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(54) IMAGE INDICATOR PROVISION IN AN ULTRASOUND SYSTEM

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(57) **ABSTRACT**

Embodiments of providing image indicators together with an ultrasound image are disclosed. A mapping table including a plurality of objects each associated with examination locations, each of the examination locations being associated with one or more image indicators. The image indicators include a target organ marker indicative of each object, a body axis marker indicative of an anatomical orientation of each object, and an ultrasound beam direction marker indicative of a transmission direction of the ultrasound beam. A processing unit accesses the storage unit to provide the image indicators corresponding to a target object and examination location selected in response to selection instructions inputted by a user. The processing unit further 3-dimensionally rotates the image indicators based on position information of an ultrasound probe.

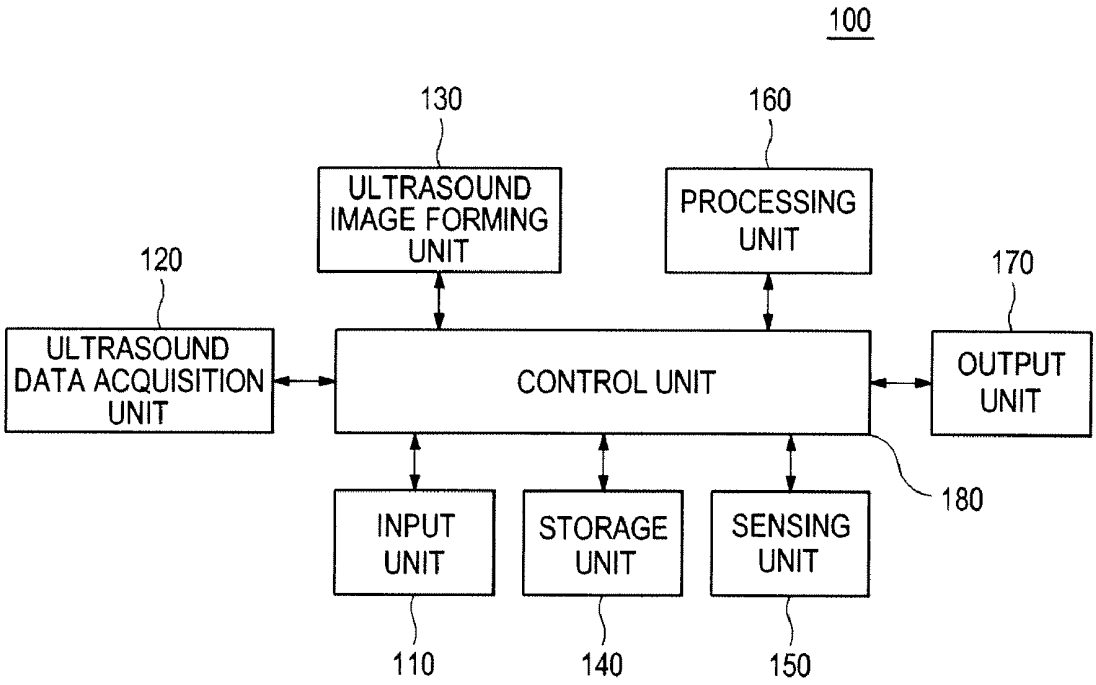


FIG. 1

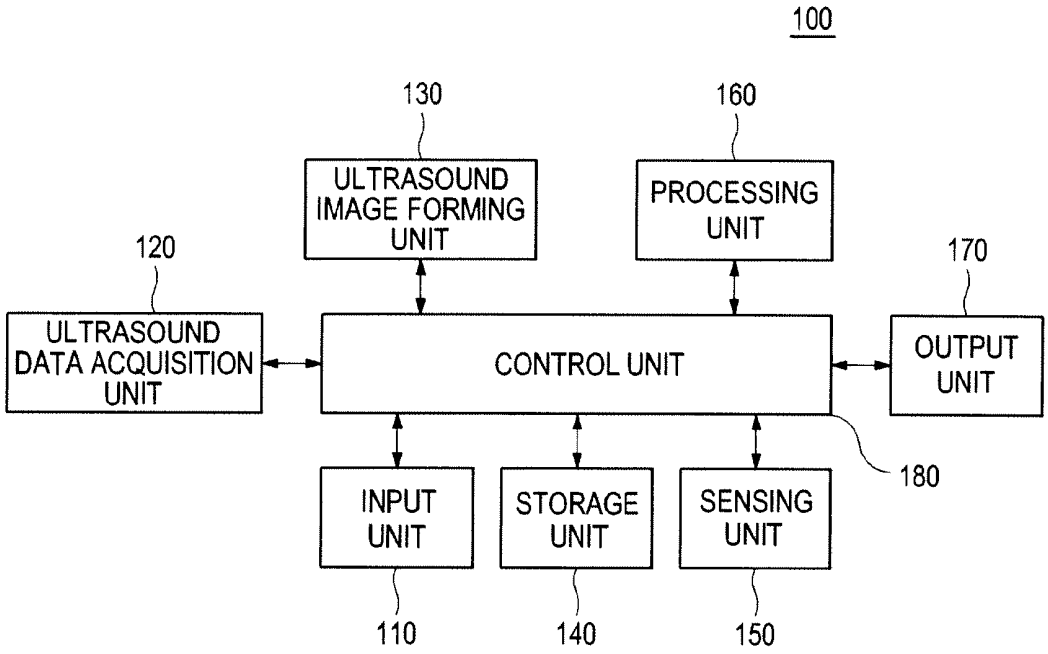

100
130
160
ULTRASOUND IMAGE FORMING UNIT
PROCESSING UNIT
120
170
ULTRASOUND DATA ACQUISITION UNIT
CONTROL UNIT
OUTPUT UNIT
180
INPUT UNIT
STORAGE UNIT
SENSING UNIT
110
140
150

