

SUMMARY OF THE INVENTION

[009a] According to a first aspect of the present invention, there is provided a wireless relay module, configured to operate in a wireless relay network, the wireless relay module comprising:

a receiver capable of ~~wirelessly receiving medical device data over a~~ the wireless relay network from at least ~~one~~ two medical devices;

a first transmitter capable of ~~wirelessly transmitting the medical device data to a second~~ wireless relay module over the wireless relay network;

a second transmitter capable of ~~wirelessly transmitting the medical device data over an~~ internet-accessible wireless communication network;

a display capable of displaying at least one of graphical data or text data;

a ~~controller-processor~~ coupled to the receiver and the first and second transmitters, the controller-processor capable of controlling the wireless relay module to select one of said first or second transmitter for transmitting medical device data received by the receiver, the ~~controller processor~~ processor capable of:

receiving medical device data from said receiver;

determining that ~~whether~~ at least a portion of the received medical device data is indicative of an alarm condition;

in response to at least a portion of the medical device data being indicative of at least one alarm condition from each of at least two medical devices, said processor is capable of, and the controller causing the display to display an alert indicative of the for each alarm condition.

[009b] According to a second aspect of the present invention, there is provided a computerized method comprising the steps of:

receiving data at a wireless relay module ~~wirelessly transmitted from at least one~~ a first medical device;

~~a-~~receiving data from ~~the at least one~~ at least a second medical device over a wireless relay network;

~~b-~~determining ~~the~~ a status of an internet-accessible wireless communications network in communication with a first transmitter of said relay module;

~~e.-transmitting said data from the at least one~~first medical device over said communications network by said first transmitter if said determined status satisfies a particular criteria;

~~d.-transmitting said received data from said at least one~~the second medical device by a second transmitter in communication with the wireless relay network to a second relay module over the wireless relay network if said determined status fails to satisfy the particular criteria:

e.-determining at the wireless relay module ~~that whether~~ at least a portion of the received data is indicative of an alarm condition; and

in response to at least a portion of the received data being indicative of at least one alarm condition from two or more of the at least first or second medical devices, displaying on a display of the wireless relay module a number of alerts corresponding to the number of alarm conditions.

~~f.-performing at least one of emitting an audible alarm at the wireless relay module based on the alarm condition, or displaying a visual alarm based on the alarm condition.~~

[009c] According to a third aspect of the present invention, there is provided a wireless relay module comprising:

a receiver capable of wirelessly receiving medical device data over a wireless relay network from at least one medical device;

a first transmitter capable of wirelessly transmitting the medical device data to a second wireless relay module over the wireless relay network;

a second transmitter capable of wirelessly transmitting the medical device data over an internet-accessible wireless communication network;

a microphone and speaker; and

a ~~controller-processor~~ coupled to the first and second transmitters, microphone and speaker, the ~~controller-processor~~ capable of controlling the wireless relay module to select one of said first or second transmitter for transmitting the medical device data received by the receiver, said processor capable of determining whether medical device data received by the receiver is indicative of at least one alarm condition from each of multiple medical devices and in response thereto said processor capable of causing a display of the wireless relay module to display multiple alerts indicative of at least one alarm condition from multiple medical devices, and the

~~controller-processor~~ also capable of exchanging voice information between a clinician proximate said wireless relay module and a remote location via the internet-accessible wireless communication network.

[0010] Embodiments of the present invention are directed to wireless relay modules for enabling alarm recognition and display alerts in networked communications between a series of medical devices and remote monitoring devices via wireless relay networks and/or internet-accessible wireless communications networks. The wireless relay module comprises a display, a receiver capable of wirelessly receiving medical device data over a wireless relay network from at least one medical device along with a first transmitter capable of wirelessly transmitting medical device data to a second wireless relay module over the wireless relay network, and a second transmitter capable of wirelessly transmitting data over an internet-accessible wireless communication network. It is possible for the transmitters and receivers to be implemented as transceivers.

[0011] A controller is coupled to the first and second transmitters, and controls the wireless relay module to select one of said first or second transmitter for transmitting medical device data received by the receiver over one of the two respective networks. The controller is further capable of determining that at least a portion of the received medical data is indicative of an alarm condition and causing the display to display an alert indicative of the alarm condition to alert caregivers.

