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(54) **SYSTEMS AND METHODS FOR REDUCING THE IMPACT OF ALARM SOUNDS ON PATIENTS**

SYSTEME UND VERFAHREN ZUR REDUZIERUNG DER AUSWIRKUNG VON ALARMTÖNEN AUF PATIENTEN

SYSTÈMES ET PROCÉDÉS POUR RÉDUIRE L'IMPACT D'ALARMS SONORES SUR DES PATIENTS

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**Description**

## TECHNICAL FIELD OF THE INVENTION

5 **[0001]** The invention relates to medical devices at the point of care used to, for example, monitor and/or treat patients in a hospital or nursing home environment, and in particular to systems and methods for reducing the impact that audible alarms issued by these medical devices have on patients.

## BACKGROUND TO THE INVENTION

10 **[0002]** Many medical devices used in intensive care units of hospitals provide acoustic (audible) alarms, if specific conditions or events occur. The medical device or devices are typically arranged near to a patient's bed and are for monitoring one or more physiological characteristics of a patient, such as heart rate, blood pressure, breathing rate, blood oxygen levels, etc, and/or for providing some treatment to a patient, such as controlling the administration of an intravenous drug, assisting the patient's breathing, etc. The specific conditions that lead to alarms being triggered can refer to, for example, abnormal values of the physiological characteristics of the patient or specific operating states or error states of the device.

15 **[0003]** The alarms issued by these devices are primarily for the attention of the healthcare staff in the hospital and serve to acoustically alert staff members to direct their attention to the device and take any appropriate or required action. Although the alarm sound level for a particular medical device may be able to be set by the end users (the healthcare staff) to specific levels, these levels will typically stay fixed after being set during installation, which means that alarm sounds are played with a fixed absolute sound power level. This level will have been set sufficiently high to guarantee that healthcare staff will be alerted despite the environment in which the medical device is being used being very noisy (for example if many staff members are speaking simultaneously and/or if there are lots of noisy medical devices being used). In some cases, the level can be set sufficiently high so that the alarm can be clearly heard outside the room in which the patient is located, which means that the alarm will be particularly loud for a patient that is lying next to the medical device.

20 **[0004]** It has been found that alarm sounds issuing from medical devices associated with a particular patient have a strong negative impact on the recovery of that patient and any nearby patients since the alarms lead to increased anxiety in the patient and sleep interruptions. This problem is particularly evident for patients in an intensive care unit where there may be many different medical devices associated with each patient, each having their own alarm sounds and volumes.

25 **[0005]** US 7,920,061 discloses systems and methods for controlling an alarm state, such as volume, based on the presence or absence of a caregiver in a patient's room.

30 **[0006]** Therefore, there is a need for systems and methods for reducing the negative impact that these alarm sounds have on patients while ensuring that healthcare staff are still adequately alerted.

## SUMMARY OF THE INVENTION

35 **[0007]** According to a first aspect of the invention, there is provided a system for use with a patient in a healthcare environment, the system comprising a medical device configured to monitor or treat a patient, the medical device being for use in a room in which the patient is located and comprising an alarm unit configured to issue an audible alarm; a detection unit configured to detect whether a healthcare staff member is in the room in which the patient is located; a remote alarm unit configured to issue an alarm to alert a healthcare staff member located outside the room in which the patient is located; and a control unit that is connected to the medical device, the detection unit and the remote alarm unit, the control unit being configured to: (i) control the alarm unit in the medical device to issue an audible alarm in the event that (a) the medical device detects an alarm condition for the patient or the medical device and (b) the detection unit detects that a healthcare staff member is in the room in which the patient is located; and (ii) control the remote alarm unit to issue an alarm to alert a healthcare staff member located outside the room in which the patient is located in the event that (a) the medical device detects an alarm condition for the patient or the medical device and (b) the detection unit detects that no healthcare staff member is in the room in which the patient is located; wherein the detection unit or a second detection unit is configured to detect the distance of the healthcare staff member from the room in which the patient is located and the control unit is further configured to set the volume of the audible alarm issued by the remote alarm unit based on the distance of a healthcare staff member from the room in which the patient is located.

40 **[0008]** In some embodiments, the control unit is further configured to prevent the alarm unit in the medical device from issuing an audible alarm in the event that the control unit controls the remote alarm unit to issue the alarm to alert a healthcare staff member. This embodiment provides the advantage that the patient is not disturbed at all by an alarm triggered by the medical device.

5 [0009] In alternative embodiments, the control unit is configured to control the alarm unit in the medical device to issue an audible alarm at a first volume level in the event that the medical device detects an alarm condition for the patient or the medical device and the detection unit detects that a healthcare staff member is in the room in which the patient is located; and wherein the control unit is further configured to control the alarm unit in the medical device to issue an audible alarm at a second volume level in the event that the control unit controls the remote alarm unit to issue the alarm to alert a healthcare staff member, wherein the second volume level is lower than the first volume level. This embodiment provides the advantage that the disturbance to the patient can be kept to a minimum (while still generating an alarm near to the patient), until a healthcare staff member is present to attend to and reassure the patient.

10 [0010] In some embodiments, the control unit is configured such that, if following the issue of an alarm by the remote alarm unit the detection unit detects that a healthcare staff member is in or has entered the patient room, the control unit controls the remote alarm unit to cease the issue of the alarm and controls the alarm unit in the medical device to issue an audible alarm.

15 [0011] In preferred embodiments, the remote alarm unit comprises an alarm unit configured to issue an audible alarm. Preferably, in these embodiments, the remote alarm unit is located outside of the room in which the patient/medical device is located. In some cases the remote alarm unit can be located immediately outside the room, and in other cases the remote alarm unit can be located in another room, for example a staff room.

20 [0012] In some embodiments, the remote alarm unit further comprises a visual indicator that is configured to be activated when the alarm unit in the remote alarm unit is controlled to issue an audible alarm. In some embodiments, the control unit is configured to modulate the luminance of the visual indicator coherently with the volume of the audible alarm.

[0013] In some embodiments the control unit can be configured to reduce the volume of the audible alarm issued by the remote alarm unit as the distance of the healthcare staff member from the room in which the patient is located decreases.

25 [0014] In some embodiments the control unit can be configured to increase the volume of the audible alarm issued by the remote alarm unit as the distance of the healthcare staff member from the room in which the patient is located increases.

30 [0015] In some embodiments the control unit is configured to set the volume of the audible alarm issued by the remote alarm unit to a first level when the healthcare staff member is a first distance from the room in which the patient is located and a second level when the healthcare staff member is a second distance from the room in which the patient is located, wherein the first level is greater than the second level and the first distance is greater than the second distance.

[0016] In other embodiments the control unit is configured to set the volume of the audible alarm issued by the remote alarm unit to a first level when the healthcare staff member is greater than a threshold distance from the room in which the patient is located, and a second (lower) level when the healthcare staff member is less than the threshold distance from the room in which the patient is located.

35 [0017] In some embodiments, the system further comprises a second detection unit configured to detect the location of a healthcare staff member relative to the room in which the patient is located; and the control unit is configured to adjust the volume of the audio alarm issued by the remote alarm unit based on the output of the second detection unit.

[0018] In some alternative or additional embodiments, the remote alarm unit can be configured to issue an alarm to alert a healthcare staff member located outside the room in which the patient is located by transmitting a message, paging message or actuation signal to a device carried or worn by a healthcare staff member.

40 [0019] In preferred embodiments, the detection unit comprises one or more of a radio frequency identification, RFID, tag reader, a near-field communication, NFC, tag reader and a camera.

45 [0020] In alternative embodiments, the detection unit is configured to detect the location of the healthcare staff member, and in particular the presence of a healthcare staff member in the room in which the patient is located, by triangulating the location of healthcare staff members using wireless communication-enabled devices carried by the healthcare staff members.

