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(54) METHOD AND APPARATUS FOR CONTROLLING ULTRASOUND SYSTEMS

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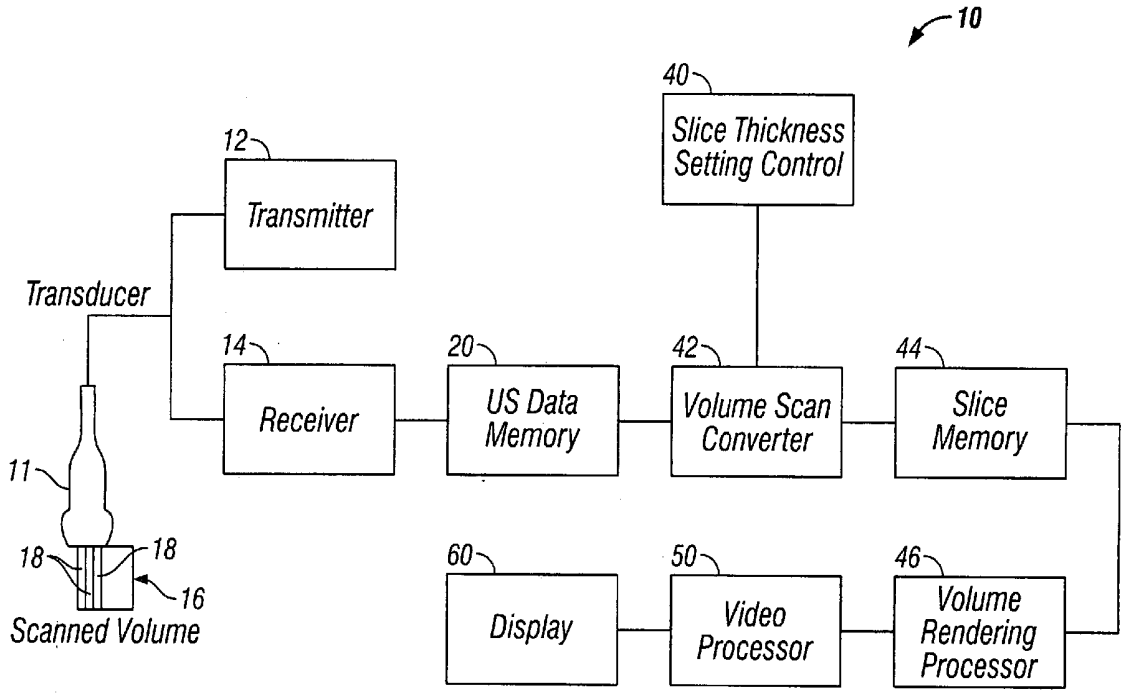
(57) **ABSTRACT**

A method and system providing control of an ultrasound system with a user interface is provided. The user interface for controlling the ultrasound system includes a plurality of selectable elements for controlling operation of the ultrasound system and a plurality of identifiers. Each identifier corresponds to one of the plurality of selectable elements and associates control commands with the selectable elements.



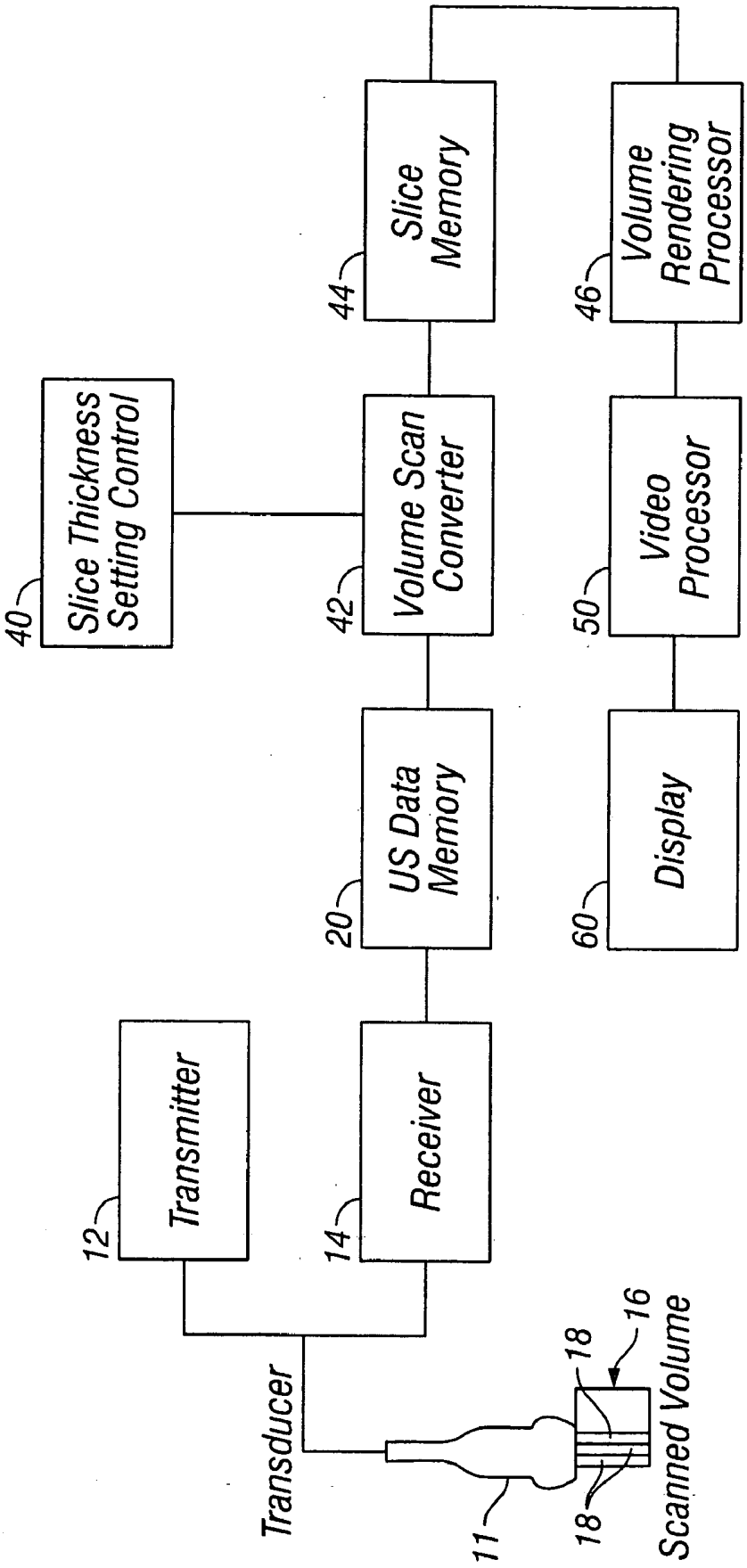

10
Slice Memory
44
Volume Rendering Processor
46
Slice Thickness Setting Control
40
Volume Scan Converter
42
Video Processor
50
US Data Memory
20
Display
60
Transmitter
12
Receiver
14
Transducer
11
18
16
18
Scanned Volume

