



(51) International Patent Classification:

A61B 6/03 (2006.01)

(21) International Application Number:

PCT/CN2022/131481

(22) International Filing Date:

11 November 2022 (11.11.2022)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

202111335122.2 11 November 2021 (11.11.2021) CN

202221824546.5 15 July 2022 (15.07.2022) CN

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE,

KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: SYSTEMS AND METHODS FOR PROMPTING

1400

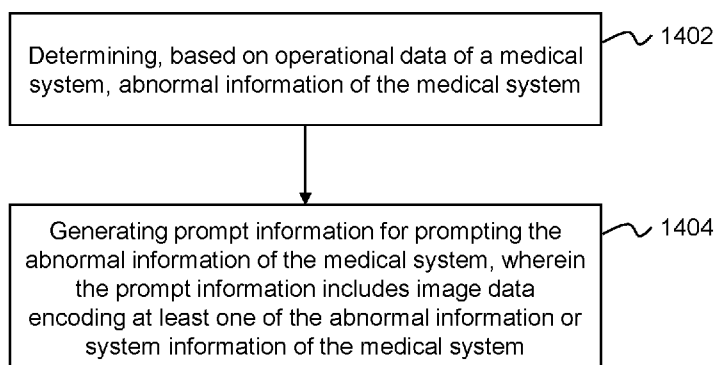


FIG. 14

(57) Abstract: Methods and systems for prompting abnormal conditions of medical systems are provided. The methods may include determining, based on operational data of a medical system, abnormal information of the medical system(1402); and generating prompt information for prompting the abnormal information of the medical system, wherein the prompt information includes image data encoding at least one of the abnormal information or system information of the medical system(1404).



SYSTEMS AND METHODS FOR PROMPTING**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] This application claims priority to Chinese Patent Application No. 202111335122.2, filed on November 11, 2021, and Chinese Patent Application No. 202221824546.5, filed on July 15, 2022, the contents of each of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure generally relates to information prompting, and more particularly, relates to systems and methods for prompting abnormal conditions of medical systems.

BACKGROUND

[0003] A medical system always includes a high technology content and a complex structure. Therefore, when the medical system includes an abnormal condition, a user cannot solve the abnormal condition. At this point, the user needs to contact a service engineer responsible for the medical system. However, since the service engineer needs to maintain a large area of medical systems, the service engineer is often not on site where the abnormal condition of the medical system occurs. In addition, different abnormal conditions of the medical system may require the service engineer to carry different repair equipment. Therefore, if the service engineer can obtain abnormal information of the medical system in advance, the service engineer can rush to the scene with the corresponding repair equipment. Alternatively, the service engineer can remotely control or instruct the user to solve the abnormal condition.

[0004] Therefore, it is desirable to provide systems and methods for prompting the abnormal condition of the medical system, which can efficiently and accurately provide prompt information for prompting the abnormal information of the medical system.

SUMMARY

[0005] In one aspect of the present disclosure, a method for prompting an abnormal condition of a medical system is provided. The method may be implemented on a computing device having at least one processor and at least one storage device. The method may include determining, based on operational data of the medical system, abnormal information of the medical system; and

generating prompt information for prompting the abnormal information of the medical system. The prompt information may include image data encoding at least one of the abnormal information or system information of the medical system.

[0006] In some embodiments, the medical system may include a rod source phantom irrigation system including a source liquid production module, a conveying module, a rod source module, and a control module. The rod source module may include a rod source phantom. The source liquid production module may be connected to the conveying module. The source liquid production module may be configured to generate, based on a first instruction sent by the control module, a mixed solution by mixing an injected radioactive source and a solvent with a preset ratio. The conveying module may be connected to the rod source phantom in the rod source module. The conveying module may be configured to transmit, based on a second instruction sent by the control module, the mixed solution from the source liquid production module to the rod source phantom in the rod source module. The control module may be in communication with the source liquid production module and the conveying module, respectively. The control module may be configured to control the source liquid production module to generate the mixed solution and the conveying module to transmit the mixed solution.

[0007] In another aspect of the present disclosure, a system for prompting an abnormal condition of a medical system is provided. The system may include at least one storage device including a set of instructions and at least one processor configured to communicate with the at least one storage device. When executing the set of instructions, the at least one processor may be configured to direct the system to perform operations including determining, based on operational data of the medical system, abnormal information of the medical system; and generating prompt information for prompting the abnormal information of the medical system, wherein the prompt information includes image data encoding at least one of the abnormal information or system information of the medical system.

[0008] In still another aspect of the present disclosure, a rod source phantom irrigation system is provided. The rod source phantom irrigation system may include a source liquid production module, a conveying module, a rod source module, and a control module. The rod source module may include a rod source phantom. The source liquid production module may be connected to the conveying module. The source liquid production module may be configured to generate, based on a

first instruction sent by the control module, a mixed solution by mixing an injected radioactive source and a solvent with a preset ratio. The conveying module may be connected to the rod source phantom in the rod source module. The conveying module may be configured to transmit, based on a second instruction sent by the control module, the mixed solution from the source liquid production module to the rod source phantom in the rod source module. The control module may be in communication with the source liquid production module and the conveying module, respectively. The control module may be configured to control the source liquid production module to generate the mixed solution and the conveying module to transmit the mixed solution.

[0009] Additional features will be set forth in part in the description which follows, and in part will become apparent to those skilled in the art upon examination of the following and the accompanying drawings or may be learned by production or operation of the examples. The features of the present disclosure may be realized and attained by practice or use of various aspects of the methodologies, instrumentalities, and combinations set forth in the detailed examples discussed below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present disclosure is further described in terms of exemplary embodiments. These exemplary embodiments are described in detail with reference to the drawings. These embodiments are non-limiting exemplary embodiments, in which like reference numerals represent similar structures throughout the several views of the drawings, and wherein:

[0011] FIG. 1 is a schematic diagram illustrating an exemplary prompting system according to some embodiments of the present disclosure;

[0012] FIG. 2 is a schematic diagram illustrating an exemplary rod source phantom irrigation system according to some embodiments of the present disclosure;

[0013] FIG. 3 is a schematic diagram illustrating an exemplary rod source phantom irrigation system according to some embodiments of the present disclosure;

[0014] FIG. 4 is a schematic diagram illustrating an exemplary rod source phantom irrigation system according to some embodiments of the present disclosure;

[0015] FIG. 5 is a schematic diagram illustrating exemplary structures of rod source phantom fixing units according to some embodiments of the present disclosure;

[0016] FIG. 6 is a schematic diagram illustrating an exemplary rod source phantom irrigation system according to some embodiments of the present disclosure;

[0017] FIG. 7 is a schematic diagram illustrating an exemplary source liquid production module according to some embodiments of the present disclosure;

[0018] FIG. 8 is a schematic diagram illustrating an exemplary source liquid production module according to some embodiments of the present disclosure;

[0019] FIG. 9 is a schematic diagram illustrating an exemplary rod source phantom irrigation system according to some embodiments of the present disclosure;

[0020] FIG. 10 is a schematic diagram illustrating an exemplary rod source phantom irrigation system according to some embodiments of the present disclosure;

[0021] FIG. 11 is a schematic diagram illustrating an exemplary structure of a rod source phantom irrigation system according to some embodiments of the present disclosure;

[0022] FIG. 12 is a flowchart illustrating an exemplary process for rod source phantom irrigation according to some embodiments of the present disclosure;

[0023] FIG. 13 is a block diagram illustrating an exemplary processing device according to some embodiments of the present disclosure;

[0024] FIG. 14 is a flowchart illustrating an exemplary process for prompting an abnormal condition of a medical system according to some embodiments of the present disclosure;

[0025] FIG. 15 is a schematic diagram illustrating an exemplary prompt information according to some embodiments of the present disclosure; and

[0026] FIG. 16 is a flowchart illustrating an exemplary process for selecting variable information from candidate variable information according to some embodiments of the present disclosure.

DETAILED DESCRIPTION

[0027] In the following detailed description, numerous specific details are set forth by way of examples in order to provide a thorough understanding of the relevant disclosure. However, it should be apparent to those skilled in the art that the present disclosure may be practiced without such details. In other instances, well-known methods, procedures, systems, components, and/or circuitry have been described at a relatively high level, without detail, in order to avoid unnecessarily obscuring aspects of the present disclosure. Various modifications to the disclosed embodiments

will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the present disclosure. Thus, the present disclosure is not limited to the embodiments shown, but to be accorded the widest scope consistent with the claims.

[0028] The terminology used herein is for the purpose of describing particular example embodiments only and is not intended to be limiting. As used herein, the singular forms “a,” “an,” and “the” may be intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprise,” “comprises,” and/or “comprising,” “include,” “includes,” and/or “including,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0029] It will be understood that when a unit, engine, module, or block is referred to as being “on,” “connected to,” or “coupled to,” another unit, engine, module, or block, it may be directly on, connected or coupled to, or communicate with the other unit, engine, module, or block, or an intervening unit, engine, module, or block may be present, unless the context clearly indicates otherwise. As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

[0030] These and other features, and characteristics of the present disclosure, as well as the methods of operation and functions of the related elements of structure and the combination of parts and economies of manufacture, may become more apparent upon consideration of the following description with reference to the accompanying drawings, all of which form a part of this disclosure. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended to limit the scope of the present disclosure. It is understood that the drawings are not to scale.

[0031] An aspect of the present disclosure relates to systems and methods for prompting. The method may include determining, based on operational data of a medical system, abnormal information of the medical system. Further, the method may include generating prompt information for prompting the abnormal information of the medical system. The prompt information may include image data encoding at least one of the abnormal information or system information of the medical

system. By encoding the abnormal information in the image data, enough information may be provided to the target user to determine the abnormal condition of the medical system when the target user does not arrive on site. In addition, the prompt information may be generated through an encoding manner, which can reduce a possibility that the prompt information is lost during the transmission, thereby improving the accuracy of the prompt information during the transmission.

[0032] Another aspect of the present disclosure relates to a rod source phantom irrigation system. The rod source phantom irrigation system may include a source liquid production module, a conveying module, a rod source module, and a control module. The rod source phantom may be automatically generated without a manual operation (e.g., a manual injection of the radioactive source and/or the solvent, a manual mixture, etc.), which can avoid a contact of a user with the radioactive source, thereby reducing the irradiation of the radioactive source to the user, reducing the damage to the user, and improve the safety during the rod source irrigation. In addition, by automatically generating the rod source phantom, the rod source phantom irrigation system may improve the efficiency of the generation of the rod source phantom.

[0033] Still another aspect of the present disclosure, the systems and methods for prompting may be applied to the rod source phantom irrigation system. Therefore, when the rod source phantom irrigation system includes an abnormal condition, the prompt information may be generated and/or transmitted automatically, which needs no contact between the user and the rod source phantom irrigation system, thereby reducing the irradiation of the radioactive source to the user and the damage to the user.

[0034] FIG. 1 is a schematic diagram illustrating an exemplary prompting system 100 according to some embodiments of the present disclosure. As shown in FIG. 1, the prompting system 100 may include a medical system 110, a network 120, one or more terminals 130, a processing device 140, and a storage device 150. In some embodiments, the medical system 110, the processing device 140, the storage device 150, and/or the terminal(s) 130 may be connected to and/or communicate with each other via a wireless connection (e.g., the network 120), a wired connection, or a combination thereof. The connection between the components in the prompting system 100 may be variable. Merely by way of example, the medical system 110 may be connected to the processing device 140 through the network 120, as illustrated in FIG. 1. As another example, the medical system 110 may be connected to the processing device 140 directly. As a further example, the

storage device 150 may be connected to the processing device 140 through the network 120, as illustrated in FIG. 1, or connected to the processing device 140 directly.

[0035] The medical system 110 may be used for a medical purpose. For example, the medical system 110 may be configured to diagnose, treat, and/or monitor a subject. In some embodiments, the medical system 110 may include an imaging device, a treatment device, a life support device, a medical monitor, etc.

[0036] The imaging device may be configured to obtain medical image data (e.g., a scanned image) of the subject. In some embodiments, the imaging device may include a single modality imaging device. For example, the imaging device may include a computed tomography (CT) device, a magnetic resonance imaging (MRI) device, a positron emission tomography (PET) device, an X-ray imaging device, a single-photon emission computed tomography (SPECT) device, an ultrasound device, etc. In some embodiments, the imaging device may include a multi-modality imaging device. Exemplary multi-modality imaging devices may include a positron emission tomography-computed tomography (PET-CT) device, a positron emission tomography-magnetic resonance imaging (PET-MRI) device, a computed tomography-magnetic resonance imaging (CT-MRI) device, etc.

[0037] The treatment device may be configured to perform a treatment on the subject. Exemplary treatment devices may include a radiation delivery device (e.g., a radiotherapy (RT) device), an infusion pump, a medical aspirator (e.g., an electric negative pressure aspirator), an electrosurgery, an electrocoagulation, etc. In some embodiments, the RT device may include a conformal radiation therapy device, an image guided radiation therapy (IGRT) device, an intensity modulated radiation therapy (IMRT) device, an intensity modulated arc therapy (IMAT) device, etc.

[0038] The life support device may be configured to maintain a bodily function of the subject. Exemplary life support devices may include a medical ventilator, an incubator, an anesthesia machine (e.g., an anesthesia ventilator, an anesthesia sewage system), a heart-lung machine, an extracorporeal membrane oxygenation (ECMO), a dialysis machine, etc.

[0039] The medical monitor may be configured to measure vital signs of the subject. Exemplary medical monitors may include an electrocardiogram (ECG) device, an electroencephalogram (EEG) device, a blood pressure device, etc.

[0040] In some embodiments, the medical system 110 may further include an assistant medical device. The assistant medical device may be configured to provide an assistance to perform the medical purpose.

[0041] Merely by way of example, the medical system 110 may include a rod source phantom irrigation system. The rod source phantom irrigation system may be configured to provide a rod source phantom including a radioactive source to a PET device. In some embodiments, the rod source phantom irrigation system may include a source liquid production module, a conveying module, a rod source module, and a control module. The rod source module may include the rod source phantom. The source liquid production module may be connected to the conveying module. In some embodiments, the source liquid production module may be configured to generate, based on a first instruction sent by the control module, a mixed solution by mixing the injected radioactive source and a solvent with a preset ratio. The conveying module may be connected to the rod source phantom in the rod source module. In some embodiments, the conveying module may be configured to transmit, based on a second instruction sent by the control module, the mixed solution from the source liquid production module to the rod source phantom in the rod source module. The control module may be in communication with the source liquid production module and the conveying module, respectively. In some embodiments, the control module may be configured to control the source liquid production module to generate the mixed solution and the conveying module to transmit the mixed solution. More descriptions regarding the rod source phantom irrigation system may be found elsewhere in the present disclosure (e.g., FIGs. 2-11 and the descriptions thereof).

[0042] The network 120 may include any suitable network that can facilitate the exchange of information and/or data for the prompting system 100. In some embodiments, one or more components (e.g., the medical system 110, the terminal 130, the processing device 140, the storage device 150, etc.) of the prompting system 100 may communicate information and/or data with one or more other components of the prompting system 100 via the network 120. For example, the processing device 140 may obtain operational data of the medical system 110 from the medical system 110 via the network 120. As another example, the processing device 140 may obtain user instructions from the terminal 130 via the network 120. In some embodiments, the network 120 may include one or more network access points.

[0043] The terminal(s) 130 may include a mobile device 130-1, a tablet computer 130-2, a laptop computer 130-3, or the like, or any combination thereof. In some embodiments, the mobile device 130-1 may include a smart home device, a wearable device, a mobile device, a virtual reality device, an augmented reality device, or the like, or any combination thereof. In some embodiments, the terminal(s) 130 may be part of the processing device 140.

[0044] The processing device 140 may process data and/or information obtained from one or more components (the medical system 110, the terminal(s) 130, and/or the storage device 150) of the prompting system 100. For example, the processing device 140 may determine, based on operational data of the medical system 110, abnormal information of the medical system 110. As another example, the processing device 140 may generate prompt information for prompting the abnormal information of the medical system 110. The prompt information may include image data encoding at least one of the abnormal information or system information of the medical system. In some embodiments, the processing device 140 may be a single server or a server group. The server group may be centralized or distributed. In some embodiments, the processing device 140 may be local or remote. In some embodiments, the processing device 140 may be implemented on a cloud platform.

