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(54) METHOD AND SYSTEM FOR ENHANCED VISUALIZATION BY AUTOMATICALLY ADJUSTING ULTRASOUND IMAGE COLOR AND CONTRAST

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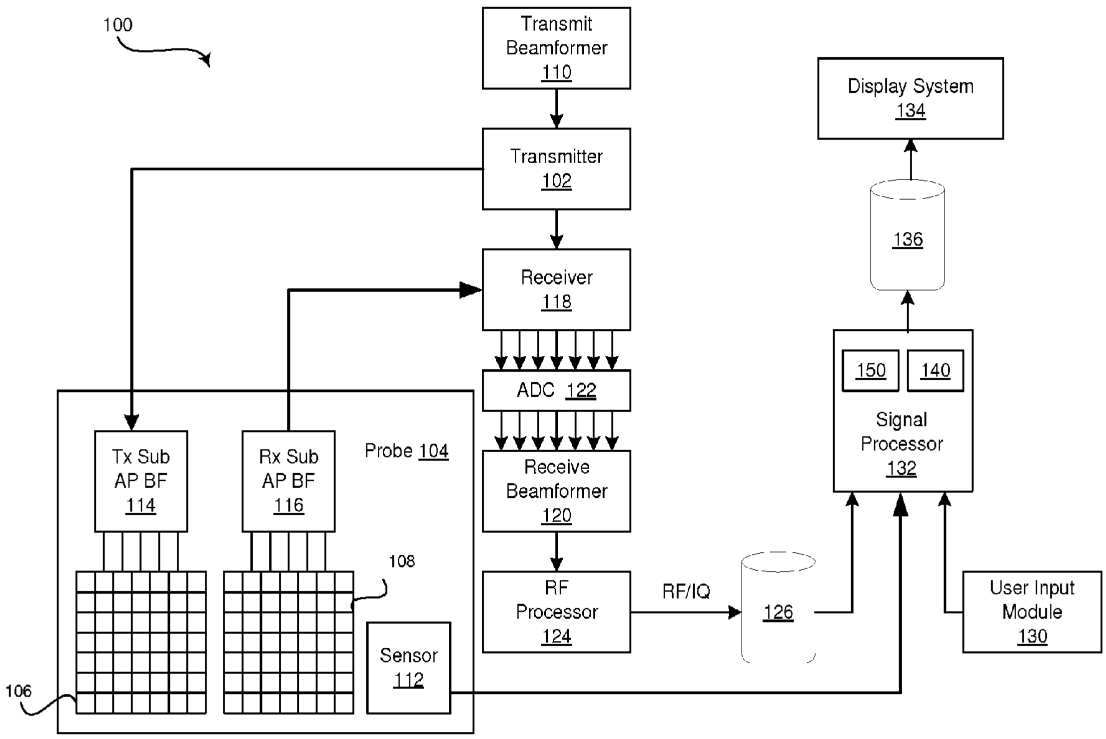
(57) **ABSTRACT**

Certain embodiments provide a method and system for enhancing visualization of an image acquired with a handheld ultrasound scanner by automatically adjusting the image to optimize the color and contrast. The method may include performing, by a probe of an ultrasound system, an ultrasound scan to acquire ultrasound scan data. The method may also include detecting, by a sensor, lighting conditions. The method may include measuring, by a processor of the ultrasound system, a characteristic of the detected lighting conditions. The method may also include selecting, by the processor, a color map based on the measured characteristic. The method may include applying, by the processor, the selected color map to the acquired ultrasound scan data to generate processed ultrasound scan data.



