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(54) **METHOD AND APPARATUS FOR VOICE RECORDING WITH ULTRASOUND IMAGING**

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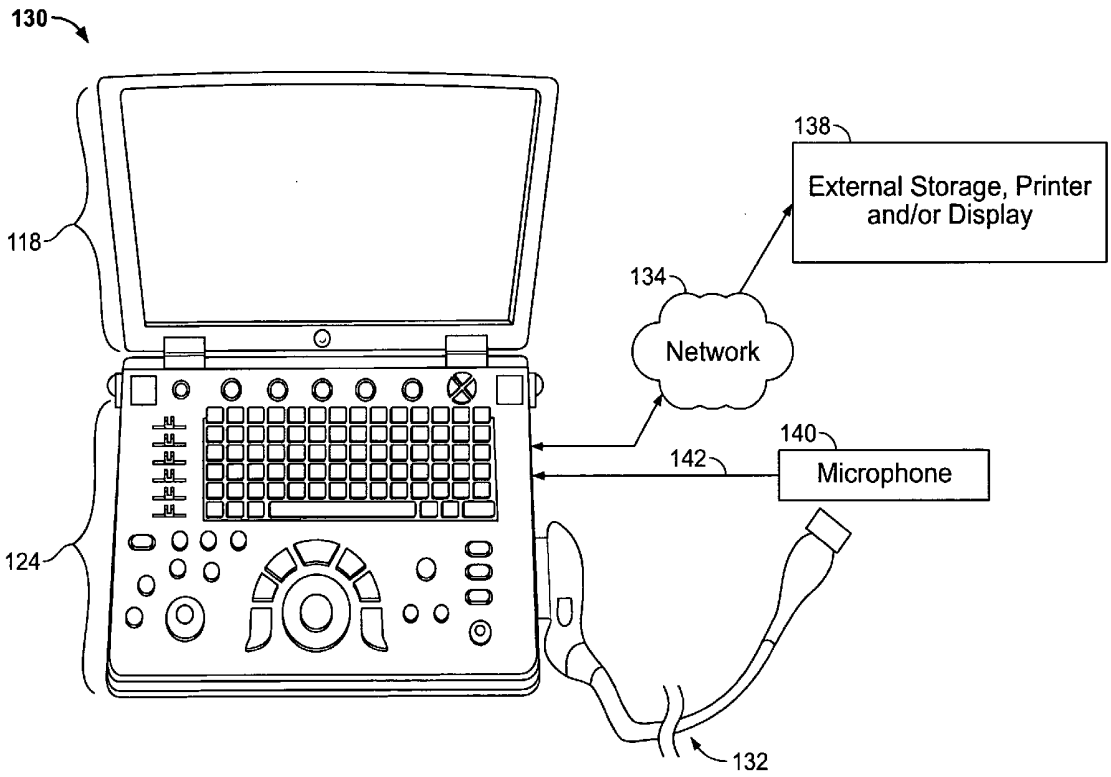
(57) **ABSTRACT**

An ultrasound system comprises a probe for acquiring ultrasound data associated with a patient and a microphone detecting audio. The system further comprises a processor module and a memory. The processor module is configured to receive the ultrasound data from the probe and processes the ultrasound data to form an image file. The processor module is further configured to receive the audio from the microphone and forms a voice recording file based on the received audio. The memory stores the image file and the voice recording file, and the processor module automatically associates the image file and the voice recording file with each other.



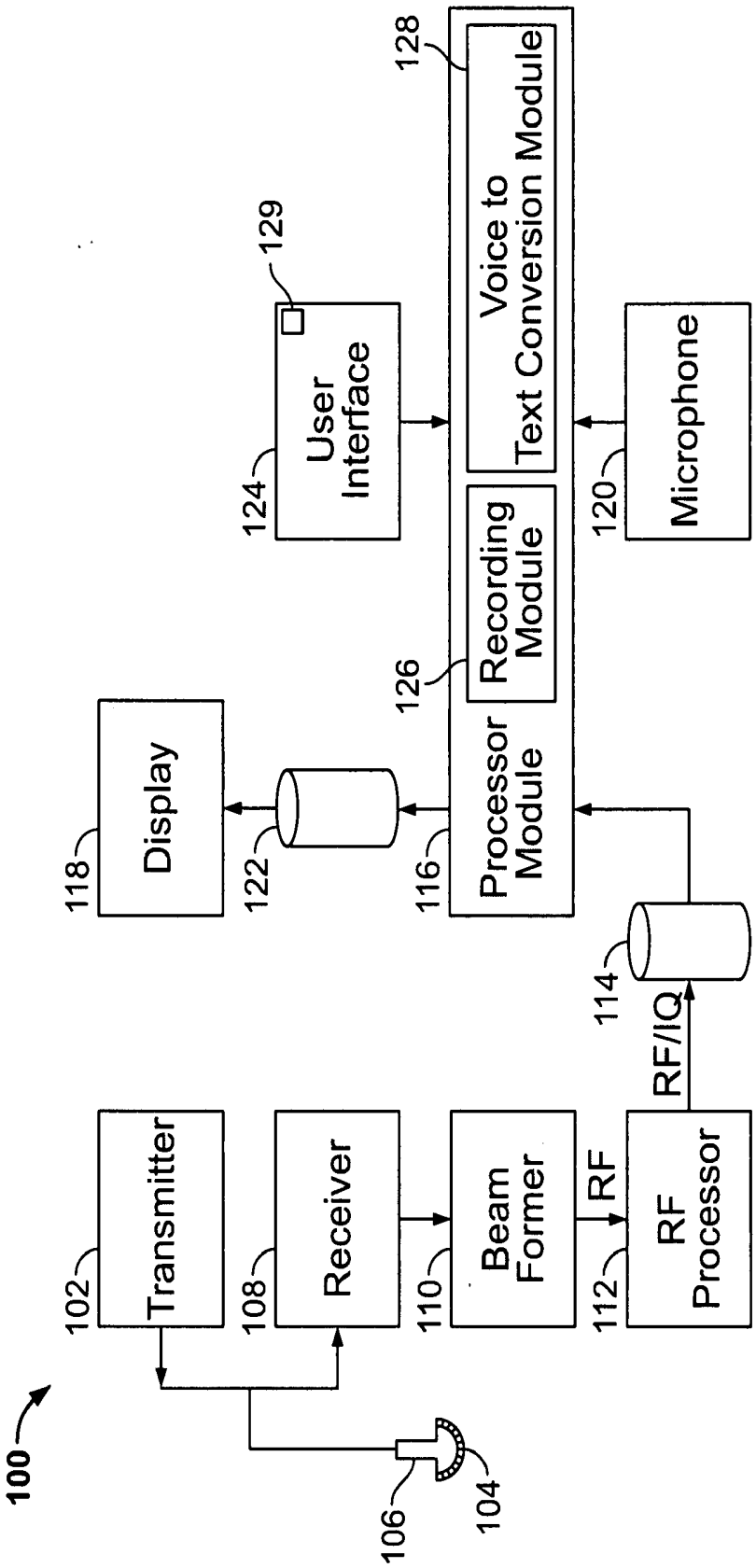

100
102
Transmitter
104
106
108
Receiver
110
Beam Former
112
RF Processor
RF
RF/IQ
114
116
Processor Module
118
Display
120
Microphone
122
124
User Interface
126
Recording Module
128
Voice to Text Conversion Module
129

