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(54) **PHOTO-ACOUSTIC IMAGING APPARATUS AND METHOD OF DISPLAYING PHOTO-ACOUSTIC IMAGES**

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(57) **ABSTRACT**

Provided are a photo-acoustic imaging apparatus and a method of displaying a photo-acoustic image by the photo-acoustic imaging apparatus. The method of displaying a photo-acoustic image by a photo-acoustic imaging apparatus includes: obtaining a first reception signal, which converts a first acoustic wave generated as light having a first wavelength is absorbed by a subject, and a second reception signal, which converts a second acoustic wave generated as light having a second wavelength is absorbed by the subject; determining a first correction coefficient for the first reception signal and a second correction coefficient for the second reception signal based on a ratio between a size of the first reception signal and that of the second reception signal;

and displaying a photo-acoustic image which is corrected based on the first and second correction coefficients.

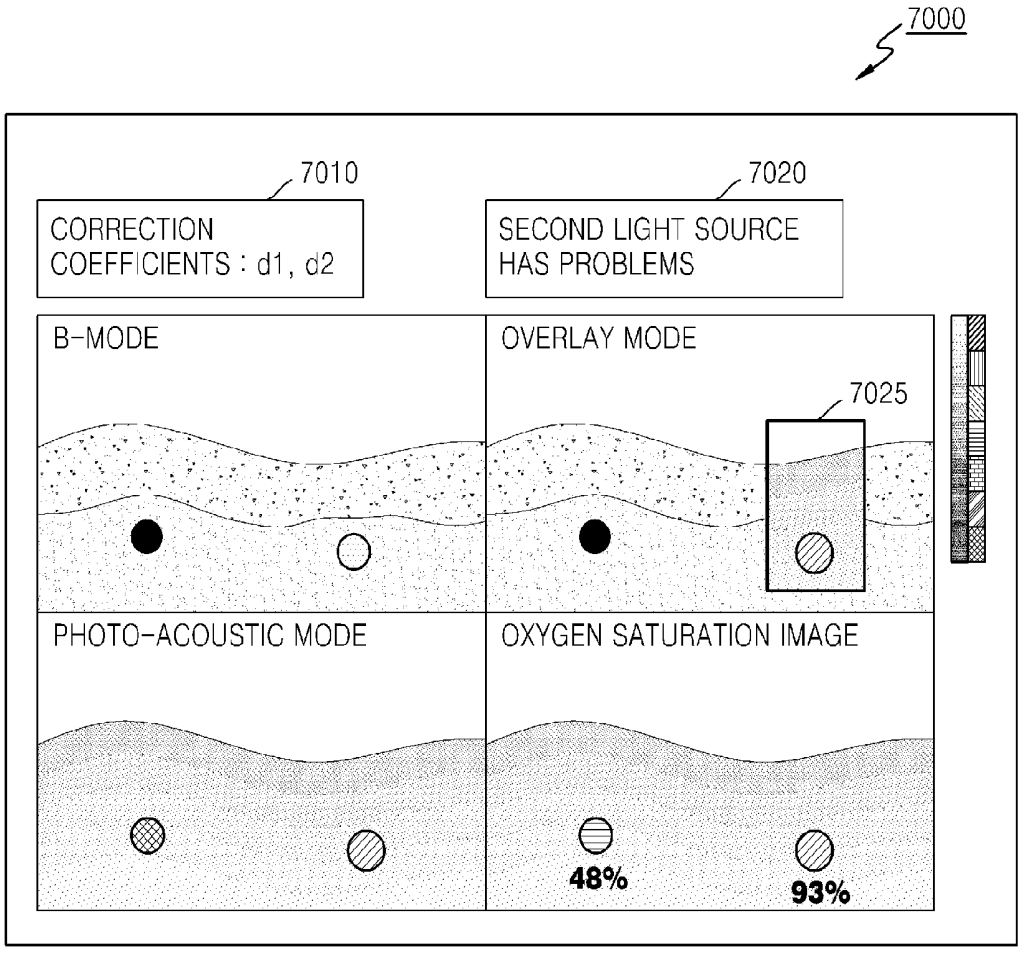


FIG. 1

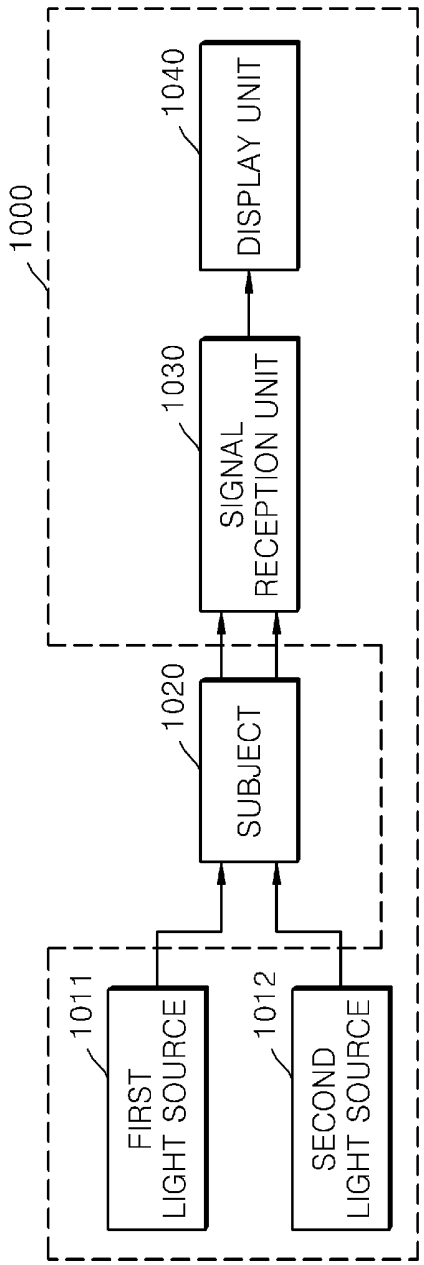

1000
1040
DISPLAY UNIT
1030
SIGNAL RECEPTION UNIT
1020
SUBJECT
1011
FIRST LIGHT SOURCE
1012
SECOND LIGHT SOURCE

FIG. 2

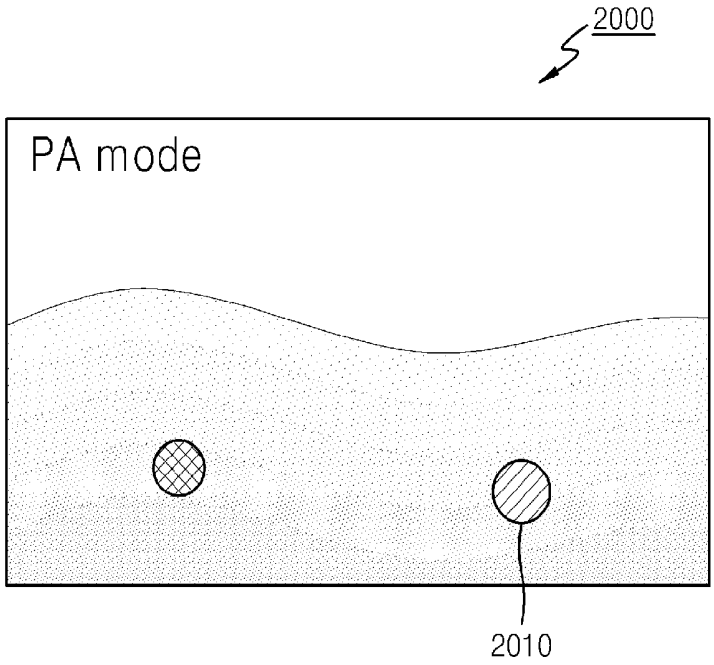



FIG. 3

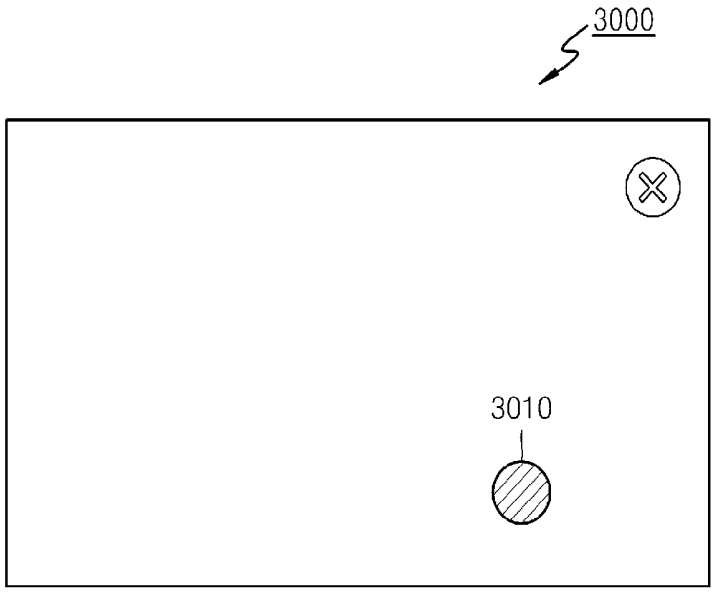


FIG. 4

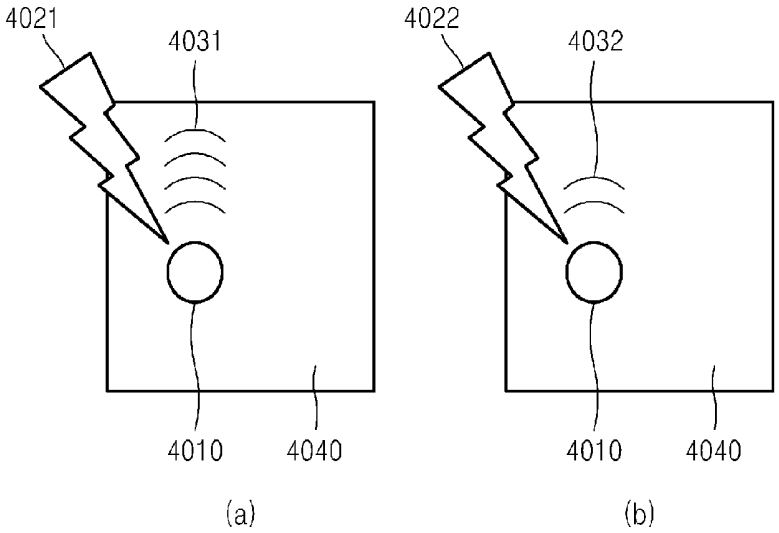

4021
4031
4010
4040
(a)
4022
4032
4010
4040
(b)