[0045] In some embodiments, the processing device 140 may be implemented by a computing device. For example, the computing device may include a processor, a storage, an input/output (I/O), and a communication port. The processor may execute computer instructions (e.g., program codes) and perform functions of the processing device 140 in accordance with the techniques described herein. The computer instructions may include, for example, routines, programs, objects, components, data structures, procedures, modules, and functions, which perform particular functions described herein. In some embodiments, the processing device 140, or a portion of the processing device 140 may be implemented by a portion of the terminal 130.

[0046] In some embodiments, the processing device 140 may include multiple processing devices. Thus, operations and/or method steps that are performed by one processing device as described in the present disclosure may also be jointly or separately performed by the multiple processing devices. For example, if in the present disclosure the, the prompting system 100 executes both operation A and operation B, it should be understood that operation A and operation B may also be performed by two or more different processing devices jointly or separately (e.g., a first processing

device executes operation A and a second processing device executes operation B, or the first and second processing devices jointly execute operations A and B).

[0047] The storage device 150 may store data/information obtained from the medical system 110, the terminal(s) 130, and/or any other component of the prompting system 100. In some embodiments, the storage device 150 may include a mass storage, a removable storage, a volatile read-and-write memory, a read-only memory (ROM), or the like, or any combination thereof. In some embodiments, the storage device 150 may store one or more programs and/or instructions to perform exemplary methods described in the present disclosure.

[0048] In some embodiments, the storage device 150 may be connected to the network 120 to communicate with one or more other components in the prompting system 100 (e.g., the processing device 140, the terminal(s) 130, etc.). One or more components in the prompting system 100 may access the data or instructions stored in the storage device 150 via the network 120. In some embodiments, the storage device 150 may be directly connected to or communicate with one or more other components in the prompting system 100 (e.g., the processing device 140, the terminal(s) 130, etc.). In some embodiments, the storage device 150 may be part of the processing device 140.

[0049] FIG. 2 is a schematic diagram illustrating an exemplary rod source phantom irrigation system 200 according to some embodiments of the present disclosure.

[0050] PET-CT device is a scanning device configured to obtain an organ function and/or a metabolism condition of a subject, which can be widely used in fields, e.g., detection and/or diagnosis of a tumor, a brain, a heart, etc. In order to ensure scanning accuracy and detection efficiency of the PET-CT device, the PET-CT device needs to be performed a quality detection. During the quality detection, a rod source phantom including a radioactive source is caused to rotate uniformly around an axis of the PET-CT device to uniformly irradiate detection units of the PET-CT device.

[0051] Conventionally, the rod source phantom may be prepared manually. For example, a user injects a radioactive source (e.g., a fluorodeoxyglucose (FDG) source) and a solvent into a rod source phantom according to a proportion between the radioactive source and the solvent, and shakes the rod source phantom to uniformly mix the radioactive source and the solvent. However, during the preparation of the rod source phantom, the user may be continuously irradiated by the

radioactive source, which can damage the user. Therefore, the rod source phantom irrigation system 200 may be provided to automatically prepare the rod source phantom.

[0052] As shown in FIG. 2, the rod source phantom irrigation system 200 may include a source liquid production module 210, a conveying module 220, a rod source module 230, and a control module 240. The rod source module 230 may include a rod source phantom 232. The source liquid production module 210 may be connected to the conveying module 220. The conveying module 220 may be connected to the rod source phantom 232 in the rod source module 230. The control module 240 may be in communication with the source liquid production module 210 and the conveying module 220, respectively.

[0053] The source liquid production module 210 may be configured to generate, based on a first instruction sent by the control module 240, a mixed solution by mixing an injected radioactive source and a solvent with a preset ratio. The conveying module 220 may be configured to transmit, based on a second instruction sent by the control module 240, the mixed solution from the source liquid production module 210 to the rod source phantom 232 in the rod source module 230. The control module 240 may be configured to control the source liquid production module 210 to generate the mixed solution and the conveying module 220 to transmit the mixed solution.

[0054] In some embodiments, the radioactive source and the solvent may be injected into the source liquid production module 210 manually. For example, the user may extract the radioactive source and the solvent with the preset ratio, and inject the radioactive source and the solvent into the source liquid production module 210. In some embodiments, the radioactive source and the solvent may be injected into the source liquid production module 210 automatically. For example, the source liquid production module 210 may be connected to a first container storing the radioactive source and a second container storing the solvent, respectively. The radioactive source and the solvent with the preset ratio may be automatically flowed into the source liquid production module 210. Alternatively, a first amount of the radioactive source may be automatically output by controlling the first container, and a second amount of the solvent may be automatically output by controlling the second container, thereby injecting the radioactive source and the solvent with the preset ratio into the source liquid production module 210.

[0055] In some embodiments, the rod source phantom irrigation system 200 may further include a source irrigation module (not shown). The source irrigation module may be configured to inject the

radioactive source and the solvent with the preset ratio into the source liquid production module 210. For example, after the source irrigation module receives an irrigation instruction sent by the control module 240, the source irrigation module may automatically inject the radioactive source and the solvent with the preset ratio to the rod source phantom 232 in the source liquid production module 210.

[0056] In some embodiments, after the radioactive source and the solvent with the preset ratio are injected into the source liquid production module 210, the source liquid production module 210 may be configured to uniformly mix the radioactive source and the solvent. In some embodiments, in response to a trigger operation of the user, the control module 240 may send the first instruction to the liquid production module 210 for mixing the radioactive source and the solvent. Alternatively, in response to determining that the radioactive source and the solvent with the preset ratio are injected into the source liquid production module 210, the control module 240 may send the first instruction to the liquid production module 210 for mixing the radioactive source and the solvent.

[0057] Merely by way of example, in response to determining that the radioactive source and the solvent with the preset ratio are injected into the source liquid production module 210, the source liquid production module 210 may send an instruction that the radioactive source and the solvent have been injected, so as to cause the control module 240 to output the first instruction.

Alternatively, the control module 240 may be connected to the first container storing the radioactive source and the second container storing the solvent, respectively. The control module 240 may receive an instruction that the radioactive source has been injected into the source liquid production module 210 from the first container, and receive an instruction that the solvent has been injected into the source liquid production module 210 from the second container. Accordingly, the control module 240 may send the first instruction to the source liquid production module 210. In some embodiments, the control module 240 may be further connected to a detection component. After the detection component determines that the radioactive source and the solvent have been injected, the detection component may send an instruction that the radioactive source and the solvent have been injected, so as to cause the control module 240 to output the first instruction. It should be noted that a manner that the control module 240 determines whether the radioactive source and the solvent with the preset ratio have been injected into the source liquid production module 210 is not limited

herein. In addition, a manner that the control module 240 outputs the first instruction may not be limited herein.

[0058] In some embodiments, after the source liquid production module 210 receives the first instruction sent by the control module 240, the source liquid production module 210 may generate, based on the first instruction, the mixed solution by mixing the injected radioactive source and the solvent with the preset ratio. In some embodiments, the source liquid production module 210 may mix the injected radioactive source and the solvent through a mixture manner, e.g., rapid rotation, rapid movement, rapid stirring, or the like, or any combination thereof. In some embodiments, the solvent may include water, ethanol, or the like, or any combination thereof. For example, the solvent may be determined based on actual requirements (e.g., a type of the mixed solution).

[0059] In some embodiments, the first instruction may further include a mixture time. For example, the source liquid production module 210 may mix the injected radioactive source and the solvent from a start time to an end time, and a time period between the start time and the end time may be the mixture time. In some embodiments, after the control module 240 sends the first instruction to the source liquid production module 210, the control module 240 may send a mixture stopping instruction to the source liquid production module 210 until the mixture time arrives. The source liquid production module 210 may receive the mixture stopping instruction, and stop the mixing of the radioactive source and the solvent. In some embodiments, a mixture operation of the source liquid production module 210 may be an operation with an operation time. For example, the source liquid production module 210 may stop the mixing of the radioactive source and the solvent after the mixture operation with the operation time is performed. In some embodiments, the time period of the mixture time may be determined based on a system default setting or set manually by the user. For example, the time period of the mixture time may be a default time period. As another example, the time period of the mixture time may be determined based on a total volume of the mixed solution. As still another example, the time period of the mixture time may be set based on an input of the user. For instance, the user may manually adjust the time period of the mixture time. In some embodiments, the user may stop the mixing. For example, the user may trigger a stop button to stop the mixing. Accordingly, after the control module 240 determines that the stop button is triggered by the user, the control module 240 may send the mixture stopping instruction to the source liquid

production module 210, so as to cause the source liquid production module 210 to stop the mixing of the radioactive source and the solvent.

[0060] In some embodiments, after the source liquid production module 210 generates the mixed solution by mixing the radioactive source and the solvent, the source liquid production module 210 may send a mixing completion instruction to the control module 240. The control module 240 may determine, based on the mixing completion instruction, that the mixed solution has been generated. And then, the control module 240 may send the second instruction to the conveying module 220. After the conveying module 220 receives the second instruction, the conveying module 220 may transmit the mixed solution from the source liquid production module 210 to the rod source phantom 232 in the rod source module 230.

[0061] In some embodiments, the source liquid production module 210 may be connected to the conveying module 220. A connection between the source liquid production module 210 and the conveying module 220 may be disposed with a conveying switch. Alternatively, the conveying switch may be disposed on the conveying module 220. It should be noted that, a position and/or a type of the conveying switch may not be limited herein, as long as the conveying switch can be used to control the flow of the mixed solution. In some embodiments, the source liquid production module 210 may be connected to the conveying module 220 in any manner, which is not limited herein. For example, the conveying module 220 may be connected to the source liquid production module 210 through a bottom portion of the source liquid production module 210. As another example, the conveying module 220 may be connected to the source liquid production module 210 by extending from a top portion of the source liquid production module 210 to the inside of the source liquid production module 210. As still another example, the conveying module 220 may be connected to the source liquid production module 210 through another portion of the source liquid production module 210.

[0062] Merely by way of example, referring to FIG. 3, FIG. 3 is a schematic diagram illustrating an exemplary rod source phantom irrigation system 300 according to some embodiments of the present disclosure. The rod source phantom irrigation system 300 may be an embodiment of the rod source phantom irrigation system 200 described in FIG. 2. As shown in FIG. 3, a conveying module 320 may be connected to a source liquid production module 310 through a bottom portion of the source liquid production module 310. A conveying switch 322 may be disposed on the conveying module

320. When the conveying module 320 receives a second instruction sent by a control module (e.g., the control module 240), the conveying module 320 may be caused to open the conveying switch 322, so as to automatically transmit a mixed solution from the source liquid production module 310 to a rod source phantom 332 in a rod source module (e.g., the rod source module 230).

[0063] As another example, referring to FIG. 4, FIG. 4 is a schematic diagram illustrating an exemplary rod source phantom irrigation system 400 according to some embodiments of the present disclosure. The rod source phantom irrigation system 400 may be an embodiment of the rod source phantom irrigation system 400 described in FIG. 4. As shown in FIG. 4, a conveying module 420 may be connected to a source liquid production module 410 by extending from a top portion of the source liquid production module 410 to the inside or a bottom portion of the source liquid production module 410. A conveying switch 422 may be disposed on the conveying module 420. When the conveying module 420 receives a second instruction sent by a control module (e.g., the control module 240), the conveying module 420 may be caused to open the conveying switch 422, so as to transmit, through a pumping manner, the mixed solution from the source liquid production module 410 to a rod source phantom 432 in a rod source module (e.g., the rod source module 230).

[0064] It should be noted that, the descriptions of the connection between the conveying module and the source liquid production component are merely provided for illustration, and not intended to limit the scope of the present disclosure. For example, the connection between the conveying module and the source liquid production component may include no conveying switch. For instance, when the conveying module is connected to the source liquid production component by extending from the top portion of the source liquid production component to the inside or the bottom portion of the source liquid production component, and the conveying module receives the second instruction sent by the control module, the conveying module may transmit, through the pumping manner, the mixed solution from the source liquid production module to the rod source phantom in the rod source module.

[0065] In some embodiments, the rod source module 230 may include a rod source phantom fixing unit 234 (e.g., a groove structure as shown in FIG. 5). The rod source phantom fixing unit 234 may be configured to fix the rod source phantom 232. In some embodiments, the rod source phantom fixing unit 234 may include a slot, a groove, a clamp, etc. The slot may be a slot with a fixed size or a slot with a variable size. When the slot is a slot with a fixed size, the rod source module 230 may

include one or more slots with fixed sizes for fixing rod source phantoms 232 with different sizes. The displacement of the groove may be similar to the displacement of the slot, which is not repeated herein. The clamp may be a clamp with a variable size for fixing rod source phantoms 232 with different sizes. It should be noted that, a shape of the rod source phantom fixing unit 234 of the rod source phantom 232 is not limited in the present disclosure.

[0066] Merely by way of example, referring to FIG. 5, FIG. 5 is a schematic diagram illustrating exemplary structures of rod source phantom fixing units according to some embodiments of the present disclosure. A count of rod source phantom fixing units 234 may be multiple. For example, as shown in FIG. 5, a rod source phantom irrigation system may include three rod source phantom fixing units 234. Each of the three rod source phantom fixing units 234 may include a fixing base with a groove 236. The groove 236 may be used for fixing the rod source phantom 232. A size of each groove may be different from sizes of other grooves. The grooves with different sizes may be used to fix rod source phantoms 232 with different sizes. In some embodiments, a size of each fixing base may be the same as sizes of other fixing bases. When rod source phantoms 232 with different sizes are irrigated, each of the rod source phantoms 232 may be matched with a rod source phantom fixing unit 234 based on the size of the rod source phantom 232 and the size of the rod source phantom fixing unit 234. For example, when a size of a rod source phantom 232 is the same as or similar to a size of a rod source phantom fixing unit 234, the rod source phantom 232 may be determined to match with the rod source phantom fixing unit 234. After the rod source phantom 232 is fixed by the rod source phantom fixing unit 234, the rod source phantom fixing unit 234 may be fixed on a fixing position of the rod source module 230. A size of the fixing position may be matched with the size of the fixing base. For example, the size of the fixing position may be the same as or similar to the size of the fixing base.

[0067] Therefore, the user (e.g., an operator) may fix the rod source phantoms 232 with different types and/or different sizes on the fixing position of the rod source module 230. For example, an end of the conveying module 220 may be connected to the rod source phantom 232 manually. Therefore, the conveying module 220 may transmit, under a control of the control module 240, the mixed solution from the source liquid production module 210 to the rod source phantom 232 in the rod source module 230. In some embodiments, the conveying module 220 may be connected to the rod source phantom 232 automatically. For example, the conveying module 220 may be

automatically connected to the rod source phantom 232 under a control of the control module 240, and automatically disconnected to the rod source phantom 232 after the conveying module 220 transmits the mixed solution from the source liquid production module 210 to the rod source phantom 232 in the rod source module 230.

[0068] In some embodiments, the rod source module 230 may further include a pressure sensor (not shown). The pressure sensor may be in communication with the control module. In some embodiments, the pressure sensor may be configured to detect a pressure on the rod source phantom fixing unit 234 and transmit the detected pressure to the control module 240. After the control module 240 receives the detected pressure, the control module 240 may determine, based on the detected pressure, a type of the rod source phantom 232. For example, different rod source phantoms may correspond to different pressures, and the control module 240 may determine the type of the rod source phantom 232 based on the detected pressure. In some embodiments, the control module 240 may further determine, based on the type of the rod source phantom, at least one operational parameter of the rod source phantom irrigation system 200. Exemplary operational parameters may include a first operational parameter of a cover opening module, a second operational parameter of a liquid level detection module, a third operational parameter (e.g., the mixture manner, the mixture time, etc.) of the source liquid production module 210, or the like, or any combination thereof.

[0069] In some embodiments, after the rod source phantom 232 is fixed on the rod source module 230, the rod source phantom irrigation system 200 may be initiated to cause the control module 240 of the rod source phantom irrigation system 200 to operate. In some embodiments, the rod source phantom irrigation system 200 may be disposed with an initiation button. After the control module 240 determines that the initiation button is triggered, the control module 240 may start to operate. In some embodiments, the rod source phantom irrigation system 200 may include a display component (e.g., a user interaction module 1070 as shown in FIG. 10). The display component may include an initiation key. After the control module 240 determines that the initiation key is triggered, the control module 240 may start to operate. In some embodiments, the rod source phantom irrigation system 200 may further include a communication component. The control module 240 may receive an instruction (e.g., the first instruction, the second instruction, etc.) sent by an external component through the communication component. That is, the control module 240 may be remotely controlled

through the external component. When the control module 240 receives an initiation instruction sent by the external component, the control module 240 may start to operate. It should be noted that, the initiation manner of the control module 240 is not limited in the present disclosure.