FIG. 1

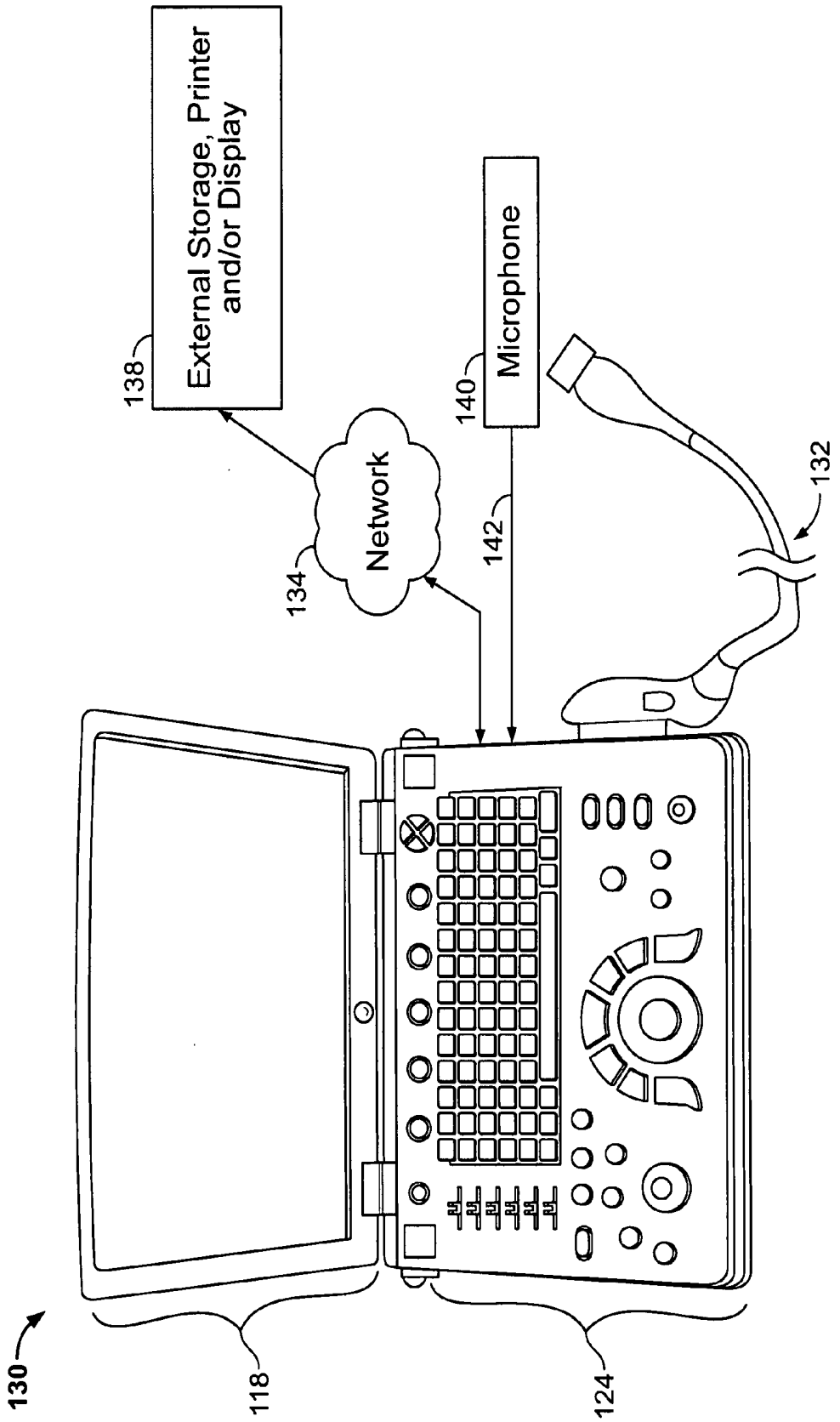

External Storage, Printer and/or Display
138
Network
134
Microphone
140
142
132
130
118
124

FIG. 2

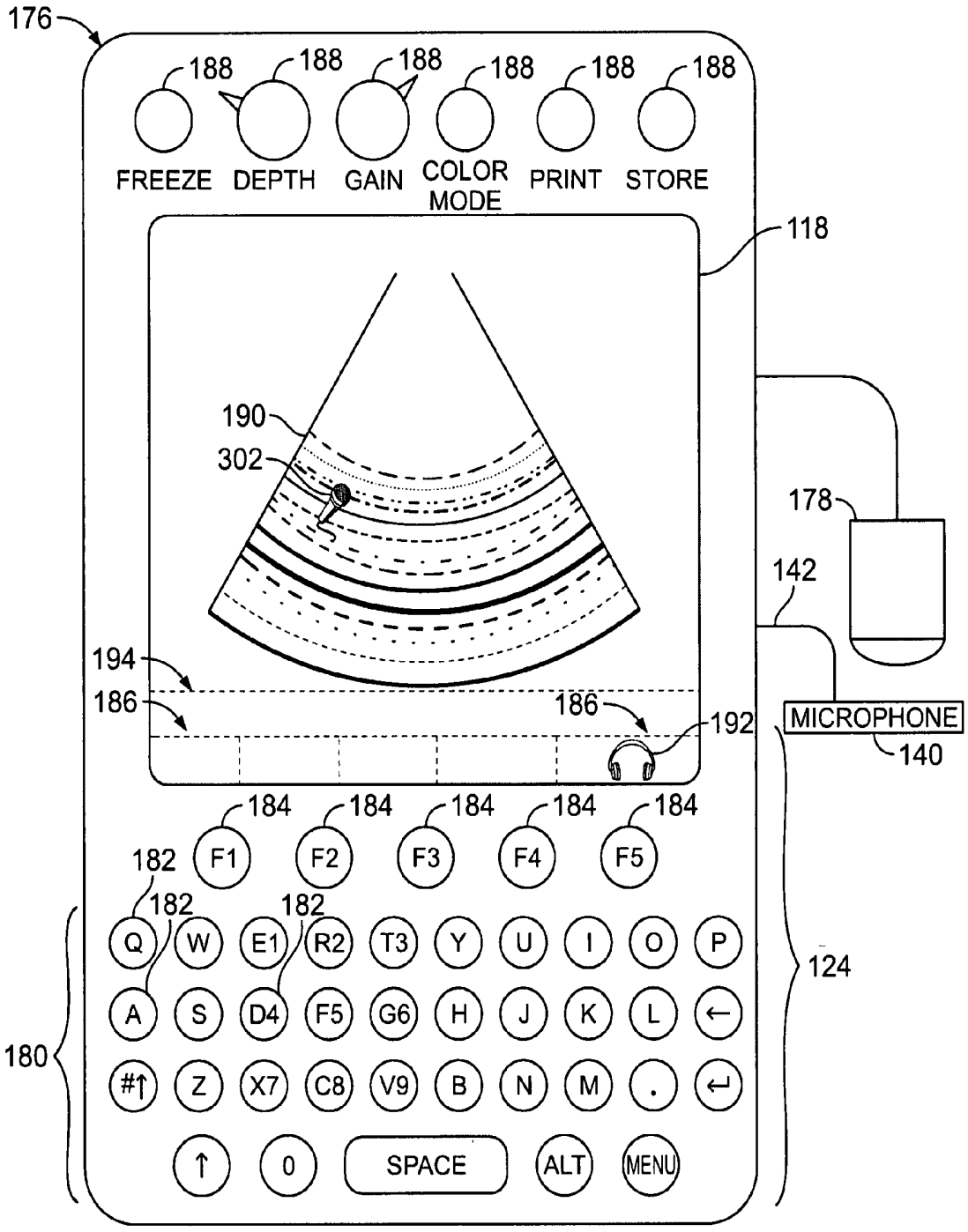

176
188
188
188
188
188
188
FREEZE
DEPTH
GAIN
COLOR MODE
PRINT
STORE
118
190
302
178
142
194
186
186
192
MICROPHONE
140
184
184
184
184
184
182
F1
F2
F3
F4
F5
182
182
Q
W
E1
R2
T3
Y
U
I
O
P
A
S
D4
F5
G6
H
J
K
L
#↑
Z
X7
C8
V9
B
N
M
.
↑
0
SPACE
ALT
MENU
180
124

