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(54) **IMAGE DIAGNOSTIC APPARATUS AND METHOD, AND RECORDING MEDIUM**

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(57) **ABSTRACT**

The image diagnostic method includes acquiring an electrocardiogram (ECG) signal of an object, selecting a scan protocol used to reconfigure a heart image of the object, based on the acquired ECG signal, and providing a user with information used to propose the selected scan protocol.

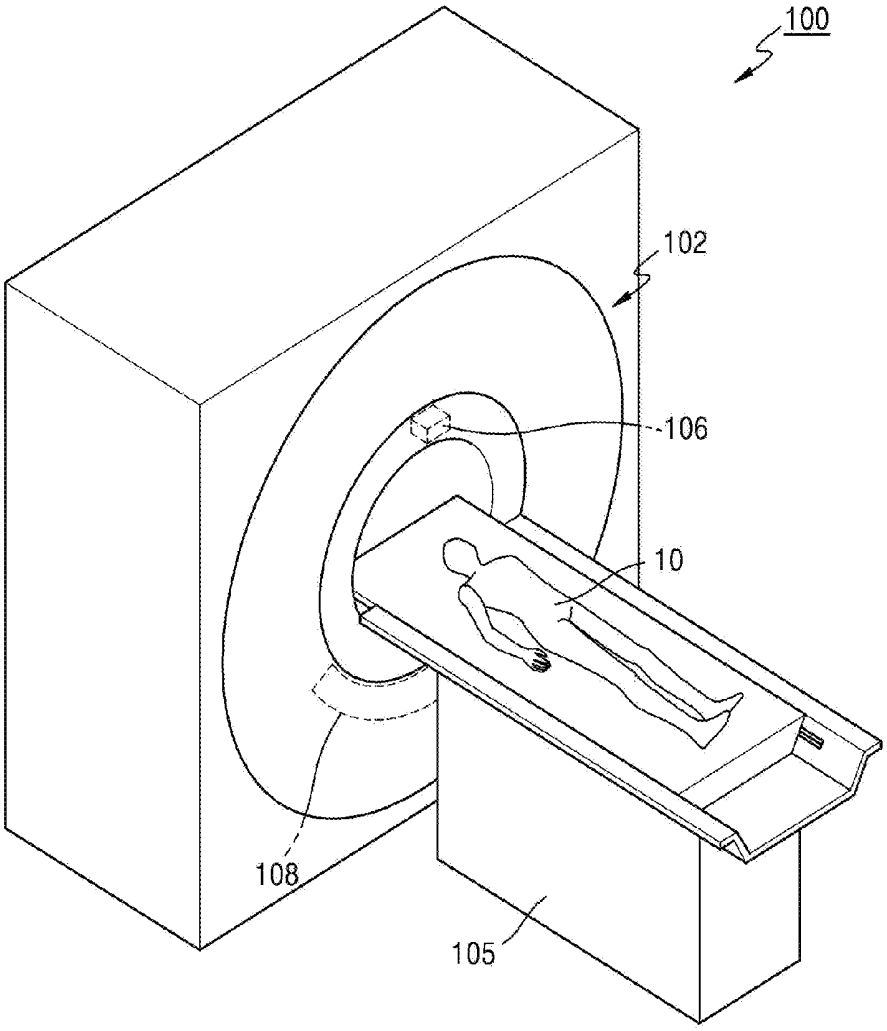

FIG. 1

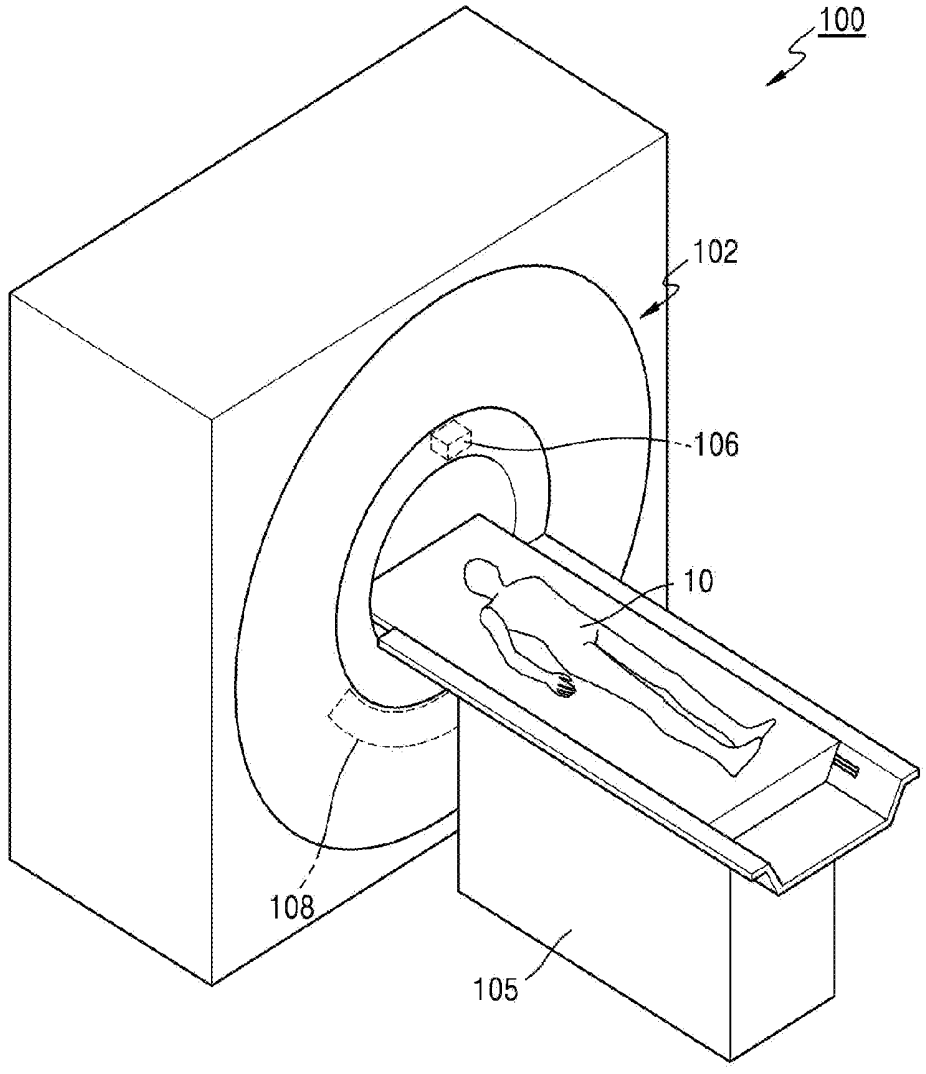

FIG. 2

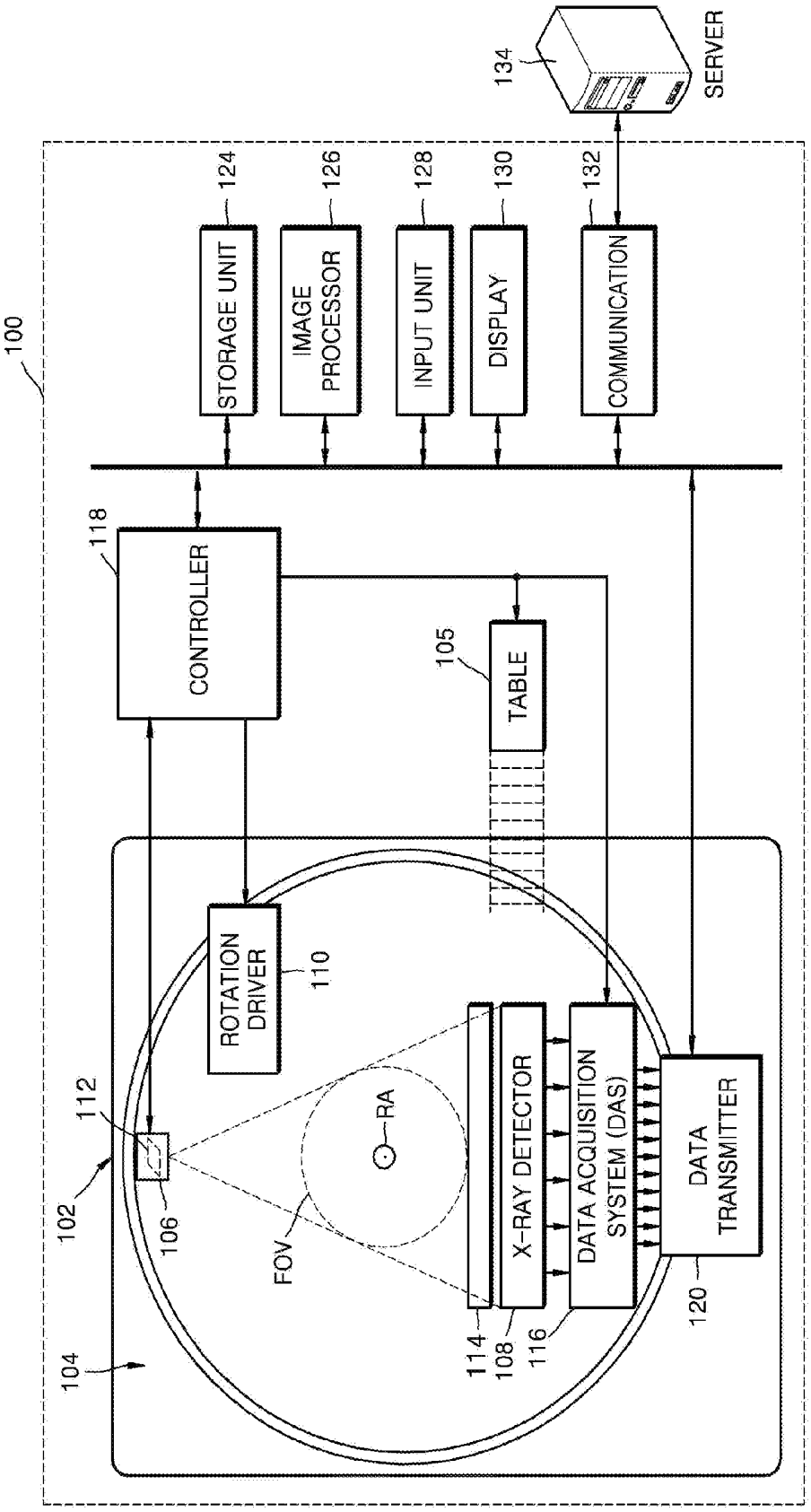
100
134
SERVER
124
STORAGE UNIT
126
IMAGE PROCESSOR
128
INPUT UNIT
130
DISPLAY
132
COMMUNICATION
118
CONTROLLER
105
TABLE
ROTATION DRIVER
110
112
102
106
FOV
RA
X-RAY DETECTOR
DATA ACQUISITION SYSTEM (DAS)
DATA TRANSMITTER
120
114
108
116
104

