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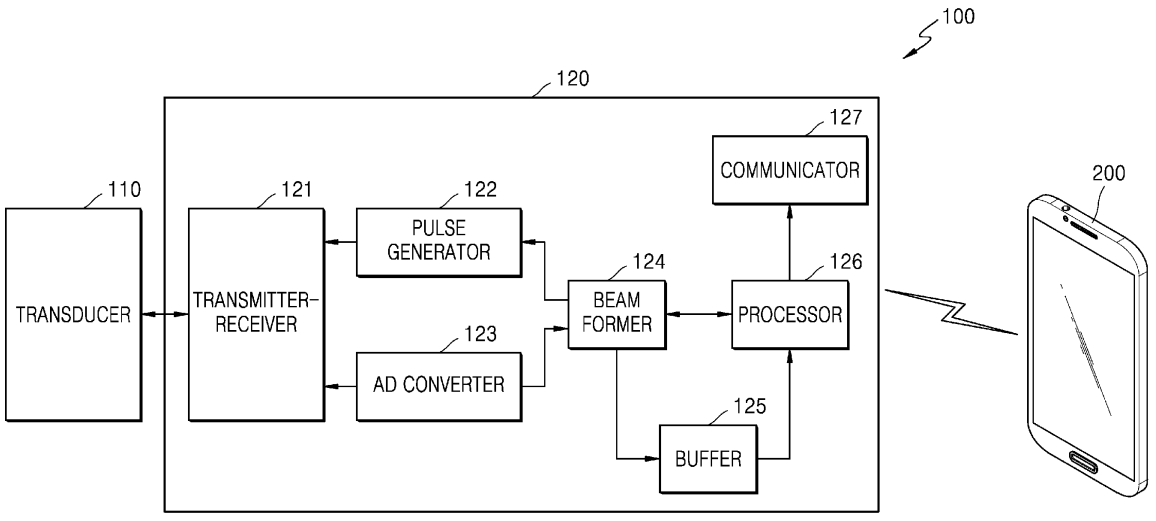
(54) PORTABLE ULTRASONIC DIAGNOSTIC DEVICE AND METHOD FOR OPERATING SAME

(57) A portable ultrasonic diagnostic device, according to the present invention, comprises: a transducer for generating an ultrasonic pulse from an applied electrical pulse, irradiating the ultrasonic pulse to a subject to be diagnosed, and receiving an echo signal; and a main circuit unit for generating an electrical pulse which is to be applied to the transducer, generating scanline data from the echo signal, and transmitting to a portable terminal the scanline data or frame data which comprises a predetermined number of scanline data items, wherein the main circuit unit transmits the scanline data or the frame data, during the time other than the time in which the echo signal is received, and generates the electrical pulse during the time other than the time in which the scanline data or the frame data is transmitted.

FIG. 1



EP 3 456 263 A1

Description

Technical Field

[0001] The present invention relates to a portable ultrasonic diagnostic device and a method of operating the same.

Background Art

[0002] Ultrasonic diagnostic devices are generally used in the medical field for obtaining information on an inside of an object to be inspected due to noninvasive and nondestructive properties thereof. Since ultrasonic diagnostic systems can provide a high-resolution image of internal organs of an object to be inspected, to a practitioner without a surgical operation of directly incising and observing the object, ultrasonic diagnostic systems are very significantly used.

[0003] An ultrasonic diagnostic device is a system which obtains images concerning tomography of soft tissue or blood flows without invasion by emitting an ultrasonic signal from a body surface of an object to be inspected toward a target part in a body and extracting information from the reflected ultrasonic signal.

[0004] Such ultrasonic diagnostic devices are generally used for diagnosing a heart, abdominal organs, urinary organs, and genital organs due to a small size, a low price, a capability of displaying in real time, and high security thereof without radiation exposure of X-rays or the like in comparison to an X-ray inspection device, a computerized tomography (CT) scanner, a magnetic resonance image (MRI) scanner, a nuclear medicine inspection device, and the like.

[0005] Recently, attempts have been made to embody a portable ultrasonic diagnostic device and connecting a portable terminal such as a smart phone and a tablet personal computer (PC) to the ultrasonic diagnostic device through wireless communications so as to perform ultrasonic diagnoses.

Disclosure of Invention

Technical Problem

[0006] In the case of a portable ultrasonic diagnostic device, during a process of obtaining ultrasonic image data, an internal signal and a high-frequency signal transmitted from the portable ultrasonic diagnostic device to a portable device have influences on each other such that signal quality suffers.

[0007] Also, since power consumption is great while transmitting data to the portable terminal, noise may occur in the internal signal due to load variation between when data is transmitted to the portable terminal and when not transmitted.

[0008] The present invention is directed to providing a portable ultrasonic diagnostic device and a method of operating the same capable of improving signal quality by preventing an internal signal and a high-frequency signal transmitted to a portable terminal from having influences on each other during a process of obtaining ultrasonic image data and capable of preventing noise occurrence in the internal signal caused by load variation between when data is transmitted to the portable terminal and when not transmitted.

Technical Solution

[0009] One aspect of the present invention provides a portable ultrasonic diagnostic device including a transducer which generates and emits an ultrasonic pulse from an applied electrical signal toward an object to be inspected and receives an echo signal therefrom and a main circuit portion which generates an electrical pulse to be applied to the transducer, generates scan line data from the echo signal, and transmits the scan line data or frame data including a certain number of scan line data to a portable terminal. Here, the main circuit portion transmits the scan line data or the frame data during a time except a reception time of the echo signal and generates the electrical pulse during a time except a transmission time of the scan line data or the frame data.

[0010] The main circuit portion may transmit the scan line data when the reception time of the echo signal is completed, and may generate an electrical pulse for a next scan line when the scan line data is completely transmitted.

[0011] The main circuit potion may include a pulse generator which generates the electrical pulse, a beam former which generates the scan line data by beam-forming the echo signal, and a processor which transmits the scan line data. Here, the processor may transmit the scan line data when the reception time of the echo signal is completed, and the pulse generator may generate the electrical pulse for the next scan line when the scan line data is completely transmitted.

[0012] The main circuit portion may further include a buffer which stores the scan line data, and the processor may transmit the scan line data stored in the buffer when the reception time of the echo signal is completed.

[0013] The reception time of the echo signal may be determined according to a set diagnosis depth of the portable ultrasonic diagnostic device.

[0014] The main circuit portion may transmit the frame data when a reception time of an echo signal for a last scan line, which forms a frame, is completed and may generate an electrical pulse for a first scan line of a next frame when the frame data is completely transmitted.

[0015] The main circuit potion may include a pulse generator which generates the electrical pulse, a beam former which generates the scan line data by beam-forming the echo signal, a buffer which stores the generated scan line data, and a processor which transmits frame data including a certain number of the scan line data stored in the buffer. Here, the processor may transmit

the frame data when the reception time of the echo signal for the last scan line is completed, and the pulse generator may generate the electrical pulse for the first scan line of the next frame when the frame data is completely transmitted.