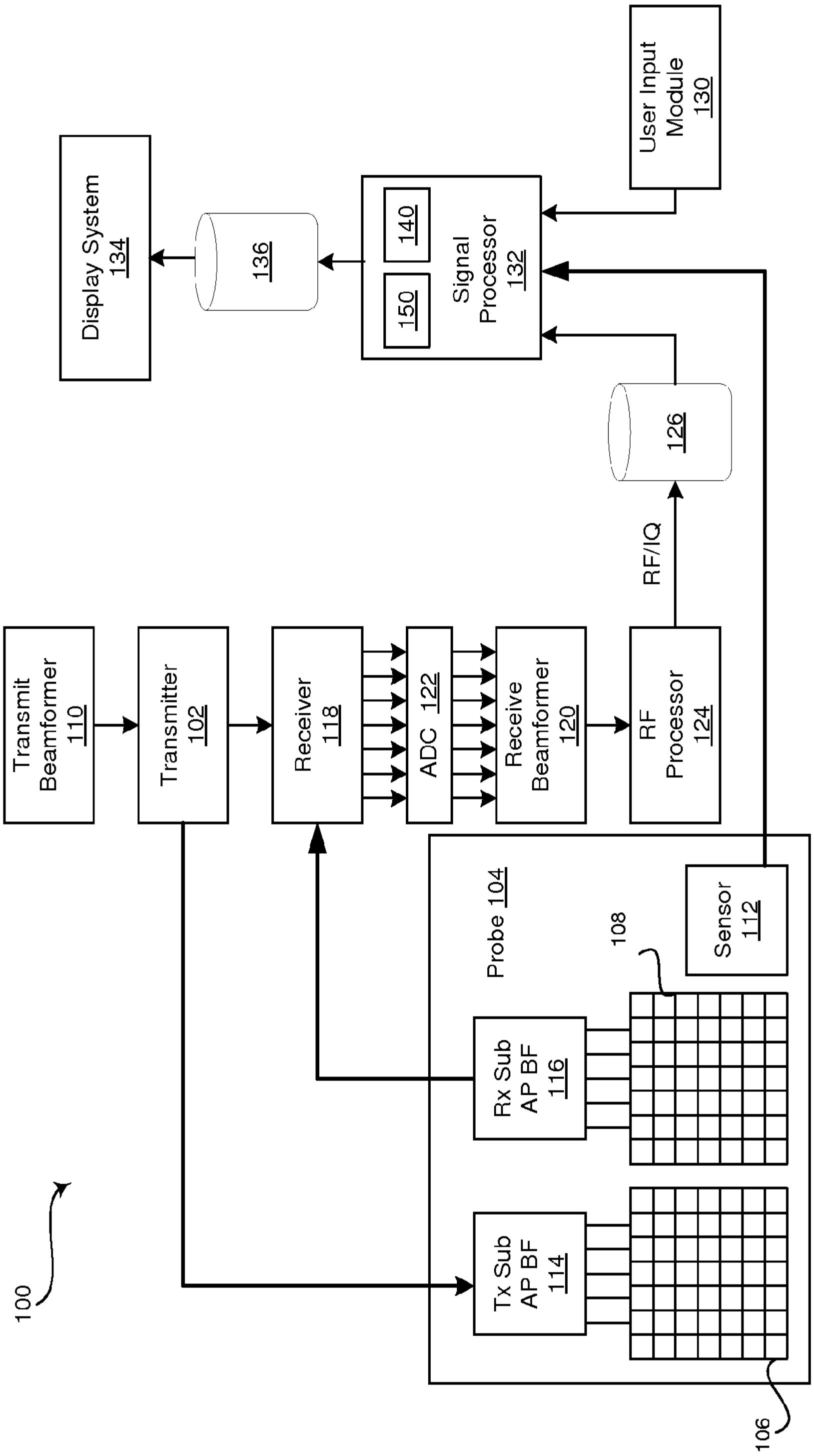

100
Transmit Beamformer 110
Transmitter 102
Receiver 118
ADC 122
Receive Beamformer 120
RF Processor 124
RF/IQ
126
Signal Processor 132
150
140
136
Display System 134
User Input Module 130
Probe 104
Tx Sub AP BF 114
Rx Sub AP BF 116
Sensor 112
106
108

