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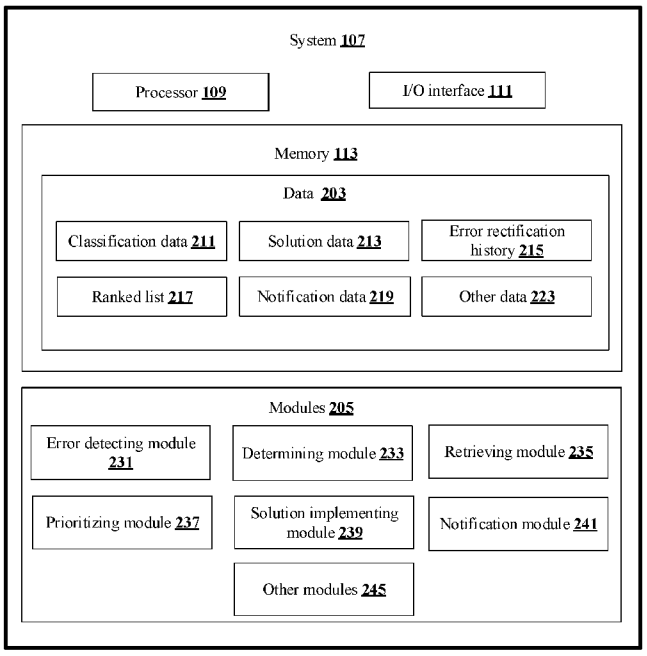

FIG.2

(57) Abstract: Disclosed subject matter relates to laboratory instruments including a method of managing errors in a laboratory instrument, which includes detecting an error occurring in a laboratory instrument, from an event log including one or more events, determining whether the error is rectifiable, upon positive determination, solutions corresponding to the identified error are retrieved from a repository associated with the laboratory instrument and the solutions are arranged in a ranked list, and one or more solutions retrieved, are implemented based on the ranked list, to rectify the error in the laboratory instrument without any manual intervention, until the error is rectified.

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MANAGING ERRORS IN A LABORATORY INSTRUMENT

TECHNICAL FIELD

This disclosure relates generally to laboratory instruments, and more specifically to diagnostic instruments.

BACKGROUND

Generally, laboratory instruments may encounter many errors during their usage. Usually, errors occurring in laboratory instruments may be constructional errors, configuration errors, calibration errors and the like. Typically, certain errors occurring in laboratory instruments may be solved by following a method or procedure suggested in a manual provided with the laboratory instrument, and few other errors may require mandatory inspection by Field Service Engineers (FSE) to fix the other errors. Generally, the errors occurring in laboratory instruments may be recorded as events in an event log, and based on the event log, the errors may be reported to FSEs, who inspects the laboratory instruments to fix these errors. However, in the midst of critical operations, waiting for FSEs to visit a location of the laboratory instrument to fix the errors may not be feasible due to an increase in turnaround time taken for fixing the errors, and an increase in instrument downtime. Usually, every visit of the FSEs for fixing or rectifying errors in the laboratory instrument may be a very expensive choice for an organization. Typically, in some other scenarios, time being wasted in consulting the manual to rectify an issue, and the laboratory instrument may be further prone to errors due to lack of expertise of the laboratory technicians in fixing the errors.

The present disclosure provides a method and a system for managing one or more errors in a laboratory instrument, preferably automatically, thereby ameliorating some of the current disadvantages.

The information disclosed in this background of the disclosure section is only for enhancement of understanding of the general background of the disclosure and should not be taken as an acknowledgement or any form of suggestion that this information forms prior art already known to a person skilled in the art

SUMMARY

One or more shortcomings of the prior art may be overcome, and additional advantages may be provided through embodiments of the present disclosure. Additional features and advantages may be realized through the techniques of the present disclosure. Other embodiments and aspects of the disclosure are described in detail herein and are considered a part of the claimed disclosure.

Embodiments of the present disclosure relate to a method of managing an error in a laboratory instrument. In one embodiment, the method includes detecting an error occurring in a laboratory instrument, from an event log. In a further embodiment, the event log comprises one or more events associated with the laboratory instrument. In a further embodiment, the method includes determining whether the error identified is rectifiable without any human intervention (hereinafter also referred to as automatically). In a further embodiment, upon determination that the error is rectifiable automatically, the method includes retrieving one or more solutions corresponding to the identified error from a repository associated with the laboratory instrument and organizing the one or more solutions in a ranked list. In a further embodiment, the method includes selecting and implementing the one or more solutions retrieved, based on the ranked list, to rectify the error in the laboratory instrument without any manual intervention, until the error is rectified. A further embodiment includes a laboratory instrument configured to perform the method of managing an error in a laboratory instrument.

The foregoing summary is only illustrative in nature and is not intended to be in any way limiting on the embodiments disclosed herein. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE ACCOMPANYING DIAGRAMS

The accompanying drawings, which are incorporated in and constitute a part of this disclosure, illustrate exemplary embodiments and, together with the description, serve to explain the disclosed principles. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The same reference numbers are used throughout the figures to reference like features and components. Some embodiments of system and/or methods in accordance with embodiments of the present

subject matter are now described, by way of example only, and with reference to the accompanying figures, in which:

FIG.1 illustrates an exemplary architecture for managing one or more errors in a laboratory instrument in accordance with some embodiments of the present disclosure;

FIG.2 illustrates an exemplary block diagram of a system for managing one or more errors in a laboratory instrument in accordance with some embodiments of the present disclosure;

FIG.3 illustrates an exemplary flowchart of a method of managing one or more errors in a laboratory instrument in accordance with some embodiments of the present disclosure; and

FIG.4 illustrates an exemplary block diagram of a computer system for implementing embodiments consistent with the present disclosure.

It should be appreciated by those skilled in the art that any block diagrams herein represent conceptual views of illustrative systems embodying the principles of the present subject matter. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and executed by a computer or processor, whether or not such computer or processor is explicitly shown.

DETAILED DESCRIPTION

In the following detailed description of the embodiments of the disclosure, reference is made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration specific embodiments in which the disclosure may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the disclosure, and it is to be understood that other embodiments may be utilized and that changes may be made without departing from the scope of the present disclosure. The following description is, therefore, not to be taken in a limiting sense. A description of an embodiment with several components in communication with each other does not imply that all such components are required. On the contrary a variety of optional components are described to illustrate the wide variety of possible embodiments of the invention.

In the present document, the word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment or implementation of the present

subject matter described herein as "exemplary" is not necessarily construed to be as preferred or advantageous over other embodiments that may be disclosed.

While the disclosure is susceptible to various modifications and alternative forms, specific embodiment thereof has been illustrated by way of example in the drawings and will be described in detail below. It should be understood, however that this is not intended to limit the disclosure to the forms disclosed, but on the contrary, the disclosure is to cover all modifications, equivalents, and alternative falling within the scope of the disclosure.