[0016] The reception time of the echo signal may be determined according to a set diagnosis depth of the portable ultrasonic diagnostic device.

[0017] Another aspect of the present invention provides a method of operating a portable ultrasonic diagnostic device, the method including emitting an ultrasonic pulse toward an object to be inspected and receiving an echo signal therefrom, generating scan line data from the echo signal when a reception time of the echo signal is completed, and transmitting the scan line data to a portable terminal, and emitting an ultrasonic pulse for a next scan line when the scan line data is completely transmitted.

[0018] Still another aspect of the present invention provides a method of operating a portable ultrasonic diagnostic device, the method including (a) emitting an ultrasonic pulse toward an object to be inspected and receiving an echo signal, (b) generating scan line data from the echo signal when a reception time of the echo signal is completed, generating frame data including a certain number of scan line data by repeatedly performing operation (a) and operation (b), transmitting the generated frame data, and emitting an ultrasonic pulse for a first scan line of a next frame when the frame data is completely transmitted.

Advantageous Effects

[0019] According to the present invention, a portable ultrasonic diagnostic device may improve signal quality by preventing an internal signal and a high-frequency signal transmitted to a portable terminal from having influences on each other during a process of obtaining ultrasonic image data and may prevent noise occurrence in the internal signal due to load variation between when data is transmitted to the portable terminal and when not transmitted.

Brief Description of Drawings

[0020]

FIG. 1 illustrates components of a portable ultrasonic diagnostic device according to one embodiment of the present invention.

FIG. 2 is a timing chart illustrating a process of generating an ultrasonic pulse and receiving an echo signal so as to generate scan line data.

FIG. 3 is a timing chart illustrating a process of obtaining frame data using a plurality of scan line data.

FIG. 4 is a timing chart illustrating obtainment and transmission of scan line data according to a method of transmitting scan line data.

FIG. 5 is a timing chart illustrating obtainment and transmission of frame data according to a method of transmitting frame data.

FIG. 6 is a timing chart illustrating obtainment and transmission of scan line data in the case of transmitting scan line data.

FIG. 7 is a timing chart illustrating obtainment and transmission of frame data in the case of transmitting frame data.

FIG. 8 is a flowchart illustrating a method of operating a portable ultrasonic diagnostic device according to one embodiment of the present invention.

FIG. 9 is a flowchart illustrating a method of operating a portable ultrasonic diagnostic device according to another embodiment of the present invention.

Mode for Invention

[0021] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the attached drawings. In the following description and the attached drawings, substantially like elements are referred to as like reference numerals such that a repetitive description will be omitted. In the description of the present invention, a detailed description on well-known functions or components of the related art will be omitted when it is deemed to obscure the essence of the present invention.

[0022] FIG. 1 illustrates components of a portable ultrasonic diagnostic device according to one embodiment of the present invention.

[0023] A portable ultrasonic diagnostic device 100 according to an embodiment of the present invention includes a transducer 110 and a main circuit portion 120.

[0024] The transducer 110 generates an ultrasonic pulse from an electrical pulse applied by the main circuit portion 120, emits the ultrasonic pulse toward an inside of an object to be inspected, converts an echo signal, which is the ultrasonic pulse reflected by the object and returns, into an electrical signal, and transmits the electrical signal to the main circuit portion 120. The transducer 110 may be formed of a piezoelectric element array module. The piezoelectric element array module may include a large number, for example, 64, 128, 192, and the like of piezoelectric elements which are arranged in an alignment shape. As the piezoelectric elements, lead zirconate titanate (PZT) having excellent electroacoustic conversion efficiency may be used. As a voltage of the electrical pulse for driving the piezoelectric elements, a voltage of+100 V to -100 V may be used.

[0025] The main circuit portion 120 generates an electrical pulse to be applied to the transducer 110, generates scan line data or frame data including a certain number scan line data by analyzing an echo signal received through the transducer 110, and transmits the scan line data or the frame data to a portable terminal 200.

[0026] The portable terminal 200 converts data received from the portable ultrasonic diagnostic device 100

into an ultrasonic image adequate for resolution of a display screen and displays the ultrasonic image through the display screen. The portable terminal 200 may be any device capable of interworking with the portable ultrasonic diagnostic device 100. For example, the portable terminal 200 may be one of a laptop personal computer (PC), a cellular phone, a portable media player, personal digital assistants (PDA), a tablet PC, a smart phone, and the like.

[0027] Data transmission and reception between portable ultrasonic diagnostic device 100 and the portable terminal 200 may be performed using a wireless communication method. As the wireless communication method, Bluetooth, wireless universal serial bus (USB), wireless local area network (LAN), wireless fidelity (WiFi), Zigbee, infrared data association (IrDA), or the like may be used.

[0028] In detail, the main circuit portion 120 includes a transmitter-receiver 121, a pulse generator 122, an analog-digital (AD) converter 123, a beam former 124, a buffer 125, a processor 126, and a communicator 127.

[0029] The transmitter-receiver 121 transmits an electrical pulse generated by the pulse generator 122 to the transducer 110 and transmits an echo signal received through the transducer 110 to the AD converter 123. For example, the transmitter-receiver 121 may be configured as a switch which connects a TX circuit to the piezoelectric element array module during ultrasound transmission and connects a RX circuit to the piezoelectric element array module during echo reception.

[0030] The pulse generator 122 generates an electrical pulse to be applied to the transducer 110 to generate an ultrasonic pulse.

[0031] The AD converter 123 converts an echo signal transmitted from the transmitter-receiver 121 into a digital signal.

[0032] The beam former 124 performs TX beam forming and RX beam forming. The TX beam forming refers to allowing the pulse generator 122 to generate an adequate electrical pulse by using a parameter corresponding to the transducer 110. For example, a time of an electrical pulse is delayed according to a position of a piezoelectric element when an ultrasound is transmitted or received, so as to focus ultrasonic energy on a focal point at a certain distance. The RX beam forming refers to performing data conversion on a digital signal from the AD converter 123 in accordance with the transducer 110 and storing the data-converted digital signal in the buffer 125. For example, an electrical signal output from each piezoelectric element is time-delayed according to a position and a reception time of the piezoelectric element when an echo signal is received, and scan line data is generated by adding the time-delayed signals.

[0033] The processor 126 controls the beam former 124 to perform beam forming adequate for the transducer 110, transmits the scan line data stored in the buffer 125 to the portable terminal 200 through the communicator 127, or transmits frame data including a certain number of scan line data stored in the buffer 125 to the portable terminal 200 through the communicator 127.

[0034] Also, the processor 126 controls each element of the portable ultrasonic diagnostic device 100. The processor 126 may compress scan line data or frame data so as to reduce a bandwidth used for communication as necessary.

[0035] The communicator 127 is a communication module for transmitting or receiving data with an external display device and may use a wired or wireless communication method. As the wired communication method, a cable such as a USB cable and the like may be used. As the wireless communication method, one of Bluetooth, wireless USB, wireless LAN, WiFi, Zigbee, and IrDA may be used.

[0036] For understanding of the present invention, an operation of an existing potable ultrasonic diagnostic device (although not always a conventional technology) will be described with reference to FIGS. 2 to 5.

