiments, the pharmaceuticals are then prepared in the

individual envelopes **2814** and delivered to the patients **2816** by the dedicated personnel **2818** of the long term care facility **2808**.

In some embodiments, the tracking comprises the following:

Actual physical location of the pharmaceuticals

In some embodiments, the computational logistic tracking module is configured to monitor and receive information regarding the actual physical location of the pharmaceuticals at every single moment. In some embodiments, the tracking is performed with known technologies, like GPS tracking devices, RFID technology, cellular technology, etc.

Behavior of the logistical process:

Referring now to Figure 29, showing a schematic illustration of an exemplary compilation of behavior of part of a logistical process, according to some embodiments of the invention. In some embodiments, from the information of the actual physical location of the pharmaceuticals, the computational logistic tracking module is configured to derive the behavior of the logistical process. In some embodiments, behavior of the logistical process includes: routes taken by the delivery, time to arrive from one location to another, time to process the pharmaceuticals at every point. Figure 29 shows an illustration of an exemplary compilation of behavior of part of a logistical process. Pharmaceuticals need to be transported from a warehouse of an external source (i.e. the pharmaceutical company's warehouse) **2902**, located in Garden City, Kansas, USA to a warehouse managed by the pharmaceutical dispensing system **2904** (internal source) located in Jefferson City, Missouri, USA, by means of a truck **2906**. Map **2908** shows the general locations of the warehouses. After the truck **2906** finishes the delivery from the first warehouse **2902** to the second warehouse **2904**, the system, compiles the data of the logistical process **2910**, for example the route taken **2910** by the truck, the distance, the time that took to arrive, the time and date of the beginning of the delivery and the time and date of the end of the delivery, the traffic conditions met during the travel, stops made, truck model, driver, weather, and any other relevant information which affects the logistical process. In some embodiments, all the information collected is stored in the servers of the pharmaceutical dispensing system to be used in the analysis of the behavior of the logistics between the first **2902** and the second **2904** warehouses. In some embodiments, the data about the logistic process is monitored in real-time, which enables the system to make recommendations and actions in case of unforeseen events (i.e. the truck is involved in an accident, unforeseen weather conditions don't allow the pharmaceuticals to be delivered, etc.).

In some embodiments, similar to the partial logistical process shown in Figure 29, other partial logistical processes are monitored, optionally in real-time, for example, the time required

for a truck to arrive from a warehouse managed by the pharmaceutical dispensing system to a long term care facility, the time to replenish a pharmaceutical dispensing machine from the time of a request from a storage facility until it is replenished, the time of preparation of pharmaceuticals at the pharmaceutical dispensing machine, etc.

Behavior of maintenance and technical issues processes that affect the logistical process:

In some embodiments, the computational logistic tracking module is configured to monitor and receive information regarding all actions related to maintenance and technical issues of the pharmaceutical dispensing machines, the warehouses, trucks, etc. In some embodiments, information related to maintenance and technical issues are correlated to the locations and pharmaceutical dispensing information of the locations. In some embodiments, the correlations are used to create a behavior pattern of the maintenance, technical issues and performance and resolution of both, that affect the logistical process. For example, in general, the computational logistic tracking module collected information that showed that in pharmaceutical dispensing machines that maintenance has not been performed for more than 6 months there is a higher percentage of technical issues. Furthermore, the collected information has showed that in pharmaceutical dispensing machines that perform more than a certain number of dispensing actions per months, there is a higher percentage of technical issues after 4 months. In some embodiments, this information is sent to the logistic action module to enable the system to perform active actions, for example: provide maintenance to pharmaceutical dispensing machines every 6 months, unless the pharmaceutical dispensing machine performed more than a certain number of dispensing actions per month, then dispatch maintenance after 4 months and/or once the pharmaceutical dispensing machine arrives at a predefined threshold number of dispensing actions.

In some embodiments, unexpected technical issues are monitored for the causes, time that took for the technical issue to be resolved, time that took for the pharmaceutical dispensing machine to return to normal operation, etc. In some embodiments, this information is used by other modules in the system.

Exemplary Computational Logistics Model Module

In some embodiments, the system comprises a computational logistics model module configured to receive information from the pharmaceutical operational system, the pharmaceutical logistic tracking module and real-time information from external sources (i.e. manual inputs, the internet, the news, the weather, etc.) and create specific models of the next cycle of pharmaceutical dispensing processes. In some embodiments, the computational logistics

model module utilizes one or more of neural networks, Machine Learning (ML), simulations, etc. In some embodiments, the models use best case scenarios to run, for example, simulations, which mean there are no technical problems, no logistics problems, no inventory problems, etc., and a model of the pharmaceutical dispensing process in the pharmaceutical dispensing machine is performed from the beginning to the end of the pharmaceutical dispensing process. In some embodiments, the models use worst case scenarios, to run, for example, simulations, which mean there are technical problems, there are logistics problems, and/or there are inventory problems, etc., and a model of the pharmaceutical dispensing process in the pharmaceutical dispensing machine, together with the response to those problems, is performed from the beginning to the end of the pharmaceutical dispensing process. In some embodiments, the models use the actual status of the pharmaceutical dispensing machine to simulate the pharmaceutical dispensing process from the beginning to end. In some embodiments, at the end of each simulation, each simulation is provided with a score, which is then used for the evaluation of the pharmaceutical dispensing process. In some embodiments, the time needed to finish a best case scenario pharmaceutical dispensing process is compared with the time needed to finish a worst case scenario pharmaceutical dispensing process to evaluate, by the pharmaceutical dispensing action module, if steps are to be taken in order to ensure the dispensing, for example, anticipating the beginning of the pharmaceutical dispensing process by the pharmaceutical dispensing machine, dispatching a technician, preparing a warehouse to dispatch pharmaceuticals, requesting a self-check analysis of a specific pharmaceutical dispensing machine, etc.

In some embodiments, the results provided by the models are responses to direct inquiries, for example, “can the pharmaceutical dispensing process be finished in time for delivery according to the pharmaceutical dispensing schedule?”, or “which pharmaceutical dispensing service ensures finishing the pharmaceutical dispensing process on time?”. In some embodiments, the computational logistics model module is configured to change the parameters in order to provide at least one possible solution so the pharmaceutical dispensing process can be achieved in the pharmaceutical dispensing schedule.

In some embodiments, models can be performed on any single part of the pharmaceutical logistical dispensing process, for example, the arrival of pharmaceuticals from a supplier, transporting pharmaceuticals from a warehouse to a long term care facility, etc.

In some embodiments, the models are performed automatically in a periodical manner. In some embodiments, the models are performed manually by an administrator of the pharmaceutical dispensing system. In some embodiments, models are performed in relation to a specific single machine in a location. In some embodiments, models are performed for entire

pharmaceutical ecosystems, and anything in between an ecosystem to a specific single pharmaceutical dispensing machine.

In some embodiments, the information used to run the simulations on the models is updated after every cycle performed by the pharmaceutical logistic tracking module, after every pharmaceutical dispensing cycle performed by the logistic operational system, and after manual insertion of information from an authorized personnel from the pharmaceutical dispensing system.

In some embodiments, models are run in the time between dispensing cycles.

Exemplary Computational Logistics Action Module

In some embodiments, information provided by pharmaceutical logistic operational system, the pharmaceutical logistic tracking module and the pharmaceutical logistic model module is received by the computational logistic action module, which is configured to analyze the information and provide actionable instructions over the pharmaceutical dispensing system in order to guarantee the dispensing of pharmaceuticals according to the main directive of the pharmaceutical dispensing system – ensuring the provision of medical care to the patients. In some embodiments, the computational logistic action module is equipped with deep learning algorithms, which enable the module to learn from each situation, actionable instruction and final outcome of the dispensing due to the actionable instruction.

In some embodiments, actionable instructions are provided in order to schedule the dispensing according to the window of foreseeable failures, the possible responses to said failures and the positive outcome of the pharmaceutical dispensing process. In some embodiments, the pharmaceutical dispensing process is scheduled according to the Mean time between failures (MTBF). In some embodiments, the MTBF is calculated by the information provided by the pharmaceutical logistic tracking module and the pharmaceutical logistic model module.

Exemplary Main Directive of the Pharmaceutical Dispensing System

In prior art pharmaceutical dispensing system the main directive is the arrival of pharmaceuticals to the patients. While this directive is also part of the directives governing the actions of the pharmaceutical dispensing system of the present invention, a higher main directive governs above all directives and instructions: guaranteeing the reliable provision of medical care to the patients.

In some embodiments, the computational logistic action module provides instructions not based on the directive that pharmaceuticals must arrive at their destination, but rather what is the

medical care needed by the patient. In some embodiments, to this scope, the system is in continuous communication with two medical sources: a medical pharmaceutical database and medical professional staff (i.e. physicians, nurses, pharmacists), which provide medical input in real-time.

Exemplary Medical Pharmaceutical Database

In some embodiments, the system comprise a medical pharmaceutical database comprising information regarding the pharmaceuticals, substitute pharmaceuticals, alternative pharmaceuticals, pathologies, patients, patient historical data, physician specific instructions and historical medical decisions. In some embodiments, the system uses the information in the medical pharmaceutical database to guide the actionable instructions in order to follow the main directive of the pharmaceutical dispensing system.

Exemplary Medical Professional Staff

In some embodiments, each pharmaceutical dispensing machine comprises a list of all the patients under its care. In some embodiments, the pharmaceutical dispensing machine comprises also the names and contact information of the medical professional staff in charge of the patients under the care of the dispensing machine. In some embodiments, when in case of need, the system contacts the medical professional staff with a specific query and, based on the response, the system provides the actionable instructions to the pharmaceutical dispensing system. In some embodiments, based on the instructions of the professional medical staff, the dispensing of a pharmaceutical could be delayed in order to meet the medical care of the patient. In some embodiments, is the medical parameter (medical needs) that affect the pharmaceutical dispensing process and provision of actionable instructions; and not the other way (where logistical dispensing problems dictate the medical needs of the patients).

As used herein with reference to quantity or value, the term “about” means “within ± 20 % of”.

The terms “comprises”, “comprising”, “includes”, “including”, “has”, “having” and their conjugates mean “including but not limited to”.

The term “consisting of” means “including and limited to”.

The term “consisting essentially of” means that the composition, method or structure may include additional ingredients, steps and/or parts, but only if the additional ingredients, steps and/or parts do not materially alter the basic and novel characteristics of the claimed composition, method or structure.

As used herein, the singular forms "a", "an" and "the" include plural references unless the context clearly dictates otherwise. For example, the term "a unit" or "at least one unit" may include a plurality of units, including sub-units thereof.

Throughout this application, embodiments of this invention may be presented with reference to a range format. It should be understood that the description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the invention. Accordingly, the description of a range should be considered to have specifically disclosed all the possible subranges as well as individual numerical values within that range. For example, description of a range such as "from 1 to 6" should be considered to have specifically disclosed subranges such as "from 1 to 3", "from 1 to 4", "from 1 to 5", "from 2 to 4", "from 2 to 6", "from 3 to 6", etc.; as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

Whenever a numerical range is indicated herein (for example "10-15", "10 to 15", or any pair of numbers linked by these another such range indication), it is meant to include any number (fractional or integral) within the indicated range limits, including the range limits, unless the context clearly dictates otherwise. The phrases "range/ranging/ranges between" a first indicate number and a second indicate number and "range/ranging/ranges from" a first indicate number "to", "up to", "until" or "through" (or another such range-indicating term) a second indicate number are used herein interchangeably and are meant to include the first and second indicated numbers and all the fractional and integral numbers therebetween.

Unless otherwise indicated, numbers used herein and any number ranges based thereon are approximations within the accuracy of reasonable measurement and rounding errors as understood by persons skilled in the art.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination or as suitable in any other described embodiment of the invention. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements.

In addition, any priority document(s) of this application is/are hereby incorporated herein by reference in its/their entirety.

WHAT IS CLAIMED IS:

1. A method of ensuring a pharmaceutical dispensing service to at least one patient in at least one facility following at least one pharmaceutical prescription, comprising:

receiving a pharmaceutical dispensing schedule;

running, on a processor, at least one model of a pharmaceutical dispensing process according to said received schedule;

wherein when said model indicates that said pharmaceutical dispensing process cannot be achieved by said pharmaceutical dispensing schedule, then automatically activating at least one supplemental pharmaceutical dispensing supplier or moving to a substitute pharmaceutical or an alternative pharmaceutical to ensure meeting said pharmaceutical dispensing schedule.

2. The method according to claim 1, wherein when said at least one supplemental pharmaceutical dispensing supplier provides one or more of: the same pharmaceutical, a substitute pharmaceutical and an alternative pharmaceutical.

3. The method according to claims 1 or 2, wherein when moving to said substitute pharmaceutical or an alternative pharmaceutical, if said substitute pharmaceutical or an alternative pharmaceutical has not been previously authorized as such, then said method further comprises requesting approval from authorized personnel of said substitute pharmaceutical or an alternative pharmaceutical.

4. The method according to anyone of claims 1-3, wherein said moving to a substitute pharmaceutical or an alternative pharmaceutical comprises accessing a medical pharmaceutical database to retrieve information regarding said substitute pharmaceutical or an alternative pharmaceutical.

5. The method according to anyone of claims 1-4, wherein evaluating of the model utilizes one or more of neural networks, machine learning and simulations.

6. The method according to anyone of claims 1-5, wherein said receiving a pharmaceutical dispensing schedule comprises a time when the pharmaceuticals need to be ready for dispensing in individual envelopes.

7. The method according to anyone of claims 1-6, wherein said pharmaceutical dispensing process cannot be achieved comprises at least one pharmaceutical that cannot be dispensed.

8. The method according to anyone of claims 1-7, wherein said at least one supplemental pharmaceutical dispensing supplier is located in one or more of: the same location of said facility, a different location in close proximity of said facility, a different location far from said facility.

9. The method according to claim 3, wherein said authorized personnel is one or more of a physician, a nurse, a pharmacist.

10. The method according to anyone of claims 1-9, wherein prescriptions delivered to said pharmaceutical dispensing schedule are optimized for pharmaceuticals already present in said at least one facility.

11. The method according to anyone of claims 1-10, wherein new prescriptions are immediately processed and inserted in said pharmaceutical dispensing schedule.

12. A pharmaceutical dispensing system comprising:

a pharmaceutical dispensing logistic operational system, comprising at least one pharmaceutical storage and dispensing machine located in at least one facility and at least one supplemental supplier of pharmaceuticals; said pharmaceutical dispensing logistic operational system in communication with at least one pharmacy management server;

a pharmacy group management computer being positioned remote from said at least one facility to manage and control said pharmaceutical dispensing logistic operational system defining a pharmacy management server; said pharmacy management server further comprises: a computational logistic tracking module, a computational logistic model module, a computational logistic action and a medical pharmaceutical database;

wherein said computational logistic action module is configured to provide instructions to said pharmaceutical dispensing logistic operational system based on received information from said at least one pharmaceutical storage and dispensing machine, said computational logistic tracking module and said computational logistic model module.

13. The system according to claim 12, wherein said at least one pharmaceutical storage and dispensing machine is configured to dispense at least one pharmaceutical in a plurality of envelopes to at least one patient in said at least one facility at a scheduled time.

14. The system according to claim 12, wherein said computational logistic tracking module is configured to monitor and record the logistic movements of the pharmaceuticals.

15. The system according to claim 12, wherein said computational logistic model module is configured to run a virtual pharmaceutical dispensing process based on received information from said at least one pharmaceutical storage and dispensing machine and said computational logistic tracking module.

16. The system according to claim 12, wherein said medical pharmaceutical database comprises medical information regarding pharmaceuticals, substitute pharmaceuticals and alternative pharmaceuticals when said dispensing will result in not meeting dispensing requirements.

17. The system according to claim 12, wherein said at least one supplemental supplier of pharmaceuticals is one or more of: another pharmaceutical dispensing machine, a storage and a pharmacy.

18. The system according to anyone of claims 12-17, wherein said at least one supplemental supplier is located in one or more of: the same location of said at least one facility, a different location in close proximity of said at least one facility, a different location far from said at least one facility.

19. The system according to anyone of claims 12-18, wherein said computational logistic model module further receives real-time information from external sources.

20. A method for minimizing the dispense time of a pharmaceutical, comprising:

receiving a new prescription;

delivering said new prescription to a pharmaceutical dispensing machine

commanding said pharmaceutical dispensing machine to dispense said pharmaceutical, immediately or within the next pharmaceutical dispensing cycle.

21. A method of optimizing a pharmaceutical dispensing process in a facility, comprising:

receiving at least one prescription of at least one pharmaceutical from at least one authorized personnel;

comparing said at least one pharmaceutical with an inventory of pharmaceuticals located in said facility;

wherein when said at least one pharmaceutical is not present in said inventory of pharmaceuticals located in said facility, then provide a substitute pharmaceutical or an alternative pharmaceutical to said at least one authorized personnel from a medical pharmaceutical database and said substitute pharmaceutical or said alternative pharmaceutical are present in said inventory of pharmaceuticals located in said facility.

22. A method of providing a pharmaceutical dispensing service to at least one facility, comprising:

a. providing at least one first pharmaceutical storage and dispensing machine to said at least one first facility; said at least one first pharmaceutical storage and dispensing machine in communication with at least one facility pharmacy management server;

b. providing a pharmacy group management computer being positioned remote from said at least one first facility to manage and control said at least one first pharmaceutical storage and dispensing machine defining a facility pharmacy management server;

c. providing at least one supplemental supplier of pharmaceuticals;

wherein said method further comprises selecting said at least one supplemental supplier of pharmaceuticals so as to ensure dispensing of pharmaceuticals to users according to a predetermined schedule;

wherein said at least one supplemental supplier of pharmaceuticals provides one or more of: the same pharmaceutical, a substitute pharmaceutical and an alternative pharmaceutical;

wherein dispensing of said substitute pharmaceutical and said alternative pharmaceutical comprises receiving approval from at least one authorized personnel.

23. The method according to claim 22, further comprising providing at least one second pharmaceutical storage and dispensing machine as supplemental supplier of pharmaceuticals.

24. The method according to claim 23, wherein said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one

second pharmaceutical storage and dispensing machine at the same facility as said at least one first pharmaceutical storage and dispensing machine.

25. The method according to claim 23, wherein said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one second pharmaceutical storage and dispensing machine at a second facility; said second facility located in the vicinity of said first facility.

26. The method according to claim 23, wherein said providing at least one second pharmaceutical storage and dispensing machine further comprises allocating said at least one second pharmaceutical storage and dispensing machine at a third facility; said third facility located far from said first facility.

27. The method according to anyone of claims 22-26, further comprising providing communication with at least one pharmacy as supplemental supplier of pharmaceuticals.

28. The method according to claim 27, wherein said pharmacy comprises a pharmaceutical storage and dispensing machine.

29. The method according to anyone of claims 22-28, further comprising providing communication with at least one storage unit as supplemental supplier of pharmaceuticals.

30. The method according to anyone of claims 22-29, wherein information regarding said predetermined schedule is located in said pharmacy group management computer.