FIG. 3

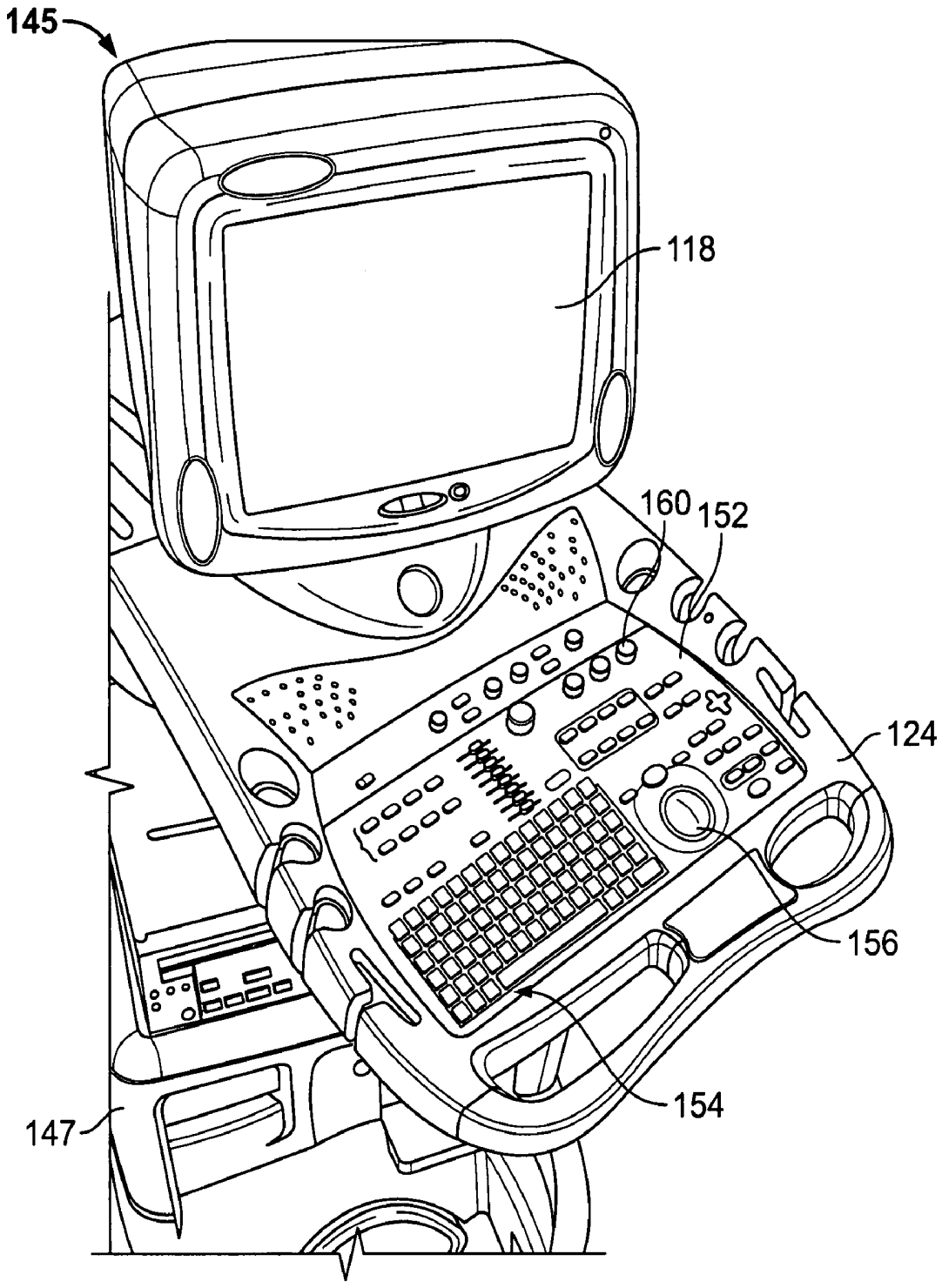


FIG. 4

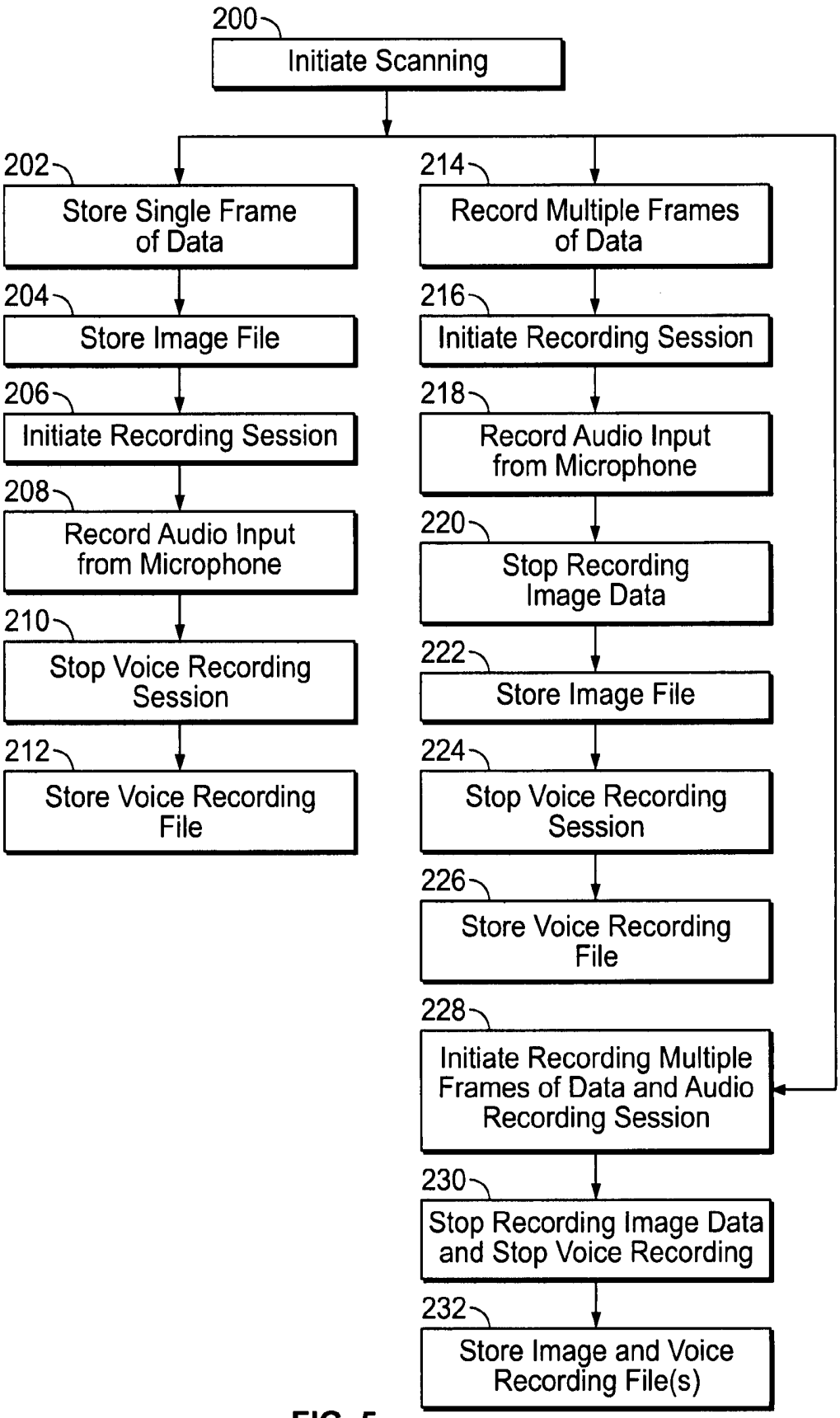

200
Initiate Scanning
202
Store Single Frame of Data
204
Store Image File
206
Initiate Recording Session
208
Record Audio Input from Microphone
210
Stop Voice Recording Session
212
Store Voice Recording File
214
Record Multiple Frames of Data
216
Initiate Recording Session
218
Record Audio Input from Microphone
220
Stop Recording Image Data
222
Store Image File
224
Stop Voice Recording Session
226
Store Voice Recording File
228
Initiate Recording Multiple Frames of Data and Audio Recording Session
230
Stop Recording Image Data and Stop Voice Recording
232
Store Image and Voice Recording File(s)