[0070] In some embodiments, the rod source phantom irrigation system 200 may include an output module. The output module may be configured to output, under the control of the control module 240, a completion instruction after the rod source phantom is irrigated. The output module may include a buzzer, a speaker, a voice broadcast component, an indicator light, or the like, or any combination thereof.

[0071] In some embodiments, the source phantom irrigation system 200 may include a detection module. The detection module may be configured to detect each component of the rod source phantom irrigation system 200. For example, after a detection instruction is received, the detection module may obtain a current value of the at least one operational parameter of the rod source phantom irrigation system 200 by detecting each component of the rod source phantom irrigation system 200, and then abnormal information of the rod source phantom irrigation system 200 may be determined.

[0072] According to some embodiments of the present disclosure, the rod source phantom irrigation system 200 may generate the mixed solution by automatically mixing the radioactive source and the solvent, and obtain the rod source phantom including uniform radioactive substances by automatically irrigating the mixed solution into the rod source phantom. Further, the rod source phantom may be used for quality detection of a PET-CT device. The rod source phantom may be automatically generated without a manual operation (e.g., a manual injection of the radioactive source and/or the solvent, a manual mixture, etc.), which can avoid a contact of the user with the radioactive source, thereby reducing the irradiation of the radioactive source to the user, reducing the damage to the user, and improve the safety during the rod source irrigation. In addition, by automatically generating the rod source phantom, the rod source phantom irrigation system 200 may improve the efficiency of the generation of the rod source phantom.

[0073] It should be noted that the rod source phantom irrigation systems are provided for illustration purposes, and not intended to limit the scope of the present disclosure. For persons having ordinary skills in the art, multiple variations and modifications may be made under the

teachings of the present disclosure. However, those variations and modifications do not depart from the scope of the present disclosure.

[0074] FIG. 6 is a schematic diagram illustrating an exemplary rod source phantom irrigation system 600 according to some embodiments of the present disclosure. The rod source phantom irrigation system 600 may be an embodiment of the rod source phantom irrigation system 200 described in FIG. 2.

[0075] As shown in FIG. 6, the rod source phantom irrigation system 600 may include a source liquid production module 610, a conveying module 620, a rod source module 630, and a control module 640.

[0076] The source liquid production module 610 may include a liquid container 612 and a stirring unit 614. The stirring unit 614 may be disposed in the liquid container 612. The conveying module 620 may include a conveying pipe 622 and a conveying control unit 624. A first end of the conveying pipe 622 may be connected with the liquid container 612, and a second end of the conveying pipe 622 may be connected with a rod source phantom 632. The control module 640 may be in communication with the stirring unit 614 and the conveying control unit 624, respectively.

[0077] The stirring unit 614 may be configured to receive a first instruction sent by the control module 640, and generate, based on the first instruction, a mixed solution by mixing a radioactive source and a solvent with a preset ratio that are injected into the liquid container 612. The conveying module 620 may be configured to receive a second instruction sent by the control module 640 after the mixed solution is generated, and transmit, based on the second instruction, the mixed solution from the liquid container 612 to the rod source phantom 632 in the rod source module 630.

[0078] In some embodiments, the liquid container 612 may be a closed container, an opened container, or a semi-closed container that can be opened or closed. In some embodiments, a shape of the liquid container 612 may include a spherical container, a cylindrical container, a conical flask, or the like, or any combination thereof. It should be noted that a structure, a shape, a size, a material, etc., of the liquid container 612 are not limited.

[0079] In some embodiments, the stirring unit 614 disposed in the liquid container 612 may include a rotatable stirring rod. The stirring rod may be controlled to rotate to obtain the mixed solution. In some embodiments, a structure of the stirring rod may include a straight structure, a screw structure,

a jagged structure, or the like, or any combination thereof. It should be noted that a structure, a material, a length, etc., of the stirring rod are not limited.

[0080] In some embodiments, the stirring unit 614 may include a mixer. The mixer may include one or more blades. For example, the mixer may be disposed in the liquid container 612 through a connecting rod. As another example, the mixer may be disposed on a bottom portion of the liquid container 612 through a connecting member. The mixed solution may be obtained by controlling a rapid rotation of the mixer. It should be noted that a structure, a shape, a shape, a material, a fixing position, a fixing manner, etc., of the mixer are not limited.

[0081] In some embodiments, after the radioactive source and the solvent with the preset ratio are injected into the liquid container 612, the control module 640 may send the first instruction to the stirring unit 614. After the first instruction is received, the stirring unit 614 may start to operate, so as to generate the mixed solution by mixing the radioactive source and the solvent with the preset ratio that are injected into the liquid container 612. In some embodiments, the stirring unit 614 may receive an instruction for stopping stirring sent by the control module 640, and stop the mixing of the radioactive source and the solvent based on the instruction for stopping stirring.

[0082] Merely by way of example, referring to FIG. 7, FIG. 7 is a schematic diagram illustrating an exemplary source liquid production module 700 according to some embodiments of the present disclosure. The source liquid production module 700 may be an embodiment of the source liquid production module 610 described in FIG. 6. As shown in FIG. 7, the source liquid production module 700 may include a liquid container 710 and a stirring unit 720. The stirring unit 720 may include a first driving unit 722 and a stirring rod 724. The first driving unit 722 may be configured to receive a first instruction, and control the stirring rod 724 to rotate based on the first instruction.

[0083] As another example, referring to FIG. 8, FIG. 8 is a schematic diagram illustrating an exemplary source liquid production module 800 according to some embodiments of the present disclosure. The source liquid production module 800 may be an embodiment of the source liquid production module 610 described in FIG. 6. As shown in FIG. 8, the source liquid production module 800 may include a liquid container 810 and a stirring unit 820. The stirring unit 820 may include a second driving unit 822, a connecting member 824, and one or more stirring blades 826. The one or more stirring blades 826 may be disposed on an end of the connecting member 824 near a bottom portion of the liquid container 810. The second driving unit 822 may be configured to receive a first

instruction, and control the one or more stirring blades 826 to rotate based on the first instruction. In some embodiments, the one or more stirring blades 826 may be fixedly connected to the connecting member 824. When the one or more stirring blades 826 rotate, the one or more stirring blades 826 may rotate together with the connecting member 824. In some embodiments, the one or more stirring blades 826 may be movably connected to the connecting member 824. When the one or more stirring blades 826 rotate, the connecting member 824 may not rotate together with the one or more stirring blades 826. In some embodiments, the connecting member 824 may include a connecting rod, a connecting tube, or the like, or any combination thereof. In some embodiments, the second driving unit 822 may be disposed at one end of the connecting member 824 away from the bottom portion of the liquid container 810. The second driving unit 822 may drive the one or more stirring blades 826 to rotate by controlling a rotation of the connecting member 824. Alternatively, the second driving unit 822 may directly control the one or more stirring blades 826 to rotate.

[0084] In some embodiments, the first end of the conveying pipe 622 may be fixedly connected with the liquid container 612. For example, the first end of the conveying pipe 622 may be fixedly connected with the bottom portion of the liquid container 612. As another example, the first end of the conveying pipe 622 may extend from the top portion of the liquid container 612 to the bottom portion of the liquid container 612. As still another example, the first end of the conveying pipe 622 may be fixedly connected with a side portion of the liquid container 612.

[0085] In some embodiments, a flow of the mixed solution may be controlled through the conveying control unit 624. For example, when the mixed solution needs to be transmitted to the rod source phantom 632 in the rod source module 630, the conveying pipe 622 may be opened through the conveying control unit 624. As another example, when no mixed solution needs to be transmitted to the rod source phantom 632, the conveying pipe 622 may be closed through the conveying control unit 624.

[0086] In some embodiments, the second end of the conveying pipe 622 may be movably connected with the rod source phantom 632. For example, when the rod source phantom 632 needs to be irrigated (i.e., the conveying control unit 624 receives the second instruction sent by the control module 640), the conveying control unit 624 may control the second end of the conveying pipe 622 to extend into the inside of the rod source phantom 632 and be connected with the rod

source phantom 632. After the source phantom 1032 has been irrigated, the conveying control unit 624 may control the second end of the conveying pipe 622 to move from the inside of the rod source phantom 632 to a position outside the rod source phantom 632. In some embodiments, a portion of the conveying pipe 622 near the second end of the conveying pipe 622 may be a retractable conduit. Alternatively, the portion of the conveying pipe 622 near the second end of the conveying pipe 622 may be connected with other portions of the conveying pipe 622 through a movable connecting member. The movable connecting member may control the portion of the conveying pipe 622 near the second end of the conveying pipe 622 to move up and down and/or move left and right.

[0087] According to some embodiments of the present disclosure, the rod source phantom irrigation system 600 may be provided for automatically generating the mixed solution and irrigating the rod source phantom, which can improve the realizability and the efficiency of the generation of the rod source phantom.

[0088] FIG. 9 is a schematic diagram illustrating an exemplary rod source phantom irrigation system 900 according to some embodiments of the present disclosure. The rod source phantom irrigation system 900 may be an embodiment of the rod source phantom irrigation system 200 described in FIG. 2.

[0089] As shown in FIG. 9, the rod source phantom irrigation system 900 may include a source liquid production module 910, a conveying module 920, a rod source module 930, a control module 940, a cover opening module 950, and a liquid level detection module 960.

[0090] The source liquid production module 910 may include a liquid container 912 and a stirring unit 914. The stirring unit 914 may be disposed in the liquid container 912. The conveying module 920 may include a conveying pipe 922 and a conveying control unit 924. The rod source module 930 may include a rod source phantom 932. The cover opening module 950 may be in communication with the control module 940. The liquid level detection module 960 may be in communication with the control module 940.

[0091] The cover opening module 950 may be configured to receive a third instruction sent by the control module 940 before the conveying module 920 transmits a mixed solution, and open a cover of the rod source phantom 932 based on the third instruction. In some embodiments, the cover opening module 950 may be configured to receive a fourth instruction sent by the control module

940 after the mixed solution has been transmitted, and close the cover of the rod source phantom 932 based on the fourth instruction.

[0092] In some embodiments, when the cover opening module 950 receives the third instruction sent by the control module 940, the cover opening module 950 may be moved to a position corresponding to the cover of the rod source phantom 932, and control to open the cover of the rod source phantom 932. After the cover of the rod source phantom 932 is opened, the cover opening module 950 may be moved to another position until the cover opening module 950 receives an instruction (e.g., the fourth instruction). When the cover opening module 950 receives the fourth instruction, the cover opening module 950 may be moved to the position corresponding to the cover of the rod source phantom 932, and close the cover of the rod source phantom 932 based on the fourth instruction. It should be noted that an opening and/or closing manner that the cover opening module 950 opens and/or closes the cover of the rod source phantom 932 may be associated with a cover structure of the cover. That is, different cover structures may correspond to different manners. In some embodiments, the manner that the cover opening module 950 opens and/or closes the cover of the rod source phantom 932 may be matched with the cover structure of the cover of the rod source phantom 932.

[0093] Merely by way of example, a cover structure of the cover of the rod source phantom 932 may be a nut structure. Accordingly, the cover opening module 950 may include an automatic nut screwing device based on the nut structure. Therefore, the automatic nut screwing device may automatically open and/or close the cover (i.e., the nut structure) of the rod source phantom 932. In some embodiments, the automatic nut screwing device may be connected with a motor. After the automatic nut screwing device is matched with the cover of the rod source phantom 932, the automatic nut screwing device may be driven to rotate through a rotation of the motor. Therefore, the nut may be screwed out from the rod source phantom 932, thereby opening the cover of the rod source phantom 932. Alternatively, the nut may be tightened to the rod source phantom 932, thereby closing the cover of the rod source phantom 932.

[0094] In some embodiments, the third instruction and/or the fourth instruction may be associated with a first operational parameter of the cover opening module 950. In some embodiments, the first operational parameter of the cover opening module 950 may be determined based on a type of the rod source phantom. Exemplary first operational parameters may include an opening and/or closing

state of the rod source phantom 932, the opening and/or closing manner of the cover opening module 950, the cover structure of the cover of the rod source phantom 932, etc.

[0095] In some embodiments, the liquid level detection module 960 may be configured to receive a fifth instruction sent by the control module 940 when the conveying module 920 transmits the mixed solution, detect a height of a liquid level in the rod source phantom 932 based on the fifth instruction, and send the height of the liquid level to the control module 940. In response to determining that the height of the liquid level exceeds a preset liquid level threshold, the control module 940 may send a sixth instruction to the conveying module 920. The sixth instruction may be used to cause the conveying module 920 to stop the transmission of the mixed solution from the source liquid production module 910 to the rod source phantom 932 in the rod source module 930.

[0096] In some embodiments, the liquid level detection module 960 may be disposed at an upper portion of the rod source phantom 932. Therefore, when the cover of the rod source phantom 932 is opened, the liquid level detection module 960 may detect the height of the liquid level in the rod source phantom 932. In some embodiments, the liquid level detection module 960 may include a contact liquid level sensor or a non-contact liquid level sensor. Exemplary liquid level sensors may include an ultrasonic liquid level sensor, a capacitive liquid level sensor, a radar liquid level sensor, or the like, or any combination thereof.

[0097] In some embodiments, when the cover of the rod source phantom 932 is opened, the control module 940 may send the fifth instruction to the liquid level detection module 960. In some embodiments, when the rod source phantom 932 is irrigated by the conveying module 920 (i.e., the conveying module 920 transmits the mixed solution from the liquid container 912 to the rod source phantom 932), the control module 940 may send the fifth instruction to the liquid level detection module 960. In some embodiments, the control module 940 may send the fifth instruction to the liquid level detection component 960 after a preset time period when the irrigation starts. The preset time period may be less than a total time period of the irrigation.

[0098] After the liquid level detection component 960 receives the fifth instruction sent by the control module 940, the liquid level detection component 960 may initiate to detect the height of the liquid level, obtain the height of the liquid level of the mixed solution in the liquid container 912, and send the obtained height of the liquid level of the mixed solution to the control module 940 in real time. Therefore, the control module 940 may determine, based on the height of the liquid level and

the preset liquid level threshold, whether the height of the liquid level exceeds the preset liquid level threshold. In some embodiments, the preset liquid level threshold may be associated with a size of the rod source phantom 932. That is, rod source phantoms with different sizes may correspond to different preset liquid level thresholds. For example, a corresponding relationship (e.g., a table) between rod source phantoms with different sizes and different preset liquid level thresholds may be stored in the control module 940. Before the rod source phantom 932 is irrigated, a type or a size of the rod source phantom 932 may be input. The control module 940 may determine, based on the input type or size of the rod source phantom 932 and the corresponding relationship, a preset liquid level threshold corresponding to the rod source phantom 932. In some embodiments, the size of the rod source phantom 932 may be determined based on the type of the rod source phantom 932. In some embodiments, the preset liquid level threshold may be determined based on an input of a user. That is, the user may directly determine the height of the liquid level of the mixed solution in the rod source phantom 932.

[0099] In some embodiments, the fifth instruction may be associated with a second operational parameter of the liquid level detection component 960. In some embodiments, the second operational parameter of the liquid level detection component 960 may be determined based on the type of the rod source phantom. Exemplary second operational parameters may include a type of the liquid level detection component 960, a detection time, etc.

[0100] According to some embodiments of the present disclosure, the rod source phantom irrigation system 900 may be used to automatically open and/or close the cover of the rod source phantom 932. Therefore, no user needs to open and/or close the cover of the rod source phantom 932, which can reduce the irradiation of the radioactive source to the user, reducing the damage to the user, and improve the safety during the rod source irrigation. In addition, the height of the liquid level of the mixed solution in the rod source phantom 932 may be detected in real time, and the irrigation may be automatically stopped based on the height of the liquid level, which can improve the intellectuality of the rod source phantom irrigation system 900. Besides, different preset liquid level thresholds may be used for rod source phantoms with different types and/or sizes, which can improve the accuracy of the automatic irrigation for different types and/or sizes of rod source phantoms, enrich functions of the rod source phantom irrigation system 900, and improve an applicable scope of the rod source phantom irrigation system 900.

[0101] FIG. 10 is a schematic diagram illustrating an exemplary rod source phantom irrigation system 1000 according to some embodiments of the present disclosure. The rod source phantom irrigation system 1000 may be an embodiment of the rod source phantom irrigation system 200 described in FIG. 2.

[0102] As shown in FIG. 10, the rod source phantom irrigation system 1000 may include a source liquid production module 1010, a conveying module 1020, a rod source module 1030, a control module 1040, a cover opening module 1050, a liquid level detection module 1060, and a user interaction module 1070.

