(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 June 2006 (22.06.2006)

PCT

(10) International Publication Number
WO 2006/064397 A2

(51) International Patent Classification:
A61B 5/00 (2006.01)

(21) International Application Number: PCT/IB2005/054063

(22) International Filing Date: 5 December 2005 (05.12.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/635,645 13 December 2004 (13.12.2004) US
60/670,386 12 April 2005 (12.04.2005) US

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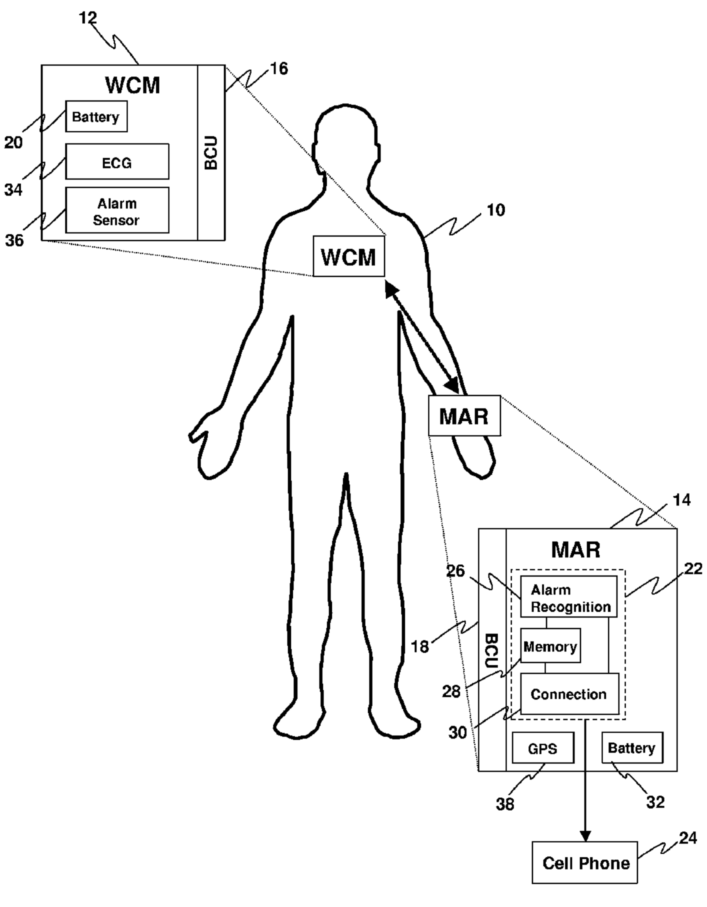
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH,

[Continued on next page]

(54) Title: MOBILE MONITORING



(57) Abstract: A wireless network for monitoring a patient (10) comprises at least one wearable monitor (12, 70) including a physiological condition sensor (34, 74) coupled to the patient (10) to sense and communicate data related to one physiological function of the patient (10). A first body communication unit (16, 78) interfaces with the at least one wearable monitor (12, 70) to communicate over the patient (10) utilizing a near field capacitive body coupled protocol. A relay system (14, 50 72) includes a second body communication unit (18, 52, 80) that receives data from the at least one wearable monitor (12, 70) and communicates with the first body communication unit (16, 78) utilizing the near field capacitive body coupled protocol. An external communication unit (22) communicates the data to a remote medical monitoring station via a cell phone network or the internet.

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GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MOBILE MONITORING

DESCRIPTION

The following relates to wireless body networks. It finds particular application with alarm relaying from one or more wireless sensors to a cellular phone and further to a surveillance and/or alarm center. However, it is to be appreciated that the invention may also find application in providing communication between wireless sensors and other wireless transponders capable of receiving near field body coupled communication technology.

Patients are typically monitored of one or more physiological functions when they receive medical attention at a medical facility. For example, it may be desirable to monitor heart function, pulse, blood pressure, blood oxygen level and the like. Conventionally, such monitoring is accomplished utilizing sensors wired to various output devices that can notify medical personnel of one or more conditions. Alternatively, wireless sensors can be employed with wireless networks to transmit such data to one or more wireless transponders such as a display, a monitor, memory, central terminal and the like.

Such sensors typically provide continuous monitoring of a particular physiological function and an alarm output if a critical event arises. The alarm output can be transmitted utilizing conventional communication technology such as a wired hospital network, radio frequency, Bluetooth or magnetic coupling (B-field), for example. However, when the patient ranges beyond the controlled medical facility communication environment, conventional communication technologies can become unreliable. While a cell phone provides a convenient communication link between a patient and a remote site, direct communication by the monitor in an emergency is more awkward. An ECG monitor can be directly wired to a cell phone, but positioning wires is inconvenient and the wires interfere with normal usage of the cell phone. Cell phones are often compatible with Bluetooth communication protocols. However, in some situations, body attenuation prevents proper signal propagation. For example, if a patient falls down (*e.g.*, due to a heart attack) and covers the chest mounted ECG system, the Bluetooth communication is heavily attenuated by the body and typically disrupted.

