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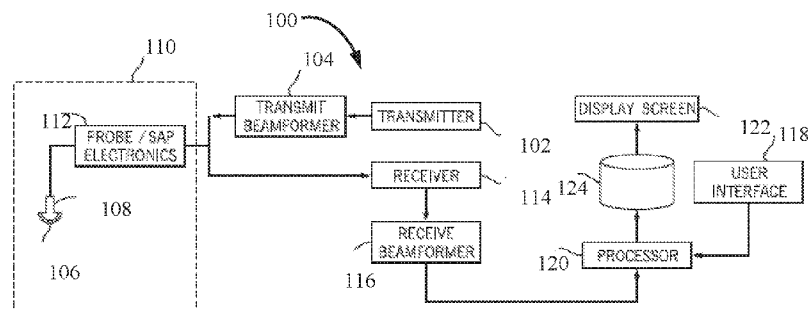
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(57) Abstract: A medical imaging system is configured to generate reports based on the observations of technician provided while reviewing the images captured. The system enables the technician to provide the observations while the images are captured and reviewed in real time. So the images are selected and stored along with the observations and thus the report generated includes the observations. As a result technician need not remember and recollect the observations.

REPORT GENERATION IN MEDICAL IMAGING

FIELD OF THE INVENTION

[0001] The subject matter disclosed herein relates to performing medical imaging on patient. More specifically the subject matter relates to generating reports from medical imaging of patient's anatomy.

BACKGROUND OF THE INVENTION

[0002] Diagnostic medical imaging systems typically include a scan portion and a control portion having a display. Ultrasound imaging is used in medical diagnostics as a non-invasive imaging mechanism for soft tissue organs. An ultrasound imaging system typically includes a handheld ultrasound probe that is communicably coupled with a processor and a display screen. The ultrasound imaging technique involves placement of the ultrasound probe on a patient's body near a region of interest. For example, to capture images of the pancreas the ultrasound probe may be placed on the abdomen of the patient. The ultrasound probe holds an ultrasound transducer that transmits ultrasound energy into the patient's body through the region of interest. The transducer detects echoes of the ultrasound sound energy from the patient's body and transfers this detected data to the processor. The processor analyzes parameters of the echo of the ultrasound energy and creates a 2-dimensional image of the region of interest. The image is displayed on the display screen to allow a doctor/attendant to analyze the state of the region of interest. The ultrasound probe further holds application specific integrated circuits (ASICs) required for, among other activities, generating control signals to transmit ultrasound energy, receiving ultrasound energy

[0003] While performing ultrasound imaging a technician reviews the ultrasound images and stores selected images for further review. The stored images are reviewed and observations are appended to these images or as separate comments. A challenge here is the technician's need to remember the observations that need to be added to the images. The images may have been selected and stored based on some observations of

the technician and now the technician needs to recollect these observations and add them. This is because the thought process and observations may be missed out while reviewing the images. Accordingly there is a need for improved method of generating report in ultrasound imaging.

SUMMARY OF THE INVENTION

[0004] The object of the invention is to provide generation of reports in medical imaging, which overcomes one or more drawbacks of the prior art. This is achieved by a system for generating reports in medical imaging such as ultrasound imaging as defined in the independent claim.

[0005] One advantage with the disclosed invention is that medical imaging system is configured to generate reports based on the observations of technician provided while reviewing the images captured. The system enables the technician to provide the observations while the images are captured and reviewed in real time. So the images are selected and stored along with the observations and thus the report generated includes the observations. As a result technician need not remember and recollect the observations.

[0006] In an embodiment a medical imaging system is disclosed. The medical imaging system includes an image processing unit for processing medical image data to generate medical images; a recording unit configured to record observations associated with the medical images simultaneously while presenting the medical images to a user, wherein the observations are based on the user's review of the medical images; and a report generation unit configured to generate a report based on the medical images and the observations recorded.

[0007] In another embodiment a method for generating reports of medical imaging is disclosed. The method includes receiving observations from a user simultaneously when medical images of an anatomy are captured and reviewed by the user; recording the observations associated with the medical images in real time; and generating a report based on the observations and the medical images.

[0008] A more complete understanding of the present invention, as well as further features and advantages thereof, will be obtained by reference to the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a schematic illustration of an ultrasound imaging system in accordance with an embodiment;

[0010] FIG. 2 illustrates a medical imaging system according to an embodiment;

[0011] FIG. 3 illustrates an user interface of the medical imaging system according to an embodiment;

[0012] FIG. 4 illustrates the user interface of FIG. 3 presenting multiple imaging protocols according to an embodiment;

[0013] FIG. 5 illustrates the user interface of FIG. 3 presenting a plurality of options for providing user's observations according to an embodiment;

[0014] FIG. 6 illustrates the user interface of FIG. 3 presenting a plurality of options for providing user's observations according to another embodiment;

[0015] FIG. 7 illustrates the user interface of FIG. 3 presenting an audio file associated user's observations that can be appended according to another embodiment

[0016] FIG. 8 illustrates a flow diagram of a method for generating reports of medical imaging according to an embodiment; and

[0017] FIG. 9 illustrates a flow diagram of a method for generating reports of medical imaging according to another embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0018] In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific embodiments that may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the embodiments, and it is to be understood that other embodiments may be utilized and that logical, mechanical and other changes may be made without departing from the scope of the embodiments. The following detailed description is, therefore, not to be taken as limiting the scope of the invention.

[0019] As discussed in detail below, embodiments of the invention including a medical imaging system is disclosed. The medical imaging system includes an image processing unit for processing medical image data to generate medical images; a recording unit configured to record observations associated with the medical images simultaneously while presenting the medical images to a user, wherein the observations are based on the user's review of the medical images; and a report generation unit configured to generate a report based on the medical images and the observations recorded.

[0020] FIG. 1 is a schematic illustration of an ultrasound imaging system 100 in accordance with an embodiment. The ultrasound imaging system 100 includes a transmitter 102 that transmits a signal to a transmit beam-former 104 which in turn drives transducer elements 106 within a transducer array 108 to emit pulsed ultrasonic signals into a structure, such as a patient (not shown). A probe 110 includes the transducer array 108, the transducer elements 106 and probe/SAP electronics 112. The probe/SAP electronics 112 may be used to control the switching of the transducer elements 106. The probe/SAP electronics 112 may also be used to group the transducer elements 104 into one or more sub-apertures. A variety of geometries of transducer arrays may be used. The pulsed ultrasonic signals are back-scattered from structures in the body, like blood cells or muscular tissue, to produce echoes that return to the transducer elements 106. The echoes are converted into electrical signals, or ultrasound data, by the transducer

elements 106 and the electrical signals are received by a receiver 114. For purposes of this disclosure, the term ultrasound data may include data that was acquired and/or processed by an ultrasound system. The electrical signals representing the received echoes are passed through a receive beam-former 116 that outputs ultrasound data. A user interface 118 may be used to control operation of the ultrasound imaging system 100, including, to control the input of patient data, to change a scanning or display parameter, and the like.