50 [0021] According to a second aspect of the invention, there is provided a method of operating a system for use with a patient in a healthcare environment, the method comprising determining whether a healthcare staff member is in the room in which a medical device that is monitoring or treating a patient is located; detecting the distance of the healthcare staff member from the room in which the patient is located; and in the event that an alarm condition for the patient or medical device is detected: (i) issuing an audible alarm from an alarm unit in the medical device if it is determined that a healthcare staff member is in the room in which the patient is located; and (ii) issuing an audible alarm from a remote alarm unit to alert a healthcare staff member located outside the room in which the patient is located if it is determined that no healthcare staff member is in the room in which the patient is located, and setting the volume of the audible alarm based on the distance of a healthcare staff member from the room in which the patient is located.

55 [0022] In some embodiments, in the event that an alarm condition for the patient or medical device is detected and it is determined that no healthcare staff member is in the room in which the patient is located, the method further comprises preventing an alarm unit in the medical device from issuing an audible alarm.

[0023] In alternative embodiments, step (i) comprises issuing the audible alarm from the alarm unit at a first volume level, and wherein step (ii) further comprises issuing an audible alarm from the alarm unit in the medical device at a second volume level, wherein the second volume level is lower than the first volume level.

[0024] In some embodiments, following the issue of an alarm according to step (ii), if it is determined that a healthcare staff member is in or has entered the patient room, the method further comprises the step of stopping the issue of the alarm used to alert a healthcare staff member located outside the room in which the patient is located and issuing an audible alarm from the alarm unit in the medical device.

[0025] In some embodiments, step (ii) further comprises activating a visual indicator. In some embodiments, step (ii) further comprises modulating the luminance of the visual indicator coherently with the volume of the audible alarm.

[0026] In some embodiments the step of adjusting or setting comprises reducing the volume of the audible alarm issued by the remote alarm unit as the distance of the healthcare staff member from the room in which the patient is located decreases.

[0027] In some embodiments the step of adjusting or setting further or alternatively comprises increasing the volume of the audible alarm issued by the remote alarm unit as the distance of the healthcare staff member from the room in which the patient is located increases.

[0028] In some embodiments the step of adjusting or setting comprises setting the volume of the audible alarm issued by the remote alarm unit to a first level when the healthcare staff member is a first distance from the room in which the patient is located and a second level when the healthcare staff member is a second distance from the room in which the patient is located, wherein the first level is greater than the second level and the first distance is greater than the second distance.

[0029] In other embodiments the step of adjusting or setting comprises setting the volume of the audible alarm issued by the remote alarm unit to a first level when the healthcare staff member is greater than a threshold distance from the room in which the patient is located, and a second (lower) level when the healthcare staff member is less than the threshold distance from the room in which the patient is located.

[0030] According to a third aspect of the invention, there is provided a computer program product, comprising computer readable code embodied therein, the computer readable code being configured such that, on execution by one or more suitable computers or processing units, the one or more suitable computers or processing units are caused to execute the steps in any of the methods described above.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0031] For a better understanding of the invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which:

- Figure 1 is an illustration of a system according to a first aspect of the invention in a healthcare environment;
- Figure 2 is a block diagram of the system shown in Figure 1;
- Figure 3 is a flow chart illustrating a method of operating a control unit in the system shown in Figure 1;

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] Figure 1 is an illustration of a system 2 according to a first aspect of the invention in a healthcare environment 4 (such as a hospital or nursing home). Figure 2 is a block diagram of that system 2. Briefly, in accordance with this aspect of the invention, the system 2 comprises a unit that is configured to detect whether a healthcare staff member is present in the same room as the medical device (and patient). When the medical device is to trigger an alarm, an audible alarm is generated by a speaker in the medical device if the detection unit determines that a healthcare staff member is in the same room as the medical device. However, if the detection unit determines that no healthcare staff member is present in the room, the alarm is issued by a remote alarm unit that is located somewhere outside the room in which the medical device and patient are located (for example the remote alarm unit can be located immediately outside the room in a corridor or another room, or at a nearby staff workstation). When the alarm is issued by the remote alarm unit, the medical device can be controlled such that it does not generate the audible alarm itself or generates the alarm at a reduced volume, thereby avoiding or reducing the disturbance to the patient and reducing the overall impact of the alarms on the patient.

[0033] In the example of Figure 1, the hospital or nursing home environment 4 comprises a patient room 6 in which patients 8 are located in respective beds 10, a corridor 12 outside the patient room 6 and a workstation or room 14 for the healthcare staff 16.

[0034] Each patient 8 has one or more medical devices 18 associated with them. Each medical device 18 is used at the point of care and can be for monitoring one or more physiological characteristics of the patient 8, such as heart rate, blood pressure, breathing rate, blood oxygen levels, etc, and/or for providing some treatment to the patient 8, such as

controlling the administration of an intravenous drug, assisting the patient's breathing, etc. Another type of medical device 18 in which the invention can be used is a patient monitor.

5 [0035] In addition to the medical devices 18, the system 2 comprises one or more detection units 20 for detecting whether there are any healthcare staff members 16 in the patient room 6, one or more remote alarm units 22 located somewhere outside the patient room 6 in which the patients 8 and medical devices 18 are located and a control unit 24. The medical devices 18, detection unit 20 and remote alarm units 22 are each connected to the control unit 24 using wires or a short or long-range wireless technology, such as Wi-Fi, Bluetooth, ZigBee, or a cellular telecommunications network, etc.

10 [0036] In this illustrated embodiment, a first remote alarm unit 22 that is configured to generate an audible alarm is located immediately outside the patient room 6, a second remote alarm unit 22 that is configured to generate an audible alarm is located at the staff workstation 14, the detection unit 20 is located in the patient room 6 (with the exact location in the patient room 6 depending on the modality the detection unit 20 uses to detect the presence of healthcare staff members 16 in the room 6), and the control unit 24 is located at the staff workstation 14, although it will be appreciated that different positioning and arrangements of the units in the system 2 are contemplated (for example the control unit 15 24 can be implemented as part of a central monitoring station in the hospital). For example, it is possible to combine the functionality of one or more of the medical devices 18, detection unit 20, remote alarm unit 22 and control unit 24 into a single device.

20 [0037] Referring to Figure 2, some of the components of each of the units in the system 2 are shown. It will be appreciated that only the components of the units that are useful for illustrating the invention are shown in Figure 2, and that in practice the units will comprise additional components.

25 [0038] The medical device 18 comprises at least one sensor 26 for monitoring one or more physiological characteristics of the patient 8 and/or for monitoring the operation of the medical device 18 (as appropriate depending on the purpose of the medical device). The medical device also comprises a processing unit 30 that is connected to the at least one sensor 26 and that controls the operation of the medical device 18. A speaker or audible alarm unit 28 is provided that is connected to the processing unit 30 and that is used to generate an audible alarm signal in response to an alarm condition being detected by the sensor 26 and processing unit 30 (although in alternative embodiments the output of the sensor 26 can be provided to the control unit 24 and the control unit 24 can determine whether an alarm condition exists). A communication interface 32 is provided that is connected to the processing unit 30 and that enables communications between the medical device 18 and the control unit 24.

30 [0039] The detection unit(s) 20 comprise staff detection means which detect whether there are any healthcare staff members 16 in the patient room 6 using any suitable technology. For example, the detection means 34 can comprise an antenna and control circuitry for detecting radio-frequency identification (RFID) tags or near-field communication (NFC) tags that are carried or worn by healthcare staff members 16. In this case, the detection unit 20 (or at least the antenna) may be positioned in the patient room 6 so that it only detects tags when they are present in the room 6 or enter the room 6. Alternatively, the staff detection means 34 can use other types of indoor tracking technology, for example based on triangulation using Wi-Fi or Zigbee-enabled devices carried by the staff members 16, or using cameras and image processing technology to determine if a staff member 16 is present in the room 6. The detection unit 20 also comprises a communication interface 36 that is connected to the staff detection means 34 and that enables communications between the detection unit 20 and the control unit 24.

