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(54) **METHOD OF CONTROLLING NEEDLE GUIDE APPARATUS, AND ULTRASOUND DIAGNOSTIC APPARATUS USING THE SAME**

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USPC **600/424**

(57) **ABSTRACT**

A method of controlling a needle guide apparatus for assisting insertion of a needle, the method including: setting target coordinates in which the tip of the needle is located inside an object to be diagnosed; and adjusting a position of the needle guide apparatus based on the set target coordinates, wherein the needle guide apparatus is connected to a probe for capturing an ultrasound image of the object to be diagnosed.

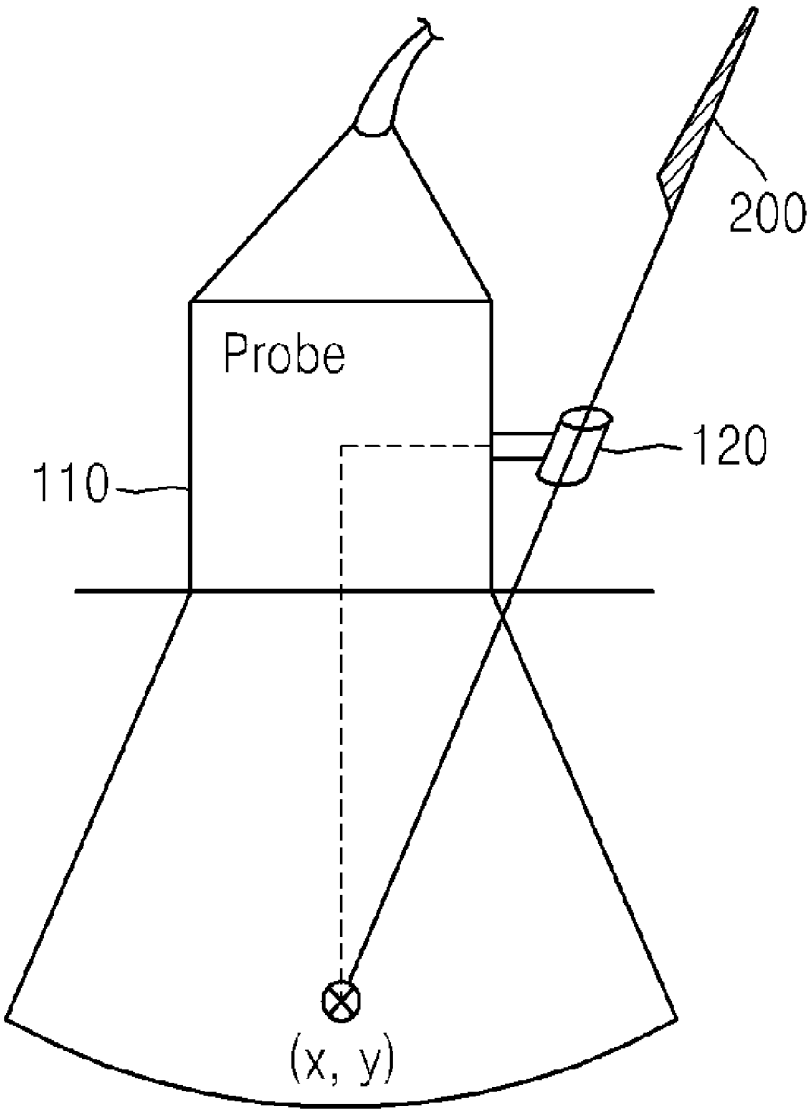


FIG. 1

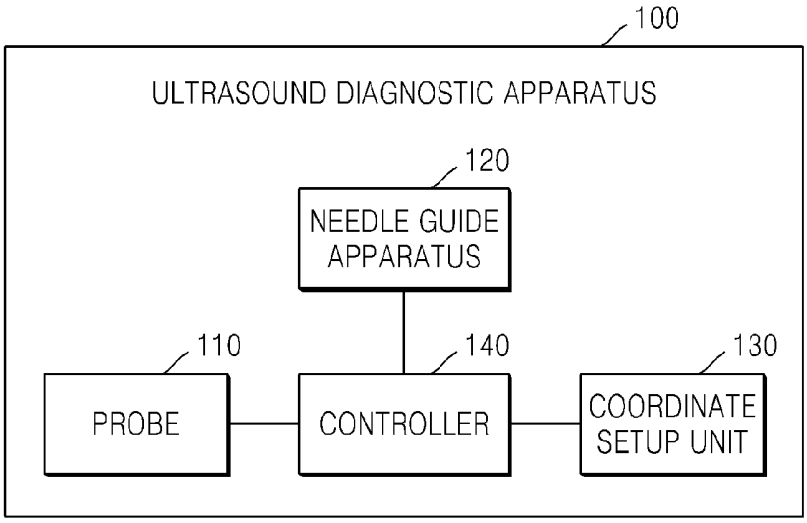

100
ULTRASOUND DIAGNOSTIC APPARATUS
120
NEEDLE GUIDE APPARATUS
110
PROBE
140
CONTROLLER
130
COORDINATE SETUP UNIT

FIG. 2

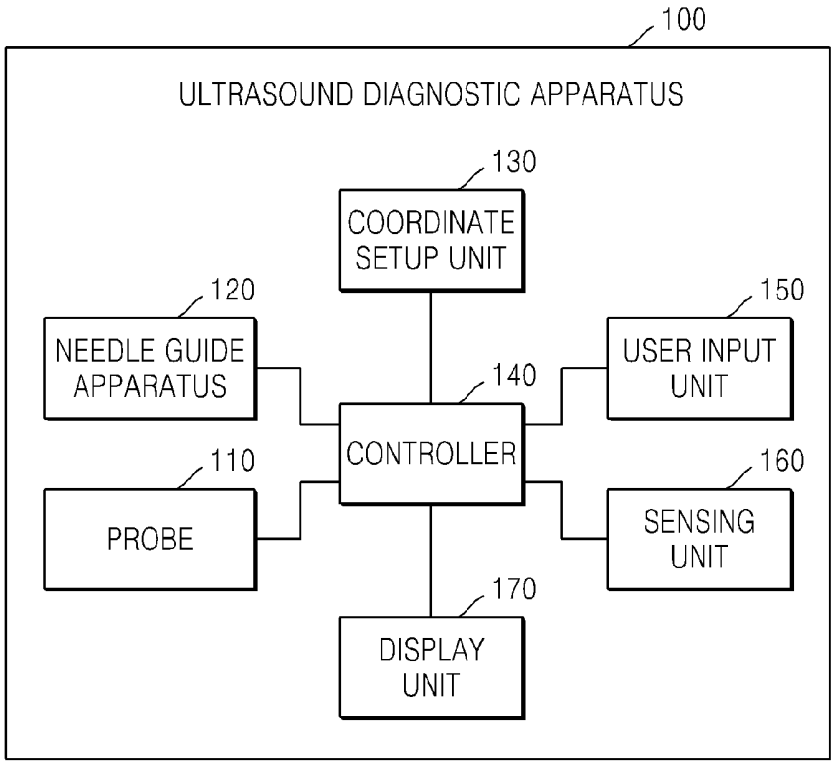

100
ULTRASOUND DIAGNOSTIC APPARATUS
130
COORDINATE SETUP UNIT
120
NEEDLE GUIDE APPARATUS
150
USER INPUT UNIT
140
CONTROLLER
110
PROBE
160
SENSING UNIT
170
DISPLAY UNIT

FIG. 3

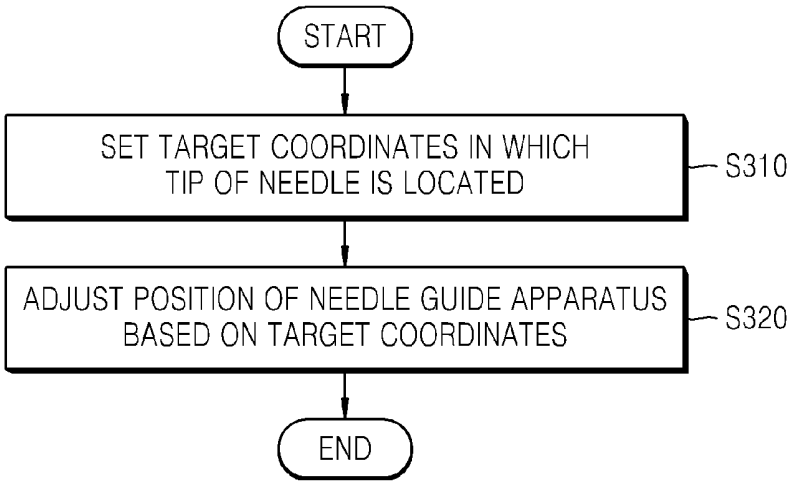

START
SET TARGET COORDINATES IN WHICH TIP OF NEEDLE IS LOCATED
S310
ADJUST POSITION OF NEEDLE GUIDE APPARATUS BASED ON TARGET COORDINATES
S320
END