31. A system of pharmaceutical dispensing for at least one first facility, comprising:

a. a data processing and management computer including a first memory to store data therein to manage and control at least one pharmaceutical storage and dispensing machine positioned remote therefrom and to thereby define a facility pharmacy group management server;

b. a facility pharmacy management software stored in said first memory of said facility pharmacy group management server to manage pharmaceutical operations in said at least one facility, to process distribution of pharmaceuticals stored in said at least one pharmaceutical storage and dispensing machine during preselected dispensing time periods;

c. a communications network in communication with said facility pharmacy group management server;

d. at least one pharmaceutical storage and dispensing machine positioned in said at least one facility remote from said facility pharmacy group management server, in communication with said facility pharmacy group management server through said communication network, to store a plurality of pharmaceuticals therein, and to individually retrieve at least one pharmaceutical of said plurality of pharmaceuticals stored in said pharmaceutical storage and dispensing machine, load said at least one pharmaceutical of the plurality of pharmaceuticals into one of a plurality of disposable individual patient dosing packages, package said at least one pharmaceutical, and dispense said loaded and packaged one of said plurality of individual patient dosing packages into a separate and removable container associated with said machine for use by authorized personnel located at said facility;

wherein said system further comprises at least one supplemental supplier of said plurality of pharmaceuticals adapted to dispense said pharmaceuticals to the users at said preselected dispensing time periods;

wherein said at least one supplemental supplier of pharmaceuticals provides one or more of: the same pharmaceutical, a substitute pharmaceutical and an alternative pharmaceutical;

wherein dispensing of said substitute pharmaceutical and said alternative pharmaceutical comprises receiving approval from at least one authorized personnel.

32. The system according to claim 31, wherein said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at the same facility.

33. The system according to anyone of claims 31-32, wherein said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at a second facility; said second facility located near said facility.

34. The system according to anyone of claims 31-33, wherein said at least one supplemental supplier is a second pharmaceutical storage and dispensing machine located at a second facility; said second facility located far from said facility.

35. The system according to anyone of claims 31-34, wherein said at least one supplemental supplier is a pharmacy located near said facility.

36. The system according to anyone of claims 31-35, wherein said at least one supplemental supplier is a storage unit.

37. A method of storage organization in a pharmaceutical dispensing system, comprising:

a. providing a plurality of storage units in communication with a server of said pharmaceutical dispensing system;

b. collecting pharmaceutical dispensing information of facilities receiving pharmaceuticals from said pharmaceutical dispensing system;

c. collecting information regarding said pharmaceuticals;

d. providing at least one parameter for analysis;

e. analyzing collected information using said at least one parameter;

f. distributing pharmaceuticals between said plurality of storage units according to the result of said analysis.

38. The method according to claim 37, wherein said at least one parameter is commonly used pharmaceuticals that are not yet prescribed to specific tenants but likely to be required.

39. The method according to anyone of claims 37-38, wherein said at least one parameter is predicted pharmaceuticals that are not yet prescribed to specific tenants but likely to be required.

40. The method according to anyone of claims 37-39, wherein a scale of importance is added to said at least one parameter by a system supervisor to enable prioritizing of parameters.

41. The method according to anyone of claims 37-40, wherein said at least one parameter is at least one selected from the group consisting of:

a. required pharmaceuticals for a current population in said facilities;

b. common prescribed pharmaceuticals;

c. pharmaceuticals dispensed on a regular basis;

d. life expectancy of said pharmaceuticals;

e. a location of use of said pharmaceuticals;

f. frequency of use of said pharmaceuticals;

g. type of said pharmaceuticals;

h. cost of said pharmaceuticals;

i. any combination thereof.

42. The method according to anyone of claims 37-41, wherein said at least one parameter is level of automation of a storage facility.

43. The method according to anyone of claims 37-42, wherein said at least one parameter is distance between said storage units and said facilities.

44. The method according to anyone of claims 37-43, wherein said pharmaceutical dispensing information is life expectancy of said pharmaceuticals.

45. The method according to anyone of claims 37-44, wherein said pharmaceutical dispensing information is cost of said pharmaceuticals.

46. The method according to anyone of claims 37-45, wherein said pharmaceutical dispensing information is expected time of supply from the pharmaceuticals suppliers.

47. The method according to anyone of claims 37-46, wherein said pharmaceutical dispensing information is type of said pharmaceuticals.

48. The method according to anyone of claims 37-47, wherein said pharmaceutical dispensing information is security requirements for said pharmaceuticals.

49. The method according to anyone of claims 37-48, wherein said pharmaceutical information is at least one selected from the group consisting of:

a. life expectancy of said pharmaceuticals;

b. cost of said pharmaceuticals;

c. expected time of supply from the pharmaceuticals suppliers;

d. type of said pharmaceuticals;

e. form that said pharmaceutical is provided;

f. security requirements for said pharmaceuticals;

g. any combination thereof.

50. A method of tracking users to dispense pharmaceuticals to said users in a pharmaceutical dispensing system, comprising:

a. providing at least one expected location of a user in a facility at least one time;

b. assessing if said user is at said at least one expected location in said facility at said at least one time;

if said user is at said at least one expected location in said facility at said at least one time, then dispense pharmaceuticals;

if said user is not at said at least one expected location in said facility at said at least one time, then:

c. assessing if said user is at a different location within said facility at said at least one time;

if said user is at a different location within said facility at said at least one time, then update said different location and dispense pharmaceuticals at said different location;

if said user is not at a different location within said facility at said at least one time, then:

d. assessing if said user is at a different facility at said at least one time;

if said user is at a different facility at said at least one time, then update location to said different facility location and dispense pharmaceuticals at said different facility location;

if said user is not at a different facility at said at least one time, then:

e. assessing if said user is at different address but not in a facility;

if said user is at a different address not within a facility at said at least one time, then update said different address location and dispense pharmaceuticals at said different address location;

if said user is not at a different address location not within a facility at said at least one time, then:

f. evaluating user status.

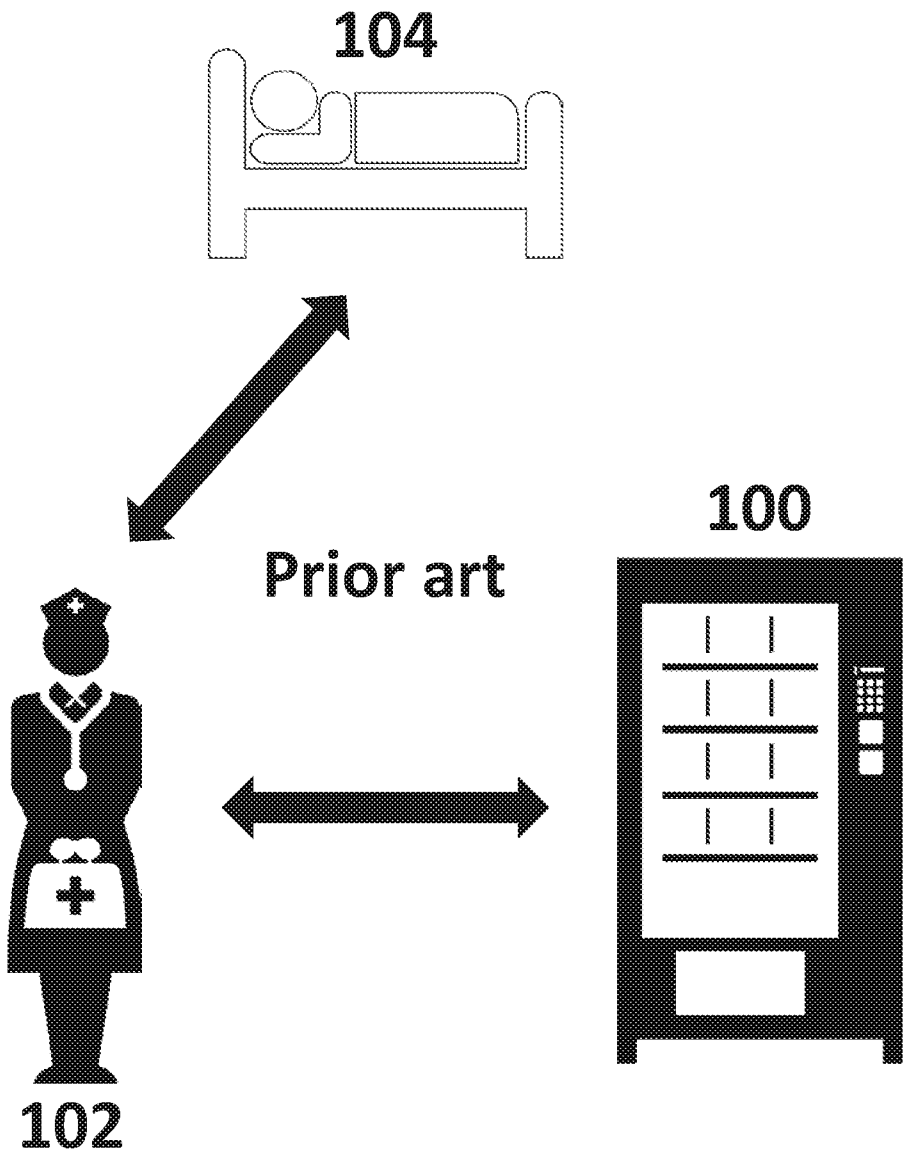


Figure 1

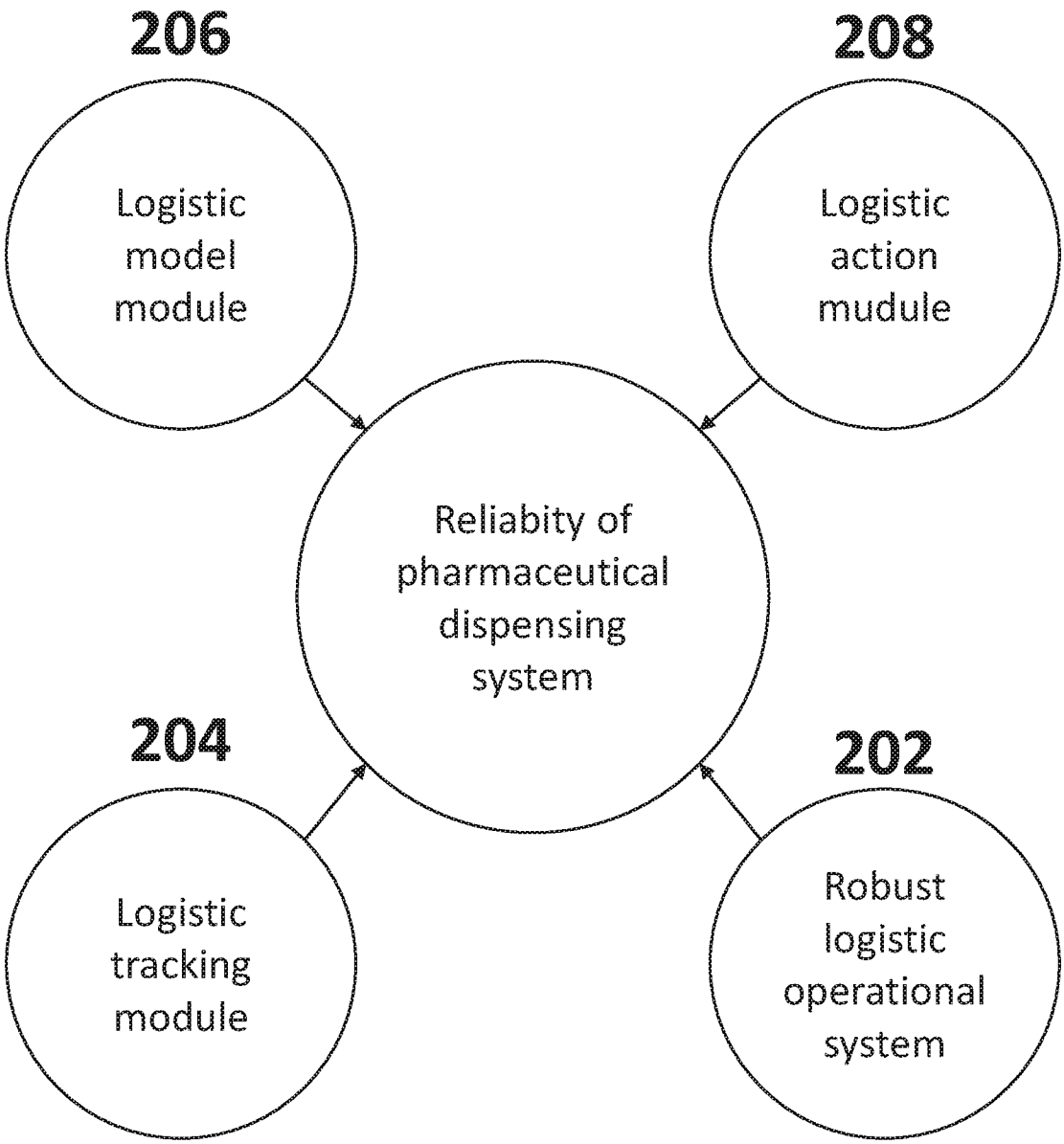

206
Logistic model module
208
Logistic action mudule
Reliabity of pharmaceutical dispensing system
204
Logistic tracking module
202
Robust logistic operational system