35 [0040] The remote alarm unit 22 comprises an alarm unit 38, which, in a preferred embodiment, is in the form of a speaker for generating an audible alarm signal for alerting staff members 16, and a communication interface 40 that enables communications between the remote alarm unit 22 and the control unit 24. In some embodiments, the alarm unit 38 may further include a light source that is illuminated or flashed to indicate the alarm condition. In other or further embodiments, the alarm unit 38 may alternatively or additionally alert the staff members 16 to the alarm condition by sending a message or alarm signal to a pager or mobile communication device (e.g. a mobile telephone) carried by the staff members 16, by sending an actuation signal to a bracelet or other device worn or carried by the staff members 16 that use haptic stimulation to alert the wearer to the alarm condition, etc. In these alternative embodiments, the alarm unit 38 will be in a suitable form (such as a transmitter) for transmitting the required message or control signals to the devices carried by the staff members 16.

40 [0041] In the embodiments where a signal is transmitted to devices carried by staff members 16 and the remote alarm unit 22 is not required to generate an audible alarm to alert the staff members 16, the alarm unit 38 in the remote alarm device 22 will comprise a transmitter for sending the required signals to the staff member devices, and it will be appreciated that it is not strictly necessary for the remote alarm unit 22 to be physically located outside of the patient room 6 (although this is of course possible). In some embodiments, the speaker 38 in the remote alarm unit 22 is preferably configured to replicate the alarm sound generated by the medical device 18 to enable a staff member 16 located outside the patient room 6 to recognize the alarm sound and determine the reason for the alarm being issued.

45 [0042] The control unit 24 comprises a processing unit 42 that processes signals received from the medical device(s) 18 and detection unit(s) 20 and controls the alarm unit 28 in the medical device 18 and the alarm unit 38 in the remote

alarm unit 22 to generate an alarm signal as appropriate in the event that an alarm condition is detected in or by the sensor 26 in the medical device 18. The control unit 24 also comprises a communication interface 44 that enables communications between the control unit 24 and each of the medical device(s) 18, detection unit(s) 20 and remote alarm unit(s) 22.

5 [0043] Figure 3 illustrates a method of operating the control unit 24 of the system 2 shown in Figure 1 in accordance with this aspect of the invention. In a first step, step 101, the control unit 24 (or rather the processing unit 42 in the control unit 24) determines whether an alarm condition has been detected for a medical device 18. In some embodiments, the processing unit 30 in the medical device 18 can determine whether an alarm condition exists on the basis of the output of the sensor 26 and communicate the existence of the alarm condition to the processing unit 42 in the control unit 24. In alternative embodiments, the output of the sensor 26 can be passed to the processing unit 42 in the control unit 24 which itself evaluates the output signal to determine if an alarm condition exists.

10 [0044] Step 101 repeats until an alarm condition exists.

[0045] If an alarm condition has been detected, the method moves to step 103 in which it is determined whether a staff member 16 is present in the patient room 6 in which the medical device 18 that is experiencing the alarm condition is located. The control unit 24 determines this on the basis of the signals received from the detection unit 20. For example, where the detection unit 20 being used by the system 2 is based on RFID or NFC tag technology, the control unit 24 can determine that a staff member 16 is present in the patient room 6 if an RFID tag or NFC tag carried by staff members 16 is detected by an antenna in the patient room or detected by an antenna placed near to the door of the patient room 6 that detects the tag as the staff member 16 enters or leaves the room 6.

15 [0046] If the control unit 24 determines that a staff member 16 is present in the room 6 in which the medical device 18 is located, the control unit 24 sends a signal to the medical device 18 to cause the alarm unit 28 in the medical device 18 to generate an audible alarm signal (step 105). In response to receiving this signal, the processing unit 30 in the medical device 18 controls the speaker (or other alarm generating unit) 28 to generate the audible alarm to alert the staff member 16 present in the patient room 6. The audible alarm generated by the medical device 18 can be generated at a default or standard volume for the alarm.

20 [0047] As a staff member 16 is present in the patient room 6, the remote alarm unit 22 is not required to generate an alarm itself (although it will be appreciated that in some embodiments the remote alarm unit 22 could also be controlled to issue an alarm).

[0048] However, if in step 103 the control unit 24 determines that a staff member 16 is not present in the room 6 in which the medical device 18 is located when the alarm condition is detected, the control unit 24 sends a signal to a remote alarm unit 22 that causes the remote alarm unit 22 to alert staff members 16 that are outside of the patient room 6 (step 107).

25 [0049] In the preferred embodiments in which the remote alarm unit 22 comprises a speaker 38 for generating an audible alarm and the remote alarm unit 22 is located outside of the patient room 6 (for example located immediately outside the patient room 6 in the corridor 12 or located at the staff workstation 14), step 107 comprises sending a signal to the remote alarm unit 22 to cause the speaker 38 in the remote alarm unit 22 to generate an audible alarm signal. If there are multiple remote alarm units 22 in the system 2, step 107 can comprise sending a signal to one or more of those remote alarm units 22 to cause those remote alarm units 22 to generate an alarm. In some embodiments where the specific or general location of the staff members 16 outside the patient room 6 is known, then only a remote alarm unit 22 close to those staff members 16 can be controlled to generate an audible alarm.

30 [0050] In embodiments where the remote alarm unit 22 alerts staff members 16 to the alarm condition by sending a message or alarm signal to a pager, mobile communication device (e.g. a mobile telephone) or a device that uses haptic stimulation (and where conceivably the remote alarm unit 22 could be integrated with the control unit 24 which may be located in the patient room 6), it will be appreciated that the signal sent by the control unit 24 to the transmitter 38 in the remote alarm unit 22 causes the transmitter 38 to transmit or broadcast an appropriate message or signal outside the patient room 6 to cause the devices carried by the staff members 16 to alert those staff members 16 to the alarm condition.

35 [0051] In some embodiments, in the event that the remote alarm unit 22 is used to issue an alarm to alert staff members 16 to the alarm condition in step 107, the control unit 24 can send a signal to the medical device 18 that causes the processing unit 30 in the medical device 18 to mute the audible alarm signal generated by the speaker 28 (or prevent the speaker 28 from generating an audible alarm signal in the first place), which means that the patient 8 will not be disturbed when the alarm condition arises (step 109). Alternatively, the control unit 24 can send a signal to the medical device 18 that causes the speaker 28 to generate an audible alarm signal at a lower volume than the volume that would be used if a staff member 16 was already present in the patient room 6 (i.e. an alarm issued according to step 105), so that the staff member 16, when they enter the patient room 6, can identify the medical device 18 that is experiencing the alarm condition. Even in this implementation, the impact of the audible alarm on the patient 8 is much less than in conventional systems.

40 [0052] A further advantage of the system 2 according to this aspect of the invention is that, even when the medical device 18 generates the audible alarm according to step 105, as it is not necessary for that alarm to alert staff members

16 that are outside of the patient room 6 (since the alarm is used according to this step when a staff member 16 is present in the patient room 6), the default or standard volume of the audible alarm can be set at a lower level than in conventional systems where the alarm has to be set loud enough to alert staff members 16 that are potentially located outside of the patient room 6 (which further reduces the negative impact these alarms have on patients 8).

5 **[0053]** In some embodiments, following step 107 (or step 109), once a staff member 16 enters the room 6 (as detected by the detection unit 20), the control unit 24 can send a signal to the remote alarm unit 22 that causes the remote alarm unit 22 to stop generating an alarm, and can send a signal to the medical device 18 that causes the speaker 28 in the medical device 18 to start generating an audible alarm (if the speaker 28 was not already generating an alarm) or to generate the audible alarm at an increased volume (if the speaker 28 in the medical device 18 was already generating an audible alarm but at a reduced volume level).