FIG. 1

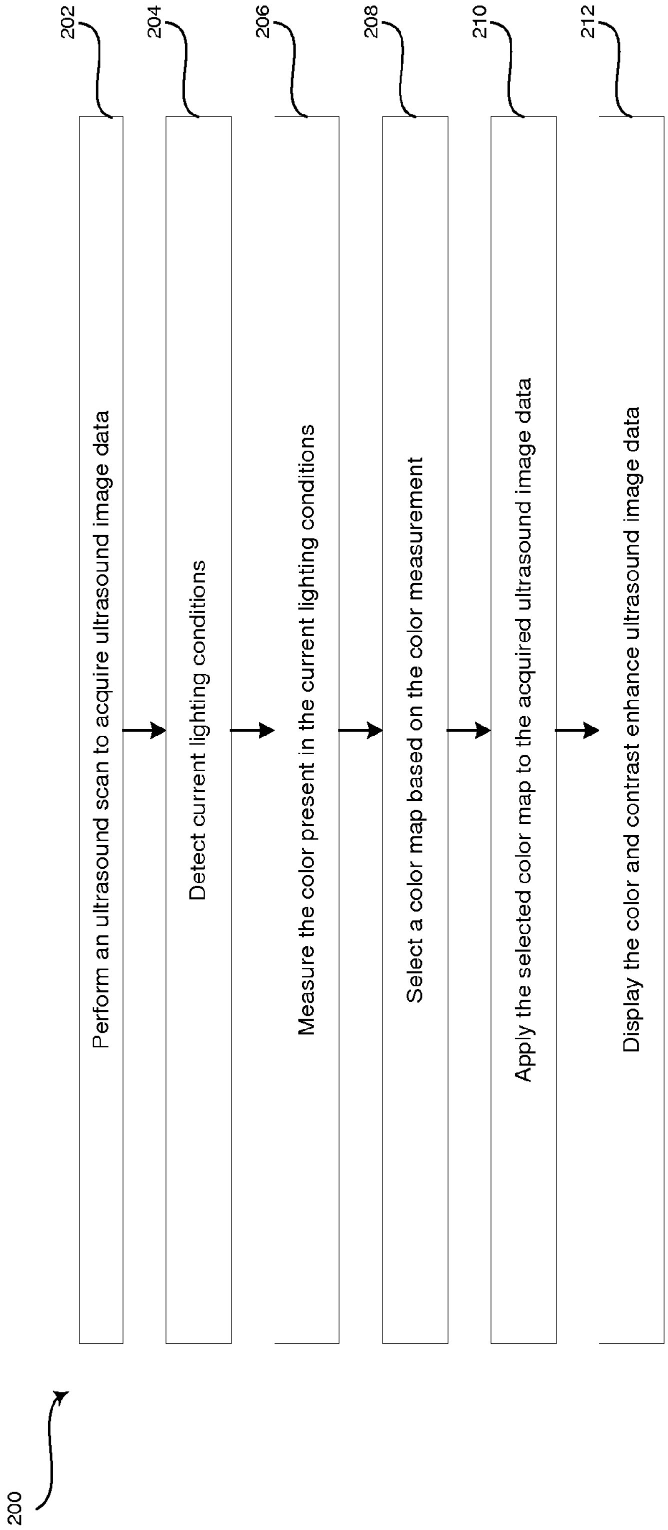

200
202
Perform an ultrasound scan to acquire ultrasound image data
204
Detect current lighting conditions
206
Measure the color present in the current lighting conditions
208
Select a color map based on the color measurement
210
Apply the selected color map to the acquired ultrasound image data
212
Display the color and contrast enhance ultrasound image data

FIG. 2

METHOD AND SYSTEM FOR ENHANCED VISUALIZATION BY AUTOMATICALLY ADJUSTING ULTRASOUND IMAGE COLOR AND CONTRAST

CROSS-REFERENCE TO RELATED APPLICATIONS/INCORPORATION BY REFERENCE

[0001] [Not Applicable]

FIELD OF THE INVENTION

[0002] Certain embodiments of the invention relate to ultrasound imaging. More specifically, certain embodiments of the invention relate to a method and system for enhanced visualization of an image acquired with a handheld ultrasound scanner by automatically adjusting the image to optimize the color and contrast.

BACKGROUND OF THE INVENTION

[0003] Ultrasound imaging is a medical imaging technique for imaging organs and soft tissues in a human body. Ultrasound imaging uses real time, non-invasive high frequency sound waves to produce a two-dimensional (2D) image and/or a three-dimensional (3D) image.

[0004] Handheld ultrasound scanners are commonly used to acquire ultrasound data in emergency situations, such as in ambulances, helicopters, and other outdoor environments with fast changing and/or difficult light conditions. For example, helicopters may use red lighting to preserve the night vision of the pilots. As another example, an ambulance may drive in and out of tunnels, causing drastic changes to lighting conditions in a fraction of a second. In emergency situations, an operator of the handheld ultrasound scanner may not have time to manually change display parameters or color maps to adapt to the changing conditions. Further, the operators of handheld ultrasound scanners in emergency situations may have less training in sonography than specialists at a hospital, for example. Consequently, less trained users may have difficulty navigating menus to select an optimal color map and may not know which of the available color maps is best for a particular lighting condition.

[0005] Existing display devices, such as mobile phones, have attempted to improve image visualization by providing automatic backlight adjustment. While backlight adjustment may improve visualization in a limited light range, a strong backlight does not provide good contrast in strong outdoor light. The use of a strong backlight also consumes a high amount of power, which is problematic for the limited battery capacity of handheld ultrasound scanners.

[0006] Further limitations and disadvantages of conventional and traditional approaches will become apparent to one of skill in the art, through comparison of such systems with some aspects of the present invention as set forth in the remainder of the present application with reference to the drawings.

BRIEF SUMMARY OF THE INVENTION

[0007] A system and/or method is provided for enhanced visualization of an image acquired with a handheld ultrasound scanner by automatically adjusting the image to optimize the color and contrast, substantially as shown in and/or described in connection with at least one of the figures, as set forth more completely in the claims.