FIG. 5

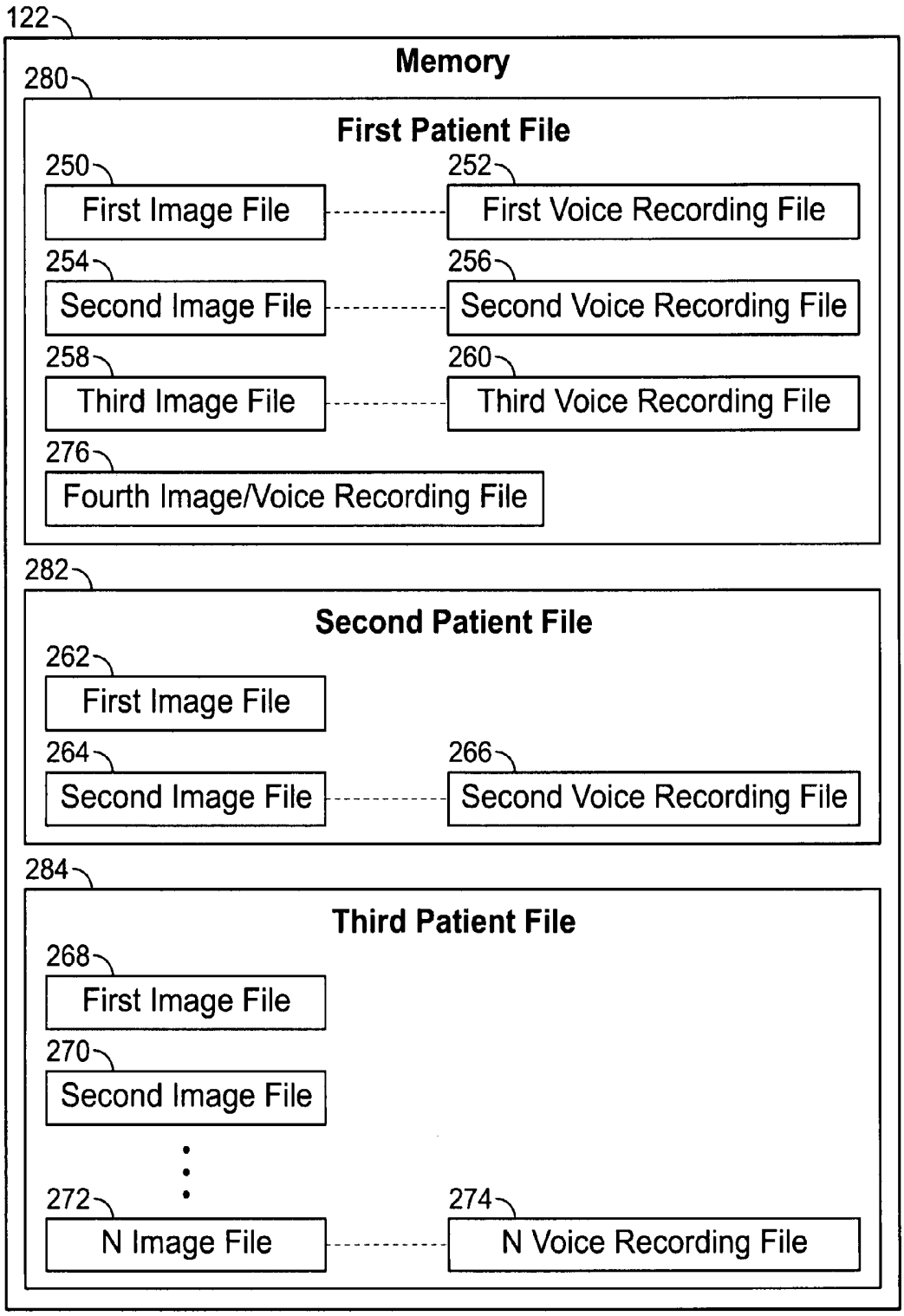

122
Memory
280
First Patient File
250
First Image File
252
First Voice Recording File
254
Second Image File
256
Second Voice Recording File
258
Third Image File
260
Third Voice Recording File
276
Fourth Image/Voice Recording File
282
Second Patient File
262
First Image File
264
Second Image File
266
Second Voice Recording File
284
Third Patient File
268
First Image File
270
Second Image File
272
N Image File
274
N Voice Recording File

FIG. 6

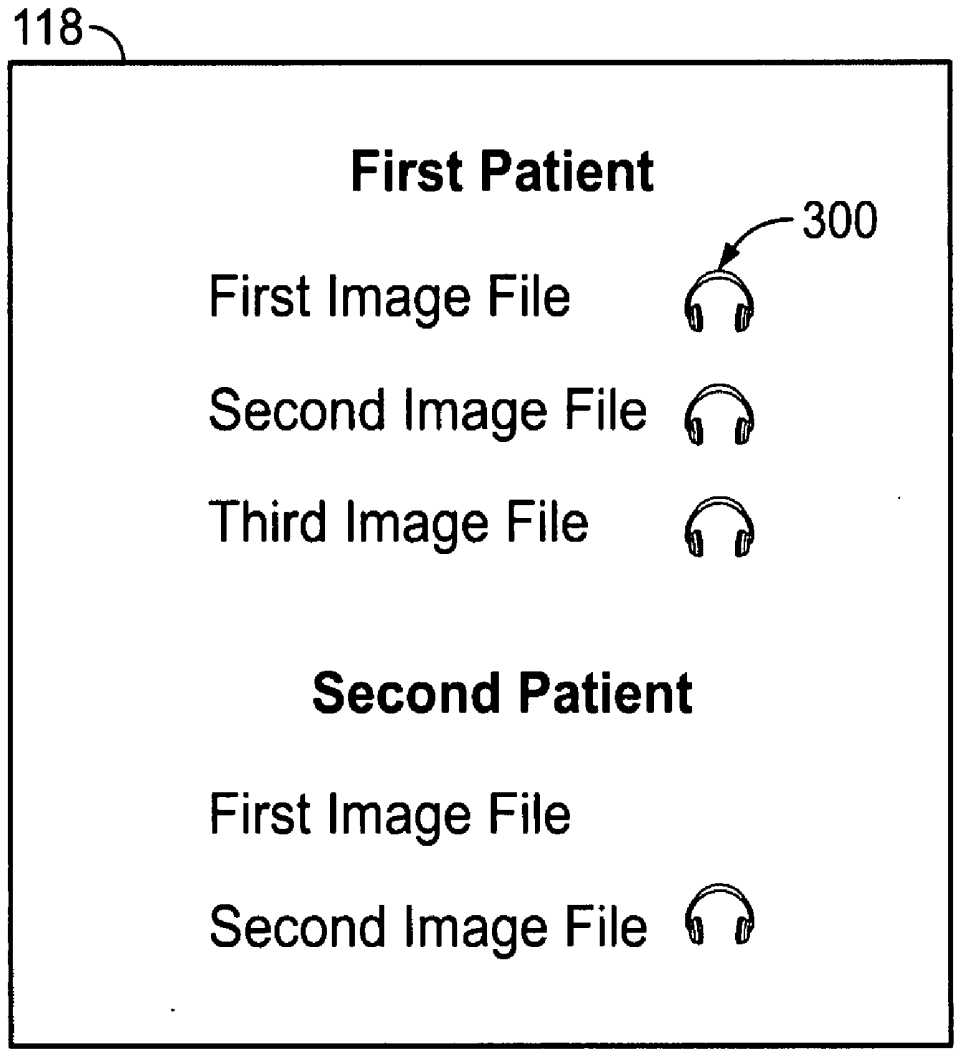

118
First Patient
300
First Image File
Second Image File
Third Image File
Second Patient
First Image File
Second Image File