[0037] FIG. 2 is a timing chart illustrating a process of generating an ultrasonic pulse and receiving an echo signal so as to generate scan line data.

[0038] The portable ultrasonic diagnostic device emits an nth ultrasonic pulse. When an echo signal is received during an echo reception time and nth scan line data is generated, the portable ultrasonic diagnostic device emits an n+1th ultrasonic pulse. The echo reception time (or a line scan time) is determined according to a set diagnosis depth of the portable ultrasonic diagnostic device. For example, when an ultrasound transmission speed is 1.54 mm/μs and a diagnosis depth is set to be 10 cm, since it takes about 65 μs to transmit an ultrasonic wave to a part 10 cm deep, an echo reception time becomes 130 μs corresponding to a reciprocation time of 10 cm. That is, in the portable ultrasound diagnostic device, when a diagnosis depth is set to be 10 cm, an echo signal is received for 130 μs from when an ultrasonic pulse is emitted, which is a line scan time taken for obtaining one piece of scan line data.

[0039] FIG. 3 is a timing chart illustrating a process of obtaining frame data using a plurality of scan line data.

[0040] For example, one frame may be formed of 128 scan lines. In this case, 128 pieces of scan line data may be generated by discharging 128 ultrasonic pulses and receiving echo signals with respect to the ultrasonic pulses so as to obtain one piece of frame data. A frame scan time, which is a time taken for obtaining one piece of frame data, is obtained by multiplying the line scan time by the number of scan lines for each frame. According to the example, 130μs$\times$128=16.64ms.

[0041] As a method of transmitting ultrasonic image data from the portable ultrasonic diagnostic device to the portable terminal, there are a method of transmitting generated scan line data each time and a method of transmitting frame data, that is, a plurality of scan line data which form one frame.

[0042] FIG. 4 is a timing chart illustrating obtainment and transmission of scan line data according to a method

of transmitting scan line data.

[0043] As shown in FIG. 4, nth scan line data, which is obtained by emitting an nth ultrasonic pulse and receiving an echo signal, is transmitted to the portable terminal while an n+1th ultrasonic pulse is emitted and an echo signal thereof is received for an n+1th scan line. Accordingly, during a process of obtaining n+1th scan line data, internal signals and high frequency signals which carry the nth scan line data transmitted to the portable terminal have influences on each other such that signal quality suffers.

[0044] FIG. 5 is a timing chart illustrating obtainment and transmission of frame data according to a method of transmitting frame data.

[0045] As shown in FIG. 5, Nth frame data, which is obtained by emitting of ultrasonic pulses and receiving of echo signals as many as the number of scan lines per frame, is transmitted to the portable terminal. The Nth frame data is transmitted to the portable terminal while repeatedly, ultrasonic pulses are emitted and echo signals are received for an N+1th frame. Accordingly, during a process of obtaining N+1th frame data, internal signals and high frequency signals which carry the nth frame data transmitted to the portable terminal have influences on each other such that signal quality suffers.

[0046] The applicant paid attention to a possibility of allowing a reception time of an echo signal and a data transmission time to a portable terminal not to overlap with each other in consideration of a frame rate of an ultrasonic image and a time taken for obtaining scan line data or frame data.

[0047] A general frame rate of an ultrasonic image is 30 frames/second. Accordingly, a time per frame is about 33 ms. When an ultrasonic diagnosis depth is 10 cm, a line scan time is 130 μs, that is, 0.13 ms. When the number of scan lines per frame is 128, a frame scan time is 16.64 ms. When frame data is transmitted to the portable terminal, since one frame is maximally transmitted every 33 ms, a spare time of 33-16.64=16.36ms remains. When the frame rate is reduced as, for example, 15 frames/sec, a spare time further increases.

[0048] In the method of transmitting frame data, the spare time is adequate for transmitting frame data. That is, one frame is scanned for 16.64 ms and then a spare time of maximum 16.36 ms is available before starting scanning of a next frame. Here, it is only needed to transmit frame data during the spare time.

[0049] In the method of transmitting scan line data, a maximum allowed period of transmitting scan line data is about 260 μs when a frame rate is 30 frames/sec and the number of scan lines per frame is 128. Accordingly, when an ultrasonic diagnosis depth is 10 cm, one scan line is scanned for 130 μs and then a spare time of maximum 130 μs is available before starting scanning of a next scan line. Here, it is only needed to transmit scan line data during the spare time. The spare time is also adequate for transmitting scan line data.

[0050] On the basis of the above point, the main circuit portion 120, during a time except a reception time of an echo signal, may transmit scan line data or frame data to the portable terminal 200, and during a time except scan line data or frame data transmission time, may generate and apply an electrical pulse for an ultrasonic pulse to the transducer 110 and may receive an echo signal therefrom.

[0051] As one embodiment, in the case of a method of transmitting scan line data from the portable ultrasonic diagnostic device 100 to the portable terminal 200, when the reception time of the echo signal is completed, the main circuit portion 120 may transmit corresponding scan line data, and when the scan line data is completely transmitted, the main circuit portion 120 may generate and apply an electrical pulse for a next scan line to the transducer 110.

[0052] In detail, the processor 126 may transmit scan line data stored in the buffer 125 when the reception time of the echo signal is completed, and the pulse generator 122 may generate and apply an electrical pulse for a next scan line to the transducer 110 through the transmitter-receiver 121 when the scan line data is completely transmitted.

[0053] For this, when an ultrasonic pulse is emitted and the reception time of the echo signal is completed therefrom, the beam former 124 may transmit a signal, which indicates the completion, to the processor 126, and the processor 126 may transmit scan line data stored in the buffer 125 to the portable terminal 200 through the communicator 127 in response to the signal.

[0054] Also, when the scan line data is completely transmitted, the processor 126 may transmit a signal, which indicates the completion, to the beam former 124 and/or the pulse generator 122, and the beam former 124 and the pulse generator 122 may generate and apply an electrical pulse for a next scan line to the transducer 110 through the transmitter-receiver 121.

[0055] The signal, which is transmitted between the processor 126 and the beam former 124 and/or the pulse generator 122, may be an actual electrical signal or may be a particular register value of a central processing unit (CPU) or a field-programmable gate array (FPGA).

[0056] FIG. 6 is a timing chart illustrating obtainment and transmission of scan line data according to an embodiment of the present invention in the case of a method of transmitting scan line data from the portable ultrasonic diagnostic device 100 to the portable terminal 200.

[0057] As shown in FIG. 6, when an ultrasonic pulse for an nth scan line is emitted and a reception time of an echo signal is completed therefrom (t1), the processor 126 transmits nth scan line data in response to a signal from the beam former 124. Also, when the nth scan line data is completely transmitted (t2), the beam former 124 and the pulse generator 122 generates and applies an electrical pulse for an n+1th scan line to the transducer 110 in response to a signal from the processor 126.