[0008] These and other advantages, aspects and novel features of the present invention, as well as details of an illustrated embodiment thereof, will be more fully understood from the following description and drawings.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0009] FIG. **1** is a block diagram of an exemplary ultrasound system that is operable to provide enhanced visualization of an image acquired with a handheld ultrasound scanner by automatically adjusting the image to optimize the color and contrast, in accordance with an embodiment of the invention.

[0010] FIG. **2** is a flow chart illustrating exemplary steps that may be utilized for providing enhanced visualization of an image acquired with a handheld ultrasound scanner by automatically adjusting the image to optimize the color and contrast, in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0011] Certain embodiments of the invention may be found in a method and system for adjusting the color and contrast of an image acquired by a handheld ultrasound scanner. For example, aspects of the present invention have the technical effect of quickly and automatically selecting a color map based on detected light conditions and applying the color map to acquired ultrasound image data, thereby improving the workflow of the operator while enhancing visualization of the image data.

[0012] The foregoing summary, as well as the following detailed description of certain embodiments will be better understood when read in conjunction with the appended drawings. To the extent that the figures illustrate diagrams of the functional blocks of various embodiments, the functional blocks are not necessarily indicative of the division between hardware circuitry. Thus, for example, one or more of the functional blocks (e.g., processors or memories) may be implemented in a single piece of hardware (e.g., a general purpose signal processor or a block of random access memory, hard disk, or the like) or multiple pieces of hardware. Similarly, the programs may be stand alone programs, may be incorporated as subroutines in an operating system, may be functions in an installed software package, and the like. It should be understood that the various embodiments are not limited to the arrangements and instrumentality shown in the drawings. It should also be understood that the embodiments may be combined, or that other embodiments may be utilized and that structural, logical and electrical changes may be made without departing from the scope of the various embodiments of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined by the appended claims and their equivalents.

[0013] As used herein, an element or step recited in the singular and proceeded with the word "a" or "an" should be understood as not excluding plural of said elements or steps, unless such exclusion is explicitly stated. Furthermore, references to "one embodiment" are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Moreover, unless explicitly stated to the contrary, embodiments "comprising" or "having" an element or a plurality of elements having a particular property may include additional elements not having that property.

[0014] Also as used herein, the term "image" broadly refers to both viewable images and data representing a viewable image. However, many embodiments generate (or are configured to generate) at least one viewable image. In addition, as used herein, the phrase "image" is used to refer to an ultrasound mode such as B-mode, CF-mode and/or sub-modes of CF such as TVI, Angio, B-flow, BMI, BMI_Angio, and in some cases also MM, CM, PW, TVD, CW where the "image" and/or "plane" includes a single beam or multiple beams.

[0015] Furthermore, the term processor or processing unit, as used herein, refers to any type of processing unit that can carry out the required calculations needed for the invention, such as single or multi-core: CPU, Graphics Board, DSP, FPGA, ASIC or a combination thereof.

[0016] It should be noted that various embodiments described herein that generate or form images may include processing for forming images that in some embodiments includes beamforming and in other embodiments does not include beamforming. For example, an image can be formed without beamforming, such as by multiplying the matrix of demodulated data by a matrix of coefficients so that the product is the image, and wherein the process does not form any "beams". Also, forming of images may be performed using channel combinations that may originate from more than one transmit event (e.g., synthetic aperture techniques).

[0017] In various embodiments, ultrasound processing to form images is performed, for example, including ultrasound beamforming, such as receive beamforming, in software, firmware, hardware, or a combination thereof. One implementation of an ultrasound system having a software beamformer architecture formed in accordance with various embodiments is illustrated in FIG. **1**.

[0018] FIG. **1** is a block diagram of an exemplary ultrasound system **100** that is operable to provide enhanced visualization of an image acquired with a handheld ultrasound scanner by automatically adjusting the image to optimize the color and contrast, in accordance with an embodiment of the invention. Referring to FIG. **1**, there is shown an ultrasound system **100**. The ultrasound system **100** comprises a transmitter **102**, an ultrasound probe **104**, a transmit beamformer **110**, a receiver **118**, a receive beamformer **120**, a RF processor **124**, a RF/IQ buffer **126**, a user input module **130**, a signal processor **132**, an image buffer **136**, and a display system **134**.