10 **[0054]** In some implementations of this aspect of the invention, for example where there are many different patient rooms 6, each with a remote alarm unit 22 located outside of the door to the room 6, it may be difficult for a staff member 16 to easily identify the room to which the alarm relates (since it is perceptually difficult for a staff member 16 to directly identify from a distance which of a number of remote alarm units 22 is active). In this case, the remote alarm units 22 can be provided with a light or other visual indicator that can be activated when the audible alarm is generated to help guide the staff member 16 to the appropriate room 6. In some embodiments, the luminance of the light can be modulated coherently with the sound level of the audible alarm, which leads to strong binding of visual and acoustic stimulus in the observer's cognitive system, and the staff member 16 can, on approaching the appropriate room 6, interpret the audible alarm signal as code for the *meaning of or reason for* the alarm condition, and use the modulated lamp to identify the correct room.

20 **[0055]** These embodiments are particularly of use in an environment where there are a plurality of patient rooms in which multiple types of medical device 18 can be used for monitoring several patients, and where those medical devices 18 are capable of issuing different (i.e. audibly different) types of alarms to each other. A healthcare staff member 16 will be trained to recognize the sound of these alarms and the reason that they are issued, and thus determine which alarm has the highest priority (i.e. the alarm that should be dealt with first) if multiple alarms are issuing at the same time. For example a particular alarm sound may be issued by a breathing monitor if it detects an absence of a breath for a certain period of time, while an infusion pump may issue a different alarm sound when a medication infusion cycle has been completed. In this example, if both alarms are being issued at the same time, the healthcare staff member will recognize the distinct alarms and appreciate that the alarm from the breathing monitor should be dealt with first. The luminance of the visual indicators on the respective remote alarm units 22 will be modulated coherently with the volume of the audible alarm issued by that remote alarm unit 22, which means that, if the alarms are being issued from different patient rooms, the staff member 16 will be able to identify the room from which the breathing monitor alarm is being issued by identifying the visual indicator on the remote alarm unit 22 that is being illuminated coherently with the sound level of the relevant alarm (e.g. the breathing monitor alarm in this embodiment). In this embodiment, the speaker 38 in the remote alarm unit 22 is preferably configured to replicate the alarm sound generated by the medical device 18 to enable the staff member 16 to recognize the alarm sound and determine the reason for the alarm being issued.

30 **[0056]** In further embodiments, when a staff member 16 is approaching the correct room 6 (for example as detected by the detection unit 20 located in the patient room or by one or more detection units 20 located outside the patient rooms 6), the audible alarm could be controlled so that volume of the alarm is reduced (for example in a stepwise manner), which provides intuitive feedback that the staff member 16 is moving in the right direction. Likewise, the volume could be increased if the staff member 16 moves away from the relevant room 6.

35 **[0057]** The detection unit 20 located in the patient room 6 and/or one or more detection units 20 located outside the patient room 6 can be used to detect the location of a staff member 16 (for example using triangulation or other tracking technologies as described above), and the control unit 24 can determine the distance of the staff member 16 from the relevant patient room 6 (i.e. the room for which the audible alarm is being issued) from the detected location and the known location of the patient room 6. The control unit 24 can then determine and set the volume of the audible alarm issued by the remote alarm unit 22 based on the determined distance. Preferably the control unit 24 is configured to control the remote alarm unit 22 to decrease the volume of the audible alarm from the remote alarm unit 22 as the staff member 16 moves closer to the patient room 6 (and also to increase the volume of the audible alarm from the remote alarm unit 22 as the staff member 16 moves away from the patient room 16). As noted above, the volume can be decreased or increased in a stepwise manner, and may be decreased or increased in a generally linear manner with respective decreases or increases in the distance of the staff member 16 from the patient room.

45 **[0058]** In one example, when the staff member 16 is a first distance from the patient room 16 the control unit 24 can control the remote alarm unit 22 to issue the audible alarm with a first (non-zero) volume level, and when the staff member 16 is a second (smaller) distance from the patient room 16 the control unit 24 can control the remote alarm unit 22 to issue the audible alarm with a second (lower, but non-zero) volume level.

50 **[0059]** In another example, when the staff member 16 is greater than a threshold distance from the patient room 16, the control unit 24 can control the remote alarm unit 22 to issue the audible alarm with a first (non-zero) volume level,

and when the staff member 16 is less than the threshold distance from the patient room 16 the control unit 24 can control the remote alarm unit 22 to issue the audible alarm with a second (lower, but non-zero) volume level.

**[0060]** As is known in the art, the sound in an enclosed space attenuates around 6 dB every doubling of the distance from a sound source up to a certain range, referred to as the 'critical distance', and then remains the same beyond that distance due to reverberation. The sound attenuation inside a room or space is affected by many factors (e.g. geometry of the space, the acoustic characteristics of the building materials, etc.), so the critical distance can typically only be determined through actual measurements or simulations.

**[0061]** Thus, in the exemplary embodiments above, the first volume level could be set to 80 dB, and the second volume level could be set to a value that is less than 80 dB and equal to or greater than 50 dB. In the first exemplary embodiment above, the first distance can be greater than the critical distance (or an estimation of the critical distance), with the second distance being a distance that is less than the critical distance (or an estimation of the critical distance). In the second exemplary embodiment the threshold distance can be the critical distance (or an estimation of the critical distance) from the remote alarm unit 22 located outside the room.

**[0062]** In embodiments where the volume can be decreased or increased in a stepwise or generally linear manner with respective decreases or increases in the distance of the staff member 16 from the patient room, the volume can be set according to the values in the following table:

Sound volume (sound pressure) [dB]	distance [m]
50	0.5
56	1
62	2
68	4
74	8
80	16 (= critical distance)
80	>16

**[0063]** Therefore, there is provided a system and method for reducing the negative impact that alarm sounds have on patients while ensuring that healthcare staff are still adequately alerted.

**[0064]** A block diagram of a system 52 according to another aspect of the invention is shown in Figure 4. It will be appreciated that this aspect of the invention can be implemented in a medical device within a healthcare environment in conjunction with the aspect described above, but it can also be implemented in medical device in a healthcare environment independently of whether the aspect described above is also being used.

**[0065]** Briefly, in accordance with this aspect of the invention, a medical device 54 in the system 52 comprises a directional speaker or speaker array 56 that generates an audible alarm in a defined directional pattern (i.e. it does not emit the alarm sound uniformly around the medical device 54), and the directivity of the speaker or speaker array 56 is set so that the amount of sound energy being emitted towards a patient (and specifically the patient's head) on a bed associated with the medical device 54 is substantially less than the amount of sound energy being emitted into the rest of the room in which the patient is located (in other words the directional speaker 56 is configured to emit the alarm signal with spatial directivity such that the alarm signal is emitted substantially away from or not generally in the direction of the patient on the bed).

**[0066]** While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments.

**[0067]** Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfil the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. A computer program may be stored/distributed on a suitable medium, such as an optical storage medium or a solid-state medium supplied together with or as part of other hardware, but may also be distributed in other forms, such as via the Internet or other wired or wireless telecommunication systems. Any reference signs in the claims should not be construed as limiting the scope.

**Claims**

1. A system for use with a patient in a healthcare environment, the system comprising:

- 5 - a medical device configured to monitor or treat a patient, the medical device being for use in a room in which the patient is located and comprising an alarm unit configured to issue an audible alarm;
- a detection unit configured to detect whether a healthcare staff member is in the room in which the patient is located;
- 10 - a remote alarm unit configured to issue an alarm to alert a healthcare staff member located outside the room in which the patient is located; and
- a control unit that is connected to the medical device, the detection unit and the remote alarm unit, the control unit being configured to:

15 (i) control the alarm unit in the medical device to issue an audible alarm in the event that (a) the medical device detects an alarm condition for the patient or the medical device and (b) the detection unit detects that a healthcare staff member is in the room in which the patient is located; and

20 (ii) control the remote alarm unit to issue an audible alarm to alert a healthcare staff member located outside the room in which the patient is located in the event that (a) the medical device detects an alarm condition for the patient or the medical device and (b) the detection unit detects that no healthcare staff member is in the room in which the patient is located; and

25 wherein the detection unit or a second detection unit is configured to detect the distance of the healthcare staff member from the room in which the patient is located and the control unit is further configured to set the volume of the audible alarm issued by the remote alarm unit based on the distance of a healthcare staff member from the room in which the patient is located.