Figure 2

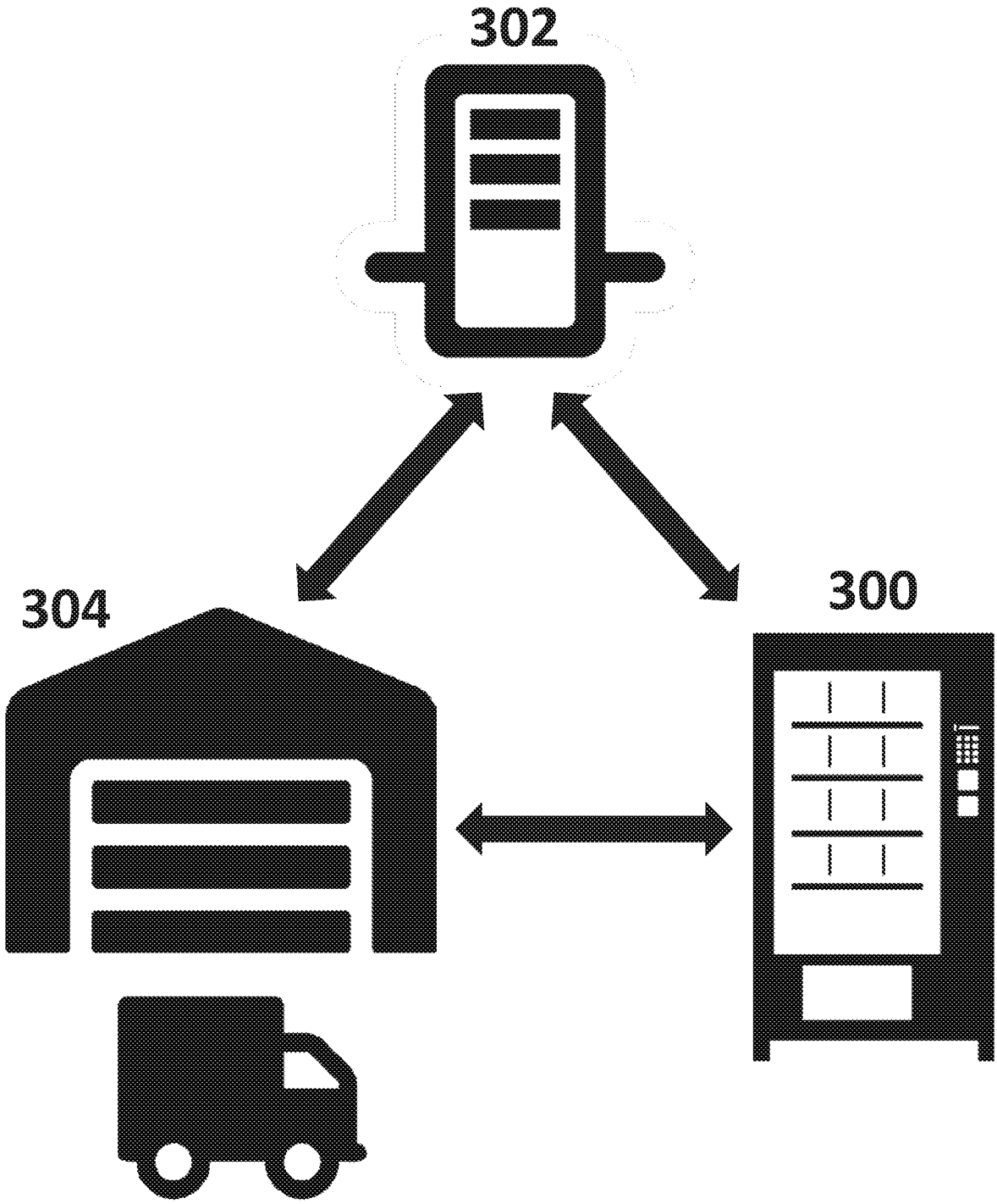


Figure 3a

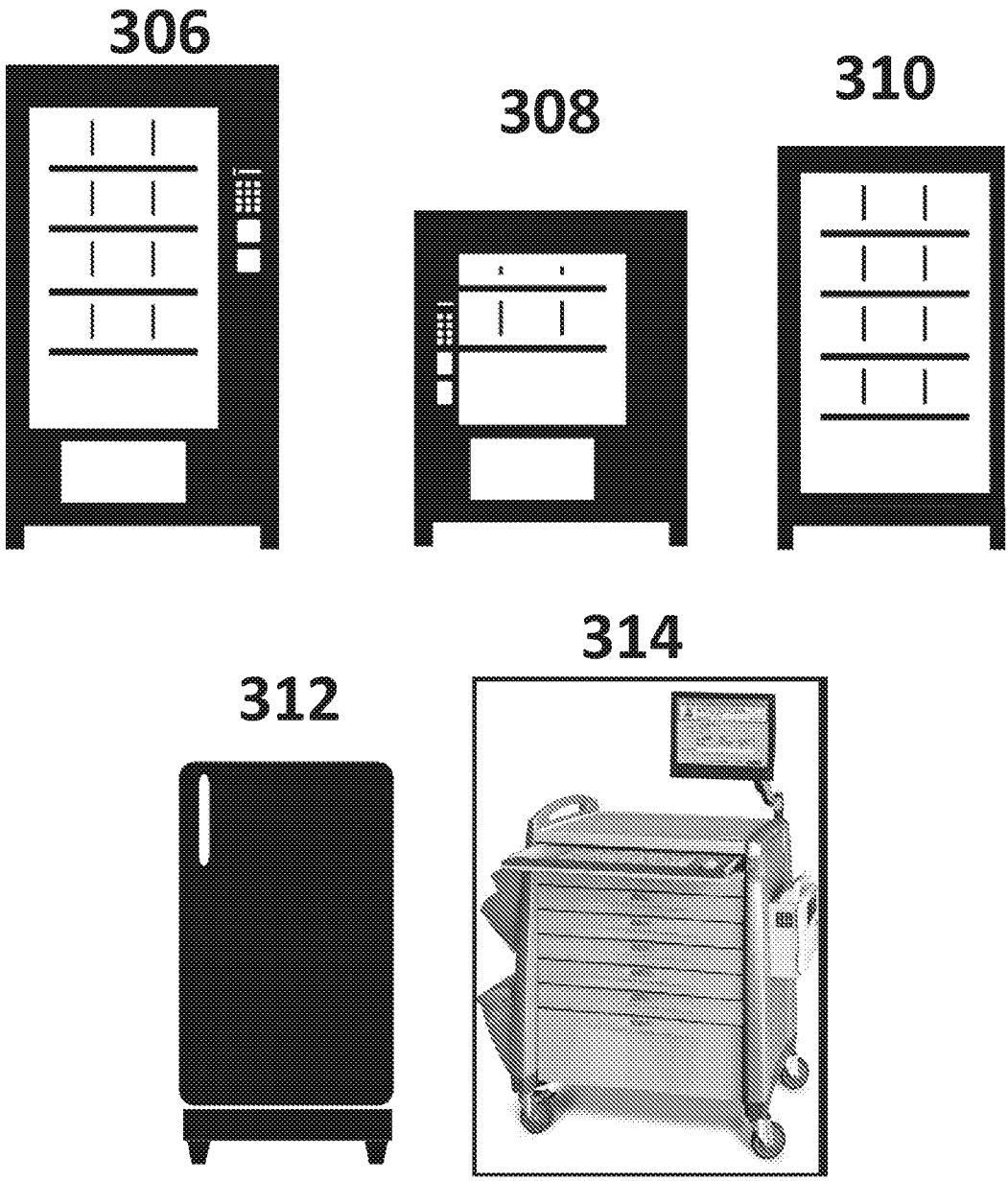


Figure 3b

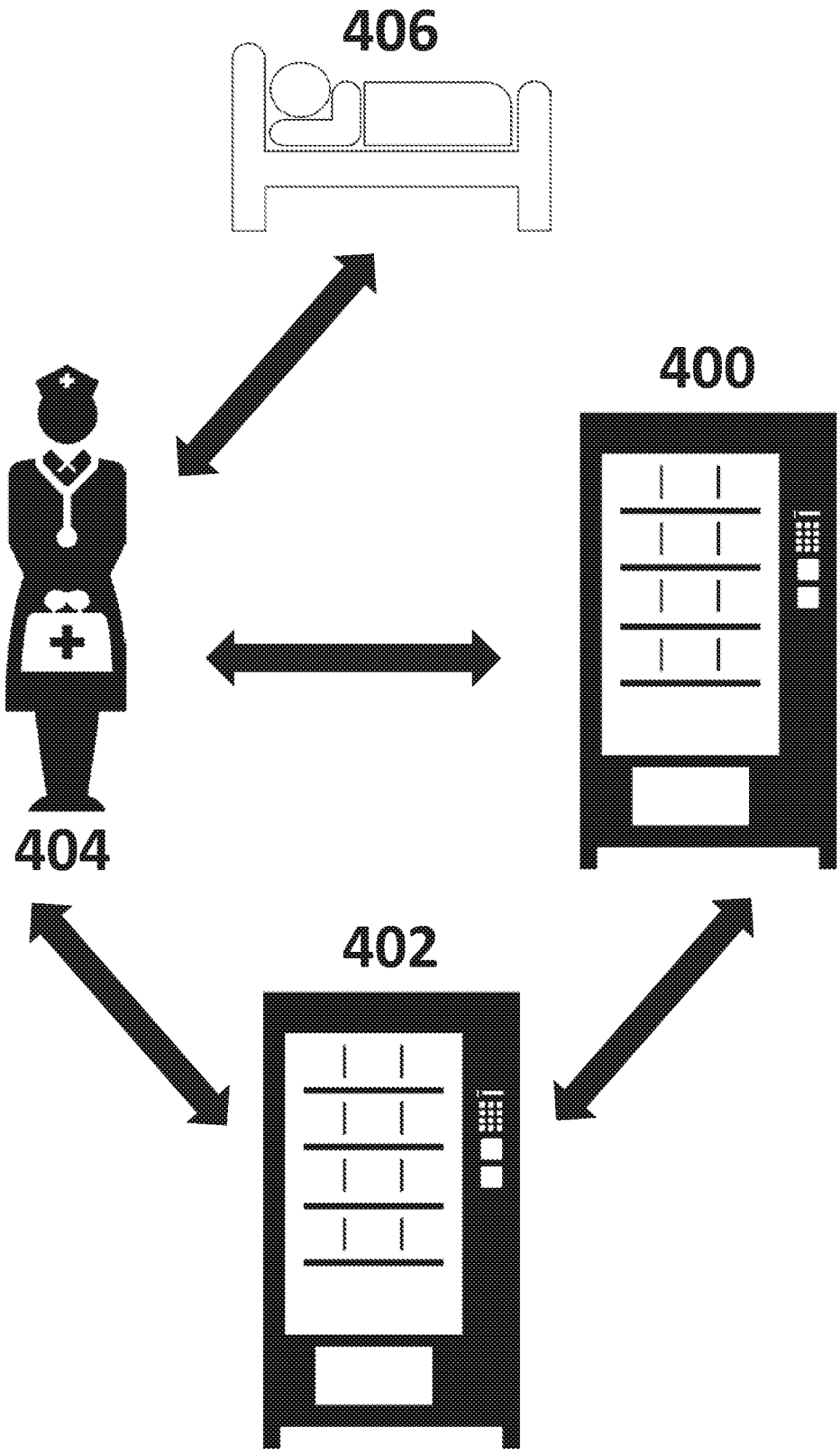


Figure 4

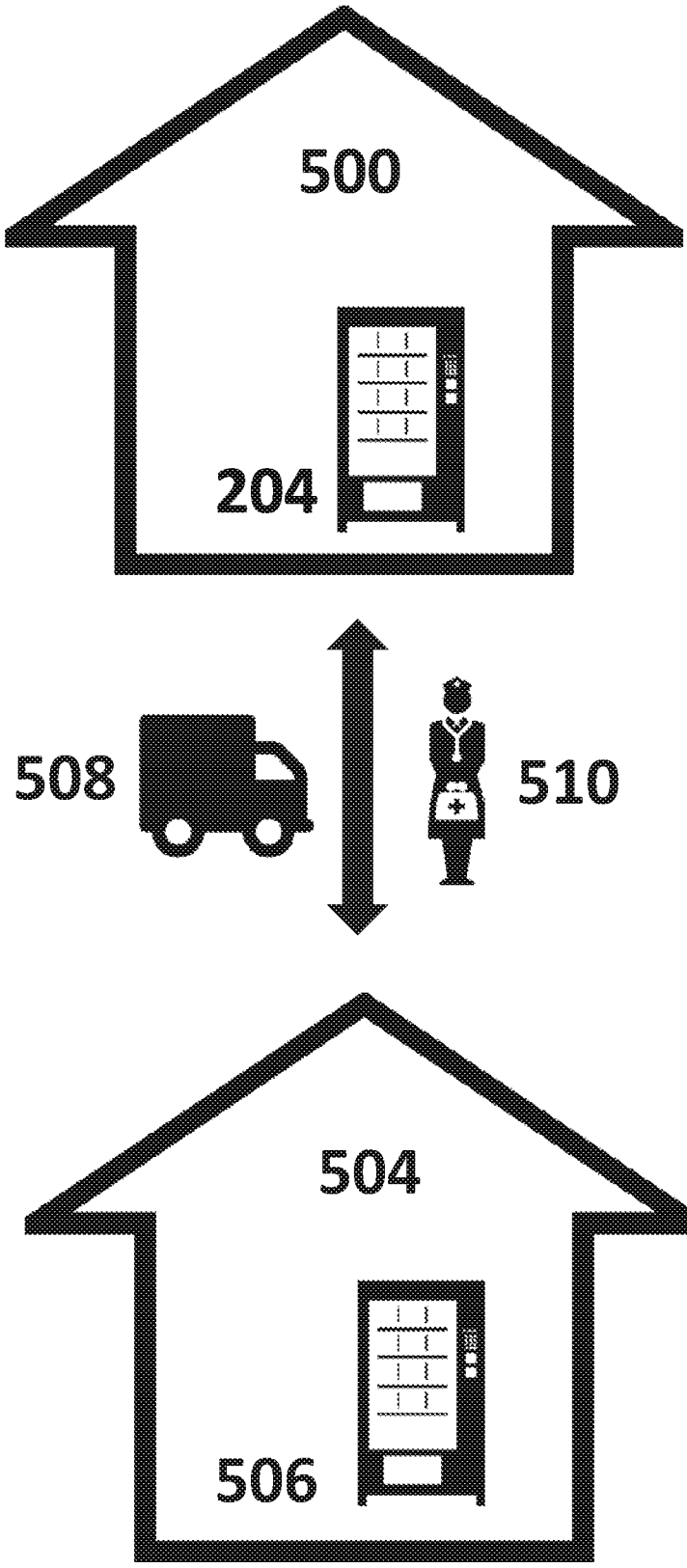


Figure 5

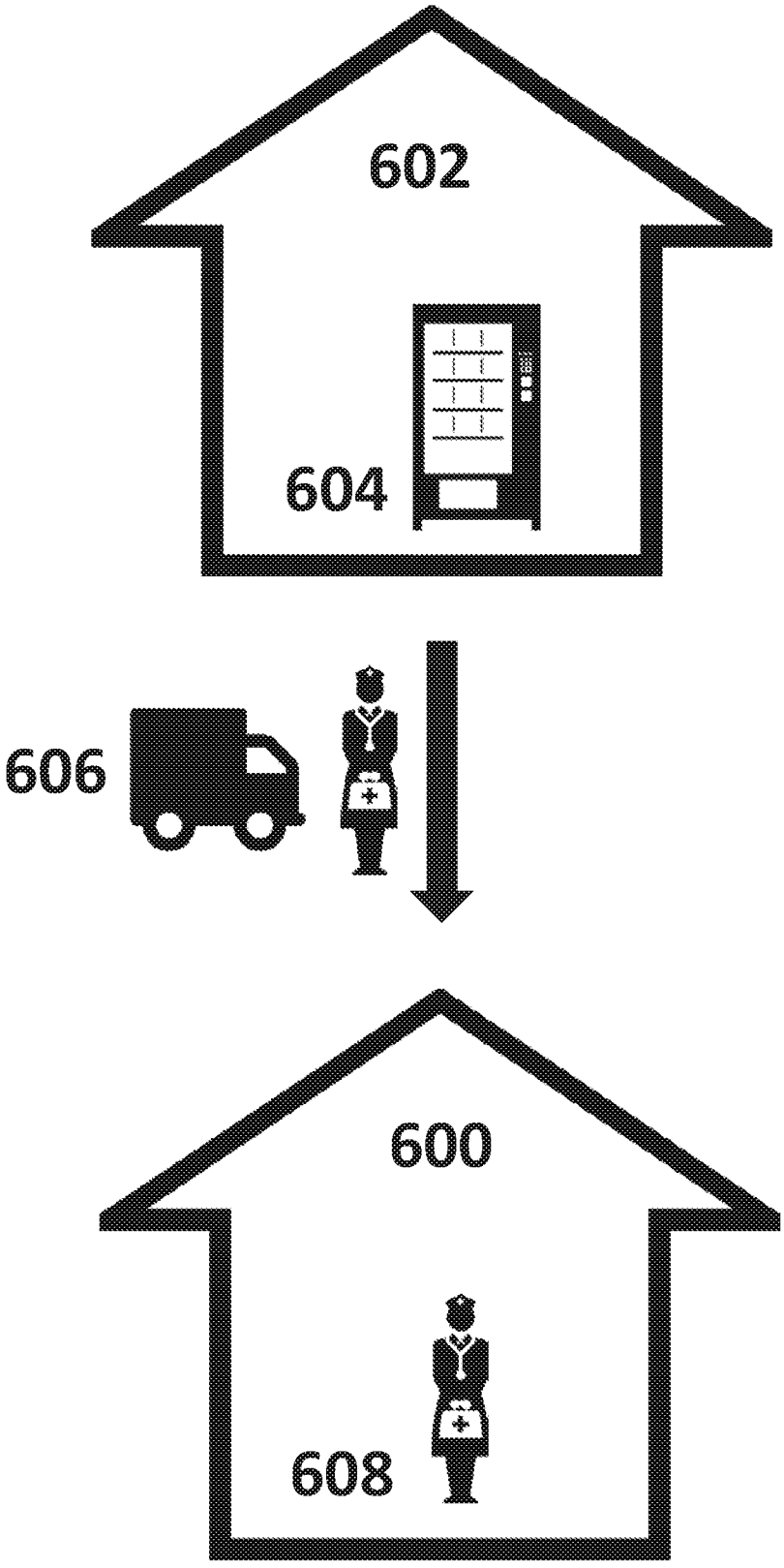


Figure 6

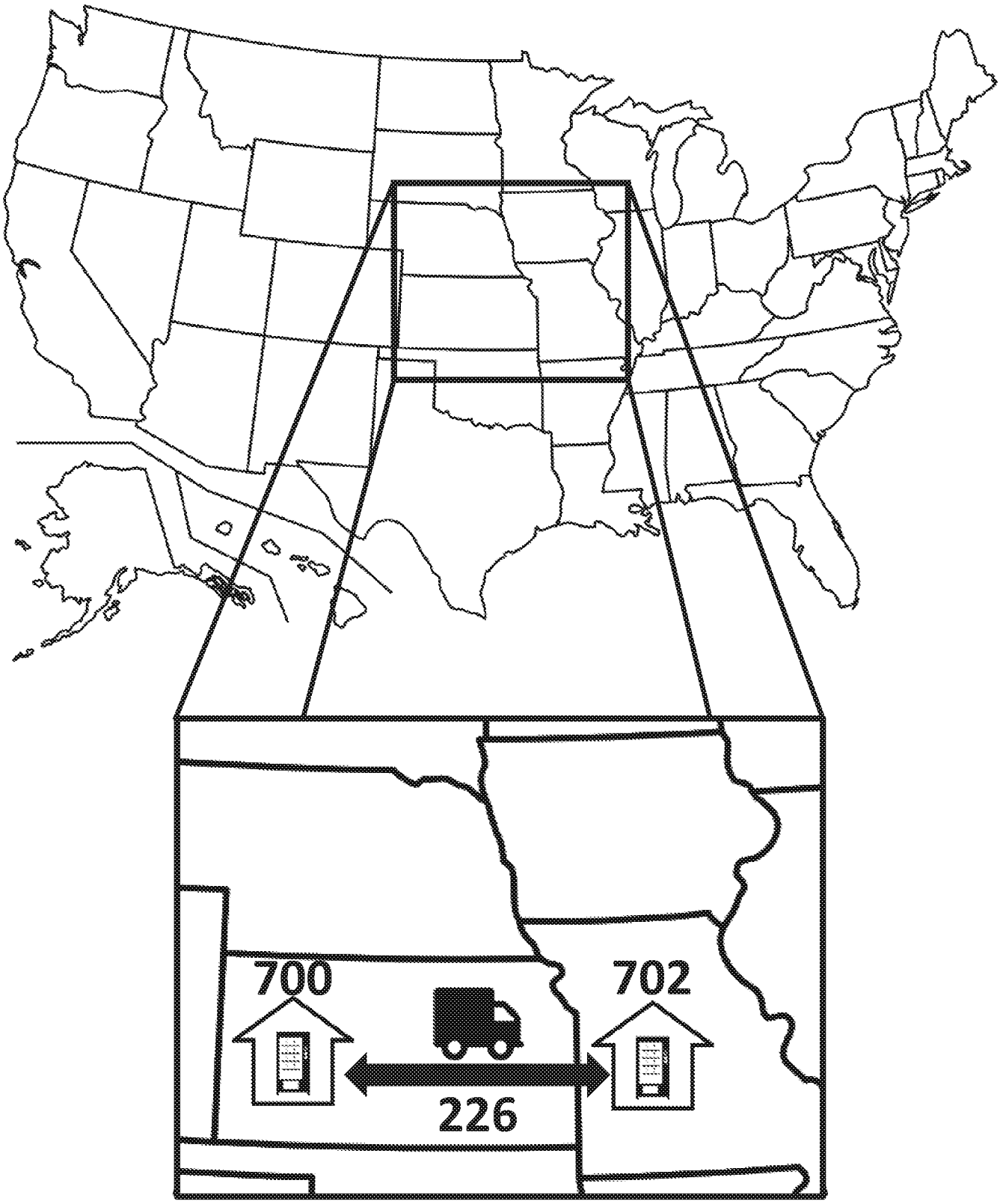


Figure 7

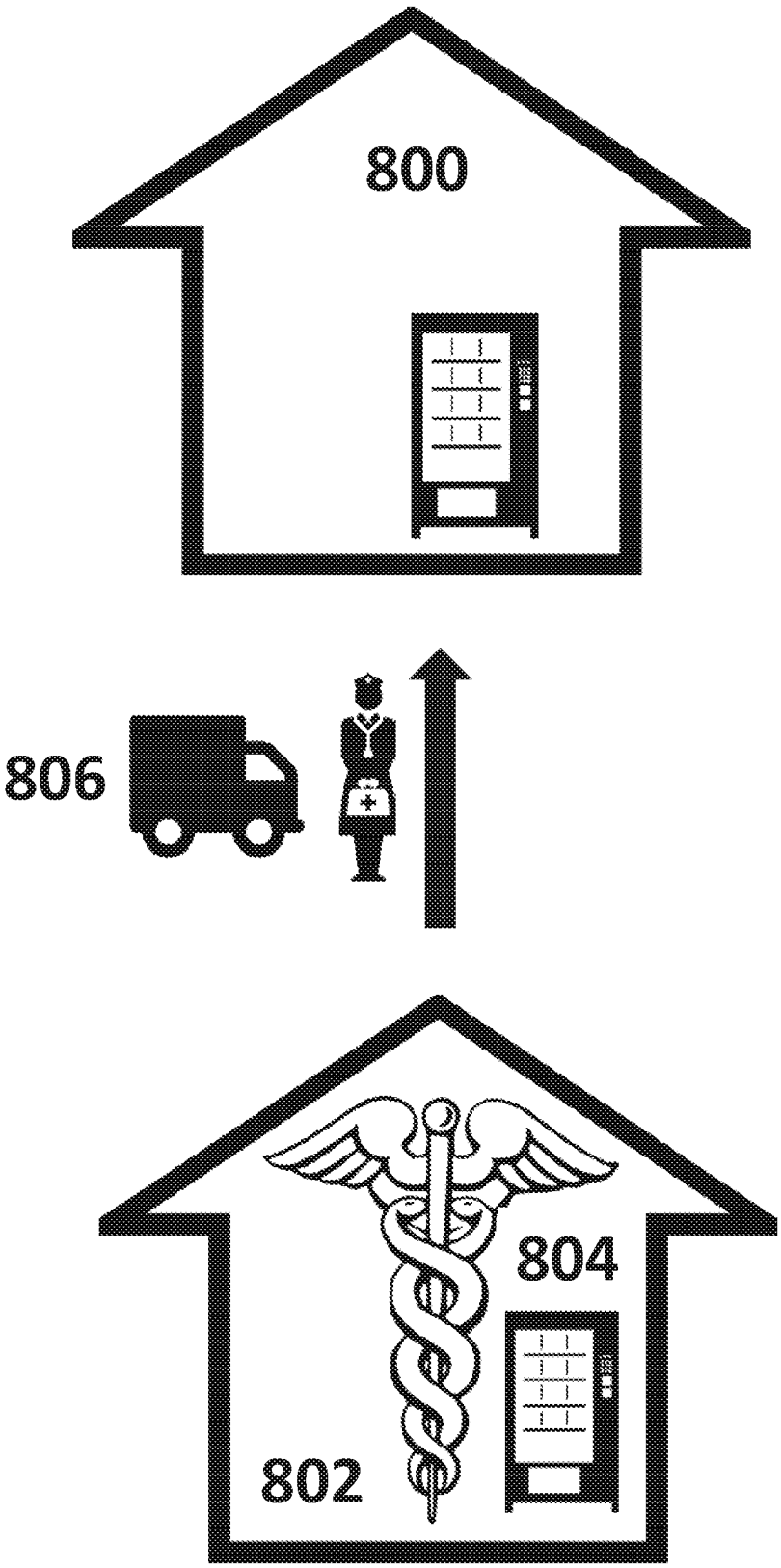


Figure 8

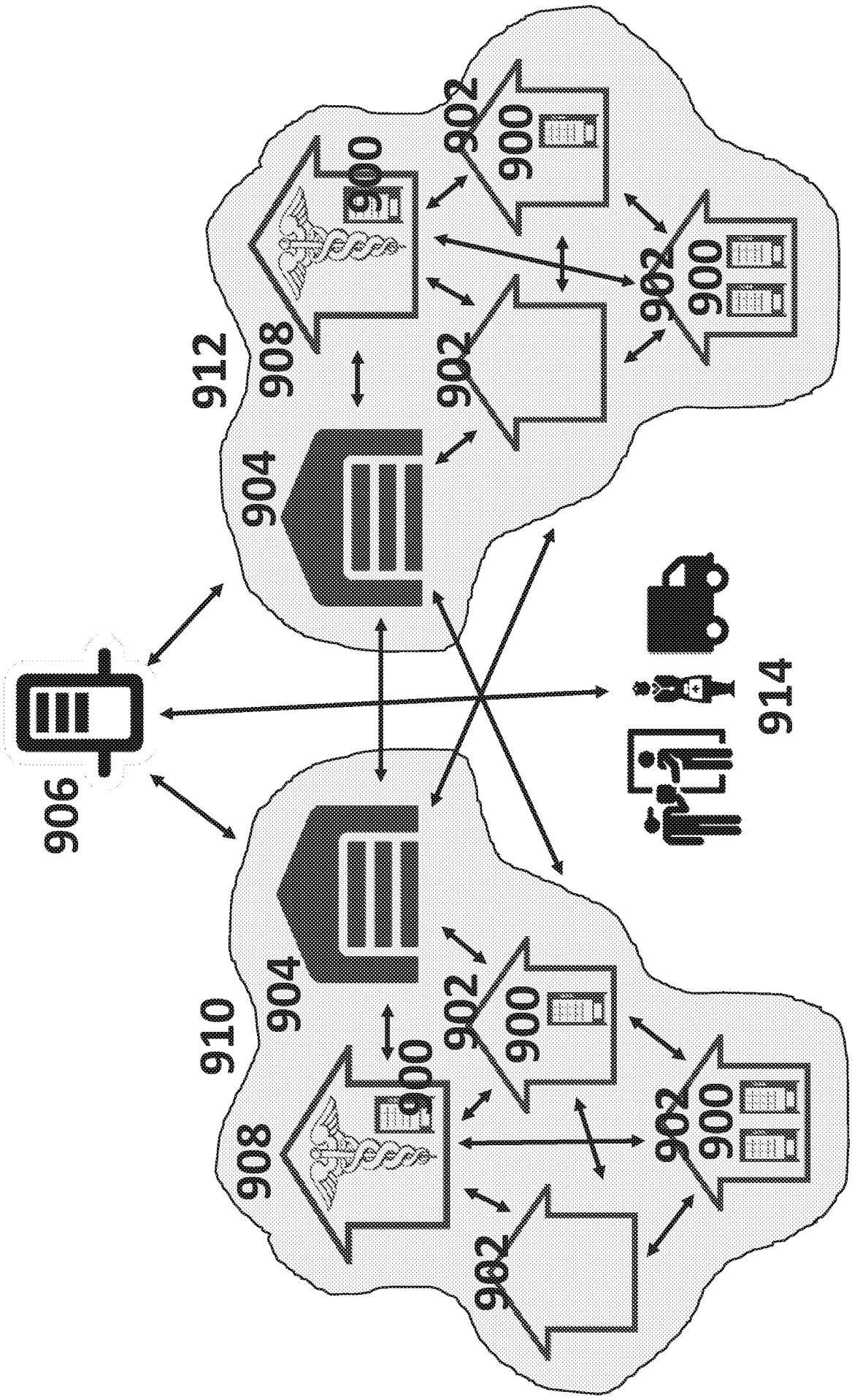


Figure 9a

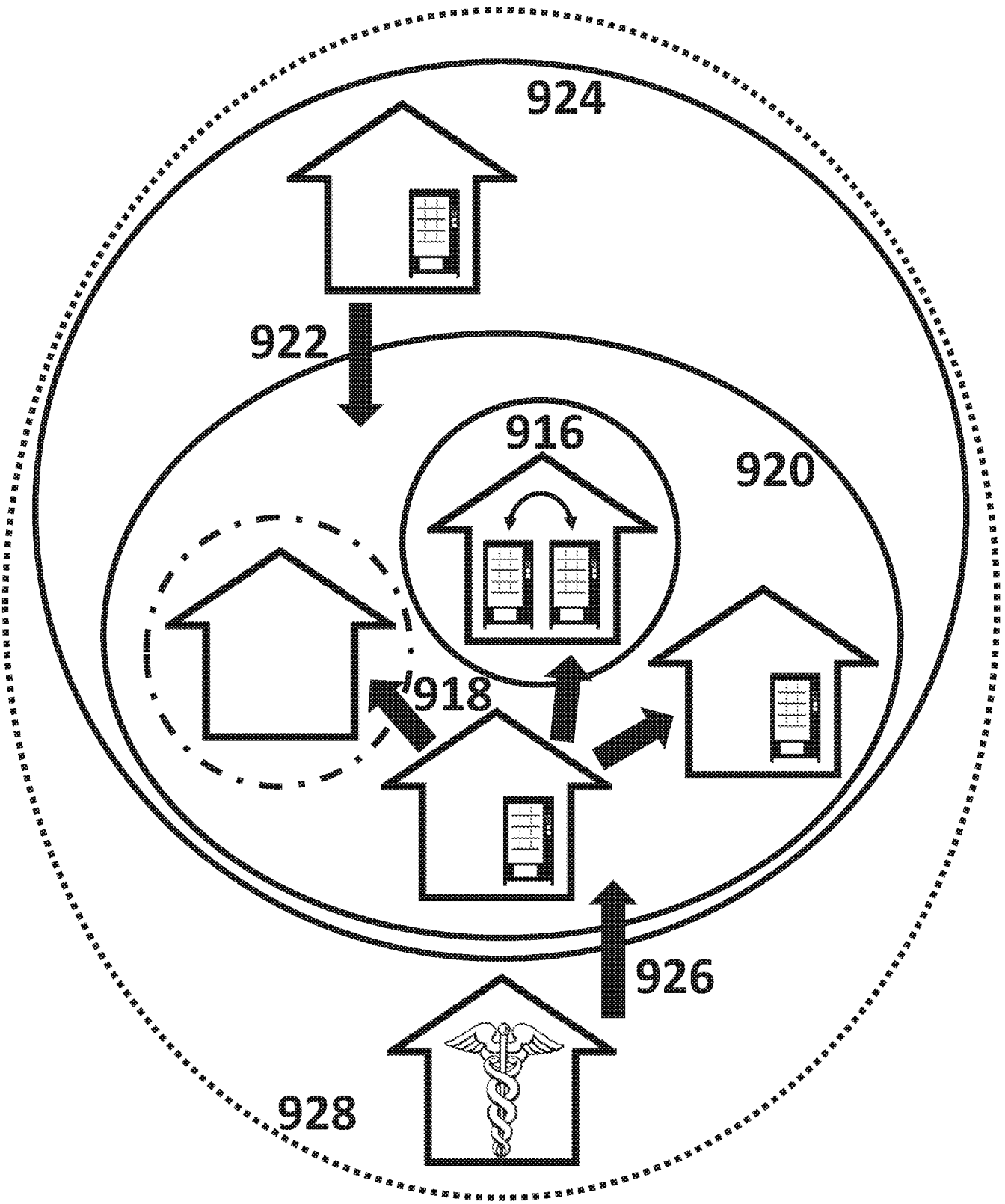


Figure 9b

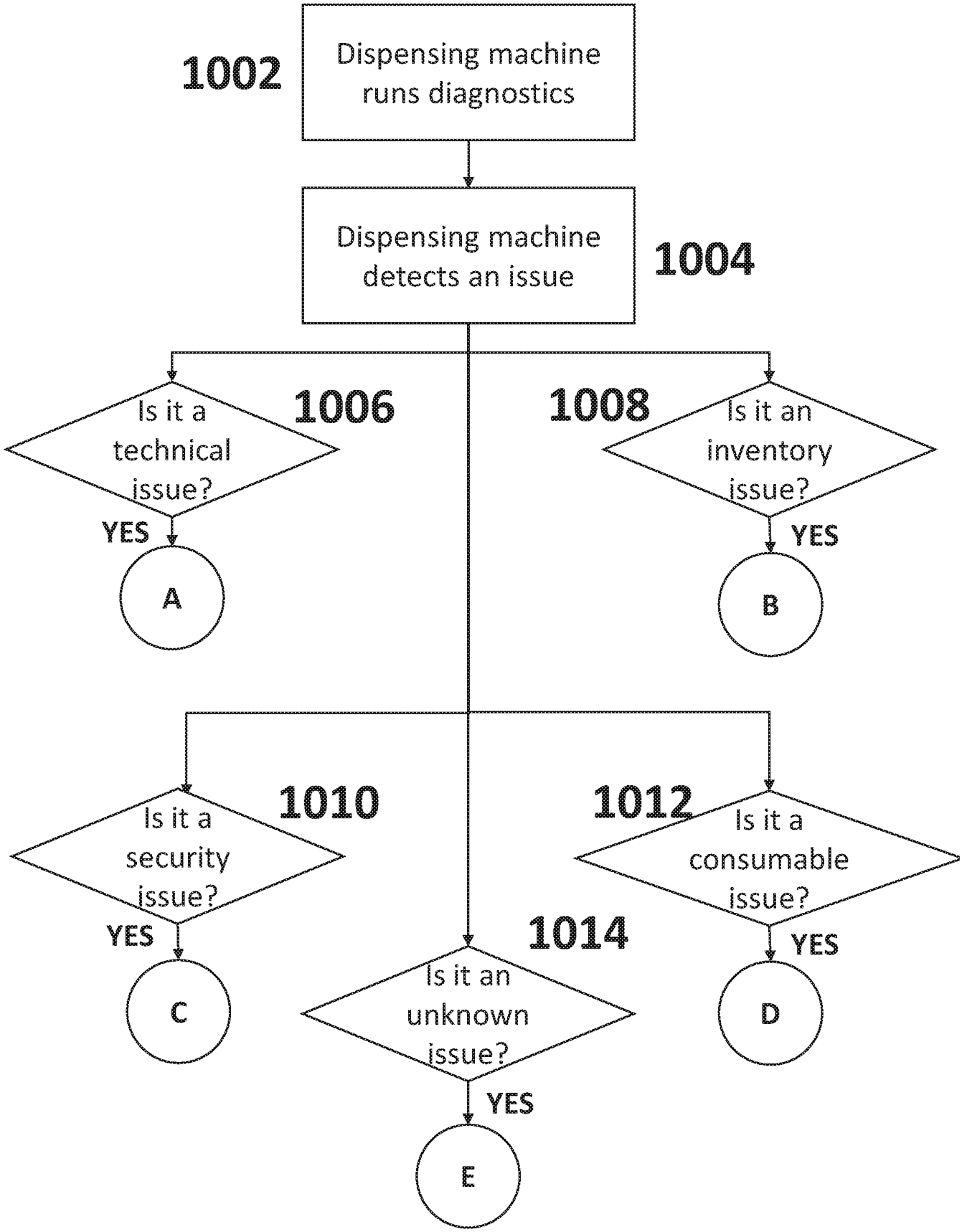