FIG. 4

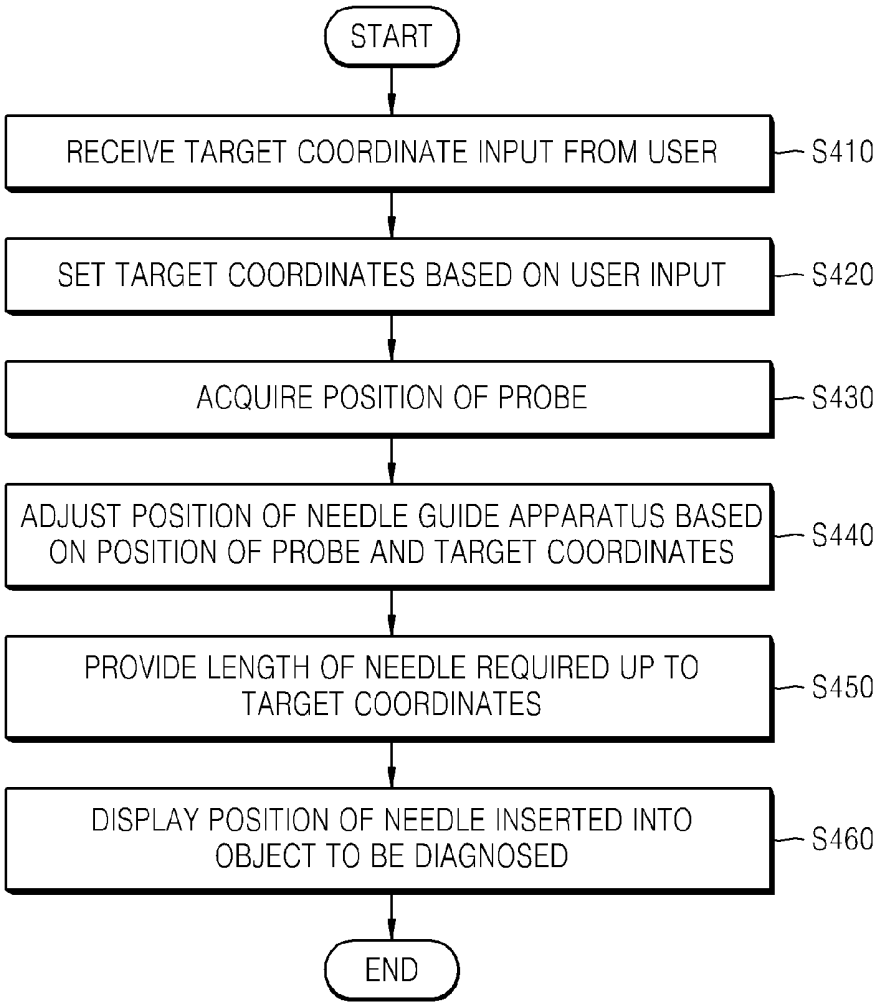

START
RECEIVE TARGET COORDINATE INPUT FROM USER
S410
SET TARGET COORDINATES BASED ON USER INPUT
S420
ACQUIRE POSITION OF PROBE
S430
ADJUST POSITION OF NEEDLE GUIDE APPARATUS BASED ON POSITION OF PROBE AND TARGET COORDINATES
S440
PROVIDE LENGTH OF NEEDLE REQUIRED UP TO TARGET COORDINATES
S450
DISPLAY POSITION OF NEEDLE INSERTED INTO OBJECT TO BE DIAGNOSED
S460
END

FIG. 5

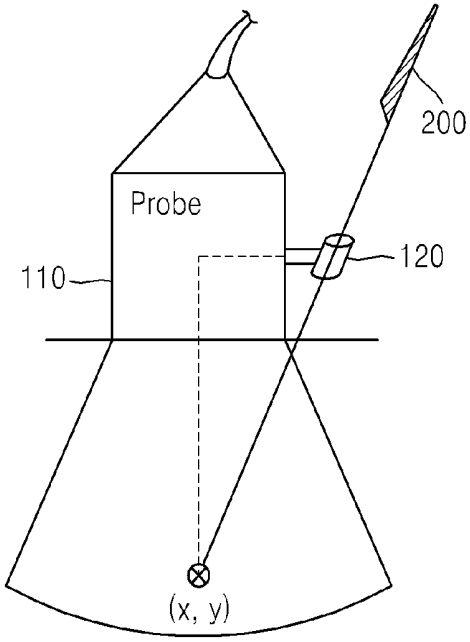
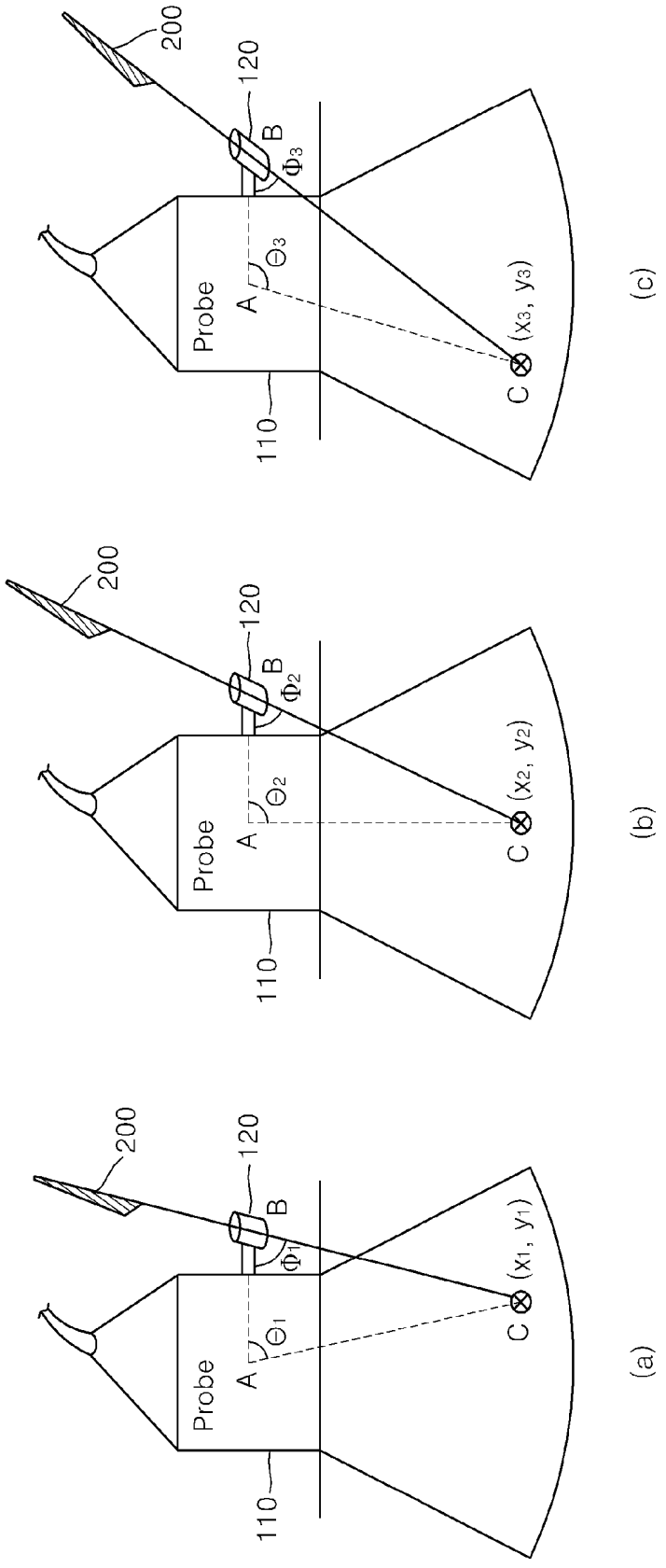