30 2. A system as claimed in claim 1, wherein the control unit is further configured to prevent the alarm unit in the medical device from issuing an audible alarm in the event that the control unit controls the remote alarm unit to issue the alarm to alert a healthcare staff member.

35 3. A system as claimed in claim 1, wherein the control unit is configured to control the alarm unit in the medical device to issue an audible alarm at a first volume level in the event that the medical device detects an alarm condition for the patient or the medical device and the detection unit detects that a healthcare staff member is in the room in which the patient is located; and wherein the control unit is further configured to control the alarm unit in the medical device to issue an audible alarm at a second volume level in the event that the control unit controls the remote alarm unit to issue the alarm to alert a healthcare staff member, wherein the second volume level is lower than the first volume level.

40 4. A system as claimed in claim 1 or 2, wherein the control unit is configured such that, if following the issue of an alarm by the remote alarm unit the detection unit detects that a healthcare staff member is in or has entered the patient room, the control unit controls the remote alarm unit to cease the issue of the alarm and controls the alarm unit in the medical device to issue an audible alarm.

45 5. A system as claimed in any preceding claim, wherein the remote alarm unit comprises an alarm unit configured to issue an audible alarm and a visual indicator that is configured to be activated when the alarm unit in the remote alarm unit is controlled to issue an audible alarm.

50 6. A system as claimed in claim 5, wherein the control unit is configured to modulate the luminance of the visual indicator coherently with the volume of the audible alarm.

7. A system as claimed in any preceding claim, wherein the control unit is configured to reduce the volume of the audible alarm issued by the remote alarm unit as the distance of the healthcare staff member from the room in which the patient is located decreases.

55 8. A system as claimed in any preceding claim, wherein the control unit is configured to increase the volume of the audible alarm issued by the remote alarm unit as the distance of the healthcare staff member from the room in which the patient is located increases.

9. A system as claimed in any of claims 1 to 6, wherein the control unit is configured to set the volume of the audible alarm issued by the remote alarm unit to a first level when the healthcare staff member is a first distance from the room in which the patient is located and a second level when the healthcare staff member is a second distance from the room in which the patient is located, wherein the first level is greater than the second level and the first distance is greater than the second distance.

10. A method of operating a system for use with a patient in a healthcare environment, the method comprising:

determining whether a healthcare staff member is in the room in which a medical device that is monitoring or treating a patient is located;  
 detecting the distance of the healthcare staff member from the room in which the patient is located; and  
 in the event that an alarm condition for the patient or medical device is detected:

(i) issuing an audible alarm from an alarm unit in the medical device if it is determined that a healthcare staff member is in the room in which the patient is located; and

(ii) issuing an audible alarm from a remote alarm unit to alert a healthcare staff member located outside the room in which the patient is located if it is determined that no healthcare staff member is in the room in which the patient is located, and setting the volume of the audible alarm based on the distance of a healthcare staff member from the room in which the patient is located.

11. A computer program product, comprising computer readable code embodied therein, the computer readable code being configured such that, on execution by one or more suitable computers or processing units, the one or more suitable computers or processing units are caused to execute the steps in the method of claim 10.

## Patentansprüche

1. System zur Verwendung mit einem Patienten in einer Einrichtung des Gesundheitswesens, wobei das System Folgendes umfasst:

- eine medizinische Vorrichtung, die konfiguriert ist, um einen Patienten zu überwachen oder zu behandeln, wobei die medizinische Vorrichtung für die Verwendung in einem Raum vorgesehen ist, in dem sich der Patient befindet, und eine Alarmeinheit umfassend, die konfiguriert ist, um einen akustischen Alarm auszugeben;
- eine Erfassungseinheit, die konfiguriert ist, um zu erfassen, ob sich ein Mitglied des Pflegepersonals im Raum befindet, in dem sich der Patient befindet;
- eine Fernalarmeinheit, die konfiguriert ist, um einen Alarm auszugeben, um ein Mitglied des Pflegepersonals zu benachrichtigen, das sich außerhalb des Raumes befindet, in dem sich der Patient befindet; und
- eine Steuerungseinheit, die mit der medizinischen Vorrichtung, der Erfassungseinheit und der Fernalarmeinheit verbunden ist, wobei die Steuerungseinheit konfiguriert ist, um:

(i) die Alarmeinheit in der medizinischen Vorrichtung zu steuern, um einen akustischen Alarm auszugeben, falls (a) die medizinische Vorrichtung eine Alarmbedingung für den Patienten oder die medizinische Vorrichtung erfasst, und (b) die Erfassungseinheit erfasst, dass sich ein Mitglied des Pflegepersonals im Raum befindet, in dem sich der Patient befindet; und

(ii) die Fernalarmeinheit zu steuern, um einen akustischen Alarm auszugeben, um ein Mitglied des Pflegepersonals, das sich außerhalb des Raumes befindet, in dem sich der Patient befindet, zu benachrichtigen, falls (a) die medizinische Vorrichtung eine Alarmbedingung für den Patienten oder die medizinische Vorrichtung erfasst, und (b) die Erfassungseinheit erfasst, dass sich kein Mitglied des Pflegepersonals im Raum befindet, in dem sich der Patient befindet; und

wobei die Erfassungseinheit oder eine zweite Erfassungseinheit konfiguriert ist, um den Abstand des Mitglieds des Pflegepersonals vom Raum zu erfassen, in dem sich der Patient befindet, und die Steuerungseinheit darüber hinaus konfiguriert ist, um die Lautstärke des akustischen Alarms, der durch die Fernalarmeinheit ausgegeben wird, basierend auf dem Abstand des Mitglieds des Pflegepersonals vom Raum einzustellen, in dem sich der Patient befindet.

2. System nach Anspruch 1, wobei die Steuerungseinheit darüber hinaus konfiguriert ist, um die Alarmeinheit in der medizinischen Vorrichtung daran zu hindern, einen akustischen Alarm auszugeben, falls die Steuerungseinheit die Fernalarmeinheit ansteuert, um den Alarm zur Benachrichtigung eines Mitglieds des Pflegepersonals auszugeben.