The terms “comprises”, “comprising”, “includes” or any other variations thereof, are intended to cover a non-exclusive inclusion, such that a setup, device or method that includes a list of components or steps does not include only those components or steps but may include other components or steps not expressly listed or inherent to such setup or device or method. In other words, one or more elements in a system or apparatus proceeded by “comprises... a” does not, without more constraints, preclude the existence of other elements or additional elements in the system or method. Also, the words "comprising," "having," "containing," and "including," and other similar forms are intended to be equivalent in meaning and be open-ended in that an item or items following any one of these words is not meant to be an exhaustive listing of such item or items, or meant to be limited to only the listed item or items. It must also be noted that as used herein and in the appended claims, the singular forms “a,” “an,” and “the” include plural references unless the context clearly dictates otherwise.

Embodiments disclosed herein may include a method and a system for managing one or more errors in a laboratory instrument. In some embodiments, the phrase "one or more errors" and the word "error" may be alternatively used. In one embodiment, the system may be a server/console associated with a laboratory instrument, capable of managing the one or more errors in the laboratory instrument. In some other embodiments, the method for managing one or more errors in the laboratory instrument may be described in conjunction with a server, and the method may also be implemented in various computing systems/devices, other than the server. In one embodiment, the one or more errors occurring in a laboratory instrument may be recorded in an event log that includes one or more events associated with the laboratory instrument.

One embodiment may include a system for managing an error in a laboratory instrument. In a further embodiment, the system may include a processor and a memory that is communicatively coupled to the processor. In a further embodiment, the memory may store processor-executable instructions, which, on execution, may cause the processor to detect an error occurring in a laboratory instrument, from an event log. In a further embodiment, the event log may include one or more events associated with the laboratory instrument. In a further embodiment, the processor may determine whether the error may be rectified automatically. In a further embodiment, on determination that the error may be rectified automatically, the processor may retrieve one or more solutions corresponding to the error from a repository associated with the laboratory instrument. In a further embodiment, a ranked list of the one or more solutions may be created. In a further embodiment, the processor may implement the one or more solutions retrieved, based on the ranked list, to rectify the error in the laboratory instrument without any manual intervention, until the error may be rectified.

A further embodiment may include a non-transitory computer readable medium including instructions stored thereon, which when processed by at least one processor may cause a system to perform operations that may include detecting an error occurring in a laboratory instrument, from an event log. In a further embodiment, the event log, may include one or more events associated with the laboratory instrument. In a further embodiment, the instructions may further cause the processor to determine whether the error may be rectified automatically. In a further embodiment, on determination that the error may be rectified automatically, the instructions may cause the processor to retrieve one or more solutions corresponding to the error from a repository associated with the laboratory instrument. In a further embodiment, a ranked list of the one or more solutions may be created. In a further embodiment, the instructions may cause the processor to implement the one or more solutions retrieved, based on the ranked list, to rectify the error in the laboratory instrument without any manual intervention, until the error is rectified.

In some embodiments, the one or more events recorded in the event log may be specific to the laboratory instrument. In some other embodiments, the one or more errors may be classified into automatically rectifiable and automatically not rectifiable categories. In some other embodiment, the one or more errors that are not automatically rectifiable may require interference of a Field Service Engineer (FSE) to rectify the one or more errors.

In some embodiment, a user of the laboratory instrument may detect the one or more errors from the event log and select an error from the one or more errors in the event log. In an example embodiment, a user of the laboratory instrument may include, but not be limited to, a laboratory technician. In some other embodiments, upon selecting the error from the event log, the system may determine a classification associated with the error i.e. the system may determine whether the error is automatically rectifiable or not.

In some embodiments, if the error is determined to be automatically rectifiable (hereinafter also referred to as positive determination), the system may retrieve one or more solutions corresponding to the error from a repository associated with the laboratory instrument. In some other embodiments, the system may retrieve the one or more solutions from the repository based on an event Identifier (ID) of the one or more events. In some other embodiments, upon retrieving the one or more solutions, the laboratory instrument may organize or create the one or more solutions as a ranked list.

In some embodiments, a ranked list of one or more solutions may be based on priority of the one or more solutions relative to an error. In some other embodiments, a system may identify one or more optimal solutions from one or more solutions and arrange the one or more optimal solutions based on priority. In some other embodiments, priority of one or more solutions or one or more optimal solutions may be determined by a system automatically based on error rectification history of one or more errors or based on one or more errors that may have occurred before and after a currently selected error.

In some embodiments, priority of one or more solutions or one or more optimal solutions may be manually selected by a user. In some other embodiments, a system may implement one or more solutions retrieved, based on a ranked list sequentially, to rectify an error in a laboratory instrument without any manual intervention, until the error may be completely rectified. In some other embodiments, upon rectification of an error, a system may display a notification indicating a message, for example, "Error Rectified".

In some embodiments, a scenario where an error selected by a system may be determined to be not automatically rectifiable (also referred as negative determination), the system may display a notification indicating a message. In an example embodiment such a message may include "Error identified (Error Number) is not automatically rectifiable. Contact FSE". In some other embodiments, upon displaying a notification, the system may receive

another selection of a user from one or more errors. In some other embodiments, one or more errors may be automatically selected by a system one after the other, without any manual interference.

In some embodiments, the present disclosure provides a feature wherein one or more errors occurring in laboratory instruments, for example, " Beckman Coulter® Access 2", " Beckman Coulter® DxI" and the like, may be automatically fixed without any manual interference. In some other embodiments, in a startup scenarios of a server/console where an event log may not be accessed or scenarios where a display of the server/console may be damaged, the present disclosure provides a feature wherein, the system automatically rectifies one or more errors without waiting for any user inputs. In some other embodiments, when a console/server is in active condition, the system indicates one or more errors that may have been rectified in the meantime and status of the one or more errors. In some other embodiments, the present disclosure may help in reducing frequent visits of a Field Service Engineer (FSE) for rectifying the one or more errors, thereby reducing high cost involved in rectifying the one or more errors. In certain other embodiments, the present disclosure may help in reducing a total turnaround time involved in rectifying one or more errors and also may reduce a total downtime of the laboratory instrument. In some other embodiments, the present disclosure may provide a feature wherein the system may be integrated with any laboratory instrument by configuring one or more solutions specific to the laboratory instrument. In some other embodiments, the present disclosure may provide a feature wherein the system may rectify one or more errors in the laboratory instrument from a remote location.

Reference is now made to **FIG.1**, which illustrates an exemplary architecture for managing one or more errors in a laboratory instrument in accordance with some embodiments of the present disclosure.

Architecture **100** includes user **101**, laboratory instrument **103**, server **105**, error managing system **107** (also referred as system **107**) and repository **108**. Laboratory instrument **103** is associated with server **105** via a communication network (not shown in the **FIG.1**). Further, system **107** is configured in server **105**. Server **105** may be a local server or a remote server. Further, laboratory instrument **103** is associated with repository **108**, comprising one or more solutions related to one or more errors occurring in laboratory instrument **103**.

System **107** includes processor **109**, Input/Output (I/O) interface **111** and memory **113**. I/O interface **111** is configured to display an event log that includes one or more events associated with laboratory instrument **103**. Further, the event log dynamically records one or more errors occurring in laboratory instrument **103**. In some embodiments, processor **109** receives one or more messages from laboratory instrument **103** dynamically. The one or more messages indicate occurrence of one or more errors in laboratory instrument **103**. Therefore, the event log dynamically records the one or more errors based on the one or more messages received from laboratory instrument **103**. Further, processor **109** detects and selects an error from the one or more errors recorded in the event log.