[0103] The source liquid production module 1010 may include a liquid container 1012 and a stirring unit 1014. The stirring unit 1014 may be disposed in the liquid container 1012. The conveying module 1020 may include a conveying pipe 1022 and a conveying control unit 1024. The rod source module 1030 may include a rod source phantom 1032. The cover opening module 1050 may be in communication with the control module 1040. The liquid level detection module 1060 may be in communication with the control module 1040.

[0104] The user interaction module 1070 may be in communication with the control module 1040. In some embodiments, the user interaction module 1070 may be configured to obtain a user instruction, and/or display operational data of the rod source phantom irrigation system 1000 and/or prompt information for prompting abnormal information of the rod source phantom irrigation system 1000 to a user. For example, the prompt information may include image data, a code corresponding to the abnormal information, a text describing the abnormal information, or the like, or any combination thereof. The image data may include a barcode, a two-dimensional (2D) code, a compressed image, or the like, or any combination thereof. More descriptions regarding the prompt information may be found elsewhere in the present disclosure (e.g., FIGs. 14-15 and the descriptions thereof).

[0105] In some embodiments, the user interaction module 1070 may include a display screen. Exemplary display screens may include a liquid crystal display (LCD), an electronic ink display, or the like, or any combination thereof. In some embodiments, the user may control the rod source phantom irrigation system 1400 through the user interaction module 1070. For example, the user may control the source liquid production module 1010, the conveying module 1020, the cover opening module 1050, the liquid level detection module 1060, etc., of the rod source phantom

irrigation system 1000 through the user interaction module 1070. For instance, the user may pause and/or stop the mixing by the source liquid production module 1010, pause and/or stop the transmission by the conveying module 1020, etc.

[0106] In some embodiments, the user may input a type of the rod source phantom 1032, a preset liquid level height threshold, etc., through the user interaction module 1070. In some embodiments, the user interaction module 1070 may be used to output information for prompting the completion of the irrigation. In some embodiments, the user interaction module 1070 may be used to implement other interactive functions, which are not limited herein.

[0107] According to some embodiments of the present disclosure, the rod source phantom irrigation system 1000 may include the user interaction module 1070. The user interaction module 1070 may be in communication with the control module 1040. The interaction between the rod source phantom irrigation system 1000 and the user may be realized through the user interaction module 1070, which can improve the operation convenience of the rod source phantom irrigation system 1000, thereby improving the user experience.

[0108] FIG. 11 is a schematic diagram illustrating an exemplary structure of a rod source phantom irrigation system 1100 according to some embodiments of the present disclosure. The rod source phantom irrigation system 1100 may be an embodiment of the rod source phantom irrigation system 200 described in FIG. 2.

[0109] As shown in FIG.11, the rod source phantom irrigation system 1100 may include a rod source phantom fixing unit 1102, a rod source phantom 1104, a cove (i.e., a nut) 1106 of the rod source phantom 1106, an automatic nut screwing device 1108, a first motor 1110, a liquid level detection module 1112, an electric telescopic pipe 1114, a water-inhaling device 1116, a second motor 1118, a third motor 1120, a fourth motor 1122, a stirring rod 1124, a liquid container 1126, a user interaction module 1128, a control module 1130, and a controller 1132. One or more stirring blades may be disposed on a bottom portion of the stirring rod 1124. The control module 1130 may include a plurality of control buttons.

[0110] Merely by way of example, as shown in FIG. 12, the rod source phantom irrigation system 1200 may be used to perform a process 1200 for rod source phantom irrigation.

[0111] In 1202, a rod source phantom may be fixed through a rod source phantom fixing unit.

[0112] In 1204, a type of the rod source phantom may be selected through a user interaction module.

[0113] In 1206, a solvent may be injected into a liquid container.

[0114] In 1208, a radioactive source may be injected into the liquid container.

[0115] In 1210, the radioactive source and the water may be automatically mixed to obtain a mixed solution.

[0116] In 1212, a nut of the rod source phantom may be automatically opened.

[0117] In 1214, a liquid level detection module may be moved to a preset position (e.g., an upper portion of the rod source phantom).

[0118] In 1216, a conveying pipe may be controlled to extend into the rod source phantom.

[0119] In 1218, the mixed solution may be automatically irrigated into the rod source phantom.

[0120] In 1220, the control component may determine whether a height of a liquid level exceeds a preset liquid level threshold. In response to determining that the height of the liquid level does not exceed the preset liquid level threshold, operation 1216 may be proceeded. That is, the mixed solution may be continued to irrigate into the rod source phantom. In response to determining that the height of the liquid level exceeds the preset liquid level threshold, operation 1222 may be proceeded. That is, the irrigation of the mixed solution may be stopped.

[0121] In 1224, the conveying pipe may be automatically moved away from the preset position.

[0122] In 1226, the nut may be automatically tightened.

[0123] In 1228, the completion of the irrigation may be prompted to a user.

[0124] It should be noted that the description of the process 1200 is provided for the purposes of illustration, and is not intended to limit the scope of the present disclosure. For persons having ordinary skills in the art, various variations and modifications may be conducted under the teaching of the present disclosure. However, those variations and modifications may not depart from the protection of the present disclosure.

[0125] FIG. 13 is a block diagram illustrating an exemplary processing device 140 according to some embodiments of the present disclosure. In some embodiments, the modules illustrated in FIG. 13 may be implemented on the processing device 140. In some embodiments, the processing device 140 may be in communication with a computer-readable storage medium (e.g., the storage device 150 illustrated in FIG. 1) and may execute instructions stored in the computer-readable

storage medium. The processing device 140 may include a determination module 1310 and a generation module 1320.

[0126] The determination module 1310 may be configured to determine, based on operational data of a medical system, abnormal information of the medical system. More descriptions regarding the determination of the abnormal information may be found elsewhere in the present disclosure. See, e.g., operation 1402 and relevant descriptions thereof.

[0127] The generation module 1320 may be configured to generate prompt information for prompting the abnormal information of the medical system. The prompt information may include image data encoding at least one of the abnormal information or system information of the medical system. More descriptions regarding the generation of the prompt information may be found elsewhere in the present disclosure. See, e.g., operation 1404 and relevant descriptions thereof.

[0128] The modules in the processing device 140 may be connected to or communicate with each other via a wired connection or a wireless connection. The wired connection may include a metal cable, an optical cable, a hybrid cable, or the like, or any combination thereof. The wireless connection may include a Local Area Network (LAN), a Wide Area Network (WAN), a Bluetooth, a ZigBee, a Near Field Communication (NFC), or the like, or any combination thereof.

[0129] It should be noted that the above descriptions of the processing device 140 are provided for the purposes of illustration, and are not intended to limit the scope of the present disclosure. For persons having ordinary skills in the art, various variations and modifications may be conducted under the guidance of the present disclosure. However, those variations and modifications do not depart from the scope of the present disclosure. In some embodiments, the processing device 140 may include one or more other modules. For example, the processing device 140 may include a storage module to store data generated by the modules in the processing device 140. In some embodiments, any two of the modules may be combined as a single module, and any one of the modules may be divided into two or more units.

[0130] FIG. 14 is a flowchart illustrating an exemplary process 1400 for prompting an abnormal condition of a medical system according to some embodiments of the present disclosure. Process 1400 may be implemented in the prompting system 100 illustrated in FIG. 1. For example, the process 1400 may be stored in the storage device 150 in the form of instructions (e.g., an application), and invoked and/or executed by the processing device 140. The operations of the

illustrated process presented below are intended to be illustrative. In some embodiments, the process 300 may be accomplished with one or more additional operations not described, and/or without one or more of the operations discussed. Additionally, the order in which the operations of the process 1400 as illustrated in FIG. 14 and described below is not intended to be limiting.

[0131] In some embodiments, when an abnormal condition of a medical system occurs, a user cannot solve the abnormal condition. Therefore, the user needs to contact a service engineer responsible for the medical system. The service engineer can obtain abnormal information of the medical system provided by the user, so that the service engineer can rush to the scene with repair equipment corresponding to the abnormal condition. Alternatively, the service engineer can remotely control or instruct the user to solve the abnormal condition.

[0132] Conventionally, the abnormal information of the medical system may be prompted through a code corresponding to the abnormal information and/or a text describing the abnormal information. However, the text may include related technical terms or types of the abnormal conditions that the user roughly knows, while the code may include only a sequence code corresponding to the abnormal information that the user does not know the meaning of the code. Therefore, the text and the code only can provide insufficient abnormal information for the service engineer. The service engineer needs to perform multiple complex detection procedures on the medical system based on the text description and the code to determine the abnormal condition of the medical system, which prolongs a repair time. In addition, the text and the code are easy to be mistaken, and are difficult to read when transmitted through photography.

[0133] In some embodiments, the abnormal information of the medical system can be provided to the service engineer by displaying in text, which partially solves the problem of the insufficient abnormal information. However, a large amount of text may cause confusion and a psychological burden to the user. The large amount of text is easy to be mistaken, and is difficult to read when transmitted through photography. In addition, a size of a display screen of the medical system is required to display the large amount of text, which increases the cost of the medical system. Therefore, the process 300 may be performed to efficiently and accurately prompt the abnormal information of the medical system.

[0134] In 1402, the processing device 140 (e.g., the determination module 1310) may determine, based on operational data of a medical system, abnormal information of the medical system.

[0135] The operational data may refer to data and/or information of the medical system when the medical system is operating. In some embodiments, the operational data may include a temperature, a humidity, etc., of the medical system (e.g., each component of the medical system 110), an environmental temperature, an environmental humidity, etc., of a location where the medical system is located, operational efficiency of the medical system, or the like, or any combination thereof. Merely by way of example, if the medical system includes a rod source phantom irrigation system (e.g., the rod source phantom irrigation system 200, the rod source phantom irrigation system 600, the rod source phantom irrigation system 900, the rod source phantom irrigation system 1000, the rod source phantom irrigation system 1100, etc.), the operational data may include a first operational parameter of a cover opening module, a second operational parameter of a liquid level detection module, a height of a liquid level obtained by the liquid level detection module, a type and a dose of a radioactive source injected by a source irrigation module into a source liquid production module, a type and a dose of a solvent, a third operational parameter of the source liquid production module, or the like, or any combination thereof.

[0136] In some embodiments, the processing device 140 may obtain the operational data of the medical system continuously or intermittently (e.g., periodically). For example, the medical system 110 (or one or more sensors mounted on the medical system 110) may collect the operational data of the medical system 110 in real-time when the medical system 110 is operating, and the processing device 140 may obtain the operational data of the medical system 110 from the medical system 110 (or the one or more sensors) continuously or intermittently. As another example, the processing device 140 may obtain the operational data of the medical system 110 from a storage device (e.g., the storage device 150, a database, or an external storage device) that stores the operational data of the medical system 110.

[0137] The abnormal information may refer to information reflecting that an abnormal condition of the medical system occurs.

[0138] In some embodiments, the processing device 140 may determine whether a portion of the operational data of the medical system satisfies a first condition. The first condition may refer to a condition that a portion of the operational data of the medical system is abnormal. In some embodiments, the first condition may include that the temperature of the medical system (or each component of the medical system) exceeds a first temperature threshold, the humidity of the medical

system exceeds a first humidity threshold, the environmental temperature exceeds a second temperature threshold, the environmental humidity exceeds a second humidity threshold, the operational efficiency of the medical system does not exceed an efficiency threshold, or the like, or any combination thereof. The first temperature threshold, the first humidity threshold, the second temperature threshold, the second humidity threshold, and/or the efficiency threshold may be determined based on a system default setting or set manually by a user (e.g., a doctor, a technician).

[0139] Merely by way of example, if the medical system includes a rod source phantom irrigation system (e.g., the rod source phantom irrigation system 200, the rod source phantom irrigation system 600, the rod source phantom irrigation system 900, the rod source phantom irrigation system 1000, the rod source phantom irrigation system 1100, etc.), the first condition may further include that the first operational parameter exceeds a first operational threshold, the height of the liquid level exceeds a height threshold, the type of the radioactive source does not matched with a preset type of the radioactive source, the dose of the radioactive source does not exceed a preset dose threshold, the second operational parameter exceeds a second operational threshold, the third operational parameter exceeds a third operational threshold, etc.

[0140] In some embodiments, in response to determining that a portion of the operational data of the medical system satisfies the first condition, the processing device 140 may determine the portion of the operational data as the abnormal information of the medical system. For example, in response to determining that the temperature of the medical system exceeds the first temperature threshold, the humidity of the medical system exceeds the first humidity threshold, the environmental temperature does not exceed the second temperature threshold, the environmental humidity does not exceed the second humidity threshold, and the operational efficiency of the medical system exceeds the efficiency threshold, the processing device 140 may determine the temperature of the medical system, the humidity of the medical system, and the operational efficiency of the medical system as the abnormal information of the medical system.

[0141] In 1404, the processing device 140 (e.g., the generation module 1320) may generate prompt information for prompting the abnormal information of the medical system. The prompt information may include image data encoding at least one of the abnormal information or system information of the medical system.

[0142] In some embodiments, the prompt information may include the image data, a code corresponding to the abnormal information, a text describing the abnormal information, or the like, or any combination thereof. The image data may include a barcode, a two-dimensional (2D) code, a compressed image, or the like, or any combination thereof. For example, the 2D code may include a static 2D code and/or a dynamic 2D code. As another example, the 2D code may include a data matrix, a maxi code, Aztec, a quick response (QR) code, Vericode, PDF417, Ultracode, Code 49, Code 16K, or the like, or any combination thereof.

[0143] In some embodiments, the abnormal information may be encoded in the image data. In some embodiments, the 2D code may be generated based on JavaScript Object Notation (JSON) data, which can reduce a count of bytes required to describe same information. Alternatively or additionally, the 2D code may include information encoded based on a preset encoding manner. Exemplary preset encoding manners may include an American standard code for information interchange (ASCII) manner, a Unicode encoding manner (e.g., a GB2312 encoding manner, a GBK encoding manner, a Unicode transformation format (UTF-8) encoding manner, etc.), or the like, or any combination thereof.

[0144] In some embodiments, the prompt information needs include enough information for a target user (e.g., a service engineer) to determine the abnormal condition of the medical system. For example, information entropy of the image data in the prompt information may exceed a preset bit threshold. The information entropy may refer to information entropy in Shannon's "Information Theory." In some embodiments, if a count of the possibility corresponding to the image data is "N," the information entropy of the image data may be " $\log_2 N$."

[0145] In some embodiments, the preset bit threshold may be determined based on a system default setting or set manually by the user. For example, the preset bit threshold may be 1024 bits. When the preset bit threshold is 1024 bits, a transmission efficiency of the image data in the prompt information may be larger than a transmission efficiency of the text describing the abnormal information. For instance, 1024 bits may correspond to 64 Chinese characters, which can improve an amount of the prompt information. It should be noted that, setting the preset bit threshold as 1024 bits is an example, and 1024 bits is a minimum value of the preset bit threshold.

[0146] Merely by way of example, when the image data is a 2D code, the image data may include 500 Chinese characters, which can be enough to provide the prompt information. In some

embodiments, when the prompt information is encoded based on the preset encoding manner, the amount of the prompt information may be improved.

[0147] As another example, the processing device 140 may determine a count of bits corresponding to the prompt information. In response to determining that the count of bits corresponding to the prompt information is less than a capacity of a static 2D code, the processing device 140 may encode the prompt information in the static 2D code. In response to determining that the count of bits corresponding to the prompt information is equal to or larger than the capacity of the static 2D code, the processing device 140 may encode the prompt information in the dynamic 2D code.

[0148] In some embodiments, system information of the medical system may be encoded in the image data. For example, the system information of the medical system may be encoded in the image data based on the preset encoding manner. In some embodiments, the preset encoding manner corresponding to the system information of the medical system may be the same as or similar to the preset encoding manner corresponding to the abnormal information.

[0149] In some embodiments, the system information may include a serial number of the medical system, an information prompting time, a current software version of the medical system, a calibration time of the medical system, a current state of the medical system, log information of the medical system in a preset time period, code information related to the abnormal information, turn-on information of the medical system, turn-off information of the medical system, or the like, or any combination thereof.

[0150] The serial number of the medical system may refer to an identify number of the medical system. Each medical system may correspond to a unique serial number. Therefore, the medical system including the abnormal condition may be determined based on the serial number of the medical system.

[0151] The information prompting time may refer to a time when the prompt information is generated. For example, when the prompt information is generated, the information prompting time may be determined.