FIG. 7

METHOD AND APPARATUS FOR VOICE RECORDING WITH ULTRASOUND IMAGING

BACKGROUND OF THE INVENTION

[0001] This invention relates generally to ultrasound imaging, and more particularly, to recording vocal information during an ultrasound exam.

[0002] Ultrasound systems are finding use in an increasing number of applications. The cost of an ultrasound exam may be less than other technologies, and the portability of the system provides many advantages. Cart-based systems are often used in hospital and clinic settings, but smaller sized systems, such as laptop computer, pocket and handheld systems are becoming more popular due to their portability as well as lower cost.

[0003] Regardless of the size of the ultrasound system, ultrasound exams can be complicated and time consuming. An operator, such as a physician and/or sonographer often wishes to record notes, findings, observations, diagnosis and the like during the exam, often directed to a particular image or series of images. For a system that provides a keyboard, the operator either types with one hand while scanning with the other, or has to remove the scanning probe from the patient. In some cases, such as during surgery or an interventional or invasive procedure, the operator may not be able to access the unit to enter comments. While scanning with a smaller handheld system, the operator may hold the unit in one hand and the probe in the other. Therefore, keyboard entry, if even provided, is difficult or impossible to accomplish without disrupting the procedure. In order to make any permanent record, the operator relies on memory and records a diagnosis after the exam is complete or must stop scanning in order to write or otherwise record notes.

[0004] Therefore, a need exists for a hands-free ability to record findings and comments during an ultrasound procedure.

BRIEF DESCRIPTION OF THE INVENTION

[0005] In one embodiment, an ultrasound system comprises a probe for acquiring ultrasound data associated with a patient and a microphone detecting audio. The system further comprises a processor module and a memory. The processor module is configured to receive the ultrasound data from the probe and processes the ultrasound data to form an image file. The processor module is further configured to receive the audio from the microphone and form a voice recording file based on the received audio. The memory stores the image file and the voice recording file, and the processor module automatically associates the image file and the voice recording file with each other.

[0006] In another embodiment, a method for recording audio associated with an ultrasound image file comprises acquiring ultrasound data from a probe. An image file is stored based on the ultrasound data. A voice recording file is digitally recorded, and the image file and the voice recording file are automatically associated with each other when storing the voice recording file.

[0007] In yet another embodiment, an ultrasound system comprises a probe for acquiring ultrasound data. A display displays the ultrasound data and a microphone detects audio. A processor module is configured to form an image file based on the ultrasound data. The processor module is configured to receive the audio from the microphone and forms a voice recording file that is associated with the image file. The voice recording file is based on the audio.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is a block diagram of an ultrasound system formed in accordance with an embodiment of the present invention.

[0009] FIG. **2** illustrates a 3D-capable miniaturized ultrasound system formed in accordance with an embodiment of the present invention.

[0010] FIG. **3** illustrates a hand carried or pocket-sized ultrasound imaging system formed in accordance with an embodiment of the present invention.

[0011] FIG. **4** illustrates a portable ultrasound imaging system formed in accordance with an embodiment of the present invention.

[0012] FIG. **5** illustrates a method for acquiring digital voice recording and ultrasound image files and associating the files with each other in accordance with an embodiment of the present invention.

[0013] FIG. **6** illustrates associated voice recording and image files stored within a memory in accordance with an embodiment of the present invention.

[0014] FIG. **7** illustrates a display showing a list of image files and recording icons associated therewith that may be selected and reviewed in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] The foregoing summary, as well as the following detailed description of certain embodiments of the present invention, 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 random access memory, hard disk, or the like). 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.

[0016] 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" of the present invention 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 such elements not having that property.

[0017] FIG. **1** is a block diagram of an ultrasound system **100** including a transmitter **102** that drives an array of elements **104** (e.g., piezoelectric elements) within a probe **106** to emit pulsed ultrasonic signals into a body. A variety of geometries may be used. Each probe **106** has a defined center operating frequency and bandwidth. The ultrasonic signals

are back-scattered from structures in the body, like blood cells or muscular tissue, to produce echoes that return to the elements **104**. The echoes are received by a receiver **108**. The received echoes are passed through a beamformer **110**, which performs beamforming and outputs an RF signal. The RF signal then passes through an RF processor **112**. Alternatively, the RF processor **112** may include a complex demodulator (not shown) that demodulates the RF signal to form IQ data pairs representative of the echo signals. The RF or IQ signal data may then be routed directly to a memory **114** for storage.

[0018] The ultrasound system **100** also includes a processor module **116** to process the acquired ultrasound information (e.g., RF signal data or IQ data pairs) and prepare frames of ultrasound information for display on display **118**. The processor module **116** is adapted to perform one or more processing operations according to a plurality of selectable ultrasound modalities on the acquired ultrasound information. Acquired ultrasound information may be processed and displayed in real-time during a scanning session as the echo signals are received. Additionally or alternatively, the ultrasound information may be stored temporarily in memory **114** during a scanning session and then processed and displayed in an off-line operation.

[0019] The processor module **116** is connected to a user interface **124** that may control operation of the processor module **116** as explained below in more detail. The functionality within the processor module **116** may be provided by hardware, software, or any combination of hardware and software. The processor module **116** also has a recording module **126** that receives audio from a microphone **120**. The microphone **120** is provided for recording voice information during the exam that is associated with an image currently being acquired and/or previously acquired. An audio recording control interface **129** may be provided on the user interface **124** to activate and/or deactivate the microphone **120** and recording module **126** to facilitate starting and/or stopping of a recording session after which a voice recording file is stored in memory **122**, which may be stored automatically or after a user confirmation.

[0020] A voice to text conversion module **128** may be provided to convert the digital voice recording file to written text. The voice to text conversion may also be accomplished on other systems, such as a laptop or review station. The voice to text conversion module **128** may produce a written transcript that may be associated with a particular image file and/or patient file, or may be used to populate a report page associated with the patient. In one example, the voice to text conversion module **128** may convert the associated voice recording file to text that is displayed within or linked to a diagnosis section, such as beneath the associated image displayed on the display **118** or indicated by an icon superimposed on the image (as described in further detail below).

[0021] The display **118** includes one or more monitors that present patient information, including diagnostic ultrasound images to the user for diagnosis and analysis. One or both of memory **114** and memory **122** may store three-dimensional data sets of the ultrasound data, where such three-dimensional (3D) data sets are accessed to present two-dimensional (2D) and 3D images. The images may be modified and the display settings of the display **118** may be manually adjusted using the user interface **124**.

[0022] The generalized ultrasound system **100** of FIG. **1** may be embodied in a small-sized system, such as laptop computer or pocket sized system as well as in a larger cart-based system. FIGS. **2** and **3** are directed towards small-sized systems, while FIG. **4** is directed towards larger systems.