FIG. 1

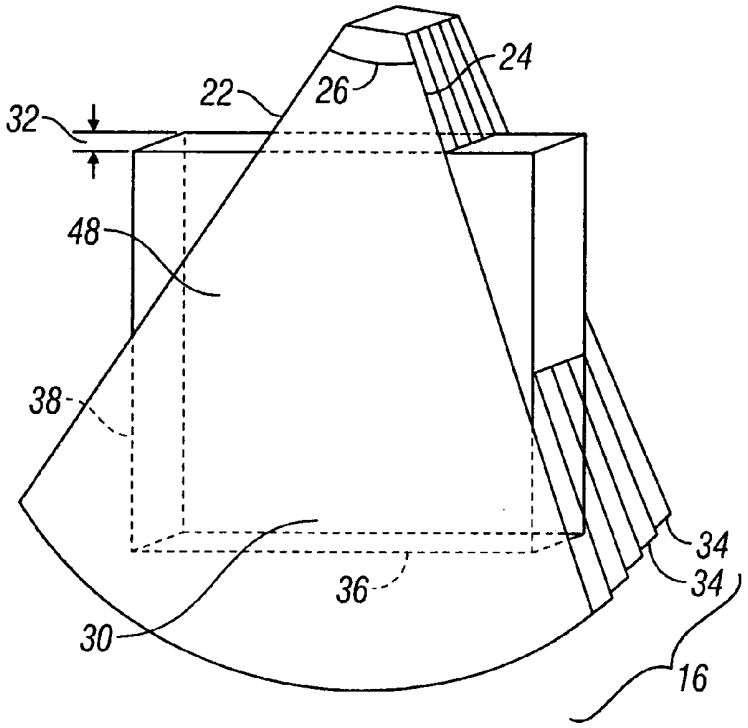

24
22
26
32
48
38
34
34
36
30
16

FIG. 2

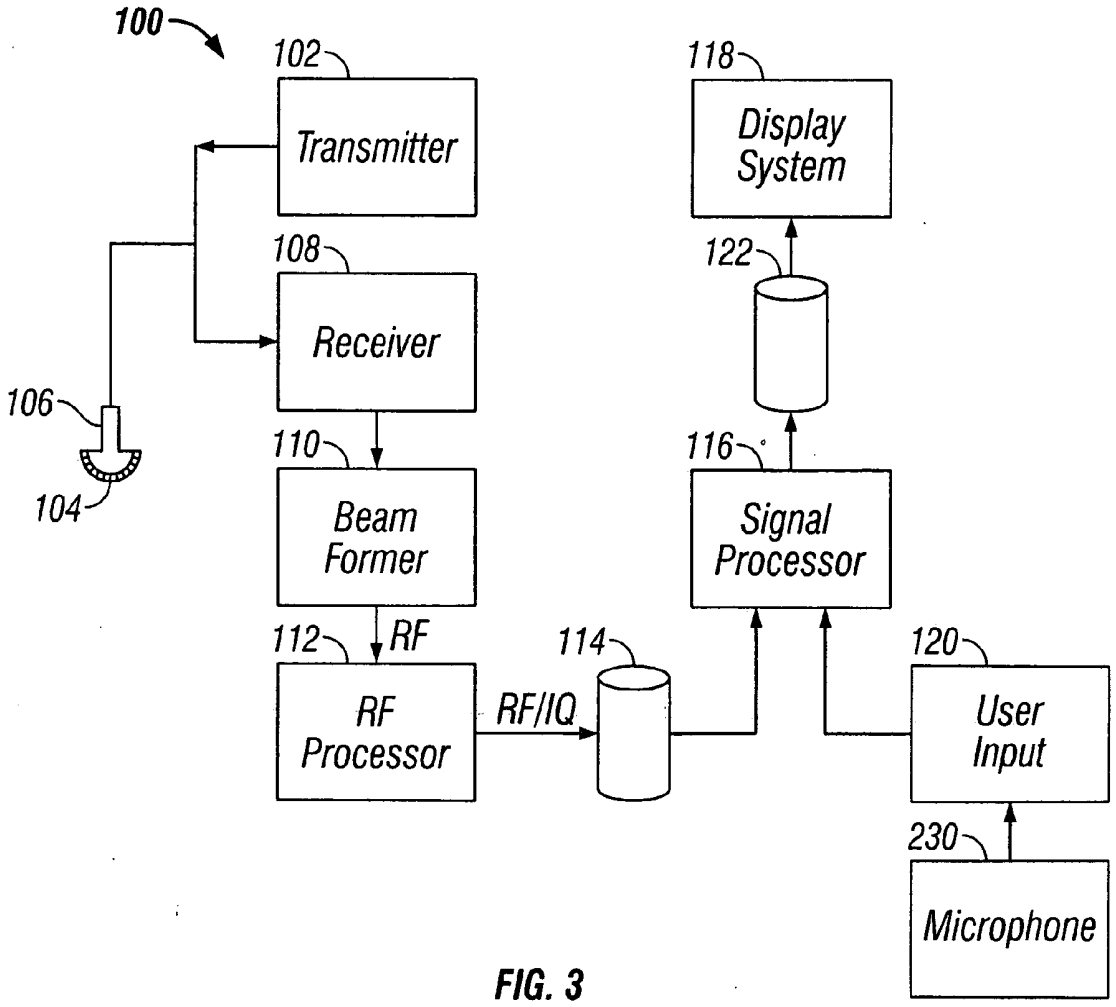

100
102
Transmitter
118
Display System
108
Receiver
122
106
104
110
Beam Former
116
Signal Processor
112
RF
114
120
RF Processor
RF/IQ
User Input
230
Microphone