FIG. 6


200
120
B
Φ1
Θ1
A
Probe
110
C
(x1, y1)
(a)
200
120
B
Φ2
Θ2
A
Probe
110
C
(x2, y2)
(b)
200
120
B
Φ3
Θ3
A
Probe
110
C
(x3, y3)
(c)

METHOD OF CONTROLLING NEEDLE GUIDE APPARATUS, AND ULTRASOUND DIAGNOSTIC APPARATUS USING THE SAME

CROSS-REFERENCE TO RELATED PATENT APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 10-2012-0010379, filed on Feb. 1, 2012, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a method of controlling a needle guide apparatus for assisting a user to insert a needle, and an ultrasound diagnostic apparatus using the same.

[0004] 2. Description of the Related Art

[0005] Ultrasound diagnostic apparatuses transmit an ultrasound signal from the surface of a human body to be diagnosed towards a predetermined part in the inside of the human body and capture a tomogram of a soft tissue or an image of a hematocele by using information of the ultrasound signal reflected from the predetermined portion.

[0006] Such ultrasound diagnostic apparatuses have advantages of miniaturized, cheap, and real-time displayable. In addition, ultrasound diagnostic apparatuses has an advantage of high stability due to non-radiation of X rays, and accordingly, are widely used together with X-ray diagnostic apparatuses, Computerized Tomography (CT) scanners, Magnetic Resonance Imaging (MRI) apparatuses, and nuclear medicine diagnostic apparatuses.

[0007] In general, an ultrasound biopsy has been popularly performed for tumor diagnosis. A biopsy indicates that a small portion of a tissue in an affected part of a patient is cut off and observed with a naked eye or a microscope. When a biopsy is performed, a malpractice may occur because an operator cannot perceive a trajectory of a needle and a correct position of a needle tip.

[0008] To prevent a malpractice in a biopsy, techniques of viewing the tip and a trajectory of an ultrasound needle using a magnetic field sensor have been developed. However, since the magnetic field sensor is located at the other end of the needle instead of a part inserted into a human body, when the needle is bent or damaged inside the human body, an ultrasound diagnostic apparatus may display a wrong position of the needle to a user.

[0009] Thus, an apparatus for guiding a user to correctly insert a needle on a position desired by the user and guiding even a user unfamiliar with a biopsy to quickly and correctly insert a needle is required.

SUMMARY OF THE INVENTION

[0010] According to an aspect of the present invention, there is provided a method of controlling a needle guide apparatus for assisting insertion of a needle, the method including: setting target coordinates in which the tip of the needle is located inside an object to be diagnosed; and adjusting a position of the needle guide apparatus based on the set target coordinates, wherein the needle guide apparatus is connected to a probe for capturing an ultrasound image of the object to be diagnosed.

[0011] The method may further include receiving the target coordinates in the ultrasound image of the object to be diagnosed from a user.

[0012] The method may further include: acquiring a position of the probe; and adjusting the position of the needle guide apparatus based on the acquired position of the probe and the target coordinates.

[0013] The method may further include rotating the needle guide apparatus by a predetermined angle based on the set target coordinates.

[0014] The method may further include providing a length of the needle required from the needle guide apparatus to the target coordinates.

[0015] The method may further include displaying a predicted path along which the needle is inserted up to the target coordinates

[0016] The method may further include displaying a position of the needle inserted into the object to be diagnosed.

[0017] According to another aspect of the present invention, there is provided an ultrasound diagnostic apparatus including: a needle guide apparatus for assisting insertion of a needle; a coordinate setup unit for setting target coordinates in which the tip of the needle is located inside an object to be diagnosed; and a controller for adjusting a position of the needle guide apparatus based on the set target coordinates, wherein the needle guide apparatus is connected to a probe for capturing an ultrasound image of the object to be diagnosed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above and other features and advantages of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

[0019] FIG. **1** is a block diagram of an ultrasound diagnostic apparatus according to an embodiment of the present invention;

[0020] FIG. **2** is a block diagram of an ultrasound diagnostic apparatus according to another embodiment of the present invention;

[0021] FIG. **3** is a flowchart illustrating a method of controlling a needle guide apparatus, according to an embodiment of the present invention;

[0022] FIG. **4** is a flowchart illustrating a method of controlling the needle guide apparatus based on a position of a probe, according to an embodiment of the present invention;

[0023] FIG. **5** is a conceptual diagram of the needle guide apparatus according to an embodiment of the present invention; and

[0024] FIGS. **6**A to **6**C are conceptual diagrams of the needle guide apparatus of which an angle is changed according to a position of a probe, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0025] Although terms used in the present invention are selected with general terms popularly used at present under the consideration of functions in the present invention, the terms may vary according to the intention of those of ordinary skill in the art, judicial precedents, or introduction of new technology. In addition, in a specific case, the applicant voluntarily may select terms, and in this case, the meaning of the terms is disclosed in a corresponding description part of the invention. Thus, the terms used in the present invention

should be defined not by the simple names of the terms but by the meaning of the terms and the contents throughout the present invention.