1002
Dispensing machine runs diagnostics
Dispensing machine detects an issue
1004
Is it a technical issue?
1006
YES
A
1008
Is it an inventory issue?
YES
B
Is it a security issue?
1010
YES
C
1012
Is it a consumable issue?
YES
D
1014
Is it an unknown issue?
YES
E

Figure 10

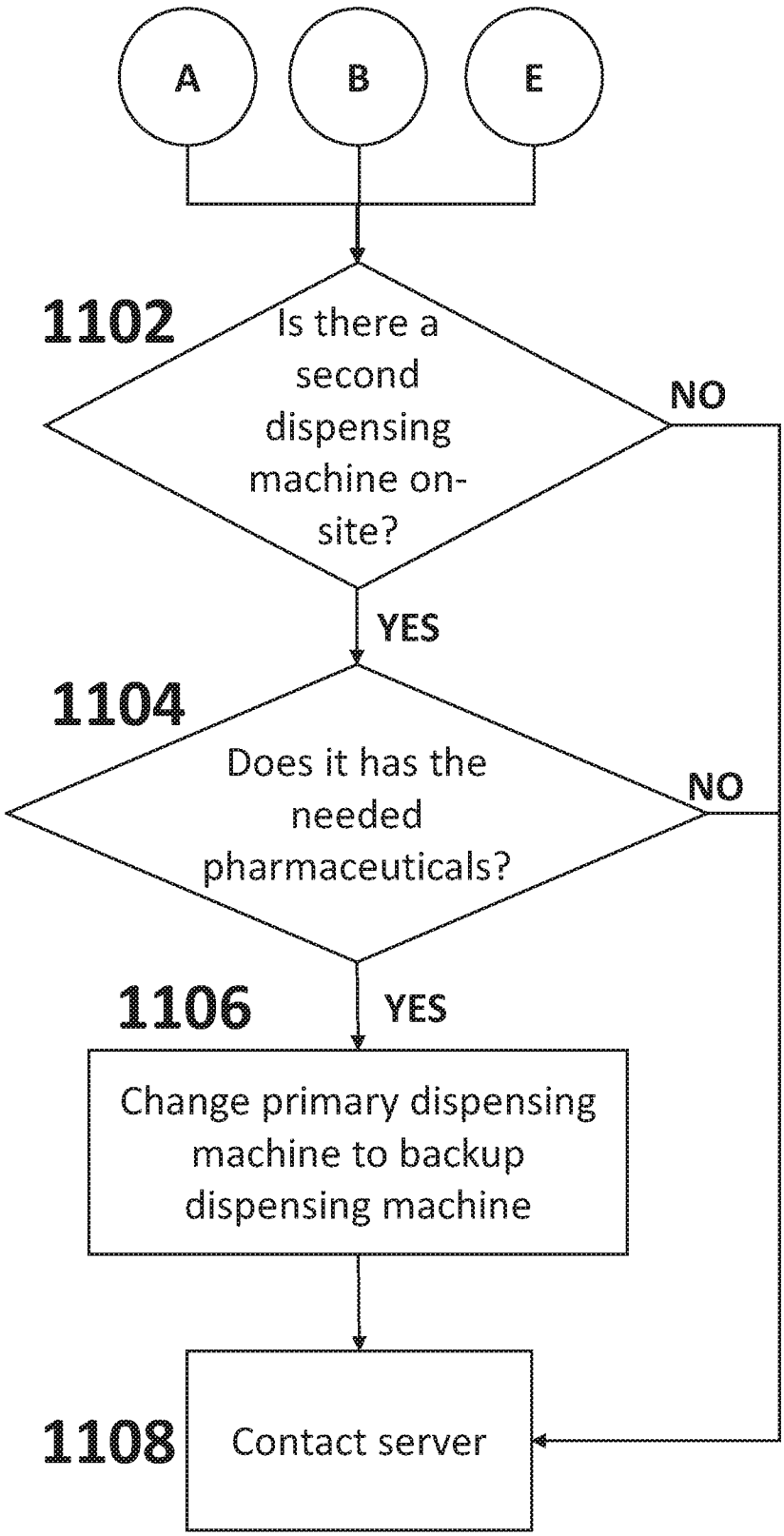

A
B
E
1102
Is there a second dispensing machine on-site?
NO
YES
1104
Does it has the needed pharmaceuticals?
NO
YES
1106
Change primary dispensing machine to backup dispensing machine
1108
Contact server