FIG. 3

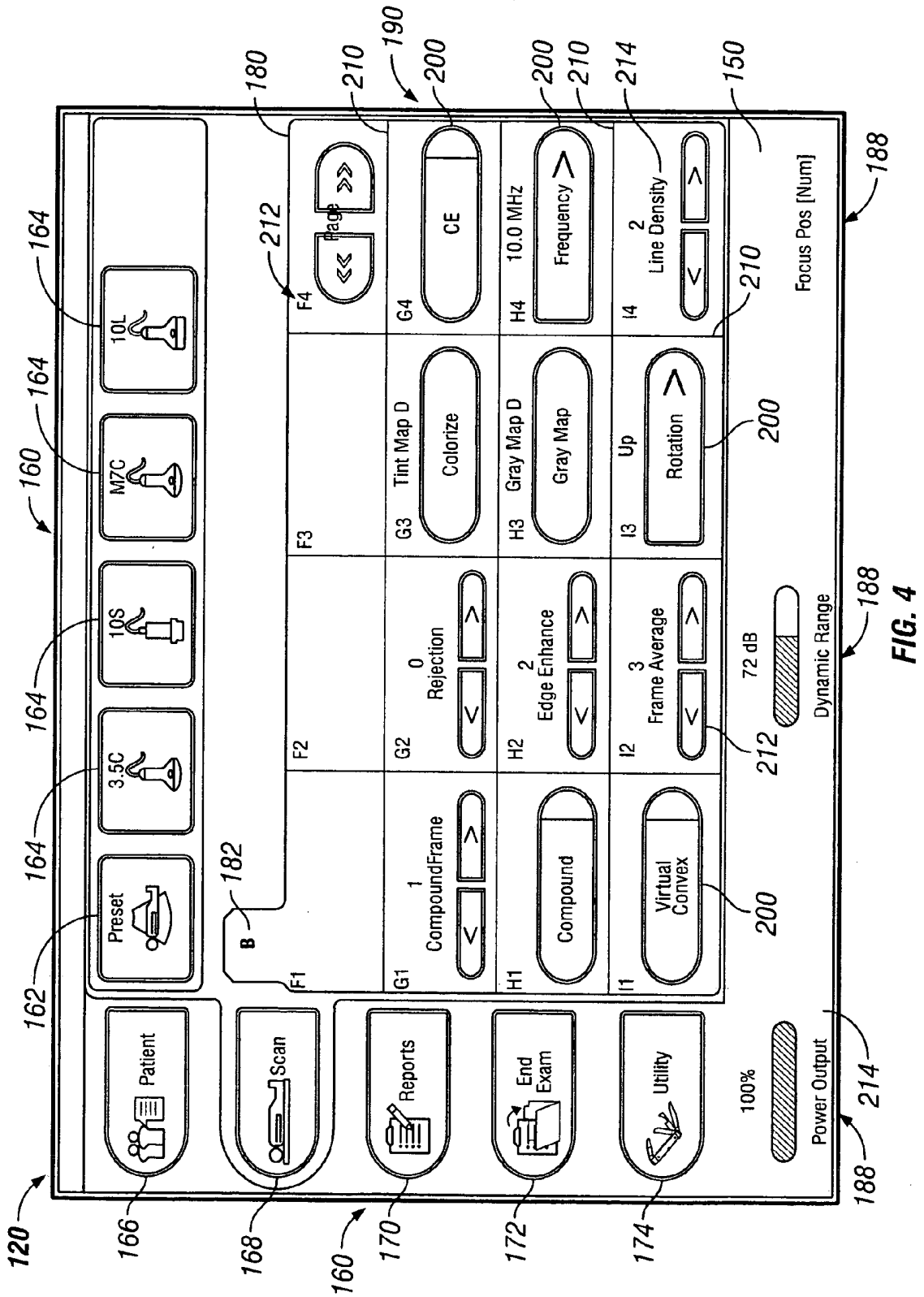

120
160
162
164
166
168
170
172
174
180
182
188
190
200
210
212
214
150
Patient
Scan
Reports
End Exam
Utility
Preset
3.5C
10S
M7C
10L
B
F1
F2
F3
F4
G1 1 CompoundFrame
G2 0 Rejection
G3 Tint Map D
G4
H1 Compound
H2 2 Edge Enhance
H3 Gray Map D
H4 10.0 MHz
I1 Virtual Convex
I2 3 Frame Average
I3 Up
I4 2 Line Density
Colorize
Gray Map
Rotation
Frequency
CE
Page
100%
Power Output
72 dB
Dynamic Range
Focus Pos [Num]

FIG. 4

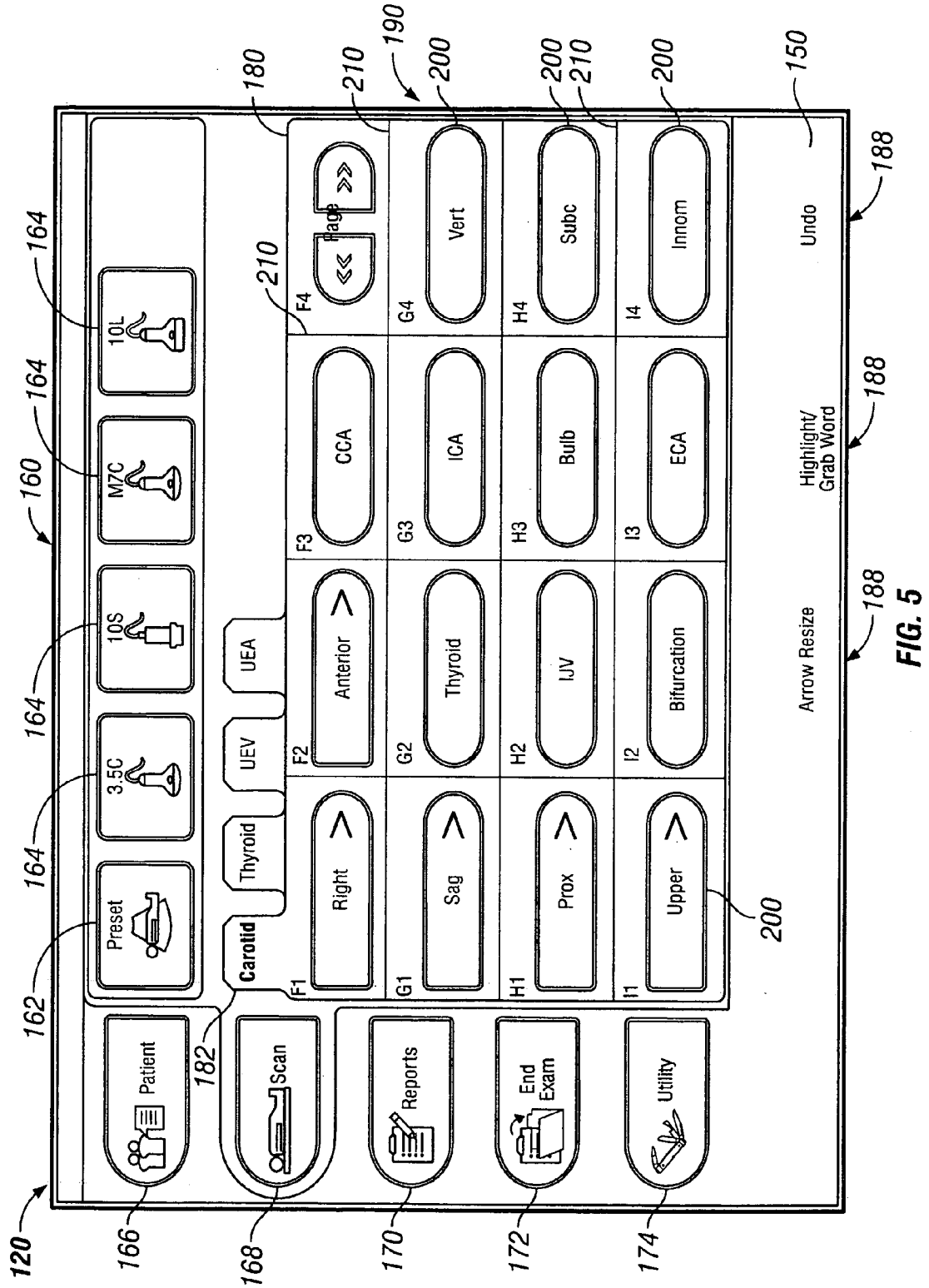

Preset
3.5C
10S
M7C
10L
Carotid
Thyroid
UEV
UEA
F1 Right
F2 Anterior
F3 CCA
F4 Page
G1 Sag
G2 Thyroid
G3 ICA
G4 Vert
H1 Prox
H2 IJV
H3 Bulb
H4 Subc
I1 Upper
I2 Bifurcation
I3 ECA
I4 Innom
Undo
Highlight/ Grab Word
Arrow Resize
Patient
Scan
Reports
End Exam
Utility
120
160
162
164
166
168
170
172
174
180
182
188
190
200
210