FIG. 3

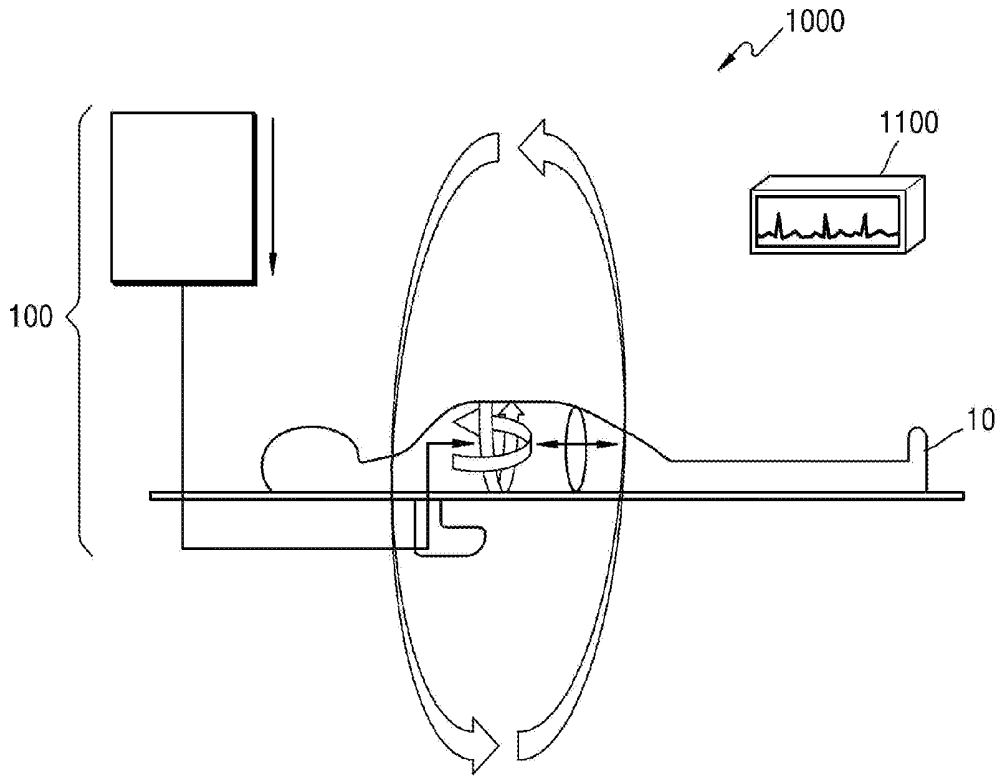
1000
1100
100
10

FIG. 4

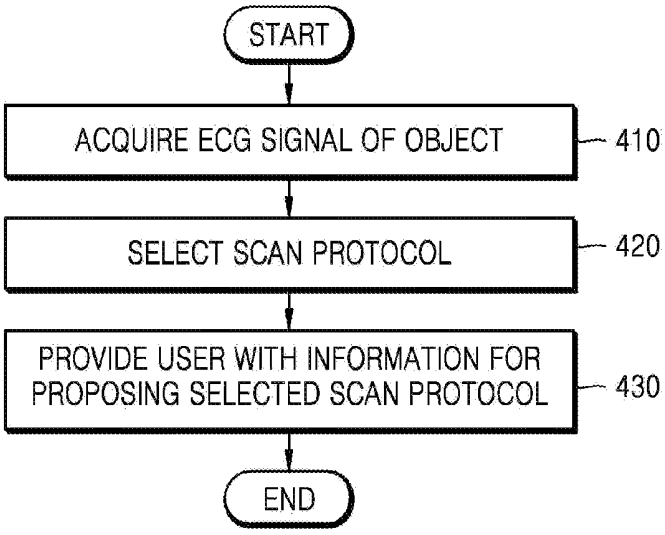
START
ACQUIRE ECG SIGNAL OF OBJECT
410
SELECT SCAN PROTOCOL
420
PROVIDE USER WITH INFORMATION FOR PROPOSING SELECTED SCAN PROTOCOL
430
END

FIG. 5

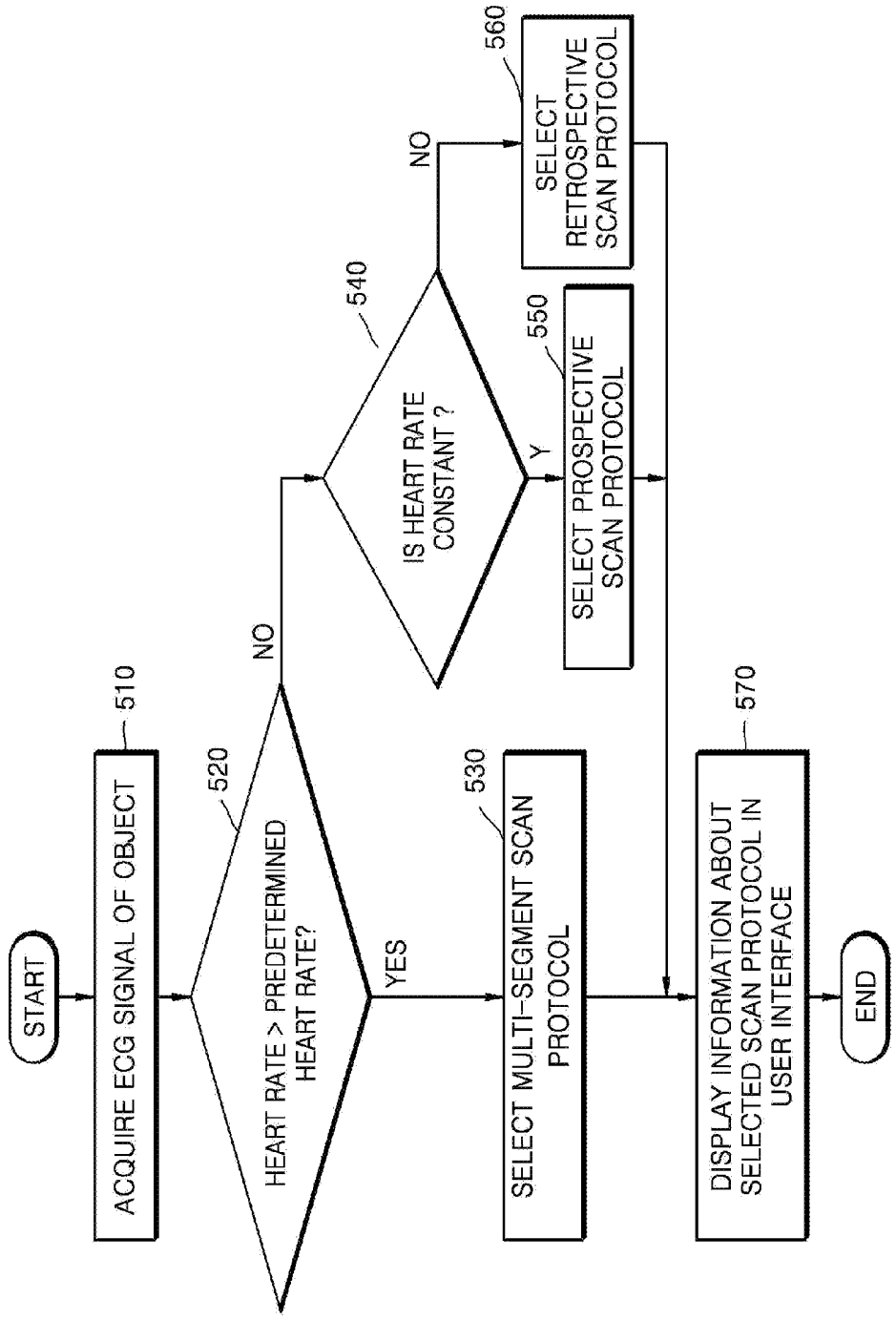
START
ACQUIRE ECG SIGNAL OF OBJECT
510
HEART RATE > PREDETERMINED HEART RATE?
520
YES
NO
IS HEART RATE CONSTANT ?
540
Y
NO
SELECT PROSPECTIVE SCAN PROTOCOL
550
SELECT RETROSPECTIVE SCAN PROTOCOL
560
SELECT MULTI-SEGMENT SCAN PROTOCOL
530
DISPLAY INFORMATION ABOUT SELECTED SCAN PROTOCOL IN USER INTERFACE
570
END

FIG. 6

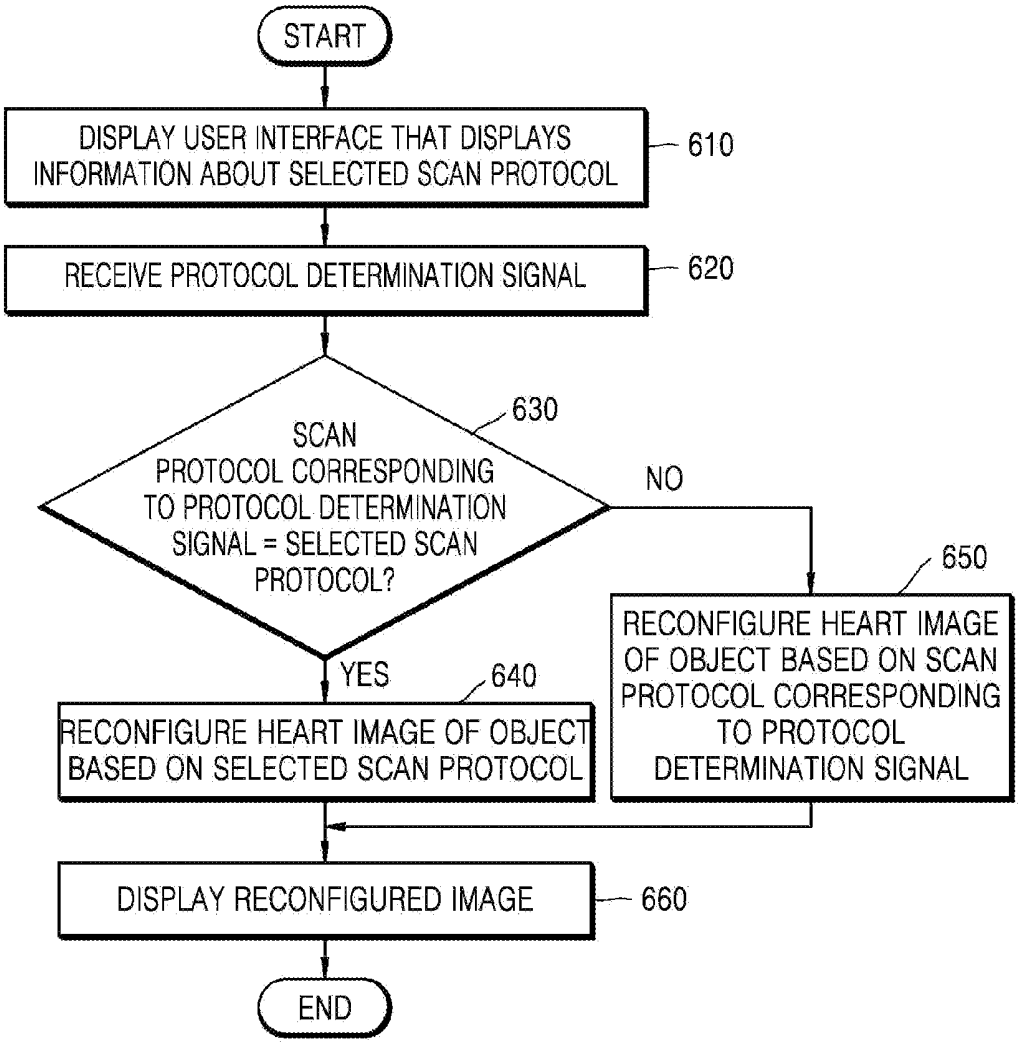
START
DISPLAY USER INTERFACE THAT DISPLAYS INFORMATION ABOUT SELECTED SCAN PROTOCOL
610
RECEIVE PROTOCOL DETERMINATION SIGNAL
620
SCAN PROTOCOL CORRESPONDING TO PROTOCOL DETERMINATION SIGNAL = SELECTED SCAN PROTOCOL?
630
NO
YES
RECONFIGURE HEART IMAGE OF OBJECT BASED ON SELECTED SCAN PROTOCOL
640
RECONFIGURE HEART IMAGE OF OBJECT BASED ON SCAN PROTOCOL CORRESPONDING TO PROTOCOL DETERMINATION SIGNAL
650
DISPLAY RECONFIGURED IMAGE
660
END