3. System nach Anspruch 1, wobei die Steuerungseinheit konfiguriert ist, um die Alarmeinheit in der medizinischen Vorrichtung anzusteuern, um einen akustischen Alarm auf einer ersten Lautstärkestufe auszugeben, falls die medizinische Vorrichtung eine Alarmbedingung für den Patienten oder die medizinische Vorrichtung erfasst, und die Erfassungseinheit erfasst, dass sich ein Mitglied des Pflegepersonals im Raum befindet, in dem sich der Patient befindet; und wobei die Steuerungseinheit darüber hinaus konfiguriert ist, um die Alarmeinheit in der medizinischen Vorrichtung anzusteuern, um einen akustischen Alarm auf einer zweiten Lautstärkestufe auszugeben, falls diese Steuerungseinheit die Fernalarmeinheit ansteuert, um einen Alarm auszugeben, um ein Mitglied des Pflegepersonals zu benachrichtigen, wobei die zweite Lautstärkestufe niedriger ist, als die erste Lautstärkestufe.
4. System nach Anspruch 1 oder 2, wobei die Steuerungseinheit konfiguriert ist, sodass, falls die Erfassungseinheit nach der Ausgabe eines Alarms durch die Fernalarmeinheit erfasst, dass sich ein Mitglied des Pflegepersonals im Patientenraum befindet oder diesen betreten hat, die Steuerungseinheit die Fernalarmeinheit ansteuert, um die Ausgabe des Alarms zu beenden und die Alarmeinheit in der medizinischen Vorrichtung ansteuert, um einen akustischen Alarm auszugeben.
5. System nach irgendeinem vorhergehenden Anspruch, wobei die Fernalarmeinheit eine Alarmeinheit umfasst, die konfiguriert ist, um einen akustischen Alarm auszugeben, sowie eine optische Anzeige, die konfiguriert ist, um aktiviert zu werden, wenn die Alarmeinheit in der Fernalarmeinheit angesteuert wird, um einen akustischen Alarm auszugeben.
6. System nach Anspruch 5, wobei die Steuerungseinheit konfiguriert ist, um die Leuchtkraft der optischen Anzeige entsprechend der Lautstärke des akustischen Alarms zu modulieren.
7. System nach irgendeinem vorhergehenden Anspruch, wobei die Steuerungseinheit konfiguriert ist, um die Lautstärke des akustischen Alarms, der durch die Fernalarmeinheit ausgegeben wird, zu verringern, wenn der Abstand des Mitglieds des Pflegepersonals vom Raum, in dem sich der Patient befindet, abnimmt.
8. System nach irgendeinem vorhergehenden Anspruch, wobei die Steuerungseinheit konfiguriert ist, um die Lautstärke des akustischen Alarms, der durch die Fernalarmeinheit ausgegeben wird, zu erhöhen, wenn der Abstand des Mitglieds des Pflegepersonals vom Raum, in dem sich der Patient befindet, zunimmt.
9. System nach irgendeinem der Ansprüche 1 bis 6, wobei die Steuerungseinheit konfiguriert ist, um die Lautstärke des akustischen Alarms, der durch die Fernalarmeinheit ausgegeben wird, auf eine erste Stufe einzustellen, wenn sich das Mitglied des Pflegepersonals in einem ersten Abstand zum Raum befindet, in dem sich der Patient befindet, und eine zweite Stufe, wenn sich das Mitglied des Pflegepersonals in einem zweiten Abstand zum Raum befindet, in dem sich der Patient befindet, wobei die erste Stufe größer ist, als die zweite Stufe, und der erste Abstand größer ist, als der zweite Abstand.
10. Verfahren zum Betreiben eines Systems zur Verwendung mit einem Patienten in einer Einrichtung des Gesundheitswesens, wobei das Verfahren Folgendes umfasst:
- Bestimmen, ob sich ein Mitglied des Pflegepersonals im Raum befindet, in dem sich eine medizinische Vorrichtung befindet, die einen Patienten überwacht oder behandelt;
- Erfassen des Abstands des Mitglieds des Pflegepersonals vom Raum, in dem sich der Patient befindet; und falls eine Alarmbedingung für den Patienten oder die medizinische Vorrichtung erfasst wird:
- (i) Ausgeben eines akustischen Alarms aus einer Alarmeinheit in der medizinischen Vorrichtung, falls bestimmt wird, dass sich ein Mitglied des Pflegepersonals im Raum befindet, in dem sich der Patient befindet; und
- (ii) Ausgeben eines akustischen Alarms aus einer Fernalarmeinheit zur Benachrichtigung eines Mitglieds des Pflegepersonals, das sich außerhalb des Raums befindet, in dem sich der Patient befindet, falls bestimmt wird, dass sich kein Mitglied des Pflegepersonals im Raum befindet, in dem sich der Patient befindet, und Einstellen der Lautstärke des akustischen Alarms basierend auf dem Abstand eines Mitglieds des Pflegepersonals vom Raum, in dem sich der Patient befindet.
11. Computerprogrammprodukt, einen vom Computer lesbaren Code umfassend, der darin enthalten ist, wobei der vom Computer lesbare Code konfiguriert ist, sodass bei Ausführung durch einen oder mehrere geeignete Computer oder Prozesseinheiten der eine oder mehrere Computer oder Prozesseinheiten dazu veranlasst werden, die Ver-

fahresschritte aus Anspruch 10 auszuführen.

## Revendications

5

1. Système destiné à une utilisation avec un patient dans un environnement de soins de santé, le système comprenant :

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- un dispositif médical configuré pour surveiller ou traiter un patient, le dispositif médical étant destiné à une utilisation dans une chambre où le patient se trouve et comprenant une unité d'alarme configurée pour émettre une alarme sonore ;

- une unité de détection configurée pour détecter si un membre du personnel soignant est dans la chambre où le patient se trouve ;

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- une unité d'alarme à distance configurée pour émettre une alarme afin d'alerter un membre du personnel soignant se trouvant à l'extérieur de la chambre où le patient se trouve ; et

- une unité de commande qui est connectée au dispositif médical, à l'unité de détection et à l'unité d'alarme à distance, l'unité de commande étant configurée pour :

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(i) commander l'unité d'alarme dans le dispositif médical pour émettre une alarme sonore dans le cas où (a) le dispositif médical détecte une condition d'alarme pour le patient ou le dispositif médical et (b) l'unité de détection détecte qu'un membre du personnel soignant est dans la chambre où le patient se trouve ; et

(ii) commander l'unité d'alarme à distance pour émettre une alarme sonore afin d'alerter un membre du personnel soignant se trouvant à l'extérieur de la chambre où le patient se trouve dans le cas où (a) le dispositif médical détecte une condition d'alarme pour le patient ou le dispositif médical et (b) l'unité de détection détecte qu'aucun membre du personnel soignant n'est dans la chambre où le patient se trouve ; et

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dans lequel l'unité de détection ou une seconde unité de détection sont configurées pour détecter la distance du membre du personnel soignant par rapport à la chambre où le patient se trouve et l'unité de commande est en outre configurée pour régler le volume de l'alarme sonore émise par l'unité d'alarme à distance sur la base de la distance du membre du personnel soignant par rapport à la chambre où le patient se trouve.

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2. Système selon la revendication 1, dans lequel l'unité de commande est en outre configurée pour empêcher l'unité d'alarme dans le dispositif médical d'émettre une alarme sonore dans le cas où l'unité de commande commande l'unité d'alarme à distance pour émettre l'alarme afin d'alerter un membre du personnel soignant.

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3. Système selon la revendication 1, dans lequel l'unité de commande est configurée pour commander l'unité d'alarme dans le dispositif médical afin d'émettre une alarme sonore à un premier niveau de volume dans le cas où le dispositif médical détecte une condition d'alarme pour le patient ou le dispositif médical et l'unité de détection détecte qu'un membre du personnel soignant est dans la chambre où le patient se trouve ; et dans lequel l'unité de commande est en outre configurée pour commander l'unité d'alarme dans le dispositif médical afin d'émettre une alarme sonore à un second niveau de volume dans le cas où l'unité de commande commande l'unité d'alarme à distance pour émettre l'alarme afin d'alerter un membre du personnel soignant, dans lequel le second niveau de volume est inférieur au premier niveau de volume.

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4. Système selon la revendication 1 ou 2, dans lequel l'unité de commande est configurée de telle sorte que, si à la suite de l'émission d'une alarme par l'unité d'alarme à distance l'unité de détection détecte qu'un membre du personnel soignant est dans ou est entré dans la chambre du patient, l'unité de commande commande l'unité d'alarme à distance pour arrêter l'émission de l'alarme et commande l'unité d'alarme dans le dispositif médical pour émettre une alarme sonore.

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5. Système selon l'une quelconque des revendications précédentes, dans lequel l'unité d'alarme à distance comprend une unité d'alarme configurée pour émettre une alarme sonore et un indicateur visuel qui est configuré pour être activé lorsque l'unité d'alarme dans l'unité d'alarme à distance est commandée pour émettre une alarme sonore.

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6. Système selon la revendication 5, dans lequel l'unité de commande est configurée pour moduler la luminance de l'indicateur visuel de manière cohérente avec le volume de l'alarme sonore.

