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(54) **ULTRASONIC IMAGE GENERATION SYSTEM**

(71) Applicant: **SOCIONEXT INC.**, Yokohama-shi (JP)

(72) Inventors: **Naoto YONEDA**, Yokohama-shi (JP); **Naoto Adachi**, Yokohama-shi (JP); **Hiroaki Takagi**, Yokohama-shi (JP); **Masaya Tamamura**, Yokohama-shi (JP); **Amane Inoue**, Yokohama-shi (JP)

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(57) **ABSTRACT**

An ultrasonic image generation system having an ultrasonic unit configured to transmit and receive an ultrasonic signal, a drive control/signal processing unit configured to repeat processing to generate an ultrasonic image signal by processing a received signal of the ultrasonic unit as well as to generate a drive signal that is supplied to the ultrasonic unit; and a display unit configured to repeat displaying an ultrasonic image based on the ultrasonic image signal, to stop updating of a displayed image in response to a stop signal input, and to resume updating of the displayed image in response to a start signal input, wherein the drive control/signal processing unit stops at least part of an operation in response to the stop signal input and resumes the stopped operation in response to the start signal input.

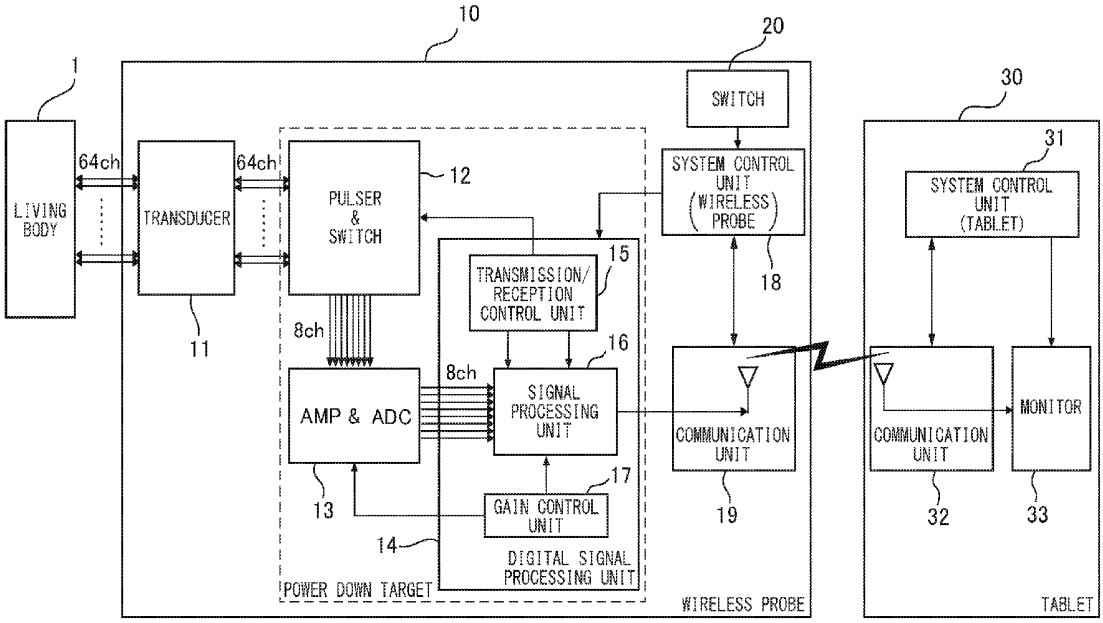

FIG. 1

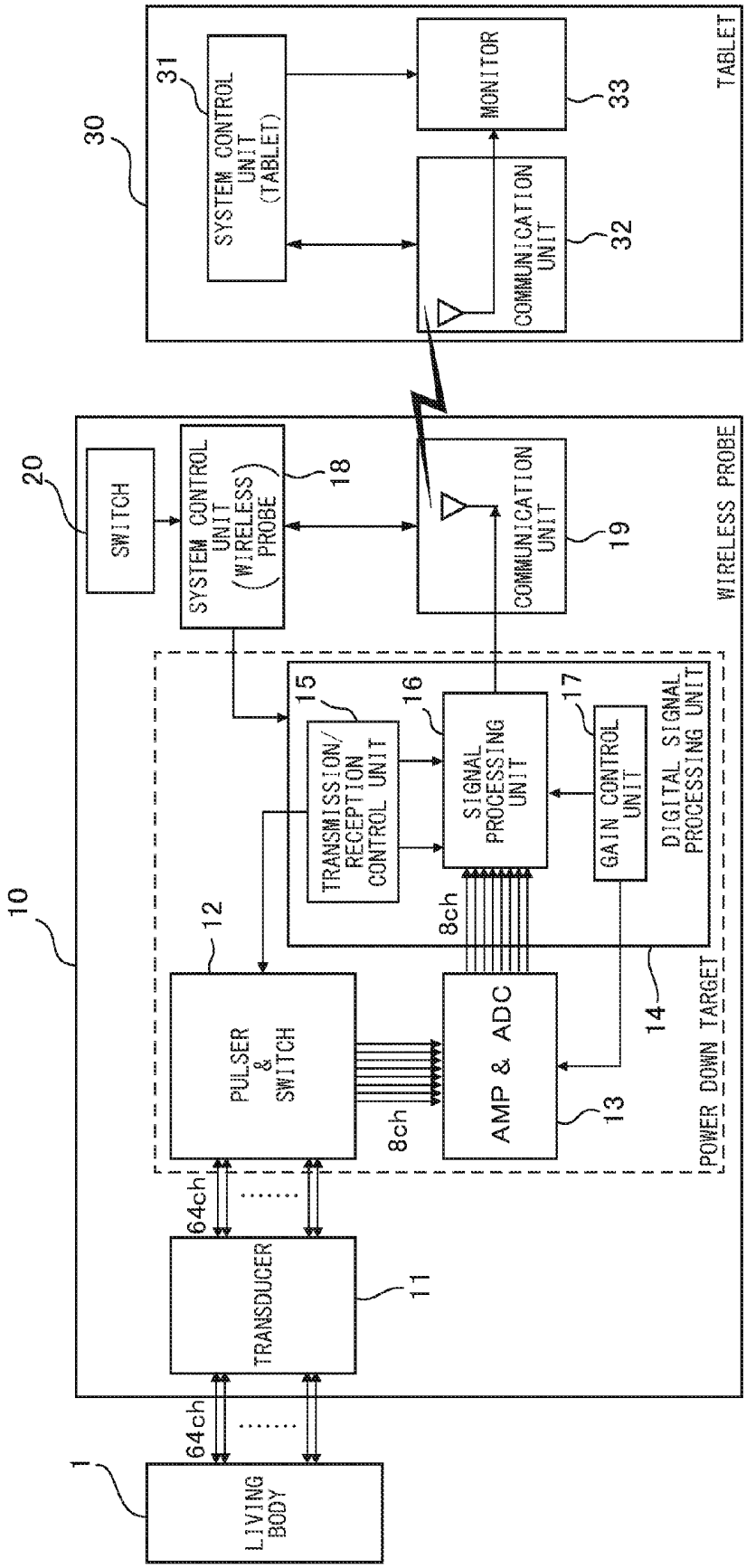
TABLET
30
31
SYSTEM CONTROL UNIT (TABLET)
MONITOR
33
COMMUNICATION UNIT
32
WIRELESS PROBE
20
SWITCH
SYSTEM CONTROL UNIT (WIRELESS PROBE)
18
COMMUNICATION UNIT
19
10
15
TRANSMISSION/ RECEPTION CONTROL UNIT
16
SIGNAL PROCESSING UNIT
17
GAIN CONTROL UNIT
DIGITAL SIGNAL PROCESSING UNIT
8ch
12
PULSER & SWITCH
8ch
AMP & ADC
13
14
POWER DOWN TARGET
64ch
TRANSDUCER
11
64ch
1
LIVING BODY