[0021] The ultrasound imaging system 100 also includes a processor 120 to process the ultrasound data and generate frames or images for display on a display screen 122. The processor 120 may be adapted to perform one or more processing operations according to a plurality of selectable ultrasound modalities on the ultrasound data. Other embodiments may use multiple processors to perform various processing tasks. The processor 120 may also be adapted to control the acquisition of ultrasound data with the probe 110. The ultrasound data may be processed in real-time during a scanning session as the echo signals are received. An embodiment may update the displayed ultrasound image at a rate of more than 20 times per second. The images may be displayed as part of a live medical image. For purposes of this disclosure, the term “live medical image” is defined to include a dynamic image that updates as additional frames of ultrasound data are acquired. For example, ultrasound data may be acquired even as images are being generated based on previously acquired data and while a live medical image is being displayed. Then, according to an embodiment, as additional ultrasound data are acquired, additional frames or images generated from more-recently acquired ultrasound data are sequentially displayed. Additionally or alternatively, the ultrasound data may be stored temporarily in a buffer (not shown) during a scanning session and processed in less than real-time in a live or off-line operation. Some embodiments of the invention may include multiple processors (not shown) to handle the processing tasks. For example, a first processor may be utilized to demodulate and decimate the ultrasound signal while a second processor may be used to further process the data prior to displaying an image. It should be appreciated that other embodiments may use a different arrangement of processors.

[0022] The images may be obtained or acquired at different scanning planes based on an imaging procedure that is performed. The imaging procedure may be for example fetal biometry and wellbeing assessment, fetal anatomical survey, abdominal scanning, and cardiac scanning. Considering the case of fetal anatomical survey, various imaging parameters may be accessed such as head, face, neck, chest/heart, abdomen, skeletal, placenta and umbilical cord. The imaging parameters in this case are body parts and/or organs of a fetus. The images are acquired from different scanning planes such as but not limited to, an axial plane, a transventricular plane, a transthalamic plane, a transcerebellar plane, a coronal plane, a sagittal plane and a mid-sagittal plane. The imaging parameters vary depending on the imaging procedure selected by the user. For instance to perform fetal biometry and wellbeing assessment, imaging parameters such as a biparietal diameter, a head circumference, an abdominal circumference and a femur diaphysis length may be analyzed using the ultrasound imaging system 100.

[0023] Still referring to Figure 1, the ultrasound imaging system 100 may continuously acquire ultrasound data at a frame rate of, for example, 20 Hz to 150 Hz. However, other embodiments may acquire ultrasound data at a different rate. A memory 124 is included for storing processed frames of acquired ultrasound data that are not scheduled to be displayed immediately. In an exemplary embodiment, the memory 124 is of sufficient capacity to store at least several seconds worth of frames of ultrasound data. The frames of ultrasound data are stored in a manner to facilitate retrieval thereof according to its order or time of acquisition. As described hereinabove, the ultrasound data may be retrieved during the generation and display of a live medical image. The memory 124 may comprise any known data storage medium.

[0024] In various embodiments of the present invention, ultrasound information may be processed by other or different mode-related modules (e.g., B-mode, Color Doppler, power Doppler, M-mode, spectral Doppler anatomical M-mode, strain, strain rate, and the like) to form 2D or 3D data sets of image frames and the like. For example, one or more modules may generate B-mode, color Doppler, power Doppler, M-mode, anatomical M-mode, strain, strain rate, spectral Doppler image frames and combinations

thereof, and the like. The image frames are stored and timing information indicating a time at which the image frame was acquired in memory may be recorded with each image frame. The modules may include, for example, a scan conversion module to perform scan conversion operations to convert the image frames from Polar to Cartesian coordinates. A video processor module may be provided that reads the image frames from a memory and displays the image frames in real time while a procedure is being carried out on a patient. A video processor module may store the image frames in an image memory, from which the images are read and displayed. The ultrasound imaging system 100 shown may comprise a console system, or a portable system, such as a hand-held or laptop-type system.

[0025] FIG. 2 illustrates a medical imaging system 200 according to an embodiment. The medical imaging system 200 may be an ultrasound imaging system. The medical imaging system 200 includes a wireless ultrasound probe (not shown in FIG. 2) that may have transducer array that can capture medical image data i.e. ultrasound data associated with an anatomy of a patient. The medical image data can be processed by an image processing unit 202 to generate one or more medical images. The transducer array includes multiple transducer elements that are configured to transmit ultrasonic signals that can be processed to generate the medical image data. The medical image data can be used to generate the one or more medical images. These medical images are presented to a user i.e. a technician. The technician may review these medical images and provide observations. The observations may include but not limited to user's interpretation of the medical image, user's comments associated with the medical images, and variations observed in the medical images. The observations are recorded when the medical images are presented to the technician. So while the imaging procedure or the scanning is performed the technician can review and provide observations as comments at the same time. These observations are recorded by a recording unit 204.