[0019] The transmitter **102** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to drive an ultrasound probe **104**. The ultrasound probe **104** may comprise a one dimensional (1D, 1.25D, 1.5D or 1.75D) array or a two dimensional (2D) array of piezoelectric elements. The ultrasound probe **104** may comprise a group of transmit transducer elements **106** and a group of receive transducer elements **108**, that normally constitute the same elements. The ultrasound probe **104** may comprise a sensor **112** for determining current lighting conditions. Additionally or alternatively, the sensor **112** may be separately housed or disposed with other components of the system, such as the signal processor **132**. The sensor **112** may be, for example, a red green blue (RGB) light color sensor that provides information regarding the amount of color in detected light, or any suitable sensor. The sensor **112** may provide the detected light information to the light measurement module **150** of the signal processor **132** for color measurement and/or any suitable processing to determine the current lighting conditions.

[0020] The transmit beamformer **110** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to control the transmitter **102** which, through a transmit sub-aperture beamformer **114**, drives the group of transmit transducer elements **106** to emit ultrasonic transmit signals into a region of interest (e.g., human, animal, underground cavity, physical structure and the like). The transmitted ultrasonic signals may be back-scattered from structures in the object of interest, like blood cells, and surgical instruments in the object of interest to produce echoes. The echoes are received by the receive transducer elements **108**. The group of receive transducer elements **108** in the ultrasound probe **104** may be operable to convert the received echoes into analog signals, undergo sub-aperture beamforming by a receive sub-aperture beamformer **116** and are then communicated to a receiver **118**.

[0021] The receiver **118** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to receive and demodulate the signals from the receive sub-aperture beamformer **116**. The demodulated analog signals may be communicated to one or more of the plurality of A/D converters **122**. The plurality of A/D converters **122** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to convert the demodulated analog signals from the receiver **118** to corresponding digital signals. The plurality of A/D converters **122** are disposed between the receiver **118** and the receive beamformer **120**. Notwithstanding, the invention is not limited in this regard. Accordingly, in some embodiments of the invention, the plurality of A/D converters **122** may be integrated within the receiver **118**.

[0022] The receive beamformer **120** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to perform digital beamforming processing on the signals received from the plurality of A/D converters **122**. The resulting processed information may be converted back to corresponding RF signals. The corresponding output RF signals that are output from the receive beamformer **120** may be communicated to the RF processor **124**. In accordance with some embodiments of the invention, the receiver **118**, the plurality of A/D converters **122**, and the beamformer **120** may be integrated into a single beamformer, which may be digital.

[0023] The RF processor **124** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to demodulate the RF signals. In accordance with an embodiment of the invention, the RF processor **124** may comprise a complex demodulator (not shown) that is operable to demodulate the RF signals to form I/Q data pairs that are representative of the corresponding echo signals. The RF or I/Q signal data may then be communicated to an RF/IQ buffer **126**.

[0024] The RF/IQ buffer **126** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to provide temporary storage of the RF or I/Q signal data, which is generated by the RF processor **124**.

[0025] The user input module **130** may be utilized to input patient data, surgical instrument data, scan parameters, settings, configuration parameters, change scan mode, and the like. In an exemplary embodiment of the invention, the user input module **130** may be operable to configure, manage and/or control operation of one or more components and/or modules in the ultrasound system **100**. In this regard, the user input module **130** may be operable to configure, manage and/or control operation of transmitter **102**, the ultrasound probe **104**, the transmit beamformer **110**, the receiver **118**, the receive beamformer **120**, the RF processor **124**, the RF/IQ buffer **126**, the user input module **130**, the signal processor **132**, the image buffer **136**, and/or the display system **134**

[0026] The signal processor **132** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to process ultrasound scan data (i.e., RF signal data or IQ data pairs) for generating an ultrasound image for presentation on a display system **134**. The signal processor **132** is operable to perform one or more processing operations according to a plurality of selectable ultrasound modalities on the acquired ultrasound scan data. In an exemplary embodiment of the invention, the signal processor **132** may be operable to perform compounding, motion tracking, and/or speckle tracking. Acquired ultrasound scan data may be processed in real-time during a scanning session as the echo signals are received. Additionally or alternatively, the ultrasound scan data may be stored temporarily in the RF/IQ buffer **126** during a scanning session and processed in less than real-time in a live or off-line operation.

[0027] In various embodiments, the signal processor may comprise a light measurement module **150** and a color map processing module **140**. The light measurement module **150** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to handle processing data from the sensor **112**. For example, the light measurement module **150** may be operable to measure the color present in the current lighting conditions detected by the sensor **112**. The light measurement module **150**, or color map processing module **140**, can select a color map from a plurality of available color maps based on the measurement to provide optimal contrast. In various embodiments, the color map selection may be determined based on an algorithm applying one or more color theory principles, such as complementary color schemes, eye color sensitivity, and color sensitivity as a function of the general light intensity (i.e., the Purkinje effect), among other things. For example, a strong outdoor light often contains large quantities of scattered blue light. Accordingly, a color map corresponding with the complimentary color orange, which is on the opposite side of the color wheel from blue, may be selected for application to the acquired ultrasound image data to provide high contrast in the subsequently displayed image data. As another example, a sensitivity shift from strong outdoor light to lower light levels may cause a transition into yellow, green, and then blue color maps, based on the Purkinje effect color theory principle. Further, the eye is generally more sensitive to yellow and green color maps, which may factor into the color map selection. The color map processing module **140** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to process the acquired ultrasound data to apply the selected color map.