7. Système selon l'une quelconque des revendications précédentes, dans lequel l'unité de commande est configurée pour réduire le volume de l'alarme sonore émise par l'unité d'alarme à distance à mesure que la distance du membre

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du personnel soignant par rapport à la chambre où le patient se trouve diminue.

5 8. Système selon l'une quelconque des revendications précédentes, dans lequel l'unité de commande est configurée pour augmenter le volume de l'alarme sonore émise par l'unité d'alarme à distance à mesure que la distance du membre du personnel soignant par rapport à la chambre où le patient se trouve augmente.

10 9. Système selon l'une quelconque des revendications 1 à 6, dans lequel l'unité de commande est configurée pour régler le volume de l'alarme sonore émise par l'unité d'alarme à distance à un premier niveau lorsque le membre du personnel soignant est à une première distance par rapport à la chambre où le patient se trouve et à un second niveau lorsque le membre du personnel soignant est à une seconde distance par rapport à la chambre où le patient se trouve, dans lequel le premier niveau est supérieur au second niveau et la première distance est supérieure à la seconde distance.

15 10. Procédé de fonctionnement d'un système destiné à une utilisation avec un patient dans un environnement de soins de santé, le procédé consistant à :

déterminer si un membre du personnel soignant est dans la chambre où un dispositif médical qui surveille ou traite un patient se trouve ;

20 détecter la distance du membre du personnel soignant par rapport à la chambre où le patient se trouve ; et dans le cas où une condition d'alarme pour le patient ou le dispositif médical est détectée :

(i) émettre une alarme sonore à partir d'une unité d'alarme dans le dispositif médical s'il est déterminé qu'un membre du personnel soignant est dans la chambre où le patient se trouve ; et

25 (ii) émettre une alarme sonore à partir d'une unité d'alarme à distance pour alerter un membre du personnel soignant se trouvant à l'extérieur de la chambre où le patient se trouve s'il est déterminé qu'aucun membre du personnel soignant n'est dans la chambre où le patient se trouve, et régler le volume de l'alarme sonore sur la base de la distance du membre du personnel soignant par rapport à la chambre où le patient se trouve.

30 11. Produit programme d'ordinateur, comprenant un code lisible par ordinateur incorporé dans celui-ci, le code lisible par ordinateur étant configuré de telle sorte que, à l'exécution par un ou plusieurs ordinateurs ou unités de traitement appropriés, le ou les ordinateurs ou unités de traitement appropriés sont amenés à exécuter les étapes dans le procédé de la revendication 10.

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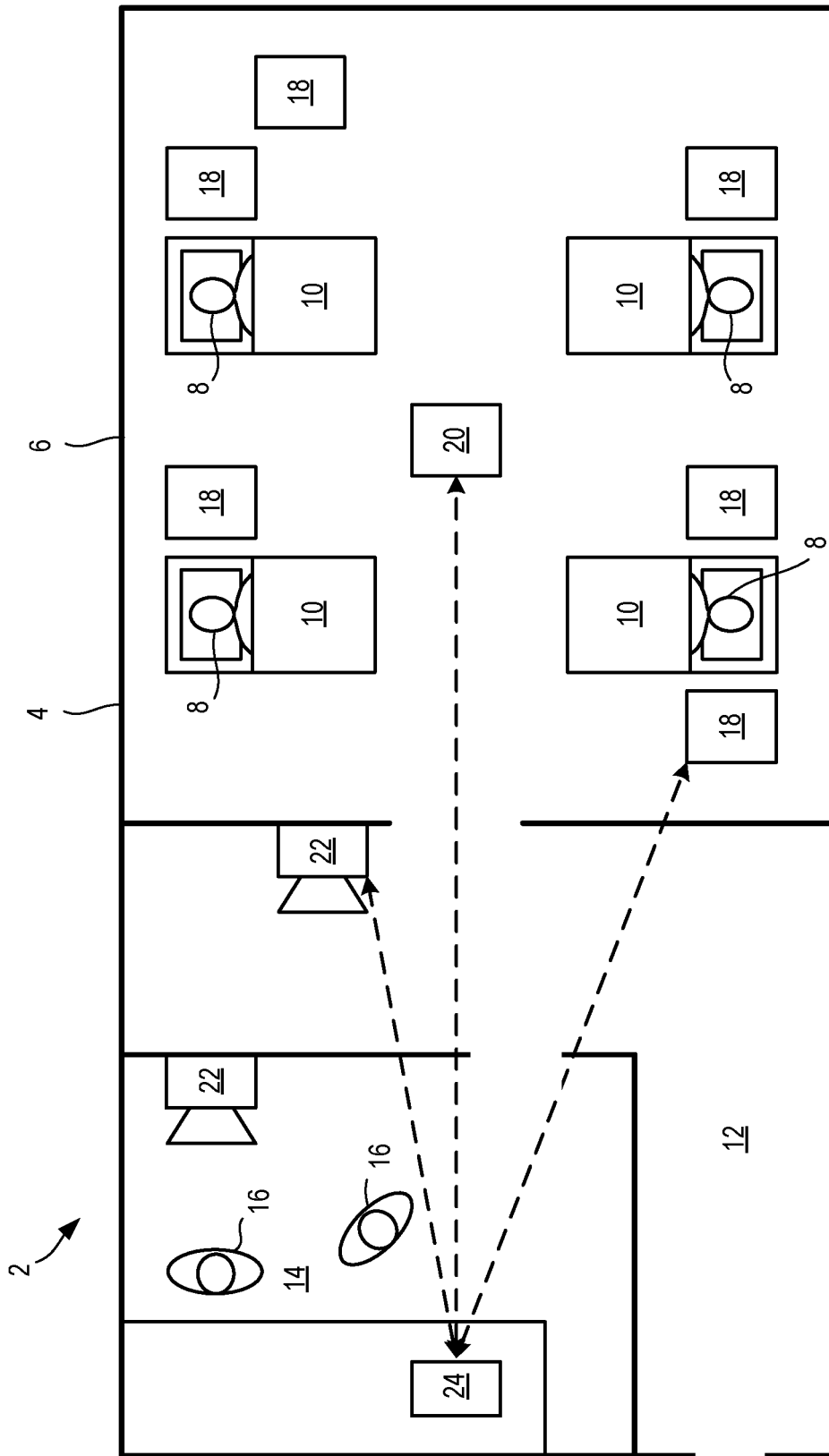