FIG. 2

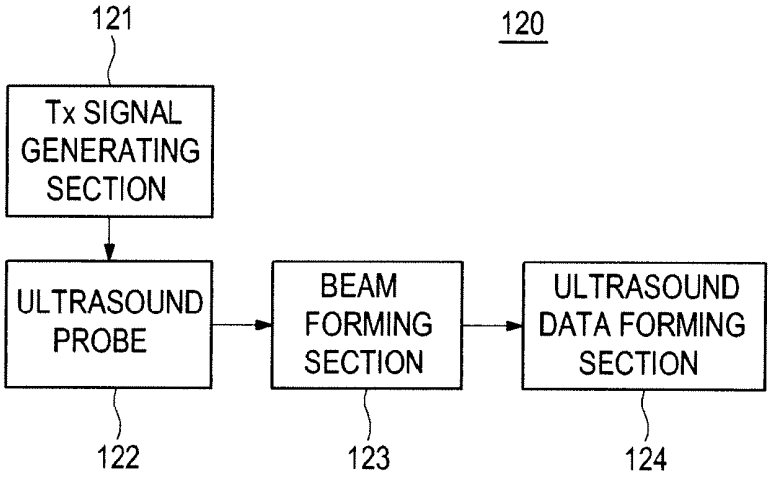

121
120
Tx SIGNAL GENERATING SECTION
ULTRASOUND PROBE
BEAM FORMING SECTION
ULTRASOUND DATA FORMING SECTION
122
123
124

FIG. 3

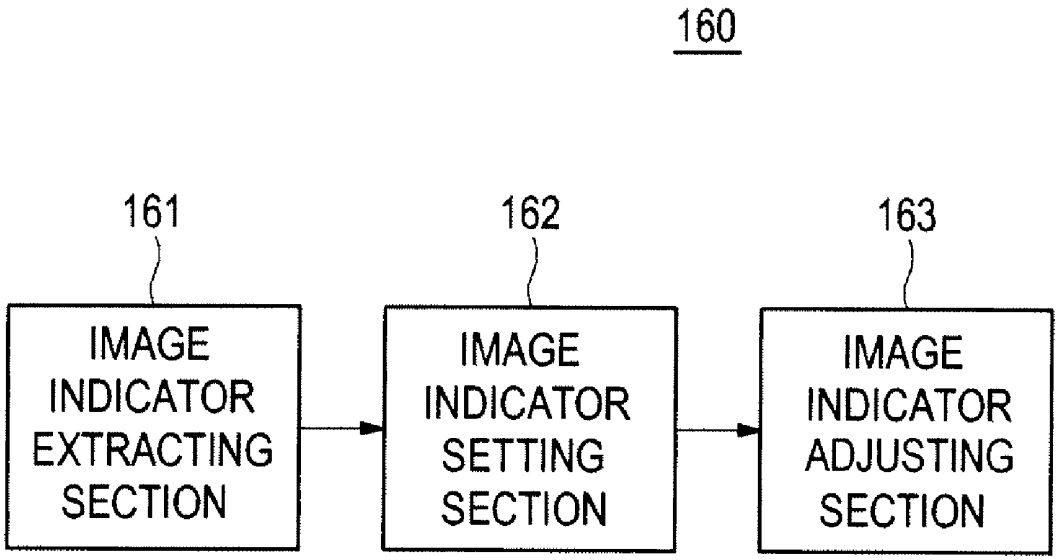

160
161
IMAGE INDICATOR EXTRACTING SECTION
162
IMAGE INDICATOR SETTING SECTION
163
IMAGE INDICATOR ADJUSTING SECTION

FIG. 4

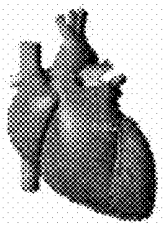
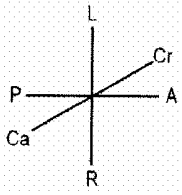
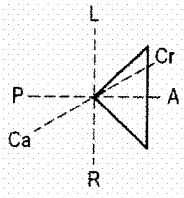
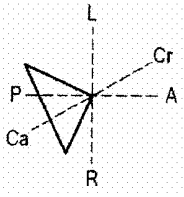
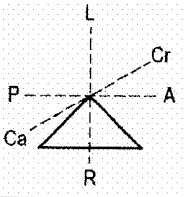
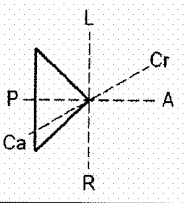
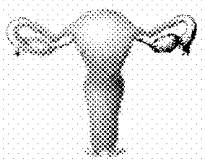
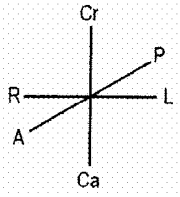
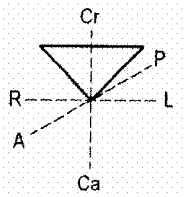
TARGET OBJECT	EXAMINATION LOCATION	TARGET ORGAN MARKER	BODY AXIS MARKER	ULTRASOUND BEAM DIRECTION MARKER
HEART	PARASTERNAL VIEW			
	APICAL VIEW			
	SUBCOSTAL VIEW			
	SUPRASTERNAL VIEW			
UTERUS	VAGINA			
⋮	⋮	⋮	⋮	⋮