Magnetic coupling communications signals travel readily through the body but consume excessive amounts of energy restricting portability. Due to the weight of batteries, carrying a large battery power supply is inconvenient. In addition, magnetic coupling is typically unidirectional which does not accommodate bi-directional verification routines.

Typically, communication between the wireless sensor and the mobile phone is fixed due to static configured connectivity. Such static configuration prevents the safe and flexible connection to other nearby mobile phones in an emergency when the primary mobile phone is unavailable. Furthermore, such fixed association inhibits the systems from working reliably in multi-user scenarios.

The present invention contemplates an improved apparatus and method that overcomes the aforementioned limitations and others.

According to one aspect, a wireless network for monitoring a patient comprises at least one wearable monitor including a physiological condition sensor coupled to the patient to sense and communicate data related to one physiological function of the patient. A first body communication unit interfaces with the at least one wearable monitor to communicate over the patient utilizing a near field capacitive body coupled protocol. A relay system includes a second body communication unit that receives data from the at least one wearable monitor and communicates with the first body communication unit utilizing the near field capacitive body coupled protocol. An external communication unit communicates the data to a remote medical monitoring station.

According to another aspect, a method for communicating medical information within a wireless network includes monitoring a physiological condition of a patient *via* a sensor coupled to the patient. Data related to one physiological function of the patient is communicated from the sensor *via* a first body communication unit that interfaces with the at least one wearable monitor to communicate over the patient utilizing a near field capacitive body coupled protocol. The data is relayed to a mobile alarm relay system from the wearable monitor *via* a second body communication unit that receives data from the at least one wearable monitor and communicates with the first body communication unit utilizing the near field capacitive body coupled protocol. The data is communicated from the mobile alarm relay system to a remote medical monitoring station.

According to yet another aspect, a method for transmitting medical information within a wireless network includes associating a wearable monitor with a mobile alarm relay system including initializing communication between a first body communication unit associated with the wearable monitor and a second body communication unit associated with the mobile alarm relay system utilizing a near field capacitive body coupled protocol. Secure communication is established between the wearable monitor and the mobile alarm relay system by sending an authentication request from the wearable monitor to the mobile alarm relay system and returning an authentication key from the mobile alarm relay system to the wearable monitor. Communication between the wearable monitor and the mobile alarm relay system is verified to be active by monitoring the connection between the wearable monitor and the mobile alarm relay system, and generating an alarm if the connection becomes inactive. An alarm is triggered if the data transmitted by the wearable monitor is outside of a predetermined threshold including transmitting an alarm message from the wearable monitor to the mobile alarm relay system, and relaying the alarm message from the mobile alarm relay system to an external network.

One advantage of the present invention is that it facilitates transmission of medical information in an emergency to a patient monitoring station.

Another advantage is that out-patient monitored medical information is automatically communicated to the patient's medical care professionals.

Another advantage is that medical information can be relayed to a wireless transponder without risk of attenuation caused by the patient.

Another advantage is that medical information can be redundantly communicated to insure that such information is received by a wireless transponder.

Another advantage resides in enabling patient monitors to interconnect with and use existing cell phone networks to communicate medical information.

Another advantage is that patients who need constant medical monitoring can move freely throughout the community.

Numerous additional advantages and benefits will become apparent to those of ordinary skill in the art upon reading the following detailed description of the preferred embodiments.

The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating the preferred embodiments and are not to be construed as limiting the invention.

FIGURE 1 illustrates a body coupled communication network that includes a wireless sensor that communicates to one or more external devices *via* a mobile alarm relay component.

FIGURE 2 illustrates a protocol employed in FIGURE 1 to facilitate communication between the wireless sensor, the mobile alarm relay component and one or more external devices.

FIGURE 3 illustrates a communication network that utilizes a body coupled communication technology and radio frequency technology to transmit information to an external network.

FIGURE 4 shows a protocol employed in FIGURE 3 to facilitate communication utilizing body coupled communication technology and radio frequency technology.

FIGURE 5 shows a redundant communication network that employs both a body coupled communication technology and radio frequency technology to transmit information between a wireless sensor and relay component.

FIGURE 6 shows a protocol employed in FIGURE 5 to facilitate redundant communication between the wireless sensor and the relay component utilizing body coupled communication technology and radio frequency technology.