FIG. 2A

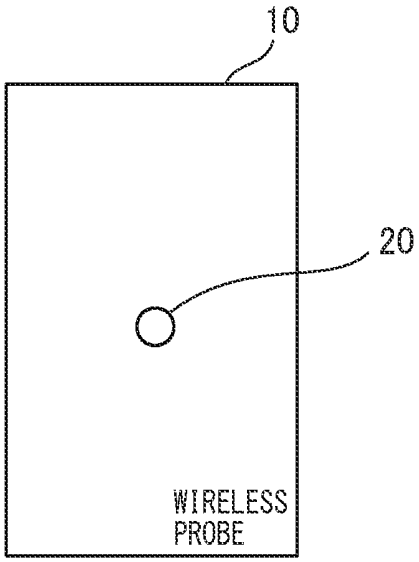

FIG. 2B

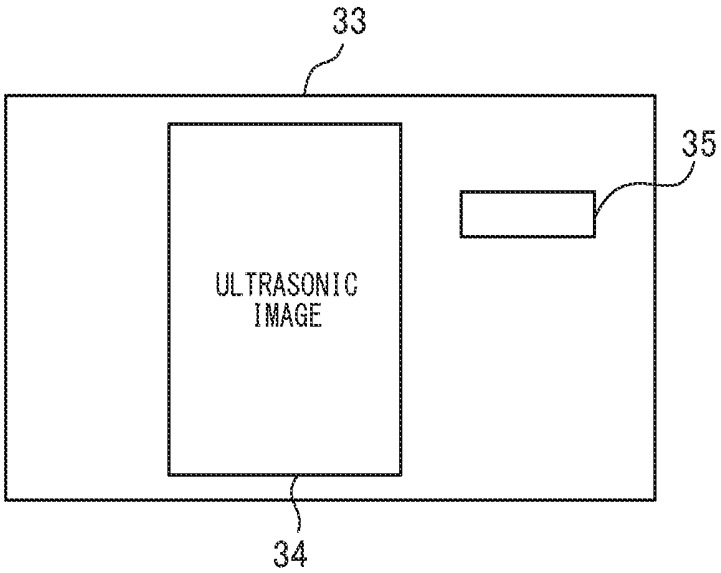

FIG. 3

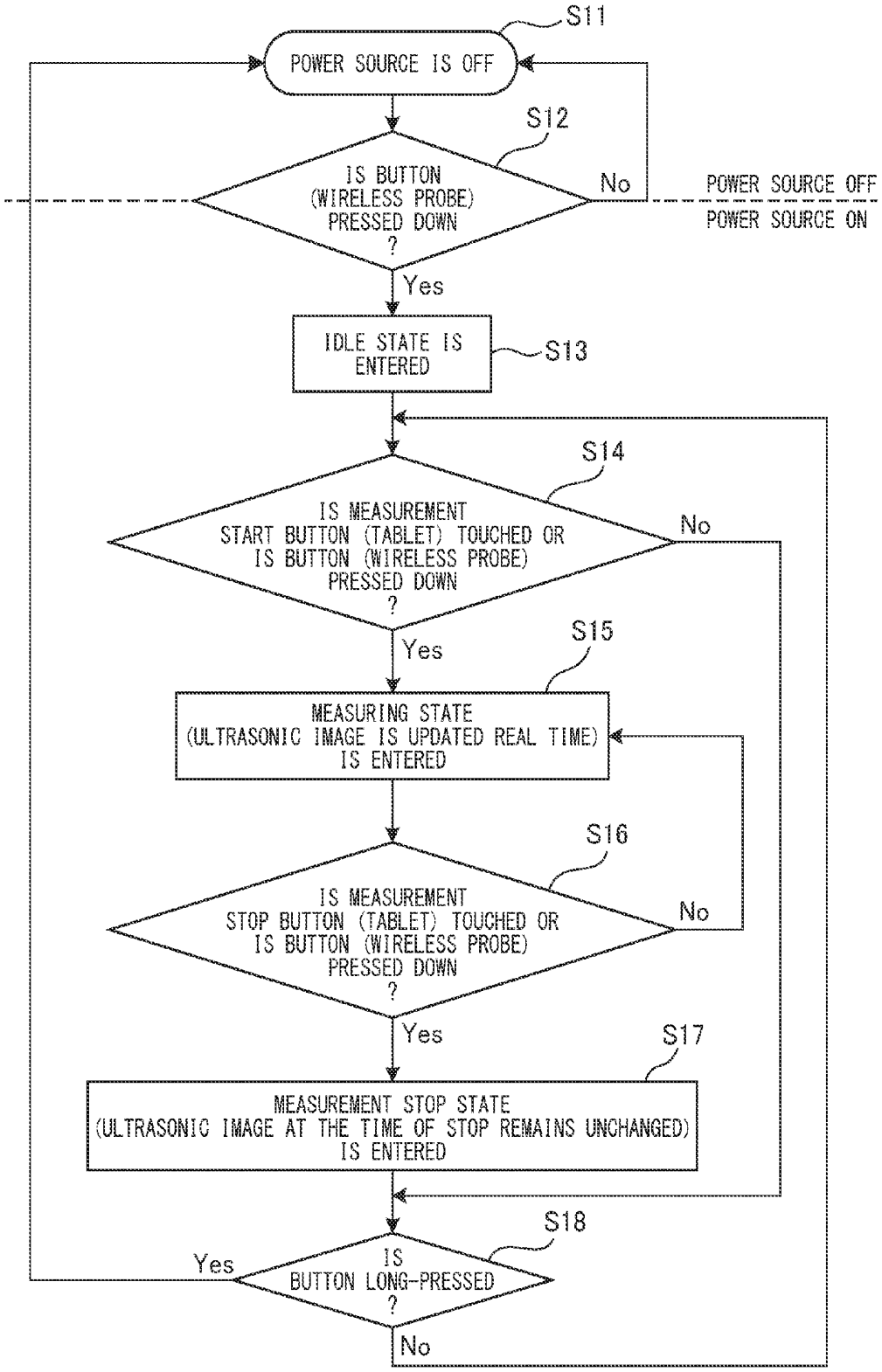
S11
POWER SOURCE IS OFF
S12
IS BUTTON (WIRELESS PROBE) PRESSED DOWN ?
No
POWER SOURCE OFF
POWER SOURCE ON
Yes
IDLE STATE IS ENTERED
S13
S14
IS MEASUREMENT START BUTTON (TABLET) TOUCHED OR IS BUTTON (WIRELESS PROBE) PRESSED DOWN ?
No
Yes
S15
MEASURING STATE (ULTRASONIC IMAGE IS UPDATED REAL TIME) IS ENTERED
S16
IS MEASUREMENT STOP BUTTON (TABLET) TOUCHED OR IS BUTTON (WIRELESS PROBE) PRESSED DOWN ?
No
Yes
S17
MEASUREMENT STOP STATE (ULTRASONIC IMAGE AT THE TIME OF STOP REMAINS UNCHANGED) IS ENTERED
S18
IS BUTTON LONG-PRESSED ?
Yes
No