[0026] In the specification, when a certain part 'includes' a certain component, this means that the part may further include other components instead of excluding another component unless the context clearly dictates otherwise. In addition, the term, such as ' . . . unit' or 'module', disclosed in the specification means a unit for processing at least one function or operation, which may be implemented by hardware, software, or a combination of hardware and software.

[0027] In the specification, an 'ultrasound image' indicates an image of an object to be diagnosed, which is acquired using an ultrasound wave. The 'object to be diagnosed' may mean a portion of a human body. For example, the object to be diagnosed may include an organ, such as a liver, a heart, or a womb, or an unborn child.

[0028] In the specification, a 'user' may be a doctor, a nurse, a clinical pathologist, or a medical image expert as a medical expert but is not limited thereto.

[0029] The present invention will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. The invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. In the drawings, parts not concerned with the description of the present invention are omitted to clearly describe the present invention, and like reference numerals are used to refer to like elements throughout the specification.

[0030] As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. 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.

[0031] FIG. **1** is a block diagram of an ultrasound diagnostic apparatus **100** according to an embodiment of the present invention.

[0032] Referring to FIG. **1**, the ultrasound diagnostic apparatus **100** means a device capable of acquiring an ultrasound image from an object to be diagnosed by using an ultrasound wave and guiding a user to perform a biopsy.

[0033] The ultrasound diagnostic apparatus **100** can be implemented in various forms. For example, the ultrasound diagnostic apparatus **100** described in the specification may be implemented in a form of a fixed terminal or a mobile terminal. Examples of the mobile terminal are a laptop computer, a Personal Digital Assistant (PDA), and a tablet computer.

[0034] According to an embodiment of the present invention, the ultrasound diagnostic apparatus **100** may include a probe **110**, a needle guide apparatus **120**, a coordinate setup unit **130**, and a controller **140**. However, not all of the components shown in FIG. **1** are mandatory components. That is, the ultrasound diagnostic apparatus **100** may be implemented by more or less components than the components shown in FIG. **1**.

[0035] The probe **110** may transmit au ultrasound signal to the object to be diagnosed. The probe **110** may also receive an ultrasound echo signal from the object to be diagnosed. The probe **110** may be at least one of a one-dimensional (1D) probe, a 2D probe, a 3D probe, and a 4D probe.

[0036] The ultrasound diagnostic apparatus **100** may generate an ultrasound image of the object to be diagnosed based on the received ultrasound echo signal. The ultrasound image may include all dimensional images, such as a 1D image, a 2D image, a 3D image, and a 4D image.

[0037] The probe **110** may transmit an ultrasound signal to a needle inserted into the object to be diagnosed and receive an ultrasound echo signal reflected from the needle, thereby tracking a position of the inserted needle.

[0038] The needle guide apparatus **120** is a device for assisting insertion of the needle so that a user can insert the needle on a correct position. The needle guide apparatus **120** may include a needle insertion hole. The needle guide apparatus **120** may be connected to one side of the probe **110** or may exist at a position penetrating the probe **110**.

[0039] A position of the needle guide apparatus **120** may be automatically adjusted by the controller **140** or manually adjusted by the user. In addition, the position of the needle guide apparatus **120** may be adjusted in various directions, such as to the top and the bottom, to the left and right, or to the front and rear.

[0040] The coordinate setup unit **130** may set target coordinates in which the tip of the needle is located inside the object to be diagnosed. According to an embodiment of the present invention, the coordinate setup unit **130** may set target coordinates based on a coordinate value input by the user.

[0041] The controller **140** may adjust a position of the needle guide apparatus **120** based on the set target coordinates. According to an embodiment of the present invention, the controller **140** may adjust a position of the needle guide apparatus **120** by further considering a position of the probe **110**. That is, the controller **140** may adjust a position of the needle guide apparatus **120** based on the position of the probe **110** and the set target coordinates.

[0042] The position of the needle guide apparatus **120** may include an angle formed by the needle guide apparatus **120** and the probe **110** and a direction of the needle guide apparatus **120** oriented to the object to be diagnosed.

[0043] According to an embodiment of the present invention, the controller **140** may rotate the needle guide apparatus **120** by a predetermined angle so that the needle is correctly inserted on the target coordinates inside the object to be diagnosed.

[0044] The controller **140** may calculate a length of the needle required from the needle guide apparatus **120** to the target coordinates inside the object to be diagnosed. In addition, the controller **140** may calculate a position of the needle inserted into the object to be diagnosed by using an ultrasound echo signal reflected from the needle.

[0045] The controller **140** may generally control the probe **110**, the needle guide apparatus **120**, and the coordinate setup unit **130**.

[0046] FIG. **2** is a block diagram of the ultrasound diagnostic apparatus **100** according to another embodiment of the present invention.

[0047] As shown in FIG. **2**, the ultrasound diagnostic apparatus **100** according to another embodiment of the present invention may further include a user input unit **150**, a sensing unit **160**, and a display unit **170** besides the probe **110**, the needle guide apparatus **120**, the coordinate setup unit **130**, and the controller **140**. The configuration shown in FIG. **1** is not described herein.