FIG. 5

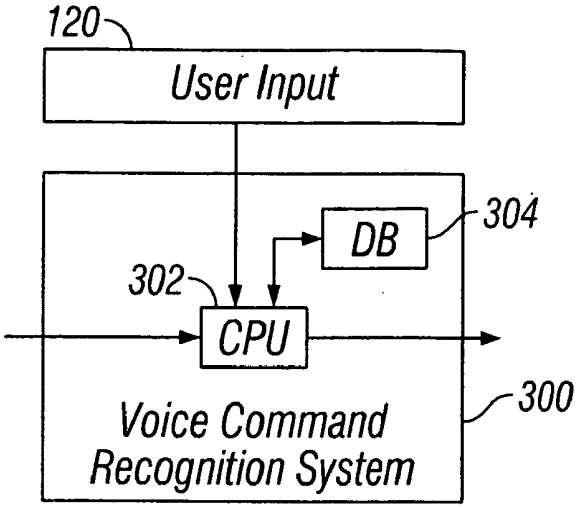

120
User Input
304
DB
302
CPU
300
Voice Command
Recognition System

FIG. 6

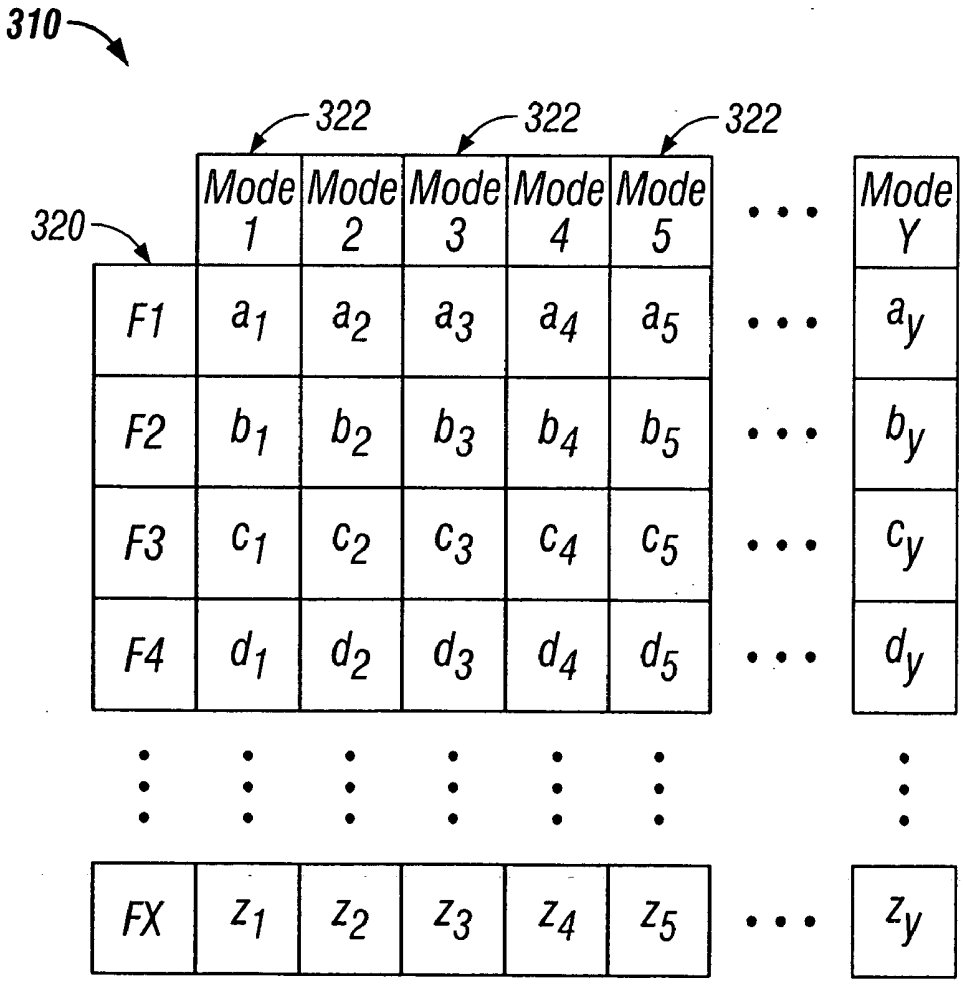

310
322
322
322
320
Mode 1
Mode 2
Mode 3
Mode 4
Mode 5
Mode Y
F1
F2
F3
F4
FX

FIG. 7

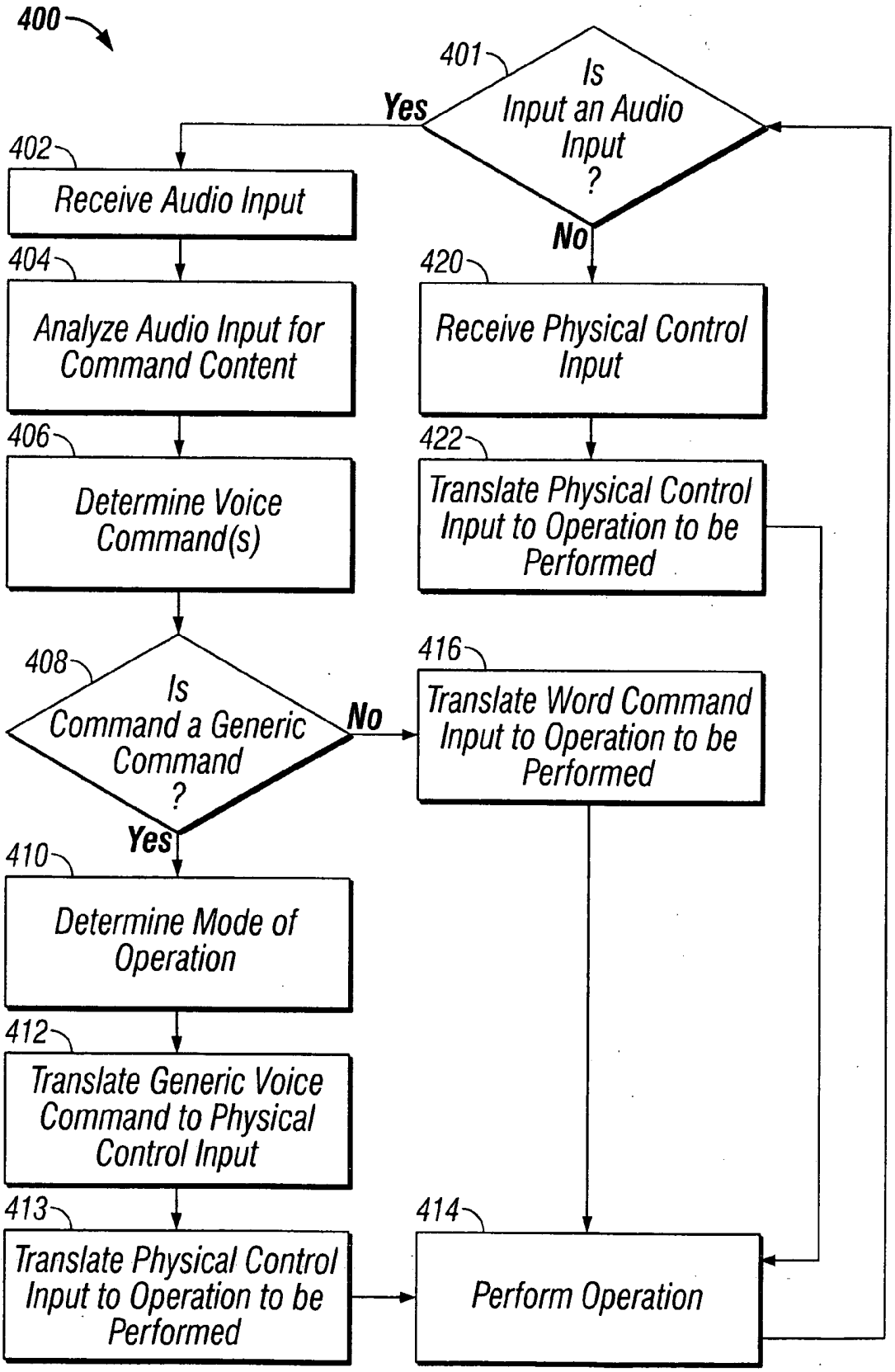

400
401
Is Input an Audio Input ?
Yes
No
402
Receive Audio Input
404
Analyze Audio Input for Command Content
406
Determine Voice Command(s)
408
Is Command a Generic Command ?
No
Yes
410
Determine Mode of Operation
412
Translate Generic Voice Command to Physical Control Input
413
Translate Physical Control Input to Operation to be Performed
420
Receive Physical Control Input
422
Translate Physical Control Input to Operation to be Performed
416
Translate Word Command Input to Operation to be Performed
414
Perform Operation

FIG. 8

METHOD AND APPARATUS FOR CONTROLLING ULTRASOUND SYSTEMS

BACKGROUND OF THE INVENTION

[0001] This invention relates generally to ultrasound systems and, more particularly, to methods and devices for controlling ultrasound systems.

[0002] In many typical ultrasound systems having, for example, an ultrasound machine or scanner, a large set of controls is provided for use by a user to control the ultrasound system. These controls may be used to drive the operation and/or behavior of the ultrasound machine. Because the physical space on the ultrasound machine is limited, it is often not possible to provide (e.g., expose) all controls at all times. Thus, a user is not able to access all controls at a single time.

[0003] A common way to handle the limited space for controls is to use an input device, such as a touch panel having on-screen controls, or other generic input device. The content of the generic input device, such as, for example, the specific control functions displayed, typically varies depending on the context of the ultrasound machine (e.g., based upon the particular operation to be performed). Therefore, only the necessary controls for the particular mode of operation are available for access by a user at any given time.

[0004] Additionally, voice commands may be used to operate an ultrasound system. However, again, because of the large set of controls, if each control is given a unique voice command, a very large command set can result. This large command set may reduce the accuracy of the voice recognition system, slow the speed of command recognition, cause misinterpreted commands due to the similarity of many of the commands and/or make it difficult for the user to learn the full list of commands. Further, if the user creates control functions once the ultrasound machine is installed, then it is difficult to provide a way to drive these control functions by voice commands.

BRIEF DESCRIPTION OF THE INVENTION

[0005] In one embodiment, a user interface for controlling an ultrasound system is provided. The user interface includes a plurality of selectable elements for controlling operation of the ultrasound system and a plurality of identifiers. Each identifier corresponds to one of the plurality of selectable elements and associates control commands with the selectable elements.

[0006] In another embodiment, a method for controlling an ultrasound system is provided. The method includes associating a set of identifiers with a plurality of operations for controlling the ultrasound system, receiving control commands, and performing operations based upon the received control commands corresponding to one or more of the set of identifiers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** is a block diagram of an ultrasound system in accordance with one exemplary embodiment of the present invention.

[0008] **FIG. 2** is a perspective view of a real-time volume acquired by the system of **FIG. 1** in accordance with an exemplary embodiment of the present invention.

[0009] **FIG. 3** is an ultrasound system in accordance with another exemplary embodiment of the present invention.