FIG. 4

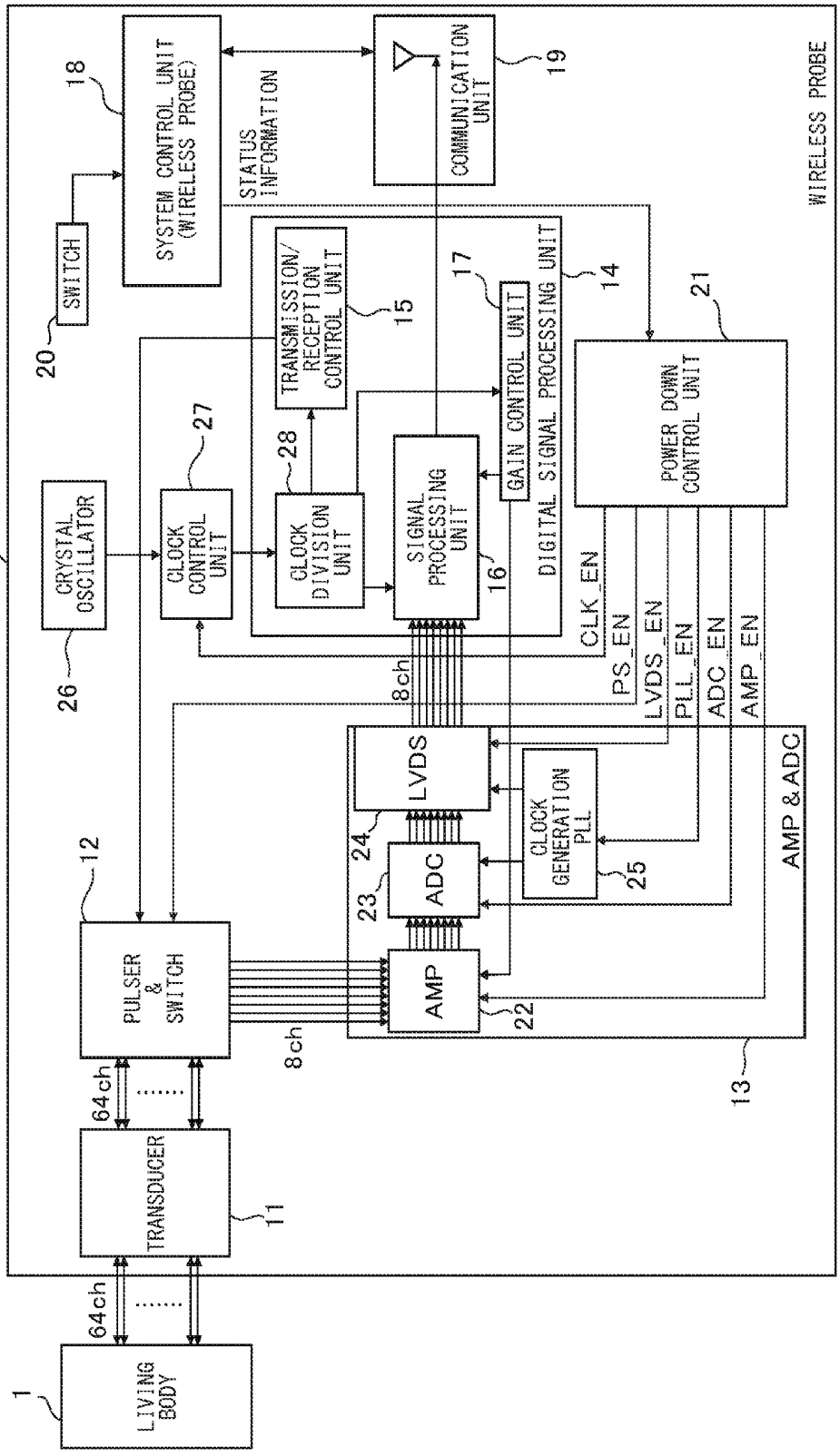
WIRELESS PROBE
10
SYSTEM CONTROL UNIT (WIRELESS PROBE)
18
STATUS INFORMATION
COMMUNICATION UNIT
19
SWITCH
20
TRANSMISSION/ RECEPTION CONTROL UNIT
15
GAIN CONTROL UNIT
17
DIGITAL SIGNAL PROCESSING UNIT
14
POWER DOWN CONTROL UNIT
21
CRYSTAL OSCILLATOR
26
CLOCK CONTROL UNIT
27
CLOCK DIVISION UNIT
28
SIGNAL PROCESSING UNIT
16
CLK_EN
PS_EN
LVDS_EN
PLL_EN
ADC_EN
AMP_EN
8ch
LVDS
24
ADC
23
AMP
22
CLOCK GENERATION PLL
25
AMP &ADC
13
PULSER & SWITCH
12
8ch
64ch
TRANSDUCER
11
64ch
LIVING BODY
1

FIG. 5

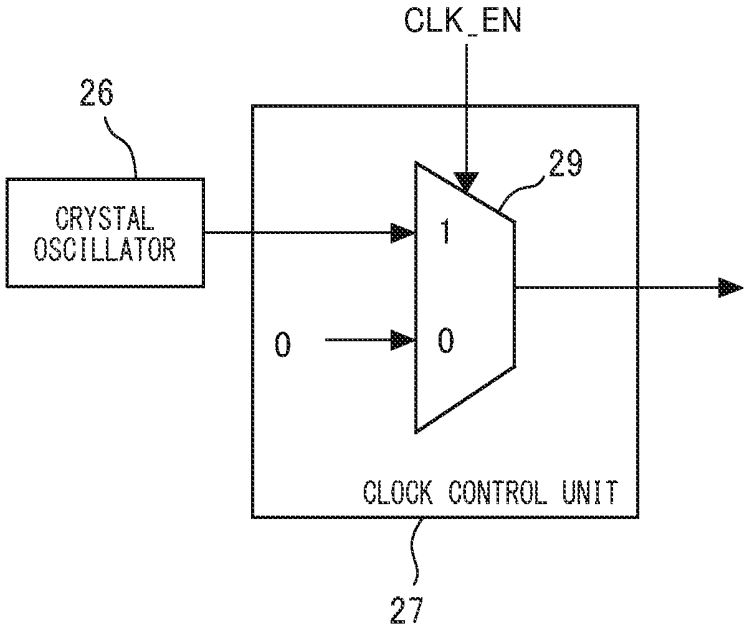

FIG. 6

PATTERN	POWER DOWN CONTROL							CIRCUIT STATE (○: OPERATING STATE, ×: POWER DOWN)					
								PULSER & SWITCH	AMP & ADC				DIGITAL SIGNAL PROCESSING UNIT
	PS_EN	AMP_EN	ADC_EN	PLL_EN	LVDS_EN	CLK_EN			AMP	ADC	PLL	LVDS	
①	1	1	1	1	1	1		○	○	○	○	○	○
②	0	0	0	0	0	0		×	×	×	×	×	×
③	0	1	1	1	1	1		×	○	○	○	○	○
④	1	0	1	1	1	1		○	×	○	○	○	○
⑤	1	1	0	1	1	1		○	○	×	○	○	○
⑥	1	1	1	0	1	1		○	○	○	×	○	○
⑦	1	1	1	1	0	1		○	○	○	○	×	○
⑧	1	1	1	1	1	0		○	○	○	○	○	×
⑨	0	0	0	1	0	0		×	×	×	○	×	×
⑩	1	0	0	1	0	0		○	×	×	○	×	×

ULTRASONIC IMAGE GENERATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation application of International Application PCT/JP2016/056093 filed on Feb. 29, 2016, the entire contents of which are incorporated herein by reference.

FIELD

[0002] The present invention relates to an ultrasonic image generation system.