[0028] The ultrasound system **100** may be operable to continuously acquire ultrasound scan data at a frame rate that is suitable for the imaging situation in question. Typical frame rates range from 20-70 but may be lower or higher. The acquired ultrasound scan data may be displayed on the display system **134** at a display-rate that can be the same as the frame rate, or slower or faster. An image buffer **136** is included for storing processed frames of acquired ultrasound scan data that are not scheduled to be displayed immediately. Preferably, the image buffer **136** is of sufficient capacity to store at least several seconds worth of frames of ultrasound scan data. The frames of ultrasound scan data are stored in a manner to facilitate retrieval thereof according to its order or time of acquisition. The image buffer **136** may be embodied as any known data storage medium.

[0029] FIG. **2** is a flow chart illustrating exemplary steps that may be utilized for providing enhanced visualization of an image acquired with a handheld ultrasound scanner **100** by automatically adjusting the image to optimize the color and contrast, in accordance with an embodiment of the invention. Referring to FIG. **2**, there is shown a flow chart **200** comprising exemplary steps **202** through **212**. Certain embodiments of the present invention may omit one or more of the steps, and/or perform the steps in a different order than the order listed, and/or combine certain of the steps discussed below. For example, some steps may not be performed in certain embodiments of the present invention. As a further example, certain steps may be performed in a different temporal order, including simultaneously, than listed below.

[0030] In step **202**, an ultrasound scan is performed to acquire ultrasound image data. For example, the ultrasound probe **104** in the ultrasound system **100** may be operable to perform an ultrasound scan of patient anatomy. The ultrasound image data may be grayscale B-mode or M-mode image data, or any suitable ultrasound image data.

[0031] In step **204**, current lighting conditions may be detected. For example, a sensor **112** may receive information regarding the lighting conditions in the vicinity of the ultrasound scan. The sensor **112** may be disposed in or on the probe **104**, housed separately and connected to ultrasound system **100** as a user input module **130**, and/or disposed with other components of the ultrasound system **100**, such as the signal processor **132**, among other things. The sensor **112** may be an RGB light color sensor that is operable to detect the amount of color in the current lighting conditions, or any suitable sensor configured to detect current lighting conditions. The detected lighting information may be communicated to a signal processor **132**.

[0032] In step **206**, a light measurement module **150** of the signal processor **132** of the ultrasound system **100** may perform a measurement of the lighting information received from the sensor **112**. For example, the light measurement module **150** may measure the color present in the current lighting conditions. In various embodiments, the measurement may correspond with a color on a color wheel representing relationships between colors based on well-known color theory principles.

[0033] In step **208**, the light measurement module **150** or a color map processing module **140** of the signal processor **132**, may select a color map based on the measurement performed at step **206**. For example, a plurality of color maps may be available for selection based on the current lighting conditions. The signal processor **132** can select a color map from a plurality of available color maps based on the measurement to provide optimal contrast. The color map selection may be determined based on, for example, an algorithm applying a complementary color scheme to the measured color, eye color sensitivity, color sensitivity as a function of the general light intensity (i.e., the Purkinje effect), and/or any suitable color theory principle. For example, if the sensor **112** provides information corresponding to a strong outdoor light and the light measurement module **150** measures large quantities of scattered blue light, a color map corresponding with the complimentary color orange, which is on the opposite side of the color wheel from blue, may be selected by the light measurement module **150** or a color map processing module **140**. As another, example, if the light measurement module **150** measures lower light levels detected by the sensor **112** in an interior of an emergency helicopter, the signal processor **132** may select a yellow, green, or blue color map, based on the Purkinje effect color theory principle. Further, the eye is generally more sensitive to yellow and green color maps, which may factor into the color map selection by the signal processor **132**.

[0034] In step **210**, a color map processing module **140** of a signal processor **132** of the ultrasound system **100** can apply the color map selected at step **208** to the ultrasound image data acquired at step **202**. For example, if grayscale B-mode image data was acquired at step **202** and an orange color map was selected at step **208** after the signal processor **132** measured large quantities of scattered blue light at step **206** detected by sensor **112** at step **204**, the orange color map is applied by the color map processing module **140** to the grayscale B-mode image data at step **210** to provide a processed ultrasound image with optimal color and contrast for the current viewing conditions. In step **212**, the color and contrast enhanced ultrasound image data may be displayed at display system **134**, or the like.