[0048] The user input unit **150** generates input data for a user to control an operation of the ultrasound diagnostic apparatus **100**. The user input unit **150** may include a keypad, a dome switch, a touch pad (pressure/electrostatic), a jog

wheel, a jog switch, etc. In particular, when the touch pad forms a layer structure with the display unit **170**, this may be called a touch screen.

[0049] The user input unit **150** may receive target coordinates in which the tip of the needle is located inside the object to be diagnosed from the user. According to an embodiment of the present invention, the user may select target coordinates in a displayed ultrasound image of the object to be diagnosed with use of the user input unit **150**.

[0050] The sensing unit **160** may generate a sensing signal for controlling an operation of the ultrasound diagnostic apparatus **100** by sensing a current state of the ultrasound diagnostic apparatus **100**. For example, the sensing unit **160** may acquire a position of the probe **110**. When the probe **110** is moving or the position of the probe **110** is changed, the sensing unit **160** may immediately detect it.

[0051] The display unit **170** displays information processed by the ultrasound diagnostic apparatus **100**. For example, the display unit **170** may provide a length of the needle required from the needle guide apparatus **120** to target coordinates in which the tip of the needle is located inside the object to be diagnosed. The display unit **170** may display a predicted insertion path of the needle from the needle guide apparatus **120** to the target coordinates.

[0052] The display unit **170** may display an actual position of the needle inserted into the object to be diagnosed. According to an embodiment of the present invention, the display unit **170** may display a trajectory and/or a current position of the needle inserted into the object to be diagnosed.

[0053] As described above, when the display unit **170** and the touch pad form the layer structure to be a touch screen, the display unit **170** may be used as an input device in addition to an output device. The display unit **170** may include at least one of a Liquid Crystal Display (LCD), a Thin Film Transistor-Liquid Crystal Display (TFT-LCD), an Organic Light Emitting Diode (OLED), a flexible display, and a 3D display. Two or more display units **170** may exist according to an implementation form of the ultrasound diagnostic apparatus **100**.

[0054] The touch screen may be configured to detect a touch input position, a touched area, and a touch input pressure. In addition, the touch screen may be configured to detect a real-touch and a proximity-touch.

[0055] In the specification, the real-touch indicates that a pointer actually touches a screen, and the proximity-touch indicates that the pointer accesses the screen with a predetermined distance without actually touching the screen. In the specification, the pointer is a tool for real-touching or proximity-touching a specific part of a displayed screen. Examples of the pointer are a stylus pen and a finger.

[0056] Although not shown, to detect the real-touch or the proximity-touch on the touch screen, various sensors may be included inside or near the touch screen. Alternatively, the various sensors for detecting the real-touch or the proximity-touch on the touch screen may be disposed in the sensing unit **160**.

[0057] The controller **140** may generally control the user input unit **150**, the sensing unit **160**, and the display unit **170** in addition to the probe **110**, the needle guide apparatus **120**, and the coordinate setup unit **130**.

[0058] Methods of controlling a position of the needle guide apparatus **120** for a user to correctly insert the needle into an object to be diagnosed by using the configurations of the ultrasound diagnostic apparatus **100** will now be described in detail with reference to FIGS. **3** and **4**.

[0059] FIG. **3** is a flowchart illustrating a method of controlling the needle guide apparatus **120**, according to an embodiment of the present invention.

[0060] Referring to FIG. **3**, the method includes operations sequentially processed by the ultrasound diagnostic apparatus **100** shown in FIG. **1**. Thus, although omitted hereinafter, the description of the ultrasound diagnostic apparatus **100** shown in FIG. **1** is also applied to the method of FIG. **3**.

[0061] As shown in FIG. **3**, in operation S**310**, the ultrasound diagnostic apparatus **100** sets target coordinates in which the tip of the needle is located inside an object to be diagnosed. The target coordinates may indicate a position of a tissue, such as a tumor, for which a biopsy is needed.

[0062] According to an embodiment of the present invention, the ultrasound diagnostic apparatus **100** may set the target coordinates in which the tip of the needle is located based on a user input.

[0063] According to another embodiment of the present invention, the ultrasound diagnostic apparatus **100** may extract the position of the tissue for which a biopsy is needed and recommend the extracted position of the tissue to the user as the target coordinates in which the tip of the needle is located.

[0064] In operation S**320**, the ultrasound diagnostic apparatus **100** adjust a position of the needle guide apparatus **120** based on the set target coordinates. That is, the ultrasound diagnostic apparatus **100** adjusts the position of the needle guide apparatus **120** so that the needle moves towards the target coordinates when the needle is inserted into the needle guide apparatus **120**.

[0065] For example, the ultrasound diagnostic apparatus **100** may measure a current angle of the needle guide apparatus **120**. When the user inserts the needle into the object to be diagnosed with the measured current angle, the tip of the needle may not arrive at the target coordinates. In this case, the ultrasound diagnostic apparatus **100** adjusts an angle and direction of the needle guide apparatus **120** so that the needle can arrive at the target coordinates.

[0066] According to an embodiment of the present invention, the user does not have to voluntarily adjust the needle guide apparatus **120** for the needle to be inserted on the target coordinates inside the object to be diagnosed. That is, since the ultrasound diagnostic apparatus **100** can automatically adjust an angle and direction of the needle guide apparatus **120**, even a user unfamiliar with a biopsy may correctly acquire a desired tissue.