FIG. 5

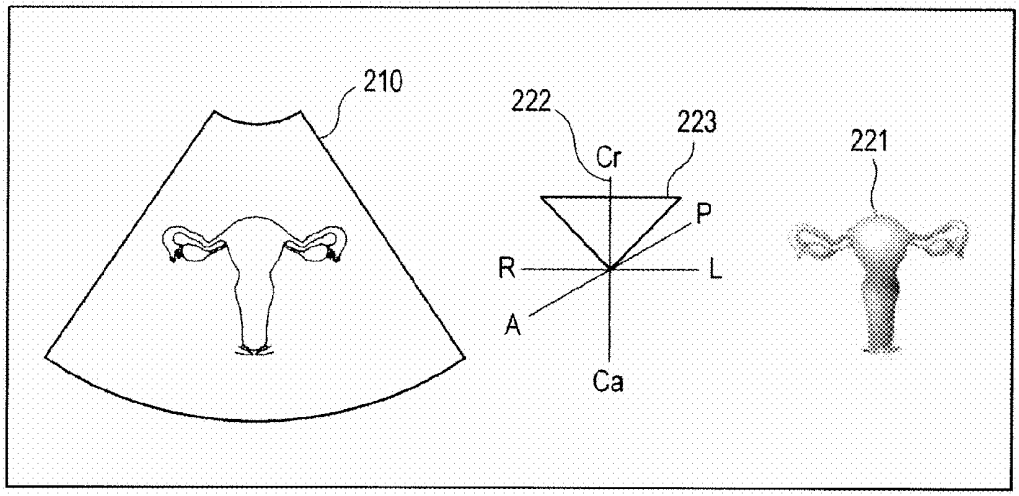


FIG. 6

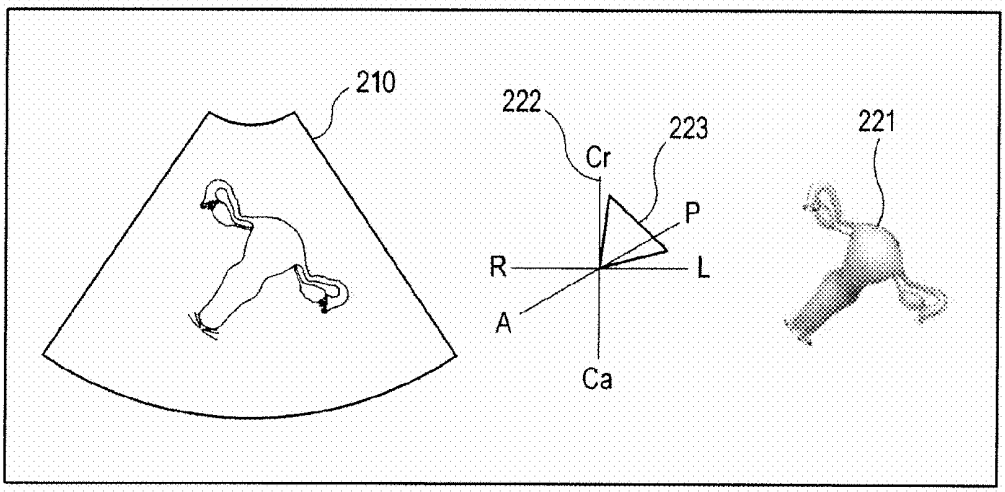


IMAGE INDICATOR PROVISION IN AN ULTRASOUND SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority from Korean Patent Application No. 10-2009-0006570 filed on Jan. 28, 2009, the entire subject matter of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure generally relates to an ultrasound system, and more particularly to an ultrasound system that can provide image indicators corresponding to a target object.

BACKGROUND

[0003] An ultrasound system has become an important and popular diagnostic tool since it has a wide range of applications. Specifically, due to its non-invasive and non-destructive nature, the ultrasound system has been extensively used in the medical profession. Modern high-performance ultrasound systems and techniques are commonly used to produce two or three-dimensional diagnostic images of internal features of an object (e.g., human organs).

[0004] Generally, the ultrasound system provides a relatively narrow view angle. This is so that scanning is performed for multiple examination locations of a target object to form ultrasound images corresponding to the respective examination locations. The ultrasound images may be outputted by using an echo printer. The examination is then implemented through the outputted ultrasound images. However, it may be difficult to intuitively recognize which part is scanned or which ultrasound image corresponds to an up, down, left or right ultrasound image of the target object. Thus, the ultrasound images may be outputted together with image indicators (e.g., icons) indicative of corresponding examination parts. The image indicators may be also referred to as body markers. The image indicators may be overlaid on the ultrasound images as texts. For example, if a user selects a text button on a control