FIG. 5

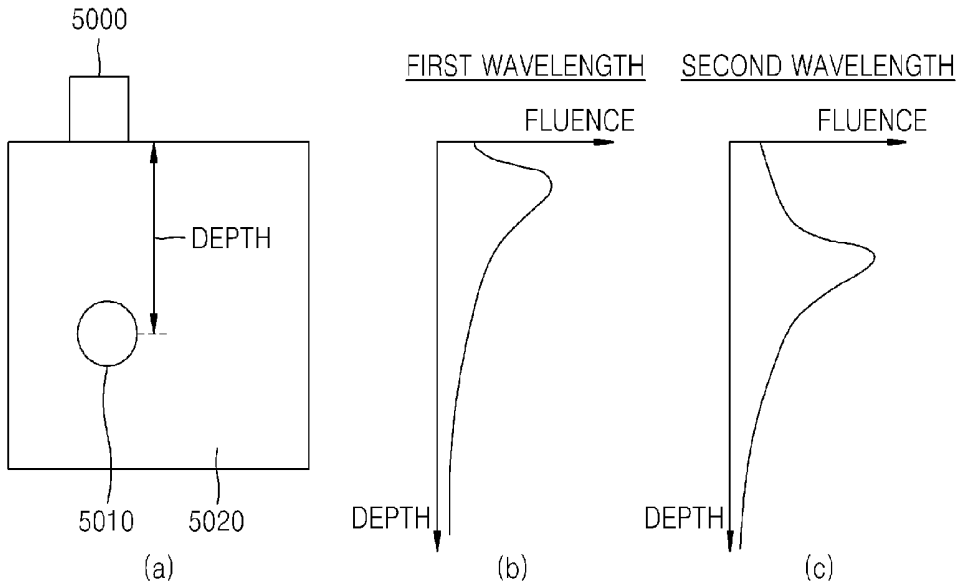

5000
DEPTH
5010
5020
(a)
FIRST WAVELENGTH
FLUENCE
DEPTH
(b)
SECOND WAVELENGTH
FLUENCE
DEPTH
(c)

FIG. 6

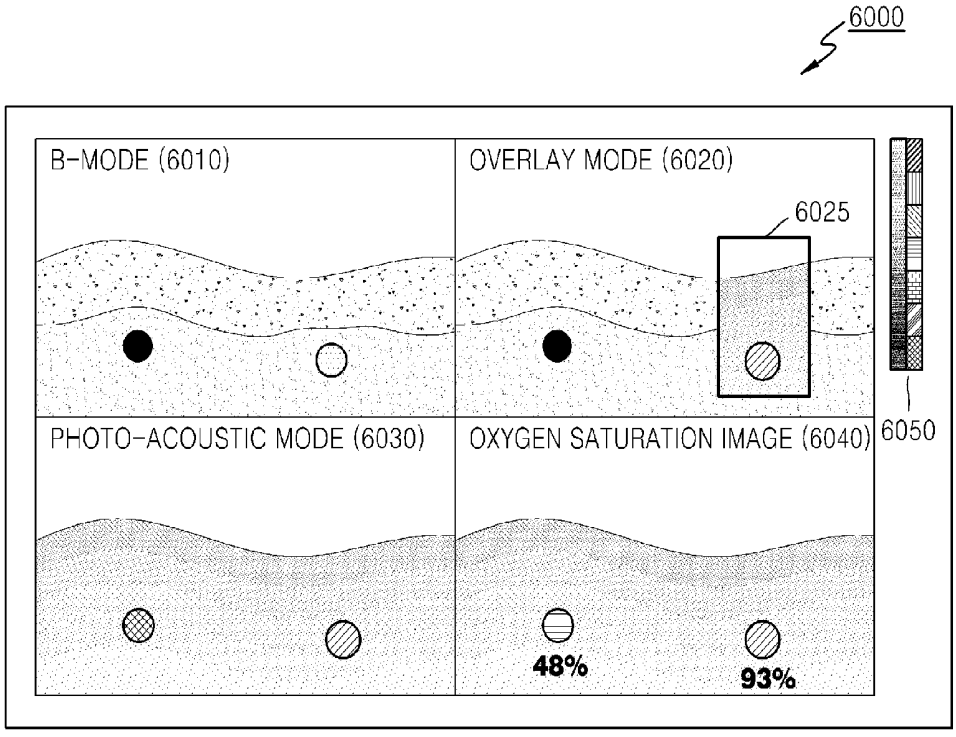

6000
B-MODE (6010)
OVERLAY MODE (6020)
6025
PHOTO-ACOUSTIC MODE (6030)
OXYGEN SATURATION IMAGE (6040)
6050
48%
93%

FIG. 7

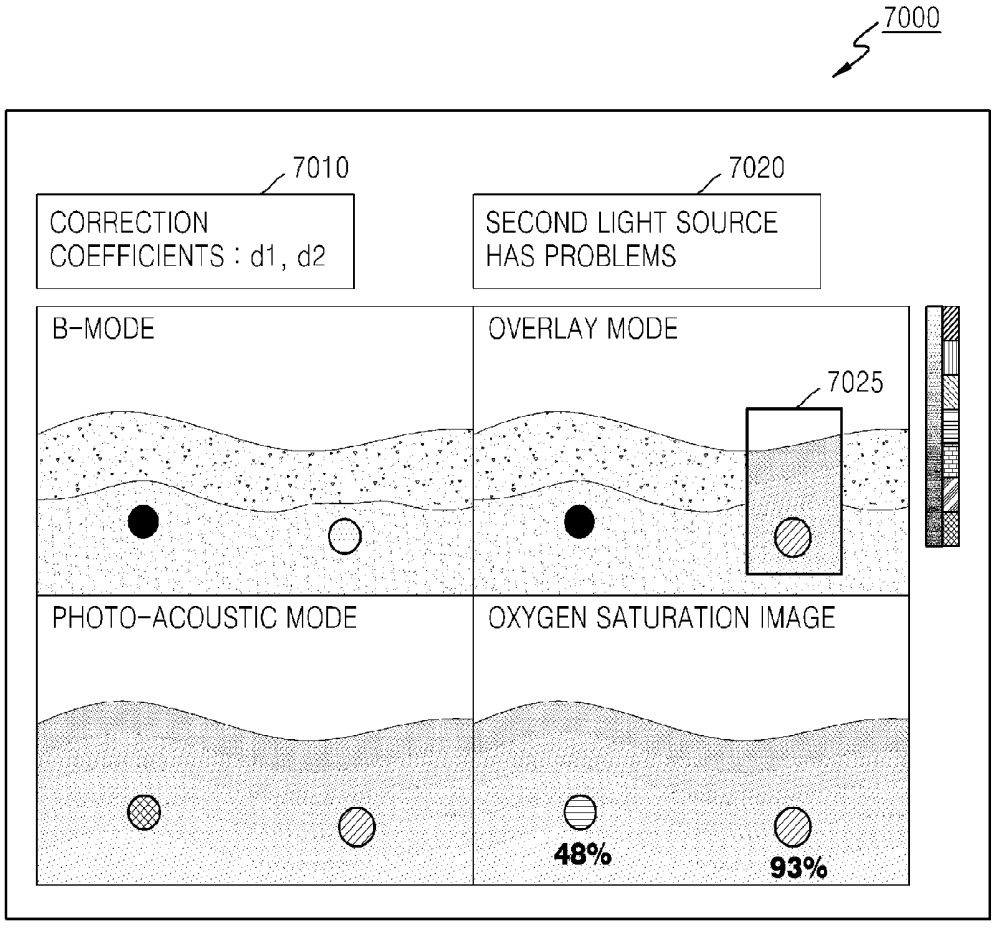
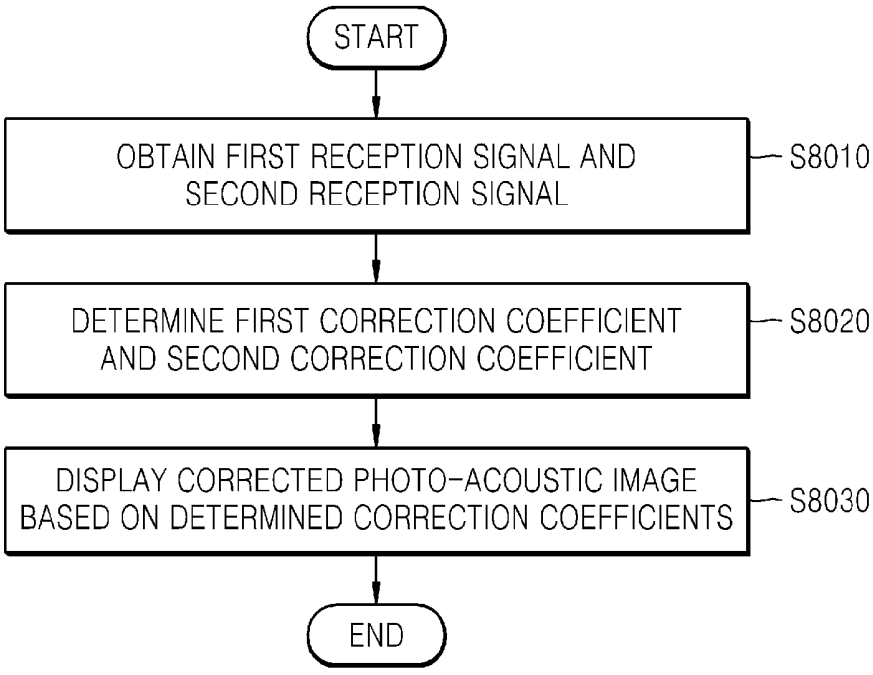

7000
7010
CORRECTION COEFFICIENTS : d1, d2
7020
SECOND LIGHT SOURCE HAS PROBLEMS
B-MODE
OVERLAY MODE
7025
PHOTO-ACOUSTIC MODE
OXYGEN SATURATION IMAGE
48%
93%

FIG. 8


START
OBTAIN FIRST RECEPTION SIGNAL AND SECOND RECEPTION SIGNAL
S8010
DETERMINE FIRST CORRECTION COEFFICIENT AND SECOND CORRECTION COEFFICIENT
S8020
DISPLAY CORRECTED PHOTO-ACOUSTIC IMAGE BASED ON DETERMINED CORRECTION COEFFICIENTS
S8030
END

# PHOTO-ACOUSTIC IMAGING APPARATUS AND METHOD OF DISPLAYING PHOTO-ACOUSTIC IMAGES

## RELATED APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 10-2014-0006265, filed on Jan. 17, 2014, 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 embodiments of the present invention relate to a photo-acoustic imaging apparatus and a method of displaying images by the photo-acoustic imaging apparatus, and more particularly, to a method and an apparatus for providing rather accurate results by correcting values received by the photo-acoustic imaging apparatus.

[0004] 2. Description of the Related Art

[0005] Various medical imaging apparatuses have been used to examine an internal body structure of a subject and diagnose diseases. For example, apparatuses applying magnetic resonance imaging (MRI), computed tomography (CT), ultrasound, X-rays, and positron emission tomography (PET), etc. are used. In particular, as optical tomography technology that does not ionize tissues unlike other medical imaging technologies, a photo-acoustic imaging apparatus using a photo-acoustic effect, which shows an acoustic reaction after materials absorb light, is used.