[0026] The observations may be provided in different ways which can be added or appended to the medical images. In an embodiment a processor 206 may be configured to present a plurality of options associated with the observations. The options provided

may change based on the imaging procedure and an imaging protocols that need to be executed. Thus the options are displayed and vary based on an imaging context defined by a type of an imaging procedure and imaging protocols used. However it may be envisioned that the imaging context may be defined in any other manner and accordingly the options vary based on the change in the imaging context according to different embodiments of this disclosure. In an embodiment the imaging procedure and the imaging protocols may define an imaging context. For instance the medical imaging system 200 presents an obstetric imaging procedure 300 with multiple imaging protocols that can be selected as shown in FIG. 3. The medical imaging system 200 includes a user interface 302 that presents a medical image 304. The imaging protocols may include but not limited to first trimester 306, a second and third trimester 308, and measure 1 310. The technician may select the imaging protocol i.e. the second and third trimester 308. In the second and third trimester 308, multiple items such as fetus 1 400, fetus 2 402 and fetus 3+ 404 are presented as shown in FIG. 4. These items are associated with an age of the fetus that needs to be examined. The technician can select one of the items. Once an item is selected the user interface 302 presents a plurality of options associated with the imaging protocol i.e. the second and third trimester 308. The plurality of options may include for instance no abnormality detected 500, head 502 and spine 504 as shown in FIG. 5. These options may be standard observations that may be noted in the medical image 304 of fetus. So if this is observed by the technician then appropriate option can be selected and the selected option enables corresponding observation to be appended on the medical image 304. The options may vary based on the fetus age as well however may include few options that may be common for all ages of the fetus. For instance if the technician does not observe any abnormality in the fetus while reviewing the medical image, then the technician selects the option i.e. no abnormality detected 500. This observation is tagged or appended on the medical image 304. In an embodiment the observation i.e. no abnormality detected is presented on medical image 304. Similarly the technician can also check for other observations in the medical image 304. The technician may observe the head and spine of the fetus and accordingly select the options i.e. the head 502 and the spine 504. The options may be presented in a drop down menu

form so that the technician can select. Further in another embodiment the options may be presented in the form of check boxes and/or radio buttons that can be selected by the user based on their judgment. However it may be envisioned that the options can be presented and selected by the user (i.e. the technician) in multiple different ways according to multiple embodiments without deviating from the scope of this disclosure.

[0027] In another embodiment the technician can manually enter the observations of the medical image 304. As shown in FIG. 6 the user interface 302 presents multiple options such as an option 600, an option 602 and an option 604. The technician may select all or one or two options to enter their observations. In an exemplary embodiment when the option 600 is selected, a window 606 may open enabling the technician to enter observation in the window 606. The window 606 with the observation may be placed by the technician at a desired position along or on the medical image 304. Similarly the option 602 and the option 604 may be selected by the technician to insert or append observations on the medical image 304. It may be noted that opening a window in response to selection of an option icon in the user interface 302 is merely an exemplary representation however it may be envisioned that in other embodiments different alternative techniques may be provided for the technician to insert or enter the observations on the medical image 304. The options may be provided in the user interface 302 in the form of drop down menu items or icons positioned in any location in the user interface 302. Once the observations are provided by the technician a report generation unit 208 generates a report. The report includes multiple images selected by the technician and observations provided for each of these images. The report may be presented through the user interface 302 or the report can be printed for viewing by the technician.

[0028] In an embodiment the observations of the technician can be provided as audio format that is recorded. The technician observations may be spelled out and recorded to generate an audio file. As illustrated in FIG. 7, the medical imaging system 200 presents imaging protocol i.e. the second and third trimester 308 that is selected. When an option 700 is selected, the technician is provided with an option to record technician's voice

describing the observations in the medical image 304. The voice is then recorded and stored as an audio file 702. The audio file 702 may be appended to the medical image 304 as shown in FIG. 7 according to an exemplary embodiment. When a report is generated the medical image 304 may be shown with the audio file 702 which can be opened to hear the observations of the technician. The report in this scenario can be viewed only through a device such as a tablet, a mobile phone and a device. These devices can be ultrasound based device or any device that includes an ultrasound imaging installed in them. While reviewing the report the user can open the audio file can be heard. The audio file may be appended to a portion of the medical image where an abnormality was viewed by the technician. For instance the technician observes a particular abnormality at a head portion of the fetus. Then the audio file associated with the technician's observations may be appended closer to the head portion indicating that observations are associated with the head portion. The user can access the audio file to play it to hear the technician's observations on the head portion.

[0029] In another embodiment an audio file may generated by recording the observations given by the technician orally. The audio file may be converted into observations that can be appended into the medical image 304. These observations may be overlaid on the medical image or any area in the user interface 302 proximal to the medical image 304. Here the observations are not provided in a verbal form or in audio form but they are appended to the medical image so that the technician can view these observations from the medical image 304. In another scenario the observations may be directly added into a report. The medical imaging system 200 may be also capable of transmitting or transferring the report to a remote computing device for printing the report. In another embodiment the remote computing device may be used to display the report to a user in a remote location. The user may be a doctor who would like to view the report and judge the medical condition of a patient. In another instance the remote computing device may be used to further edit the report by a nurse or any other person and then printed.

[0030] FIG. 8 illustrates a flow diagram of a method 800 for generating reports of medical imaging according to an embodiment. A report in medical imaging such as ultrasound imaging includes ultrasound images and observations of a technician. At block 802 observations are received from a user (i.e. the technician) simultaneously when medical images of the anatomy are captured and reviewed by the user. The observations may include but not limited to user's interpretation of the medical image, user's comments associated with the medical images, and variations observed in the medical images. The observations are recorded when the medical images are presented and reviewed by the technician at block 802. So when the medical images are shown as live to the user, the user can review the medical images and provide their observations. Once the observations are completed a report is generated at block 806. The generated report includes multiple medical images and observations associated with these images appended.

[0031] FIG. 9 illustrates a flow diagram of a method 900 for generating reports of medical imaging according to another embodiment. A plurality of options is presented to the user for inputting their observations at block 902. The options provided may change based on the imaging procedure and an imaging protocols that need to be executed. Thus the options are displayed and vary based on an imaging context defined by a type of an imaging procedure and imaging protocols used. However it may be envisioned that the imaging context may be defined in any other manner and accordingly the options vary based on the change in the imaging context according to different embodiments of this disclosure. The user selects one or more options of the plurality of options for providing observations of the medical image based on the user input at block 904. The observations are input by the user simultaneously while reviewing the medical images.