[0012] The alert may include, for example, at least one of medical device description, medical device identification, medical device location, patient identification, patient condition, alarm type or code, alarm error code, and alarm severity or priority. The information indicative of an alarm condition in certain instances may be received from the wireless relay module itself and/or the second wireless relay module as well as possibly being received from the one or more medical devices as described above.

[0013] In another embodiment, the controller is configured to alternately display alerts on the display at intermittent intervals if data from more than one medical device data is indicative of alarm conditions. The controller may determine what information is displayed, as well as the duration of such information on the display based upon the severity of the alarm condition. In a

further embodiment, the controller is configured to display a color on the display indicative of the alarm condition or normal, non-alarm status.

[0014] In yet a further embodiment, a speaker is coupled to the controller, where the speaker is capable of providing an audible alert, e.g., speech or other sounds, of the alarm condition. It is contemplated in accordance with embodiments of the invention that the volume or type of such

What is claimed:

1. A wireless relay module configured to operate in a wireless relay network, the wireless relay module comprising:

a receiver capable of ~~wirelessly~~ receiving medical device data over a ~~the~~ wireless relay network from at least ~~one~~ two medical devices;

a first transmitter capable of ~~wirelessly~~ transmitting the medical device data to a second wireless relay module over the wireless relay network;

a second transmitter capable of ~~wirelessly~~ transmitting ~~the~~ the medical device data over an internet-accessible wireless communication network;

a display capable of displaying at least one of graphical data or text data;

a ~~controller~~ processor coupled to said receiver and said ~~the~~ first and second transmitters, ~~the controller~~ said processor capable of controlling the wireless relay module to select one of said first or second transmitter for transmitting medical device data received by the receiver, ~~the controller~~ said processor capable of:

receiving medical device data from said receiver;

determining that ~~whether~~ at least a portion of the ~~received~~ medical device data is indicative of an alarm condition;

in response to at least a portion of the medical device data being indicative of at least one alarm condition from each of at least two medical devices, ~~said, and the controller~~ processor is capable of causing ~~the said~~ display to display an alert ~~indicative of the~~ for each alarm condition.

2. The wireless relay module of claim 1, wherein the ~~alarm condition~~ medical device data includes at least one of: a medical device description, a medical device identification, a medical device location, a patient identification, an alarm type, an alarm error code, or an alarm severity.

3. The wireless relay module of claim 1, wherein ~~the said controller~~ processor is configured to ~~enable the~~ cause said display to alternately show a plurality of alerts on the display at intermittent intervals.

4. The wireless relay module of claim 3, wherein the alternately displayed alerts is based on receiving an alarm condition from a second relay module.

5. The wireless relay module of claim 3, wherein the duration of respective intermittent intervals is determined by an alarm severity of the alerts to be displayed.

6. The wireless relay module of claim 1, wherein the ~~controller~~processor is configured to show a color on the display depending on the alarm condition.

7. The wireless relay module of claim 1, wherein the ~~controller~~processor is configured to enable the display to show a battery charge level of the wireless relay module.

8. The wireless relay module of claim 1 further comprising a second receiver coupled to the ~~controller~~processor, said second receiver capable of wirelessly receiving data over the internet-accessible wireless communication network.

9. The wireless relay module of claim 1, wherein the ~~controller~~processor is configured to cause the display to display strength of at least one of a received signal of the wireless relay network or internet-accessible wireless communication network.

10. The wireless relay module of claim 1 further comprising at least one of a speaker or a microphone coupled to the ~~controller~~processor.

11. The wireless relay module of claim 10, wherein said ~~controller~~processor is capable of causing said speaker to emit an audible alert having a characteristic indicative of a severity of the alarm condition.

12. The wireless relay module of claim 11, wherein said characteristic indicative of a severity of the alarm condition is at least one of volume, pitch, tone, type, audible sequence or duty cycle, or recorded sound.

13. The wireless relay module of claim 11 further comprising a user-actuable input interface operatively coupled to the ~~controller~~processor, the input interface configured to disable the audible alert.

14. The wireless relay module of claim 10 further comprising at least one of:
a codec coupled between the ~~controller~~processor and the at least one of the speaker or microphone; or
a codec functionality provided by the ~~controller~~processor.

15. The wireless relay module of claim 14, wherein said at least one of the codec or the codec functionality provided by the ~~controller~~processor provides at least one of speech detection or speech recognition.