[0067] FIG. **4** is a flowchart illustrating a method of controlling the needle guide apparatus **120** based on a position of the probe **110**, according to an embodiment of the present invention.

[0068] Referring to FIG. **4**, the method includes operations sequentially processed by the ultrasound diagnostic apparatus **100** shown in FIG. **2**. Thus, although omitted hereinafter, the description of the ultrasound diagnostic apparatus **100** shown in FIG. **2** is also applied to the method of FIG. **4**.

[0069] As shown in FIG. **4**, in operation S**410**, the ultrasound diagnostic apparatus **100** receives a target coordinate input from a user. In operation S**420**, the ultrasound diagnostic apparatus **100** sets or confirms target coordinates based on the user input.

[0070] According to an embodiment of the present invention, the ultrasound diagnostic apparatus **100** may display an

ultrasound image of an object to be diagnosed to a user. In this case, the user may select target coordinates in the displayed ultrasound image.

[0071] An ultrasound image according to an embodiment of the present invention may be at least one of a brightness mode (B mode) image in which an amplitude of an ultrasound echo signal reflected from an object to be diagnosed is represented as brightness, a Doppler mode image in which an image of a moving object to be diagnosed is represented in a spectrum format using a Doppler effect, a motion mode (M mode) image in which a motion of an object to be diagnosed along time at a predetermined position is represented, an elastic mode image in which a reaction difference between when a compression is added to an object to be diagnosed and when the compression is not added to the object to be diagnosed is represented as an image, and a color mode (C mode) image in which a speed of a moving object to be diagnosed is represented as colors using the Doppler effect.

[0072] In operation S**430**, the ultrasound diagnostic apparatus **100** acquires a position of the probe **110** by using a sensor. The sensor may be attached to or separated from the probe **110**. In operation S**440**, the ultrasound diagnostic apparatus **100** adjusts a position of the needle guide apparatus **120** based on the position of the probe **110** and the target coordinates.

[0073] In operation S**450**, the ultrasound diagnostic apparatus **100** provides a length of the needle required from the needle guide apparatus **120** to the target coordinates inside the object to be diagnosed.

[0074] For example, when the length of the needle required from the needle guide apparatus **120** to the target coordinates inside the object to be diagnosed is 5 cm, the ultrasound diagnostic apparatus **100** may adjust the position of the needle guide apparatus **120** and display the required length of the needle (e.g., 5 cm). In this case, the user may not insert the needle up to an unnecessary depth by using the needle guide apparatus **120**.

[0075] In operation S**460**, the ultrasound diagnostic apparatus **100** displays a position of the needle inserted into the object to be diagnosed.

[0076] For example, the ultrasound diagnostic apparatus **100** may acquire position information of the needle inserted into the object to be diagnosed by using an ultrasound signal. The ultrasound diagnostic apparatus **100** may display a current position and/or an insertion path of the needle based on the acquired position information of the needle. In this case, the current position and/or the insertion path of the needle may be overlaid and displayed on the ultrasound image of the object to be diagnosed.

[0077] According to an embodiment of the present invention, the ultrasound diagnostic apparatus **100** may display a predicted insertion path from the needle guide apparatus **120** to the target coordinates.

[0078] FIG. **5** is a conceptual diagram of the needle guide apparatus **120** according to an embodiment of the present invention.

[0079] As shown in FIG. **5**, the probe **110** may receive an ultrasound echo signal reflected from an object to be diagnosed. In this case, the ultrasound diagnostic apparatus **100** may display an ultrasound image of the object to be diagnosed based on the ultrasound echo signal.

[0080] The needle guide apparatus **120** may be connected to the probe **110**. A user may insert a needle **200** into the object to be diagnosed by using the needle guide apparatus **120** to perform a biopsy.

[0081] The ultrasound diagnostic apparatus **100** may receive target coordinates of a tissue for which the biopsy is performed from the user. For example, the target coordinates may be (x, y). When the needle **200** is inserted into the object to be diagnosed by means of the needle guide apparatus **120**, the ultrasound diagnostic apparatus **100** may adjust a position of the needle guide apparatus **120** so that the needle **200** arrives at the target coordinates (x, y).

[0082] FIGS. **6**A to **6**C are conceptual diagrams of the needle guide apparatus **120** of which an angle is changed according to a position of the probe **120**, according to an embodiment of the present invention.

[0083] As shown in FIG. **6**A, target coordinates (x**1**, y**1**) inside an object to be diagnosed may be located in the relatively right from the center point of the probe **110**. Assuming that the center point of the probe **110** is A, the center point of the needle guide apparatus **120** is B, and the target coordinates (x**1**, y**1**) are C, an angle formed between a line connecting A and B (hereinafter, 'segment AB') and a line connecting A and C (hereinafter, 'segment AC') may be θ**1**.

[0084] In this case, the ultrasound diagnostic apparatus **100** may adjust a position of the needle guide apparatus **120** so that an angle formed between a line connecting B and A (hereinafter 'segment BA') and a line connecting B and C (hereinafter 'segment BC') is ϕ**1**.

[0085] As shown in FIG. **6**B, target coordinates (x**2**, y**2**) inside the object to be diagnosed may be located on a direct line from the center point of the probe **110**.