[0058] As another embodiment, in the case of a method of transmitting frame data from the portable ultrasonic

diagnostic device 100 to the portable terminal 200, when a reception time of an echo signal for a last scan line, which forms a frame, is completed, the main circuit portion 120 may transmit corresponding frame data, and when the frame data is completely transmitted, the main circuit portion 120 may generate and apply an electrical pulse for a first scan line of a next frame to the transducer 110.

[0059] In detail, the processor 126 may transmit corresponding frame stored in the buffer 125 when the reception time of the echo signal for the last scan line, which forms the frame, is completed, and the pulse generator 122 may generate and apply an electrical pulse for the first scan line of the next frame to the transducer 110 through the transmitter-receiver 121 when the frame data is completely transmitted.

[0060] For this, when an ultrasonic pulse for the last scan line, which forms the frame, is emitted and the reception time of the echo signal is completed therefrom, the beam former 124 may transmit a signal, which indicates the completion, to the processor 126, and the processor 126 may transmit frame data stored in the buffer 125 to the portable terminal 200 through the communicator 127 in response to the signal.

[0061] Also, when the frame data is completely transmitted, the processor 126 may transmit a signal, which indicates the completion, to the beam former 124 and/or the pulse generator 122, and the beam former 124 and the pulse generator 122 may generate and apply an electrical pulse for a first scan line of a next frame to the transducer 110 through the transmitter-receiver 121.

[0062] The signal, which is transmitted between the processor 126 and the beam former 124 and/or the pulse generator 122, may be an actual electrical signal or may be a particular register value of a CPU or an FPGA.

[0063] FIG. 7 is a timing chart illustrating obtainment and transmission of frame data according to an embodiment of the present invention in the case of a method of transmitting frame data from the portable ultrasonic diagnostic device 100 to the portable terminal 200.

[0064] As shown in FIG. 7, when an ultrasonic pulse for a last scan line, which forms an Nth frame, is emitted and a reception time of an echo signal is completed therefrom (T1), the processor 126 transmits Nth frame data stored in the buffer 125 in response to the signal from the beam former 124. Also, when the Nth frame data is completely transmitted (T2), the beam former 124 and the pulse generator 122 generates and applies an electrical pulse for a first scan line of an N+1th frame to the transducer 110 in response to a signal from the processor 126.

[0065] FIG. 8 is a flowchart illustrating a method of operating a portable diagnostic device according to one embodiment of the present invention and illustrates operations of a method of transmitting scan line data from the portable ultrasonic diagnostic device to a portable device.

[0066] The portable ultrasonic diagnostic device 100 emits an ultrasonic pulse toward an object to be inspected (810) and receives an echo signal which is reflected and returns (820).

[0067] When the ultrasonic pulse is emitted and a reception time of the echo signal is completed therefrom (830), the portable ultrasonic diagnostic device 100 generates scan line data (840) and transmits the scan line data to the portable terminal 200 (850).

[0068] When the scan line data is completely transmitted (860), the portable ultrasonic diagnostic device 100 returns to operation 810 to emit an ultrasonic pulse for a next scan line and performs the operations next thereto.

[0069] FIG. 9 is a flowchart illustrating a method of operating a portable diagnostic device according to another embodiment of the present invention and illustrates operations of a method of transmitting frame data from the portable ultrasonic diagnostic device to a portable device.

[0070] The portable ultrasonic diagnostic device 100 emits an ultrasonic pulse toward an object to be inspected (910) and receives an echo signal which is reflected and returns (920).

[0071] When the ultrasonic pulse is emitted and a reception time of the echo signal is completed therefrom (930), the portable ultrasonic diagnostic device 100 generates scan line data (940).

[0072] When frame data is not completely configured (950), the portable ultrasonic diagnostic device 100 repeatedly performs operation 910 to operation 940.

[0073] When the frame data is completely configured (950), that is, when an ultrasonic pulse for a last scan line, which forms a frame, is emitted and a reception time of an echo signal is completed therefrom such that scan line data is generated, the portable ultrasonic diagnostic device 100 transmits corresponding frame data (960).

[0074] When the frame data is completely transmitted (970), the portable ultrasonic diagnostic device 100 returns to operation 910 to emit an ultrasonic pulse for a first scan line of a next frame and performs the operations next thereto.

[0075] The exemplary embodiments of the present invention have been described above. It will be understood by one of ordinary skill in the art that modifications may be made without departing from the essential features of the present invention. Therefore, the disclosed embodiments should be considered in a descriptive point of view not in limitative one. The scope of the present invention is defined by the claims not by the above description, and it should be understood that all differences within the equivalent scope thereof are included in the present invention.

Claims

1. A portable ultrasonic diagnostic device comprising:

a transducer which generates and emits an ultrasonic pulse from an applied electrical signal toward an object to be inspected and receives

an echo signal therefrom; and
a main circuit portion which generates an electrical pulse to be applied to the transducer, generates scan line data from the echo signal, and transmits the scan line data or frame data including a certain number of scan line data to a portable terminal,
wherein the main circuit portion transmits the scan line data or the frame data during a time except a reception time of the echo signal and generates the electrical pulse during a time except a transmission time of the scan line data or the frame data.

2. The portable ultrasonic diagnostic device of claim 1, wherein the main circuit portion transmits the scan line data when the reception time of the echo signal is completed, and generates an electrical pulse for a next scan line when the scan line data is completely transmitted.

3. The portable ultrasonic diagnostic device of claim 2, wherein the main circuit potion comprises:

a pulse generator which generates the electrical pulse;
a beam former which generates the scan line data by beam-forming the echo signal; and
a processor which transmits the scan line data,
wherein the processor transmits the scan line data when the reception time of the echo signal is completed, and
wherein the pulse generator generates the electrical pulse for the next scan line when the scan line data is completely transmitted.

4. The portable ultrasonic diagnostic device of claim 3, wherein the main circuit portion further comprises a buffer which stores the scan line data, and
wherein the processor transmits the scan line data stored in the buffer when the reception time of the echo signal is completed.

5. The portable ultrasonic diagnostic device of claim 2, wherein the reception time of the echo signal is determined according to a set diagnosis depth of the portable ultrasonic diagnostic device.

6. The portable ultrasonic diagnostic device of claim 1, wherein the main circuit portion transmits the frame data when a reception time of an echo signal for a last scan line, which forms a frame, is completed, and generates an electrical pulse for a first scan line of a next frame when the frame data is completely transmitted.

7. The portable ultrasonic diagnostic device of claim 6, wherein the main circuit potion comprises:

a pulse generator which generates the electrical pulse;
a beam former which generates the scan line data by beam-forming the echo signal;
a buffer which stores the generated scan line data; and
a processor which transmits frame data including a certain number of the scan line data stored in the buffer,
wherein the processor transmits the frame data when the reception time of the echo signal for the last scan line is completed, and
wherein the pulse generator generates the electrical pulse for the first scan line of the next frame when the frame data is completely transmitted.