[0152] The current software version of the medical system may refer to a software version of an application operated on the medical system.

[0153] The calibration time of the medical system may refer to a time when the medical system is calibrated previously. For example, when the medical system is calibrated, the calibration time of the medical system may be updated.

[0154] The current state of the medical system may refer to a state of the medical system when the abnormal condition of the medical system occurs. For example, if the medical system is imaging a subject when the abnormal condition of the medical system occurs, the current state of the medical system may be determined as an operating state. As another example, if the medical system is pending when the abnormal condition of the medical system occurs, the current state of the medical system may be determined as a pending state. As still another example, if the medical system is shutdown when the abnormal condition of the medical system occurs, the current state of the medical system may be determined as a shutdown state.

[0155] The log information of the medical system in the preset time period may refer to information of one or more operations that the medical system performed in the preset time period. The preset time period may be determined based on a system default setting or set manually by the user, e.g., a time period from ten minutes before the abnormal condition occurs to a time point when the abnormal condition occurs.

[0156] The code information related to the abnormal information may refer to descriptions of the code corresponding to the abnormal information. In some embodiments, the code information related to the abnormal information may include a text describing the abnormal information, a solution for processing the abnormal condition, or the like, or any combination thereof. The solution for processing the abnormal condition may include an analysis of the abnormal condition, a candidate tool for processing the abnormal condition, a processing operation, or the like, or any combination thereof. In some embodiments, the solution for processing the abnormal condition may be stored in a storage, and the processing device 140 may obtain the solution by retrieving the storage. For example, different candidate solutions may be determined for different abnormal conditions (or different abnormal information), and the processing device 140 may determine the solution from the candidate solutions based on the abnormal condition (or the abnormal information). As another example, the processing device 140 may determine the solution based on the abnormal condition (or the abnormal information) and historical data including historical abnormal conditions and historical solutions.

[0157] The turn-on information of the medical system may refer to information relating to a turn-on operation of the medical system. In some embodiments, the turn-on information may include a last time point when the medical system is turned on, a time period that the medical system spent on the last turn-on operation, etc.

[0158] The turn-off information of the medical system may refer to information relating to a turn-off operation of the medical system. In some embodiments, the turn-off information may include a last time point when the medical system is turned off, a time period that the medical system spent on the last turn-off operation, a last time point when the medical system is power-off, etc.

[0159] In some embodiments, the prompt information may further include the code corresponding to abnormal information and/or the text describing the abnormal information. The code corresponding to the abnormal information may include a sequence code representing the abnormal information. For example, a corresponding relationship (e.g., a table) between a plurality of codes and abnormal information. The text may describe the abnormal information. For example, the text may include related technical terms or types of the abnormal conditions.

[0160] Since the abnormal information and/or the system information of the medical system are encoded in the image data, the user may obtain the abnormal information and/or the system information of the medical system through a decoder (e.g., a mobile phone). Alternatively, the user may transmit the abnormal information and/or the system information of the medical system through a photography device (e.g., a camera). By providing the code corresponding to abnormal information and/or the text describing the abnormal information, the prompt information may be provided to the user visually. Therefore, the user may provide a portion of the prompt information without the decoder or the photography device.

[0161] Merely by way of example, referring to FIG. 15, FIG. 15 is a schematic diagram illustrating an exemplary prompt information according to some embodiments of the present disclosure.

[0162] As shown in FIG. 15, prompt information may include a 2D code 402, a code 1504 corresponding to abnormal information, and a text 1506 describing the abnormal information. For example, when a medical system detects that a humidity of the medical system exceeds the first humidity threshold, prompt information may be generated. The prompt information may include the 2D code 1502, the code 1504 (i.e., "P00001") corresponding to the abnormal information, and the

text 1506 that prompts “Humidity of the medical system exceeds the first humidity threshold, please detect the environmental humidity.”

[0163] In some embodiments, the system information may include fixed information and variable information. The fixed information may refer to information that is fixedly encoded in the image data. The variable information may refer to information that is variably encoded in the image data.

[0164] In some embodiments, a portion of the system information may be described in a little amount of text and be helpful for the analysis of the abnormal condition. Therefore, the portion of the system information may be determined as a fixed content (i.e., the fixed information) of the image data. Exemplary fixed information may include the serial number of the medical system, the information prompting time, the current software version, the calibration time of the medical system, the code information, the turn-on information of the medical system, the turn-off information of the medical system, or the like, or any combination thereof.

[0165] In some embodiments, a portion of the system information may be described in a large amount of content, and not all the portion of the system information may be helpful for the analysis of the abnormal condition. Therefore, the portion of the system information may be determined as a variable content (i.e., the variable information) of the image data. Exemplary variable information may include the current state of the medical system and/or the log information of the medical system in the preset time period.

[0166] Since the amount of the image data is fixed, the processing device 140 may determine the variable information before the prompt information is generated by encoding the abnormal information and/or the system information.

[0167] In some embodiments, the processing device 140 may determine, based on the abnormal information, the variable information. For example, the processing device 140 may determine, based on the abnormal information, an error reporting component of the medical system. The error reporting component may refer to a component including an abnormal condition. For example, in response to determining that a temperature of a component in the medical system exceeds the first temperature threshold, the processing device 140 may determine the component as the error reporting component of the medical system. Further, the processing device 140 may determine, based on information of the error reporting component, the variable information. The information of the error reporting component may include log information of the error reporting component, a

current state of the error reporting component, or the like, or any combination thereof. For instance, the processing device 140 may designate the information of the error reporting component as a portion of the variable information.

[0168] As another example, the processing device 140 may determine an associated component of the error reporting component in the medical system based on the abnormal information. The associated component may be a component associated with the error reporting component. For instance, the associated component may include a component connected to the error reporting component, a component around the error reporting component, or the like, or any combination thereof. The processing device 140 may determine, based on information of the associated component, the variable information. The information of the associated component may include log information of the associated component, a current state of the associated component, or the like, or any combination thereof. For instance, the processing device 140 may designate the information of the associated component as a portion of the variable information.

[0169] In some embodiments, the processing device 140 may determine the variable information using an importance degree prediction model. For example, the processing device 140 may obtain candidate variable information including the current state of the medical system and the log information of the medical system in the preset time period. The processing device 140 may determine, based on the abnormal information, an importance degree of the candidate variable information using the importance degree prediction model. The importance degree prediction model may be a machine learning model. Further, the processing device 140 may select, based on the importance degree, the variable information from the candidate variable information. More descriptions regarding the determination of the variable information using the importance degree prediction model may be found elsewhere in the present disclosure (e.g., FIG. 16 and the descriptions thereof).

[0170] In some embodiments, the processing device 140 may encode the fixed information and the variable information in the image data. For example, the fixed information and the variable information may be encoded in the image data based on a preset encoding manner.

[0171] In some embodiments, the processing device 140 may receive an information acquisition instruction for requesting specific information of the medical system. The specific information may be used for the analysis of the abnormal condition. In some embodiments, the user may input the

information acquisition instruction through a user interface. For example, the user may input the information acquisition instruction, through a keyboard, a mouse, a touch screen, etc.

[0172] In some embodiments, the processing device 140 may generate, based on the information acquisition instruction, the image data to encode the requested specific information of the medical system. For example, the processing device 140 may determine, based on the information acquisition instruction, the requested specific information of the medical system from the abnormal information and/or the system information, and generate the image data by encoding the requested specific information of the medical system.

[0173] In some embodiments, the processing device 140 may display the prompt information through a user interface of the medical system (e.g., a user interface module 1070).

[0174] In some embodiments, the prompt information may be transmitted to a target user (e.g., a service engineer). For example, the processing device 140 may transmit the prompt information to a terminal of the target user, and the target user may obtain the prompt information through a user interface of the terminal. As another example, the user may acquire an image including the prompt information through photography, and transmit the image to the target user (e.g., a terminal of the target user). By obtaining the image including the prompt information, the prompt information may be retained in the image, which can reduce a difficulty of the transmission of the prompt information. In some embodiments, a portion of the prompt information may be used for error correction, which can reduce a possibility that the prompt information is lost during the transmission.

[0175] In some embodiments, the photography may refer to a manner of copying with light (or electromagnetic waves) as an intermediary. The photography may include shooting, scanning, copying, etc., that can reproduce a content of the prompt information but may distort the prompt information during the copying process.

[0176] In some embodiments, before the prompt information is transmitted to the target user, the processing device 140 may determine the target user from one or more candidate users. For example, the processing device 140 may determine the target user from one or more candidate users based on the prompt information. For instance, when the prompt information corresponds to a seriously and urgently abnormal condition of the medical system, the processing device 140 may determine a candidate user who has time to process the abnormal condition immediately as the target user. When the prompt information corresponds to a non-urgently abnormal condition, the

processing device 140 may determine a candidate user who is good at processing the abnormal condition as the target user. In some embodiments, the processing device 140 may directly transmit the prompt information to the target user when the abnormal condition of the medical system is serious and urgent.

[0177] In some embodiments, after the target user obtains the prompt information, the target user may decode the prompt information to obtain the abnormal information and/or the system information. For example, the prompt information may be decoded through a decoder. In some embodiments, the decoding manner may correspond to the encoding manner. For example, if the abnormal information and/or the system information are encoded through a Unicode encoding manner, the prompt information may be decoded through a Unicode decoding manner.

[0178] In some embodiments, the decoder may be the same as or different from the terminal of the target user. For example, the target user may obtain the prompt information and decode the prompt information through a mobile phone. As another example, the target user may obtain the prompt information through a computer, and decode the prompt information through a mobile phone.

[0179] According to some embodiments of the present disclosure, the abnormal information of the medical system may be determined based on the operational data of the medical system, and the prompt information for prompting the abnormal information of the medical system may be generated, which can provide enough information for the target user to determine the abnormal condition of the medical system when the target user does not arrive on site, thereby improving the accuracy and efficiency of the determination of the abnormal condition. By determining the abnormal condition of the medical system, the target user may arrive at the scene with repair equipment corresponding to the abnormal condition. Alternatively, the target user may remotely control or instruct the user to solve the abnormal condition, which can improve the accuracy and efficiency of the solving of the abnormal condition. In addition, the prompt information may be generated through an encoding manner, which can reduce a possibility that the prompt information is lost during the transmission, thereby improving the accuracy of the prompt information during the transmission.

[0180] It should be noted that the description of the process 1400 is provided for the purposes of illustration, and is not intended to limit the scope of the present disclosure. For persons having ordinary skills in the art, various variations and modifications may be conducted under the teaching

of the present disclosure. However, those variations and modifications may not depart from the protection of the present disclosure.

[0181] FIG. 16 is a flowchart illustrating an exemplary process 1600 for selecting variable information from candidate variable information according to some embodiments of the present disclosure. In some embodiments, the process 1600 may be performed to achieve at least part of operation 1404 as described in connection with FIG. 14.

[0182] In 1602, the processing device 140 (e.g., the determination module 1310) may obtain candidate variable information including a current state of a medical system and log information of the medical system in a preset time period.

[0183] The candidate variable information may refer to information that is described in a large amount of content, and cannot be helpful for the analysis of an abnormal condition of the medical system. In some embodiments, the processing device 140 may obtain the current state of the medical system and the log information of the medical system in the preset time period as the candidate variable information.

[0184] In some embodiments, the processing device 140 may obtain the current state of the medical system and the log information of the medical system in the preset time period from the medical system 110 or a storage device (e.g., the storage device 150, a database, or an external storage device) that stores the current state of the medical system and the log information of the medical system in the preset time period. Accordingly, the processing device 140 may determine the current state of the medical system and the log information of the medical system in the preset time period as the candidate variable information.

[0185] In 1604, the processing device 140 (e.g., the determination module 1310) may determine, based on abnormal information, an importance degree of the candidate variable information using an importance degree prediction model. The importance degree prediction model may be a machine learning model.

[0186] The importance degree may refer to a degree of influence of the candidate variable information on analyzing the abnormal condition of the medical system. The larger the importance degree, the higher the degree of influence of the candidate variable information on analyzing the abnormal condition of the medical system.

[0187] In some embodiments, the candidate variable information may be input into the importance degree prediction model, and the importance degree prediction model may output the importance degree of the candidate variable information.

[0188] In some embodiments, the importance degree prediction model may include an embedding layer and an importance degree determination layer.

[0189] In some embodiments, a first input of the embedding layer may include the candidate variable information, and a first output of the embedding layer may include at least one information segment of the candidate variable information. An information segment of the candidate variable information may refer to a portion of information obtained by segmented the candidate variable information according to a dividing standard (e.g., a content of the candidate variable information, a time of the candidate variable information, a type of the candidate variable information, etc.). For example, the current state of the medical system may be segmented into at least one information segment based on information types. As another example, the log information of the medical system in the preset time period may be segmented into at least one information segment based on different components of the medical system.

[0190] A second input of the importance degree determination layer may include code information and the at least one information segment, and a second output of the importance degree determination layer may include an importance degree of each of the at least one information segment. For example, the importance degree determination layer may determine a relevance degree between each of the at least one information segment and the code information, and designate the relevance degree of each of the at least one information segment as the importance degree of each of the at least one information segment.

[0191] In some embodiments, the importance degree prediction model may be obtained by training an initial model based on a plurality of training samples. In some embodiments, each of the plurality of training samples may include a sample current state of a sample medical system, sample log information of the sample medical system in the preset time period, and sample code information as an input of the initial model, and a sample importance degree of each of at least one sample information segment of the sample current state and the sample log information as a label. In some embodiments, the sample importance degree may be manually labelled. For the sample current state, the sample importance degree may be labelled on each information type of the sample current

state. For the sample log information, the sample importance degree may be labelled on each portion of the sample log information corresponding to each component of the sample medical system.

[0192] The obtaining of the sample current state of the sample medical system, the sample log information of the sample medical system in the preset time period, and the sample code information may be similar to the obtaining of the system information described in operation 1404. In some embodiments, the processing device 140 may obtain the plurality of training samples by retrieving (e.g., through a data interface) a database or a storage device.

[0193] During the training of the initial model, the plurality of training samples may be input to the initial model, and parameter(s) of the initial model may be updated through one or more iterations. For example, the processing device 140 may input the sample current state of the sample medical system, the sample log information of the sample medical system in the preset time period, and the sample code information of each training sample into the initial model, and obtain a prediction result. The processing device 140 may determine a loss function based on the prediction result and the label (i.e., the sample importance degree of each of the at least one sample information segment of the sample current state and the sample log information) of each training sample. The loss function may be associated with a difference between the prediction result and the label. The processing device 140 may adjust the parameter(s) of the initial model based on the loss function to reduce the difference between the prediction result and the label, for example, by continuously adjusting the parameter(s) of the initial model to reduce or minimize the loss function.

[0194] In some embodiments, the loss function may be a perceptual loss function, a squared loss function, a logistic regression loss function, etc.

[0195] In some embodiments, the importance degree prediction model may also be obtained according to other training manners. For example, the importance degree prediction model may be obtained based on an initial learning rate (e.g., 0.1) and/or an attenuation strategy using the plurality of training samples.

[0196] In 1606, the processing device 140 (e.g., the determination module 1310) may select, based on the importance degree, variable information from the candidate variable information.

[0197] For example, the processing device 140 may rank the at least one information segment based on the importance degree, and select top N information segments from the candidate variable information as the variable information.

[0198] According to some embodiments, the variable information may be selected from the candidate variable information using the importance degree prediction model, which can improve the efficiency of the determination of the variable information, thereby improving the efficiency of the generation of the prompting information.

[0199] It should be noted that the description of the process 1600 is provided for the purposes of illustration, and is not intended to limit the scope of the present disclosure. For persons having ordinary skills in the art, various variations and modifications may be conducted under the teaching of the present disclosure. However, those variations and modifications may not depart from the protection of the present disclosure.

[0200] Having thus described the basic concepts, it may be rather apparent to those skilled in the art after reading this detailed disclosure that the foregoing detailed disclosure is intended to be presented by way of example only and is not limiting. Various alterations, improvements, and modifications may occur and are intended for those skilled in the art, though not expressly stated herein. These alterations, improvements, and modifications are intended to be suggested by this disclosure, and are within the spirit and scope of the exemplary embodiments of this disclosure.

[0201] Moreover, certain terminology has been used to describe embodiments of the present disclosure. For example, the terms “one embodiment,” “an embodiment,” and/or “some embodiments” mean that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present disclosure. Therefore, it is emphasized and should be appreciated that two or more references to “an embodiment” or “one embodiment” or “an alternative embodiment” in various portions of this disclosure are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined as suitable in one or more embodiments of the present disclosure.