[0006] If a multi-wavelength photo sound is used, oxygen saturation ($SpO_2$) can be measured. In this case, however, oxygen saturation values cannot be accurately measured due to various reasons such as actual wavelengths and a tissue state. For example, when cancers are chemically treated, oxygen saturation of cancer tissues and tissues around them is changed. In order to measure a change in the oxygen saturation, a variety of multi-wavelength photo-acoustic apparatuses are used, but it is difficult to measure accurate values.

## SUMMARY

[0007] One or more embodiments of the present invention include a photo-acoustic imaging apparatus capable of accurately measuring oxygen saturation ($SpO_2$) through correction and a method of displaying a photo-acoustic image.

[0008] Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the presented embodiments.

[0009] According to one or more embodiments of the present invention, a method of displaying a photo-acoustic image by a photo-acoustic imaging apparatus, the method including: obtaining a first reception signal, which converts a first acoustic wave generated as light having a first wavelength is absorbed by a subject, and a second reception signal, which converts a second acoustic wave generated as light having a second wavelength is absorbed by the subject; determining a first correction coefficient for the first reception signal and a second correction coefficient for the second reception signal based on a ratio between a size of the first reception signal and that of the second reception signal; and displaying a photo-acoustic image which is corrected based on the first and second correction coefficients.

[0010] The determining the first and second correction coefficients may include: obtaining an oxygen saturation value of the subject, which is measured by an oxygen saturation measuring instrument; determining a standard ratio with regard to the size of the first reception signal and that of the second reception signal based on the oxygen saturation value; and determining the first and second correction coefficients which correct the ratio between the size of the first reception signal and that of the second reception signal based on the determined standard ratio.