panel provided by the ultrasound system, then a text input window may be activated on the ultrasound image. The user may manipulate a track ball mounted on the control panel to position a cursor on the text input window for text input. Inputting the text may be performed by using a keyboard, which is also mounted on the control panel. However, inputting the text in such fashion may take a long time and greatly inconvenience the user. Also, since the image indicators are directly selected by the user, the image indicators may be incorrectly set.

SUMMARY

[0005] Embodiments for providing image indicators in an ultrasound system are disclosed herein. In one embodiment, by way of non-limiting example, an ultrasound system comprises: an ultrasound probe configured to transmit and receive an ultrasound beam to and from a target object for ultrasound imaging; a sensing unit configured to sense a 3-dimensional position of the ultrasound probe to form position information; a storage unit to store a mapping table associating a plurality of objects and examination locations for each object with predetermined image indicators including a target organ marker indicative of each object, a body axis marker indicative of an anatomical orientation of the examination location for each object, and an ultrasound beam direction marker indicative of a transmission direction of the ultrasound beam; an input unit configured to allow a user to input selection instructions for selecting the target object among the plurality of objects and an examination location for the target object; and a processing unit configured to access the storage unit to provide the image indicators corresponding to the target object and examination location in response to the selection instructions and to 3-dimensionally rotate the image indicators based on the position information of the ultrasound probe.