[0032] For instance the medical imaging system presents an obstetric imaging procedure with multiple imaging protocols that can be selected. The medical imaging system includes a user interface that presents a medical image. The imaging protocols may include but not limited to a first trimester, a second and third trimester, and a measure 1. The technician may select the imaging protocol i.e. the second and third

trimester. In the second and third trimester, multiple items such as fetus 1, fetus 2 and fetus 3+ are presented. These items are associated with an age of the fetus that needs to be examined. The technician can select one of the items. Once an item is selected the user interface presents a plurality of options associated with the imaging protocol i.e. the second and third trimester. The plurality of options may include for instance no abnormality detected, head and spine. These options may be standard observations that may be noted in the medical image of fetus. So if this is observed by the technician then appropriate option can be selected and the selected option enables corresponding observation to be appended on the medical image. The options may vary based on the fetus age as well however may include few options that may be common for all ages of the fetus. For instance if the technician does not observe any abnormality in the fetus while reviewing the medical image, then the technician selects the option i.e. no abnormality detected. This observation is tagged or appended on the medical image. In an embodiment the observation i.e. no abnormality detected is presented on medical image. Similarly the technician can also check for other observations in the medical image. The technician may observe the head and spine of the fetus and accordingly select the options i.e. the head and the spine. The options may be presented in a drop down menu form so that the technician can select. Further in another embodiment the options may be presented in the form of check boxes and/or radio buttons that can be selected by the user based on their judgment. However it may be envisioned that the options can be presented and selected by the user (i.e. the technician) in multiple different ways according to multiple embodiments without deviating from the scope of this disclosure.

[0033] When an option is selected, the technician is provided with an option to record technician's voice describing the observations in the medical image. The voice is then recorded and stored as an audio file. The audio file may be appended to the medical image according to an exemplary embodiment. When a report is generated the medical image may be shown with the audio file which can be opened to hear the observations of the technician. The report in this scenario can be viewed only through a device such as a tablet, a mobile phone and a device. These devices can be ultrasound based device or any

device that includes an ultrasound imaging application installed in them. While reviewing the report the user can open the audio file and can be heard. The audio file may be appended to a portion of the medical image where an abnormality was viewed by the technician. For instance the technician observes a particular abnormality at a head portion of the fetus. Then the audio file associated with the technician's observations may be appended closer to the head portion indicating that observations are associated with the head portion. The user can access the audio file to play it to hear the technician's observations on the head portion.

[0034] In another embodiment an audio file may generated by recording the observations given by the technician orally. The audio file may be converted into observations that can be appended into the medical image. Once the observations are completed a report is generated at block 906. The generated report includes multiple medical images and observations associated with these images appended. Thus the observations of the user (i.e. the technician) are captured and included in the report while reviewing and selecting the medical images. So when the report is generated the medical images and their observations are automatically included.

[0035] From the foregoing, it will appreciate that the above disclosed a medical imaging system that can record observations of the user while reviewing the medical images provide numerous benefits to healthcare enterprises, such as improved way of generating report of an imaging procedure performed on a patient including the observations provided by the user simultaneously while reviewing the medical images of patient's anatomy. The observations get automatically populated in the report. During the imaging procedure the user may have to select few medical images to be part of the report. The present system avoids the user to revisit the medical images to rethink their observations made while selecting the medical images as the observations are provided at simultaneously while reviewing the medical images. Thus while the imaging procedure is completed most of the user's observations are already captured in the report.

[0036] The various embodiments and/or components, for example, the modules, or components and controllers therein, also may be implemented as part of one or more

computers or processors. The computer or processor may include a computing device, an input device, a display unit and an interface, for example, for accessing the Internet. The computer or processor may include a microprocessor. The microprocessor may be connected to a communication bus. The computer or processor may also include a memory. The memory may include Random Access Memory (RAM) and Read Only Memory (ROM). The computer or processor further may include a storage device, which may be a hard disk drive or a removable storage drive such as a floppy disk drive, optical disk drive, and the like. The storage device may also be other similar means for loading computer programs or other instructions into the computer or processor.

[0037] As used herein, the term “computer” or “module” may include any processor-based or microprocessor-based system including systems using microcontrollers, reduced instruction set computers (RISC), application specific integrated circuits (ASICs), logic circuits, and any other circuit or processor capable of executing the functions described herein. The above examples are exemplary only, and are thus not intended to limit in any way the definition and/or meaning of the term “computer”.

[0038] The computer or processor executes a set of instructions that are stored in one or more storage elements, in order to process input data. The storage elements may also store data or other information as desired or needed. The storage element may be in the form of an information source or a physical memory element within a processing machine.

[0039] This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any computing system or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

We Claim:

1. A medical imaging system comprising:
 - an image processing unit for processing medical image data to generate medical images;
 - a recording unit configured to record observations associated with the medical images simultaneously while presenting the medical images to a user, wherein the observations are based on the user's review of the medical images; and
 - report generation unit configured to generate a report based on the medical images and the observations recorded.
2. The medical imaging system of claim 1, wherein the observations comprise a user's interpretation of the medical images and user's comments associated with the medical images.
3. The medical imaging system of claim 1 further comprises a processor for:
 - presenting a plurality of options associated with the observations; and
 - selecting at least one option of the plurality of options for providing the observations of the medical images based on user input.
4. The medical imaging system of claim 3, wherein the plurality of options is presented based on a medical imaging context.
5. The medical imaging system of claim 3, wherein the processor is configured to enable the user to manually input the observations while the user reviews the medical images.
6. The medical imaging system of claim 3, wherein the processor is further configured to receive at least one audio file as user input, wherein an audio file of the at least one audio file is associated with the observations of the user.

7. The medical imaging system of claim 6, wherein the audio file is created simultaneously while reviewing the medical images by the user.
8. The medical imaging system of claim 1, wherein the observations are appended on the medical images based on user input.
9. A method for generating reports of medical imaging, the method comprising:
 - receiving observations from a user simultaneously when medical images of an anatomy are captured and reviewed by the user;
 - recording the observations associated with the medical images in real time;
 - and
 - generating a report based on the observations and the medical images.
10. The method of claim 9, wherein the observations comprise a user's interpretation of the medical images and user's comments associated with the medical images.
11. The method of claim 10, wherein the plurality of options is presented based on a medical imaging context.
12. The method of claim 9 further comprises:
 - presenting a plurality of options associated with the observations; and
 - selecting at least one option of the plurality of options for providing the observations of the medical images based on user input.
13. The method of claim 9 further comprises enabling the user to manually input the observations while the user reviews the medical images.

14. The method of claim 9 further comprises receiving at least one audio file as user input, wherein an audio file of the at least one audio file is associated with the observations of the user.
15. The method of claim 13 further comprises creating the audio file simultaneously while reviewing the medical images by the user.
16. The method of claim 9 further comprises appending the observations on the medical images based on user's input.