[0023] FIG. **2** illustrates a 3D-capable miniaturized ultrasound system **130** having a probe **132** that may be configured to acquire 3D ultrasonic data. For example, the probe **132** may have a 2D array of elements **104** as discussed previously with respect to the probe **106** of FIG. **1**. A user interface **124** (that may also include an integrated display **118**) is provided to receive commands from an operator. As used herein, "miniaturized" means that the ultrasound system **130** is a handheld or hand-carried device or is configured to be carried in a person's hand, pocket, briefcase-sized case, or backpack. For example, the ultrasound system **130** may be a hand-carried device having a size of a typical laptop computer, for instance, having dimensions of approximately 2.5 inches in depth, approximately 14 inches in width, and approximately 12 inches in height. The ultrasound system **130** may weigh about ten pounds, and thus is easily portable by the operator. The integrated display **118** (e.g., an internal display) is also provided and is configured to display a medical image.

[0024] The ultrasonic data may be sent to an external device **138** via a wired or wireless network **134** (or direct connection, for example, via a serial or parallel cable or USB port). In some embodiments, external device **138** may be a computer or a workstation having a display. Alternatively, external device **138** may be a separate external display or a printer capable of receiving image data from the hand carried ultrasound system **130** and of displaying or printing images that may have greater resolution than the integrated display **118**.

[0025] A microphone **140** may be provided separate from or integral with the ultrasound system **130**. The microphone **140** may be any known audio pick-up device. For example, the microphone **140** may be a desk stand model, extending substantially perpendicular from a base configured to rest on a flat surface. Alternatively, the microphone **140** may be configured with a clip such as to attach to an operator's collar or other clothing to be positioned near the operator's mouth. Communication link **142** may be a hard-wired link between the microphone **140** and system **130**, or may be wireless, communicating, for example, over infrared or radio waves.

[0026] FIG. **3** illustrates a hand carried or pocket-sized ultrasound imaging system **176** wherein the display **118** and user interface **124** form a single unit. By way of example, the pocket-sized ultrasound imaging system **176** may be a pocket-sized or hand-sized ultrasound system approximately 2 inches wide, approximately 4 inches in length, and approximately 0.5 inches in depth and weighs less than 3 ounces. The pocket-sized ultrasound imaging system **176** generally includes the display **118** and user interface **124**, which may or may not include a keyboard-type interface and an input/output (I/O) port for connection to a scanning device, for example, an ultrasound probe **178**. The display **118** may be, for example, a 320×320 pixel color LCD display (on which a medical image **190** may be displayed). A typewriter-like keyboard **180** of buttons **182** may optionally be included in the user interface **124**.

[0027] Multi-function controls **184** may each be assigned functions in accordance with the mode of system operation. Therefore, each of the multi-function controls **184** may be configured to provide a plurality of different actions. Label display areas **186** associated with the multi-function controls **184** may be included as necessary on the display **118**. The system **176** may also have additional keys and/or controls **188**

for special purpose functions, which may include, but are not limited to "freeze," "depth control," "gain control," "color-mode," "print," and "store."

[0028] The microphone **140** and communication link **142** are also shown. One of the label display areas **186** may display a recording icon **192** associated with audio recording, indicating that recording capability is available and/or that the recording capability is active or not active. The recording icon **192** may be any representation and may be configurable by the operator. The recording icon **192** may also change based on the state of recording. A first color may be used to indicate an ON state of recording while a second different color is used to indicate an OFF state of recording. Alternatively, separate, different icons (not shown) may be used to indicate activated (ON state) and deactivated (OFF state) recording status. The control of the recording may be provided through the associated multi-function control **184**. For example, recording may be activated and deactivated by selecting multi-function control F**5** as shown in FIG. **3**. Additionally, audio recordings may be associated with particular location(s) on the image **190**, as shown by recording icon **302** displayed on the image **190** and as discussed further below.

[0029] The display **118** may also have a textual display area **194**. After the user records an audio recording, the voice to text conversion module **128** may convert the audio recording to text that is displayed within the textual display area **194** concurrently with the associated diagnostic image.

[0030] It should be noted that the various embodiments may be implemented in connection with miniaturized or small-sized ultrasound systems having different dimensions, weights, and power consumption. For example, the pocket-sized ultrasound imaging system **176** and the miniaturized ultrasound system **130** of FIG. **2** may provide the same scanning and processing functionality as the system **100** (shown in FIG. **1**).

[0031] FIG. **4** illustrates a portable ultrasound imaging system **145** provided on a movable base **147**. The portable ultrasound imaging system **145** may also be referred to as a cart-based system. A display **118** and user interface **124** are provided and it should be understood that the display **118** may be separate or separable from the user interface **124**. The user interface **124** may optionally be a touchscreen, allowing the operator to select options by touching displayed graphics, icons, and the like.

[0032] The user interface **124** also includes control buttons **152** that may be used to control the portable ultrasound imaging system **145** as desired or needed, and/or as typically provided. The user interface **124** provides multiple interface options that the user may physically manipulate to interact with ultrasound data and other data that may be displayed, as well as to input information and set and change scanning parameters. An audio recording control interface **160** and an attached or detached microphone (not shown) are provided as previously discussed. The interface options may be used for specific inputs, programmable inputs, contextual inputs, and the like. For example, a keyboard **154** and track ball **156** may be provided.

[0033] FIG. **5** illustrates a method for acquiring and associating a digital voice recording file and an ultrasound image file. By being able to record one or more digital voice recording files during an exam, the operator does not have to stop scanning to record findings, comments, notes and the like manually and does not have to take extra time that may be needed to enter findings with one hand via a keyboard. Also, an ultrasound system may not have a keyboard, and thus a voice recording file can be entered by the operator at the time of the acquisition. This may allow additional information to be recorded about the patient that may be pertinent to a particular image without the operator having to enter detailed notes manually into a patient's file. Also, during some procedures, such as a biopsy, it may not be possible to stop the exam in order to record findings, and the concurrent voice recording ability allows the operator to easily record the findings quickly and without having to stop scanning.

[0034] At **200**, an operator initiates scanning of a patient. The operator may select a predefined protocol or may enter parameters manually by selecting one or more buttons on the user interface **124**. The operator may scan for a period of time until locating or forming an image that is to be recorded in the memory **122**. For example, a single frame of data or a snapshot may be recorded or multiple frames of data may be recorded. An example of multiple frames of data is a cine-loop or movie-clip type of file.

[0035] In one embodiment, at **202** the operator may select a button to store a single frame of image data. At **204**, the processor module **116** stores the frame of data, such as in an ultrasound image file in the memory **122**. FIG. **6** illustrates files stored within the memory **122** of FIG. **1**. The files may be stored in a database format or other known format. Typically, the files are organized such that all files associated with a patient and/or a particular scanning session of the patient are stored or linked together. Returning to **204** of FIG. **5**, the processor module **116** may store a first frame of data as first image file **250** within First Patient File **280**. The first image file **250** may be any known file storage format, such a jpg, DICOM and the like.

[0036] At **206**, the operator may initiate a recording session, such as by pushing or activating the audio recording control interface **129** on the user interface **124**. In this example, when the recording session is initiated, the processor module **116** associates the resultant voice recording file with the last stored image file. Therefore, the operator may acquire and store a plurality of ultrasound image files, and when the recording session is initiated, the recording session is associated with the last stored image file in the plurality of ultrasound image files. In another embodiment, the operator may select or identify a different image to associate the voice recording file with that is not the last stored image file. The associated image file may be stored prior to or subsequent to acquisition of the voice recording file.