[0006] In one embodiment, there is provided a method of providing an image indicator in an ultrasound system including an ultrasound probe, comprising: a) storing a mapping table associating a plurality of objects and examination locations for each object with predetermined image indicators in a storage unit, the image indicators including a target organ marker indicative of each object, a body axis marker indicative of an anatomical orientation of the examination location of each object, and an ultrasound beam direction marker indicative of a transmission direction of the ultrasound beam; b) inputting selection instructions for selecting a target object among the plurality of objects and an examination location for the target object; c) accessing the storage unit to provide image indicators corresponding to the selected target object and examination location in response to the inputted instructions; d) sensing a position of the ultrasound probe by using a sensing unit mounted on the ultrasound probe to form position information; and e) 3-dimensionally rotating the image indicators based on the position information.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a block diagram showing an illustrative embodiment of an ultrasound system.

[0008] FIG. **2** is a block diagram showing an illustrative embodiment of an ultrasound data acquisition unit.

[0009] FIG. **3** is a block diagram showing an illustrative embodiment of a processing unit.

[0010] FIG. **4** is an exemplary diagram showing a mapping table associating a plurality of objects and examination locations for each of the objects with image indicators.

[0011] FIG. **5** is a schematic diagram showing an example of displaying image indictors together with an ultrasound image.

[0012] FIG. **6** is a schematic diagram showing an example of displaying image indicators together with an ultrasound image, wherein their orientation has been adjusted according to position information of an ultrasound probe.

DETAILED DESCRIPTION

[0013] A detailed description may be provided with reference to the accompanying drawings. One of ordinary skill in the art may realize that the following description is illustrative only and is not in any way limiting. Other embodiments of the present invention may readily suggest themselves to such skilled persons having the benefit of this disclosure.

[0014] FIG. **1** is a block diagram showing an illustrative embodiment of an ultrasound system. As shown therein, the ultrasound system **100** may include an input unit **110** for allowing a user to input instructions. The instructions may include selection instructions for selecting a target object for diagnosis among a plurality of objects and a specific exami-

nation location for the selected target object. The instructions may further include output instructions for requesting an output of the ultrasound image and showing/hiding image indicators on a screen. The target object, examination location and image indicators will be described in detail later. The input unit **110** may include at least one of a control panel, a mouse, a keyboard, a trackball, a touch screen, etc.

[0015] The ultrasound system **100** may further include an ultrasound data acquisition unit **120**. The ultrasound data acquisition unit **120** may transmit and receive ultrasound signals to and from the target object to thereby acquire ultrasound data corresponding to a plurality of frames. Referring to FIG. **2**, the ultrasound data acquisition unit **120** may include a transmit (Tx) signal generating section **121**, which may be configured to generate a plurality of Tx signals.

[0016] The ultrasound data acquisition unit **120** may further include an ultrasound probe **122** coupled to the Tx signal generating section **121**. The ultrasound probe **122** may transmit the ultrasound signals to the target object in response to the Tx signals. The ultrasound probe **122** may be further configured to receive echo signals reflected from the target object to thereby form electrical receive signals. The ultrasound probe **122** may contain an array transducer consisting of a plurality of transducer elements. In one embodiment, the ultrasound probe **122** may include a convex probe, a linear probe, a 3-dimensional probe, an insertion probe etc., although it is not limited thereto. The insertion probe may include a transvaginal probe and a transrectal probe.

[0017] The ultrasound data acquisition unit **120** may further include a beam forming section **123**. The beam forming section **123** may apply delays to the electrical receive signals in consideration of positions of the transducer elements and focal points. The beam forming section **123** may further sum the delayed receive signals to thereby output a plurality of receive-focused beams. The ultrasound data acquisition unit **120** may further include an ultrasound data forming section **124**, which may form the ultrasound data corresponding to the plurality of frames based on the receive-focused beams. The ultrasound data forming section **124** may be operable to perform signal processing upon the receive-focused beams such as gain adjustment, filtering and the like.