FIG. 7

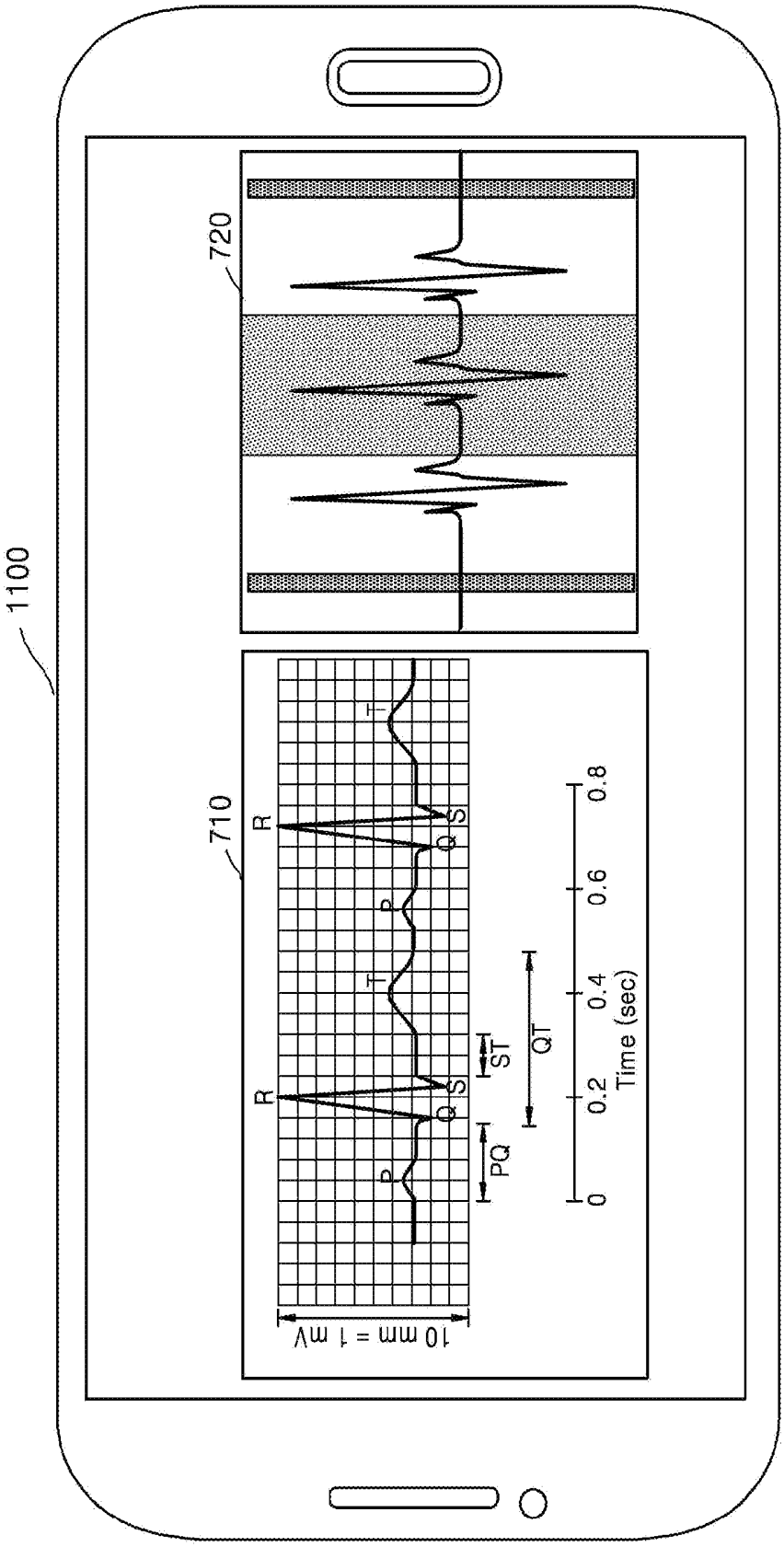

FIG. 8

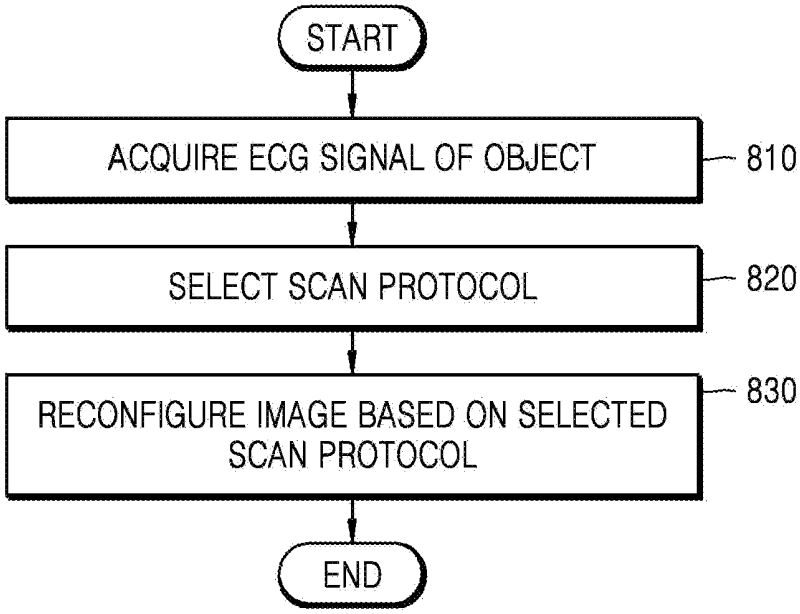
START
ACQUIRE ECG SIGNAL OF OBJECT
810
SELECT SCAN PROTOCOL
820
RECONFIGURE IMAGE BASED ON SELECTED SCAN PROTOCOL
830
END

FIG. 9

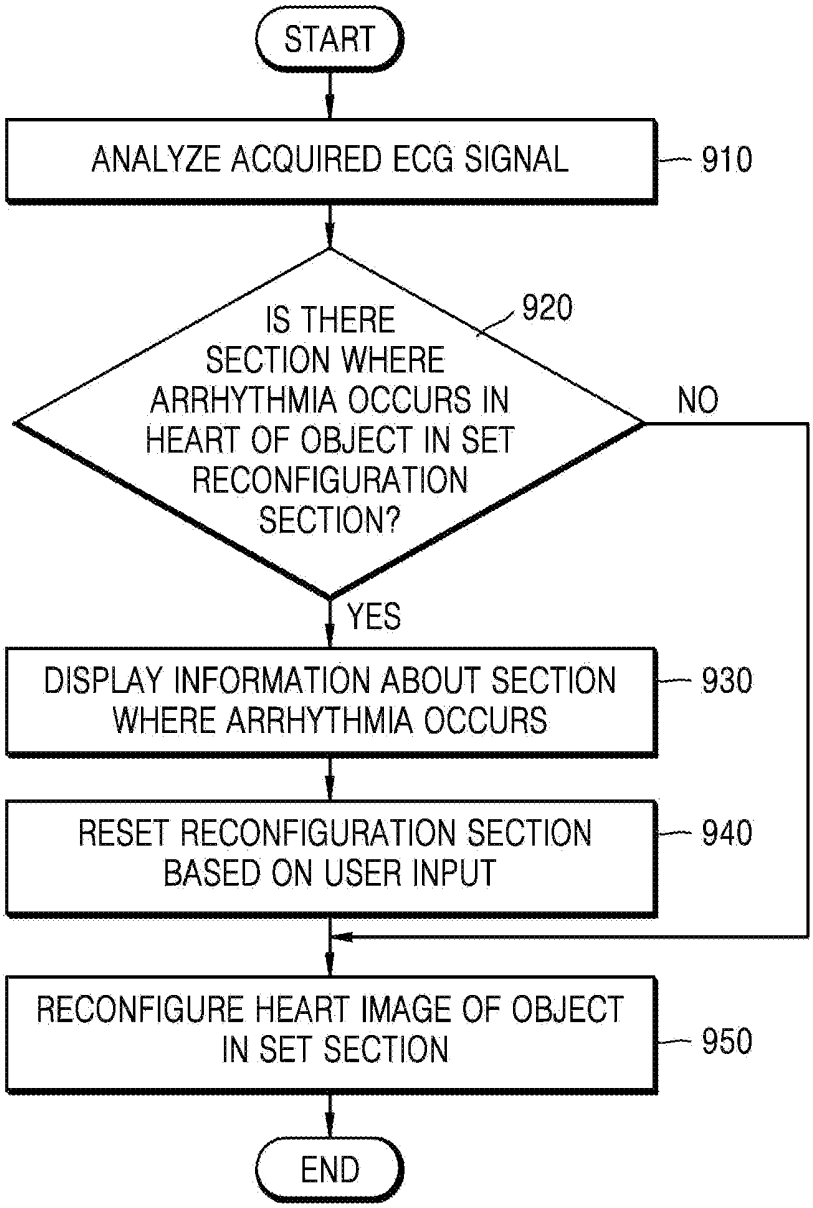
START
ANALYZE ACQUIRED ECG SIGNAL
910
IS THERE SECTION WHERE ARRHYTHMIA OCCURS IN HEART OF OBJECT IN SET RECONFIGURATION SECTION?
920
NO
YES
DISPLAY INFORMATION ABOUT SECTION WHERE ARRHYTHMIA OCCURS
930
RESET RECONFIGURATION SECTION BASED ON USER INPUT
940
RECONFIGURE HEART IMAGE OF OBJECT IN SET SECTION
950
END