Upon positive determination, i.e. if an error is determined to be automatically rectifiable, processor **109** retrieves one or more solutions corresponding to the error from repository **108**. Further, processor **109** ranks the one or more solutions into a ranked list based on priority of the one or more solutions. Furthermore, processor **109** implements the one or more solutions retrieved, based on the ranked list, to rectify the error in laboratory instrument **103** without any manual intervention. Upon rectification of the error, the system displays a notification indicating a message, for example, "Error Rectified". Upon negative determination, i.e. if the error is determined to be not automatically rectifiable, I/O interface **111** displays a notification indicating a message, for example, "Error is not automatically rectifiable. Contact FSE". Upon displaying the notification, processor **109** proceeds to detect another error from the one or more errors.

In an example embodiment, laboratory instrument **103** may be "Beckman Coulter® Access 2", "Beckman Coulter® DxI" and the like. In another example embodiment, server **105** may be a console such as a computer, a laptop, a desktop and the like. In some embodiments, the communication network may be at least one of, a wired communication network and a wireless communication network or a combination thereof.

In some embodiments, repository **108** may be external to server **105**. In an alternate embodiment, repository **108** may be configured in server **105**. In some other embodiments, server **105** and repository **108** may be configured within laboratory instrument **103**. In some embodiments, processor **109** may detect and select the error automatically based on one or more predefined settings. In an example embodiment, one or more predefined setting may include time stamp basis, sequential order of error occurrence, random order and the like. In an alternate embodiment, processor **109** may receive a user input for detecting and

selecting the error. In some embodiments, user **101** may provide a user input, and the user may not be limited to, a laboratory technician. In a further embodiment, processor **109** may determine whether the error is automatically rectifiable. In some embodiments, processor **109** may identify one or more optimal solutions from the one or more solutions and arrange the one or more optimal solutions in a ranked list based on priority. In some embodiments, processor **109** may sequentially implement one or more solutions or one or more optimal solutions, until the identified error is rectified.

Reference is now made to **FIG.2**, which illustrates an exemplary block diagram of a system for managing one or more errors in a laboratory instrument in accordance with some embodiments of the present disclosure.

In some implementations, system **107** may include data **203** and modules **205**. As an example, data **203** is stored in memory **113** configured in system **107** as shown in the **FIG.2**. Data **203** may include classification data **211**, solution data **213**, error rectification history **215**, ranked list **217**, notification data **219**, and other data **223**. In the illustrated **FIG.2**, module **205** are described herein in detail.

Data **203** may be stored in memory **113** in form of various data structures. Additionally, data **203** may be organized using data models, such as relational or hierarchical data models. Other data **223** may store data, including temporary data and temporary files, generated by modules **205** for performing the various functions of system **107**.

Data **203** stored in memory **113** may be processed by modules **205** of system **107**. Modules **205** may be stored within memory **113**. In an example, modules **205** is communicatively coupled to processor **109** configured in system **107**, and may also be present outside memory **113** as shown in **FIG.2** and implemented as hardware. As used herein, the term modules may refer to an application specific integrated circuit (ASIC), an electronic circuit, a processor (shared, dedicated, or group) and memory that execute one or more software or firmware programs, a combinational logic circuit, and/or other suitable components that provide the described functionality.

Modules **205** may include, for example, error detecting module **231**, determining module **233**, retrieving module **235**, prioritizing module **237**, solution implementing module **239**, notification module **241** and other modules **245**. Other modules **245** may be used to perform various miscellaneous functionalities of system **107**. It will be appreciated that

such aforementioned modules **205** may be represented as a single module or a combination of different modules.

Error detecting module **231** detects and selects an error from one or more errors recorded in an event log. The event log includes one or more events associated with laboratory instrument **103**. Error detecting module **231** detects and selects an error automatically based on one or more predefined settings, for example, time stamp basis, sequential order of error occurrence, random order and the like. Alternatively, error detecting module **231** may receive a user input based on which error detecting module **231** may detect and select the error. In some embodiments, the one or more errors may be indicated using one or more indications in an event log such as an exclamatory mark, a cross mark, a colored background and the like. In some embodiments, different colors may be used to indicate different classifications of the one or more errors in the event log.

Further, determining module **233** determines whether the error is automatically rectifiable. In some embodiments, the one or more errors may be classified into automatically rectifiable and automatically not rectifiable. In some other embodiments, the one or more errors that are not automatically rectifiable may require manual interference such as interference of a Field Service Engineer (FSE) to rectify the one or more errors. Determining module **233** compares the selected error with a predefined list of one or more errors. The predefined list of one or more errors may be stored as classification data **211**. Based on the comparison, determining module **233** determines the classification of the error.

In some embodiments, retrieving module **235** retrieves one or more solutions from a repository **108** associated with laboratory instrument **103**. Upon positive determination i.e. when an error is determined to be automatically rectifiable, retrieving module **235** maps an event Identifier (ID) corresponding to the error with an event ID corresponding to the one or more solutions in repository **108**. Based on the mapping, retrieving module **235** retrieves the one or more solutions corresponding to the event ID. The one or more solutions thus retrieved from repository **108** may be stored as solution data **213**. Further, retrieving module **235** identifies and retrieves one or more optimal solutions from the one or more solutions. In some embodiments, one or more optimal solutions may be the solutions that are best suited for rectifying the error. In some other embodiments, the one

or more optimal solutions may be identified based on error rectification history **215** of the one or more errors.

In some embodiments, prioritizing module **237** ranks the one or more solutions or the one or more optimal solutions based on priority. Prioritizing module **237** determines the priority of the one or more solutions or the one or more optimal solutions, automatically, based on error rectification history **215**. Alternatively, prioritizing module **237** may determine the priority based on the one or more errors that may have occurred before and after the currently selected error. Prioritizing module **237** may receive a priority as a user input i.e. the priority may be manually selected by user **101**. Upon determining the priority, prioritizing module **237** creates ranked list **217**.

Solution implementing module **239** implements the one or more solutions and the one or more optimal solutions based on the ranked list, sequentially. Solution implementing module **239** implements the one or more solutions or the one or more optimal solutions, without any manual intervention, until the error is rectified. In some embodiments, when the error is rectified, remaining of the one or more solutions or the one or more optimal solutions may not be implemented.

Notification module **241** displays a notification indicating rectification status. As an example, notification module **241** may display a message such as "Error rectified", upon rectifying the error. Further, when the error is determined to be not automatically rectifiable, notification module **241** displays a notification indicating a message, for example, "Error cannot be automatically rectifiable. Contact FSE". The messages may be pre-stored in system **107** as notification data **219**. Upon displaying the notification, the error detecting module **231** detects and selects another error from the one or more errors recorded in the event log.

Server **105** comprising system **107** is inactive and user **101** is not be able to view the event log due to scenarios such as start-up delay, broken display and the like, system **107** may automatically select the one or more errors for rectification and perform the method as explained above to rectify the one or more errors. Further, when server **105** is in active mode, system **107** may notify user **101** about error status of the one or more errors that were selected for rectification when server **105** was inactive.