A patient **10** is equipped with one or more wearable monitors, such as a wearable electrocardiographic (ECG) monitor (WCM) **12**, and a mobile alarm relay system (MAR) **14** (*e.g.*, mobile phone, PDA or other device which connects to wireless networks), which is utilized to forward alarms generated by the wearable monitor **12** to an external entity. It is to be appreciated that the wearable monitor **12** can be employed to monitor any physiological function related to the patient **10**. Both the wearable monitor **12** and the mobile alarm relay system **14** are equipped with a body communication unit (BCU) **16, 18.**

The BCUs **16, 18** communicate utilizing a near-field body-coupled communication technology, based on capacitive coupling.

The wearable monitor **12** is designed to be power efficient and use low energy consumption technologies so that it can be powered by a relatively small battery **20**. The monitor communicates the monitored physiological condition to a remote monitoring station *via* an external connection device **22**, *e.g.* the transmit/receive portion of a cell phone **24** that communicates with the cell phone network. The external connection device **22** includes an alarm recognition component **26** that determines if an alarm condition has been sensed by the wearable monitor **12**. A memory **28** is employed by the alarm recognition component **26** to store monitor output before and after the alarm for subsequent retrieval. The memory **28** can store additional data sent by the wearable monitor **12** that relates to a particular physiological function of the patient **10**. A connection component element **30** connects the mobile relay **14** to the cell phone **24**.

The mobile relay **14** is preferably designed to be carried in contact or close proximity with a portion of the body, *e.g.* in a clothing pocket, or wrapped around the wrist, that can carry more weight, particularly a larger battery **32**. In the preferred embodiment, the mobile alarm relay system **14** is a cell phone hand set that has been modified to include the BCU and other circuitry and has been appropriately programmed.

First, the BCUs **16, 18** are associated *via* body coupled communication. At this stage of communication, security can be set up and a shared authentication key can be exchanged among communication components. After initialization of the BCUs **16, 18** is complete, connections between the BCUs **16, 18** is established and communication can begin. Once communication is started, verification of the communication between the BCUs **16, 18** is monitored to insure that the communication remains active. If communication is inactive, an alarm can be triggered to notify the system of such communication failure.

The wearable monitor BCU **16** receives physiological information from an electrocardiograph (ECG) sensor **34** or other sensor(s). Optionally, an alarm sensor **36** determines if the output of the monitor calls for an alarm message to be issued. The alarm message is communicated *via* the wearable monitor BCU **16** to the mobile alarm relay system **14** for further relaying. Alternately, all monitored data can be transferred and the alarm recognition circuit **26** of the relay **14** can recognize the alarm condition rather than the alarm signal. In the preferred cell phone embodiment, the alarm signal causes the cell phone to dial a preselected telephone number to report the emergency. Preferably, the cell phone includes a GPS system **38** which communicates the stricken patient's location as well to medical professionals or emergency dispatchers at the receiving station.

Additionally, ECG data can be transferred to the mobile alarm relay system **14** with the alarm signal so that the remote receiving station can determine a plan of action based on such particularized data. For example, if the patient's pulse exceeds an alarm threshold, the caregiver can utilize such pulse data to determine the appropriate action to take when administering care to the patient **10**. In another embodiment, the data is stored into the memory **28** in the mobile alarm relay system **14** or in the wearable monitor **12** so that data can be trended to determine the previous condition of the patient **10**. In yet another embodiment, data can be downloaded on a periodic basis from the memory **28** to a remote processor for analysis.

Fig. 2 illustrates the communication protocol between the wearable monitor **12** and the mobile alarm relay system **14** shown in Fig. 1. A body coupled communication protocol is employed to facilitate communication between the wearable monitor **12** and the mobile alarm relay system **14**. Discovery of the wearable monitor **12** is accomplished by sending a discovery signal from the wearable monitor **12** to the mobile alarm relay system **14** once the wearable monitor **12** is introduced to the network (*e.g.*, attached to the patient). A response signal is transmitted back to the wearable monitor **12** by the mobile alarm relay system **14**. Security can be set up by exchanging a shared authentication key between the wearable monitor **12** and mobile alarm relay system **14**. An authentication request is communicated from the wearable monitor **12** to the mobile alarm relay system **14** and an authentication key is returned by the mobile alarm relay system **14** to the wearable monitor **12**. An association signal is sent from the wearable monitor **12** to the mobile alarm relay system **14** and the mobile alarm relay system **14** returns a confirm signal to verify establishment of a connection between the wearable monitor **12** and mobile alarm relay system **14** on the network.