FIG. 10

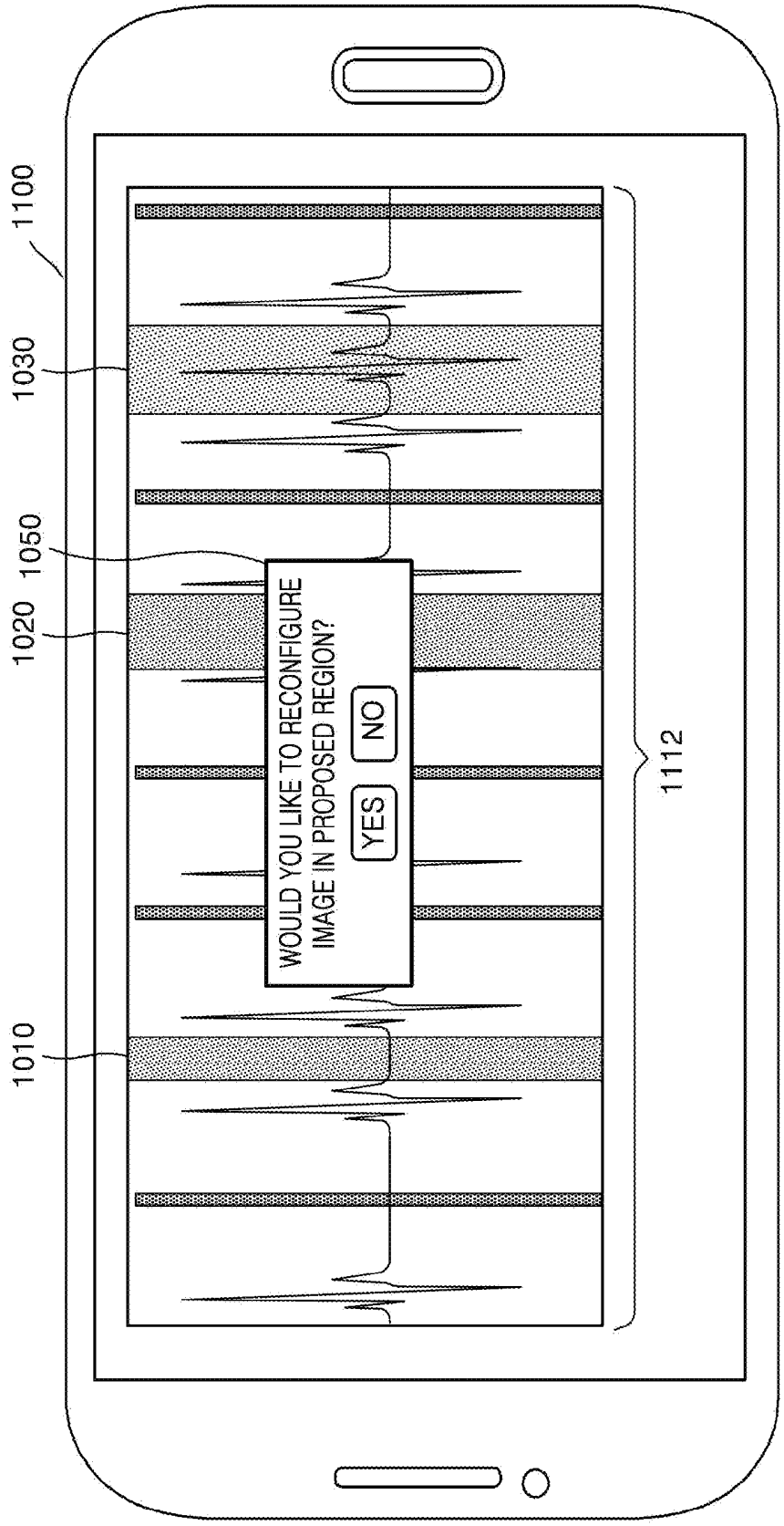
1100
1030
1050
1020
1010
1112
WOULD YOU LIKE TO RECONFIGURE IMAGE IN PROPOSED REGION?
YES
NO

FIG. 11

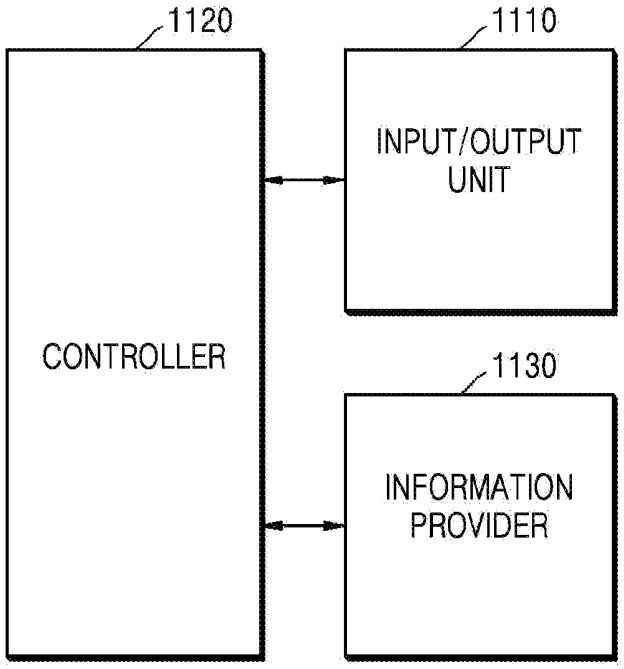
1120
1110
INPUT/OUTPUT UNIT
CONTROLLER
1130
INFORMATION PROVIDER

FIG. 12

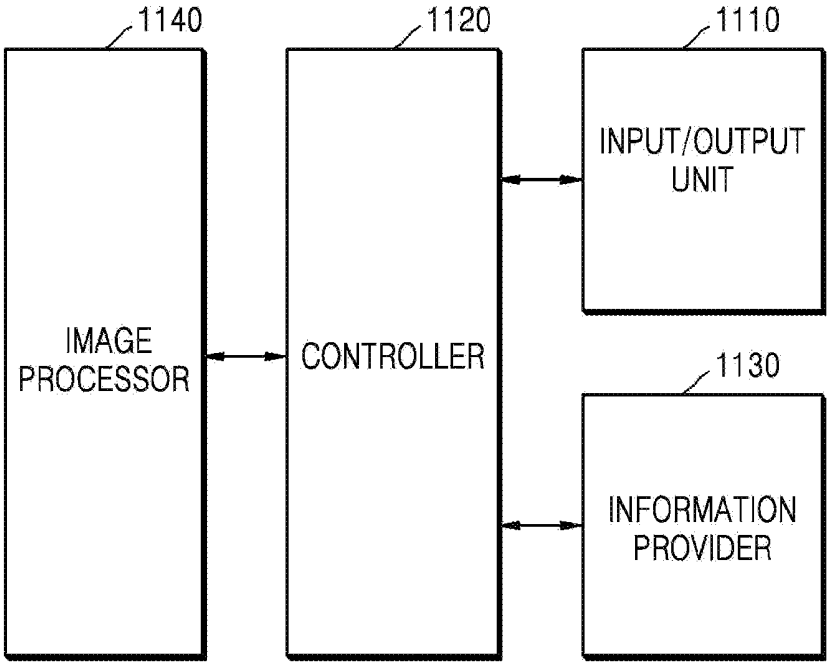
1140
1120
1110
INPUT/OUTPUT UNIT
IMAGE PROCESSOR
CONTROLLER
1130
INFORMATION PROVIDER

IMAGE DIAGNOSTIC APPARATUS AND METHOD, AND RECORDING MEDIUM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from Korean Patent Application No. 10-2013-0167487, filed on Dec. 30, 2013, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND

[0002] 1. Field

[0003] One or more exemplary embodiments relate to an image diagnostic apparatus and method and a recording medium.

[0004] 2. Description of the Related Art

[0005] Examples of high-tech image diagnostic apparatuses, which are used to diagnose various diseases of a human body, include magnetic resonance imaging (MRI) apparatuses, computed tomography (CT) apparatuses, etc.

[0006] In order to image an object by using an image diagnostic apparatus, a user needs to select an imaging protocol in consideration of a state of the object. Also, the user needs to consider variables that will occur in imaging. Therefore, it may be difficult for a user to image an object.

[0007] In the related art, guidelines for an imaging method necessary to image an object are not provided, and for this reason, a user manually selects a desired imaging method. The quality of an acquired image depends on a user's skill or an imaging method selected by the user.

SUMMARY

[0008] Exemplary embodiments address at least the above problems and/or disadvantages and other disadvantages not described above. Also, the exemplary embodiments are not required to overcome the disadvantages described above, and may not overcome any of the problems described above.

[0009] One or more exemplary embodiments include an image diagnostic apparatus and method and a recording medium, which provide guidelines for an imaging method that a user may use to diagnose a disease.

[0010] One or more exemplary embodiments include an image diagnostic apparatus and method and a recording medium, which enable a user to easily select an imaging method that a user may use to diagnose a disease.

[0011] According to an aspect of an exemplary embodiment, an image diagnostic method includes: acquiring an electrocardiogram (ECG) signal of an object; selecting a scan protocol used to reconfigure a heart image of the object, based on the acquired ECG signal; and providing a user with information used to propose the selected scan protocol.

[0012] According to an aspect of an exemplary embodiment, an image diagnostic apparatus includes: an input/output unit that acquires an electrocardiogram (ECG) signal of an object; a controller that selects a scan protocol used to reconfigure a heart image of the object, based on the acquired ECG signal; and an information provider that provides a user with information used to propose the selected scan protocol.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The above and/or other aspects will become more apparent by describing certain exemplary embodiments, with reference to the accompanying drawings, in which:

[0014] FIG. **1** is a schematic diagram of a computed tomography (CT) system;

[0015] FIG. **2** is a diagram illustrating a structure of a CT system according to an exemplary embodiment;

[0016] FIG. **3** is a diagram illustrating an image diagnostic system according to an exemplary embodiment;

[0017] FIG. **4** is a flowchart for describing an image diagnostic method according to an exemplary embodiment;

[0018] FIG. **5** is a flowchart for describing a method in which an image diagnostic apparatus selects a scan protocol for reconfiguring a heart image of an object, according to an exemplary embodiment;

[0019] FIG. **6** is a flowchart for describing a method in which the image diagnostic apparatus reconfigures an image of an object based on a determined scan protocol, according to an exemplary embodiment;

[0020] FIG. **7** is a diagram illustrating a user interface in which an electrocardiogram signal sample and an acquired electrocardiogram signal are shown as waveforms, according to an exemplary embodiment;

[0021] FIG. **8** is a flowchart for describing an image diagnostic method according to an exemplary embodiment;

[0022] FIG. **9** is a flowchart for describing a method in which the image diagnostic apparatus sets a reconfiguration section of an image obtained by imaging a heart of an object, according to an exemplary embodiment;

[0023] FIG. **10** is a diagram for describing a method in which the image diagnostic apparatus displays a section in which arrhythmia occurs in a user interface, according to an exemplary embodiment; and

[0024] FIGS. **11** and **12** are block diagrams of the image diagnostic apparatus according to an exemplary embodiment.

DETAILED DESCRIPTION

[0025] Certain exemplary embodiments are described in greater detail below with reference to the accompanying drawings.

[0026] In the following description, like drawing reference numerals are used for like elements, even in different drawings. The matters defined in the description, such as detailed construction and elements, are provided to assist in a comprehensive understanding of the exemplary embodiments. However, it is apparent that the exemplary embodiments can be practiced without those specifically defined matters. Also, well-known functions or constructions are not described in detail since they would obscure the description with unnecessary detail.