Henceforth, the process of managing the one or more errors in the laboratory instrument is explained with the help of one or more examples for better understanding of the present disclosure. However, the one or more examples should not be considered as limitation of the present disclosure.

Consider an exemplary event log as shown in the below **Table 1**.

TYPE	DATE AND TIME	EVENT
✖	19/01/2018 1:30PM	Motion error
✖	19/01/2018 1:35PM	RV cleanout error
ⓘ	19/01/2018 1:37PM	Database size management service completed
ⓘ	19/01/2018 1:45PM	Databased size management service activated
✖	19/01/2018 1:49PM	Communication error
ⓘ	19/01/2018 1:55PM	Console inactivation

Table 1

Consider system **107** detects and selects "RV cleanout error" as a first error to be processed for rectification. Consider that the event ID associated with the event of "RV cleanout error" is "13253". System **107** may determine if the selected error "RV cleanout error" is automatically rectifiable. If system **107** obtains a positive determination, system **107** may identify and retrieve one or more solutions associated with the event ID "13253". System **107** determines that the error is automatically rectifiable, and system **107** may enable an autofix icon as an indicator that the error is being fixed. Further, system **107** may receive a user input through the autofix icon for running autocorrect method before retrieving one or more solutions from repository **108.**

Consider that 10 solutions associated with the event ID "13253" are retrieved from repository **108**. System **107** may analyze error rectification history **215** to check if previously "RV cleanout error" was rectified. If the "RV cleanout error" was rectified

previously, system **107** may identify the one or more solutions that were implemented for rectifying the error. Based on error rectification history **215**, system **107** may choose 4 optimal solutions among the 10 solutions and may prioritize the 4 optimal solutions based on user input. Therefore, system **107** may generate the ranked list comprising the 4 optimal solutions arranged based on the priority. An exemplary ranked list of the optimal solutions is as shown below:

Solution 5

Solution 3

Solution 1

Solution 9

System **107** may implement the 4 optimal solutions sequentially, based on the ranked list, until the error is rectified. When the error is rectified, system **107** may display a notification indicating "Error rectified". Alternatively, if the error is not rectified upon implementing all the 4 optimal solutions, system **107** may display a notification indicating "Error not rectified. Would you like to implement remaining solutions?" Upon receiving an input from user **101** to continue the process of rectifying the identified error, system **107** may implement the remaining of one or more solutions and accordingly notify user **101** regarding the error status.

Further, consider a scenario where system **107** obtains a negative determination. System **107** may display a notification indicating "Error cannot be automatically rectified. Contact a field service engineer". Further, system **107** may proceed and select a next error "communication error" for processing.

Reference is now made to **FIG.3**, which illustrates a flowchart of a method of managing one or more errors in a laboratory instrument in accordance with some embodiments of the present disclosure.

As illustrated in **FIG.3**, method **300** includes one or more blocks illustrating a method of managing one or more errors in laboratory instrument **103**. Method **300** may be described in the general context of computer executable instructions. Generally, computer executable instructions can include routines, programs, objects, components, data

structures, procedures, modules, and functions, which perform functions or implement abstract data types.

The order in which method **300** is described is not intended to be construed as a limitation, and any number of the described method blocks can be combined in any order to implement method **300**. Additionally, individual blocks may be deleted from the methods without departing from the spirit and scope of the subject matter described herein. Furthermore, the method **300** can be implemented in any suitable hardware, software, firmware, or combination thereof.

At **block 301**, method **300** may include detecting, by processor of a system , one or more errors occurring in laboratory instrument, from an event log. In some embodiments, the event log may include one or more events associated with laboratory instrument . At **block 302**, processor may check if the one or more errors are detected in the event log. If the one or more errors are detected in the event log, processor may proceed to **block 303** via "Yes". If the one or more errors are not detected in the event log, processor may proceed to **block 313** via "No". At **block 313**, processor may terminate method **300**.

At **block 303**, method **300** may include selecting, by processor , an error from the one or more errors. Processor may select the error based on a user input received from user operating laboratory instrument . Processor may automatically select the error based on one or more predefined settings, for example, time stamp basis, sequential order of error occurrence, random order and the like.

At **block 305**, method **300** may include determining, by processor, whether the error is automatically rectifiable. If method **300** results in a positive determination, processor may proceed to **block 307** via "Yes". If method **300** results in a negative determination, processor proceeds to **block 311** via "No". At **block 311**, processor may display a notification indicating a message such as "The error cannot be automatically rectified. Contact a field service engineer". Upon displaying the notification, processor may proceed to **block 313** to terminate method **300**.

At **block 307**, method **300** may include, retrieving, by processor, one or more solutions corresponding to the error from repository associated with laboratory instrument. In some embodiments, one or more solutions may be retrieved based on an event Identifier (ID) of one or more events. In some other embodiments, processor may identify and retrieve one

or more optimal solutions from one or more solutions. In some other embodiments, one or more optimal solutions may be solutions that are best suited for rectifying an identified error. In some other embodiments, processor may prioritize one or more solutions or one or more optimal solutions. In some other embodiments, processor may generate a ranked list including one or more solutions or one or more optimal solutions arranged based on the priority.

At **block 309**, method **300** may include, implementing, by processor, the one or more solutions or the one or more optimal solutions, based on the ranked list, to rectify the error in laboratory instrument without any manual intervention, until the error is rectified. In some embodiments, upon rectification of the error, processor may display a notification indicating a message such as "Error rectified".

Reference is now made to **FIG.4**, which illustrates an exemplary block diagram of a computer system for implementing embodiments consistent with the present disclosure. **FIG.4** illustrates a block diagram of exemplary computer system **400** for implementing embodiments consistent with the present disclosure. In an embodiment, the computer system **400** can be system **107** that is used for managing one or more errors in a laboratory instrument **103**. Computer system **400** may be interfaced with a laboratory information system (LIS) or a hospital information system (HIS) and/or a repository which may be part of the LIS/HIS or may be separate.

Computer system **400** may include central processing unit ("CPU" or "processor") **402**. Processor **402** may include at least one data processor for executing program components for executing user or system-generated business processes. A user may include a person, a person using a device such as such as those included in this invention, or such a device itself. Processor **402** may include specialized processing units such as integrated system (bus) controllers, memory management control units, floating point units, graphics processing units, digital signal processing units, etc.

Processor **402** may be disposed in communication with one or more input/output (I/O) devices (**411** and **412**) via I/O interface **401**. I/O interface **401** may employ communication protocols/methods such as, without limitation, audio, analog, digital, stereo, IEEE-1394, serial bus, Universal Serial Bus (USB), infrared, PS/2, BNC, coaxial, component, composite, Digital Visual Interface (DVI), high-definition multimedia interface (HDMI),

Radio Frequency (RF) antennas, S-Video, Video Graphics Array (VGA), IEEE 802.n /b/g/n/x, Bluetooth, cellular (e.g., Code-Division Multiple Access (CDMA), High-Speed Packet Access (HSPA+), Global System For Mobile Communications (GSM), Long-Term Evolution (LTE), WiMax, or the like), etc.