[0011] The obtaining the first reception signal and the second reception signal may further include selecting the subject included in an image displayed through the photo-acoustic imaging apparatus.

[0012] The method may further include displaying a window which displays the subject included in the image and displayed through the photo-acoustic imaging apparatus as the subject is selected.

[0013] The displaying the corrected photo-acoustic image may include simultaneously displaying the corrected photo-acoustic image along with at least one of a B-mode ultrasound image, a C-mode ultrasound image, an oxygen saturation display image, and a signal characteristic image.

[0014] The displaying the corrected photo-acoustic image may include displaying the corrected photo-acoustic image along with the determined first and second correction coefficients.

[0015] The displaying the corrected photo-acoustic image may further include displaying a light source error message in a case where at least one of the first correction coefficient and the second correction coefficient exceeds a reference range.

[0016] The displaying the corrected photo-acoustic image may further include: setting a region of interest; and displaying the photo-acoustic image, which corresponds to the set region of interest, on the region of interest.

[0017] The determining the first and second correction coefficients may include determining the first and second correction coefficients based on a degree in which light of the first wavelength and the second wavelength, which is emitted from skin tissues, has influence on the generation of acoustic waves according to a depth of the subject.

[0018] According to one or more embodiments of the present invention, a photo-acoustic imaging apparatus includes: a first light source emitting light having a first wavelength; a second light source emitting light having a second wavelength; a signal reception unit which obtains a first reception signal based on a first acoustic wave generated as light emitted from the first light source is absorbed by a subject, and obtains a second reception signal based on a second acoustic wave generated as light emitted from the second light source is absorbed by the subject; and a display unit which determines a first correction coefficient for the first reception signal and a second correction coefficient for the second reception signal based on a ratio between a size of the first reception signal and that of the second reception signal, and displays a photo-acoustic image that is corrected based on the first and second correction coefficients.

[0019] The display unit may determine the first correction coefficient and the second correction coefficient which obtain an oxygen saturation value of the subject, which is measured by an oxygen saturation measuring instrument, determine a standard ratio with regard to the size of the first reception signal and that of the second reception signal based on the oxygen saturation value, and correct the ratio between the

size of the first reception signal and that of the second reception signal based on the determined standard ratio.

**[0020]** The photo-acoustic imaging apparatus may further include a subject selection unit which selects the subject included in an image displayed through the display unit.

**[0021]** The display unit may display a window which displays the selected subject when the subject is selected by the subject selection unit.

**[0022]** The display unit may display the corrected photo-acoustic image together with at least one of a B-mode ultrasound image, a C-mode ultrasound image, an oxygen saturation display image, and a signal characteristic image.

**[0023]** The display unit may display the corrected photo-acoustic image together with the determined first and second correction coefficients.

**[0024]** The display unit may display a light source error message when at least one of the first correction coefficient and the second correction coefficient exceeds a reference ratio.

**[0025]** The photo-acoustic imaging apparatus may further include a region of interest selection unit which sets a region of interest. The display unit may display the photo-acoustic image, which corresponds to the set region of interest, on the region of interest when the region of interest is set by the region of interest selection unit.

**[0026]** The display unit may determine the first and second correction coefficients based on a degree in which light of the first wavelength and the second wavelength, which is emitted from skin tissues, has influence on the generation of acoustic waves according to a depth of the subject.

**[0027]** According to one or more embodiments of the present invention, there is provided a computer-readable recording medium having recorded a program thereon for executing the method of displaying a photo-acoustic image by a photo-acoustic imaging apparatus.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0028]** These and/or other aspects will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings in which:

**[0029]** FIG. **1** is a structural view of a photo-acoustic imaging apparatus according to an embodiment of the present invention;

**[0030]** FIG. **2** is a view of a photo-acoustic image according to an embodiment of the present invention;

**[0031]** FIG. **3** is a view of a user interface which displays a selected subject, according to an embodiment of the present invention;

**[0032]** FIGS. **4**A and **4**B are views showing photo-acoustic effects according to an embodiment of the present invention;

**[0033]** FIGS. **5**A through **5**C are views showing a relation between a depth of a subject's tissues and fluence, according to an embodiment of the present invention;

**[0034]** FIG. **6** is a view of a displayed image according to an embodiment of the present invention;

**[0035]** FIG. **7** is a view of a displayed image according to another embodiment of the present invention; and

**[0036]** FIG. **8** is a flowchart of a process of displaying a photo-acoustic image, according to an embodiment of the present invention.

## DETAILED DESCRIPTION

**[0037]** Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. In this regard, the present embodiments may have different forms and should not be construed as being limited to the descriptions set forth herein. Accordingly, the embodiments are merely described below, by referring to the figures, to explain aspects of the present description. As used herein, 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.

**[0038]** Throughout the specification, when a portion is "connected" to another portion, the portion may be "directly connected" to the other portion, and also the portion may be "electrically connected" to the other portion by interposing a device therebetween. Also, when a portion "includes" an element, another element may be further included, rather than excluding the existence of the other element, unless otherwise described.

**[0039]** Of body parts, breasts have soft tissues and are exposed to the outside. Thus, a shape of the breasts may severely change due to gravity, pressure, or the like. Therefore, images of the breasts will be a main example of the present invention. However, the present invention is not limited thereto, and may be applied to other medical images.

**[0040]** Hereinafter, the present invention will be described in detail by explaining exemplary embodiments of the invention with reference to the attached drawings.

**[0041]** FIG. **1** is a structural view of a photo-acoustic imaging apparatus **1000** according to an embodiment of the present invention.

**[0042]** The photo-acoustic imaging apparatus **1000** may include a first light source **1011**, a second light source **1012**, a signal reception unit **1030**, and a display unit **1040**. FIG. **1** is a view for explaining an embodiment, and the photo-acoustic imaging apparatus **1000** may include more or less components than the components illustrated in FIG. **1**. Also, the components of FIG. **1** may be replaced by other components that perform the same functions as the components illustrated in FIG. **1**.