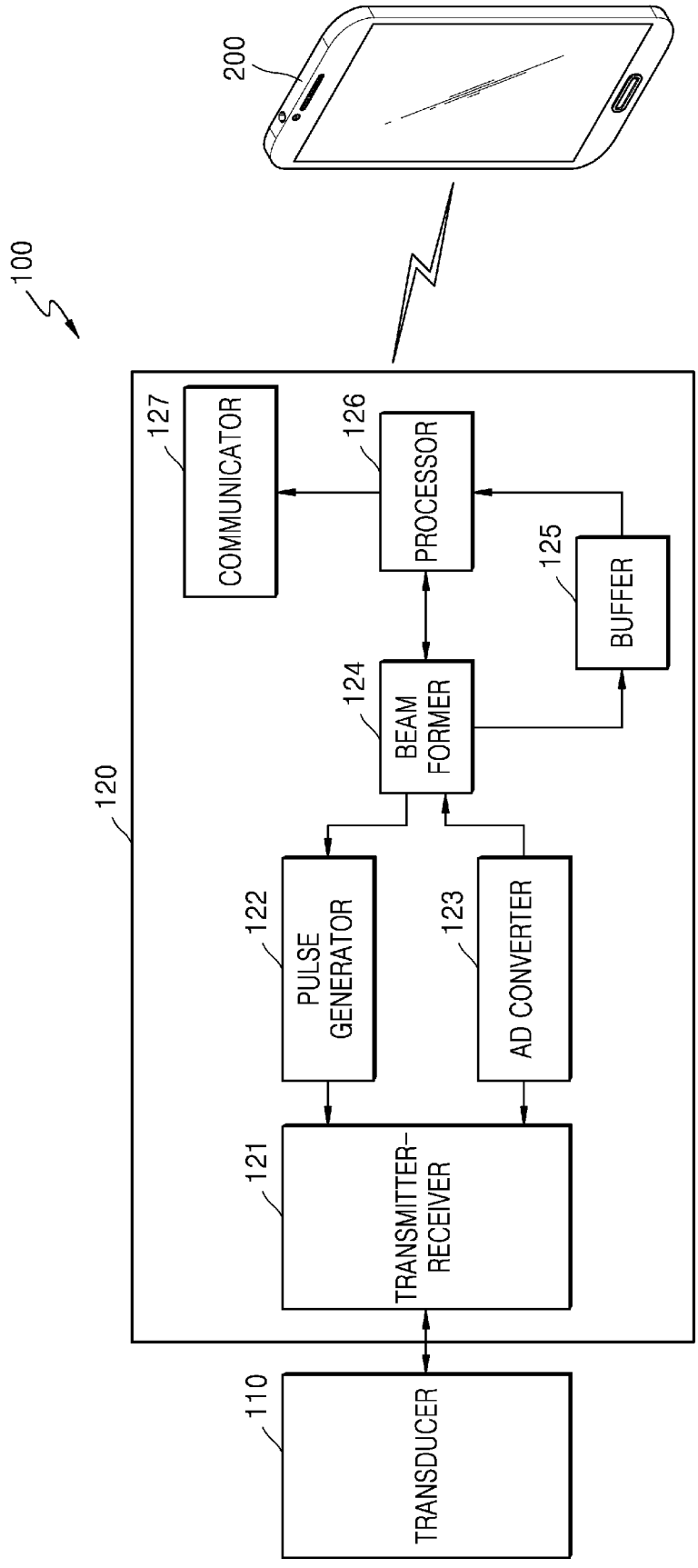
8. The portable ultrasonic diagnostic device of claim 7, wherein the reception time of the echo signal is determined according to a set diagnosis depth of the portable ultrasonic diagnostic device.

9. A method of operating a portable ultrasonic diagnostic device, comprising:

emitting an ultrasonic pulse toward an object to be inspected and receiving an echo signal therefrom;
generating scan line data from the echo signal when a reception time of the echo signal is completed, and transmitting the scan line data to a portable terminal; and
emitting an ultrasonic pulse for a next scan line when the scan line data is completely transmitted.

10. A method of operating a portable ultrasonic diagnostic device, comprising:(a) emitting an ultrasonic pulse toward an object to be inspected and receiving an echo signal;(b) generating scan line data from the echo signal when a reception time of the echo signal is completed;
generating frame data including a certain number of scan line data by repeatedly performing operation (a) and operation (b);transmitting the generated frame data; and
emitting an ultrasonic pulse for a first scan line of a next frame when the frame data is completely transmitted.

FIG. 1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100
120
127
COMMUNICATOR
126
PROCESSOR
125
BUFFER
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PULSE GENERATOR
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AD CONVERTER
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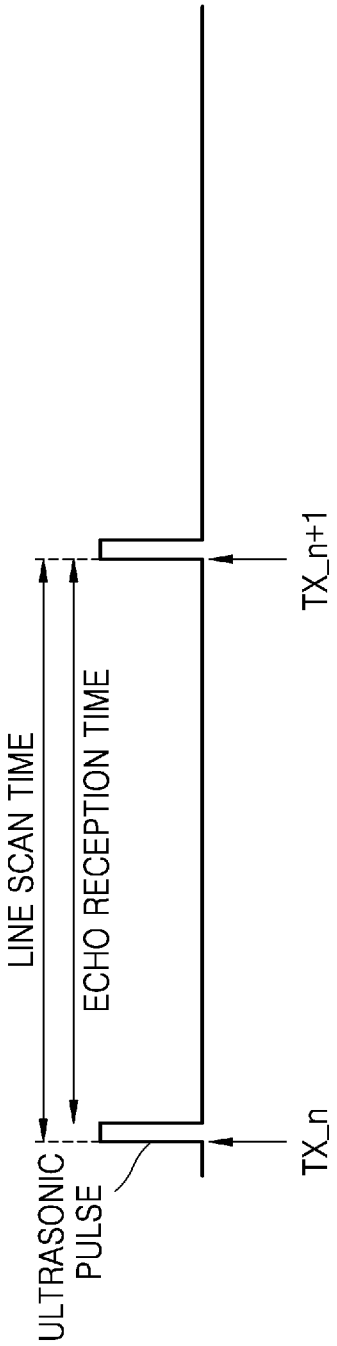
TRANSMITTER-RECEIVER
110
TRANSDUCER

FIG. 2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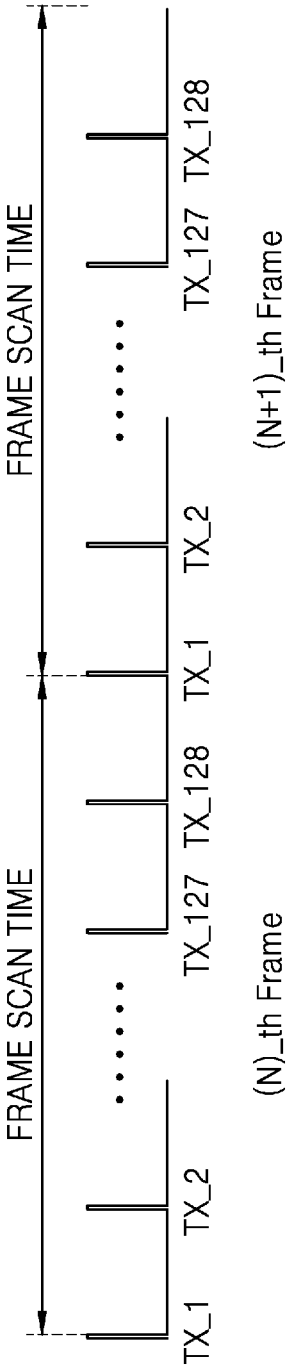
ECHO RECEPTION TIME
TX_n
ULTRASONIC PULSE