Once communication is established, a verification signal is sent at various times from the wearable monitor **12** to the mobile alarm relay system **14**. When a verification signal is received, the mobile alarm relay system **14** returns a confirm signal to indicate that communication is active between the wearable monitor **12** and the network.

In case of an alarm detected by the wearable monitor **12**, an alarm signal is transmitted from the wearable monitor **12** to the mobile alarm relay system **14**. In one embodiment, data is also transmitted with the alarm signal to provide specific information relative to the alarm. The alarm signal is further transmitted from the mobile alarm relay system **14** to a remote receiving component (*e.g.*, transponder) to trigger an external alarm. When there are a plurality of mobile monitors, analogous protocol is used each to establish communication with the mobile alarm relay system **14**.

In Fig. 3, the patient **10** is again equipped with a wearable monitor **12** and an identification and relaying component (IRC) **50**. The wearable monitor **12** and the relay **50** are each equipped with a body communication unit (BCU) **16, 52**. The BCUs **16, 52** communicate utilizing a two-way near field body coupled communication technology, which is based on capacitive coupling with the patient's body. The wearable monitor BCU **16** receives alarm information from an electrocardiograph (ECG) sensor **34** detected by the wearable monitor **12**. An alarm message is transferred from an alarm sensor **36** *via* the wearable monitor BCU **16** to the IRC **50** for further relaying.

In contrast to the wearable monitor **12**, which is located in close proximity to the heart, the IRC **50** can be placed on a part of the body with no risk of attenuation (*e.g.* arms or legs). The IRC **50** includes an identification (ID) component **54** that provides unique patient identification. The IRC **50** further includes an RF system **56** that transmits information for communication *via* an RF system **58** to a mobile alarm relay system, preferably a cellular phone **60**, preferably using a Bluetooth or other short range, lower power transmission system. In turn, the cellular phone **60** relays data over the cell phone network to the medical professionals at a receiving station. Alternatively or additionally, the relay can communicate with a PC or PCA which communicates the alarm and other information over the Internet. Other network communications devices are also contemplated. In this manner, patient information gathered at one area of a patient's body can be communicated from a central location on the patient **10** to a global network.

An alarm recognition component **26** determines if an alarm has been sent by the wearable monitor **12**. The memory **28** is employed by the alarm recognition component **26** to store alarms for subsequent retrieval. The memory **28** can store additional data sent by the wearable monitor **12** that relates to a particular physiological function of the patient **10**. The connection element **30** connects the relay **50** to the cell phone **60**. More specifically, the RF system **56** of the relay **60** interfaces to the external connection device, *e.g.*, the transmit / receive portion of the cell phone to communicate through the cell phone network.

Fig. 4 illustrates the message flow between the wearable monitor **12**, the relay **50** and the mobile alarm relay system or cell phone **60** of Fig. 3. Communication between the wearable monitor **12** and the relay **50** is facilitated *via* a body coupled communication technology. Communication between the relay **50** and the mobile alarm relay system or cell phone **38** is accomplished *via* radio frequency (RF) technology. Initially, the BCUs **16, 52** of the wearable monitor **12** and the relay **50** are discovered by the body coupled communication network. A discovery signal is sent from the wearable monitor **12** to the relay **50** which returns a response signal to the wearable monitor **12**. Next, security is established by exchanging a shared authentication key between the wearable monitor **12** and the relay **50**. The wearable monitor **12** sends an authentication request to the relay **50** and the relay **50** returns an authentication key to the wearable monitor **12**. Finally, the connection between the BCUs **16, 52** of the wearable monitor **12** and relay **50** is established *via* the body coupled communication network. An association signal is sent from the wearable monitor **12** to the relay **50.** The relay **50** returns a confirm signal to the wearable monitor **12** to verify that communication is established. Additionally, an RF connection between the relay **50** and the cell phone **60** is established after the relay **50** sends a connection signal to the cell phone **60.**

The connection between the wearable monitor **12**, the relay **50** and the cell phone **60** (mobile alarm relay system) is monitored and verified. The wearable monitor **12** sends a verification signal to the relay **50** and another verification signal is sent from the relay **50** to the cell phone **60** or other mobile alarm relay system. The cell phone **60** responds by sending a confirm signal to the relay **50**. A confirm signal is also sent from the relay **50** to the wearable monitor **12**. In this manner, the network is notified if a communication failure takes place. Once the communication between the wearable monitor **12**, the relay **50** and the cell phone **60** is established, security is implemented and transmission and reception of signals is verified.