[0010] **FIG. 4** is a an exemplary embodiment of a user input of an ultrasound system displaying an exemplary control screen.

[0011] **FIG. 5** is the user input of **FIG. 4** displaying another exemplary control screen.

[0012] **FIG. 6** is a block diagram of a voice command recognition system in accordance with an exemplary embodiment of the present invention.

[0013] **FIG. 7** is a lookup table of the voice command recognition system of **FIG. 6** in accordance with an exemplary embodiment of the present invention.

[0014] **FIG. 8** is a flowchart illustrating a voice recognition process in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] Exemplary embodiments of ultrasound systems and methods for controlling such systems are described in detail below. A detailed description of exemplary ultrasound systems will first be provided followed by a detailed description of various embodiments of a user input for controlling the operation of ultrasound systems.

[0016] **FIG. 1** illustrates a block diagram of an exemplary embodiment of an ultrasound system **10**. The ultrasound system **10** includes a probe **11**, such as, for example, a transducer, connected to a transmitter **12** and a receiver **14**. The probe **11** transmits ultrasonic pulses and receives echoes from structures inside a scanned ultrasound volume **16**. A memory **20** stores ultrasound data from the receiver **14** derived from the scanned ultrasound volume **16**. The volume **16** may be obtained by various techniques, including, for example, real-time imaging, volume scanning, scanning with transducers having positioning sensors, freehand scanning using a Voxel correlation technique or scanning with matrix array transducers and the like.

[0017] The probe **11** is moved, such as along a linear or arcuate path, while scanning a region of interest (ROI). At each linear or arcuate position, the probe **11** obtains scan planes **18**. The scan planes **18** are collected for a thickness, such as from a group or set of adjacent scan planes **18**. The scan planes **18** are stored in the memory **20**, and then passed to a volume scan converter **42**. In some embodiments, the probe **11** may obtain lines instead of the scan planes **18**, and the memory **20** may store lines obtained by the probe **11** rather than the scan planes **18**. The volume scan converter **42** may store lines obtained by the probe **11** rather than the scan planes **18**. The volume scan converter **42** receives a slice thickness setting from a slice thickness setting control **40**, which identifies the thickness of a slice to be created from the scan planes **18**. The volume scan converter **42** creates a data slice from multiple adjacent scan planes **18**. The number of adjacent scan planes **18** that are obtained to form each data slice is dependent upon the thickness selected by the slice thickness setting control **40**. The data slice is stored in slice memory **44** and is accessed by a volume rendering processor **46**. The volume rendering processor **46** performs

volume rendering upon the data slice. The output of the volume rendering processor **46** is passed to a video processor **50** and a display **60**.

[**0018**] The position of each echo signal sample (Voxel) is defined in terms of geometrical accuracy (i.e., the distance from one Voxel to the next) and ultrasonic response (and derived values from the ultrasonic response). Suitable ultrasonic responses include gray scale values, color flow values, and angio or power Doppler information.

[**0019**] It should be noted that the ultrasound system **10** may include additional or different components. For example, a user interface or input may be provided and used to control the operation of the ultrasound system **10**, including, to control the input of patient data, scan parameters, a change of scan mode, and the like.