[0027] Expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

[0028] When a part "includes" or "comprises" an element, unless there is a particular description contrary thereto, the part can further include other elements, not excluding the other elements. Also, the term 'unit' means a software component or hardware components such as a field-programmable gate array (FPGA) or an application-specific integrated circuit (ASIC), and performs a specific function. However, the term 'unit' is not limited to software or hardware. The 'unit' may be formed so as to be in an addressable storage medium, or may be formed so as to operate one or more processors. Thus, for example, the term 'unit' may refer to components such as software components, object-oriented software components, class components, and task components, and may include processes, functions, attributes, pro-

cedures, subroutines, segments of program code, drivers, firmware, micro codes, circuits, data, a database, data structures, tables, arrays, or variables. A function provided by the components and 'units' may be associated with the smaller number of components and 'units', or may be divided into additional components and 'units'.

[0029] Throughout the specification, an "image" may mean multi-dimensional data formed of discrete image elements (e.g., pixels in a two-dimensional (2D) image and voxels in a three-dimensional (3D) image). For example, the image may include a medical image of an object which is captured by a computed tomography (CT) imaging apparatus.

[0030] Throughout the specification, a "CT image" may mean an image generated by synthesizing a plurality of X-ray images that are obtained by imaging an object while a CT imaging apparatus rotates about at least one axis with respect to the object.

[0031] Throughout the specification, an "object" may include a human, an animal, or a part of a human or animal. For example, the object may include organs such as a liver, heart, womb, brain, breast, abdomen, or the like, or a blood vessel. Also, the object may include a phantom. The phantom is a material having a volume that is very close to a density and effective atomic number of an organism or living thing, and may include a sphere phantom having a characteristic similar to a physical body.

[0032] Throughout the specification, a "user" may be, but is not limited to, a medical professional including a doctor, a nurse, a medical laboratory technologist, a medial image expert, and a technician who repairs a medical apparatus.

[0033] Since a CT system is capable of providing a cross-sectional image of an object, the CT system may express an inner structure (e.g., an organ such as a kidney, a lung, etc.) of the object without an overlap therebetween, compared to a general X-ray capturing apparatus.

[0034] The CT system may obtain a plurality of pieces of image data with a thickness no more than 2 mm for several tens to several hundreds of times per second and then may process the plurality of pieces of image data, so that the CT system may provide a relatively accurate a cross-sectional image of the object. Examples of image reconstruction methods are as below.

[0035] A shade surface display (SSD) method: The SSD method is an initial 3D imaging method that displays only voxels having a predetermined Hounsfield Units (HU) value.

[0036] A maximum intensity projection (MIP)/minimum intensity projection (MinIP) method: The MIP/MinIP method is a 3D imaging method that displays only voxels having the greatest or smallest HU value from among voxels that construct an image.

[0037] A volume rendering (VR) method: The VR method is an imaging method capable of adjusting a color and transmittance of voxels that construct an image, according to interest areas.

[0038] A virtual endoscopy method: This method allows an endoscopy observation in a 3D image that is reconstructed by using the VR method or the SSD method.

[0039] A multi-planar reformation (MPR) method: The MPR method is used to reconstruct an image into a different cross-sectional image. A user may reconstruct an image in every desired direction.

[0040] An editing method: This method involves editing adjacent voxels so as to allow a user to easily observe an interest area in volume rendering.

[0041] A voxel of interest (VOI) method: The VOI method displays only a selected area in volume rendering.

[0042] A CT system **100** according to an exemplary embodiment will now be described with reference to FIG. **1**. The CT system **100** may include devices having various forms.

[0043] FIG. **1** schematically illustrates the CT system **100**. Referring to FIG. **1**, the CT system **100** may include a gantry **102**, a table **105**, an X-ray generator **106**, and an X-ray detector **108**.

[0044] The gantry **102** may include the X-ray generator **106** and the X-ray detector **108**.

[0045] An object **10** may be positioned on the table **105**.

[0046] The table **105** may move in a predetermined direction (e.g., at least one of up, down, right, and left directions) during a CT imaging procedure. Also, the table **105** may tilt or rotate by a predetermined degree in a predetermined direction.

[0047] The gantry **102** may also tilt by a predetermined degree in a predetermined direction.

[0048] FIG. **2** is a diagram illustrating a structure of the CT system **100**.

[0049] The CT system **100** may include the gantry **102**, the table **105**, a controller **118**, a storage unit **124**, an image processor **126**, an input unit **128**, a display **130**, and a communicator **132**.

[0050] As described above, the object **10** may be positioned on the table **105**. In the present exemplary embodiment, the table **105** may move in a predetermined direction (e.g., at least one of up, down, right and left directions), and movement of the table **105** may be controlled by the controller **118**.

[0051] The gantry **102** may include a rotating frame **104**, the X-ray generator **106**, the X-ray detector **108**, a rotation driver **110**, a data acquisition system (DAS) **116**, and a data transmitter **120**.

[0052] The rotating frame **104** included in the gantry **102** may have a loop shape capable of rotating with respect to a predetermined rotation axis RA. The rotating frame **104** may be disc shaped.

[0053] The X-ray generator **106** and the X-ray detector **108** included in the rotating frame **104** may face each other so as to have predetermined field of views (FOVs). The rotating frame **104** may also include an anti-scatter grid **114**. The anti-scatter grid **114** may be positioned between the X-ray generator **106** and the X-ray detector **108**.

[0054] In a medical imaging system, X-ray radiation that reaches a detector (or a photosensitive film) includes attenuated primary radiation that forms a useful image and also includes scattered radiation that deteriorates a quality of an image. In order to transmit the primary radiation and to attenuate the scattered radiation, the anti-scatter grid **114** may be positioned between a patient and the detector (or the photosensitive film).

[0055] For example, the anti-scatter grid **114** may be formed by alternately stacking lead foil strips and an interspace material such as a solid polymer material, solid polymer, or a fiber composite material. However, formation of the anti-scatter grid **114** is not limited thereto.

[0056] The rotating frame **104** may receive a driving signal from the rotation driver **110** and may rotate the X-ray gen-

erator **106** and the X-ray detector **108** at a predetermined rotation speed. The rotating frame **104** may receive the driving signal and power from the rotation driver **110** while the rotating frame **104** contacts the rotation driver **110** via a slip ring (not shown). The rotating frame **104** may receive the driving signal and power from the rotation driver **110** via wireless communication.

[0057] The X-ray generator **106** may receive a voltage and current from a power distribution unit (PDU) (not shown) via a slip ring (not shown) and then a high voltage generator (not shown), and then may generate and emit an X-ray. When the high voltage generator applies a predetermined voltage (hereinafter, referred as the tube voltage) to the X-ray generator **106**, the X-ray generator **106** may generate X-rays having a plurality of energy spectrums that correspond to the tube voltage.

[0058] The X-ray generated by the X-ray generator **106** may have a predetermined form due to a collimator **112** and then may be emitted.

[0059] The X-ray detector **108** may be positioned while facing the X-ray generator **106**. The X-ray detector **108** may include a plurality of X-ray detecting devices. Each of the plurality of X-ray detecting devices may establish one channel but the exemplary embodiments are not limited thereto.

[0060] The X-ray detector **108** may detect the X-ray that is generated by the X-ray generator **106** and that is transmitted through the object **10**, and may generate an electrical signal corresponding to intensity of the detected X-ray.

[0061] The X-ray detector **108** may include an indirect-type X-ray detector for detecting radiation after converting the radiation into light, and a direct-type X-ray detector for detecting radiation after directly converting the radiation into electric charges. The indirect-type X-ray detector may use a scintillator. The direct-type X-ray detector may use a photon counting detector. The DAS **116** may be connected to the X-ray detector **108**. The electrical signal generated by the X-ray detector **108** may be collected by the DAS **116** wirelessly or via a wire. The electrical signal generated by the X-ray detector **108** may be provided to an analog-to-digital converter (not shown) via an amplifier (not shown).

[0062] According to a slice thickness or the number of slices, only some of a plurality of data collected by the X-ray detector **108** may be provided to the image processor **126** via the data transmitter **120**, or the image processor **126** may select only some of the plurality of data.

[0063] The digital signal may be provided to the image processor **126** via the data transmitter **120**. The digital signal may be provided wirelessly or via a wire to the image processor **126**.

[0064] The controller **118** may control an operation of the elements in the CT system **100**. For example, the controller **118** may control operations of the table **105**, the rotation driver **110**, the collimator **112**, the DAS **116**, the storage unit **124**, the image processor **126**, the input unit **128**, the display **130**, the communicator **132**, and the like.

[0065] The image processor **126** may receive data (e.g., pure data before a processing operation), which is obtained from the DAS **116**, via the data transmitter **120**, and may perform pre-processing.

[0066] The pre-processing may include a process of correcting sensitivity irregularity between channels, a process of correcting a signal loss due to a rapid decrease in signal strength or due to an X-ray absorbing material such as metal, or the like.

[0067] Data output from the image processor **126** may be referred to as raw data or projection data. The projection data and image-capturing conditions (e.g., the tube voltage, an image-capturing angle, etc.) during obtainment of the data may be stored together in the storage unit **124**.

[0068] The projection data may be a group of data values that correspond to the intensity of the X-ray that passes through the object **10**. For convenience of description, it is assumed that a group of a plurality of pieces of projection data that are simultaneously obtained from all channels of a same image-capturing degree is referred to as a projection data set.

[0069] The storage unit **124** may include at least one storage medium from a flash memory-type storage medium, a hard disk-type storage medium, a multimedia card micro-type storage medium, card-type memories (e.g., an SD card, an XD memory, and the like), Random Access Memory (RAM), Static Random Access Memory (SRAM), Read-Only Memory (ROM), Electrically Erasable Programmable Read-Only Memory (EEPROM), Programmable Read-Only Memory (PROM) magnetic memory, a magnetic disc, and an optical disc.

[0070] The image processor **126** may reconstruct a cross-sectional image with respect to the object **10** by using the projection data set. The cross-sectional image may be a 3D image. The image processor **126** may reconstruct the 3D image of the object **10** by using a cone beam reconstruction method or the like, based on the projection data set.

[0071] The input unit **128** may receive an external input with respect to an X-ray tomography imaging condition, an image processing condition, or the like. For example, the X-ray tomography imaging condition may include a tube voltage, energy value setting with respect to a plurality of X-rays, selection of an image-capturing protocol, selection of an image reconstruction method, setting of a FOV area, the number of slices, a slice thickness, parameter setting with respect to image post-processing, or the like. The image processing condition may include resolution of an image, attenuation coefficient setting with respect to the image, setting of an image combining ratio, or the like.

[0072] The input unit **128** may include a device for receiving a predetermined input from an external source. For example, the input unit **128** may include a microphone, a keyboard, a mouse, a joystick, a touch pad, a touch pen, a voice recognition device, a gesture recognition device, or the like.

[0073] The display **130** may display an X-ray tomography image reconstructed by the image processor **126**.

[0074] Exchanges of data, power, or the like between the aforementioned elements may be performed by using at least one of wired communication, wireless communication, and optical communication.

[0075] The communicator **132** may communicate with an external device, an external medical apparatus, etc., via a server **134** or the like.

[0076] The communicator **132** may exchange data with a hospital server or other medical apparatuses in a hospital connected via a Picture Archiving and Communication System (PACS). The communicator **132** may perform data communication with the portable device, according to a Digital Imaging and Communications in Medicine (DICOM) standard.