[0202] Furthermore, the recited order of processing elements or sequences, or the use of numbers, letters, or other designations therefore, is not intended to limit the claimed processes and methods to any order except as may be specified in the claims. Although the above disclosure discusses through various examples what is currently considered to be a variety of useful

embodiments of the disclosure, it is to be understood that such detail is solely for that purpose, and that the appended claims are not limited to the disclosed embodiments, but, on the contrary, are intended to cover modifications and equivalent arrangements that are within the spirit and scope of the disclosed embodiments. For example, although the implementation of various components described above may be embodied in a hardware device, it may also be implemented as a software only solution, e.g., an installation on an existing server or mobile device.

[0203] Similarly, it should be appreciated that in the foregoing description of embodiments of the present disclosure, various features are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure aiding in the understanding of one or more of the various inventive embodiments. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed subject matter requires more features than are expressly recited in each claim. Rather, inventive embodiments lie in less than all features of a single foregoing disclosed embodiment.

[0204] In some embodiments, the numbers expressing quantities or properties used to describe and claim certain embodiments of the application are to be understood as being modified in some instances by the term “about,” “approximate,” or “substantially.” For example, “about,” “approximate,” or “substantially” may indicate $\pm 20\%$ variation of the value it describes, unless otherwise stated. Accordingly, in some embodiments, the numerical parameters set forth in the written description and attached claims are approximations that may vary depending upon the desired properties sought to be obtained by a particular embodiment. In some embodiments, the numerical parameters should be construed in light of the number of reported significant digits and by applying ordinary rounding techniques. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of some embodiments of the application are approximations, the numerical values set forth in the specific examples are reported as precisely as practicable.

[0205] Each of the patents, patent applications, publications of patent applications, and other material, such as articles, books, specifications, publications, documents, things, and/or the like, referenced herein is hereby incorporated herein by this reference in its entirety for all purposes, excepting any prosecution file history associated with same, any of same that is inconsistent with or in conflict with the present document, or any of same that may have a limiting effect as to the broadest scope of the claims now or later associated with the present document. By way of

example, should there be any inconsistency or conflict between the description, definition, and/or the use of a term associated with any of the incorporated material and that associated with the present document, the description, definition, and/or the use of the term in the present document shall prevail.

[0206] In closing, it is to be understood that the embodiments of the application disclosed herein are illustrative of the principles of the embodiments of the application. Other modifications that may be employed may be within the scope of the application. Thus, by way of example, but not of limitation, alternative configurations of the embodiments of the application may be utilized in accordance with the teachings herein. Accordingly, embodiments of the present application are not limited to that precisely as shown and described.

WHAT IS CLAIMED IS:

1. A method for prompting an abnormal condition of a medical system, implemented on a computing device having at least one processor and at least one storage device, the method comprising:

determining, based on operational data of the medical system, abnormal information of the medical system; and

generating prompt information for prompting the abnormal information of the medical system, wherein the prompt information includes image data encoding at least one of the abnormal information or system information of the medical system.

2. The method of claim 1, wherein the image data includes at least one of a barcode or a two-dimensional (2D) code.

3. The method of claim 2, wherein the system information includes at least one of a serial number of the medical system, an information prompting time, a current software version of the medical system, a calibration time of the medical system, a current state of the medical system, log information of the medical system in a preset time period, code information related to the abnormal information, turn-on information of the medical system, or turn-off information of the medical system.

4. The method of claim 3, wherein the system information includes fixed information and variable information; and

the generating prompt information for prompting the abnormal information of the medical system includes:

determining, based on the abnormal information, the variable information; and

encoding the fixed information and the variable information in the image data, wherein the fixed information includes at least one of the serial number of the medical system, the information prompting time, the current software version, the calibration time of the medical system, the code information, the turn-on information of the medical system, or the turn-off information of the medical system, and the variable information includes at least one of the current state of the medical system or the log information of the medical system in the preset time period.

5. The method of claim 4, wherein the determining, based on the abnormal information, the variable information includes:

determining, based on the abnormal information, an error reporting component of the medical system; and

determining, based on information of the error reporting component, the variable information, wherein the information of the error reporting component includes at least one of log information of the error reporting component or a current state of the error reporting component.

6. The method of claim 5, wherein the determining, based on the abnormal information, the variable information further includes:

determining, in the medical system based on the abnormal information, an associated component of the error reporting component; and

determining, based on information of the associated component, the variable information, wherein the information of the associated component includes at least one of log information of the associated component or a current state of the associated component.

7. The method of claim 4, wherein the determining, based on the abnormal information, the variable information includes:

obtaining candidate variable information including the current state of the medical system and the log information of the medical system in the preset time period;

determining, based on the abnormal information, an importance degree of the candidate variable information using an importance degree prediction model, wherein the importance degree prediction model is a machine learning model; and

selecting, based on the importance degree, the variable information from the candidate variable information.

8. The method of claim 7, wherein the importance degree prediction model includes:

an embedding layer, wherein a first input of the embedding layer includes the candidate variable information, and a first output of the embedding layer includes at least one information segment of the candidate variable information; and

an importance degree determination layer, wherein a second input of the importance degree determination layer includes the code information and the at least one information segment, and a second output of the importance degree determination layer includes an importance degree of each of the at least one information segment.

9. The method of claim 2, wherein the 2D code includes a dynamic 2D code.

10. The method of claim 2, wherein

the 2D code is generated based on JavaScript Object Notation (JSON) data, or

the 2D code includes information encoded based on a preset encoding manner.

11. The method of claim 1, further comprising:

receiving an information acquisition instruction for requesting specific information of the medical system; and

generating, based on the information acquisition instruction, the image data to encode the requested specific information of the medical system.

12. The method of claim 1, wherein the prompt information further includes at least one of a code corresponding to the abnormal information or a text describing the abnormal information.

13. The method of claim 1, wherein the medical system includes a rod source phantom irrigation system including a source liquid production module, a conveying module, a rod source module, and a control module; wherein

the rod source module includes a rod source phantom;

the source liquid production module is connected to the conveying module, the source liquid production module being configured to generate, based on a first instruction sent by the control module, a mixed solution by mixing an injected radioactive source and a solvent with a preset ratio;

the conveying module is connected to the rod source phantom in the rod source module, the conveying module being configured to transmit, based on a second instruction sent by the control

module, the mixed solution from the source liquid production module to the rod source phantom in the rod source module; and

the control module is in communication with the source liquid production module and the conveying module, respectively, the control module being configured to control the source liquid production module to generate the mixed solution and the conveying module to transmit the mixed solution.

14. The method of claim 13, wherein

the source liquid production module includes a liquid container and a stirring unit disposed in the liquid container;

the conveying module includes a conveying pipe and a conveying control unit, one end of the conveying pipe being connected with the liquid container, and another end of the conveying pipe being connected with the rod source phantom; and

the control module is in communication with the stirring unit and the conveying control unit, respectively; wherein

the stirring unit is configured to generate, based on the first instruction sent by the control module, the mixed solution by mixing the injected radioactive source and the solvent with the preset ratio;

the conveying control unit is configured to transmit, based on the second instruction sent by the control module, the mixed solution from the source liquid production module to the rod source phantom in the rod source module.

15. The method of claim 13, wherein the rod source phantom irrigation system further includes a cover opening module in communication with the control module, wherein

the cover opening module is configured to open a cover of the rod source phantom based on a third instruction sent by the control module or close the cover of the rod source phantom based on a fourth instruction sent by the control module.

16. The method of claim 13, wherein the rod source phantom irrigation system further includes a liquid level detection module in communication with the control module, wherein

the liquid level detection module is configured to detect a height of a liquid level in the rod source phantom and send the height of the liquid level to the control module; and

the control module is further configured to:

determining, based on the height of the liquid level, whether the height of the liquid level exceeds a preset liquid level threshold; and

in response to determining that the height of the liquid level exceeds the preset liquid level threshold, sending a fifth instruction for stopping the transmission of the mixed solution to the conveying module.

17. The method of claim 13, wherein the rod source module further includes a rod source phantom fixing unit and a pressure sensor, wherein

the rod source phantom fixing unit is configured to fix the rod source phantom, and

the pressure sensor is in communication with the control module, the pressure sensor being configured to detect a pressure on the rod source phantom fixing unit and transmit the detected pressure to the control module; and

the control module is further configured to:

determining, based on the detected pressure, a type of the rod source phantom; and

determining, based on the type of the rod source phantom, at least one operational parameter of the medical system, the at least one operational parameter including a first operational parameter of a cover opening module and a second operational parameter of a liquid level detection module.

18. The method of claim 17, wherein the rod source phantom irrigation system further includes a source irrigation module configured to inject the radioactive source and the solvent with the preset ratio into the source liquid production module.

19. The method of claim 13, wherein the operational data includes at least one of a first operational parameter of a cover opening module, a second operational parameter of a liquid level detection module, a height of a liquid level obtained by the liquid level detection module, a type and a dose of the radioactive source injected by a source irrigation module into the source liquid production module,

a type and a dose of the solvent, or a third operational parameter of the source liquid production module.

20. The method of claim 13, wherein the rod source phantom irrigation system further includes a user interaction module in communication with the control module; wherein

the user interaction module is configured to obtain a user instruction, and/or display the operational data of the medical system and/or the prompt information to a user.

21. A system for prompting an abnormal condition of a medical system, comprising:

at least one storage device including a set of instructions; and

at least one processor configured to communicate with the at least one storage device, wherein when executing the set of instructions, the at least one processor is configured to direct the system to perform operations including:

determining, based on operational data of the medical system, abnormal information of the medical system; and

generating prompt information for prompting the abnormal information of the medical system, wherein the prompt information includes image data encoding at least one of the abnormal information or system information of the medical system.

22. The system of claim 21, wherein the medical system includes a rod source phantom irrigation system including a source liquid production module, a conveying module, a rod source module, and a control module; wherein

the rod source module includes a rod source phantom;

the source liquid production module is connected to the conveying module, the source liquid production module being configured to generate, based on a first instruction sent by the control module, a mixed solution by mixing an injected radioactive source and a solvent with a preset ratio;

the conveying module is connected to the rod source phantom in the rod source module, the conveying module being configured to transmit, based on a second instruction sent by the control module, the mixed solution from the source liquid production module to the rod source phantom in the rod source module; and

the control module is in communication with the source liquid production module and the conveying module, respectively, the control module being configured to control the source liquid production module to generate the mixed solution and the conveying module to transmit the mixed solution.

23. A rod source phantom irrigation system, comprising:

a source liquid production module, a conveying module, a rod source module, and a control module; wherein

the rod source module includes a rod source phantom;

the source liquid production module is connected to the conveying module, the source liquid production module being configured to generate, based on a first instruction sent by the control module, a mixed solution by mixing an injected radioactive source and a solvent with a preset ratio;

the conveying module is connected to the rod source phantom in the rod source module, the conveying module being configured to transmit, based on a second instruction sent by the control module, the mixed solution from the source liquid production module to the rod source phantom in the rod source module; and

the control module is in communication with the source liquid production module and the conveying module, respectively, the control module being configured to control the source liquid production module to generate the mixed solution and the conveying module to transmit the mixed solution.

24. The system of claim 23, wherein

the source liquid production module includes a liquid container and a stirring unit disposed in the liquid container;

the conveying module includes a conveying pipe and a conveying control unit, one end of the conveying pipe being connected with the liquid container, and another end of the conveying pipe being connected with the rod source phantom; and

the control module is in communication with the stirring unit and the conveying control unit, respectively; wherein

the stirring unit is configured to generate, based on the first instruction sent by the control module, the mixed solution by mixing the injected radioactive source and the solvent with the preset ratio;

the conveying control unit is configured to transmit, based on the second instruction sent by the control module, the mixed solution from the source liquid production module to the rod source phantom in the rod source module.

25. The system of claim 23, further comprising:

a cover opening module in communication with the control module, wherein

the cover opening module is configured to open a cover of the rod source phantom based on a third instruction sent by the control module or close the cover of the rod source phantom based on a fourth instruction sent by the control module.

26. The system of claim 23, further comprising:

a liquid level detection module in communication with the control module, wherein

the liquid level detection module is configured to detect a height of a liquid level in the rod source phantom and send the height of the liquid level to the control module; and

the control module is further configured to:

determining, based on the height of the liquid level, whether the height of the liquid level exceeds a preset liquid level threshold; and

in response to determining that the height of the liquid level exceeds the preset liquid level threshold, sending a fifth instruction for stopping the transmission of the mixed solution to the conveying module.

27. The system of claim 23, further comprising:

a rod source phantom fixing unit and a pressure sensor, wherein

the rod source phantom fixing unit is configured to fix the rod source phantom, and

the pressure sensor is in communication with the control module, the pressure sensor being configured to detect a pressure on the rod source phantom fixing unit and transmit the detected pressure to the control module; and

the control module is further configured to:

determining, based on the detected pressure, a type of the rod source phantom; and

determining, based on the type of the rod source phantom, at least one operational parameter of the medical system, the at least one operational parameter including a first operational parameter of a cover opening module and a second operational parameter of a liquid level detection module.

28. The system of claim 27, further comprising:

a source irrigation module configured to inject the radioactive source and the solvent with the preset ratio into the source liquid production module.

29. The system of claim 23, further comprising:

a system for prompting an abnormal condition of the rod source phantom irrigation system configured to:

determine, based on operational data of the medical system, abnormal information of the medical system; and

generate prompt information for prompting the abnormal information of the medical system, wherein the prompt information includes image data encoding at least one of the abnormal information or system information of the medical system.

30. The system of claim 29, wherein the operational data includes at least one of a first operational parameter of a cover opening module, a second operational parameter of a liquid level detection module, a height of a liquid level obtained by the liquid level detection module, a type and a dose of the radioactive source injected by a source irrigation module into the source liquid production module, a type and a dose of the solvent, or a third operational parameter of the source liquid production module.

31. The system of claim 30, further comprising:

a user interaction module in communication with the control module; wherein

the user interaction module is configured to obtain a user instruction, and/or display the operational data of the rod source phantom irrigation system and/or the prompt information to a user.