[**0020**] **FIG. 2** illustrates a real-time volume **16** acquired by the ultrasound system **10** of **FIG. 1**. It should be noted that the ultrasound system **100** of **FIG. 3** as described below may also be used to acquire the real-time volume **16**. The volume **16** includes a sector shaped cross-section with radial borders **22** and **24** diverging from one another at an angle **26**. The probe **11** (shown in **FIG. 1**) electronically focuses and directs ultrasound firings longitudinally to scan along adjacent scan lines in each scan plane **18** and electronically or mechanically focuses and directs ultrasound firings laterally to scan adjacent scan planes **18**. Scan planes **18** obtained by the probe **11**, and as illustrated in **FIG. 1**, are stored in the memory **20** and are scan converted from spherical to Cartesian coordinates by the volume scan converter **42**. A volume comprising multiple scan planes is output from the volume scan converter **42** and stored in the slice memory **44** as a rendering box **30**. The rendering box **30** in the slice memory **44** is formed from multiple adjacent image planes **34**.

[**0021**] The rendering box **30** may be defined in size by an operator using a user interface or input to have a slice thickness **32**, width **36** and height **38**. The volume scan converter **42** may be controlled by the slice thickness setting control **40** to adjust the thickness parameter of the slice to form a rendering box **30** of the desired thickness. The rendering box **30** designates the portion of the scanned volume **16** that is volume rendered. The volume rendering processor **46** accesses the slice memory **44** and renders along the slice thickness **32** of the rendering box **30**.

[**0022**] Referring now to **FIGS. 1 and 2**, during operation, a slice having a pre-defined, substantially constant thickness (also referred to as the rendering box **30**) is acquired by the slice thickness setting control **40** and is processed in the volume scan converter **42**. The echo data representing the rendering box **30** may be stored in the slice memory **44**. Predefined thicknesses between about 2 mm and about 20 mm are typical, however, thicknesses less than about 2 mm or greater than about 20 mm may also be suitable depending on the application and the size of the area to be scanned. The slice thickness setting control **40** may include a rotatable knob with discrete or continuous thickness settings.

[**0023**] The volume rendering processor **46** projects the rendering box **30** onto an image portion **48** of an image plane **34**. Following processing in the volume rendering processor **46**, the pixel data in the image portion **48** may pass through a video processor **50** and then to a display **60**. The rendering box **30** may be located at any position and oriented at any direction within the scanned volume **16**. In some situations, depending on the size of the region being scanned, it may be advantageous for the rendering box **30** to be only a small portion of the scanned volume **16**.

[**0024**] **FIG. 3** illustrates a block diagram of another exemplary embodiment of an ultrasound system **100**. The ultrasound system **100** includes a transmitter **102** that drives transducers **104** within a probe **106** to emit pulsed ultrasonic signals into a body. A variety of geometries may be used. The ultrasonic signals are back-scattered from structures in the body, like blood cells or muscular tissue, to produce echoes that return to the transducers **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 an RF/IQ buffer **114** for temporary storage. A user input device **120** as described in more detail below may be used to control operation of the ultrasound system **100**, including, to control the input of patient data, scan parameters, a change of scan mode, and the like. This may include using voice commands provided via a microphone **230**.

[**0025**] The ultrasound system **100** also includes a signal processor **116** to process the acquired ultrasound information (i.e., RF signal data or IQ data pairs) and prepare frames of ultrasound information for display on display system **118**. The signal processor **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 in real-time during a scanning session as the echo signals are received. Additionally or alternatively, the ultrasound information may be stored temporarily in the RF/IQ buffer **114** during a scanning session and processed in less than real-time in a live or off-line operation.

[**0026**] The ultrasound system **100** may continuously acquire ultrasound information at a frame rate that exceeds fifty frames per second, which is the approximate perception rate of the human eye. The acquired ultrasound information is displayed on the display system **118** at a slower frame-rate. An image buffer **122** is included for storing processed frames of acquired ultrasound information that are not scheduled to be displayed immediately. In an exemplary embodiment, the image buffer **122** is of sufficient capacity to store at least several seconds worth of frames of ultrasound information. The frames of ultrasound information are stored in a manner to facilitate retrieval thereof according to its order or time of acquisition. The image buffer **122** may comprise any known data storage medium.

[**0027**] Referring now to a user interface or input, such as, for example, the user input device **120** (shown in **FIG. 3**), various embodiments may be implemented for controlling the ultrasound systems **10** and **100**. Such various embodiments may include control functionality, such as a set of user controls for controlling the ultrasound systems **10** and **100**. The set of user controls may be provided, for example, as part of a touch screen or panel, or as manual inputs,

including, for example, user operable switches, buttons, and the like. The set of user controls may be manually operable or voice operated.

[0028] In an exemplary embodiment as shown in **FIG. 4**, a user input device **120** may include a user interface, such as, for example, a panel or screen **150**, that is operable and selectable by touching the screen **150** to select the desired operation or command for controlling the ultrasound systems **10** and **100**. The user input device **120** may also include a voice control input or voice activated component (not shown), such as a microphone **230** (shown in **FIG. 3**), for controlling the operation of the ultrasound systems **10** and **100**.

[0029] Specifically, and as shown in **FIG. 4**, the screen **150** includes a first set of selectable elements **160**, for example, a plurality of icons selectable by a user touching the icons on the screen **150** or by voice command as described below, that control operation of the ultrasound systems **10** and **100** in various modes of operation. In one exemplary embodiment, the plurality of selectable elements **160** are fixed and do not change based upon the particular mode of operation. Thus, the icons do not change when the mode of operation changes, for example, as selected by a user. The first set of selectable elements **160** may include, for example, functionality to control general operation of the ultrasound systems **10** and **100**. The icons, may control, for example, the area of a patient to scan (Preset icon **162**) and/or the selection of a particular transducer to use for a scan (3.5C, 10S, M7C and 10L icons **164**). The icons may also allow for selection of general operations such as to enter patient information (Patient icon **166**), start a scan (Scan icon **168**), create or generate a report (Reports icon **170**), end a scan or exam (End Exam icon **172**) and/or configure the ultrasound machines **10** and **100** (Utility icon **174**). These icons are selectable by touching the screen **150** or by voice commands as described below.

[0030] The screen **150** also includes a control portion **180** having a second set of selectable elements **190**, for example, a plurality of icons **200** selectable by a user touching the icons **200** on the screen **150** or by voice command as described below, that control operation of the ultrasound systems **10** and **100** in various modes of operation. In one exemplary embodiment, the plurality of selectable elements **190** change based upon the selected mode of operation. Thus, the icons **200** change when the mode of operation changes, for example, as selected by a user. A mode selection element, such as a tab **182**, indicates the current mode of operation and defines a set of icons **200** corresponding to that mode of operation to be displayed in the control portion **180**. The second set of selectable elements **190** may include, for example, functionality to control operation of the ultrasound systems **10** and **100** in the selected mode of operation. The icons **200** may control, for example, the parameters of operation during the selected mode of operation. For example, and as shown in **FIG. 4**, when a B-mode of operation is selected, the icons **200**, may control, for example, the scanning parameters in the B-mode, such as compounding, rotation, map, frequency, etc. These icons **200** are selectable by touching the screen **150** or by voice commands as described below.

[0031] It should be noted that the number and type of icons **200** change based upon the mode of operation selected. For example, as shown in **FIG. 5**, the icons **200** in the control portion **180** correspond to control functionally desired or needed during a Carotid mode of operation, with the mode of operation selected and indicated by the tab **182**. More than one tab **182** may be displayed on the screen **150** that are selectable by a user to change the mode of operation, thereby changing the icons **200** displayed within the control portion **180**. For example, in addition to the Carotid tab **182**, tabs **184** for other modes of operation, such as, Thyroid, UEV and UEA may be provided. The tabs **182** and **184** may be selected by a user or predetermined based upon a particular procedure to be performed. Thus, the tabs **182** and **184** are selectable based upon the mode of operation.