**[0043]** The first light source **1011** may emit light having a first wavelength. Also, the second light source **1012** may emit light having a second wavelength. The first wavelength and the second wavelength may be different. According to the present embodiment, the first and second light sources **1011** and **1012** may each include a semiconductor for emitting laser, but are not limited thereto.

**[0044]** The first light source **1011** and the second light source **1012** may each further include an amplifier (not shown) for amplifying energy of light emitted by the first light source **1011** and the second light source **1012**. The amplifier (not shown) may be an optical fiber amplifier for amplifying light.

**[0045]** When the light emitted by the first light source **1011** and the second light source **1012** is absorbed by a subject **1020**, the subject **1020** emits energy of the absorbed light and generates acoustic waves. The signal reception unit **1030** detects a first acoustic wave, which is generated as the light emitted by the first light source **1011** is absorbed by the subject **1020**, and may convert the detected first acoustic wave into a first reception signal. Also, the signal reception unit **1030** detects a second acoustic wave, which is generated as the light emitted by the second light source **1012** is absorbed

by the subject **1020**, and may convert the detected second acoustic wave into a second reception signal. Here, the first and second acoustic waves may be ultrasound. In the specification, the photo-acoustic imaging apparatus **1000** includes two light sources, but, according to some embodiments, may include a plurality of light sources.

**[0046]** The display unit **1040** may generate a photo-acoustic image and display the generated photo-acoustic image based on the first and second reception signals. The display unit **1040** may include a processor for processing image data and a display medium for outputting images.

**[0047]** The photo-acoustic imaging apparatus **1000** may further include a subject selection unit (not shown) capable of selecting the subject **1020** from among subjects included in the photo-acoustic image. For example, referring to FIG. **2**, the subject selection unit (not shown) may select a subject **2010** based on information that is input by a user by using an input device (not shown). The input device (not shown) may be variously configured as a track ball, a mouse, a keypad, or a combination thereof. Alternatively, the subject selection unit (not shown) may automatically detect the subject **2010** by using image recognition regarding the photo-acoustic image.

**[0048]** When the subject **2010** is selected as shown in FIG. **2**, the display unit **1040** may display a window **3000** in order to highlight and display the selected subject **2010**, as illustrated in FIG. **3**. The window **3000** may include a subject **3010**. FIG. **3** is a view of a user interface which displays a selected subject, according to an embodiment of the present invention. A user interface for highlighting and displaying the subject **3010** may be variously configured.

**[0049]** Referring back to FIG. **1**, the display unit **1040** may determine a signal ratio of the first reception signal and the second reception signal. In addition, the display unit **1040** may determine correction coefficients corresponding to the first and second reception signals based on the determined signal ratio. When the correction coefficients are determined, the display unit **1040** corrects a photo-acoustic image based on the determined correction coefficients, and may display the corrected photo-acoustic image. When a user interface for highlighting and displaying selected subjects, for example, the window **3000** of FIG. **3**, is terminated, the display unit **1040** may display the corrected photo-acoustic image according to the correction coefficients determined with regard to the selected subjects. Throughout the specification, the correction coefficients may denote values for correcting photo-acoustic images by correcting fluence of each wavelength.

**[0050]** In an embodiment, the subject **1020** may be arteries. In the case of arteries, the fluence of a wavelength is determined according to oxygen saturation. The oxygen saturation may be transmitted by a separate oxygen saturation measuring instrument (not shown) or may be obtained based on an oxygen saturation measuring instrument (not shown) included in the photo-acoustic imaging apparatus **1000**.

**[0051]** Referring to FIGS. **4**A and **4**B, the display unit **1040** may determine a signal ratio of the first reception signal corresponding to a first acoustic wave **4031** that is emitted by an artery **4010** absorbing light having a first wavelength **4021** and of the second reception signal corresponding to a second acoustic wave **4032** that is emitted by the artery **4010** absorbing light having a second wavelength **4022**. Also, the display unit **1040** may compare a reference ratio of the first and second reception signals according to the oxygen saturation with the determined signal ratio. The display unit **1040** may determine the correction coefficients for correcting the determined signal ratio by using the reference ratio. The display unit **1040** corrects the photo-acoustic image with regard to tissues **4040** based on the determined correction coefficients, and may display the corrected photo-acoustic image. For example, when the oxygen saturation is 95%, the reference ratio corresponding to the oxygen saturation of 95% is 0.9:0.8 and the measured signal ratio is 0.9:0.4, the display unit **1040** may determine a correction coefficient which doubles the second reception signal in comparison with the first reception signal so as to correct the signal ratio to 0.9:0.8.

**[0052]** According to another example, the subject **1020** may be a material injected into body tissue during a surgical operation. The material injected into the body tissue may be carbon. A carbon tattoo has a high light absorption rate, and thus a photo-acoustic signal is proportional to the fluence, not the light absorption rate. Therefore, if the subject **1020** is the carbon tattoo injected into the body tissue, the reference ratio to each reception signal becomes 1:1. Based on the reference ratio, the display unit **1040** determines the correction coefficients and may correct the photo-acoustic image based on the determined correction coefficients.

**[0053]** The above-described reference ratio is an example, and the reference ratio may vary according to embodiments. Also, according to an embodiment, the display unit **1040** may determine the correction coefficients as the user interface illustrated in FIG. **3** is terminated and may display the corrected photo-acoustic image.

**[0054]** FIGS. **5**A through **5**C are views showing a relation between a depth of tissues **5020** of a subject **5010** and fluence, according to an embodiment of the present invention.

**[0055]** The fluence of light may change according to the depth from a light source **5000** to tissues **5020** of the subject **5010**. In addition, the change of the fluence may be different according to a wavelength of the light, as illustrated in FIG. **5**. Therefore, the display unit **1040** determines the depth from the light source **5000** to the tissues **5020** of the subject **5010** and may determine a correction coefficient in consideration of the determined depth.