16. A computerized method comprising the steps of:

receiving data at a wireless relay module ~~wirelessly~~ transmitted from at least ~~one~~ a first medical device;

~~a.~~ receiving data from the ~~at least one~~ at least a second medical device over a wireless relay network;

~~b.~~ determining a the status of an internet-accessible wireless communications network in communication with a first transmitter of said relay module;

~~c.~~ transmitting said data from the ~~at least one~~ first medical device over said communications network by said first transmitter if said determined status satisfies a particular criteria;

~~d.~~ transmitting said received data from ~~said at least one~~ the second medical device by a second transmitter in communication with the wireless relay network to a second relay module over the wireless relay network if said determined status fails to satisfy the particular criteria:

~~e.~~ determining at the wireless relay module whether ~~that~~ at least a portion of the received data is indicative of an alarm condition; and

in response to at least a portion of the received data being indicative of at least one alarm condition from two or more of the at least first or second medical devices,

displaying on a display of the wireless relay module a number of alerts corresponding to the number of alarm conditions.

~~f. performing at least one of emitting an audible alarm at the wireless relay module based on the alarm condition, or displaying a visual alarm based on the alarm condition.~~

17. The method of claim 16, wherein the alarm condition includes at least one of medical device description, medical device identification, medical device location, patient identification, alarm type, alarm error code, and alarm severity.

18. The method of claim 16 further comprising alternately displaying information on the display at respective intermittent intervals ~~if data from more than one medical device is~~ indicative of a plurality of alarm conditions.

~~19. The method of claim 18, wherein the alternately displaying information on the display at respective intermittent intervals is based on receiving an alarm condition from a second relay module.~~

~~20~~19. The method of claim ~~18~~9, wherein the duration of respective intermittent intervals is determined by an alarm condition severity of the visual alarms to be displayed.

~~21~~20. The method of claim 16, wherein the displayed visual alarm has an associated predetermined color representing the severity of the alarm condition.

~~22~~21. The method of claim 16 further comprising displaying on the display an indication of a charge level of a battery connected to the wireless relay module.

~~23~~22. The method of claim 16 further comprising displaying on the display an indication of a signal strength of at least one of the wireless relay network or internet-accessible wireless communication network.

~~24~~23. The method of claim 16, wherein the step of emitting the audible alarm comprises emitting the audible alarm with a characteristic based upon a severity of said alarm condition.

~~25~~24. The method of claim 24 further comprising changing the emitted audible alarm by at least one of decibel level, type of sound, duty cycle or speech command if no response is detected to said audible alarm in a particular time interval.

~~26~~25. The method of claim 16 further comprising the step of disabling the emitted audible alarm when a signal is received from a user-actuable input.

~~27~~26. The method of claim 16, further comprising the step of enabling voice communication between the wireless relay module and a remote monitoring device.

2827. The method of claim 16 further comprising the steps of:
receiving a voice command by the wireless relay module; and
said wireless relay module performing a function in response to said voice command.

2928. The method of claim 28-27 wherein the step of performing a function comprises dialing an emergency response service and establishing voice communication with said emergency response service.

3029. A wireless relay module comprising:
a receiver capable of wirelessly receiving medical device data over a wireless relay network from at least one medical device;
a first transmitter capable of wirelessly transmitting the medical device data to a second wireless relay module over the wireless relay network;
a second transmitter capable of wirelessly transmitting the medical device data over an internet-accessible wireless communication network;
a microphone and speaker; and
a ~~controller~~processor coupled to the first and second transmitters, microphone and speaker, the ~~controller~~processor capable of controlling the wireless relay module to select one of said first or second transmitter for transmitting the medical device data received by the receiver, said processor capable of determining whether medical device data received by the receiver is indicative of at least one alarm condition from each of multiple medical devices and in response thereto said processor capable of causing a display of the wireless relay module to display multiple alerts indicative of at least one alarm condition from multiple medical devices, and the ~~controller~~processor also capable of exchanging voice information between a clinician proximate said wireless relay module and a remote location via the internet-accessible wireless communication network.

3130. The wireless relay module of claim 30-29 further comprising a codec coupled between the ~~controller~~processor and at least one of the speaker or microphone.

3231. The wireless relay module of claim 3130, wherein said codec is voice-activated.

3332. The wireless relay module of claim 30-29 wherein said ~~controller~~processor provides voice-activated functionality.

~~34~~33. The wireless relay module of claim ~~30-29~~ further comprising a dialer for establishing a telephone connection for the wireless relay module.