FIG. 3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TX_1
TX_2
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(N)_th Frame
FRAME SCAN TIME
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TX_2
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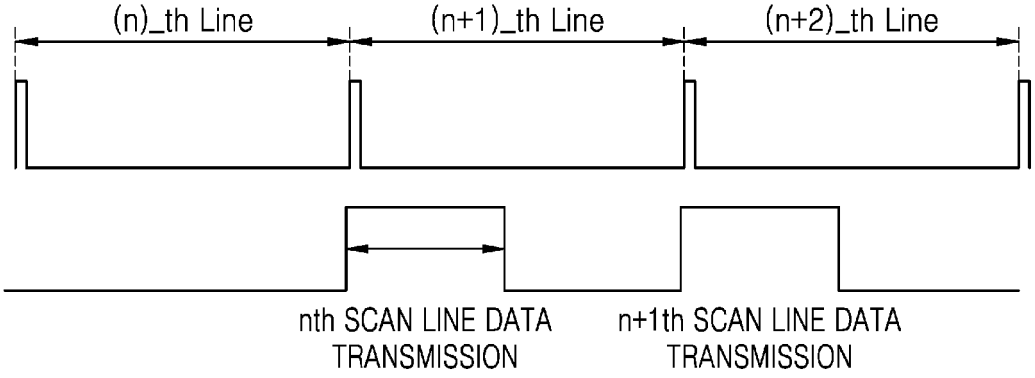
(N+1)_th Frame

FIG. 4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(n+1)_th Line
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nth SCAN LINE DATA TRANSMISSION
n+1th SCAN LINE DATA TRANSMISSION

FIG. 5

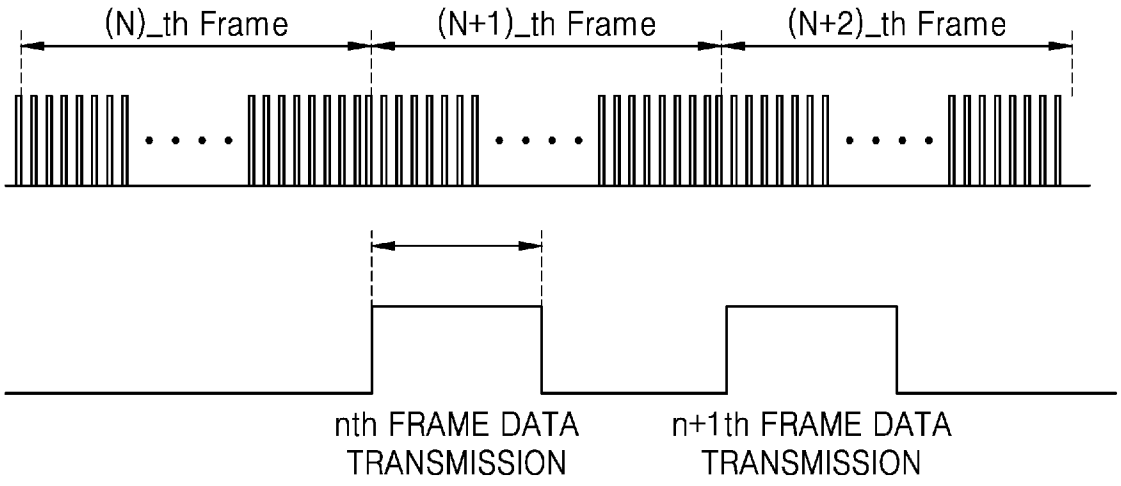

(N)_th Frame
(N+1)_th Frame
(N+2)_th Frame
nth FRAME DATA TRANSMISSION
n+1th FRAME DATA TRANSMISSION

FIG. 6

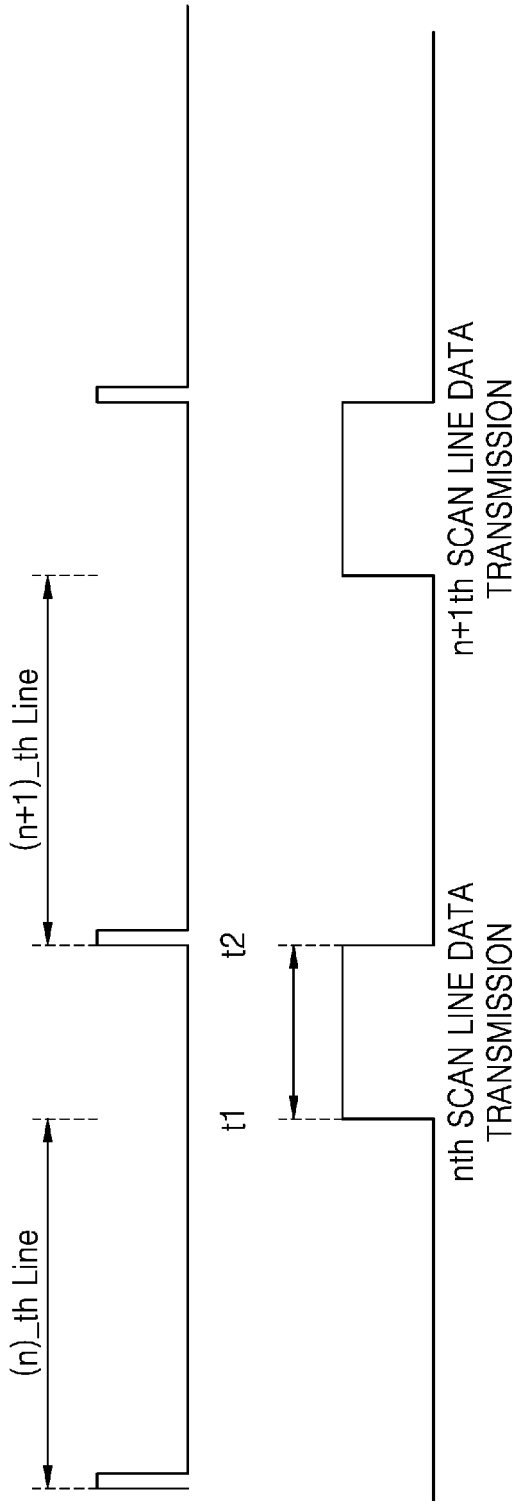

(n)_th Line
(n+1)_th Line
t1
t2
nth SCAN LINE DATA TRANSMISSION
n+1th SCAN LINE DATA TRANSMISSION