**[0056]** FIG. **6** is a view of a displayed image according to an embodiment of the present invention.

**[0057]** According to the embodiment, the display unit **1040** may simultaneously display a photo-acoustic image **6030** with at least one of a B-mode ultrasound image **6010**, an oxygen saturation image **6040**, a C-mode ultrasound image (not shown), and a signal characteristic image (not shown). Also, the display unit **1040** may display the photo-acoustic image **6030** together with an overlay image **6020** in which the B-mode ultrasound image **6010** is overlaid with the photo-acoustic image **6030**. Here, the B-mode ultrasound image **6010** may be a two-dimensional (2D) image. Also, the C-mode ultrasound image (not shown) may be a three-dimensional (3D) image. The signal characteristic image (not shown) may be an image which displays a characteristic of a signal thereon. The oxygen saturation image **6040** may be an image which displays the oxygen saturation of tissues within a display range of the image. The overlay image **6020** may be an image which displays the photo-acoustic image **6030** in a region of interest **6025** that is set based on a user input or image recognition. The display unit **1040** according to the present embodiment may display a multiple view **6000** shown in FIG. **6**.

**[0058]** Another image displayed with the photo-acoustic image **6030** may be displayed based on a color map that is

different from that of the photo-acoustic image **6030**. In addition, the display unit may simultaneously display a color bar **6050** corresponding to the color map used to display the photo-acoustic image **6030**.

**[0059]** FIG. **7** is a view of a displayed image according to another embodiment of the present invention.

**[0060]** The display unit of the photo-acoustic imaging apparatus may simultaneously display a correction coefficient **7010** and an image including a photo-acoustic image. The photo-acoustic imaging apparatus may determine whether there is any problem in a light source of the photo-acoustic imaging apparatus based on a value of a determined correction coefficient. When it is determined that the light source has a problem, the display unit of the photo-acoustic imaging apparatus may display a light-source error message **7020** at the same time.

**[0061]** The photo-acoustic imaging apparatus may provide a user interface for setting a region of interest **7025** on an image. The display unit of the photo-acoustic imaging apparatus may overlap a photo-acoustic image, which corresponds to the image on which the region of interest **7025** is set, within the region of interest **7025**.

**[0062]** FIG. **8** is a flowchart of a process of displaying a photo-acoustic image, according to an embodiment of the present invention.

**[0063]** The photo-acoustic imaging apparatus may first obtain a first reception signal and a second reception signal (S**8010**). The first reception signal may be a signal generated by corresponding to light emitted by a first light source of the photo-acoustic imaging apparatus. In addition, the second reception signal may be a signal generated by corresponding to light emitted by a second light source of the photo-acoustic imaging apparatus. The light emitted by the first light source and the light emitted by the second light source may have different frequencies.

**[0064]** Then, the photo-acoustic imaging apparatus may determine a first correction coefficient and a second correction coefficient (S**8020**). The first and second correction coefficients may be determined based on a ratio of intensity of the first and second correction coefficients.

**[0065]** In operation S**8020**, the photo-acoustic imaging apparatus may obtain an oxygen saturation value of a subject measured by an oxygen saturation measuring instrument. The photo-acoustic imaging apparatus may determine a reference ratio to sizes of the first and second reception signals based on the oxygen saturation value. The reference ratio corresponding to the oxygen saturation value may be a preset value. The photo-acoustic imaging apparatus may determine the first and second correction coefficients in order to correct the ratio of the sizes of the first and second reception signals with the reference ratio.

**[0066]** According to another example, the photo-acoustic imaging apparatus may determine the first and second correction coefficients based on the reference ratio determined by selecting a subject having a fixed reference ratio. For example, when carbon injected into body tissues during a cancer surgery is selected as a subject, the reference ratio of the first and second reception signals becomes 1:1. In this case, operation S**8020** may further include selecting a subject included in an image displayed through the photo-acoustic imaging apparatus. The photo-acoustic imaging apparatus may display a window which displays the subject included in the image displayed through the photo-acoustic imaging apparatus as the subject is selected.

**[0067]** According to a wavelength and a depth from skin tissues to the subject, correction coefficients may be determined based on a degree of influence on the generation of acoustic waves.

**[0068]** The photo-acoustic imaging apparatus may correct the photo-acoustic image based on the determined correction coefficients. The photo-acoustic imaging apparatus may display the corrected photo-acoustic image (S**8030**).

**[0069]** In operation S**8030**, the photo-acoustic imaging apparatus may display the corrected photo-acoustic image together with at least one of a B-mode ultrasound image, a C-mode ultrasound image, an oxygen saturation display image, and a signal characteristic image. Also, the photo-acoustic imaging apparatus may display the corrected photo-acoustic image together with at least one of a first correction coefficient, the second correction coefficient, and the light-source error message.

**[0070]** Furthermore, in operation S**8030**, the photo-acoustic imaging apparatus may set a region of interest on the at least one of the B-mode ultrasound image, the C-mode ultrasound image, the oxygen saturation display image, and the signal characteristic image according to a user input. The photo-acoustic imaging apparatus may overlap the set region of interest with some portion of the photo-acoustic image.

**[0071]** In the specification, the photo-acoustic imaging apparatus has two light sources, two reception signals, and two correction coefficients. However, according to embodiments, it would be obvious to one of ordinary skill in the art that the number of light sources, reception signals, and correction coefficients may vary.

**[0072]** In addition, other embodiments of the present invention can also be implemented through computer-readable code/instructions in/on a medium, e.g., a computer-readable medium, to control at least one processing element to implement any above-described embodiment. The medium can correspond to any medium/media permitting the storage and/or transmission of the computer-readable code.