[0077] The communicator **132** may transmit and receive data related to diagnosing the object **10**, via the network. The communicator **132** may transmit and receive a medical image.

[0078] Furthermore, the communicator **132** may receive a diagnosis history or a medical treatment schedule about a patient from the server **134** and may use the diagnosis history or the medical treatment schedule in a clinical diagnosis for the patient. The communicator **132** may perform data communication with the portable device of a user or patient.

[0079] The communicator **132** may transmit information about a device error, information about a quality control status, or the like to a system manager or a service manager via the network, and may receive a feedback corresponding to the information.

[0080] FIG. **3** is a diagram illustrating an image diagnostic system **1000** according to an exemplary embodiment.

[0081] The image diagnostic system **1000** of FIG. **3** is illustrated as including only elements associated with the present exemplary embodiment. However, the image diagnostic system **1000** may further include other general-use elements in addition to the elements of FIG. **3**.

[0082] Referring to FIG. **3**, the image diagnostic system **1000** according to an exemplary embodiment may include an image diagnostic apparatus **1100** and a CT system **100**.

[0083] The image diagnostic apparatus **1100** may provide a user with guidelines for reconfiguring an image of an object **10** which is captured by the CT system **100**. The image diagnostic apparatus **1100** may provide the user with scan protocol information suitable for reconfiguring a captured image of the object **10** based on information of the object **10**. For example, the image diagnostic apparatus **1100** may provide scan protocol information suitable for reconfiguring a heart image of the object **10** which is captured by the CT system **100**, based on an electrocardiogram (ECG) signal of the object **10**.

[0084] The CT system **100** is merely an example of a system that is used to image the object **10** in an exemplary embodiment, but is not limited thereto. For example, the image diagnostic apparatus **1100** may provide the user with guidelines for reconfiguring an image of the object **10** which is captured by an MRI apparatus.

[0085] The image diagnostic apparatus **1100** according to an exemplary embodiment may communicate with another device. For example, the image diagnostic apparatus **1100** may communicate with the CT system **100**. The image diagnostic apparatus **1100** may communicate with a device, such as an ECG device, which acquires a bio-signal from the object **10**.

[0086] The image diagnostic apparatus **1100** may be provided outside the CT system **100** as in FIG. **3**, but is not limited thereto. According to another exemplary embodiment, the image diagnostic apparatus **1100** may include the CT system **100**.

[0087] The CT system **100** may project X-rays onto an object at various angles, and generate an image by reconfiguring an internal cross-sections of the object, based on the projection result.

[0088] FIG. **4** is a flowchart for describing an image diagnostic method according to an exemplary embodiment.

[0089] In operation **410**, the image diagnostic apparatus **1100** acquires an ECG signal of the object **10**.

[0090] The image diagnostic apparatus **1100** may receive data of the ECG signal of the object **10**, as measured by the ECG device. According to another exemplary embodiment, the image diagnostic apparatus **1100** may receive the data of the ECG signal of the object **10** from an external server that stores medical information of the object **10**.

[0091] The image diagnostic apparatus **1100** may acquire bio-signal information of the object **10**, in addition to the ECG signal of the object **10**. The bio-signal information is not limited to an electrical signal acquirable from the object **10**. For example, the image diagnostic apparatus **1100** may acquire a heart image of the object **10** captured by the CT system **100**. In the image diagnostic method according to an exemplary embodiment, a case in which the ECG signal is acquired as the information acquired in operation **410** for acquiring a scan protocol will be described as an example.

[0092] In operation **420**, the image diagnostic apparatus **1100** selects a scan protocol used to reconfigure a heart image of an object, based on the acquired ECG signal.

[0093] Examples of the scan protocol may include a prospective scan protocol, a retrospective scan protocol, and a multi-segment scan protocol. The scan protocols may further include other appropriate scan protocols; however, exemplary embodiments are described with reference to the above examples of the protocols.

[0094] The image diagnostic apparatus **1100** may select a scan protocol used to reconfigure a captured image of the object **10**, based on at least one of a period of the acquired ECG signal and a heart rate that is calculated based on the acquired ECG signal. The image diagnostic apparatus **1100** may select a scan protocol to be executed automatically, or may recommend the scan protocol to a user as a candidate scan protocol, to be confirmed and/or verified by the user.

[0095] In operation **430**, the image diagnostic apparatus **1100** may provide a user with information which has been used to propose the selected scan protocol. The image diagnostic apparatus **1100** according to an exemplary embodiment displays a user interface that displays information about the selected scan protocol. For example, the image diagnostic apparatus **1100** may display the selected scan protocol as text data or image data in the user interface.

[0096] The image diagnostic apparatus **1100** may display an explanation of a method in which the selected scan protocol reconfigures the captured image of the object **10** and/or a reason substantiating as to why the image diagnostic apparatus **1100** selected a certain scan protocol for the acquired ECG signal.

[0097] For example, when the image diagnostic apparatus **1100** selects the prospective scan protocol, the image diagnostic apparatus **1100** may determine the ECG signal acquired from the object **10** as being periodic, and display information, indicating a selection of the prospective scan protocol, in a certain region of the user interface.

[0098] The image diagnostic apparatus **1100** according to an exemplary embodiment may provide the user with guidelines for reconfiguring the captured image of the object **10**, based on the information acquired from the object **10**, thereby aiding the user in easily reconfiguring the captured image of the object **10**.

[0099] The image diagnostic apparatus **1100** according to an exemplary embodiment may display the acquired ECG signal along with an ECG signal sample corresponding to the selected scan protocol. The sample of the ECG signal corresponding to the selected scan protocol may be information

which is pre-stored and is used for the image diagnostic apparatus **1100** to select a scan protocol in comparison with the acquired ECG signal.

[0100] For example, the image diagnostic apparatus **1100** may store in advance a first ECG signal sample, a second ECG signal sample, and a third ECG signal sample. When the acquired ECG signal is most similar to the first ECG signal sample, the image diagnostic apparatus **1100** may select the prospective scan protocol as a scan protocol used to reconfigure the heart image of the object **10**. When the acquired ECG signal is most similar to the second ECG signal sample, the image diagnostic apparatus **1100** may select the retrospective scan protocol as the scan protocol used to reconfigure the heart image of the object **10**. When the acquired ECG signal is most similar to the third ECG signal sample, the image diagnostic apparatus **1100** may select the multi-segment scan protocol as the scan protocol used to reconfigure the heart image of the object **10**.

[0101] For example, the first ECG signal sample corresponds to an ECG signal having a substantially regular period. The second ECG signal sample corresponds to an ECG signal having an irregular period. The third ECG signal sample corresponds to an ECG signal that has a higher heart rate than an average heart rate.

[0102] The image diagnostic apparatus **1100** may differently set an ECG signal sample used to select a scan protocol, based on a disease, age, and gender of the object **10**.

[0103] The image diagnostic apparatus **1100** according to an exemplary embodiment may provide the user with the acquired ECG signal, ECG signal sample and the selected scan protocol, thereby providing the user with a scan protocol which is suitable for reconfiguring the heart image of the object **10**.

[0104] FIG. **5** is a flowchart for describing a method in which the image diagnostic apparatus **1100** selects a scan protocol for reconfiguring a heart image of an object **10**, according to an exemplary embodiment.

[0105] In operation **510**, the image diagnostic apparatus **1100** may acquire an ECG signal of the object **10**. The image diagnostic apparatus **1100** may receive data of the ECG signal of the object **10**, as measured by the ECG device.

[0106] Operation **510** of FIG. **5** may correspond to operation **410** of FIG. **4**.

[0107] In operation **520**, the image diagnostic apparatus **1100** may determine whether a heart rate, which is calculated based on the acquired ECG signal, exceeds a predetermined heart rate.

[0108] The image diagnostic apparatus **1100** according to an exemplary embodiment may determine whether to select the multi-segment scan protocol as a protocol used to reconfigure a heart image of the object **10**, based on the heart rate which is calculated based on the acquired ECG signal. For example, when a heart rate is high, the multi-segment scan protocol may be used to reconfigure an image of a heart.

[0109] For example, when a heart rate which is calculated based on an ECG signal exceeds 100 per minute, the image diagnostic apparatus **1100** may select the multi-segment scan protocol as a protocol used to reconfigure an image of a heart. The heart rate may be an average heart rate which is calculated for a predetermined time based on the ECG signal.

[0110] A user may adjust a predetermined heart rate in the image diagnostic apparatus **1100**. The user may adjust the predetermined heart rate so as to be suitable for a purpose of reconfiguring the image of the heart.

[0111] In operation **530**, the image diagnostic apparatus **1100** may select the multi-segment scan protocol as a protocol used to reconfigure the heart image of the object **10**. The image diagnostic apparatus **1100** according to an exemplary embodiment may select the multi-segment scan protocol for reconfiguring a captured image of a heart of an object **10** having a heart rate which exceeds the predetermined heart rate.

[0112] If a heart rate of the object is determined as not exceeding the predetermined heart rate in operation **520**, the image diagnostic apparatus **1100** may determine whether a period of the acquired ECG signal is constant, in operation **540**. The image diagnostic apparatus **1100** may determine whether the period of the acquired ECG signal is constant, for reconfiguring a captured image of a heart of an object **10** which is equal to or lower than the predetermined heart rate.

[0113] Generally, when a period of an ECG signal is constant, the prospective scan protocol is used, and when the period of the ECG signal is not constant, the retrospective scan protocol is used.

[0114] A related art ECG signal analyzing method may be used as a method in which the image diagnostic apparatus **1100** determines whether the period of the ECG signal is constant. A method in which the image diagnostic apparatus **1100** analyzes the ECG signal is not limited and any appropriate method known to those skilled in the art may be used.

[0115] In operation **550**, the image diagnostic apparatus **1100** may select the prospective scan protocol as a protocol used to reconfigure the heart image of the object **10**. The image diagnostic apparatus **1100** according to an exemplary embodiment may select the prospective scan protocol for reconfiguring a captured image of a heart of an object **10** having a constant heart rate.

[0116] In operation **560**, the image diagnostic apparatus **1100** may select the retrospective scan protocol as a protocol used to reconfigure the heart image of the object **10**. The image diagnostic apparatus **1100** according to an exemplary embodiment may select the retrospective scan protocol for reconfiguring a captured image of a heart of an object **10** having an irregular heart rate.

[0117] The image diagnostic apparatus **1100** may first determine whether the period of the acquired ECG signal is constant, before calculating the heart rate from the acquired ECG signal. That is, in a method where the image diagnostic apparatus **1100** selects a scan protocol, it is possible to switch the order in which operation **520** and operation **540** are performed.

[0118] In operation **570**, the image diagnostic apparatus **1100** may display a user interface that displays information about the selected scan protocol on a display included in the image diagnostic apparatus **1100** or on separately provided display.

[0119] FIG. **6** is a flowchart for describing a method in which the image diagnostic apparatus **1100** reconfigures an image of an object **10** based on a determined scan protocol, according to an exemplary embodiment.

[0120] In operation **610**, the image diagnostic apparatus **1100** may display a user interface that displays information about a selected scan protocol.

[0121] Operation **610** of FIG. **6** may correspond to the above-described operation **410** of FIG. **4**.