[0018] The ultrasound system **100** may further include an ultrasound image forming unit **130** connected to the ultrasound data acquisition unit **120** to receive the ultrasound data. The ultrasound image forming unit **130** may form an ultrasound image of the target object by using the ultrasound data. The ultrasound image may include a brightness-mode image formed by using reflection coefficients of echo signals reflected from the target object, a Doppler-mode image showing spectral Doppler representative of velocities of a moving object by using the Doppler Effect, a color-mode image showing velocities of moving objects by using predetermined colors mapped to the respective velocities, an elastic image visualizing mechanical characteristics of tissues based on strain representing deformation of tissues due to the application of the compression and the like.

[0019] The ultrasound system **100** may further include a storage unit **140**, which may store predetermined image indicators corresponding to a plurality of objects and examination locations for each object. In one embodiment, the image indicators may include target organ markers indicative of the objects such as a heart, liver, stomach, uterus, anus and the like. It may also include body axis markers indicative of anatomical orientation of the examination location for each object such as cranial Cr, caudal Ca, anterior A, posterior P, right R and left L on a 2-dimensional or 3-dimensional coordinate system. The image indicators may further include an ultrasound beam direction marker indicative of a transmission direction of an ultrasound beam transmitted from the ultrasound probe **122** for each examination location. In one embodiment, the storage unit **140** may store a mapping table associating the objects and examination locations for each object with the image indicators including the target organ markers, body axis markers and ultrasound beam direction markers, as shown in FIG. **4**.

[0020] In one embodiment, the target organ markers may be 3-dimensionally or 2-dimensionally represented. Also, the body axis markers may be represented on a 3-dimensional Cartesian coordinate system. Further, the ultrasound beam direction marker may be 2-dimensionally or 3-dimensionally represented according to the type of the ultrasound probe **122**. For example, when the ultrasound probe **122** is a 1-dimensional array probe, the ultrasound beam direction marker may be 2-dimensionally represented. Also, when the ultrasound probe **122** is a 2-dimensional array probe or a 3-dimensional mechanical probe, the ultrasound beam direction marker may be 3-dimensionally represented.

[0021] The ultrasound system **100** may further include a sensing unit **150**, which may sense a position of the ultrasound probe **122** to thereby form 3-dimensional position information of the ultrasound probe **122**. The sensing unit **150** may be mounted on a predetermined position of the ultrasound probe **122**. Thus, when the ultrasound probe **122** is located in a specific examination location, the sensing unit **150** may sense the 3-dimensional position of the ultrasound probe **122** to form the position information. Any type of sensors capable of sensing a 3-dimensional position of the ultrasound probe **122** may be employed as the sensing unit **150**. For example, the sensing unit **150** may include at least one of an angular velocity sensor, magnetic sensor, accelerometer sensor, gravity sensor, Gyro sensor and the like.

[0022] The ultrasound system **100** may further include a processing unit **160**. The processing unit **160** may access the storage unit **140** to provide the image indicators corresponding to an object and an examination location selected in response to the instruction inputted by the user. The processing unit **160** may further 3-dimensionally rotate the provided image indicators based on the position information of the ultrasound probe **122**, which is formed by the sensing unit **150**.

[0023] FIG. **3** is a block diagram showing an illustrative embodiment of the processing unit **160**. Referring to FIG. **3**, the processing unit **160** may include an image indicator extracting section **161**. The image indicator extracting section **161** may access the storage unit **140** in response to the selection instruction inputted by the user to extract the image indicators (i.e., target organ marker, body axis marker and ultrasound beam direction marker). For example, if the selection instructions for selecting the uterus as a target object and the vagina as an examination location are inputted through the input unit **110**, then the image indicator extracting section **161** may access the storage unit **140** to extract the corresponding image indicators including the target organ marker, body axis marker and ultrasound beam from the mapping table. Also, the selection instructions for selecting the heart as the target object and the parasternal view as the examination location are inputted through the input unit **110**, the image indicator extracting section **161** may access the storage unit **140** to

extract the image indicators including the target organ marker, body axis marker and ultrasound beam corresponding to the heart and the parasternal view.