Figure 11

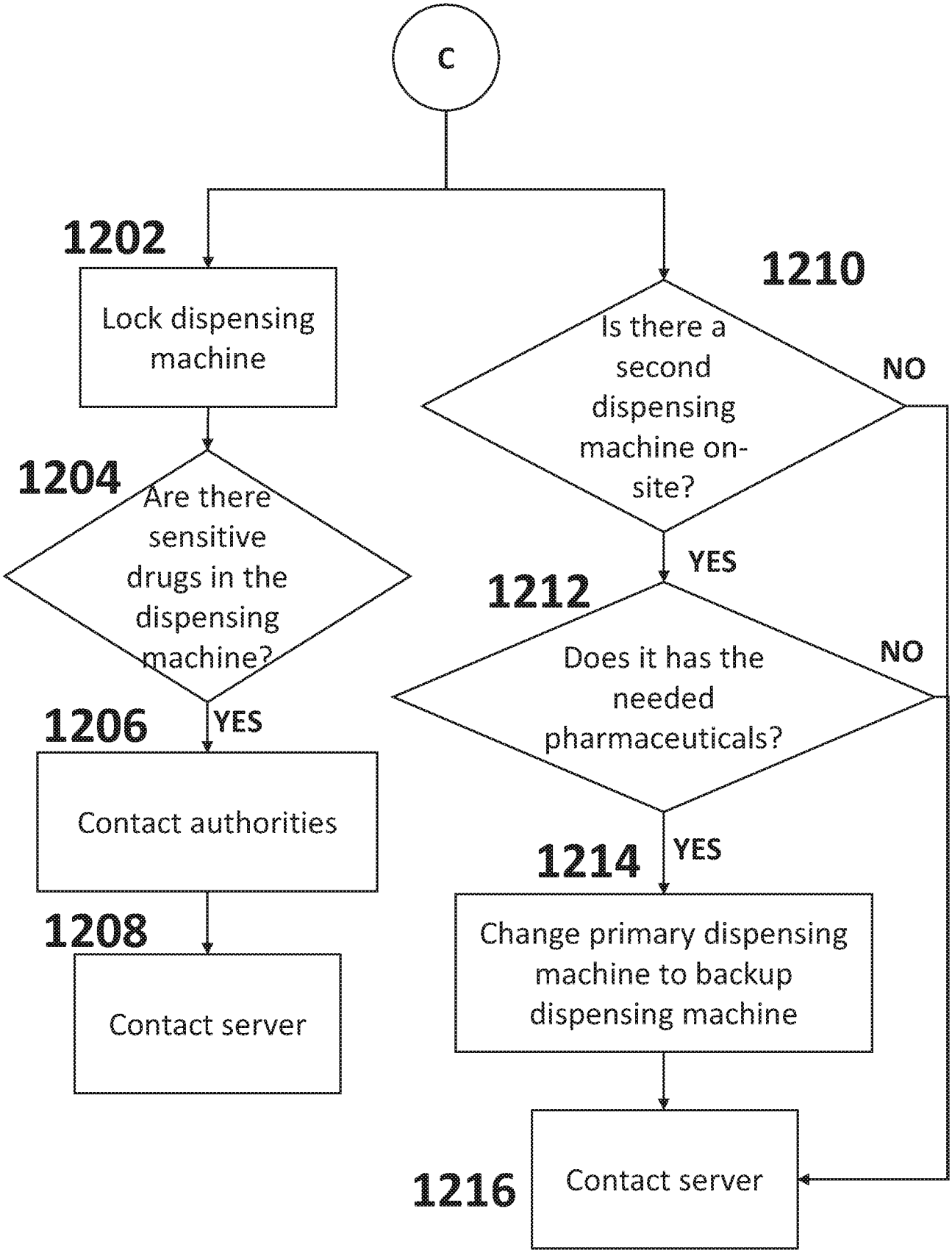

C
1202
Lock dispensing machine
1204
Are there sensitive drugs in the dispensing machine?
YES
1206
Contact authorities
1208
Contact server
1210
Is there a second dispensing machine on-site?
NO
YES
1212
Does it has the needed pharmaceuticals?
NO
YES
1214
Change primary dispensing machine to backup dispensing machine
1216
Contact server

Figure 12

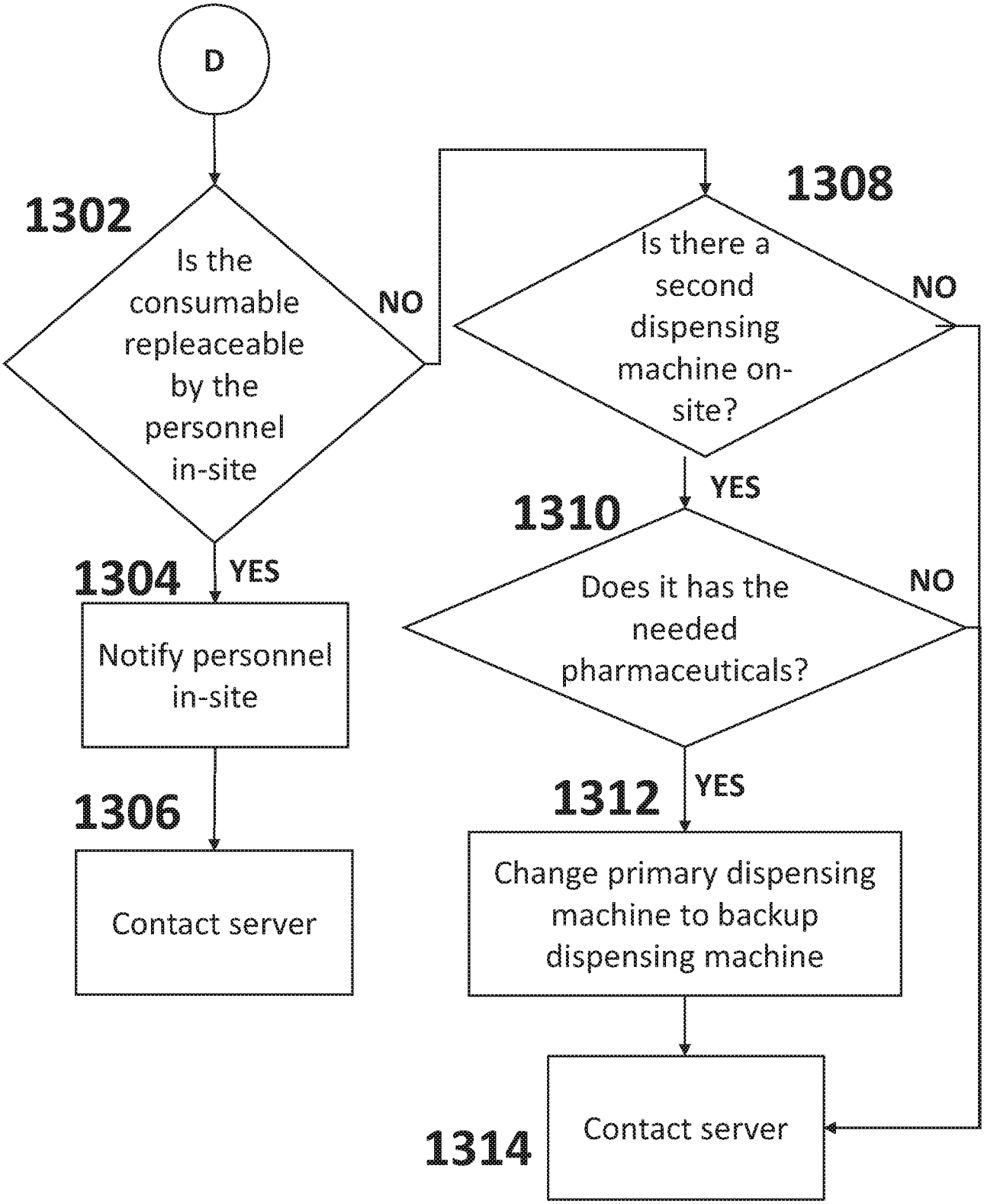

D
1302
Is the consumable repleaceable by the personnel in-site
NO
YES
1304
Notify personnel in-site
1306
Contact server
1308
Is there a second dispensing machine on-site?
NO
YES
1310
Does it has the needed pharmaceuticals?
NO
YES
1312
Change primary dispensing machine to backup dispensing machine
1314
Contact server

Figure 13

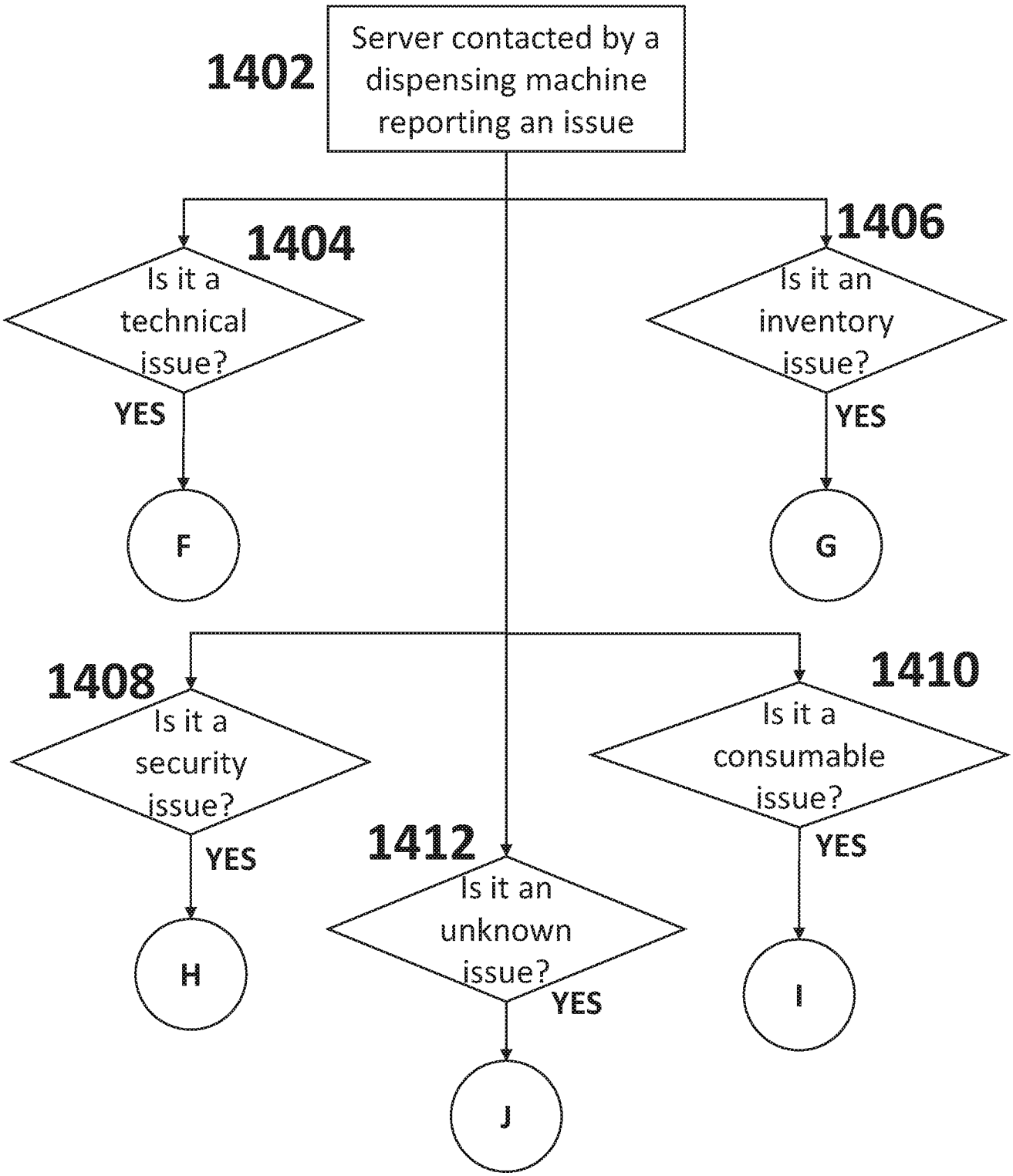

1402
Server contacted by a dispensing machine reporting an issue
1404
Is it a technical issue?
YES
F
1406
Is it an inventory issue?
YES
G
1408
Is it a security issue?
YES
H
1412
Is it an unknown issue?
YES
J
1410
Is it a consumable issue?
YES
I

Figure 14

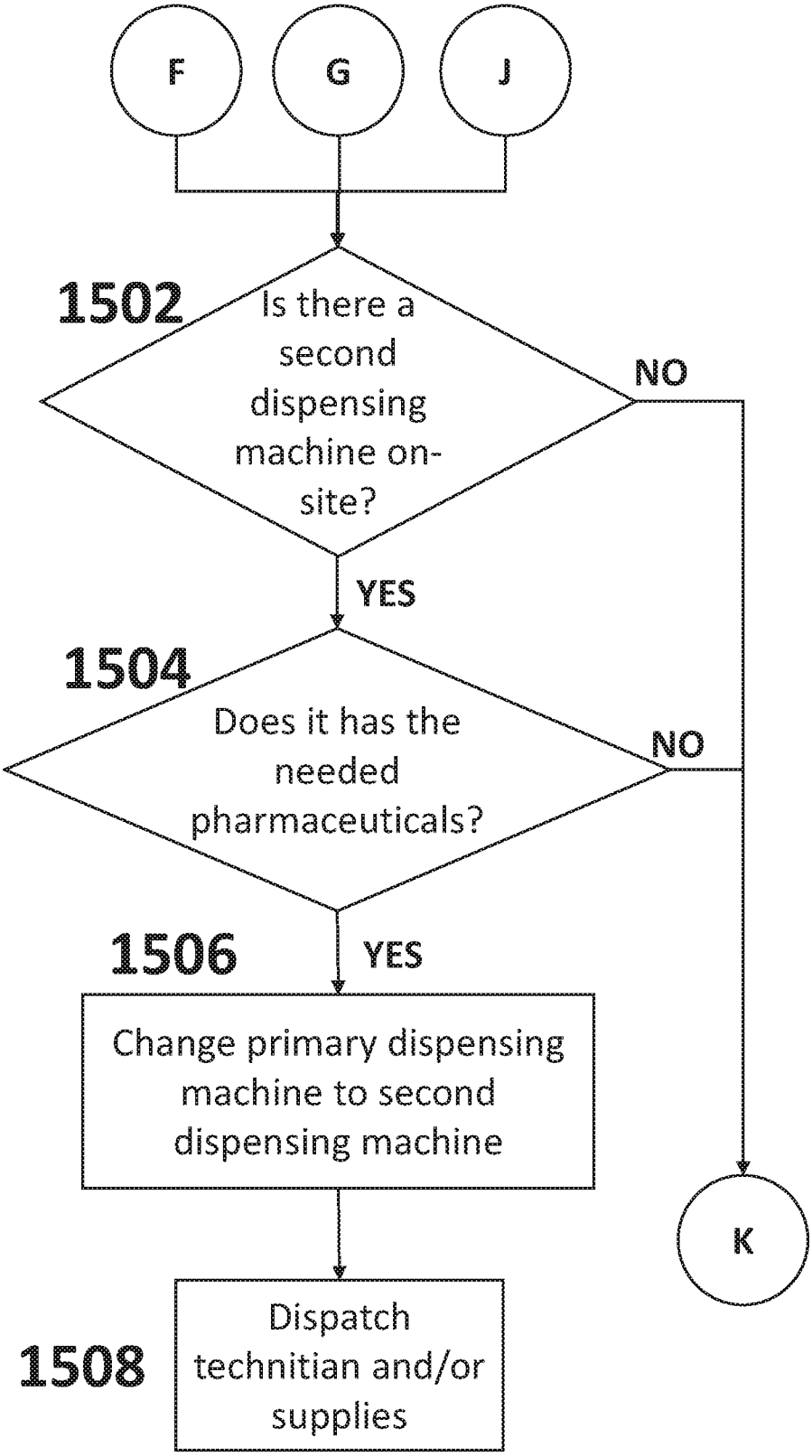

F
G
J
1502
Is there a second dispensing machine on-site?
NO
YES
1504
Does it has the needed pharmaceuticals?
NO
1506
YES
Change primary dispensing machine to second dispensing machine
K
1508
Dispatch technitian and/or supplies

Figure 15

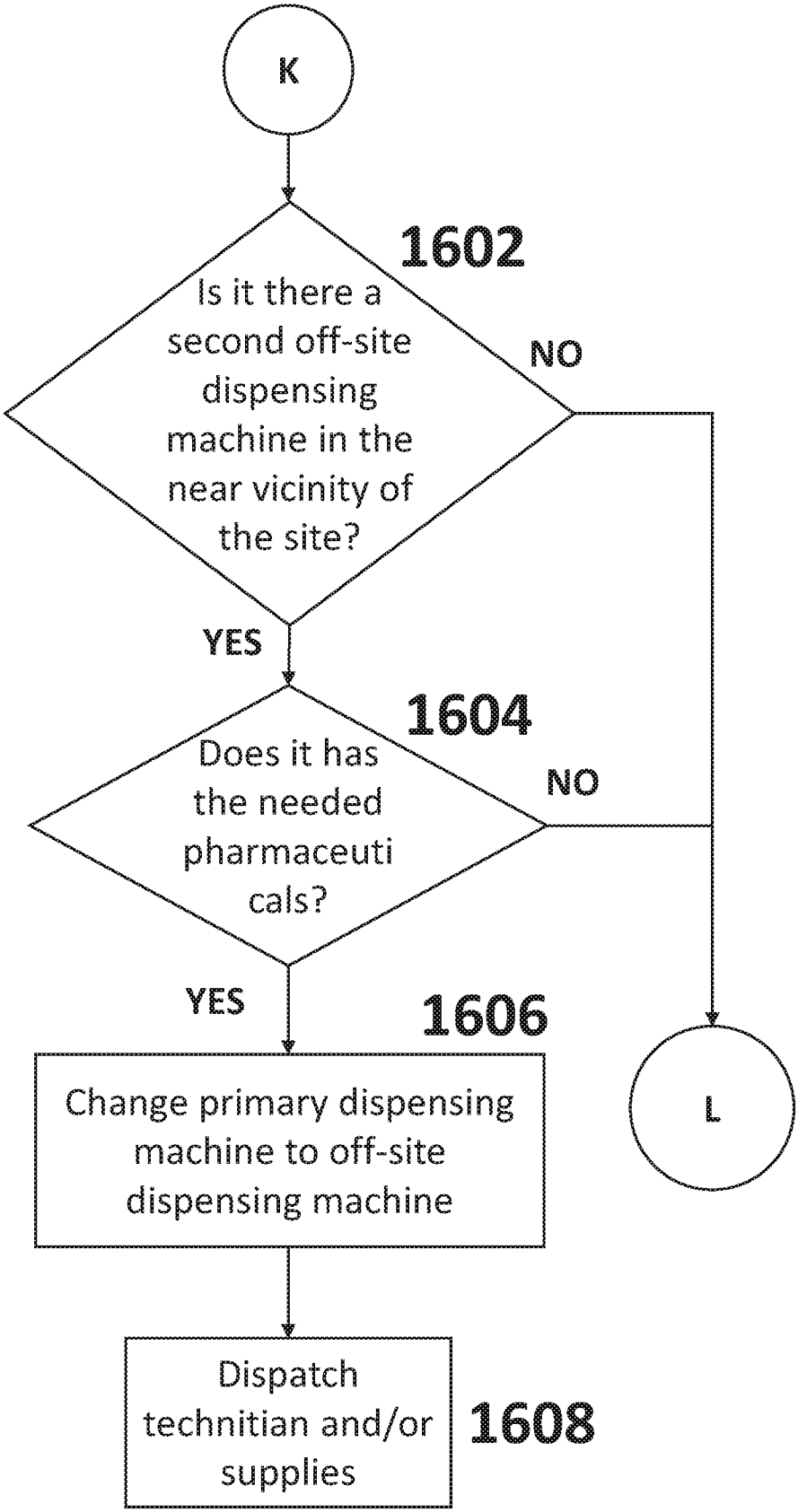

K
1602
Is it there a second off-site dispensing machine in the near vicinity of the site?
NO
YES
1604
Does it has the needed pharmaceuti cals?
NO
YES
1606
Change primary dispensing machine to off-site dispensing machine
L
Dispatch technitian and/or supplies
1608