FIG. 7

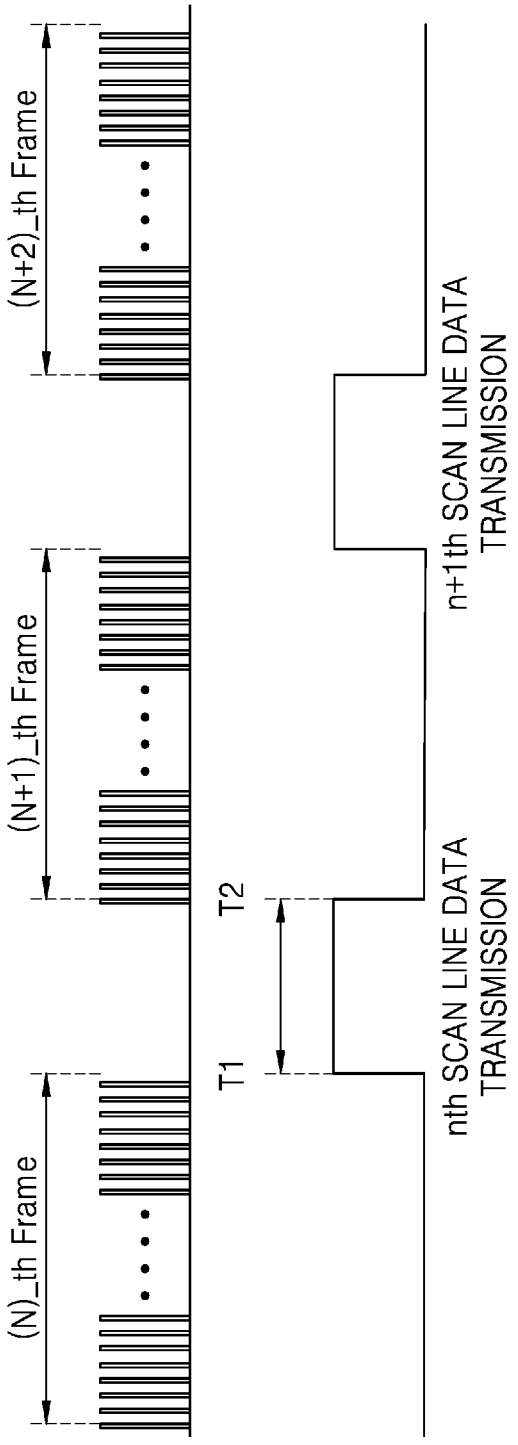

(N)_th Frame
(N+1)_th Frame
(N+2)_th Frame
T1
T2
nth SCAN LINE DATA TRANSMISSION
n+1th SCAN LINE DATA TRANSMISSION

FIG. 8

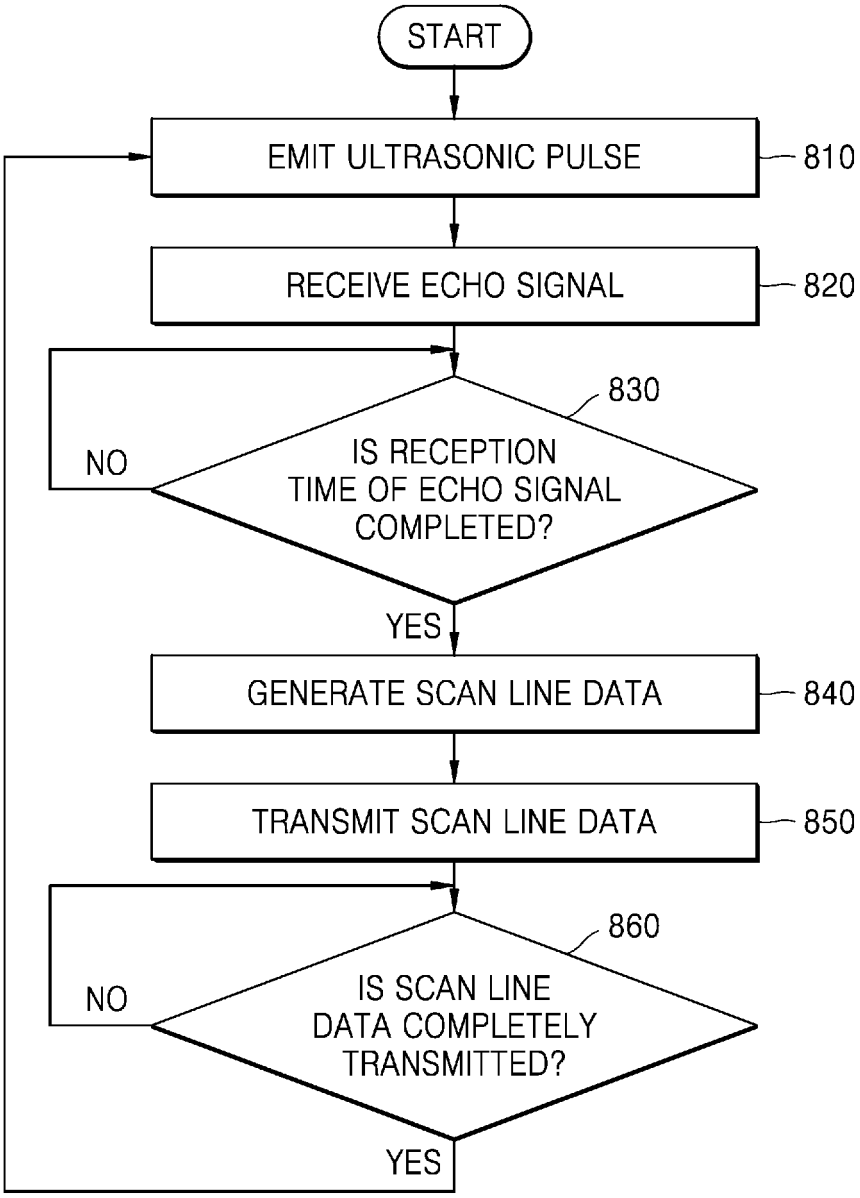
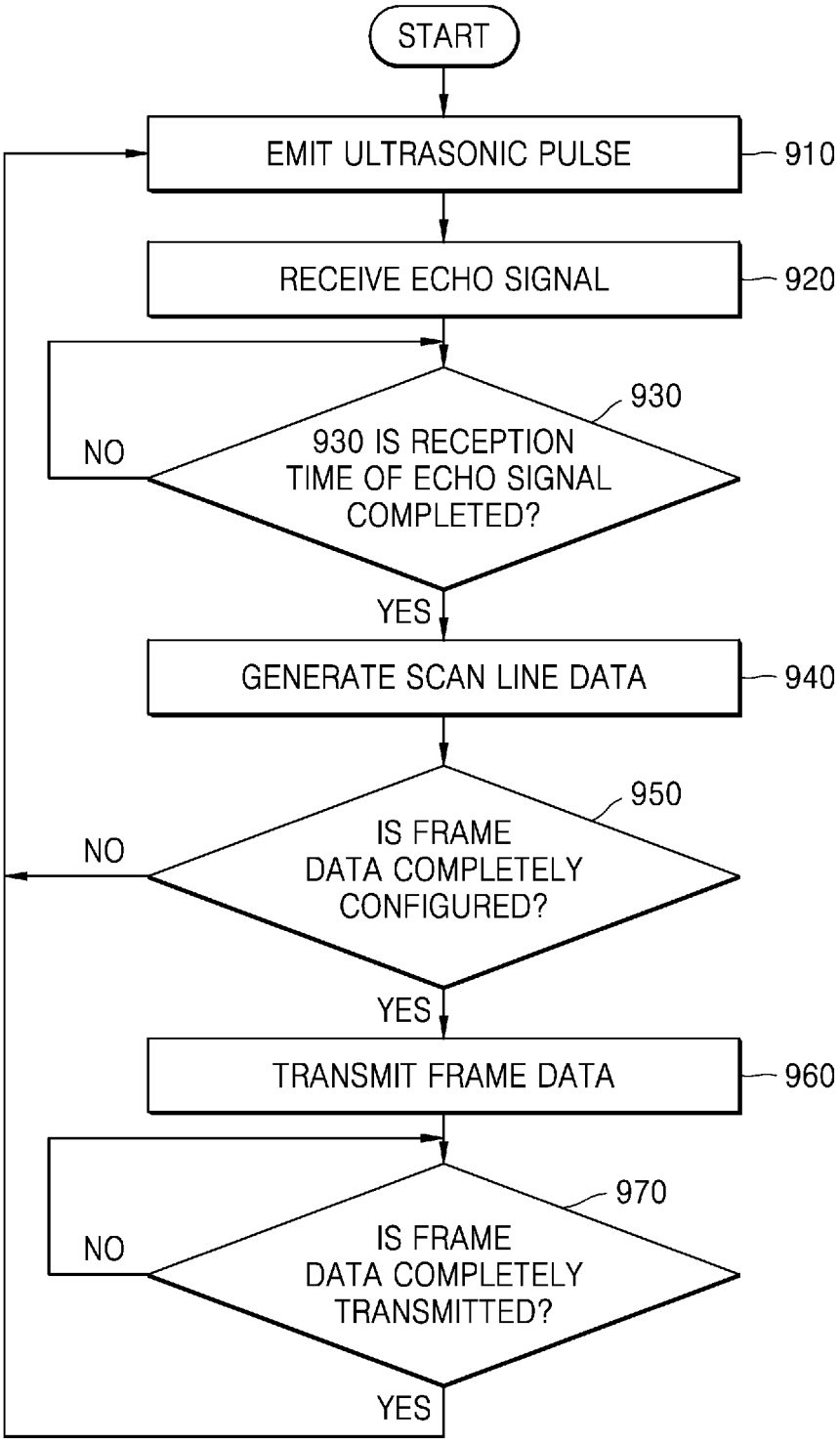