Using I/O interface **401**, computer system **400** may communicate with one or more input devices **411** and output devices **412**. For example, input device **411** may be an antenna, keyboard, mouse, joystick, (infrared) remote control, camera, card reader, fax machine, dongle, biometric reader, microphone, touch screen, touchpad, trackball, stylus, scanner, storage device, transceiver, video device/source, etc. Output device **412** may be a printer, fax machine, video display (e.g., cathode ray tube (CRT), liquid crystal display (LCD), light-emitting diode (LED), plasma, Plasma display panel (PDP), Organic light-emitting diode display (OLED) or the like), audio speaker, etc.

Processor **402** may be disposed in communication with communication network **409** via network interface **403**. Network interface **403** may communicate with communication network **409**. Network interface **403** may employ connection protocols including, without limitation, direct connect, Ethernet (e.g., twisted pair 10/100/1000 Base T), Transmission Control Protocol/Internet Protocol (TCP/IP), token ring, IEEE 802.11a/b/g/n/x, etc. Using network interface **403** and communication network **409**, computer system **400** may communicate with repository **410a** and server **410b**. Communication network **409** can be implemented as one of the different types of networks, such as intranet or Local Area Network (LAN) and such within the organization. Communication network **409** may either be a dedicated network or a shared network, which represents an association of the different types of networks that use a variety of protocols, for example, Hypertext Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol (TCP/IP), Wireless Application Protocol (WAP), etc., to communicate with each other. Further, communication network **409** may include a variety of network devices, including routers, bridges, servers, computing devices, storage devices, etc. Server **410b** may include, but not limited to, a computer, a laptop, a desktop and a tablet. In some embodiments, processor **402** may be disposed in communication with memory **405** (e.g., RAM, ROM, etc. not shown in **FIG.4**) via storage interface **404**. Storage interface **404** may connect to memory **405** including, without limitation, memory drives, removable disc drives, etc., employing connection protocols such as Serial Advanced Technology Attachment (SATA), Integrated Drive

Electronics (IDE), IEEE-1394, Universal Serial Bus (USB), fibre channel, Small Computer Systems Interface (SCSI), etc. The memory drives may further include a drum, magnetic disc drive, magneto-optical drive, optical drive, Redundant Array of Independent Discs (RAID), solid-state memory devices, solid-state drives, etc.

Memory **405** may store a collection of program or database components, including, without limitation, user interface **406**, operating system **407**, web browser **408** etc. In some embodiments, computer system **400** may store user/application data, such as the data, variables, records, etc. as described in this invention. Such databases may be implemented as fault-tolerant, relational, scalable, secure databases such as Oracle ® or Sybase®.

Operating system **407** may facilitate resource management and operation of computer system **400**. Examples of operating systems include, without limitation, APPLE® MACINTOSH® OS X®, UNIX®, UNIX-like system distributions (E.G., BERKELEY SOFTWARE DISTRIBUTION® (BSD), FREEBSD®, NETBSD®, OPENBSD, etc.), LINUX® DISTRIBUTIONS (E.G., RED HAT®, UBUNTU®, KUBUNTU®, etc.), IBM®OS/2®, MICROSOFT® WINDOWS® (XP®, VISTA®/7/8, 10 etc.), APPLE® IOS®, GOOGLE™ ANDROID™, BLACKBERRY® OS, or the like. User interface **406** may facilitate display, execution, interaction, manipulation, or operation of program components through textual or graphical facilities. For example, user interfaces may provide computer interaction interface elements on a display system operatively connected to computer system **400**, such as cursors, icons, check boxes, menus, scrollers, windows, widgets, etc. Graphical User Interfaces (GUIs) may be employed, including, without limitation, Apple® Macintosh® operating systems' Aqua®, IBM® OS/2®, Microsoft® Windows® (e.g., Aero, Metro, etc.), web interface libraries (e.g., ActiveX®, Java®, Javascript®, AJAX, HTML, Adobe® Flash®, etc.), or the like.

Computer system **400** may implement web browser **408** stored program components. Web browser **408** may be a hypertext viewing application, such as MICROSOFT® INTERNET EXPLORER®, GOOGLE™ CHROME™, MOZILLA® FIREFOX®, APPLE® SAFARI®, etc. Secure web browsing may be provided using Secure Hypertext Transport Protocol (HTTPS), Secure Sockets Layer (SSL), Transport Layer Security (TLS), etc. Web browsers **408** may utilize facilities such as AJAX, DHTML, ADOBE® FLASH®, JAVASCRIPT®, JAVA®, Application Programming Interfaces (APIs), etc. Computer system **400** may implement a mail server stored program component. The mail server may be an Internet

mail server such as Microsoft Exchange, or the like. The mail server may utilize facilities such as ASP, ACTIVEX®, ANSI® C++/C#, MICROSOFT®, .NET, CGI SCRIPTS, JAVA®, JAVASCRIPT®, PERL®, PHP, PYTHON®, WEBOBJECTS®, etc. The mail server may utilize communication protocols such as Internet Message Access Protocol (IMAP), Messaging Application Programming Interface (MAPI), MICROSOFT® exchange, Post Office Protocol (POP), Simple Mail Transfer Protocol (SMTP), or the like. In some embodiments, the computer system **400** may implement a mail client stored program component. The mail client may be a mail viewing application, such as APPLE® MAIL, MICROSOFT® ENTOURAGE®, MICROSOFT® OUTLOOK®, MOZILLA® THUNDERBIRD®, etc.

Furthermore, one or more computer-readable storage media may be utilized in implementing embodiments consistent with the present disclosure. A computer-readable storage medium refers to any type of physical memory on which information or data readable by a processor may be stored. Thus, a computer-readable storage medium may store instructions for execution by one or more processors, including instructions for causing the processor(s) to perform steps or stages consistent with the embodiments described herein. The term “computer-readable medium” should be understood to include tangible items and exclude carrier waves and transient signals, i.e., non-transitory. Examples include Random Access Memory (RAM), Read-Only Memory (ROM), volatile memory, non-volatile memory, hard drives, Compact Disc (CD) ROMs, Digital Video Disc (DVDs), flash drives, disks, and any other known physical storage media.

In an embodiment, the present disclosure provides a method and a system for managing one or more errors in a laboratory instrument. In a further embodiment, the present disclosure provides a feature wherein the one or more errors occurring in laboratory instruments, for example, " Beckman Coulter® Access 2", "Beckman Coulter® DxI" and the like, can be automatically fixed without any manual interference. In a further embodiment, in a startup scenario of a server/console where an event log cannot be accessed or scenarios where a display is damaged, the present disclosure provides a feature wherein, a system automatically rectifies the one or more errors without waiting for user inputs. In a further embodiment, when a console/server is in active condition, a system may indicate one or more errors that may have been rectified in the meantime and status of the one or more errors.

In a further embodiment, the present disclosure facilitates in reducing high expenses involved in rectifying the one or more errors. In a further embodiment, the present disclosure facilitates in reducing a total turnaround time involved in rectifying one or more errors and also may reduce a total downtime of a laboratory instrument. In a further embodiment, the present disclosure provides a feature wherein a system may be integrated with any laboratory instrument by configuring one or more solutions specific to the laboratory instrument. In a further embodiment, the present disclosure provides a feature wherein a system may rectify one or more errors in the laboratory instrument from a remote location.