Figure 16

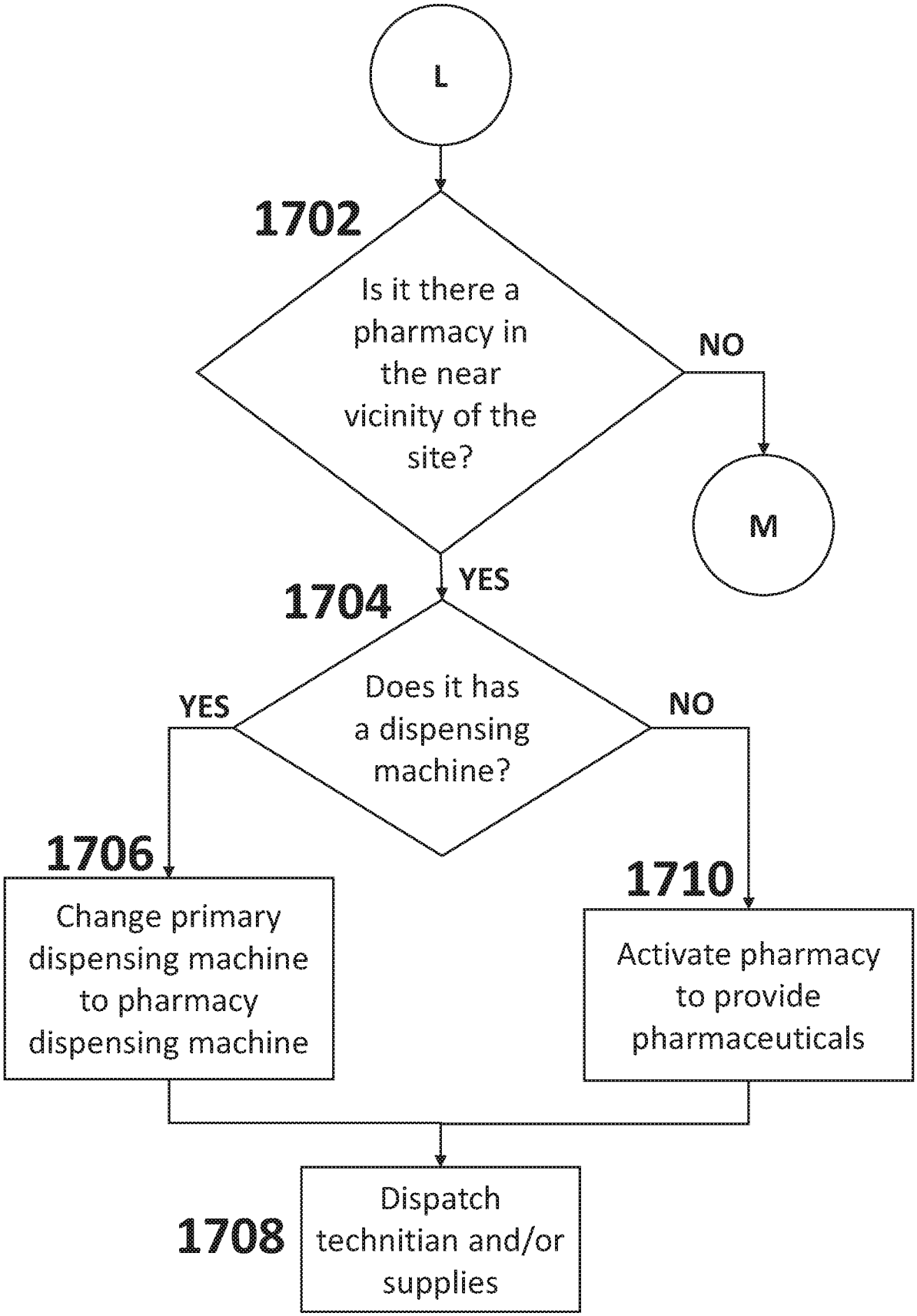

L
1702
Is it there a pharmacy in the near vicinity of the site?
NO
M
YES
1704
Does it has a dispensing machine?
YES
NO
1706
Change primary dispensing machine to pharmacy dispensing machine
1710
Activate pharmacy to provide pharmaceuticals
1708
Dispatch technitian and/or supplies

Figure 17

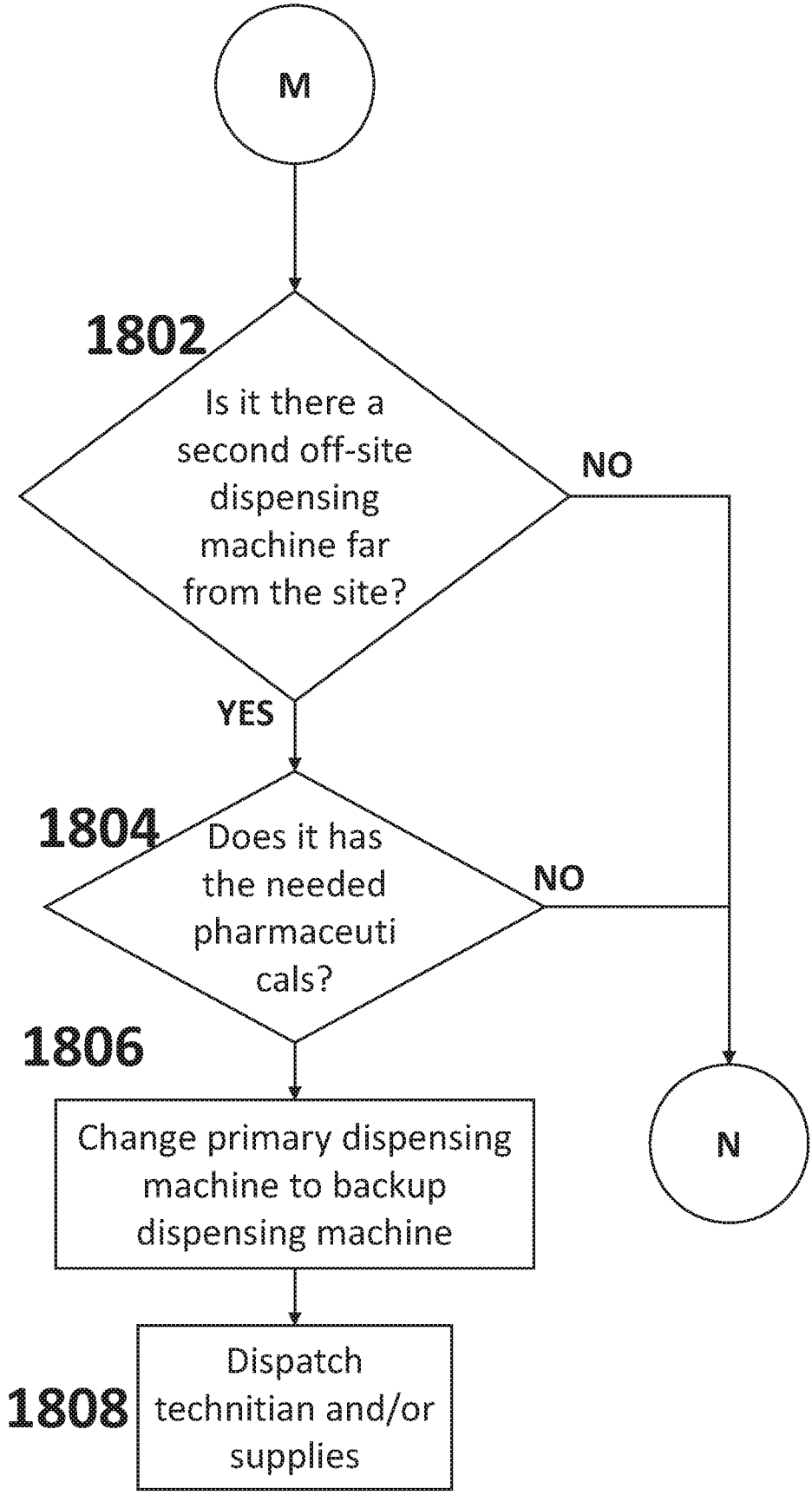

M
1802
Is it there a second off-site dispensing machine far from the site?
NO
YES
1804
Does it has the needed pharmaceuti cals?
NO
1806
Change primary dispensing machine to backup dispensing machine
N
1808
Dispatch technitian and/or supplies

Figure 18

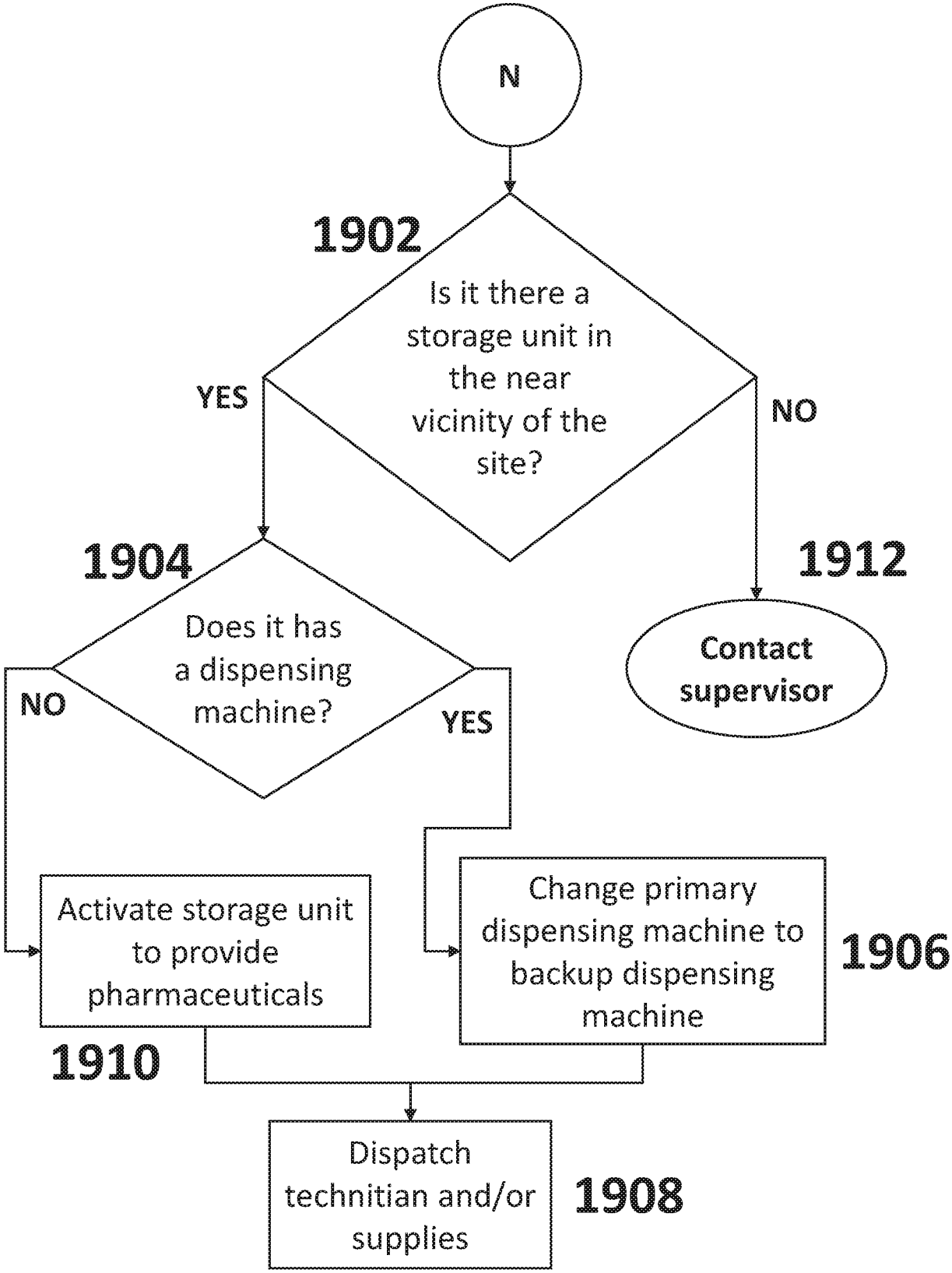

N
1902
Is it there a storage unit in the near vicinity of the site?
YES
NO
1904
Does it has a dispensing machine?
NO
YES
1912
Contact supervisor
Activate storage unit to provide pharmaceuticals
1910
Change primary dispensing machine to backup dispensing machine
1906
Dispatch technitian and/or supplies
1908

Figure 19

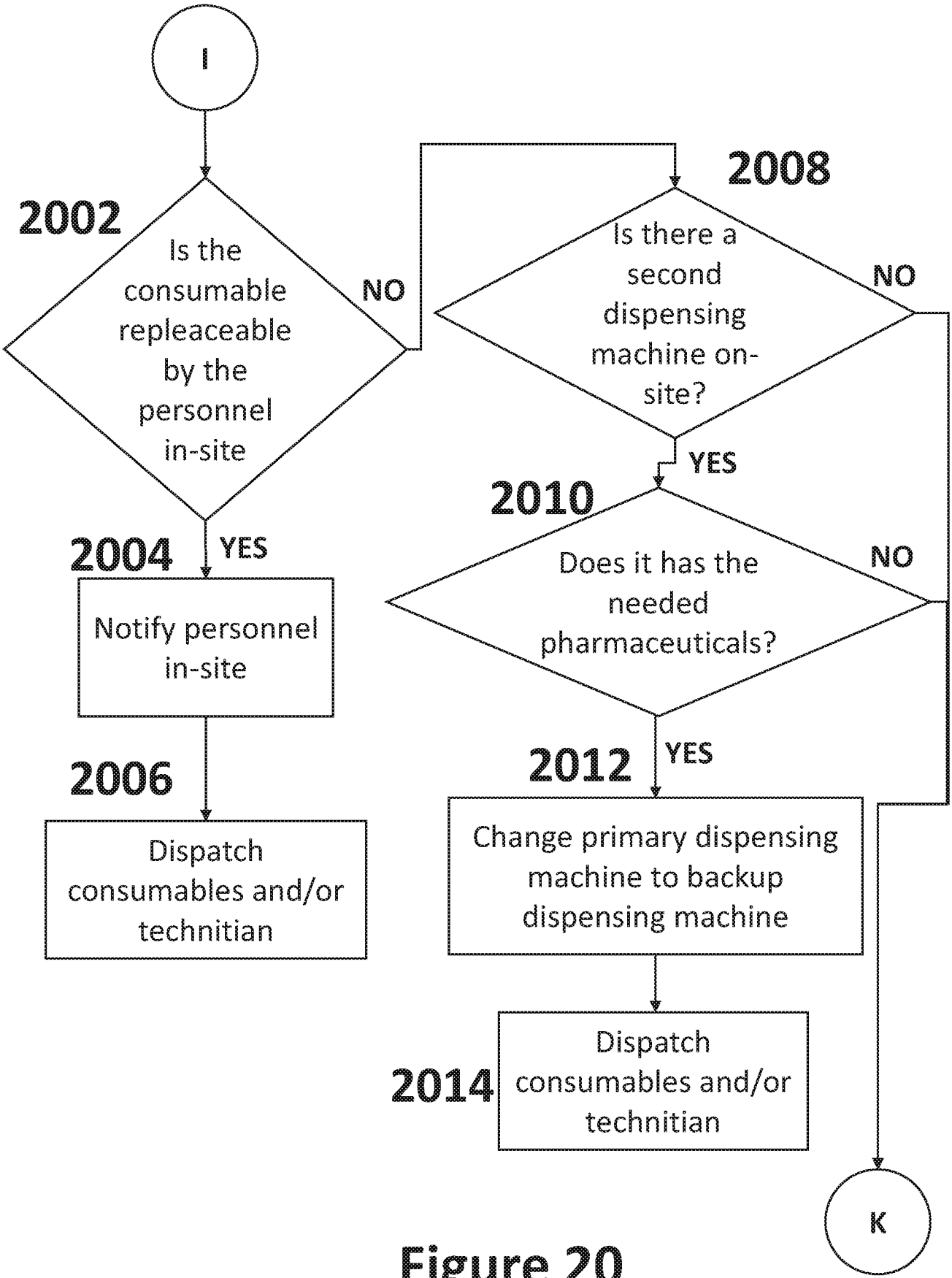

I
2002
Is the consumable repleaceable by the personnel in-site
NO
YES
2004
Notify personnel in-site
2006
Dispatch consumables and/or technitian
2008
Is there a second dispensing machine on-site?
NO
YES
2010
Does it has the needed pharmaceuticals?
NO
YES
2012
Change primary dispensing machine to backup dispensing machine
2014
Dispatch consumables and/or technitian
K

Figure 20

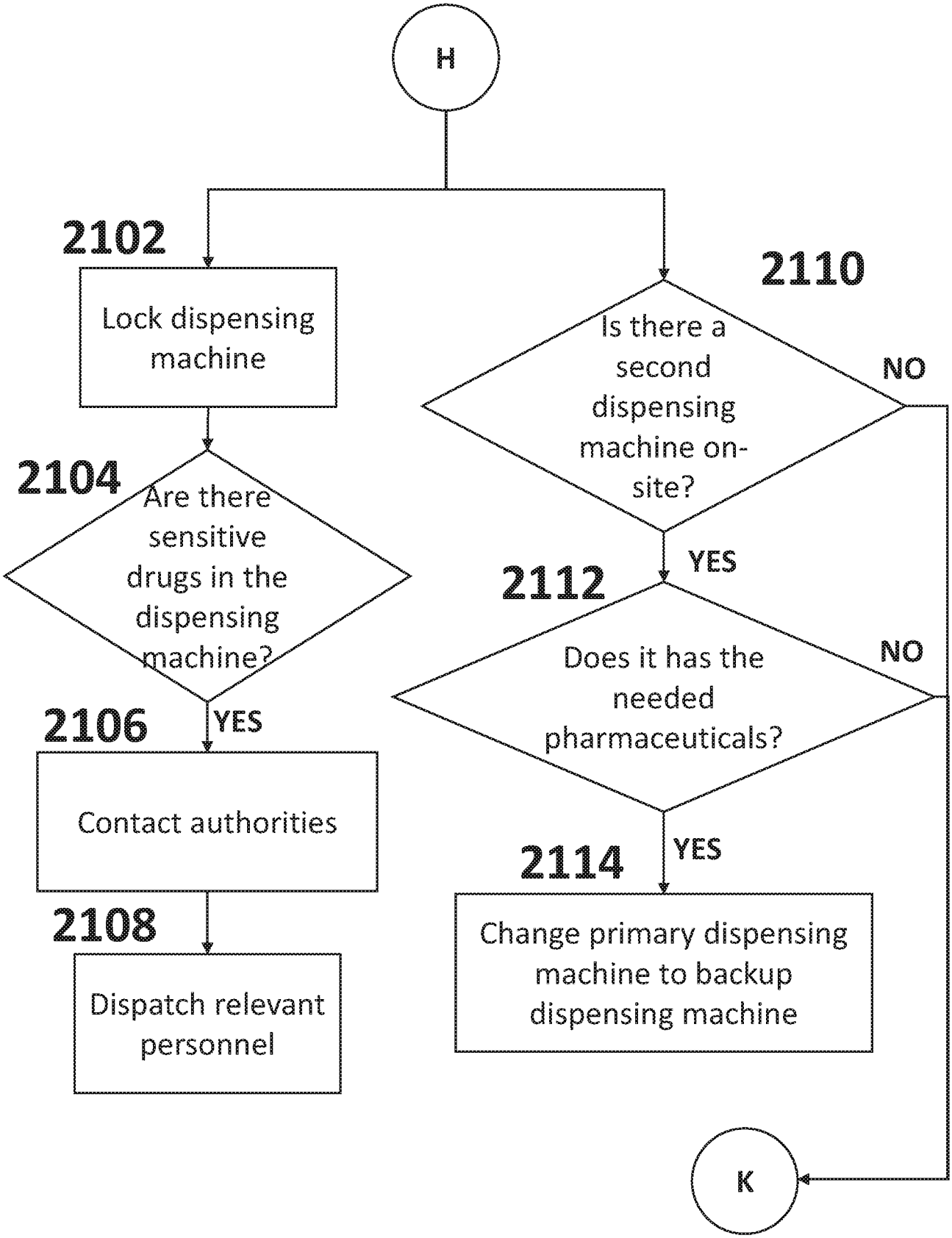

H
2102
Lock dispensing machine
2104
Are there sensitive drugs in the dispensing machine?
YES
2106
Contact authorities
2108
Dispatch relevant personnel
2110
Is there a second dispensing machine on-site?
NO
YES
2112
Does it has the needed pharmaceuticals?
NO
YES
2114
Change primary dispensing machine to backup dispensing machine
K