Figure 1

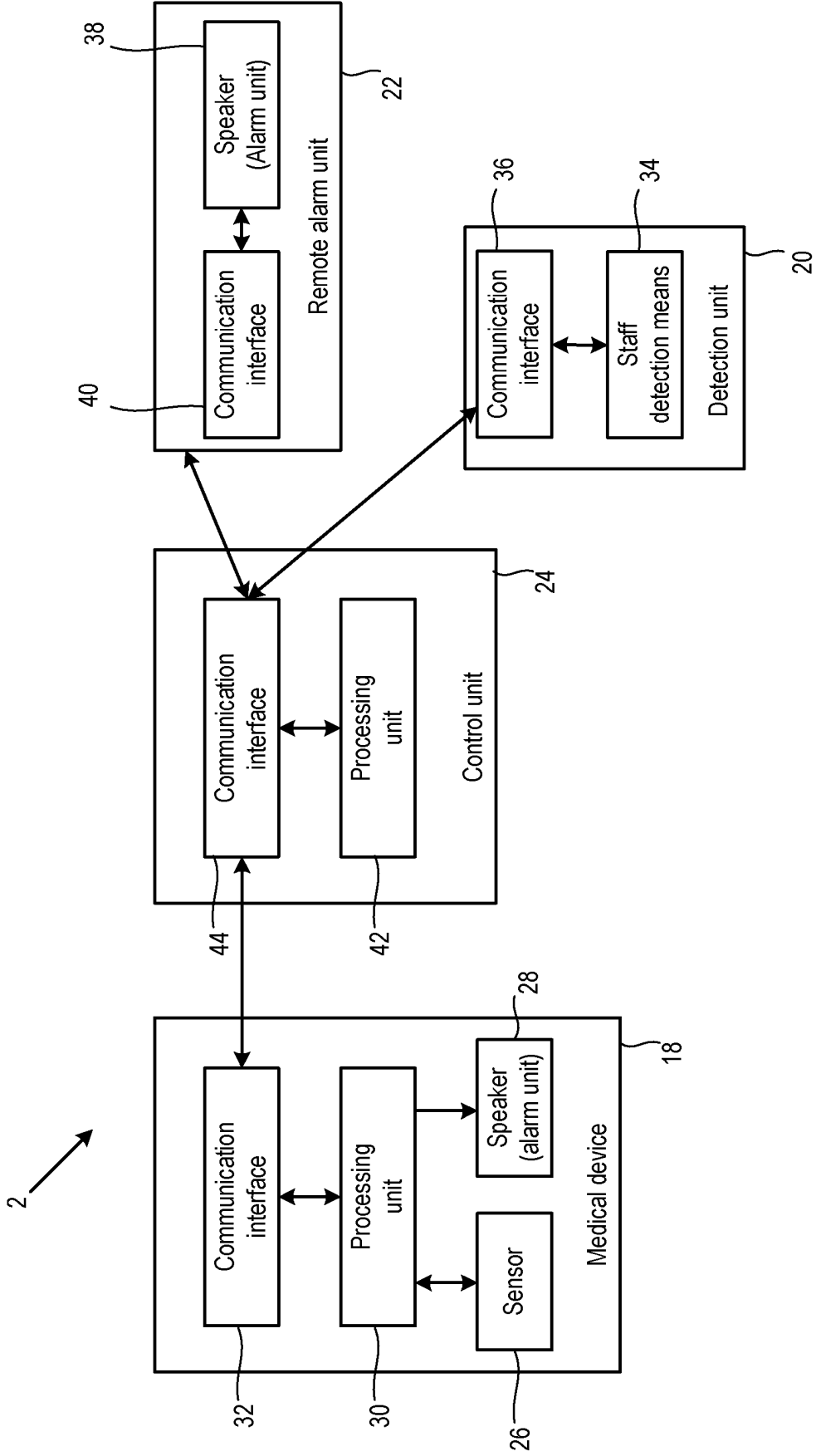


Figure 2

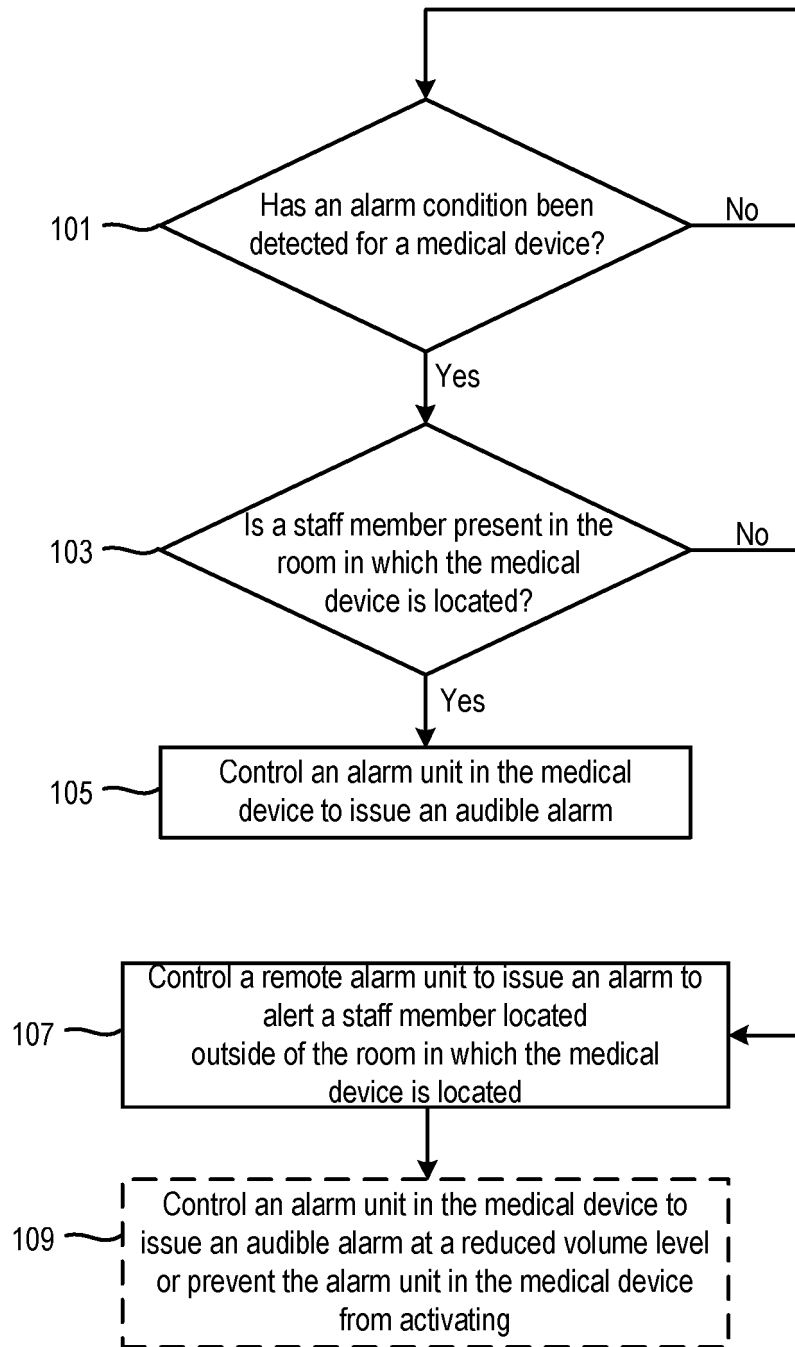


Figure 3

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- US 7920061 B [0005]

专利名称(译)	用于减少警报声对患者的影响的系统和方法		
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摘要(译)

本发明涉及一种用于在卫生保健环境中的患者使用的系统，包括配置成监测或治疗的患者的医疗装置的系统，该医疗装置适于在位于一个房间中使用患者和包括一个报警单元，被配置来提供可听报警；检测单元，配置成检测构件保健人员是否是在将患者躺在所述室；一远程报警单元，配置为发出警报，以提醒位于哪个病人躺在房间外的个人保健人员；以及连接到医疗装置的控制单元，所述检测单元距离和报警单元，所述控制单元被配置为：(i) 命令所述报警单元中的医疗装置发出的情况下，可听报警的医疗装置检测到的状态对患者或医疗装置和检测单元报警检测部件医护人员是在将患者躺在在所述室；和(ii) 远程控制报警单元发出警报，以提醒位于哪个病人躺在在的情况下的房间外部的个人保健人员，其中所述医疗装置检测到对患者或医疗装置和检测单元报警的状态检测到没有医护人员的部件是在房间中的位于患者。

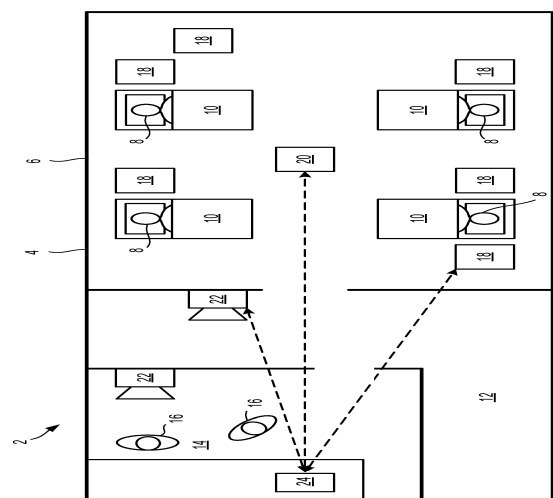


Figure 1