[0035] Aspects of the present invention provide a method **200** and system **100** for enhancing the visualization of an image acquired with a handheld ultrasound scanner by automatically adjusting the image to optimize the color and contrast. In accordance with various embodiments of the invention, the method **200** comprises performing **202**, by a probe **104** of an ultrasound system **100**, an ultrasound scan to acquire ultrasound scan data. The method **200** comprises detecting **204**, by a sensor **112**, lighting conditions. The method **200** comprises measuring **206**, by a processor **132**, **150** of the ultrasound system **100**, a characteristic of the detected lighting conditions. The method **200** comprises selecting **208**, by the processor **132**, **140**, **150**, a color map based on the measured characteristic. The method **200** comprises applying **210**, by the processor **132**, **140**, the selected color map to the acquired ultrasound scan data to generate processed ultrasound scan data.

[0036] In a representative embodiment, the method **200** comprises presenting **212**, at a display system **134**, the processed ultrasound scan data. In various embodiments, the acquired ultrasound scan data is one of a grayscale B-mode image and a grayscale M-mode image. In certain embodiments, the sensor **112** is a red, green, blue (RGB) light color sensor. In a representative embodiment, the characteristic is one or more of color and intensity. In various embodiments, the selected color map corresponds with a color that is one or more of complimentary to the measured color, a function of the intensity, and sensitive to human vision. In certain embodiments, the sensor **112** is disposed one or more of in or on the probe **104**.

[0037] Various embodiments provide a system comprising an ultrasound device **100**. The ultrasound device **100** comprises a probe **104** configured to acquire ultrasound scan data. The ultrasound device **100** comprises a sensor **112** configured to detect lighting conditions. The ultrasound device **100** comprises a processor **132**, **150** configured to measure a characteristic of the detected lighting conditions. The processor **132**, **140**, **150** is configured to select a color map based on the measured characteristic. The processor **132**, **140** is configured to apply the selected color map to the acquired ultrasound scan data to generate processed ultrasound scan data.

[0038] In certain embodiments, the ultrasound device **100** comprises a display system **134** configured to present the processed ultrasound scan data. In a representative embodiment, the acquired ultrasound scan data is one of a grayscale B-mode image and a grayscale M-mode image. In various embodiments, the sensor **112** is a red, green, blue (RGB) light color sensor. In certain embodiments, the characteristic is one or more of color and intensity. In a representative embodiment, the selected color map corresponds with a color that is one or more of complimentary to the measured color, a function of the intensity, and sensitive to human vision. In various embodiments, the sensor **112** is disposed one or more of in or on the probe **104**. In certain embodiments, the processor **132**, **140**, **150** is configured to select the color map from a plurality of color maps. In a representative embodiment, each of the plurality of color maps corresponds with a different one of a plurality of lighting conditions.

[0039] As utilized herein the term "circuitry" refers to physical electronic components (i.e. hardware) and any software and/or firmware ("code") which may configure the hardware, be executed by the hardware, and or otherwise be associated with the hardware. As used herein, for example, a particular processor and memory may comprise a first "circuit" when executing a first one or more lines of code and may comprise a second "circuit" when executing a second one or more lines of code. As utilized herein, "and/or" means any one or more of the items in the list joined by "and/or". As an example, "x and/or y" means any element of the three-element set {(x), (y), (x, y)}. As another example, "x, y, and/or z" means any element of the seven-element set {(x), (y), (z), (x, y), (x, z), (y, z), (x, y, z)}. As utilized herein, the term "exemplary" means serving as a non-limiting example, instance, or illustration. As utilized herein, the terms "e.g.," and "for example" set off lists of one or more non-limiting examples, instances, or illustrations. As utilized herein, circuitry is "operable" to perform a function whenever the circuitry comprises the necessary hardware and code (if any is necessary) to perform the function, regardless of whether performance of the function is disabled, or not enabled, by some user-configurable setting.

[0040] Other embodiments of the invention may provide a computer readable device and/or a non-transitory computer readable medium, and/or a machine readable device and/or a non-transitory machine readable medium, having stored thereon, a machine code and/or a computer program having at least one code section executable by a machine and/or a computer, thereby causing the machine and/or computer to perform the steps as described herein for enhanced visualization of an image acquired with a handheld ultrasound scanner by automatically adjusting the image to optimize the color and contrast.