**[0073]** The computer-readable code can be recorded/transferred on a medium in a variety of ways, with examples of the medium including recording media, such as magnetic storage media (e.g., ROM, floppy disks, hard disks, etc.) and optical recording media (e.g., CD-ROMs, DVDs, etc.), and transmission media such as Internet transmission media. Thus, the medium may be such a defined and measurable structure including or carrying a signal or information, such as a device carrying a bitstream according to one or more embodiments of the present invention. The media may also be a distributed network, so that the computer-readable code is stored/transferred and executed in a distributed fashion. Furthermore, the processing element could include a processor or a computer processor, and processing elements may be distributed and/or included in a single device.

**[0074]** It should be understood that the exemplary embodiments described therein should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each embodiment should typically be considered as available for other similar features or aspects in other embodiments.

**[0075]** While one or more embodiments of the present invention have been described with reference to the figures, 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 displaying a photo-acoustic image by a photo-acoustic imaging apparatus, the method comprising:

obtaining a first reception signal, which converts a first acoustic wave generated as light having a first wavelength is absorbed by a subject, and a second reception signal, which converts a second acoustic wave generated as light having a second wavelength is absorbed by the subject;

determining a first correction coefficient for the first reception signal and a second correction coefficient for the second reception signal based on a ratio between a size of the first reception signal and that of the second reception signal; and

displaying a photo-acoustic image which is corrected based on the first and second correction coefficients.

2. The method of claim 1, wherein the determining the first and second correction coefficients comprises:

obtaining an oxygen saturation value of the subject, which is measured by an oxygen saturation measuring instrument;

determining a standard ratio with regard to the size of the first reception signal and that of the second reception signal based on the oxygen saturation value; and

determining the first and second correction coefficients which correct the ratio between the size of the first reception signal and that of the second reception signal based on the determined standard ratio.

3. The method of claim 1, wherein the obtaining the first reception signal and the second reception signal further comprises selecting the subject comprised in an image displayed through the photo-acoustic imaging apparatus.

4. The method of claim 3, further comprising displaying a window which displays the subject comprised in the image and displayed through the photo-acoustic imaging apparatus as the subject is selected.

5. The method of claim 1, wherein the displaying the corrected photo-acoustic image comprises simultaneously displaying the corrected photo-acoustic image along with at least one of a B-mode ultrasound image, a C-mode ultrasound image, an oxygen saturation display image, and a signal characteristic image.

6. The method of claim 1, wherein the displaying the corrected photo-acoustic image comprises displaying the corrected photo-acoustic image along with the determined first and second correction coefficients.

7. The method of claim 1, wherein the displaying the corrected photo-acoustic image further comprises displaying a light source error message in a case where at least one of the first correction coefficient and the second correction coefficient exceeds a reference range.

8. The method of claim 1, wherein the displaying the corrected photo-acoustic image further comprises:

setting a region of interest; and

displaying the photo-acoustic image, which corresponds to the set region of interest, on the region of interest.

9. The method of claim 1, wherein the determining the first and second correction coefficients comprises determining the first and second correction coefficients based on a degree in which light of the first wavelength and the second wavelength, which is emitted from skin tissues, has influence on the generation of acoustic waves according to a depth of the subject.

10. A photo-acoustic imaging apparatus comprising:

a first light source emitting light having a first wavelength;

a second light source emitting light having a second wavelength;

a signal reception unit which obtains a first reception signal based on a first acoustic wave generated as light emitted from the first light source is absorbed by a subject, and obtains a second reception signal based on a second acoustic wave generated as light emitted from the second light source is absorbed by the subject; and

a display unit which determines a first correction coefficient for the first reception signal and a second correction coefficient for the second reception signal based on a ratio between a size of the first reception signal and that of the second reception signal, and displays a photo-acoustic image that is corrected based on the first and second correction coefficients.

11. The photo-acoustic imaging apparatus of claim 10, wherein the display unit determines the first correction coefficient and the second correction coefficient which obtain an oxygen saturation value of the subject, which is measured by an oxygen saturation measuring instrument, determine a standard ratio with regard to the size of the first reception signal and that of the second reception signal based on the oxygen saturation value, and correct the ratio between the size of the first reception signal and that of the second reception signal based on the determined standard ratio.

12. The photo-acoustic imaging apparatus of claim 10, further comprising a subject selection unit which selects the subject comprised in an image displayed through the display unit.

13. The photo-acoustic imaging apparatus of claim 12, wherein the display unit displays a window which displays the selected subject when the subject is selected by the subject selection unit.

14. The photo-acoustic imaging apparatus of claim 10, wherein the display unit displays the corrected photo-acoustic image together with at least one of a B-mode ultrasound image, a C-mode ultrasound image, an oxygen saturation display image, and a signal characteristic image.

15. The photo-acoustic imaging apparatus of claim 10, wherein the display unit displays the corrected photo-acoustic image together with the determined first and second correction coefficients.

16. The photo-acoustic imaging apparatus of claim 10, wherein the display unit displays a light source error message when at least one of the first correction coefficient and the second correction coefficient exceeds a reference ratio.

17. The photo-acoustic imaging apparatus of claim 10, further comprising a region of interest selection unit which sets a region of interest, wherein the display unit displays the photo-acoustic image, which corresponds to the set region of interest, on the region of interest when the region of interest is set by the region of interest selection unit.

18. The photo-acoustic imaging apparatus of claim 10, wherein the display unit determines the first and second correction coefficients based on a degree in which light of the first wavelength and the second wavelength, which is emitted from skin tissues, has influence on the generation of acoustic waves according to a depth of the subject.

19. A computer-readable recording medium having recorded a program thereon for executing the method of claim 1.

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摘要(译)

提供了一种光声成像设备和通过光声成像设备显示光声图像的方法。一种通过光声成像装置显示光声图像的方法，包括：获得第一接收信号和第二接收信号，所述第一接收信号将作为第一波长的光产生的第一声波转换为被对象吸收，所述第二接收信号转换由第二波长的光被对象吸收时产生的第二声波;基于第一接收信号的大小与第二接收信号的大小之间的比率，确定第一接收信号的第一校正系数和第二接收信号的第二校正系数; 并显示基于第一和第二校正系数校正的光声图像。