START
EMIT ULTRASONIC PULSE
810
RECEIVE ECHO SIGNAL
820
830
IS RECEPTION TIME OF ECHO SIGNAL COMPLETED?
NO
YES
GENERATE SCAN LINE DATA
840
TRANSMIT SCAN LINE DATA
850
860
IS SCAN LINE DATA COMPLETELY TRANSMITTED?
NO
YES

FIG. 9


START
EMIT ULTRASONIC PULSE
910
RECEIVE ECHO SIGNAL
920
930
930 IS RECEPTION TIME OF ECHO SIGNAL COMPLETED?
NO
YES
GENERATE SCAN LINE DATA
940
950
IS FRAME DATA COMPLETELY CONFIGURED?
NO
YES
TRANSMIT FRAME DATA
960
970
IS FRAME DATA COMPLETELY TRANSMITTED?
NO
YES

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2017/004743

A. CLASSIFICATION OF SUBJECT MATTER

A61B 8/00(2006.01)i, A61B 8/08(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; A61B 8/06; A61B 8/12; G01N 29/26; A61B 8/14; A61B 5/07; A61B 8/08

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: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

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

eKOMPASS (KIPO internal) & Keywords: ultrasonic, portable, mobile, transmission, reception, depth

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-1515809 B1 (DONGGUK UNIVERSITY INDUSTRY-ACADEMIC COOPERATION FOUNDATION et al.) 04 May 2015 See paragraphs [28]-[46], [62]-[69] and figures 1-3, 10.	1-10
Y	JP 2011-212070 A (FUJIFILM CORP.) 27 October 2011 See paragraphs [14]-[27] and figures 1, 2.	1-10
Y	JP 2002-209897 A (GE MEDICAL SYSTEMS GLOBAL TECHNOLOGY CO., LLC.) 30 July 2002 See paragraphs [86]-[90] and figure 15.	5,8
A	JP 2006-122586 A (OLYMPUS CORP.) 18 May 2006 See claims 1-3 and figures 1-3.	1-10
A	KR 10-2014-0026289 A (SAMSUNG MEDISON CO., LTD. et al.) 05 March 2014 See paragraphs [64]-[69] and figures 1-3, 9.	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 JULY 2017 (07.07.2017)	**10 JULY 2017 (10.07.2017)**

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2017/004743

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-1515809 B1	04/05/2015	US 2016-0374645 A1	29/12/2016
		WO 2015-084092 A1	11/06/2015
JP 2011-212070 A	27/10/2011	JP 5452319 B2	26/03/2014
		US 2011-0245677 A1	06/10/2011
		US 8808184 B2	19/08/2014
JP 2002-209897 A	30/07/2002	NONE	
JP 2006-122586 A	18/05/2006	NONE	
KR 10-2014-0026289 A	05/03/2014	EP 2889003 A1	01/07/2015
		EP 2889003 A4	24/08/2016
		KR 10-1562210 B1	22/10/2015
		US 2015-0297180 A1	22/10/2015
		WO 2014-030933 A1	27/02/2014

Form PCT/ISA/210 (patent family annex) (January 2015)

专利名称(译)	便携式超声诊断装置及其操作方法		
公开(公告)号	EP3456263A4	公开(公告)日	2019-12-11
申请号	EP2017796329	申请日	2017-05-08
[标]申请(专利权)人(译)	和赛仑有限公司		
申请(专利权)人(译)	HEALCERION CO.，LTD.		
当前申请(专利权)人(译)	HEALCERION CO.，LTD.		
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IPC分类号	A61B8/00 A61B8/08		
CPC分类号	A61B8/4427 A61B8/54 A61B8/56 A61B8/5207 A61B8/565 A61B8/14		
代理机构(译)	瑞士信贷技术合作伙伴公司		
优先权	1020160057023 2016-05-10 KR		
其他公开文献	EP3456263A1		
外部链接	Espacenet		

摘要(译)

根据本发明的便携式超声诊断设备，包括：换能器，用于从所施加的电脉冲产生超声脉冲，将超声脉冲照射到要诊断的对象，并且接收回波信号；以及 主电路单元，其用于产生将被施加到换能器的电脉冲，从回波信号产生扫描线数据，并且将包括预定数量的扫描线数据项的扫描线数据或帧数据发送到便携式终端，其中 主电路单元在除了接收回波信号的时间之外的时间期间发送扫描线数据或帧数据，并且在除了扫描线数据或帧数据被检测的时间之外的时间期间生成电脉冲。 传输。