[0032] A set of indicators **188** are also provided on the screen **150** that correspond to physical controls (not shown) of the ultrasound systems **10** and **100**. The set of indicators **188** also change based upon the mode of operation and may, for example, indicate the level of a particular setting selectable by a physical rotary control (e.g., dynamic range as shown in **FIG. 4**), or the option selectable by a physical button (e.g., Undo as shown in **FIG. 5**). In an exemplary embodiment, each of the indicators **188** is displayed on the screen in proximity to (e.g., above) its corresponding physical control provided as part of the ultrasound systems **10** and **100**.

[0033] In an exemplary embodiment, the control portion **180** is configured as a matrix or grid defined by grid lines **210**. The matrix or grid defines locations for each of the icons **200**. Specifically, an identifier **212** is associated with each grid position or cell **214** having a corresponding icon **200** therein. In an exemplary embodiment, the identifier associates a voice command with a control command represented by the icon **200** for controlling an operation or parameter of the ultrasound systems **10** and **100**. The identifier **212** does not change when the mode of operation changes. As described above, the icons **200** displayed in the control portion **180** may change with a change in the mode of operation. Thus, in different modes of operation, particular identifiers **212** correspond to different icons **200** for controlling a different operation or parameter during that mode of operation. It should be noted that some of the cells **214** may not include a corresponding icon **200** in a particular mode of operation.

[0034] In an exemplary embodiment, an icon is selectable by a user by touching the icon displayed on the screen **150** or by voice command. Specifically, during a particular mode of operation, a user may touch the icon **200** to select or adjust a particular parameter in that mode of operation. The various parameters or controls represented by the icons also may be selected using voice commands. In an exemplary embodiment, a user, using a voice control input, such as, for example, a microphone **230** (shown in **FIG. 3**) that may be wireless or hardwired to the user input **120**, may control with voice commands the operation of the ultrasound systems **10** and **100**. Specifically, the icons **200** may be selected using the identifier **212** associated with a particular desired or required operation or parameter. For example, the user may speak into the microphone **230** the identifier(s) **212** associated with the icon(s) **200** representing the desired or required operation or parameter, which may include a desired or required change. For example, a user may speak "G1 down," which would decrement the parameter associated with the icon in the cell **214** associated with the G1 identifier **212**.

Thus, a user can control the ultrasound systems **10** and **100** with a simple set of voice commands defined by the identifiers **212**.

[**0035**] It should be noted that voice commands also may be provided using word commands for operations or parameters that are often used (i.e., high use controls). For example, a user may speak "scan" to activate the scan operation associated with the Scan icon **168**. The word commands may also be used in connection with high use controls in the control portion **180**. Further, as should be appreciated, the voice control operation and display of icons on the screen **150** may be provided in various different manners based upon the requirements of the specific ultrasound system.

[**0036**] The association of a voice command with a control command represented by the icon **200** for controlling an operation or parameter of the ultrasound systems **10** and **100** is provided by a voice command recognition system. A block diagram of an exemplary embodiment of a voice command recognition system **300** is shown in **FIG. 6**. The voice command recognition system **300** includes a processor **302** (e.g., CPU) for receiving an audio signal, such as a voice command from a user, and processing the audio signal to determine the corresponding control command for use in controlling an operation or parameter of the ultrasound systems **10** and **100**. The processor **302** also receives information from the user input **120** (e.g., current mode of operation) and accesses a database **304** containing association information for associating a voice command with a control command. It should be noted that the voice command recognition system **300** may be provided separate from or as part of the user input **120** or user interface.

[**0037**] The database **304** contains one or more lookup tables **310** as shown in **FIG. 7**. It should be noted that the database **304** having the lookup tables **310** contained therein may be stored, for example, in a memory or other storage component, for example, in local memory in the ultrasound systems **10** and **100** or on a server remote from the ultrasound systems **10** and **100**. It should also be noted that the association information an may be provided in other forms, such as, for example, as lists in separate files stored within a memory.

[**0038**] As shown in **FIG. 7**, an exemplary embodiment of a lookup table **310** includes a first column **320**, which includes the possible identifiers **212** for one set or row of the matrix in the control portion **180** (e.g., F1 through F4 in **FIG. 4**). A plurality of mode columns **322** corresponding to the different modes of operation of the ultrasound systems **10** and **100** are provided and include address values corresponding to control commands for each of the modes of operation. Thus, for each identifier entry in the first column **320**, a corresponding row includes addresses (e.g., a_1 to a_5 for five different modes of operation) in the database **304** for the control commands associated with the identifier **212** for each mode of operation. In one exemplary embodiment, the length of the columns and rows is determined based upon the number of identifiers **212** and modes of operation for the ultrasound systems **10** and **100**, respectively. It should be noted that separate lookup tables **310** may be provided for each set of identifiers **212** or a single lookup table **310** may be provided for all possible identifiers **212**. Additionally, the first column **320** may be modified to include word commands or physical control inputs with the corresponding row entries identifying the addresses in the database **304** for the operations to be performed associated with the word commands or physical control inputs, respectively.

[**0039**] In operation, the voice command recognition system **300** associates a voice command with a control command represented by the icon **200** for controlling an operation or parameter of the ultrasound systems **10** and **100**. Specifically, an exemplary embodiment of a voice recognition process **400** performed by the voice command recognition system **300** is shown in **FIG. 8**. At step **401**, a determination is made as to whether the input to the ultrasound system **10** or **100** is an audio input. If the input is an audio input, then at step **402**, an audio input (e.g., spoken words from a user) is received. The audio input is then analyzed at step **404** for command content. Based upon the analysis, recognized voice commands are determined at step **406**. A determination is then made at step **408** whether the voice command(s) is a generic voice command (i.e., identifier **212**). If a determination is made at step **408** that the voice command is a generic voice command, then at step **410** a determination is made as to the mode of operation of the ultrasound systems **10** or **100**. At step **412**, the generic voice command is translated to a physical control input. For example, using the lookup table **310** (shown in **FIG. 7**), the address in the database **304** (shown in **FIG. 6**) of the physical control input (e.g., control command) associated with the identifier **212** for the determined mode of operation is determined. Then, at step **413**, the physical control input is translated to the operation to be performed (e.g., determine operation to be performed based upon the physical control input using the lookup table **310**). The operation (e.g., adjustment to an operating parameter) is then performed at step **414** based upon the translated generic voice command. Another input is then processed or may be processed in parallel using the voice recognition process **400**.

[**0040**] If a determination is made at step **408** that the voice command is not a generic voice command (e.g., command is a word command), then at step **416** the word command is translated to the operation to be performed. For example, a determination is made using the lookup table **310** as to the operation to be performed associated with any word commands (i.e., address in the database **304** (shown in **FIG. 6**) of the operation to be performed associated with the word command). The operation is then performed at step **414** based upon the determined address. Another input is then processed or may be processed in parallel using the voice recognition process **400**.