[0037] The operator may use the microphone **120**, which may be provided on the system or may be separate from the system, such as a clip-on audio pick-up device, to record audio. The processor module **116** activates the recording module **126**, and at **208**, audio such as voice and other sound detected by the microphone **120** is recorded. For example, the operator may wish to verbally record findings and analysis related to the first image file **250**. The operator may also wish to record data that may be used to annotate the recorded image, such as identification of the imaged anatomy. The operator may also wish to verbally input data associated with the first image file **250** that will be used to populate a report page or annotate an image associated with the first image file **250**.

[0038] At **210**, the operator stops the recording session, such as by pressing the audio recording control interface **129** again. At **212**, the processor module **116** may store a digital voice recording file in the memory **122** as first voice recording

file **252**. The first voice recording file **252** may be stored in any known audio-capable digital file storage format such as "wav", "MP3", "MP4" and the like. The first voice recording file **252** is logically associated with the first image file **250**, that is, the processor module **116** forms a digital link between the two files. The files may be similarly named, such as first file, or may be named based on the type of scan being acquired, such as second cardiac file, third cardiac file and the like, but have a different extension indicating the type of storage format. For example, the extension of the image file may be "jpg" while the extension of the voice recording is "MP3", based on the particular file storage format. Alternatively, both the image file and voice recording may be stored as "MP3" or "MP4". It should be understood that other types of naming conventions, extensions and file storage formats may be used.

[0039] Returning to **200**, in another embodiment multiple frames of data, such as a cine-loop or movie, may be desired. At **214**, the operator may select a button to begin recording a series of frames of data. One common type of scan is a cine-loop that acquires one or more cardiac cycles. The acquisition therefore varies in length of time, and may be several seconds long or longer, such as when scanning a fetus.

[0040] At **216**, the operator may initiate a recording session, and at **218** the recording module **126** records an audio recording as detected by the microphone **120**. The audio recording may therefore overlap in time with the acquisition of the image file. At **220** the operator may stop recording image data and at **222**, the processor module **116** stores the ultrasound image file, such as in second image file **254**. At **224** the operator stops the audio recording session, and at **226** the processor module **116** stores the audio recording as second voice recording file **256**. The second image file **254** and the second voice recording file **256** are associated with each other.

[0041] It should be understood that the length of the image file time t**1** and the voice recording file time t**2** may be different. For example, the image file time t**1** may be 3 or 5 seconds, while the voice recording file time t**2** is 60 seconds. Also, the voice recording may be stopped prior to the image recording, resulting in a relatively shorter voice recording file time t**2**. In another embodiment, the operator may choose to record the cine-loop prior to initiating the voice recording. For example, the operator may watch the recorded cine-loop playing on the display **118** while recording the voice recording file.

[0042] In yet another embodiment, at **228** the operator may select an option that initiates recording multiple frames of image data simultaneously with an audio recording session. In this example, the voice recording file time t**2** is the same as the image file time t**1**. If the operator is scanning over a longer period of time, this option may allow the operator to verbally identify select landmarks and other points of interest in the image file as the landmarks are displayed. If desired, the operator can also record movements of a cursor or other visible on-screen tool (e.g., a measurement indicator) synchronized with the audio recording so that when the audio recording is played back, the image file with movements of the cursor or other on-screen tool is replayed. In other words, the image file and the voice recording file (and optionally on-screen cursor or other tool movements) are synchronized with respect to each other. At **230**, the operator stops the image and voice recording, and at **232** the processor module **116** stores a third image file **258** and a third voice recording file **260**. The two files are associated with each other as discussed previously. Alternatively, a single combined file, such as fourth image/voice recording file **276** may be created and stored using technology that supports both video and audio, such as MP3 or MP4. The fourth image/voice recording file **276** may combine the ultrasound images with the voice recording in a single synchronized file.

[0043] In some embodiments, the image file may include stereo sound, such as when scanning in Spectral Doppler mode. In this example, the third image file **258** may have both the ultrasound image data as well as audio that is other than voice, and may also be associated with the third voice recording file **260**. Alternatively, when scanning to acquire both image data and audio, a single combined file including voice data may be stored. For example, the fourth image/voice recording file **276** may include image data and audio, such as associated with Doppler scanning, as well as voice recording that is synchronized with the image data.

[0044] In yet another embodiment, the processor module **116** may monitor input from the microphone **120**. When voice input is detected, the processor module **116** may automatically activate the recording module **126** to record the audio input into a voice recording file. The processor module **116** may deactivate the recording module **126** automatically when voice input is not detected for a predetermined period of time, such as, but not limited to, 5 or 10 seconds. Therefore, the recording module **126** may not record low level background noise. The processor module **116** may then store multiple voice recording files by automatically activating and deactivating the recording module **126**, or may optionally store consecutive sessions of voice recordings in a single voice recording file without long time periods of silence or background noise when no voice input is present. Optionally, the processor module **116** may also activate and/or deactivate the recording module **126** based on a particular word or phrase detected from the microphone **120**. For example, a particular phrase may be used, such as "start recording" and "stop recording" to activate and deactivate, respectively, the recording module **126**. In this example, the operator may converse with the patient or other personnel without having unwanted conversation recorded.

[0045] An operator may not wish to record a voice recording for every image file. For example, referring to FIG. **6**, the operator may scan and record a first image file **262** for Second Patient File **282**. The operator may then record a second image file **264** and wish to record an associated voice recording file. The operator may record second voice recording file **266** immediately after storing the second image file **264**, or simultaneously with or overlapping in time with, the second image file **264**. The processor module **116** logically associates the second image file **264** and the second voice recording file **266**.

[0046] In yet another embodiment, the operator may choose to store a plurality of image files, such as first, second through N image files **268**, **270** and **272** in Third Patient File **284**. After storing N image file **272**, the operator may initiate a voice recording that is stored as N voice recording file **274**. The N image file **272** and N voice recording file **274** are associated with each other. The N voice recording file **274** may refer to the N image file **272**, or may provide a summary, diagnosis and/or overall findings associated with the Third Patient File **284**.

[0047] Alternatively, the operator may store a plurality of image files. The operator may wish to store a voice recording file that is associated with an overall patient file rather than a

specific image file. In this example, the operator may display a list of image files of a patient, and may, for example, highlight the patient identifier or a sub-folder. When the operator stores the voice recording, the voice recording file is associated with the highlighted file or folder, such as the overall patient file, rather than a specific image file.

[0048] The images may be reviewed on the ultrasound system used for acquisition and voice recording, or may be reviewed on a different system or work station. For example, images and associated voice recording(s) may be transferred over the Internet or other network, or may be transferred by way of physical media, such as disc or portable flash memory.

[0049] FIG. **7** illustrates the display **118** showing a list of image files associated with first and second patients that may be selected and reviewed. When the images are reviewed, a recording icon **300** may be displayed to indicate that a voice recording associated with a particular image file from a particular patient is available. For example, the operator may select the First Patient File **280** from the list of patients. The image files within the First Patient File **280** may be displayed and selected for viewing. In this example, each of the first, second and third image files **250**, **254** and **258** may have an associated recording icon **300**. If the Second Patient File **282** is selected, a recording icon is not displayed associated with the first image file **262**, while the second image file **264** has an associated recording icon **300**. Therefore, the recording file may not be indicated as a separate file on the display **118**.

[0050] In one embodiment, the voice recording may be selectable separately from the associated image file, such as by selecting the displayed recording icon **300**. In another embodiment, each time an image file is selected for display, if an associated voice recording file has been stored, the voice recording is played.