As described herein a description of an embodiment with several components in communication with each other does not imply that all such components are required. On the contrary a variety of optional components are described to illustrate the wide variety of possible embodiments of the invention.

When a single device or article is described herein, it will be apparent that more than one device/article (whether or not they cooperate) may be used in place of a single device/article. Similarly, where more than one device or article is described herein (whether or not they cooperate), it will be apparent that a single device/article may be used in place of the more than one device or article or a different number of devices/articles may be used instead of the shown number of devices or programs. The functionality and/or the features of a device may be alternatively embodied by one or more other devices which are not explicitly described as having such functionality/features. Thus, other embodiments of the disclosure need not include the device itself.

The specification describes a method and a system for managing one or more errors in a laboratory instrument. The illustrated steps are set out to explain exemplary embodiments shown, and it should be anticipated that on-going technological development will change the manner in which particular functions are performed. These examples are presented herein for purposes of illustration, and not as a limitation. Further, the boundaries of the functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternative boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed. Alternatives (including equivalents, extensions, variations, deviations, etc., of those described herein) will be apparent to

persons skilled in the relevant art(s) based on the teachings contained herein. Such alternatives fall within the scope and spirit of the disclosed embodiments.

Finally, the language used in the specification has been principally selected for readability and instructional purposes, and it may not have been selected to delineate or circumscribe the inventive subject matter. It is therefore intended that the scope of the invention be limited not by this detailed description, but rather by any claims that issue on an application based here on. Accordingly, the embodiments of the present disclosure are intended to be illustrative, but not limiting, of the scope of the disclosure, which is set forth in the following claims.

Claims:

1. A method of managing an error in a laboratory instrument (103), the method comprising:

detecting an error occurring in a laboratory instrument (103), from an event log, wherein the event log comprises one or more events associated with the laboratory instrument (103);

determining whether the detected error is rectifiable;

upon positive determination, retrieving one or more solutions corresponding to the error from a repository (108) associated with the laboratory instrument (103) and creating a ranked list (217) of the one or more solutions; and

implementing the one or more solutions retrieved, based on the ranked list (217), to rectify the detected error in the laboratory instrument (103) without any manual intervention, until the error is rectified.

2. The method as claimed in claim 1, further comprises displaying a notification indicating a rectification status of the error upon rectification of the error.

3. The method as claimed in claim 1, further comprises identifying one or more optimal solutions from the one or more solutions, wherein the one or more optimal solutions are arranged based on priority for sequential implementation.

4. The method as claimed in claim 1, wherein the one or more solutions are retrieved from the repository (108) based on an event Identifier (ID) of the one or more events.

5. The method as claimed in claim 1, further comprises determining whether the error is automatically rectifiable, and on negative determination, receiving a user (101) selection for rectification of the error.

6. A laboratory instrument (103) configured to perform the method as claimed in any of the preceding claims 1 to 5.

7. A system (107) for managing an error in a laboratory instrument (103), the system (107) comprising:

a processor (109); and

a memory (113) communicatively coupled to the processor (109), wherein the memory (113) stores the processor-executable instructions, which, on execution, causes the processor (109) to:

detect an error occurring in a laboratory instrument (103), from an event log, wherein the event log comprises one or more events associated with the laboratory instrument (103);

determine whether the detected error is rectifiable;

upon positive determination, retrieve one or more solutions corresponding to the error from a repository (108) associated with the laboratory instrument (103) and creating a ranked list (217) of the one or more solutions; and

implement the one or more solutions retrieved, based on the ranked list (217), to rectify the detected error in the laboratory instrument (103) without any manual intervention, until the error is rectified.

8. The system (107) as claimed in claim 7, wherein the processor (109) is further configured to display a notification indicating a rectification status of the error upon rectification of the error.

9. The system (107) as claimed in claim 7, wherein the processor (109) is further configured to identify one or more optimal solutions from the one or more solutions, wherein the one or more optimal solutions are arranged based on priority for sequential implementation.

10. The system (107) as claimed in claim 7, wherein the processor (109) determines whether the error is automatically rectifiable, and on negative determination, the processor (109) receives a user (101) selection for rectification of the error.

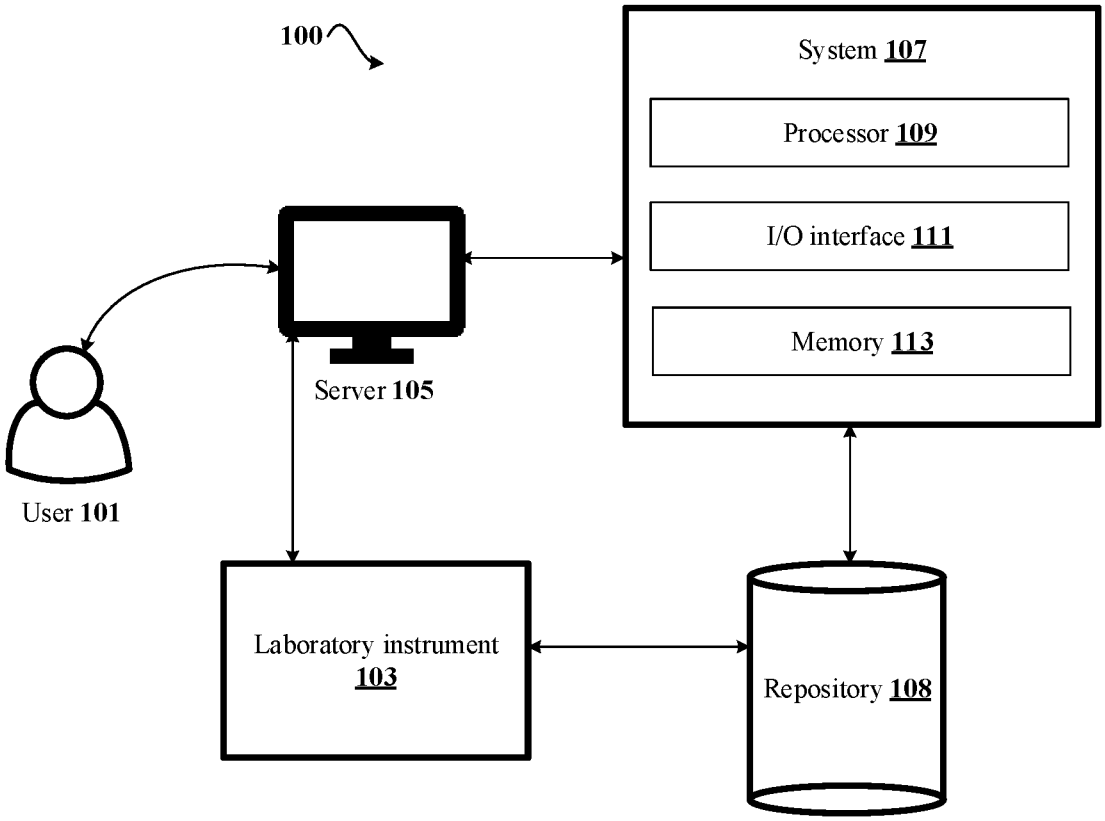
100
System 107
Processor 109
I/O interface 111
Memory 113
Server 105
User 101
Laboratory instrument 103
Repository 108