Figure 21

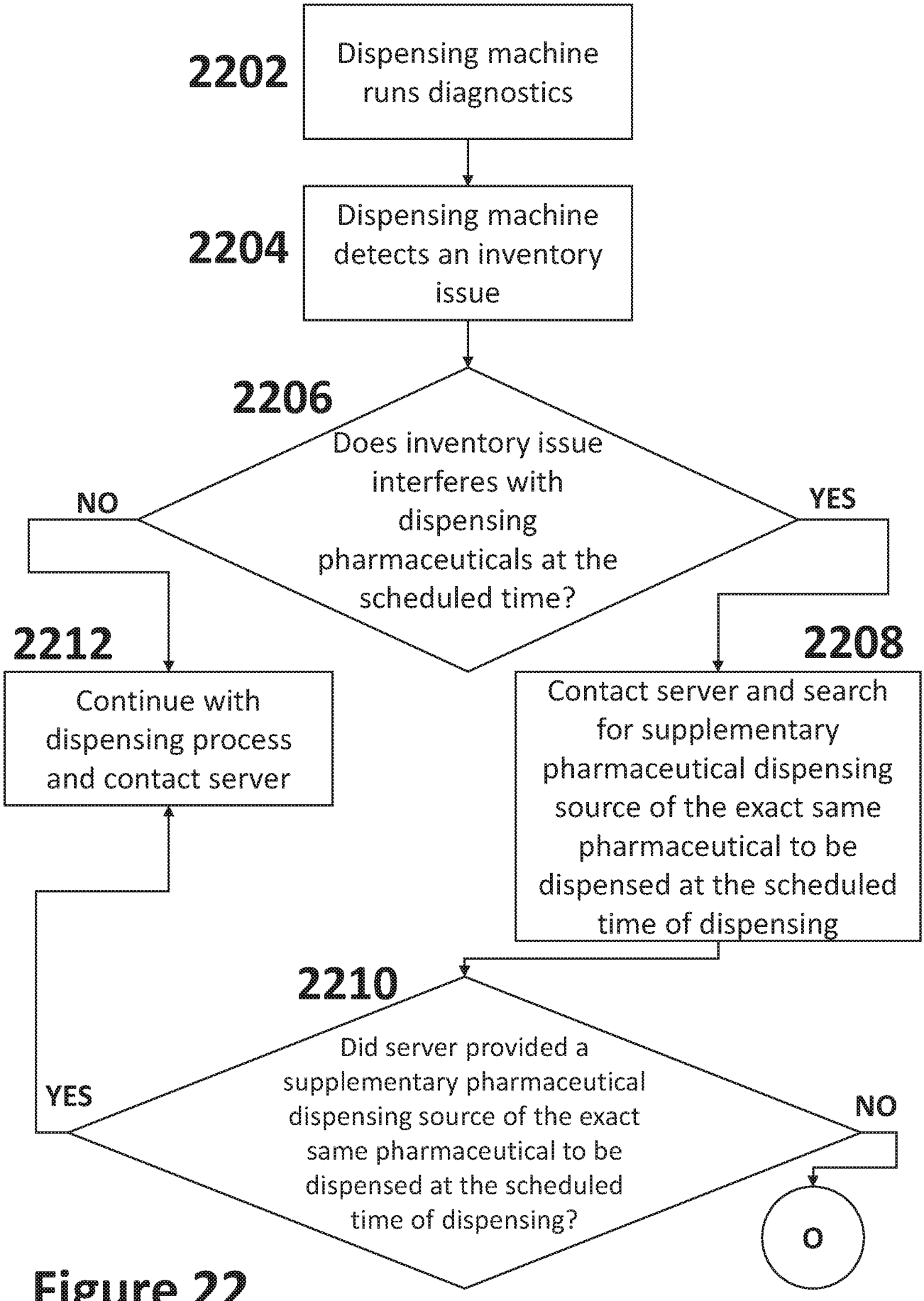

2202
Dispensing machine runs diagnostics
2204
Dispensing machine detects an inventory issue
2206
Does inventory issue interferes with dispensing pharmaceuticals at the scheduled time?
NO
YES
2212
Continue with dispensing process and contact server
2208
Contact server and search for supplementary pharmaceutical dispensing source of the exact same pharmaceutical to be dispensed at the scheduled time of dispensing
2210
Did server provided a supplementary pharmaceutical dispensing source of the exact same pharmaceutical to be dispensed at the scheduled time of dispensing?
YES
NO
O

Figure 22

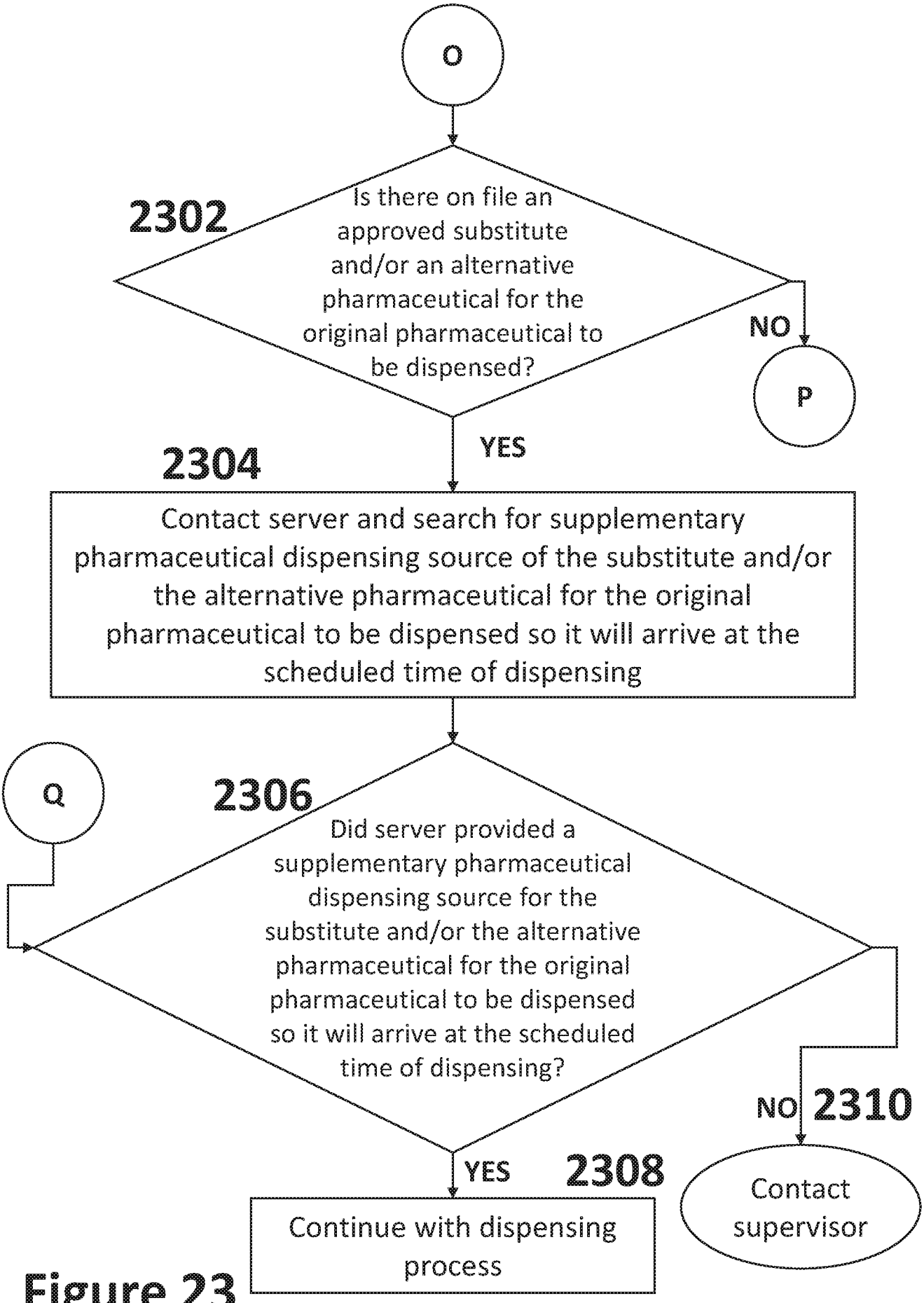

O
2302
Is there on file an approved substitute and/or an alternative pharmaceutical for the original pharmaceutical to be dispensed?
NO
P
YES
2304
Contact server and search for supplementary pharmaceutical dispensing source of the substitute and/or the alternative pharmaceutical for the original pharmaceutical to be dispensed so it will arrive at the scheduled time of dispensing
Q
2306
Did server provided a supplementary pharmaceutical dispensing source for the substitute and/or the alternative pharmaceutical for the original pharmaceutical to be dispensed so it will arrive at the scheduled time of dispensing?
NO
2310
Contact supervisor
YES
2308
Continue with dispensing process

Figure 23

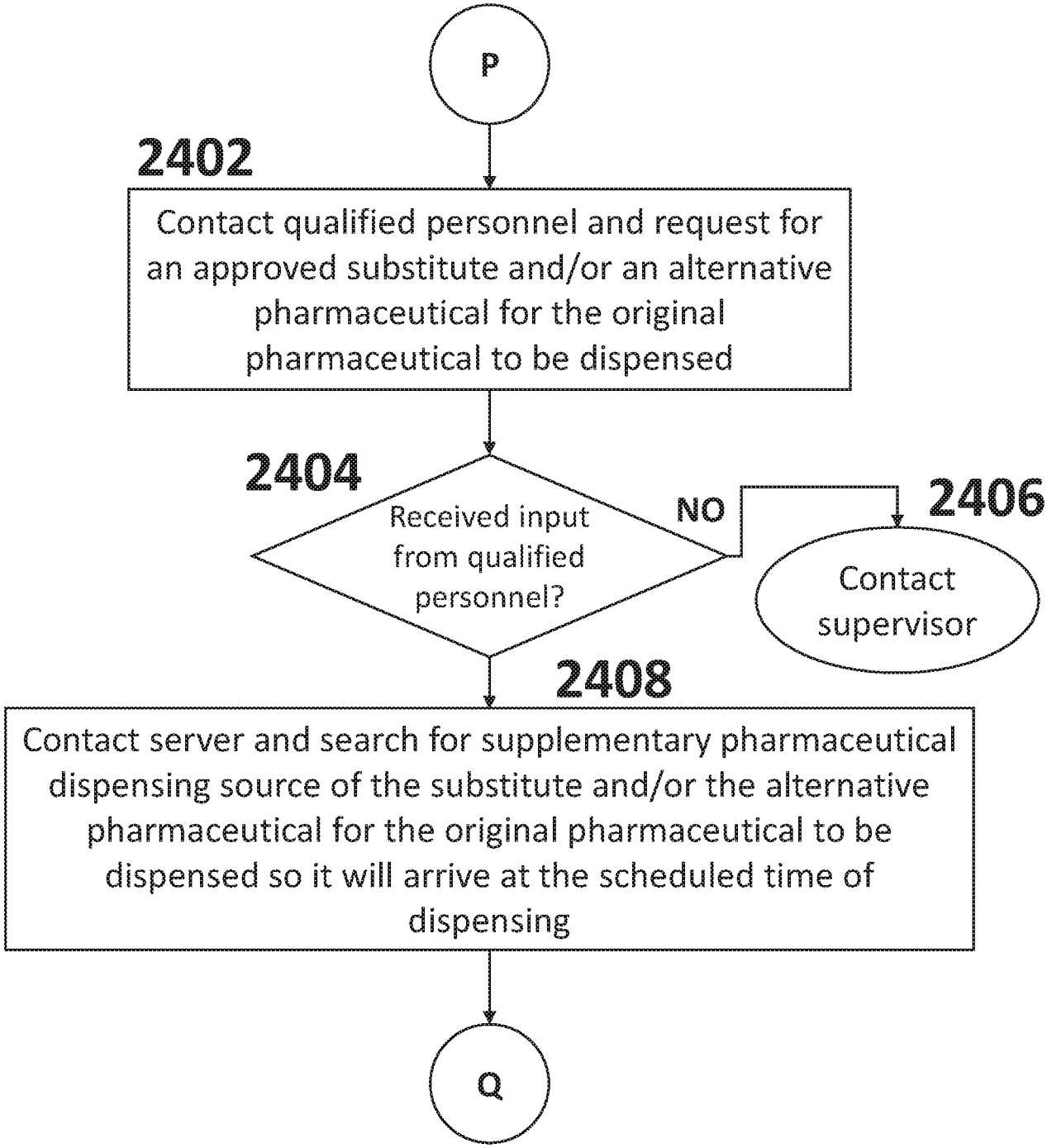

P
2402
Contact qualified personnel and request for an approved substitute and/or an alternative pharmaceutical for the original pharmaceutical to be dispensed
2404
Received input from qualified personnel?
NO
2406
Contact supervisor
2408
Contact server and search for supplementary pharmaceutical dispensing source of the substitute and/or the alternative pharmaceutical for the original pharmaceutical to be dispensed so it will arrive at the scheduled time of dispensing
Q

Figure 24

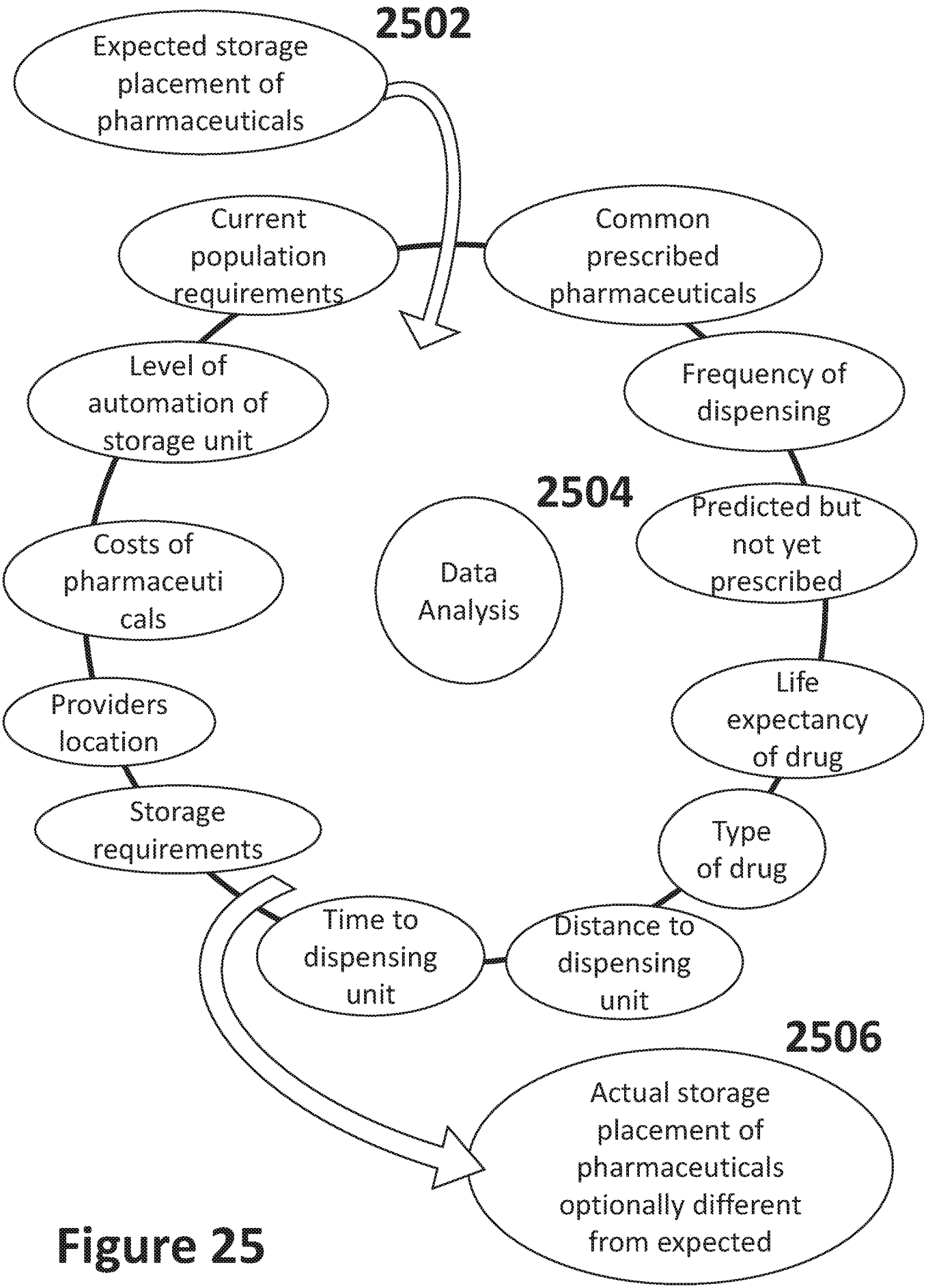

2502
Expected storage placement of pharmaceuticals
Current population requirements
Common prescribed pharmaceuticals
Level of automation of storage unit
Frequency of dispensing
2504
Data Analysis
Costs of pharmaceuticals
Predicted but not yet prescribed
Providers location
Life expectancy of drug
Storage requirements
Type of drug
Time to dispensing unit
Distance to dispensing unit
2506
Actual storage placement of pharmaceuticals optionally different from expected