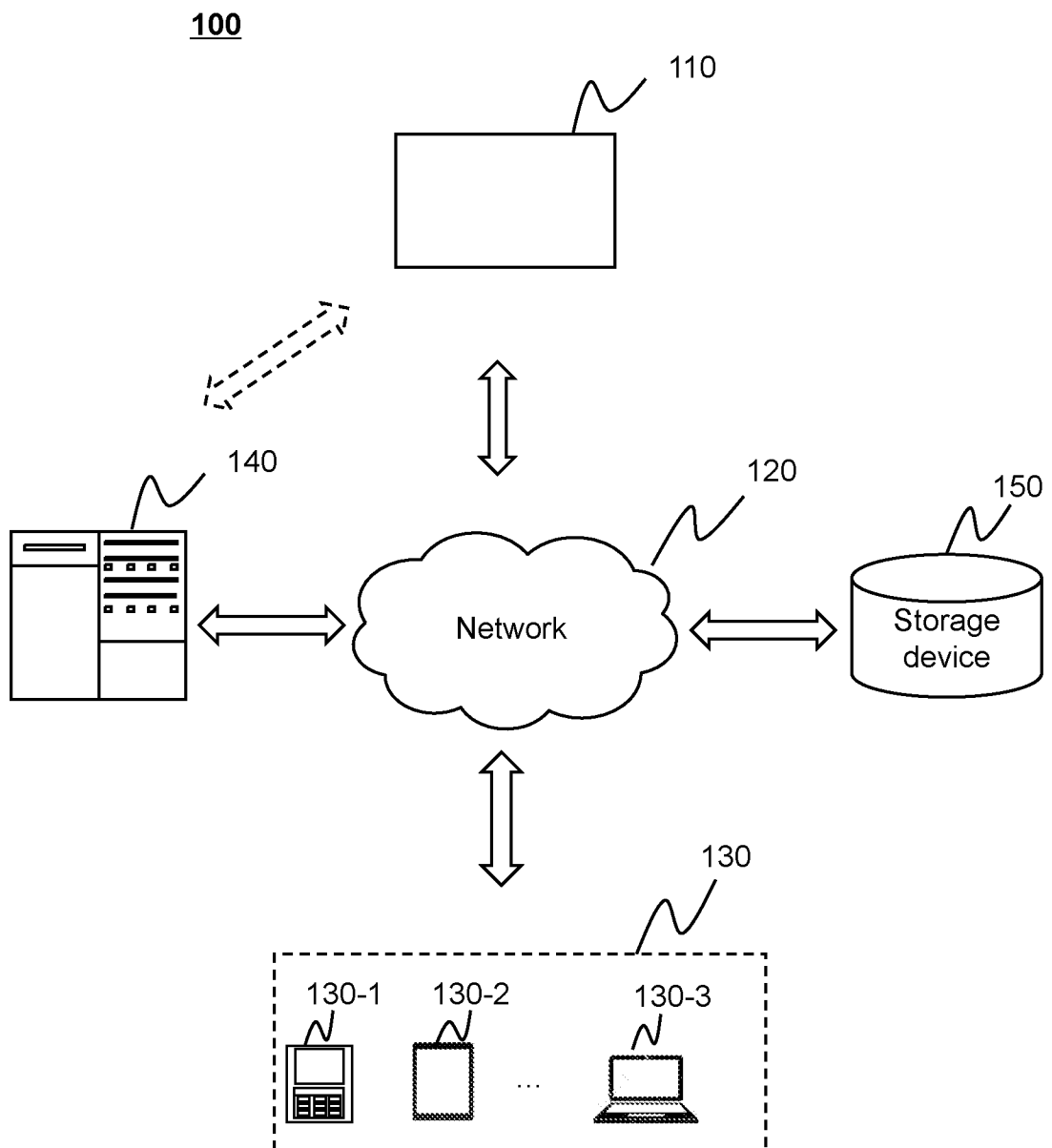


FIG. 1

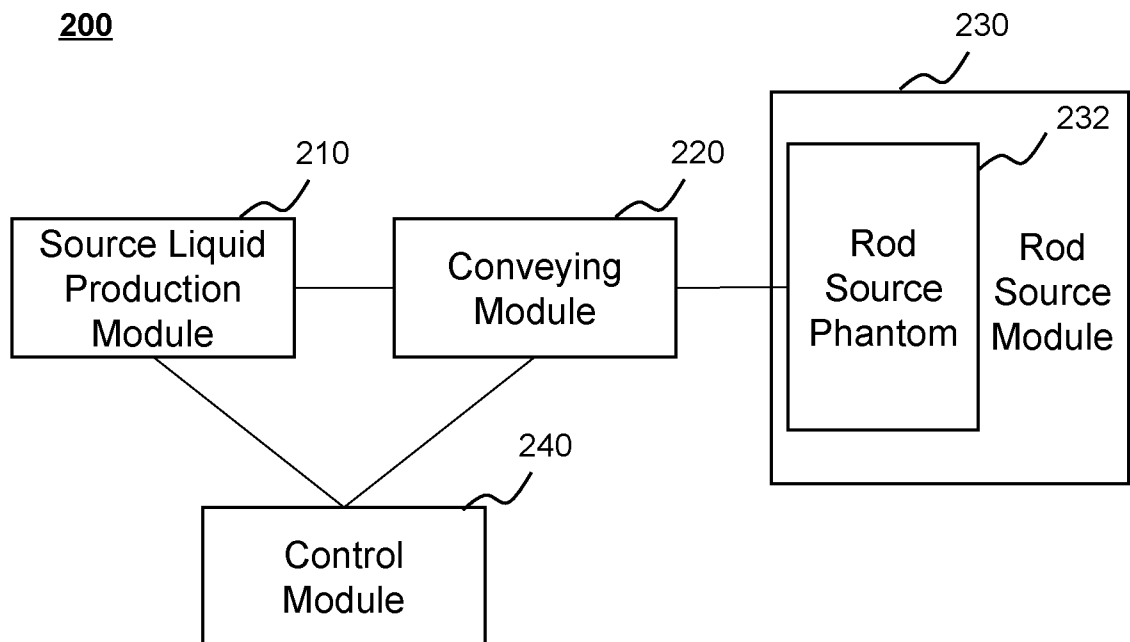


FIG. 2

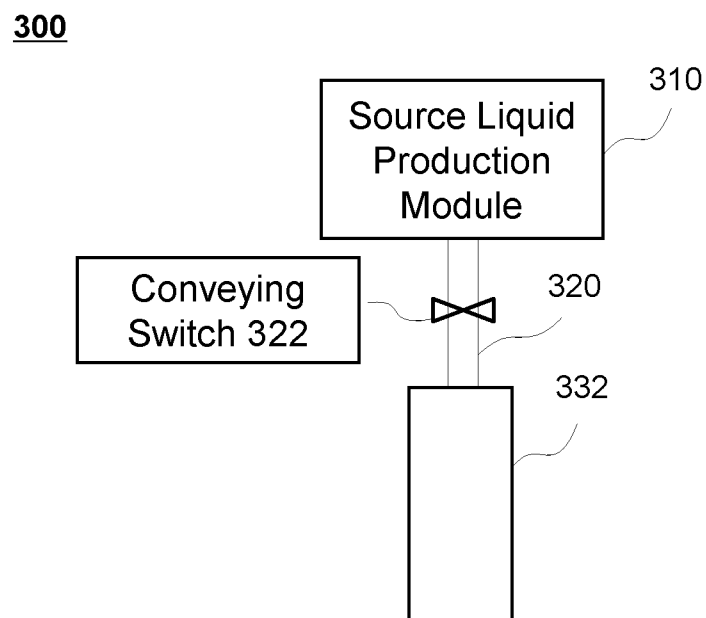


FIG. 3

400

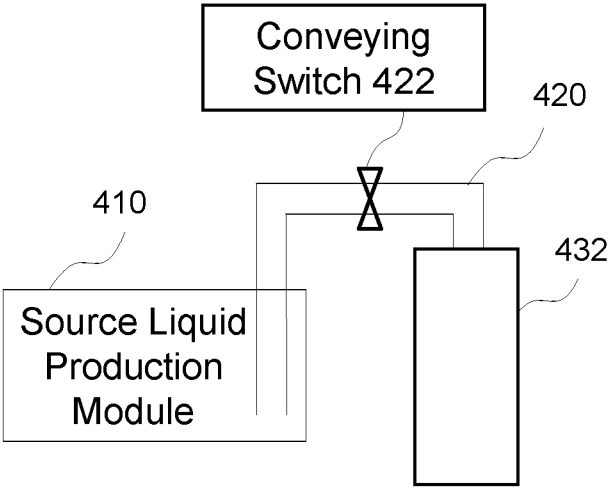


FIG. 4

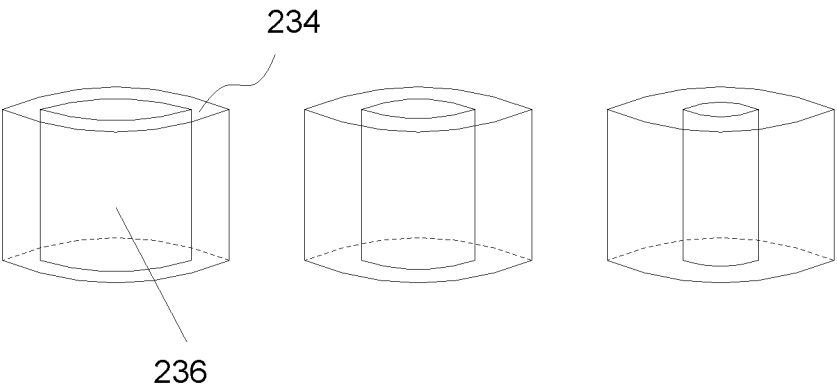
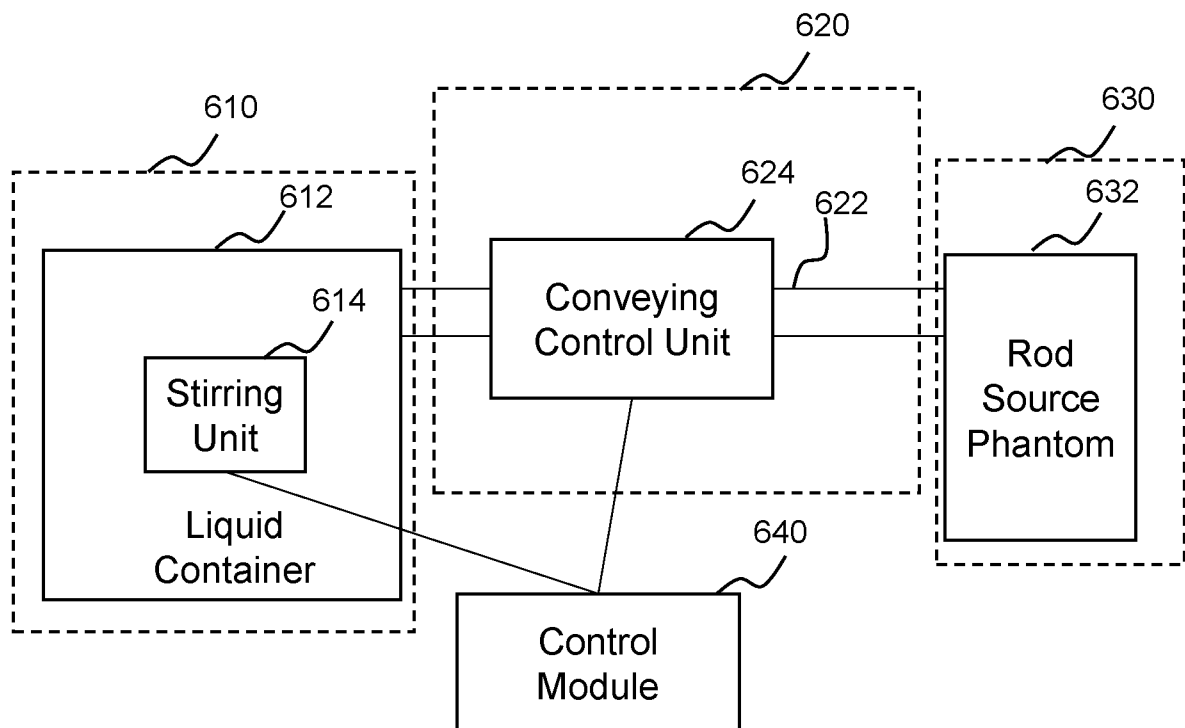
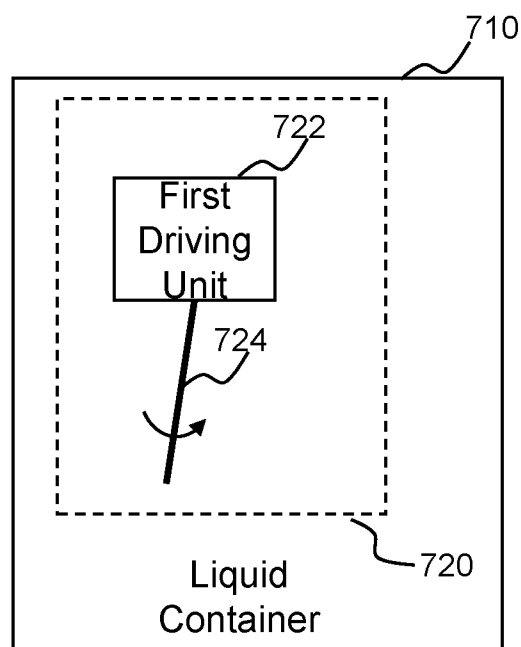
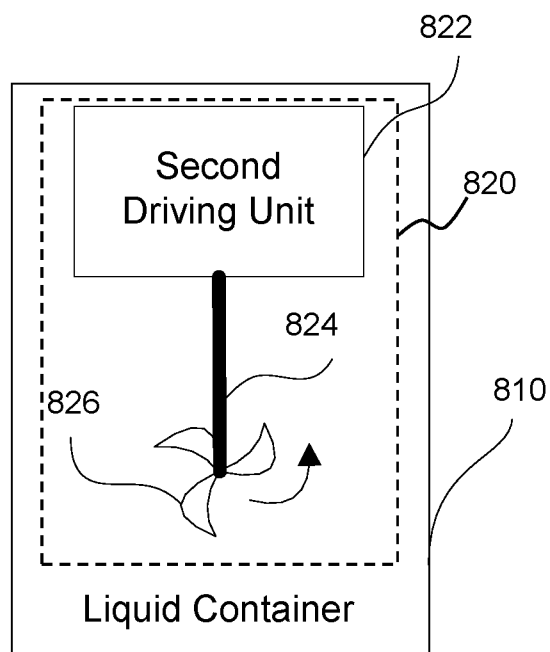
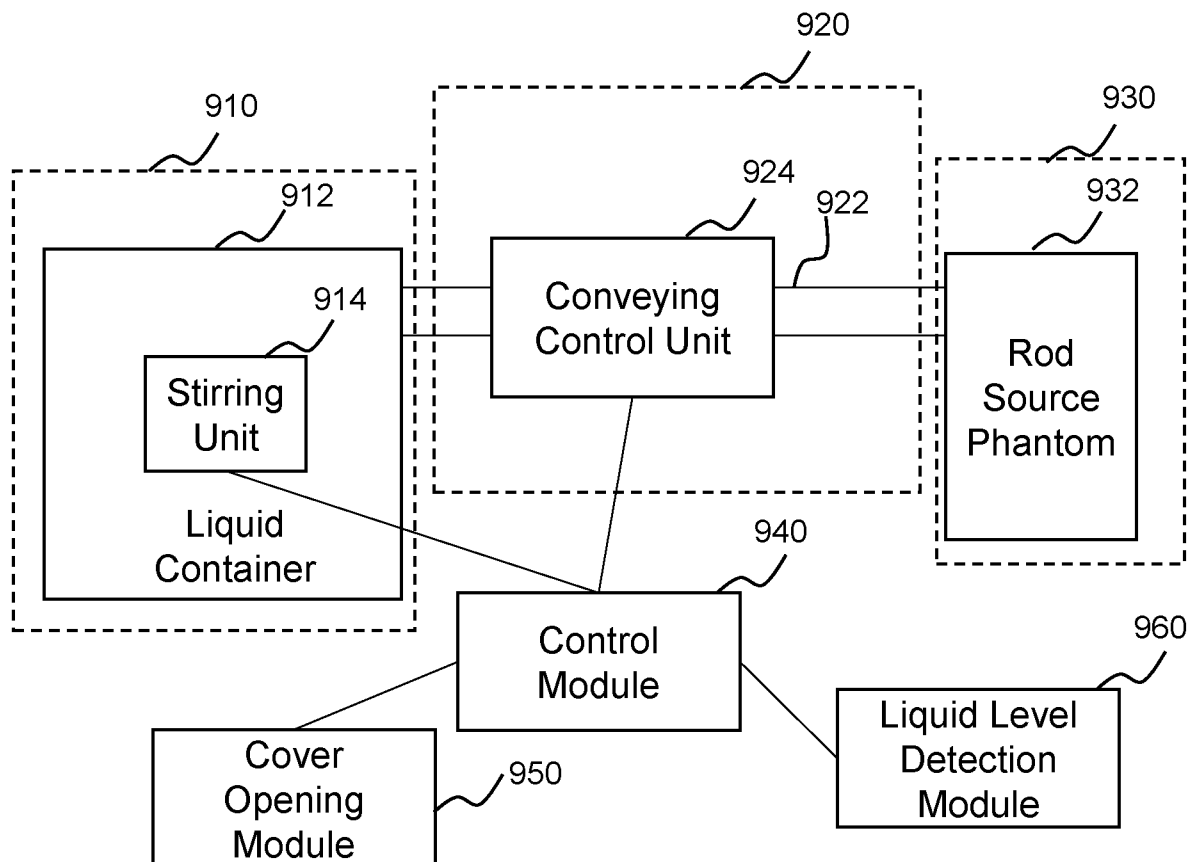
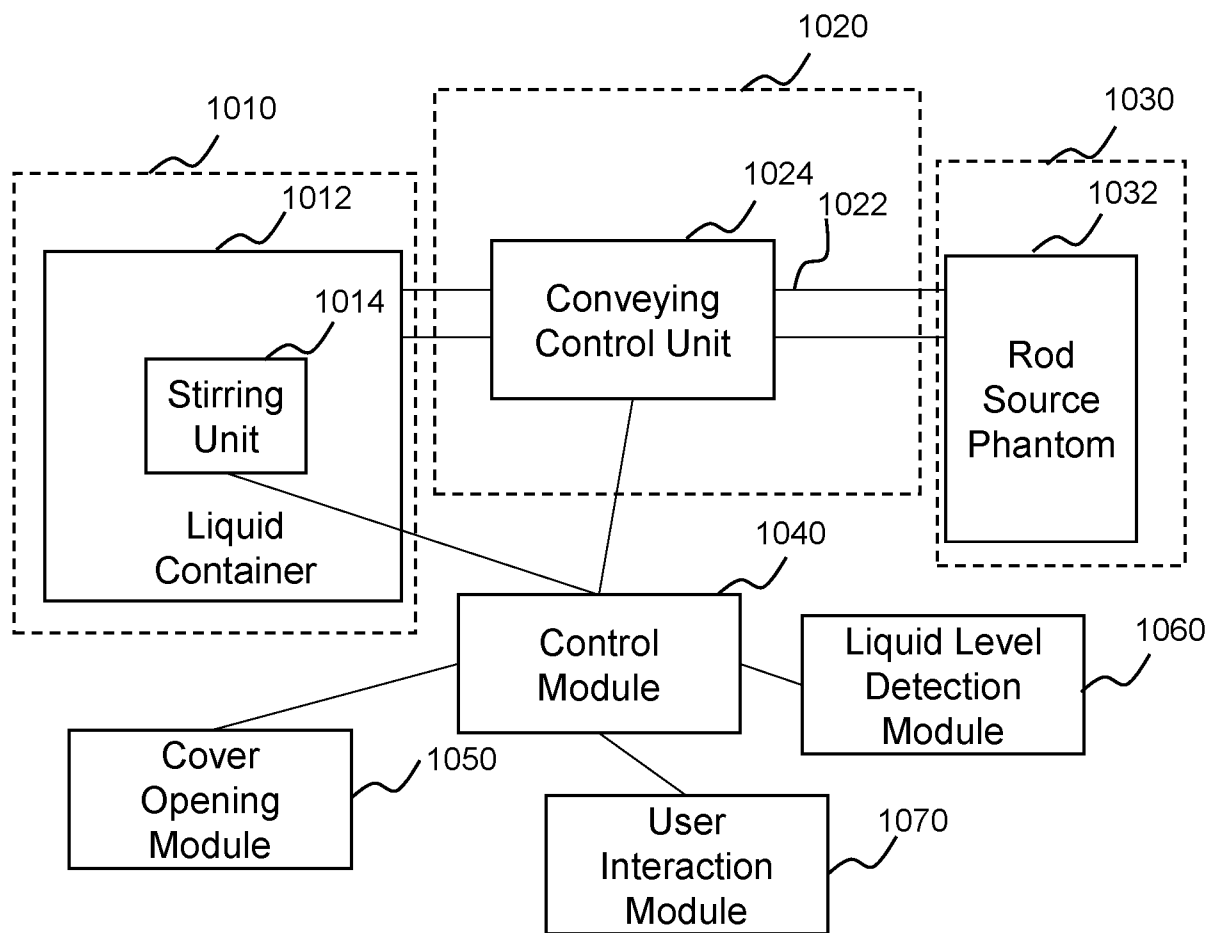
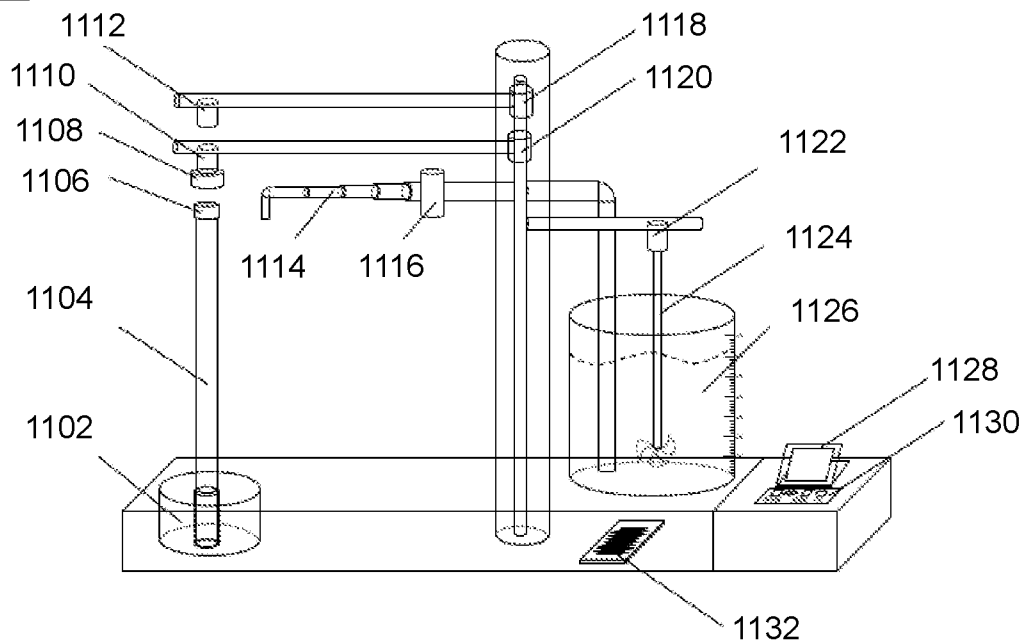
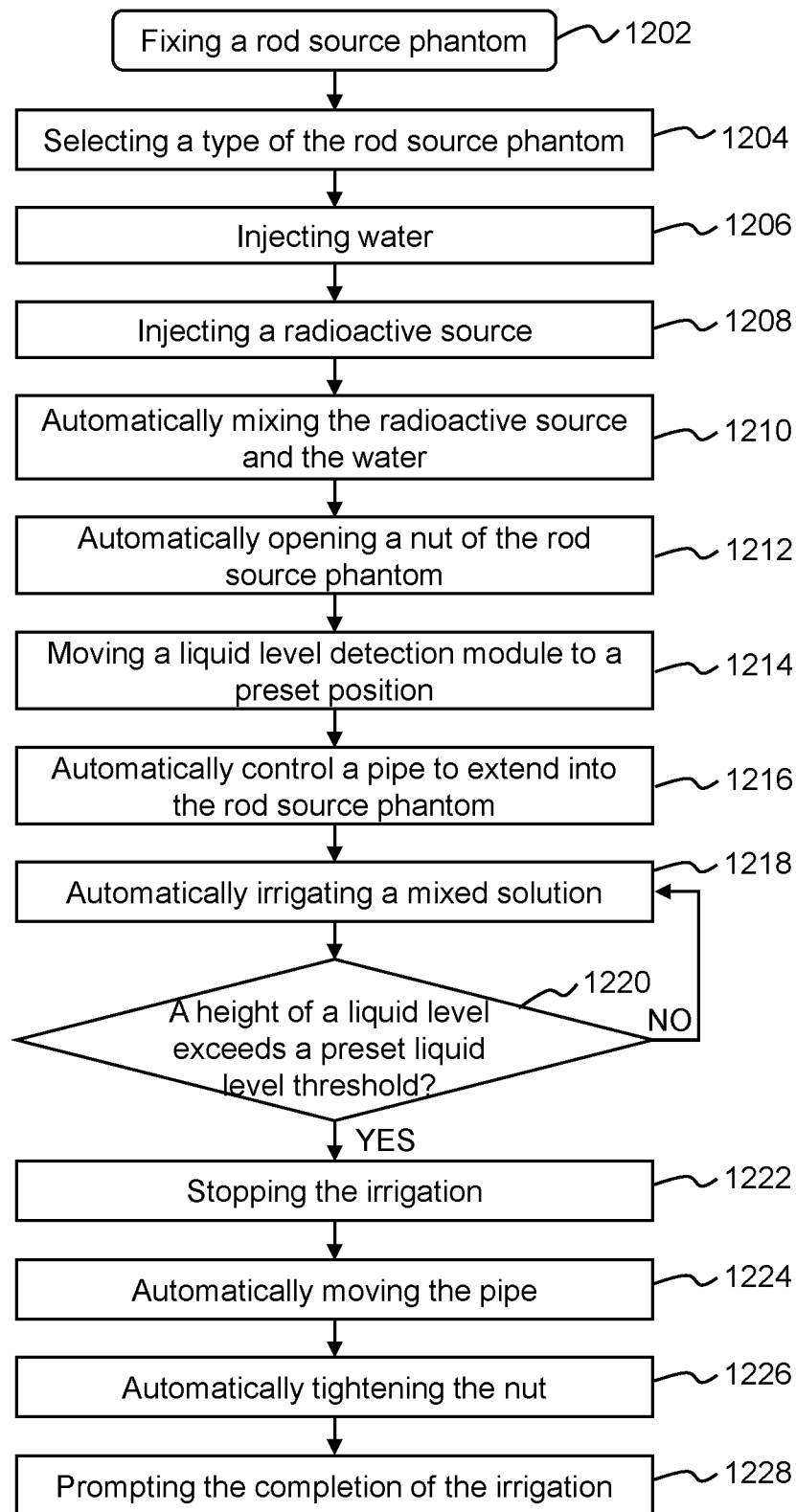