BACKGROUND

[0003] An ultrasonic image generation system that generates an ultrasonic image representing a state of the inside of a living body by irradiating the living body with an ultrasonic wave and detecting the reflected wave is widely used. A common ultrasonic image generation system has a main body unit and an ultrasonic transducer (hereinafter, referred to as an ultrasonic unit) connected to the main body unit by a cable. The main body unit generates a drive signal of the ultrasonic unit and transmits the generated drive signal to the ultrasonic unit via the cable. The ultrasonic unit outputs an ultrasonic wave in accordance with the drive signal, generates a reflected ultrasonic wave signal by capturing the reflected ultrasonic wave, and transmits the reflected ultrasonic wave signal to the main body unit. The main body unit generates an ultrasonic image by processing the received reflected ultrasonic wave signal and displays the ultrasonic image on a display.

[0004] The main body unit repeats the generation of a drive signal that is necessary to generate ultrasonic images corresponding to one screen and in response to the generation of the drive signal, the generation of ultrasonic image signals corresponding to one screen is repeated and an ultrasonic image is displayed real time. An observer observes the ultrasonic image that changes real time, and when the observer observes particularly, the observer performs an operation to give instructions to hold image updating. In response to the operation, the displayed ultrasonic image is maintained without updated, and the observer observes the fixed ultrasonic image in detail and performs a necessary task, such as measurement, and if necessary, the observer gives instruction to store the ultrasonic image in a storage device. When instructions to start ultrasonic image updating are given in the state where ultrasonic image updating is held, ultrasonic image updating is resumed.

[0005] Even while the ultrasonic image updating is held, the generation of the drive signal and the generation of the ultrasonic image signal are repeated, from the viewpoint of operability that the image is immediately updated to a new image when the displayed image updating is resumed.

[0006] In recent years, an ultrasonic image generation system is expected to be turned into a mobile device and reduction in size, reduction in cost, and improvement of operability have been sought. Thus, it has been proposed that the portion relating to the drive signal generation of the ultrasonic unit and the reflected ultrasonic wave signal processing in the main body unit is turned into a compact probe in accordance with the ultrasonic unit, a wireless communication function is installed in the probe, and the probe and the display unit configured to display an ultrasonic image are connected by wireless communication. Thus, the probe is a wireless probe and operability improves and, if a general-purpose communication terminal having a display function as a display unit is used, an ultrasonic image generation system may be implemented at a low cost.

RELATED DOCUMENTS

[0007] [Patent Document 1] Japanese National Publication of International Patent Application No. 2002-530174

[0008] [Patent Document 2] Japanese Laid Open Patent Document No. 2008-61938

SUMMARY

[0009] An ultrasonic image generation system of a first aspect has an ultrasonic unit configured to transmit and receive an ultrasonic signal, a drive control/signal processing unit, and a display unit. The drive control/signal processing unit repeats processing to generate an ultrasonic image signal by processing a received signal of the ultrasonic unit as well as to generate a drive signal that is supplied to the ultrasonic unit. The display unit repeats displaying an ultrasonic image based on the ultrasonic image signal, holds displayed image updating in accordance with a stop signal input, and resumes displayed image updating in accordance with a start signal input. The drive control/signal processing unit holds at least part of the operation in accordance with the stop signal input and resumes the held operation in accordance with the start signal input.

[0010] The object and advantages of the embodiments will be realized and attained by means of the elements and combination particularly pointed out in the claims.

[0011] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are not restrictive of the invention.

BRIEF DESCRIPTION OF DRAWINGS

[0012] FIG. **1** is a block diagram illustrating a configuration of an ultrasonic image generation system of an embodiment.

[0013] FIG. **2**A and FIG. **2**B are each a diagram illustrating a configuration for a user to perform an operation input in the ultrasonic image generation system of the embodiment, and FIG. **2**A illustrates switch arrangement on the side of a wireless probe and FIG. **2**B illustrates a display example on the side of a tablet.

[0014] FIG. **3** is an operation flowchart of the ultrasonic image generation system of the embodiment.

[0015] FIG. **4** is a diagram illustrating a configuration of the ultrasonic image generation system of the embodiment in FIG. **1** in more detail, and, explaining blocks that turn off in a measurement stop (idle) state.

[0016] FIG. **5** is a diagram illustrating a configuration of a clock control unit.

[0017] FIG. **6** is a diagram illustrating a table of combination examples of blocks that power down.

DESCRIPTION OF EMBODIMENTS

[0018] FIG. **1** is a block diagram illustrating a configuration of an ultrasonic image generation system of an embodiment.

[0019] The ultrasonic image generation system of the embodiment has a wireless probe **10** and a tablet **30**. The wireless probe **10** is held by a user of the ultrasonic image generation system and contacts with the surface of a living body **1**, which is the target of measurement, and the inside of the living body **1** is measured by ultrasonic waves. As the tablet **30**, a widely spread PC tablet is used by installing application software for an ultrasonic image generation system. The wireless probe **10** and the tablet **30** each have a short-range wireless communication function (for example, BLUETOOTH (registered trademark) and are capable of wirelessly communicating (wireless communication) with each other. The tablet **30** is not limited to a PC tablet, and a PC, a smartphone having a wireless communication function may be used.

[0020] The wireless probe **10** has a transducer **11**, a pulser & switch **12**, an AMP & ADC **13**, a digital signal processing unit **14**, a (wireless probe) system control unit **18**, a communication unit **19**, and a switch **20**. The digital signal processing unit **14** has a transmission/reception control unit **15**, a signal processing unit **16**, and a gain control unit **17**. Although not illustrated schematically, the wireless probe **10** has a battery and each unit is driven by a battery. The battery may be a primary battery or a rechargeable secondary battery.