FIG.1

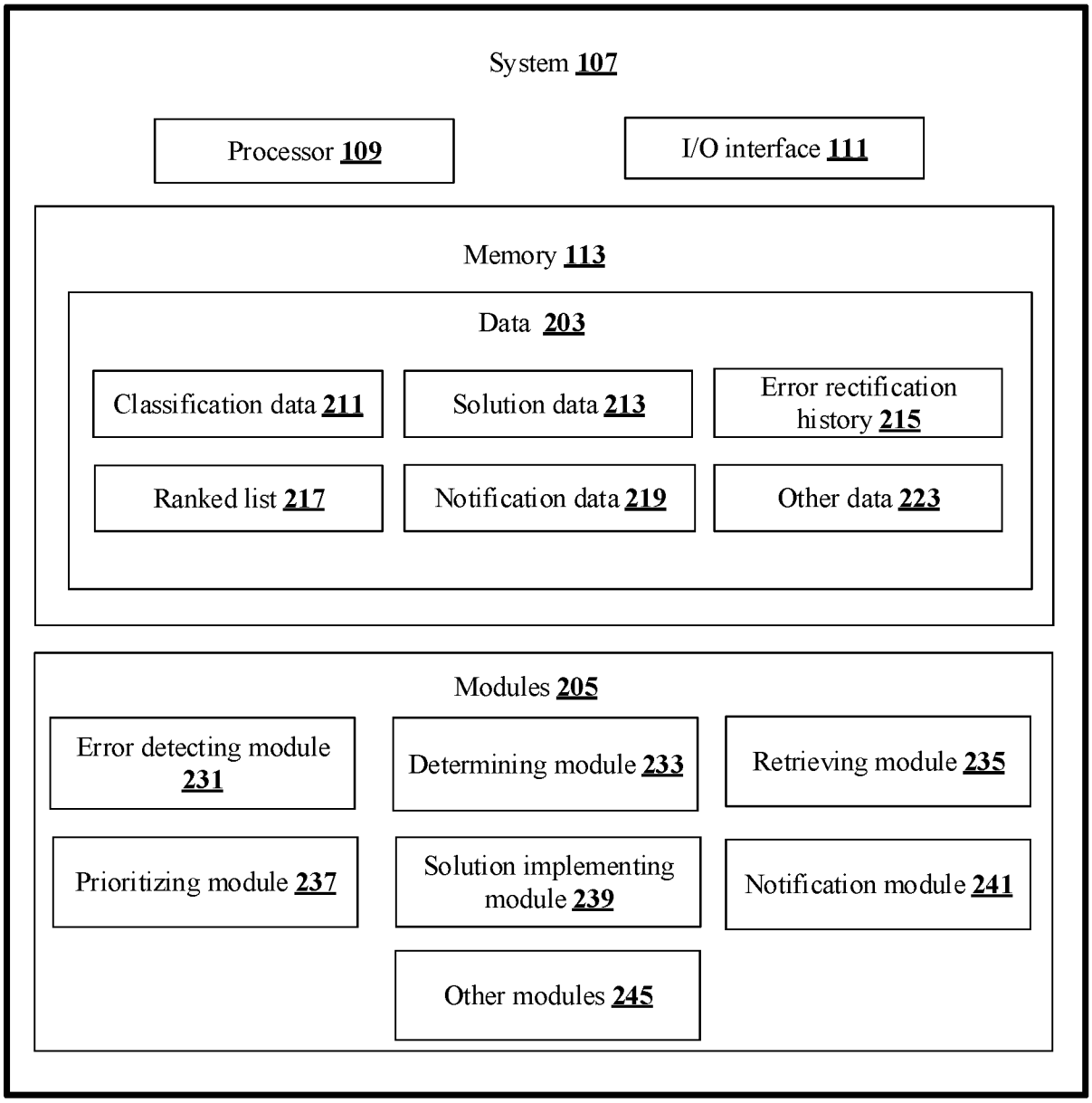
System 107
Processor 109
I/O interface 111
Memory 113
Data 203
Classification data 211
Solution data 213
Error rectification history 215
Ranked list 217
Notification data 219
Other data 223
Modules 205
Error detecting module 231
Determining module 233
Retrieving module 235
Prioritizing module 237
Solution implementing module 239
Notification module 241
Other modules 245

FIG.2

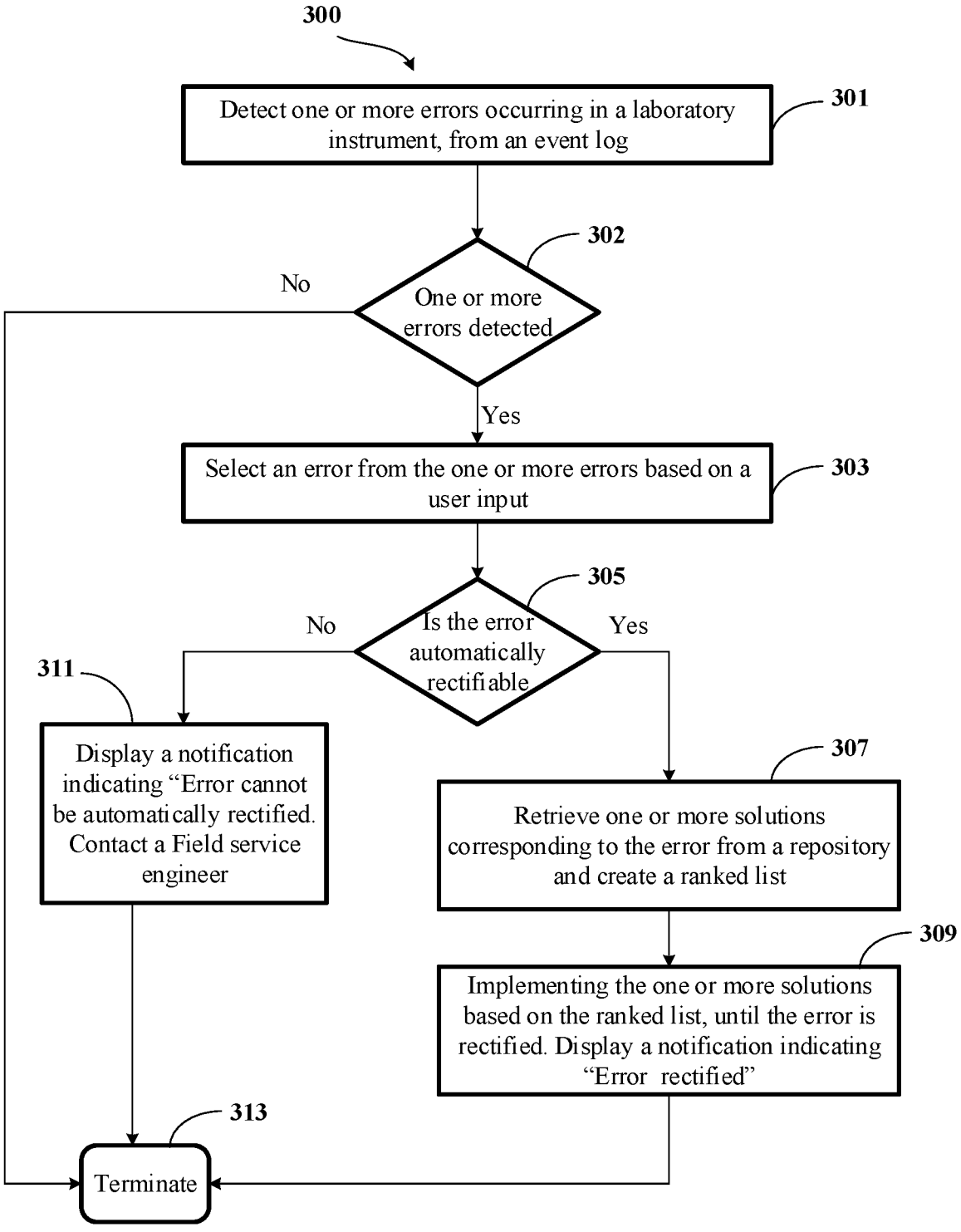
300
Detect one or more errors occurring in a laboratory instrument, from an event log
301
302
One or more errors detected
No
Yes
Select an error from the one or more errors based on a user input
303
305
Is the error automatically rectifiable
No
Yes
311
Display a notification indicating "Error cannot be automatically rectified. Contact a Field service engineer
307
Retrieve one or more solutions corresponding to the error from a repository and create a ranked list
309
Implementing the one or more solutions based on the ranked list, until the error is rectified. Display a notification indicating "Error rectified"
313
Terminate