[0041] Accordingly, the present invention may be realized in hardware, software, or a combination of hardware and software. The present invention may be realized in a centralized fashion in at least one computer system, or in a distributed fashion where different elements are spread across several interconnected computer systems. Any kind of computer system or other apparatus adapted for carrying out the methods described herein is suited. A typical combination of hardware and software may be a general-purpose computer system with a computer program that, when being loaded and executed, controls the computer system such that it carries out the methods described herein.

[0042] The present invention may also be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present context means any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

[0043] While the present invention has been described with reference to certain embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the present invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present invention without departing from its scope. Therefore, it is intended that the present invention not be limited to the particular embodiment disclosed, but that the present invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A method, comprising:

performing, by a probe of an ultrasound system, an ultrasound scan to acquire ultrasound scan data;

detecting, by a sensor, lighting conditions;

measuring, by a processor of the ultrasound system, a characteristic of the detected lighting conditions;

selecting, by the processor, a color map based on the measured characteristic; and

applying, by the processor, the selected color map to the acquired ultrasound scan data to generate processed ultrasound scan data.

2. The method according to claim **1**, comprising presenting, at a display system, the processed ultrasound scan data.

3. The method according to claim **1**, wherein the acquired ultrasound scan data is one of:

a grayscale B-mode image, and

a grayscale M-mode image.

4. The method according to claim **1**, wherein the sensor is a red, green, blue (RGB) light color sensor.

5. The method according to claim **1**, wherein the characteristic is one or more of color and intensity.

6. The method according to claim **5**, wherein the selected color map corresponds with a color that is one or more of:

complimentary to the measured color,

a function of the intensity, and

sensitive to human vision.

7. The method according to claim **1**, wherein the sensor is disposed one or more of in or on the probe.

8. A system, comprising:

an ultrasound device comprising:

a probe configured to acquire ultrasound scan data;

a sensor configured to detect lighting conditions; and

a processor configured to:

measure a characteristic of the detected lighting conditions,

select a color map based on the measured characteristic, and

apply the selected color map to the acquired ultrasound scan data to generate processed ultrasound scan data.

9. The system according to claim **8**, wherein the ultrasound device comprises a display system configured to present the processed ultrasound scan data.

10. The system according to claim **8**, wherein the acquired ultrasound scan data is one of:

a grayscale B-mode image, and

a grayscale M-mode image.

11. The system according to claim **8**, wherein the sensor is a red, green, blue (RGB) light color sensor.

12. The system according to claim **8**, wherein the characteristic is one or more of color and intensity.

13. The system according to claim **12**, wherein the selected color map corresponds with a color that is one or more of:

complimentary to the measured color,

a function of the intensity, and

sensitive to human vision.

14. The system according to claim **8**, wherein the sensor is disposed one or more of in or on the probe.

15. The system according to claim **8**, wherein the processor is configured to select the color map from a plurality of color maps, each of the plurality of color maps corresponding with a different one of a plurality of lighting conditions.

16. A non-transitory computer readable medium having stored thereon, a computer program having at least one code section, the at least one code section being executable by a machine for causing the machine to perform steps comprising:

receiving acquired ultrasound scan data;

receiving detected lighting conditions;

measuring a characteristic of the detected lighting conditions;

selecting a color map based on the measured characteristic; and

applying the selected color map to the acquired ultrasound scan data to generate processed ultrasound scan data.

17. The non-transitory computer readable medium according to claim **16**, comprising presenting the processed ultrasound scan data.

18. The non-transitory computer readable medium according to claim **16**, wherein the acquired ultrasound scan data is one of:

a grayscale B-mode image, and

a grayscale M-mode image.

19. The non-transitory computer readable medium according to claim **15**, wherein the characteristic is one or more of color and intensity.

20. The non-transitory computer readable medium according to claim **19**, wherein the selected color map corresponds with a color that is one or more of:

complimentary to the measured color,

a function of the intensity, and

sensitive to human vision.

* * * * *

专利名称(译)	通过自动调整超声图像颜色和对比度来增强可视化的方法和系统		
公开(公告)号	US20160174942A1	公开(公告)日	2016-06-23
申请号	US14/580575	申请日	2014-12-23
[标]申请(专利权)人(译)	通用电气公司		
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摘要(译)

某些实施例提供了一种方法和系统，用于通过自动调整图像以优化颜色和对比度来增强用手持式超声扫描仪获取的图像的可视化。该方法可以包括通过超声系统的探头执行超声扫描以获取超声扫描数据。该方法还可以包括由传感器检测照明条件。该方法可以包括由超声系统的处理器测量检测到的照明条件的特征。该方法还可以包括由处理器基于测量的特征选择彩色图。该方法可以包括由处理器将所选择的颜色图应用于所采集的超声扫描数据以生成处理的超声扫描数据。