Figure 25

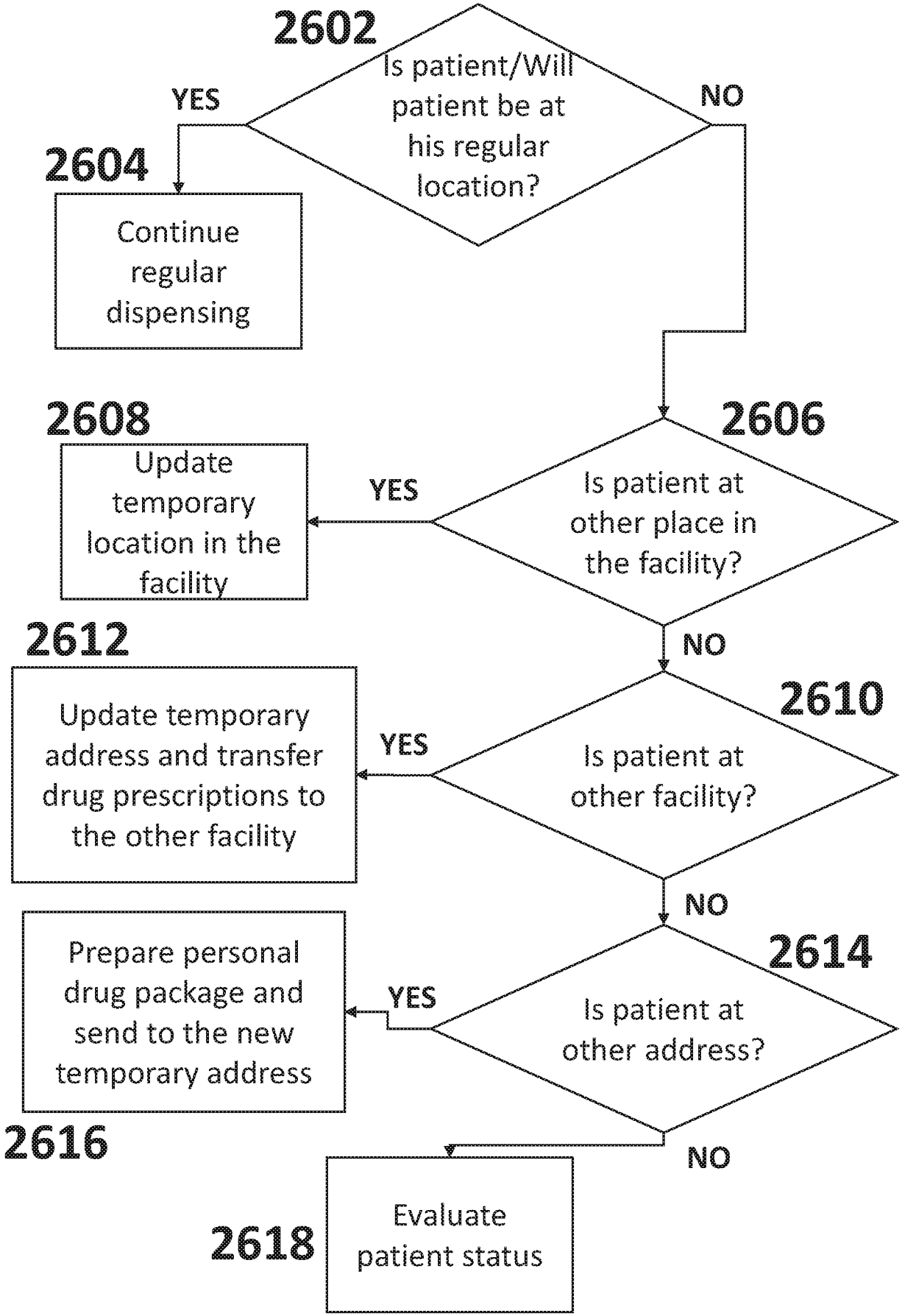

2602
Is patient/Will patient be at his regular location?
YES
NO
2604
Continue regular dispensing
2606
Is patient at other place in the facility?
YES
2608
Update temporary location in the facility
NO
2610
Is patient at other facility?
YES
2612
Update temporary address and transfer drug prescriptions to the other facility
NO
2614
Is patient at other address?
YES
Prepare personal drug package and send to the new temporary address
NO
2616
2618
Evaluate patient status

Figure 26

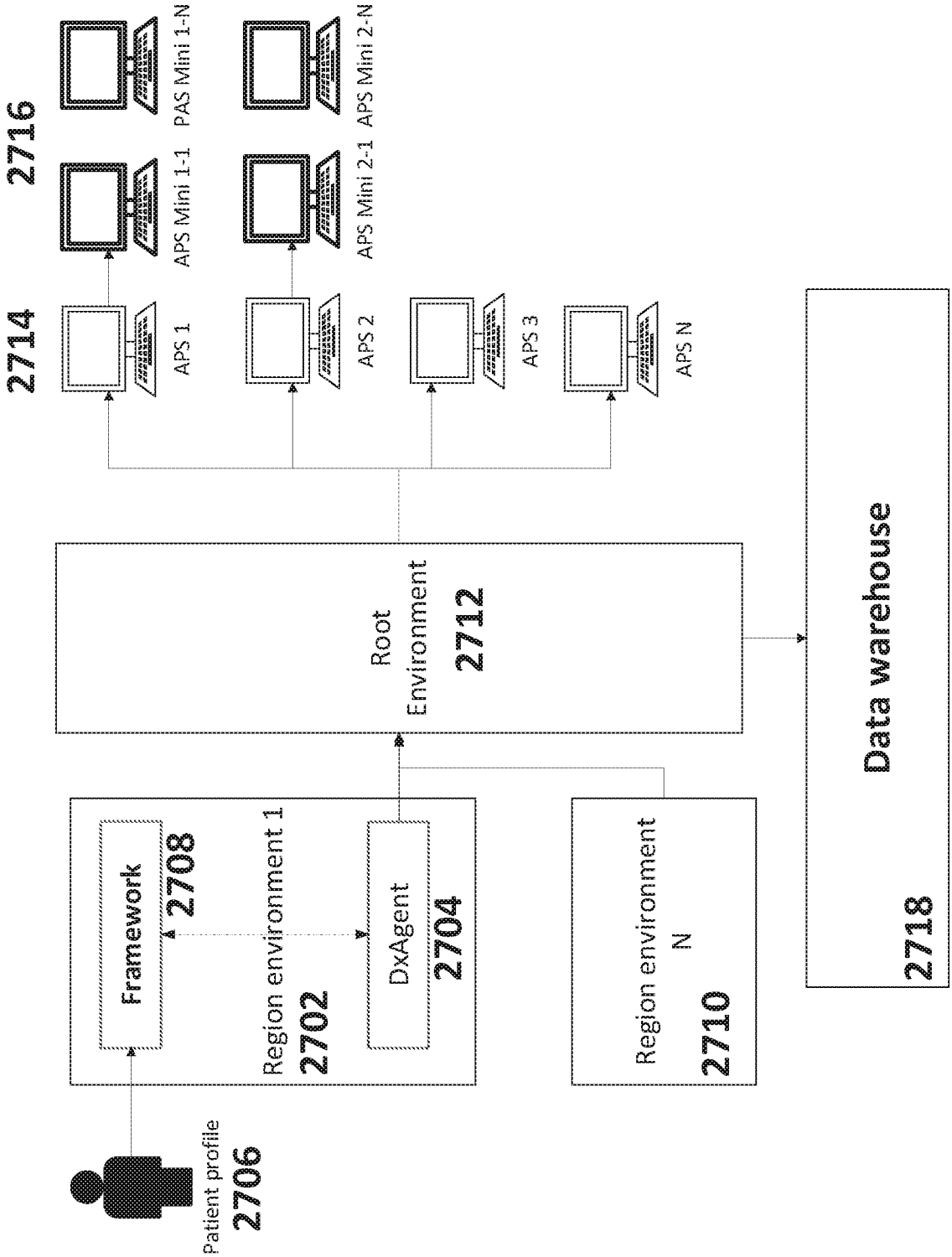

2716
2714
PAS Mini 1-N
APS Mini 1-1
APS Mini 2-N
APS Mini 2-1
APS 1
APS 2
APS 3
APS N
Root Environment
2712
Data warehouse
2718
Framework
2708
Region environment 1
2702
DxAgent
2704
Region environment N
2710
Patient profile
2706

Figure 27

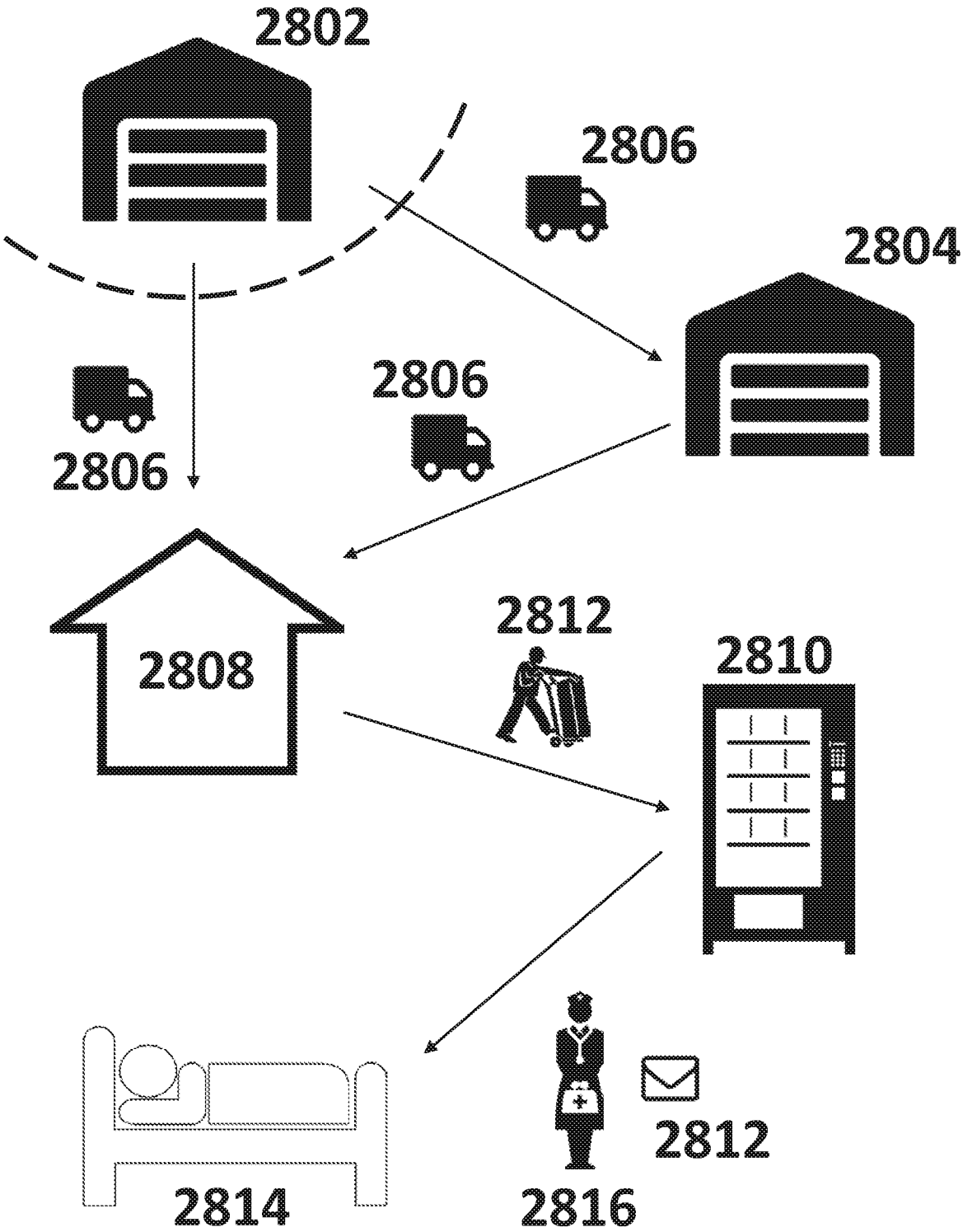
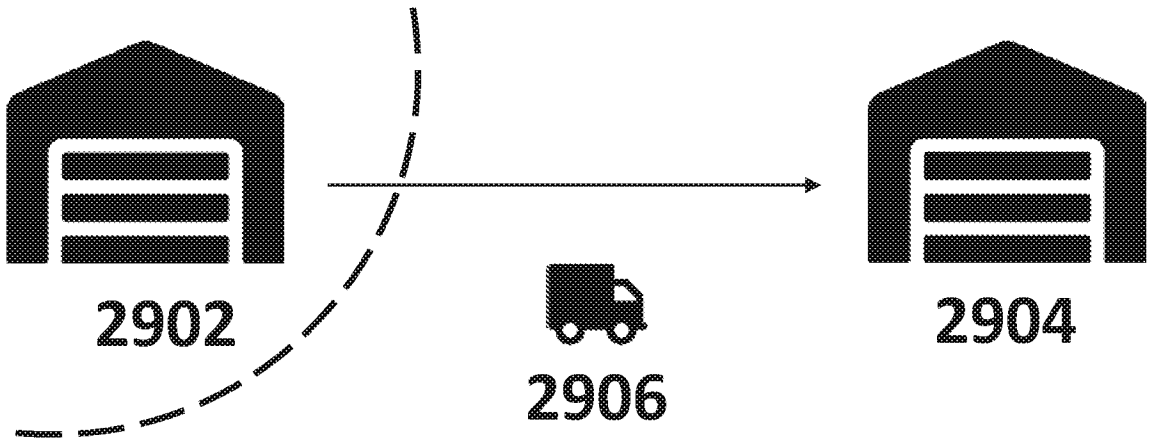
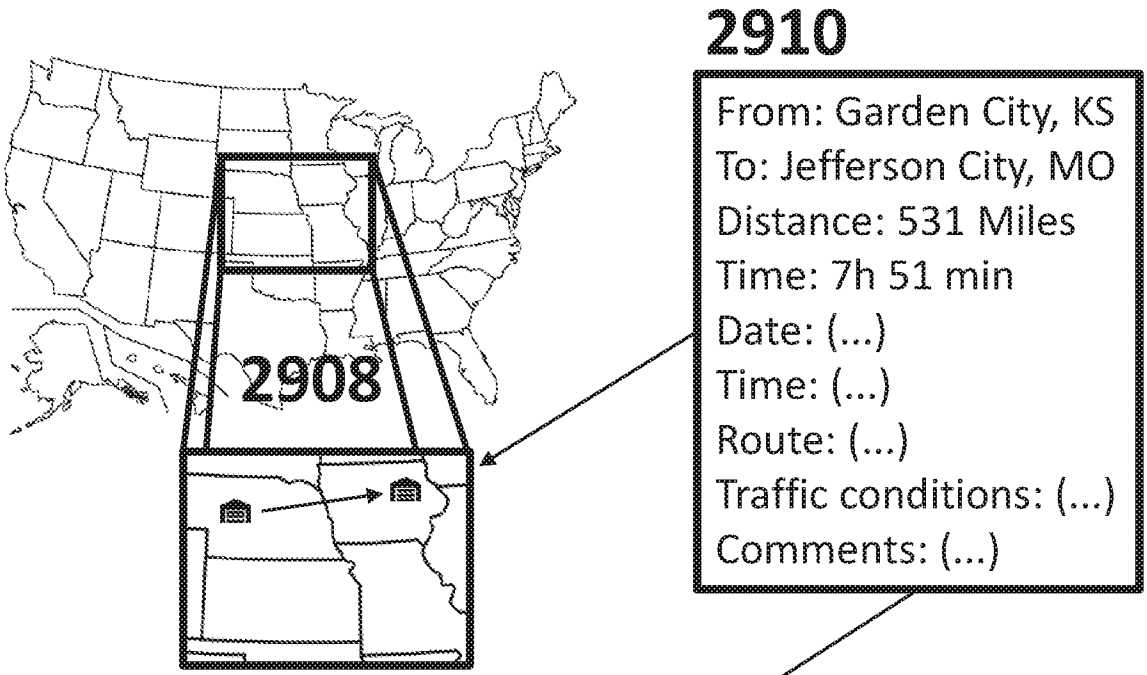


Figure 28


2902
2906
2904


2908
2910
From: Garden City, KS
To: Jefferson City, MO
Distance: 531 Miles
Time: 7h 51 min
Date: (...)
Time: (...)
Route: (...)
Traffic conditions: (...)
Comments: (...)

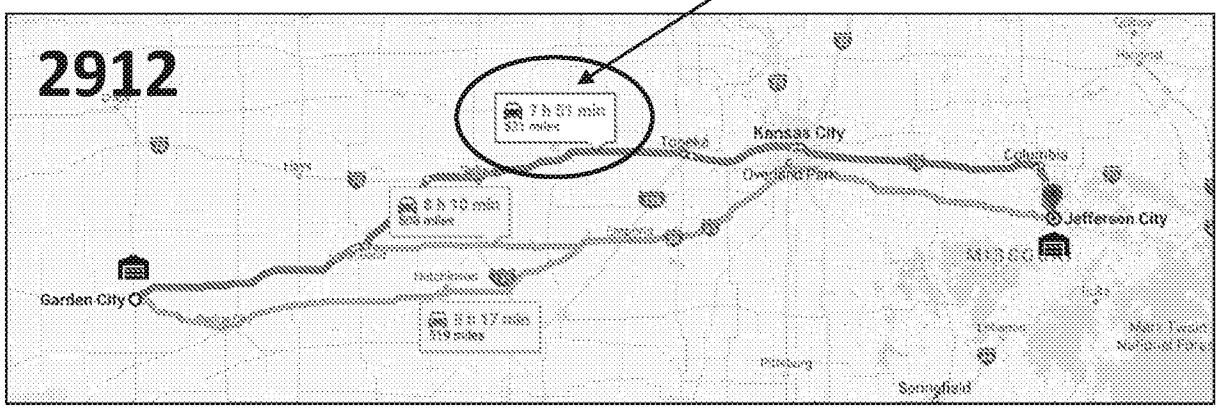

2912
Kansas City
Jefferson City
Garden City

Figure 29

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2019/060572

A. CLASSIFICATION OF SUBJECT MATTER
IPC (20180101) G06F 19/00, G06Q 10/08, G16H 40/20, G16H 10/60
CPC (20130101) G06F 19/3456, G06F 19/3418, G06F 19/3462, G06Q 10/08, G16H 40/20, G16H 10/60
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC (20180101) G06F 19/00, G06Q 10/08, G16H 40/20, G16H 10/60
CPC (20130101) G06F 19/3456, G06F 19/3418, G06F 19/3462, G06Q 10/08, G16H 40/20, G16H 10/60

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)
Databases consulted: PATENTSCOPE, Esp@cenet, Google Patents, Orbit
Search terms used: pharmaceutical, logistic, dispense, processor, prescription, automatic, schedule, storage, store, track, generic, substitute, alternative, server, inventory, stock, communicate, pack, supply, dose, dosage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	WO 2004036481 A2 MCKESSON AUTOMATION SYS INC 29 Apr 2004 (2004/04/29) The whole document	21
A	WO 2005043440 A1 TECH PHARMACY SERVICES INC et al 12 May 2005 (2005/05/12) The whole document	1-50

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 Mar 2020	22 Mar 2020

Name and mailing address of the ISA:
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Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel
Email address: pctoffice@justice.gov.il

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YuliaI@justice.gov.il
Telephone No. 972-2-5651680

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2019/060572

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2019/060572

Patent document cited search report	Publication date	Patent family member(s)	Publication Date
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		US 7685004 B2	23 Mar 2010
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		US 8204761 B2	19 Jun 2012
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2019/060572

Patent document cited search report	Publication date	Patent family member(s)	Publication Date
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		US 9710609 B2	18 Jul 2017
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		US 9740830 B2	22 Aug 2017
		US 2016132663 A1	12 May 2016
		US 9747422 B2	29 Aug 2017
		US 2015112715 A1	23 Apr 2015
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