[0024] The processing unit **160** may further include an image indicator setting section **162**. The image indicator setting section **160** may perform orientation setting of the extracted image indicators based on the position information of the ultrasound probe **122**. The image indicators, which are set by the image indicator setting section **160**, may be outputted to an output unit **170**. The output unit **170** may include a display unit (not shown) such as a CRT monitor, LCD display, OLED display and the like to display the ultrasound image. Further, the output unit **170** may include an echo printer (not shown) to print out the ultrasound image and the image indicators. For example, the image indicator setting section **162** may arrange the extracted body axis marker **222** and ultrasound beam direction marker **223** based on anatomical characteristics of the target object, and set the ultrasound beam direction marker **223** to be overlaid over the body axis marker **222**, as shown in FIG. **5**. Further, the image indicator setting section **162** may position the target organ marker **221** at the right side of the body axis marker **222** and the ultrasound beam direction marker **223** to perform the orientation setting upon the body axis marker **222**, the ultrasound beam direction marker **223** and the target organ marker **221** based on the position information.

[0025] Although the above embodiment has been described that the body axis marker is overlaid over the ultrasound beam marker and the target organ marker is positioned at the right side of the body axis marker, the arrangement thereof may not be limited thereto. The body axis marker, the ultrasound beam direction marker and the target organ marker may be set to be overlaid or to be separated from each other.

[0026] The image processing unit **160** may further include an image indicator adjusting section **163**. If the ultrasound probe **122** is moved along a predetermined guide line, then the position information of the ultrasound probe **122** may be changed. The image indicator adjusting section **163** may be configured to adjust the image indicators based on the changed position information. For example, the image indicator adjusting section **163** may rotate the image indicators 3-dimensionally based on the changed position information. The image indicator adjusting section **163** may compute a position difference of the ultrasound probe **122** based on the changed position information, and 3-dimensionally rotate the image indicators including the target organ marker **221**, the body axis marker **222** and the ultrasound beam direction marker **223** based on the computed position difference, as illustrated in FIG. **6**. In FIGS. **5** and **6**, reference numeral "**210**" may represent an ultrasound image. The image indicator adjusting section **163** may further show or hide the image indicator in response to an instruction for showing/hiding the image indicators on a screen, which may be inputted through the input unit **110**.

[0027] Referring back to FIG. **1**, the ultrasound system **100** may further include a control unit **180**. The control unit **180** may control the transmission and reception of the ultrasound signals in the ultrasound data acquisition unit **120** according to an image mode. Further, the control unit **180** may be configured to control entire operations of the elements of the ultrasound system **100**.

[0028] While the present invention is described by some preferred embodiments, it will be appreciated by those skilled in the art that many modifications and changes can be made without departing from the spirit and scope of the appended claims.

What is claimed is:

1. An ultrasound system, comprising:

an ultrasound probe configured to transmit and receive an ultrasound beam to and from a target object for ultrasound imaging;

a sensing unit configured to sense a 3-dimensional position of the ultrasound probe to form position information;

a storage unit configured to store a mapping table including a plurality of objects each associated with examination locations, each of the examination locations being associated with one or more image indicators, the one or more image indicators including a target organ marker indicative of the respective object, a body axis marker indicative of an anatomical orientation determined according to the respective examination location, and an ultrasound beam direction marker indicative of a transmission direction of the ultrasound beam determined according to the respective examination location;

an input unit configured to allow a user to input one or more selection instructions for selecting a target object among the plurality of objects and one of the examination locations for the target object; and

a processing unit configured to access the storage unit to provide the image indicators corresponding to the target object and the one examination location in response to the selection instructions and to rotate the image indicators 3-dimensionally based on the position information of the ultrasound probe.

2. The ultrasound system of claim **1**, wherein the target organ marker is represented in a 2-dimensional or 3-dimensional marker.

3. The ultrasound system of claim **1**, wherein the ultrasound beam direction marker is 2-dimensionally or 3-dimensionally represented according to a type of the ultrasound probe.

4. The ultrasound system of claim **1**, wherein the sensing unit is selected from the group consisting of an angular velocity sensor, magnetic sensor, accelerometer sensor, gravity sensor, Gyro sensor and combinations thereof.

5. The ultrasound system of claim **1**, wherein the processing unit includes:

an image indicator extracting section configured to access the storage unit to extract the target organ marker, the body axis marker and the ultrasound beam direction marker corresponding to the target object and the examination location selected in response to the instructions;

an image indicator setting section configured to perform orientation setting upon the extracted target organ marker, body axis marker and ultrasound beam direction marker based on the position information; and

an image indicator adjusting section configured to rotate the extracted target organ marker, body axis marker and ultrasound beam direction marker 3-dimensionally based on position information changed due to a movement of the ultrasound probe.