[0021] The transducer **11** converts a high-voltage pulse signal from the pulser & switch **12** into a sound wave, outputs the sound wave to the living body **1**, and converts the sound wave reflected at the boundary between muscle and fat and the like within the living body **1**, whose acoustic impedances are different, into an electric signal. The pulser & switch **12** selects the electric signal of the reflected sound wave by a switch circuit and outputs the electric signal to the AMP & ADC **13**. The pulser & switch circuit **12** performs processing to bring into focus the signals transmitted simultaneously in a plurality of channels within the living body by changing the amount of delay for each channel. After amplifying the electric signal by the amplifier (AMP), the AMP & ADC **13** converts the electric signal into a digital signal by the ADC (Analog-to-Digital Converter) and outputs the digital signal to the digital signal processing unit **14**. Here, an example is illustrated, in which the number of input/output channels of the transducer **11** is sixty-four and the number of channels of the AMP & ADC **13** is eight, but these numbers are optional and the width and resolution of an ultrasonic image that is obtained are determined by the channel interval and the number of channels of the transducer **11**. The pulser & switch **12** performs simultaneous pulser transmission corresponding to the number of channels of the ADC. The configuration of the above-described portion is described in Patent Documents 1, 2, and is known widely, and therefore explanation thereof is omitted.

[0022] In the digital signal processing unit **14**, the transmission/reception control unit **15** controls the focusing processing by the above-described pulser & switch circuit **12**. The signal processing unit **16** converts the digital signal from the AMP & ADC **13** into luminance information by using the control signal from the transmission/reception control unit **15**. The gain control unit **17** performs gain correction or the like that considers the attenuation within the living body. By the above processing, an ultrasonic image can be obtained by performing transmission and reception while shifting the sixty-four channels one by one and processing the received signals.

[0023] The communication unit **19** of the wireless probe **10** performs short-range wireless communication to receive an operation command and the like from the tablet **30** and outputs the command to the system control unit **18** and, transmits the ultrasonic image data generated by the digital signal processing unit **14** to the tablet **30**. The system control unit **18** controls the entire wireless probe **10** based on the operation command and the like from the communication unit **19** and the operation signal of the switch **20**. The switch **20** is a button switch provided to the wireless probe **10** and the operation of the switch **20** will be described later.

[0024] The portion except for the system control unit **18** enters the off state when the power source is turned off. It is necessary for the system control unit **18** to detect the operation of the switch **20** to turn on the power source, and therefore the system control unit **18** remains on even while the power source is off. The portion unrelated to the detection of the operation of the switch **20** within the system control unit **18** may be turned off when the power source is turned off.

[0025] The tablet **30** has a (tablet) system control unit **31**, a communication unit **32**, and a monitor **33**. The system control unit **31** performs control of the tablet. The communication unit **32** performs short-range wireless communication and transmits an operation command and the like to the wireless probe **10** and, receives ultrasonic image data from the wireless probe **10**. The monitor **33** is a display device having a touch screen function and displays ultrasonic image data and, detects the operation by a user, which is input by using the touch screen function. The monitor **33** is not limited to one having the touch screen function and may be one having a display unit, an operation switch. The capacity of the power source of the tablet **30** is sufficiently large and power consumption does not bring any problem, and therefore explanation thereof is not given in particular.

[0026] In the ultrasonic image generation system of the embodiment, a power down control unit is provided to the system control unit **18**, in addition to the above-described configuration, and therefore i power down control may be carried out in accordance with a switch operation.

[0027] FIG. **2**A and FIG. **2**B are each a diagram illustrating a configuration for a user to perform an operation input in the ultrasonic image generation system of the embodiment, and FIG. **2**A illustrates switch arrangement on the side of the wireless probe and FIG. **2**B illustrates a display example on the side of the tablet.

[0028] As illustrated in FIG. **2**A, the wireless probe **10** has the shape of a substantially rectangular parallelepiped. For example, on the lower side in FIG. **2**A, the transducer **11** is provided and the bottom surface contacts with the living body **1** and sound waves are input and output at the bottom surface. The button switch **20** for operation is arranged on the lateral side. A user grasps the lateral side of the wireless probe **10** by hooking his/her finger on the button switch **20**, contacts the bottom surface with the living body **1**, and operates the button switch **20**. The operation to press down the button switch **20** in the state where the power source of the wireless probe **10** is off is determined to be the operation to turn on the power source of the wireless probe **10**. The operation to press down the button switch **20** for a short time in the state where the power source is on and the image is held (measurement stop) is determined to be instructions to change the state into the state where the image display is updated (during measurement) and the operation to press

down the button switch **20** for a predetermined time or longer is determined to be the operation to change the power source of the wireless probe **10** into the off state. Hereinafter, the operation to press down the button switch **20** for a short time is referred to as short pressing and the operation to press down the button switch **20** for a predetermined time or longer is referred to as long pressing. Further, the short pressing operation in the state where the power source is on and the image is updated (during measurement) is determined to be the operation to change the state into the state where the image is held (measurement stop) and the long pressing operation is determined to be the operation to change the power source of the wireless probe **10** into the off state.

[0029] As shown in FIG. **2**B, on the monitor **33** of the tablet **30**, an ultrasonic image **34** and an operation button **35** by the touch screen function are displayed and various displays are produced other than the ultrasonic image **34** and the operation button **35**, but they are not illustrated schematically. While the ultrasonic image **34** is updated real time, "stop" is displayed on the operation button **35** and when "stop" is touched, the ultrasonic image **34** is held (updating of the image display is held and the image when "stop" is touched continues to be displayed) (stop). Further, while the ultrasonic image **34** is held (measurement stop), "start" is displayed on the operation button **35** and when "start" is touched, updating of the ultrasonic image **34** is resumed (start).

[0030] FIG. **3** is an operation flowchart of the ultrasonic image generation system of the embodiment.

[0031] As illustrated schematically, the operation flow is divided into the state where the power source of the wireless probe **10** is ON and the state where the power source is OFF. The flow is illustrated on the assumption that the tablet **30** is in the power source ON state.

[0032] At step S**11**, the wireless probe **10** is in the power source OFF state.