[0122] In operation **620**, the image diagnostic apparatus **1100** may receive a protocol determination signal, used to determine a scan protocol, from a user through the user inter-

face. The user may determine the scan protocol based on the information which is displayed in the user interface about the scan protocol.

[0123] According to an exemplary embodiment, the user interface may display, as information about a scan protocol, an ECG signal sample for a scan protocol, which are pre-stored and pre-selected, and an ECG signal which is acquired by the image diagnostic apparatus **1100**.

[0124] FIG. **7** is a diagram illustrating a user interface in which an ECG signal sample **710** and an acquired ECG signal **720** are shown as waveforms, according to an exemplary embodiment.

[0125] Referring to FIG. **7**, a user may compare the ECG signal sample **710** and the acquired ECG signal **720**, which are displayed in the user interface, to determine whether to reconfigure a heart image of an object **10**, by using a scan protocol selected by the image diagnostic apparatus **1100**.

[0126] The image diagnostic apparatus **1100** may display an explanation facilitating an analysis of a waveform as additional information in the ECG signal sample **710**. Statistical data of each section of the ECG signal may be displayed in the ECG signal sample **710**. For example, the statistical data may be displayed for each of an RR section, a P-Q section, a Q-T section, and an S-T section. The image diagnostic apparatus **1100** may display information about a statistically used scan protocol depending on a length of each section.

[0127] The image diagnostic apparatus **1100** may display information indicating a degree of similarity between the ECG signal sample **710** and the acquired ECG signal **720**.

[0128] For example, the user may perform setting so that the image diagnostic apparatus **1100** extracts an ECG signal sample having a similarity of about 80% or more with an acquired ECG signal to select a scan protocol. When a similarity of about 90% is calculated as a result that is obtained by analyzing a similarity between waveforms of the ECG signal sample **710** and the acquired ECG signal **720**, information indicating a calculated similarity being about 90% may be displayed as additional information along with information of the selected scan protocol, in the user interface.

[0129] The user interface of FIG. **7** is merely an example of the present exemplary embodiment, and various user interfaces may be provided. In FIG. **7**, a case in which the ECG signal sample **710** and the acquired ECG signal **720** are displayed separately from each other is shown as an example, but the image diagnostic apparatus **1100** may display the ECG signal sample **710** and the acquired ECG signal **720** to be overlapped with each other.

[0130] In operation **630**, the image diagnostic apparatus **1100** may determine whether a scan protocol corresponding to the protocol determination signal received from a user matches the scan protocol selected by the image diagnostic apparatus **1100**. The user may determine a scan protocol, in addition to the scan protocol selected by the image diagnostic apparatus **1100**.

[0131] The protocol determination signal may include identification information that enables the image diagnostic apparatus **1100** to select one scan protocol among a plurality of selectable scan protocols.

[0132] In operation **640**, the image diagnostic apparatus **1100** may reconfigure a captured heart image of the object **10** based on the selected scan protocol when the selected scan protocol matches a scan protocol determined by the user, i.e., confirmed or verified by a user.

[0133] The image diagnostic apparatus **1100** may be provided independently from the CT system **100**, or may include the CT system **100** and operate as an image diagnostic system. When the image diagnostic apparatus **1100** is provided independently from the CT system **100**, the image diagnostic apparatus **1100** may transmit a signal, which includes information about a determined scan protocol and a command for reconfiguring the captured heart image of the object **10**, to the CT system **100**. The CT system **100** may reconfigure the captured heart image of the object **10** according to the determined scan protocol, based on the signal received from the image diagnostic apparatus **1100**.

[0134] According to another exemplary embodiment, when the image diagnostic apparatus **1100** includes the CT system **100**, the image diagnostic apparatus **1100** may reconfigure the captured heart image of the object **10** based on the determined scan protocol.

[0135] In operation **650**, the image diagnostic apparatus **1100** may reconfigure the captured heart image of the object **10** based on the scan protocol determined by the user when the selected scan protocol does not match the scan protocol determined by the user.

[0136] A method, which reconfigures the captured heart image of the object **10** based on the determined scan protocol (operation **650**), may correspond to a method that reconfigures the captured heart image of the object **10** based on the selected scan protocol (operation **640**).

[0137] In operation **660**, the image diagnostic apparatus **1100** may display the reconfigured image on the display of the image diagnostic apparatus **1100**.

[0138] When the image diagnostic apparatus **1100** is provided independently from the CT system **100**, the image diagnostic apparatus **1100** may receive reconfigured image information from the CT system **100**, and display the received image information.

[0139] According to another exemplary embodiment, when the image diagnostic apparatus **1100** includes the CT system **100**, the image diagnostic apparatus **1100** may display image information that is reconfigured based on the determined or selected scan protocol.

[0140] FIG. **8** is a flowchart for describing an image diagnostic method according to an exemplary embodiment.

[0141] In operation **810**, the image diagnostic apparatus **1100** may acquire an ECG signal of an object **10**.

[0142] The image diagnostic apparatus **1100** may receive data of the ECG signal of the object **10**, as measured by the ECG device, or may receive the data of the ECG signal of the object **10** from an external server that stores medical information of the object **10**.

[0143] Operation **810** of FIG. **8** may correspond to the above-described operation **410** of FIG. **4**.

[0144] In operation **820**, the image diagnostic apparatus **1100** may select a scan protocol to reconfigure a captured heart image of the object **10**, based on the acquired ECG signal.

[0145] According to an exemplary embodiment, the image diagnostic apparatus **1100** may select a scan protocol to reconfigure a captured image of the object **10**, based on at least one of a period of the acquired ECG signal and a heart rate that is calculated based on the acquired ECG signal.

[0146] Operation **820** of FIG. **8** may correspond to the above-described operation **420** of FIG. **4**.

[0147] In operation **830**, the image diagnostic apparatus **1100** may reconfigure a captured heart image of the object **10** based on the selected scan protocol.

[0148] According to an exemplary embodiment, the image diagnostic apparatus **1100** may reconfigure a captured heart image of the object **10** based on the selected scan protocol even without receiving a user input signal.

[0149] The image diagnostic apparatus **1100** may be provided independently from the CT system **100**, or may be included in the CT system **100** and operate as the image diagnostic system. When the image diagnostic apparatus **1100** is provided independently from the CT system **100**, the image diagnostic apparatus **1100** may transmit a signal, which includes information about the selected scan protocol and a command for reconfiguring the captured heart image of the object **10**, to the CT system **100** via a wired/wireless connection. The CT system **100** may reconfigure the captured heart image of the object **10** according to the selected scan protocol, based on the signal received from the image diagnostic apparatus **1100**.

[0150] According to another exemplary embodiment, when the image diagnostic apparatus **1100** is included in the CT system **100**, the image diagnostic apparatus **1100** may reconfigure the captured heart image of the object **10** based on the selected scan protocol.

[0151] FIG. **9** is a flowchart for describing a method in which the image diagnostic apparatus **1100** sets a reconfiguration section of a captured heart image of an object **10**, according to an exemplary embodiment.

[0152] In operation **910**, the image diagnostic apparatus **1100** may analyze an ECG signal acquired from the object **10**.

[0153] The image diagnostic apparatus **1100** may acquire the heart image of the object **10** along with the ECG signal. According to another exemplary embodiment, the image diagnostic apparatus **1100** may analyze the captured heart image of the object **10**.

[0154] In operation **920**, the image diagnostic apparatus **1100** may determine whether there is a section where arrhythmia occurs, in the acquired ECG signal.

[0155] According to an exemplary embodiment, the image diagnostic apparatus **1100** may store information about an ECG signal of when the arrhythmia occurs. For example, the image diagnostic apparatus **1100** may store a sample waveform of the ECG signal of when arrhythmia occurs. The image diagnostic apparatus **1100** may compare the stored sample waveform and a waveform of an acquired ECG signal to determine whether there is a section where arrhythmia occurs in a section of the acquired ECG signal.

[0156] The method, which determines whether arrhythmia occurs based on an ECG signal, is merely an example, and is not limited thereto. For example, the image diagnostic apparatus **1100** may analyze the captured heart image of the object **10** to determine whether there is a section where arrhythmia occurs.

[0157] In operation **930**, the image diagnostic apparatus **1100** may display information about a section, where arrhythmia occurs, in the user interface.

[0158] According to an exemplary embodiment, when there is arrhythmia-occurring section as a result that is obtained by determining whether arrhythmia occurs in a section of the ECG signal acquired by the image diagnostic apparatus **1100**, the image diagnostic apparatus **1100** may display a section where arrhythmia occurs in the section of the acquired ECG signal, in the user interface.

[0159] In operation **940**, the image diagnostic apparatus **1100** may reset a section for reconfiguring the captured heart image based on a user input. When the user inputs a signal for commanding a section of the acquired ECG signal to be changed, the image diagnostic apparatus **1100** may reset a section, to exclude the section where arrhythmia occurs in the section of the acquired ECG signal.

[0160] On the other hand, when the user does not input a command to change the section of the acquired ECG signal, the image diagnostic apparatus **1100** does not exclude the section where arrhythmia occurs in the section of the acquired ECG signal.

[0161] In operation **950**, the image diagnostic apparatus **1100** may reconfigure the heart image of the object **10** in the reset section.

[0162] According to an exemplary embodiment, when the image diagnostic apparatus **1100** is not provided independently from the CT system **100**, the image diagnostic apparatus **1100** may transmit a signal, which includes information about a selected scan protocol, information about a set section, and a command for reconfiguring the captured heart image of the object **10**, to the CT system **100**. The CT system **100** may reconfigure the captured heart image of the object **10** according to the selected scan protocol, based on the signal received from the image diagnostic apparatus **1100**.

[0163] According to another exemplary embodiment, when the image diagnostic apparatus **1100** includes the CT system **100**, the image diagnostic apparatus **1100** may reconfigure the captured heart image of the object **10** in a section that is set based on the selected scan protocol.

[0164] According to an exemplary embodiment, the image diagnostic apparatus **1100** may provide the user with signal section information which is used to propose an ECG signal section for reconfiguring a heart of an object in an entire section of an acquired ECG signal. For example, the image diagnostic apparatus **1100** may provide the user with, as the signal section information, a section or sections, excluding a section or sections where arrhythmia occurs, in an entire section of the acquired ECG signal.

[0165] FIG. **10** is a diagram for describing a method in which the image diagnostic apparatus **1100** displays a section in which arrhythmia occurs in a user interface, according to an exemplary embodiment. Referring to FIG. **10**, the image diagnostic apparatus **1100** may display that arrhythmia occurs in three parts **1010**, **1020** and **1030** illustrated as box blocks, of an entire portion **1112** of an ECG signal displayed in the user interface.

[0166] According to an exemplary embodiment, the image diagnostic apparatus **1100** may recommend a section which does not include an arrhythmic section, where arrhythmia occurs, as a section for reconfiguring the captured heart image of the object **10**, to the user.

[0167] In FIG. **10**, the image diagnostic apparatus **1100** may display a conversation box block **1050** for checking whether to accept the section that is recommended to the user for reconfiguring the captured heart image. When the user selects "yes" from the conversation box block **1050**, the image diagnostic apparatus **1100** may newly set a first section to not include a section where arrhythmia occurs in the section of the acquired ECG signal. On the other hand, when the user selects "no" from the conversation box block **1050**, the image diagnostic apparatus **1100** may immediately reconfigure the captured heart image without any change in the section of the acquired ECG signal.