[0051] Referring again to FIG. **3**, in another embodiment, one or more audio recordings may be associated with an ultrasound image **190** and assigned to one or more locations in that image **190** by the operator who is being recorded. When this has been done and the image **190** is subsequently displayed, the associated recording icons **302** will be displayed on the image **190** at their assigned image locations. Hence, the operator being recorded can create one or more audio recordings (i.e. voice recording files) associated with different features of interest in the image **190** and then attach those recordings to the features they are discussing. When the image **190** with the icons **302** is subsequently displayed, the recording icons **302** are visible and can be activated (e.g. by double-clicking on them) to play the recording. The recording icons **302** can also be moved or deleted when displayed on an image **190**.

[0052] A technical effect of at least one embodiment is the ability of an operator to record findings, diagnosis and the like in a hands-free manner while scanning a patient. The operator can easily activate a recording session to verbally record findings. Upon being stored in memory, the audio file, or the voice recording file, is automatically associated with a patient image file, overall patient file and/or a particular location on an image within a patient image file. Therefore, findings associated with a particular image are automatically linked or associated with the image file. The image file may be a single image frame or multiple frames, and the voice recording file may be any length, and thus an image file of multiple frames may have a different length in time than the associated image file. When a list of saved files is displayed, an icon may be used to indicate that an image file has an associated voice recording file.

[0053] It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-described embodiments (and/or aspects thereof) may be used in combination with each other. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from its scope. While the dimensions and types of materials described herein are intended to define the parameters of the invention, they are by no means limiting and are exemplary embodiments. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Moreover, in the following claims, the terms "first," "second," and "third," etc. are used merely as labels, and are not intended to impose numerical requirements on their objects. Further, the limitations of the following claims are not written in means-plus-function format and are not intended to be interpreted based on 35 U.S.C. § 112, sixth paragraph, unless and until such claim limitations expressly use the phrase "means for" followed by a statement of function void of further structure.

What is claimed is:

1. An ultrasound system, comprising:

a probe for acquiring ultrasound data associated with a patient;

a microphone for detecting audio;

a processor module configured to receive the ultrasound data from the probe, the processor module processing the ultrasound data to form an image file, the processor module being further configured to receive the audio from the microphone, the processor module forming a voice recording file based on the received audio; and

a memory for storing the image file and the voice recording file, the processor module automatically associating the image file and the voice recording file with each other.

2. The ultrasound system of claim **1**, further comprising a display for displaying a list of at least one image file associated with the patient, the processor module displaying a recording icon proximate to an image file that has an associated voice recording file.

3. The ultrasound system of claim **1**, further comprising a display for displaying the ultrasound data received from the probe and a recording icon, the recording icon indicating at least one of an availability of recording capability, an ON state of recording and an OFF state of recording.

4. The ultrasound system of claim **1**, further comprising a user interface providing an audio recording control interface, the audio recording control interface being configured to provide at least one of starting a recording session and stopping a recording session.

5. The ultrasound system of claim **1**, wherein the voice recording file is one of acquired subsequent to an acquisition of the image file and acquired during an acquisition of the image file.

6. The ultrasound system of claim **1**, wherein the image file comprises at least one frame of data and has a length of time t**1**, wherein the voice recording file has a length of time t**2**,

wherein the lengths of time t1 and t2 may be the same as each other or may be different with respect to each other.

7. The ultrasound system of claim 1, wherein the ultrasound system is one of a hand carried system, miniaturized system, pocket-sized system, and portable system.

8. The ultrasound system of claim 1, wherein the image file comprises multiple consecutive frames of data acquired over time, the processor module combining the voice recording file and the image file into a single combined file, wherein the voice recording file is synchronized with respect to the image file within the single combined file.

9. The ultrasound system of claim 1, further comprising:

a display for displaying an image associated with the image file, the display further displaying at least one recording icon at a first image location on the image; and

a user interface for at least one of selecting the at least one recording icon to play the associated voice recording file and moving the at least one recording icon to a different image location on the image.

10. A method for recording audio associated with an ultrasound image file, the method comprising:

acquiring ultrasound data from a probe;

storing an image file based on the ultrasound data;

digitally recording a voice recording file; and

automatically associating the image file and the voice recording file with each other when storing the voice recording file.

11. The method of claim 10, wherein the scanning and the digitally recording overlap in time with respect to each other.

12. The method of claim 10, wherein the voice recording file is automatically associated with an image file that was a most recently stored image file.

13. The method of claim 10, further comprising:

displaying an image based on the image file; and

displaying a recording icon associated with the voice recording file at a first image location on the image.

14. The method of claim 10, wherein the image file and the voice recording file are stored using one of a same file storage format and different file storage formats.

15. The method of claim 10, wherein the image file comprises multiple consecutive frames of data acquired over a time t1 and the voice recording file comprises audio recorded over a time t2, wherein the times t1 and t2 may be one of the same and different with respect to each other, and wherein the times t1 and t2 may one of overlap each other or be separate in time.

16. The method of claim 15, wherein the voice recording file is synchronized with respect to the image file, the method further comprising recording movement of at least one of a cursor and a visible on-screen tool while acquiring the multiple consecutive frames of data, the movement being synchronized with respect to the image file and the voice recording file.

17. An ultrasound system, comprising:

a probe for acquiring ultrasound data;

a display for displaying the ultrasound data;

a microphone detecting audio; and

a processor module configured to form an image file based on the ultrasound data, the processor module being configured to receive the audio from the microphone, the processor module forming a voice recording file that is associated with the image file, the voice recording file being based on the audio.

18. The system of claim 17, wherein the processor module further comprises a voice to text conversion module for converting the voice recording file into text, the processor module displaying the text on the display.

19. The system of claim 17, wherein the processor module is configured to monitor for a voice input to set an audio recording status as one of an ON state of recording and on OFF state of recording.

20. The system of claim 17, wherein the processor module further comprises a voice to text conversion module for converting the voice recording file into text, the processor module populating a report page based on the text.

21. The system of claim 17, wherein the processor module is further configured to form a second image file based on the ultrasound data, the processor module forming a second voice recording file that is associated with the second image file, the second voice recording file being based on the audio from the microphone.

22. The system of claim 17, further comprising a user input for associating the voice recording file with an image location within the ultrasound data, the display displaying a recording icon associated with the voice recording file at the image location, the user input being configured to at least one of move the recording icon within the image and select the recording icon to play the voice recording file.

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专利名称(译)	用于使用超声成像的语音记录的方法和设备		
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[标]申请(专利权)人(译)	HALMANN梅纳赫姆 贝茨大卫·		
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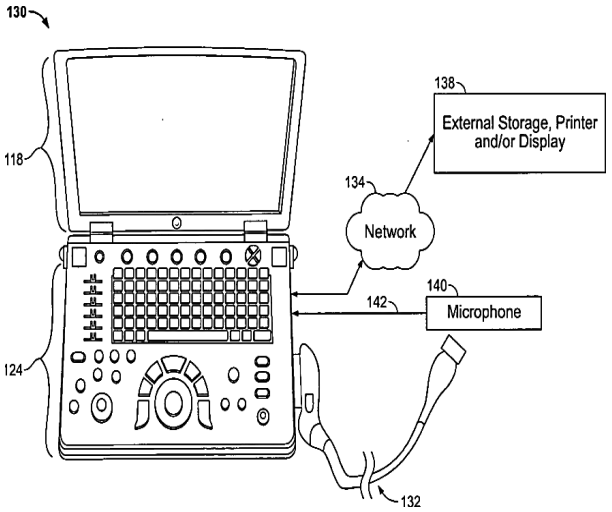
摘要(译)

超声系统包括用于采集与患者相关的超声数据的探头和用于检测音频的麦克风。该系统还包括处理器模块和存储器。处理器模块被配置为从探针接收超声数据并处理超声数据以形成图像文件。处理器模块还被配置为从麦克风接收音频并基于接收的音频形成语音记录文件。存储器存储图像文件和语音记录文件，处理器模块自动将图像文件和语音记录文件相互关联。