[0086] Assuming that the center point of the probe **110** is A, the center point of the needle guide apparatus **120** is B, and the target coordinates (x**2**, y**2**) are C, an angle formed between the segment AB and the segment AC may be θ**2**(=90°).

[0087] In this case, the ultrasound diagnostic apparatus **100** may adjust a position of the needle guide apparatus **120** so that an angle formed between the segment BA and the segment BC is ϕ**2**.

[0088] As shown in FIG. **6**C, target coordinates (x**3**, y**3**) inside the object to be diagnosed may be located in the relatively left from the center point of the probe **110**. Assuming that the center point of the probe **110** is A, the center point of the needle guide apparatus **120** is B, and the target coordinates (x**3**, y**3**) are C, an angle formed between the segment AB and the segment AC may be θ**3**.

[0089] In this case, the ultrasound diagnostic apparatus **100** may adjust a position of the needle guide apparatus **120** so that an angle formed between the segment BA and the segment BC is ϕ**3**.

[0090] That is, according to an embodiment of the present invention, when the probe **110** moves in the right based on target coordinates, an angle formed between the segment AB and the segment AC may increase (θ**1**<θ**2**<θ**3**). The ultrasound diagnostic apparatus **100** may adjust a position of the needle guide apparatus **120** so that an angle formed between the segment BA and the segment BC gradually decrease (θ**3**<θ**2**<θ**1**).

[0091] The method according to an embodiment of the present invention may be embodied in a program command format executable by various computer means and recorded in a computer-readable recording medium. The computer-readable recording medium may include program com-

mands, data files, data structures, or a combination of them. The program commands recorded in the computer-readable recording medium may be specifically designed and constructed for the present invention or be well known and usable to those of ordinary computer software skill in the art. Examples of the computer-readable recording medium are magnetic media such as hard disks, floppy disks, and magnetic tapes, optical media such as CD-ROMs and DVDs, magneto-optical media such as floptical disks, and hardware devices such as ROMs, RAMs, and flash memories, which are specifically constructed to store and execute program commands. Examples of the program commands are machine language codes created by a compiler and high-level language codes executable by computers using an interpreter.

[0092] According to an embodiment of the present invention, the ultrasound diagnostic apparatus **100** may automatically adjust a position of the needle guide apparatus **120** so that a user can correctly insert a needle on target coordinates inside an object to be diagnosed. Thus, even a user unfamiliar with a biopsy can correctly insert a needle on target coordinates.

[0093] While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

1. A method of controlling a needle guide apparatus for assisting insertion of a needle, the method comprising:

setting target coordinates in which the tip of the needle is located inside an object to be diagnosed; and

adjusting a position of the needle guide apparatus based on the set target coordinates,

wherein the needle guide apparatus is connected to a probe for capturing an ultrasound image of the object to be diagnosed.

2. The method of claim **1**, wherein the setting of the target coordinates comprises receiving the target coordinates in the ultrasound image of the object to be diagnosed from a user.

3. The method of claim **1**, wherein the adjusting of the position of the needle guide apparatus comprises:

acquiring a position of the probe; and

adjusting the position of the needle guide apparatus based on the acquired position of the probe and the target coordinates.

4. The method of claim **1**, wherein the adjusting of the position of the needle guide apparatus comprises rotating the needle guide apparatus by a predetermined angle based on the set target coordinates.

5. The method of claim **1**, further comprising providing a length of the needle required from the needle guide apparatus to the target coordinates.

6. The method of claim **1**, further comprising displaying a predicted path along which the needle is inserted up to the target coordinates.

7. The method of claim **1**, further comprising displaying a position of the needle inserted into the object to be diagnosed.

8. An ultrasound diagnostic apparatus comprising:

a needle guide apparatus for assisting insertion of a needle;

a coordinate setup unit for setting target coordinates in which the tip of the needle is located inside an object to be diagnosed; and

a controller for adjusting a position of the needle guide apparatus based on the set target coordinates,

wherein the needle guide apparatus is connected to a probe for capturing an ultrasound image of the object to be diagnosed.

9. The ultrasound diagnostic apparatus of claim **8**, further comprising a user input unit for receiving the target coordinates in the ultrasound image of the object to be diagnosed from a user.

10. The ultrasound diagnostic apparatus of claim **8**, further comprising a sensing unit for acquiring a position of the probe,

wherein the controller adjusts the position of the needle guide apparatus based on the acquired position of the probe and the target coordinates.

11. The ultrasound diagnostic apparatus of claim **8**, wherein the controller rotates the needle guide apparatus by a predetermined angle based on the set target coordinates.

12. The ultrasound diagnostic apparatus of claim **8**, further comprising a display unit for providing a length of the needle required from the needle guide apparatus to the target coordinates.

13. The ultrasound diagnostic apparatus of claim **8**, further comprising a display unit for displaying a predicted path along which the needle is inserted up to the target coordinates.

14. The ultrasound diagnostic apparatus of claim **8**, further comprising a display unit for displaying a position of the needle inserted into the object to be diagnosed.

15. A computer-readable recording medium storing a computer-readable program for executing the method of claim **1**.

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专利名称(译)	控制导针装置的方法和使用该导针装置的超声波诊断装置		
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摘要(译)

一种控制用于辅助插入针的针引导装置的方法，该方法包括：设定针尖位于待诊断对象内的目标坐标;根据设定的目标坐标调整导针装置的位置，其中导针装置连接到用于捕获待诊断对象的超声图像的探头。