[0168] FIGS. **11** and **12** are block diagrams of the image diagnostic apparatus **1100** according to an exemplary embodiment.

[0169] As illustrated in FIG. **11**, the image diagnostic apparatus **1100** according to an exemplary embodiment may include an input/output unit **1110**, a controller **1120**, and an information provider **1130**. However, the image diagnostic apparatus **1100** may include other elements in addition to the illustrated elements or may include less elements than the illustrated elements.

[0170] For example, as illustrated in FIG. **12**, the image diagnostic apparatus **1100** may further include an image processor **1140**.

[0171] The input/output unit **1110** may include one or more elements that enable communication between the image diagnostic apparatus **1100** and another device or another system. For example, the input/output unit **1110** may perform Bluetooth communication, Bluetooth low energy (BLE) communication, short-distance wireless communication, and the like.

[0172] The input/output unit **1110** communicates with another device or another system to acquire information about the object **10**. For example, the input/output unit **1110** may acquire the ECG signal of the object **10**. According to an exemplary embodiment, the input/output unit **1110** may receive data of the ECG signal of the object **10**, as measured by the ECG device, or may receive the data of the ECG signal of the object **10** from an external server that stores medical information of the object **10**.

[0173] The input/output unit **1110** may acquire bio-signal information of the object **10**, in addition to the ECG signal of the object **10**. The bio-signal information acquired by the input/output unit **1110** is not limited to an electrical signal acquirable from the object **10**. For example, the input/output unit **1110** may acquire a heart image of the object **10** captured by the CT system **100**.

[0174] The controller **1120** selects a scan protocol used to reconfigure a heart image of an object, based on the acquired ECG signal.

[0175] The controller **1120** may select a scan protocol used to reconfigure a captured image of the object **10**, based on at least one of a period of the acquired ECG signal and a heart rate that is calculated based on the acquired ECG signal.

[0176] For example, the controller **1120** may determine whether a heart rate, which is calculated based on the acquired ECG signal, exceeds a predetermined heart rate. The controller **1120** according to an exemplary embodiment may determine whether to select the multi-segment scan protocol as a protocol used to reconfigure a heart image of the object **10**, based on the heart rate which is calculated based on the acquired ECG signal.

[0177] The controller **1120** may determine whether a period of the acquired ECG signal is constant. The controller **1120** may determine whether the period of the acquired ECG signal is constant, for reconfiguring a captured image of a heart of an object **10** which is equal to or lower than the predetermined heart rate.

[0178] For example, when a period of an ECG signal is constant, the prospective scan protocol is used, and when the period of the ECG signal is not constant, the retrospective scan protocol is used.

[0179] The controller **1120** according to an exemplary embodiment may first determine whether the period of the acquired ECG signal is constant, before determining for the heart rate calculated from the acquired ECG signal.

[0180] The information provider **1130** may include a display panel (not shown) that displays a screen corresponding to image data, and display the screen in the display panel.

[0181] The information provider **1130** may be configured to include a touch screen, for example, a touch pad coupled to the display panel (not shown). In this case, the information provider **1130** may output the touch screen onto the display panel, and when a command is input through the touch screen, the touch pad may detect the command.

[0182] For example, a user interface screen may be output onto the display panel. When the user touches a certain position of the user interface screen, the touch pad detects the touched position. The information about the touched position may be transferred to the controller **1120**.

[0183] The information provider **1130** according to an exemplary embodiment may provide the user with information used to propose the selected scan protocol to the user. For example, the information provider **1130** may display a user interface that displays information about the selected scan protocol. The information provider **1130** may display an explanation of a method by which the selected scan protocol reconfigures the captured image of the object **10**. The information provider **1130** may display the reason or information indicating as to why a certain scan protocol has been selected, i.e., recommended, for the acquired ECG signal.

[0184] The information provider **1130** according to an exemplary embodiment may display the acquired ECG signal along with a sample of an ECG signal corresponding to the selected scan protocol. The sample of the ECG signal corresponding to the selected scan protocol with the selected scan protocol applied thereto may be included in a database that is used by the image diagnostic apparatus **1100** to select a scan protocol in comparison with the acquired ECG signal.

[0185] The information provider **1130** according to an exemplary embodiment may display pre-stored scan protocol information about an ECG signal of which a similarity with the acquired ECG signal is equal to or greater than a predetermined value.

[0186] The information provider **1130** may receive a protocol determination signal, used to determine a scan protocol, from the user.

[0187] The information provider **1130** may provide the user with signal section information which is used to propose an ECG signal section for reconfiguring a heart of an object in a whole section of an acquired ECG signal. For example, the information provider **1130** may provide the user with, as the signal section information, a section except a section where arrhythmia occurs in a whole section of the acquired ECG signal.

[0188] The image processor **1140** may reconfigure the heart image of the object **10** based on a scan protocol corresponding to the protocol determination signal received from the user. When the scan protocol corresponding to the received protocol determination signal is the same as the selected protocol, the image processor **1140** may reconfigure the heart image of the object **10** based on the selected scan protocol. On the other hand, when the scan protocol corresponding to the received protocol determination signal differs from the selected protocol, the image processor **1140** may reconfigure the heart image of the object **10** based on the scan protocol corresponding to the protocol determination signal. The image processor **1140** may set a reconfiguration section

for the acquired ECG signal. When the set reconfiguration section includes a first section where arrhythmia occurs in the heart of the object **10**, the image processor **1140** may control the image provider **1130** to display information about the first section.

[0189] The exemplary embodiments may be written as computer programs and may be implemented in general-use digital computers that execute the programs using a computer-readable recording medium.

[0190] Examples of the computer-readable recording medium include magnetic storage media (e.g., ROM, floppy disks, hard disks, etc.), optical recording media (e.g., CD-ROMs, or DVDs), etc.

[0191] The foregoing exemplary embodiments and advantages are merely exemplary and are not limiting. The present teaching can be readily applied to other types of apparatuses. Also, the description of the exemplary embodiments is intended to be illustrative, and not to limit the scope of the claims, and many alternatives, modifications, and variations will be apparent to those skilled in the art.

What is claimed is:

1. An image diagnostic method comprising:

acquiring an electrocardiogram (ECG) signal of an object;

selecting a scan protocol to reconfigure a heart image of the object, based on the acquired ECG signal; and

providing a user with information which was used to propose the selected scan protocol.

2. The image diagnostic method of claim **1**, wherein the selecting the scan protocol comprises:

selecting the scan protocol, based on at least one of a period of the acquired ECG signal and a heart rate of the object.

3. The image diagnostic method of claim **1**, wherein the scan protocol comprises one of a prospective scan protocol, a retrospective scan protocol, and a multi-segment scan protocol.

4. The image diagnostic method of claim **1**, wherein the providing the information comprises:

displaying a user interface configured to display the acquired ECG signal together with information about the selected scan protocol.

5. The image diagnostic method of claim **1**, further comprising:

receiving a protocol determination signal, to designate the scan protocol, from the user; and

reconfiguring the heart image of the object, based on the designated scan protocol corresponding to the received protocol determination signal.

6. The image diagnostic method of claim **5**, wherein the reconfiguring the heart image comprises:

reconfiguring the heart image of the object, based on the selected scan protocol, in response to the designated scan protocol being the same as the selected scan protocol; and

reconfiguring the heart image of the object, based on the designated scan protocol, in response to the designated scan protocol being different from the selected scan protocol.

7. The image diagnostic method of claim **5**, wherein the reconfiguring the heart image comprises:

setting a reconfiguration section for the acquired ECG signal;

determining that the reconfiguration section includes a first section where arrhythmia occurs in a heart of the object; and

providing the user with information about the first section.

8. The image diagnostic method of claim **5**, wherein the reconfiguring the heart image comprises:

reconfiguring the heart image in one or more sections, by excluding an arrhythmic section, in an entire section of the acquired ECG signal,

wherein the arrhythmic section is a section in which arrhythmia occurs in a heart of the object.

9. The image diagnostic method of claim **5**, wherein the reconfiguring the heart image comprises:

providing the user with signal section information, which is used to propose an ECG signal section for reconfiguring the heart image of the object in an entire section of an acquired ECG signal.

10. The image diagnostic method of claim **1**, wherein the providing the information comprises:

displaying pre-stored scan protocol information about an ECG signal in which a similarity with the acquired ECG signal is equal to or greater than a predetermined value.

11. An image diagnostic apparatus comprising:

an input/output unit configured to acquire an electrocardiogram (ECG) signal of an object;

a controller configured to select a scan protocol to reconfigure a heart image of the object, based on the acquired ECG signal; and

an information provider configured to provide a user with information which was used to propose the selected scan protocol.

12. The image diagnostic apparatus of claim **11**, wherein the controller is configured to select the scan protocol, based on at least one of a period of the acquired ECG signal and a heart rate of the object.

13. The image diagnostic apparatus of claim **11**, wherein the scan protocol comprises one of a prospective scan protocol, a retrospective scan protocol, and a multi-segment scan protocol.

14. The image diagnostic apparatus of claim **11**, wherein the information provider is configured to display a user interface configured to display the acquired ECG signal together with information about the selected scan protocol.

15. The image diagnostic apparatus of claim **11**, wherein the information provider is configured to receive a protocol determination signal, to designate the scan protocol, from the user, and

the image diagnostic apparatus further comprises an image processor configured to reconfigure the heart image of the object, based on the designated scan protocol corresponding to the received protocol determination signal.

16. The image diagnostic apparatus of claim **15**, wherein the image processor is configured to reconfigure the heart image of the object, based on the selected scan protocol, in response to the designated scan protocol being the same as the selected scan protocol, and reconfigure the heart image of the object, based on the designated scan protocol, in response to the designated scan protocol being different from the selected scan protocol.

17. The image diagnostic apparatus of claim **15**, wherein the image processor is configured to set a reconfiguration section for the acquired ECG signal, and

when the set reconfiguration section includes a first section where arrhythmia occurs in a heart of the object, the image processor is configured to perform control so that information about the first section is displayed by the information provider.

18. The image diagnostic apparatus of claim **15**, wherein the image processor is configured to reconfigure an image in one or more sections, by excluding an arrhythmic section, in an entire section of the acquired ECG signal, and

the arrhythmic section is a section in which arrhythmia occurs in a heart of the object.

19. The image diagnostic apparatus of claim **15**, wherein the information provider is configured to provide the user with signal section information, which is used to propose an ECG signal section for reconfiguring a heart of the object in an entire section of an acquired ECG signal.

20. The image diagnostic apparatus of claim **11**, wherein the information provider is configured to display pre-stored scan protocol information about an ECG signal of which a similarity with the acquired ECG signal is equal to or greater than a predetermined value.

21. A non-transitory computer-readable storage medium storing a program which, when executed by a computer, causes the computer to execute the method of claim **1**.

* * * * *

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摘要(译)

图像诊断方法包括获取对象的心电图（ECG）信号，基于所获取的ECG信号选择用于重新配置对象的心脏图像的扫描协议，以及向用户提供用于提出所选择的扫描协议的信息。。