[**0041**] If a determination is made at step **401** that the input to the ultrasound system **10** or **100** is not an audio input (e.g., input is a physical control input such as a change in a physical dial or switch, or touch on a touch panel) then at step **420** a physical control input (e.g., flipping a switch or rotating a rotary dial) is received. At step **422** the physical control input is translated to the operation to be performed. For example, a determination is made using the lookup table **310** as to the operation to be performed associated with the physical control input (i.e., address in the database **304** (shown in **FIG. 6**) of the operation to be performed associated with the physical control input). The operation is then performed at step **414** based upon the determined address.

Another input is then processed or may be processed in parallel using the voice recognition process **400**.

[**0042**] Thus, in operation, user manual action and/or voice commands may be used to control the operation of the ultrasound systems **10** and **100**. With respect to voice commands, and for example, using the identifiers **212**, the various operations and parameters within each of the modes of operation may be easily controlled. As shown in **FIGS. 4 and 5**, the screen **150** includes a control portion **180** selectable by a tab **182**, with each tab **182** corresponding to a grid layout representing commands and/or parameters for the selected mode of operation. A user, for example, may then speak "Tab" to select the particular tab **182** corresponding to a mode of operation, in this B-mode case, the user would speak "Tab 1", and thereafter, speak a command such as "H1" to operate a particular control within the grid, in this case to turn on/off the Compound feature as determined using the voice recognition process **400**. As further examples, the voice command "I4" or "I4 Up" would increase the Line Density setting by one step. The voice command "I4 Down 2" would decrease the Line Density setting by two steps. Further, and as shown in **FIG. 5**, a voice command such as "Tab 2" could be used to switch from the Carotid tab to the Thyroid tab, causing the screen **150** to display a new set of icons **200** in the control portion **180**.

[**0043**] It should be noted that the voice commands for some operations and parameters, such as low use controls, may only be operable using the generic voice commands (i.e., identifiers **212**), while voice commands for some operations and parameters, such as high use commands, may be operable using the generic voice command or a word command. For example, a voice command such as "Compound" turns on/off the compounding when in the B-mode of operation as shown in **FIG. 4**. Alternatively, a voice command such as "H1" may also be used to turn on/off the compounding operation.

[**0044**] To control the physical controls (e.g., rotaries) corresponding to the set of indicators **188**, and referring to **FIG. 4**, a voice command such as "Rotary 1 down 2" decreases the Power Output setting by two steps. It this case, the command would cause the same effect as the physical rotary being turned two clicks to the left. A voice command such as "Push Rotary 1" causes the ultrasound systems **10** and **100** to take the same action as if that physical control was pushed.

[**0045**] Thus, the ease of use of the voice commands of the various embodiments of the present invention provides improved recognition accuracy as a result of the reduced command set size, and also decreases misinterpreted commands due to similar voice commands. Users also are not required to learn a large set of voice commands to control operation of the ultrasound machines **10** and **100**, for example, learning all voice commands including low use commands. Users also may view the specific generic commands on the screen **150** as needed and new or additional controls may be associated with a generic voice command (i.e., identifier **212**).

[**0046**] While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.

What is claimed is:

1. A user interface for controlling an ultrasound system, comprising:

a plurality of selectable elements for controlling operation of the ultrasound system; and

a plurality of identifiers, each identifier corresponding to one of the plurality of selectable elements and associating control commands with the selectable elements.

2. A user interface in accordance with claim 1, wherein the plurality of selectable elements are configured for manual selection.

3. A user interface in accordance with claim 1, wherein the plurality of selectable elements are configured for selection using voice commands.

4. A user interface in accordance with claim 3, wherein the plurality of identifiers are voice control identifiers associating the voice commands with the plurality of selectable elements.

5. A user interface in accordance with claim 1, wherein the plurality of selectable elements comprise icons.

6. A user interface in accordance with claim 1, wherein the plurality of selectable elements are configured in a matrix arrangement.

7. A user interface in accordance with claim 1, wherein the plurality of selectable elements comprises a first set of selectable elements and a second set of selectable elements, and wherein the first set of selectable elements is fixed and the second set of selectable elements is configured to change based upon a mode of operation of the ultrasound system.

8. A user interface in accordance with claim 1, wherein the plurality of selectable elements comprise one or more mode selection elements.

9. A user interface in accordance with claim 1, further comprising a voice control input for receiving voice control commands, the identifiers associating the voice control commands with the plurality of selectable elements.

10. A user interface in accordance with claim 9, wherein the voice control commands comprise command words corresponding to one or more of the plurality of selectable elements.

11. A user interface in accordance with claim 1, further comprising a database having stored therein the control commands and a lookup table with addresses associating the selectable elements corresponding to the identifiers with the control commands stored within the database.

12. A voice controlled ultrasound system, comprising:

a user input providing selection of one or more of a plurality of control commands for controlling the ultrasound system; and

a voice control input for receiving voice commands corresponding to control commands for controlling the ultrasound system.

13. A voice controlled ultrasound system in accordance with claim 12, wherein the user input is configured to display voice command identifiers corresponding to each of the plurality of control commands and associating the voice commands with the control commands.

14. A voice controlled ultrasound system in accordance with claim 12, wherein the user input comprises a display for displaying a voice command matrix defining voice command identifiers corresponding to each of the control commands.

15. A voice controlled ultrasound system in accordance with claim 12, wherein the voice control input comprises one of a wired or wireless microphone.

16. A voice controlled ultrasound system in accordance with claim 12, wherein the user input is configured for manual selection of the plurality of control commands.

17. A voice controlled ultrasound system in accordance with claim 12, further comprising a database having stored therein the control commands and a lookup table with addresses associating the voice commands with the control commands stored within the database.

18. A method for controlling an ultrasound system, the method comprising:

receiving an audio input;

determining voice commands within the audio input; and

associating the voice command with a control command to control the operation of the ultrasound system.

19. A method in accordance with claim 18, wherein the voice commands comprise one or more identifiers, and further comprising associating the one or more identifiers with operations for controlling the ultrasound system.

20. A method in accordance with claim 18, further comprising receiving manual user inputs for controlling the ultrasound system.

21. A method in accordance with claim 18, wherein the voice commands comprise word commands corresponding to one or more operations.

22. A method in accordance with claim 18, wherein the associated control commands change based upon a mode of operation of the ultrasound system.

23. A method in accordance with claim 18, wherein the associating comprises accessing a database having stored therein the control commands and a lookup table with addresses for associating the voice commands with the control commands stored within the database.

* * * * *

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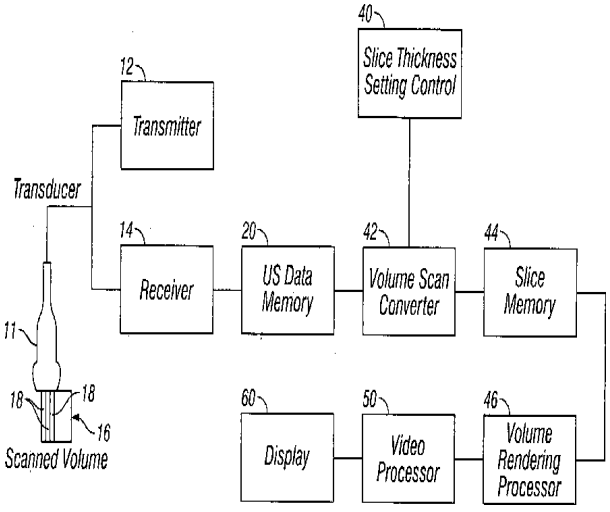
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