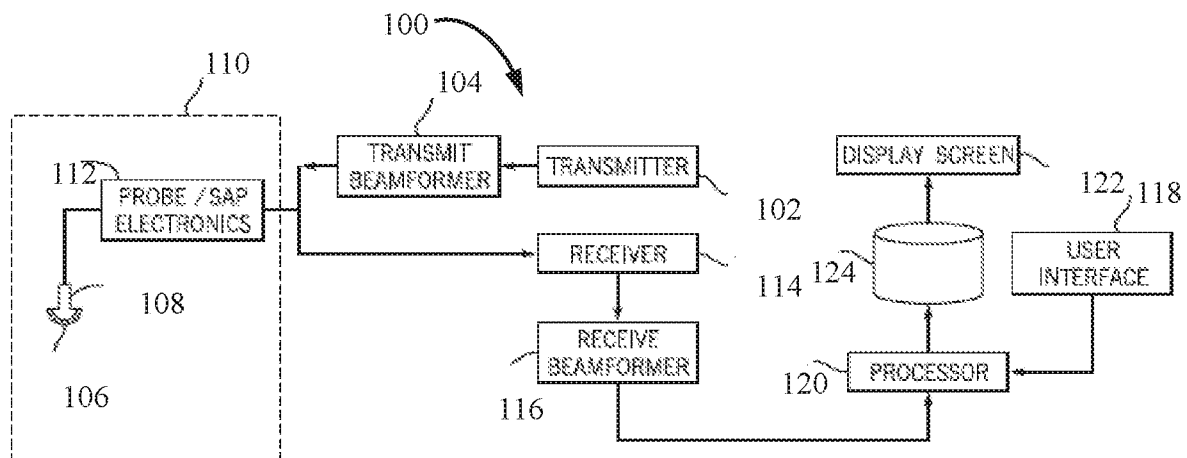


FIG. 1

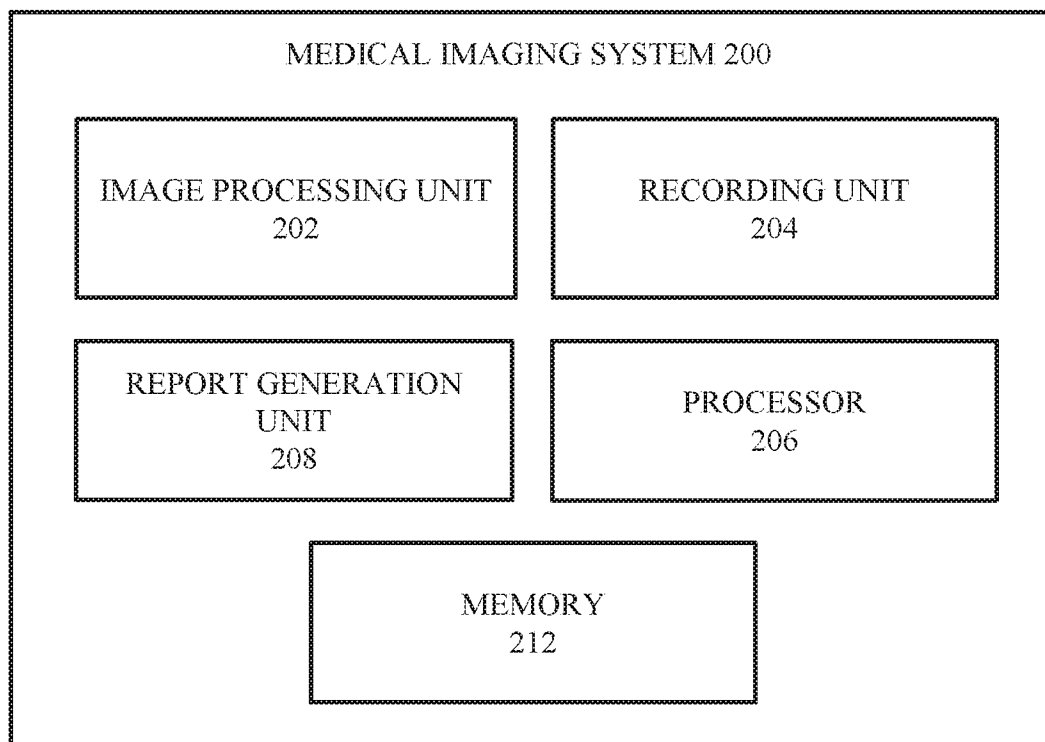


FIG. 2

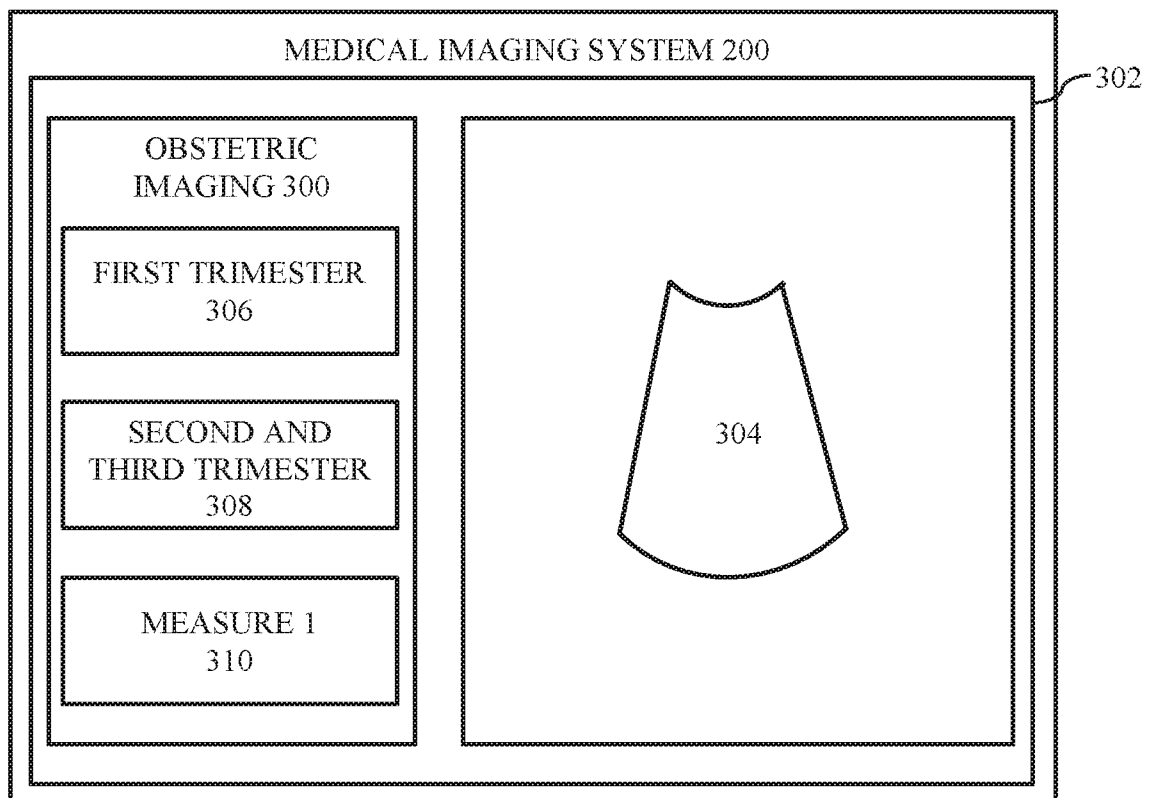


FIG. 3

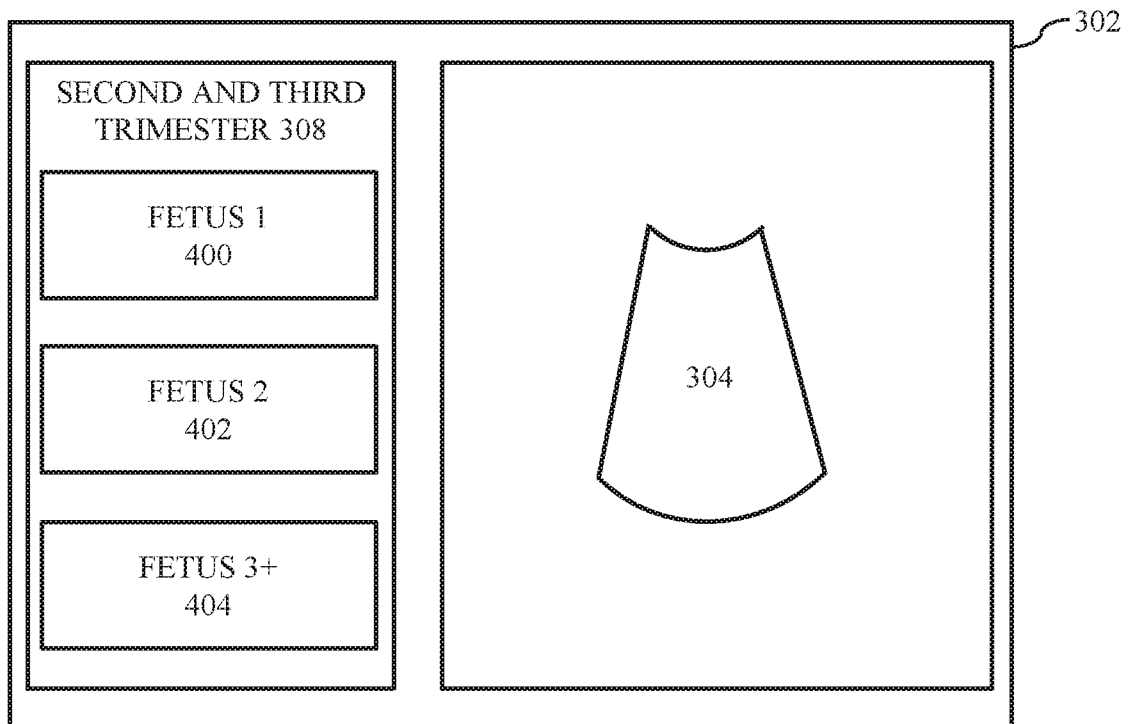


FIG. 4

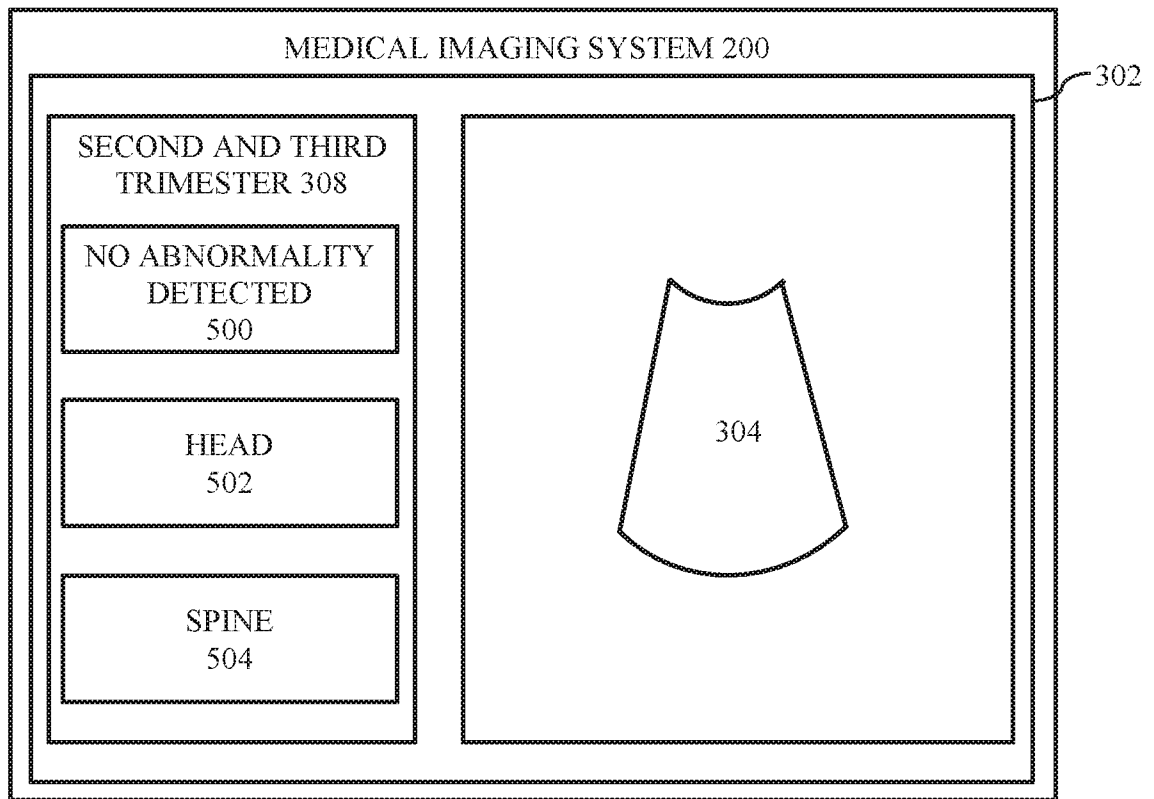


FIG. 5

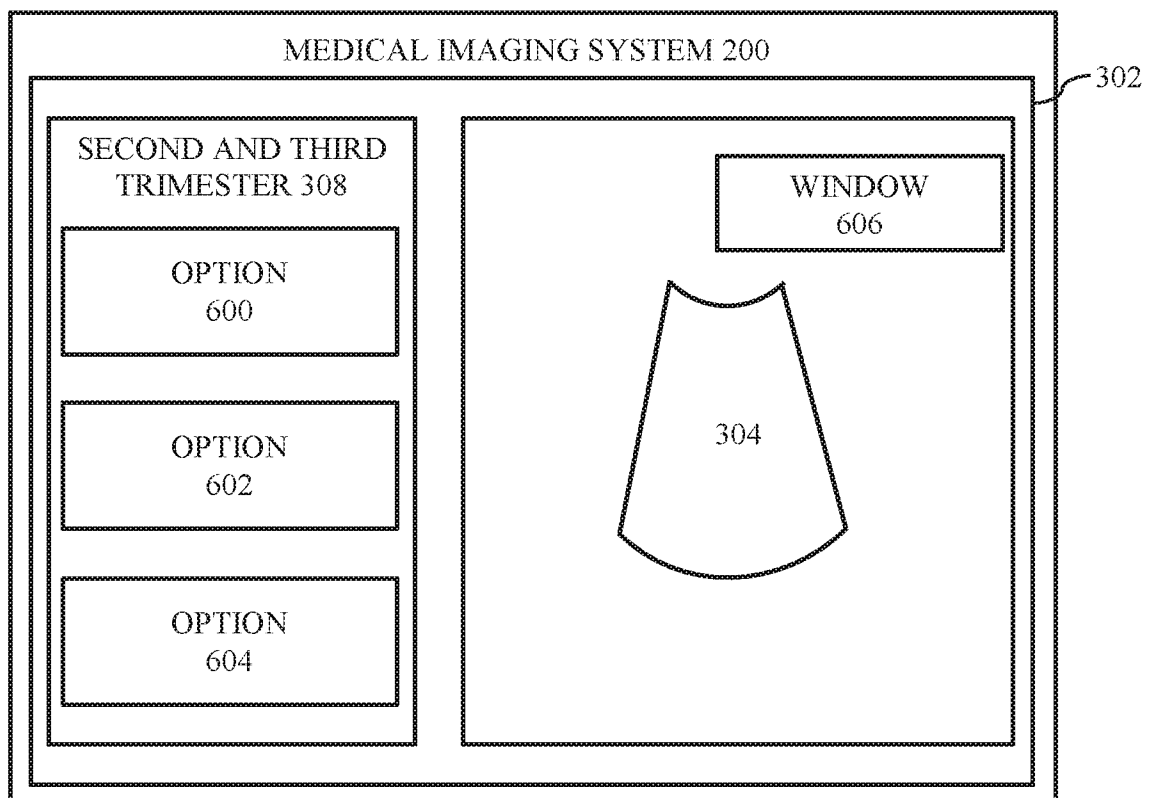


FIG. 6

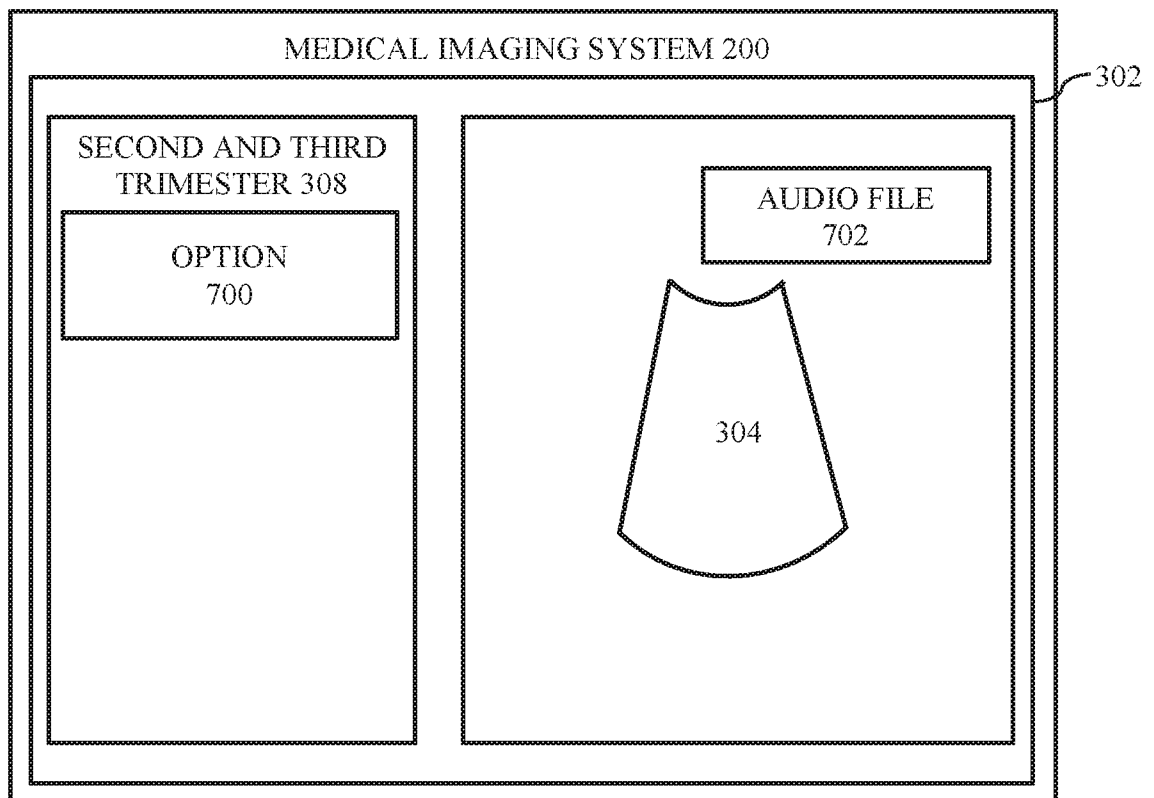


FIG. 7

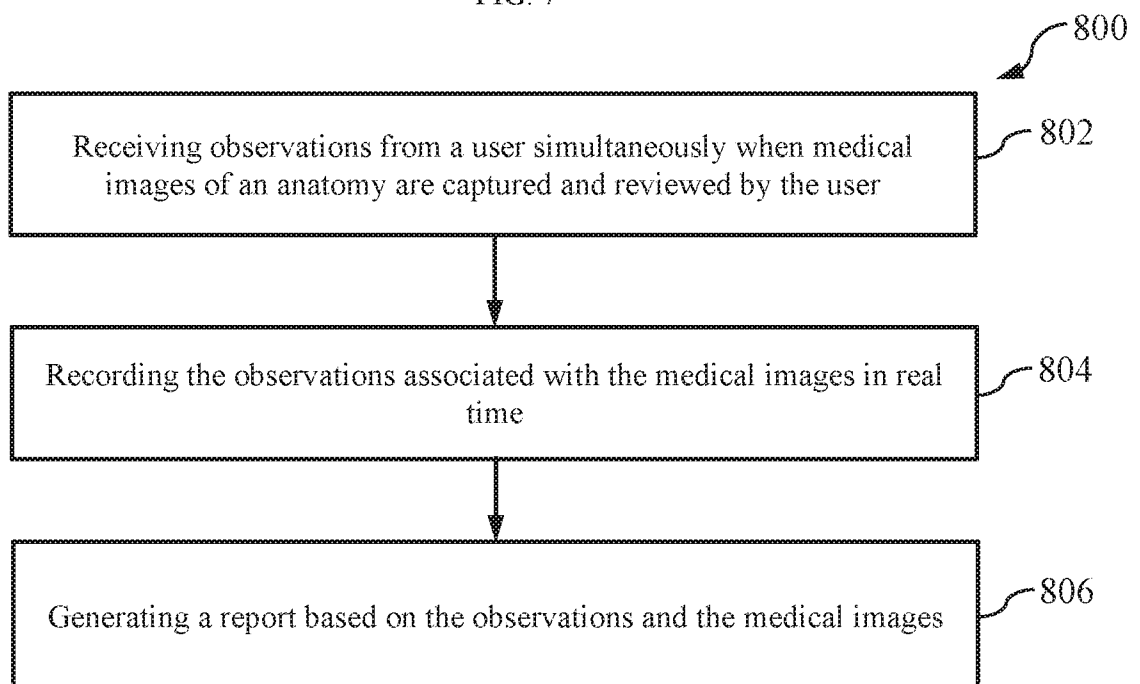


FIG. 8

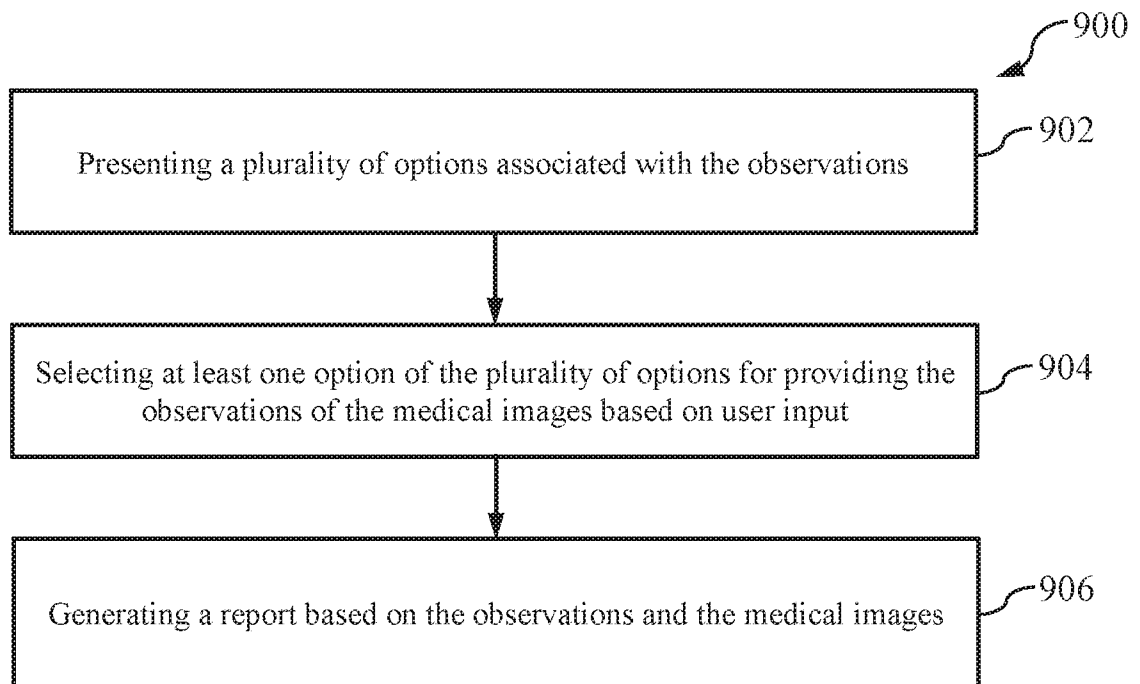