[0033] At step S**12**, whether the button switch **20** is pressed down is detected and when the pressing down is not detected, the processing returns to step S**11** and when the pressing down is detected, the wireless probe **10** is brought into the power source ON state and the processing advances to step S**13**.

[0034] At step S**13**, the wireless probe **10** enters the idle state. The idle (stop) state is the same as a measurement stop state, described later, in that image updating is not carried out, but the immediately previous ultrasonic image does not exist, and therefore no ultrasonic image is displayed on the monitor **33**. In the idle (stop) state, part of the portion surrounded by the broken line, which is described as "power down target", in FIG. **1** of the wireless probe **10** is in the OFF state.

[0035] At step S**14**, whether the operation button (start) **35** is touched on the monitor **33** of the tablet **30**, or the button switch **20** is pressed down is detected. When the touch and the pressing down are not detected, the processing advances to step S**18** and when the touch or the pressing down is detected, the processing advances to step S**15**.

[0036] At step S**15**, the wireless probe **10** enters the measuring state and all the portions of the wireless probe **10** enter the ON state, and the ultrasonic image is updated real time.

[0037] At step S**16**, whether the operation button (stop) **35** is touched on the monitor **33** of the tablet **30**, or the button switch **20** is pressed down is detected. When the touch and the pressing down are not detected, the processing returns to step S**15** and when the touch or the pressing down is detected, the processing advances to step S**17**.

[0038] At step S**17**, the wireless probe **10** enters the measurement stop state and the ultrasonic image displayed on the monitor **33** when the wireless probe **10** is stopped is not updated and remains unchanged. At this time, as will be described later, part of the portion surrounded by the broken line, which is described as "power down target", in FIG. **1** of the wireless probe **10** is in the OFF state.

[0039] At step S**18**, whether the button switch **20** is long-pressed is determined and when the button switch **20** is long-pressed, the power source of the wireless probe **10** is turned off and the processing returns to step S**11** and when the button switch **20** is not long-pressed, the processing returns to step S**14**.

[0040] As explained above, the ultrasonic image generation system of the embodiment is roughly divided into two states, one is the state where the power source of the wireless probe **10** is OFF and the other is the state where the power source is ON. The power source ON state includes two states, one is the measurement stop (idle) state and the other is the measuring state. As described above, in the ultrasonic measurement, it is necessary to fix the ultrasonic image once, which is updated real time during measurement, by bring about the measurement stop state. Thus, the measuring state and the measurement stop state are repeated at the time of actual use. During measurement, it is necessary to acquire and update the ultrasonic image at all times, and therefore it is difficult to power down a specific block, but in the measurement stop state, it is not necessary to acquire the ultrasonic image, and therefore each block may be powered down.

[0041] Next, the portion that turns off in the measurement stop (idle) state in the wireless probe **10** is explained.

[0042] The blocks that turn off in the measurement stop state are the pulser & switch **12**, the AMP & ADC **13**, and the digital signal processing unit **14** within "power down target" surrounded by the broken line in FIG. **1**. The system control unit **18** and the communication unit **19** need to receive the notification of the pressing down detection of the button switch **20** and the button (start, stop) operation of the tablet **30** at all times, and therefore they are excluded from the power down target.

[0043] FIG. **4** is a diagram explaining the blocks that turn off in the measurement stop (idle) state, as well as illustrating in more detail the configuration of the ultrasonic image generation system of the embodiment in FIG. **1**.

[0044] In FIG. **4**, a power down control unit **21**, a crystal oscillator **26**, and a clock control unit **27** are further illustrated. The power down control unit **21** and the clock control unit **27** are portions that are originally included in the system control unit **18**, but in order to make easy the schematic representation, in FIG. **4**, they are illustrated outside the system control unit **18**. Further, the schematic representation of the crystal oscillator **26** is omitted in FIG. **1**.

[0045] The power down control unit **21** performs power down control based on status information from the system control unit **18**. The status information is information to determine whether the state is the measuring state or the measurement stop state and the power down control unit **21**

performs control so as to keep the power down state during measurement stop and releases the power down state during measurement.

[0046] The crystal oscillator **26** generates and outputs a clock based on which the wireless probe **10** performs the clock operation. The clock control unit **27** controls whether to perform or stop the clock supply in the digital signal processing unit **14** from the crystal oscillator **26**.

[0047] As illustrated schematically, the AMP & ADC **13** has an AMP (amplifier) **22**, an ADC **23**, an LVDS (Low Voltage Differential Signaling) **24**, and a clock generation PLL **25**. The AMP **22** amplifies each 8-ch signal from the pulser & switch **12**. The ADC **23** converts each 8-ch output signal of the AMP **22** into a digital signal. The LVDS **24** converts the 8-ch digital signal (parallel signal) output from the AMP **22** into a low voltage differential signal (serial signal) to be transmitted to the digital signal processing unit **14** and outputs the low voltage differential signal. The clock generation PLL **25** generates an operation clock, which is used in the AMP & ADC **13**, from an internal clock (for example, a clock output from the crystal oscillator **26**).

[0048] The digital signal processing unit **14** has a clock division unit **28**, in addition to the transmission/reception control unit **15**, the signal processing unit **16**, and the gain control unit **17**, described previously. The clock division unit **28** divides a clock output from the crystal oscillator **26** and generates an operation clock that is used in the digital signal processing unit **14**.

[0049] The power down control unit **21** performs power down control of the AMP (amplifier) **22**, the ADC **23**, the LVDS (Low Voltage Differential Signaling) **24**, the clock generation PLL **25**, and the clock control unit **27**. Further, in the digital signal processing unit **14**, power down is carried out by stopping the clock supply.

[0050] As illustrated in FIG. **4**, the power down control unit **21** outputs a power down control signal in correspondence to the following control units.