FIG.3

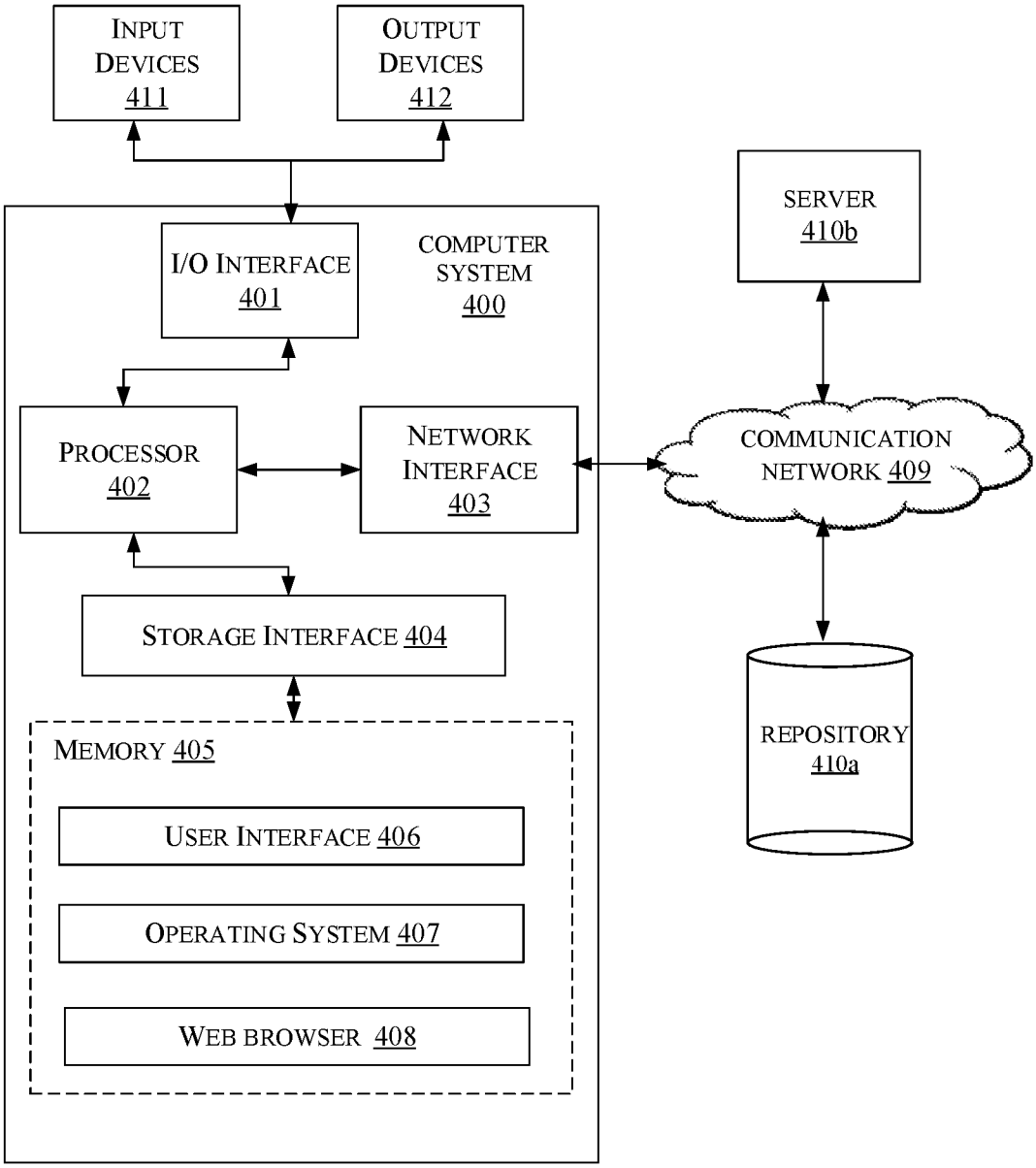
INPUT DEVICES 411
OUTPUT DEVICES 412
SERVER 410b
I/O INTERFACE 401
COMPUTER SYSTEM 400
PROCESSOR 402
NETWORK INTERFACE 403
COMMUNICATION NETWORK 409
STORAGE INTERFACE 404
REPOSITORY 410a
MEMORY 405
USER INTERFACE 406
OPERATING SYSTEM 407
WEB BROWSER 408

FIG.4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/051118

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F11/07
ADD.

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)
G06F

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 9 069 737 B1 (KIMOTHO LABAN MWANGI [ZA] ET AL) 30 June 2015 (2015-06-30)	1-10
Y	abstract; figures 7, 9 column 1, line 66 - line 67 column 3, line 55 - line 59 column 4, line 14 - line 21 column 5, line 5 - line 24 column 12, line 30 - line 32 column 13, line 27 - line 41 column 15, line 63 - line 65 column 16, line 7 - line 18	1-10
Y	US 2017/060717 A1 (NANJUNDAIAH DATTAGURU BASAVAPATNA [IN] ET AL) 2 March 2017 (2017-03-02) figure 3 paragraph [0019] paragraph [0032] paragraph [0041]	1-10

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

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"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
10 May 2019	23/05/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Iannuzzi, Silvia

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2019/051118

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 9069737 B1	30-06-2015	NONE	
US 2017060717 A1	02-03-2017	NONE	