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/065192**A. CLASSIFICATION OF SUBJECT MATTER****A61B 8/00(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B 8/00; G06K 9/00; G06K 9/62; G06Q 50/00; G06Q 10/00; G10L 21/00; G09G 5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: image, record, observation, review, interpretation, report

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011-0002515 A1 (HIKARU FUTAMI et al.) 06 January 2011	1-5,9-13
Y	See abstract, paragraphs [3],[29],[34]-[39],[80],claim 1 and figures 1-10.	6-8,14-16
Y	US 2008-0114601 A1 (PETER C. BOYLE et al.) 15 May 2008	6,7,14,15
	See abstract, paragraph [15] and figures 1,2.	
Y	US 2011-0238446 A1 (MUNDEEP CHAUDHRY) 29 September 2011	8,16
	See abstract, paragraphs [23]-[27],[63] and figure 1.	
A	US 2012-0176408 A1 (YOSHIYUKI MORIYA) 12 July 2012	1-16
	See abstract, paragraphs [75]-[96] and figures 5-9.	
A	US 2007-0270695 A1 (RONALD KEEN) 22 November 2007	1-16
	See abstract, paragraphs [15]-[34] and figures 1-3.	



Further documents are listed in the continuation of Box C.



See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search

28 March 2016 (28.03.2016)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/065192

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US 2007-0270695 A1	22/11/2007	US 8015032 B2	06/09/2011