[0051] pulser & switch **12**: power down by enable signal (PS_EN) control

[0052] AMP **22**: power down by enable signal (AMP_EN) control

[0053] ADC **23**: power down by enable signal (ADC_EN) control

[0054] LVDS **24**: power down by enable signal (LVDS_EN) control

[0055] PLL **25**: power down by enable signal (PLL_EN) control

[0056] digital signal processing unit **14**: power down by clock control to the digital signal processing unit **14** with an enable signal (CLK_EN). At the normal time, the clock from the crystal oscillator **26** is connected and at the time of power down, the clock is masked by the clock control unit **27**.

[0057] FIG. **5** is a diagram illustrating a configuration of the clock control unit.

[0058] The clock control unit **27** has a selector **29** that selects one of the clock from the crystal oscillator and the fixed value (here, 0) in accordance with the CLK_EN signal.

[0059] As described above, powered down blocks are freely selected, and it is desirable to select a block by considering not only the power consumption but also the time taken to resume the operating state from the power down state.

[0060] FIG. **6** is a diagram showing a table of combination examples of blocks that power down.

[0061] Pattern **1** is a combination in which all the blocks are in the operating state, a combination during measurement.

[0062] Pattern **2** is a combination in which all the relevant blocks are in the power down state, a combination that can implement the lowest power consumption.

[0063] Each of Pattern **3** to **8** describes a circuit state when one of a plurality of power down control signals is enable (power down control signal "0"). From the patterns, it is known that the control signal and the circuit state can be controlled in a one-to-one manner.

[0064] Pattern **9** is a combination in which only the power down control signal PLL_EN is disenable (power down control signal "1") and the other five power down control signals are enable. The clock generation PLL **25** controlled by PLL_EN requires a stability-waiting period of time until the circuit is stable and outputs an operation clock and when the period is problematic, it is desirable not to power down only a block which requires the stability-waiting period.

[0065] Pattern **10** is a combination in which the pulser & switch **12** is also not powered down, in addition to the clock generation PLL **25**. Once the pulser & switch **12** is brought into the power down state, it is necessary to set again the amount of delay of the transmission pulse and the output channel to the register, and therefore the period of time until the rise lengthens.

[0066] The relationship between the length of the period of time until the rise and the degree of a reduction in power consumption is a trade-off relationship, and therefore a combination of powered down units are may be selected in accordance with an item to which priority is given.

[0067] As above, the embodiment is explained, but all the examples and conditions described here are described for the purpose of aiding understanding of the invention and the concepts of the invention applied to the art. Particularly, the examples and conditions described are not intended to limit the scope of the invention and the configurations of such examples in the specification do not indicate the superiority and inferiority of the invention. The embodiment of the invention is described in detail, but is should be understood that the various changes, substitutions, and alterations can be made without deviating from the sprit and scope of the invention.

CITATION LIST

[0068] **10** wireless probe
[0069] **11** transducer
[0070] **12** pulser & switch
[0071] **13** AMP & ADC
[0072] **14** digital signal processing unit
[0073] **15** transmission/reception control unit
[0074] **16** signal processing unit
[0075] **17** gain control unit
[0076] **18** (wireless probe) system control unit
[0077] **19** communication unit
[0078] **20** switch
[0079] **21** power down control unit
[0080] **22** amplifier
[0081] **23** ADC
[0082] **24** LVDS
[0083] **25** clock generation PLL
[0084] **26** crystal oscillator

[0085] **27** clock control unit

[0086] **28** clock division unit

What is claimed is:

1. An ultrasonic image generation system comprising:

an ultrasonic transducer configured to transmit and receive an ultrasonic signal;

a processor configured to repeat processing to generate an ultrasonic image signal by processing a received signal of the ultrasonic transducer as well as to generate a drive signal that is supplied to the ultrasonic transducer; and

a display configured to repeat displaying an ultrasonic image based on the ultrasonic image signal, to stop updating of a displayed image in response to a stop signal input, and to resume updating of the displayed image in response to a start signal input, wherein

the processor stops at least part of an operation in response to the stop signal input and resumes the stopped operation in response to the start signal input.

2. The ultrasonic image generation system according to claim **1**, comprising:

a probe including the ultrasonic transducer and the processor; and

a tablet including the display and independent of the probe, wherein

the probe and the tablet each include a communicator configured to wirelessly communicate with each other, and

the probe is driven by a battery.

3. The ultrasonic image generation system according to claim **2**, wherein

the stop signal input is an input by an operation of a switch provided to the probe or by a touch screen operation of the tablet, and

one of the probe and the tablet, which has detected the stop signal input, notifies the other of the stop signal input via the communicator.

4. The ultrasonic image generation system according to claim **3**, wherein

the probe enters a power source off state when the switch has been operated for a predetermined time or longer.

* * * * *

专利名称(译)	超声波图像生成系统		
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[标]申请(专利权)人(译)	株式会社索思未来		
申请(专利权)人(译)	SOCIONEXT INC.		
当前申请(专利权)人(译)	SOCIONEXT INC.		
[标]发明人	YONEDA NAOTO ADACHI NAOTO TAKAGI HIROAKI TAMAMURA MASAYA INOUE AMANE		
发明人	YONEDA, NAOTO ADACHI, NAOTO TAKAGI, HIROAKI TAMAMURA, MASAYA INOUE, AMANE		
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摘要(译)

一种超声波图像生成系统，具有用于发送和接收超声波信号的超声波单元，驱动控制/信号处理单元，被配置为通过处理超声波单元的接收信号来重复处理以生成超声波图像信号，以及生成超声波图像生成系统。提供给超声波单元的驱动信号;显示单元，被配置为基于超声图像信号重复显示超声图像，响应于停止信号输入而停止更新显示图像，并且响应于开始信号输入而恢复显示图像的更新，其中驱动控制/信号处理单元响应于停止信号输入停止至少一部分操作，并响应于开始信号输入重新开始停止操作。