FIG. 5

600**FIG. 6****700****FIG. 7**

800**FIG. 8****900****FIG. 9**

1000**FIG. 10****1100****FIG. 11**

1200**FIG. 12**

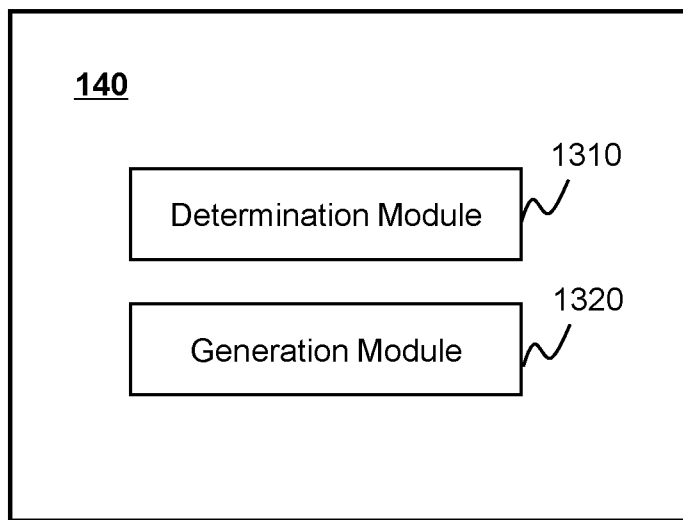
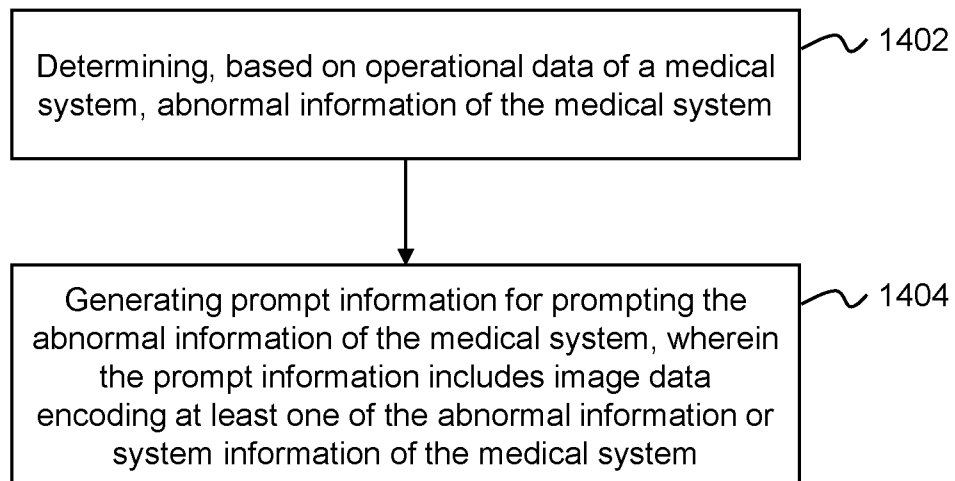


FIG. 13

1400**FIG. 14**

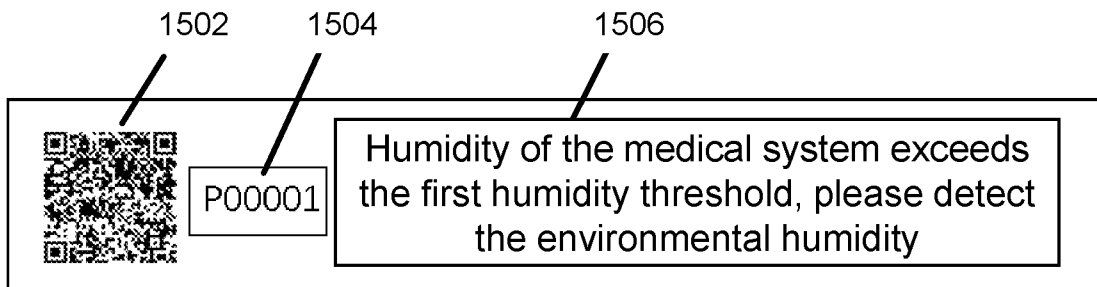


FIG. 15

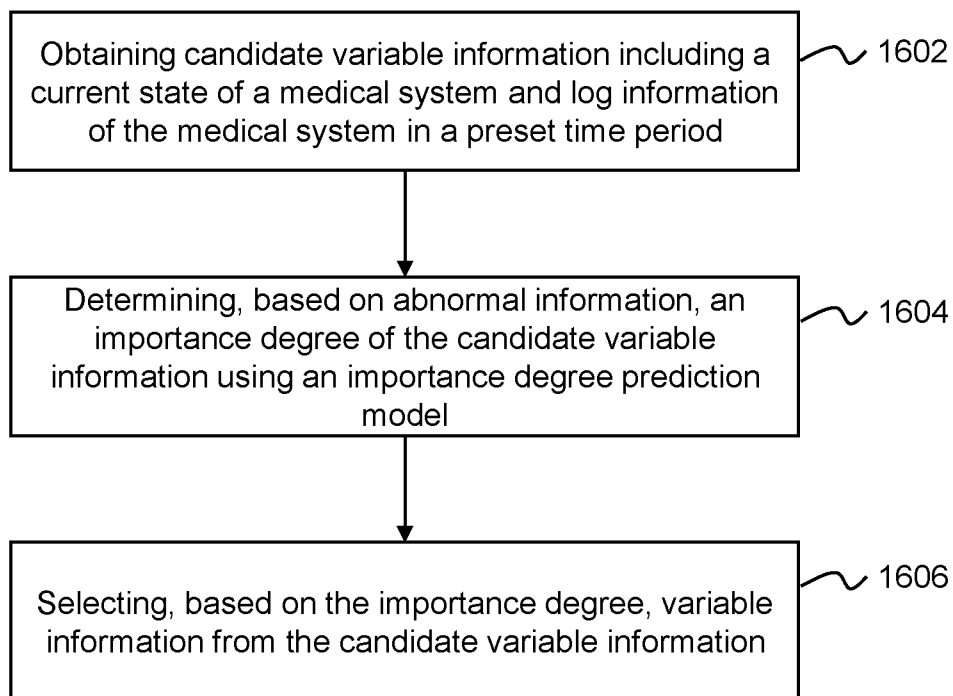
1600

FIG. 16

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/131481

A. CLASSIFICATION OF SUBJECT MATTER

A61B 6/03(2006.01)i

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)

A61B

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)

DWPI, USTXT, WOTXT, CNTXT, CNKI: liquid, medical, image, abnormal, prompt, code, encod+, state, rod, source, mix+, convey+, phantom, irrigat+, ratio

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 114121251 A (SHANGHAI UNITED IMAGING HEALTHCARE CO., LTD.) 01 March 2022 (2022-03-01) description, paragraphs [0028]-[0050]	1-12, 21
X	CN 109065135 A (LIU, Lida) 21 December 2018 (2018-12-21) description, paragraphs [0049]-[0112]	1-12, 21
Y	CN 109065135 A (LIU, Lida) 21 December 2018 (2018-12-21) description, paragraphs [0049]-[0112]	13-20, 22, 29-31
X	CN 213348531 U (SUZHOU FANGDE MENDA NEW DRUG DEVELOPMENT CO., LTD.) 04 June 2021 (2021-06-04) description, paragraphs [0024]-[0030]	23-28
Y	CN 213348531 U (SUZHOU FANGDE MENDA NEW DRUG DEVELOPMENT CO., LTD.) 04 June 2021 (2021-06-04) description, paragraphs [0024]-[0030]	13-20, 22, 29-31
A	US 2015023574 A1 (ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE) 22 January 2015 (2015-01-22) the whole document	1-31



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

29 January 2023

Date of mailing of the international search report

07 February 2023

Name and mailing address of the ISA/CN

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/131481

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN	114121251	A	01 March 2022	无	
CN	109065135	A	21 December 2018	无	
CN	213348531	U	04 June 2021	无	
US	2015023574	A1	22 January 2015	KR 20150009915	A 27 January 2015