6. The ultrasound system of claim **5**, wherein the image indicator setting section is configured to arrange the extracted target organ marker, body axis marker and ultrasound beam direction marker based on anatomical characteristics of the target object.

7. The ultrasound system of claim **1**, wherein the input unit is configured to allow a user to input instructions for showing/hiding the image indicators.

8. The ultrasound system of claim **7**, wherein the processing unit is configured to show/hide the image indicator in response to the instructions for showing/hiding the image indicator.

9. The ultrasound system of claim **1**, further comprising an output unit to output the image indicator.

10. A method of providing an image indicator in an ultrasound system including an ultrasound probe, comprising:

a) storing a mapping table including a plurality of objects each associated with examination locations, each of the examination locations being associated with one or more image indicators, the one or more image indicators including a target organ marker indicative of the respective object, a body axis marker indicative of an anatomical orientation determined according to the respective examination location, and an ultrasound beam direction marker indicative of a transmission direction of the ultrasound beam determined according to the respective examination location;

b) inputting one or more selection instructions for selecting a target object among the plurality of objects and one of the examination locations for the target object;

c) accessing the storage unit to provide image indicators corresponding to the selected target object and examination location in response to the inputted instructions;

d) sensing a position of the ultrasound probe by using a sensing unit mounted on the ultrasound probe to form position information; and

e) 3-dimensionally rotating the image indicators based on the position information.

11. The method of claim **10**, wherein the target organ marker is represented in a 2-dimensional or 3-dimensional marker.

12. The method of claim **10**, wherein the ultrasound beam direction marker is 2-dimensionally or 3-dimensionally represented according to a type of the ultrasound probe.

13. The method of claim **10**, wherein the sensing unit is selected from the group consisting of an angular velocity sensor, magnetic sensor, accelerometer sensor, gravity sensor, Gyro sensor and combinations thereof.

14. The method of claim **10**, wherein step c) includes:

accessing the storage unit to extract the target organ marker, the body axis marker and the ultrasound beam direction marker corresponding to the target object and the examination location selected in response to the instructions; and

performing orientation setting upon the extracted target organ marker, body axis marker and ultrasound beam direction marker based on the position information.

15. The method of claim **14**, wherein step e) includes 3-dimensionally rotating the extracted target organ marker, body axis marker and ultrasound beam direction marker based on position information changed due to a movement of the ultrasound probe.

16. The method of claim **15**, wherein step c) further includes arranging the extracted target organ marker, body axis marker and ultrasound beam direction marker based on anatomical characteristics of the target object.

17. The method of claim **10**, further comprising inputting instructions for showing/hiding the image indicators.

18. The method of claim **17**, further comprising showing/hiding the image indicator in response to the instructions for showing/hiding the image indicator.

19. The method of claim **10**, further comprising outputting the image indicators.

* * * * *

专利名称(译)	超声系统中的图像指示器		
公开(公告)号	US20100191114A1	公开(公告)日	2010-07-29
申请号	US12/693347	申请日	2010-01-25
申请(专利权)人(译)	MEDISON CO.，LTD.		
当前申请(专利权)人(译)	三星MEDISON CO.，LTD.		
[标]发明人	HYUN DONG GYU SHINOZUKA NORIO		
发明人	HYUN, DONG GYU SHINOZUKA, NORIO		
IPC分类号	A61B8/14		
CPC分类号	A61B8/00 A61B8/465 A61B8/461 A61B8/4254 A61B8/463 A61B8/466 A61B8/467		
优先权	1020090006570 2009-01-28 KR		
其他公开文献	US9211105		
外部链接	Espacenet USPTO		

摘要(译)

公开了提供图像指示符和超声图像的实施例。一种映射表，包括多个对象，每个对象与检查位置相关联，每个检查位置与一个或多个图像指示符相关联。图像指示器包括指示每个对象的目标器官标记，指示每个对象的解剖学取向的体轴标记，以及指示超声波束的传输方向的超声波束方向标记。处理单元访问存储单元以提供与响应于用户输入的选择指令而选择的目标对象和检查位置相对应的图像指示符。处理单元还基于超声探头的位置信息三维地旋转图像指示器。