If the wearable monitor **12** detects an alarm, an ECG alarm signal is sent from the wearable monitor **12** to the relay **50**. Afterward, an alarm signal and an alarm identification signal are sent from the relay **50** to the cell phone **60** or other mobile alarm relay system. After receiving the alarm and identification signals from the relay **26**, the cell phone **60** sends an external alarm signal to the medical emergency receiving station.

Fig. 5 illustrates a redundant communication system where the patient **10** is equipped with a wearable monitor (WCM) **70** and a mobile alarm relay system (MAR) **72**, which is utilized for alarm forwarding to an external network. An ECG monitors **74** the patient's heart. Additionally or alternatively, an alarm sensor **76** monitors the second ECG or other physiological condition and determines when an alarm triggering aberration has occurred. Both the wearable monitor **70** and the relay system **72** are equipped with body communication units (BCUs) **78, 80** as well as with RF (*e.g.*, Bluetooth) communication units **82, 84** for mutual peer-to-peer communication. In one embodiment, the relay system **72** is additionally equipped with cellular network connectivity, which is used for alarm forwarding. For example, the relay system may be embodied in a cell phone which communicates with the wearable monitor using the body-coupled communication system, when available. However, when the cell phone is separated from the patient, *e.g.* while recharging, the short range radio communication system is used.

The wearable monitor **70** and the relay system **72** automatically manage their communication by regular checking both communication links and ensuring that at least one communication link is available at any point in time. If no communication link is available, an automatic warning/notification can be communicated.

Fig. 6 illustrates the communication protocol flow between the wearable monitor **70** and the relay system **72** from Fig. 5. This communication can be broken down into three stages: association, verification and alarming. During the association phase, the BCUs **78, 80** related to the wearable monitor **70** and the relay system **72** discover each other *via* the body coupled communication network. A discovery signal is transmitted from the wearable monitor **70** to the relay system **72**. A shared authentication key is exchanged between the wearable monitor **70** and the relay system **72** to establish secure communication between the wearable monitor **70** and the relay system **72**. An authentication request signal is sent from the wearable monitor **70** to the relay system **72** and the relay system **72** returns an authentication key signal to the wearable monitor **70**.

In this embodiment, there are two stages of association of the wearable monitor **70** and the relay system **72**. First, BCUs **78, 80** of wearable monitor **70** and IRC (not shown) are connected. An association signal is sent *via* body coupled communication from the wearable monitor **70** to the relay system **72** and a confirm signal is returned from the relay system **72** to the wearable monitor **70** *via* body coupled communication. Second, an additional RF connection is established between the wearable monitor **70** and the relay system **72**. A connection signal is sent *via* RF from the wearable monitor **70** to the relay system **72**. The relay system **72** sends a confirm signal back to the wearable monitor **70** to indicate an RF connection is made between the wearable monitor **70** and the relay system **72**.

Verification provides a regular monitoring of connections (body coupled and RF) between the wearable monitor **70** and the relay system **72**. The system is notified if there is a failure of communication with either the body coupled communication or the RF connection. For both the body coupled communication and the RF connection, a verification signal is sent from the wearable monitor **70** to the relay system **72**. The relay system **72** returns a confirm signal to the wearable monitor **70** to verify communication.

Alarming is provided utilizing both the body coupled communication and the RF connection. In case an ECG alarm is detected by the wearable monitor **70**, an alarm message is transferred to the relay system **72**. In addition to the alarm signal, ECG data can be transferred to the relay system **72**. Both connection technologies, body coupled and RF, are employed in parallel to ensure connectivity. An ECG alarm signal is sent from the wearable monitor **70** utilizing both body coupled communication and an RF connection. After the relay system **72** receives at least one of the communicated ECG alarm signals, an external alarm signal is relayed from the relay system **72** to an external component *via* a cellular network.

In another variation, the wearable monitor **70** or the relay unit **72** connects with any nearby cell phone that is equipped to receive the signal. This assures that the alarm communication reaches the remote medical monitoring station even if the patient's cell phone is unavailable, *e.g.* dead battery, left out of range, *etc.*

The invention has been described with reference to the preferred embodiments. Modifications and alterations may occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

CLAIMS

Having thus described the preferred embodiments, the invention is now claimed to be:

1. A wireless network for monitoring a patient **(10)**, the wireless network comprising:

at least one wearable monitor **(12, 70)** including:

a physiological condition sensor **(34, 74)** coupled to the patient **(10)** to sense and communicate data related to one physiological function of the patient **(10)**, and

a first body communication unit **(16, 78)** that interfaces with the physiological condition sensor to communicate over the patient **(10)** utilizing a near field capacitive body coupled protocol; and

a relay system **(14, 50, 72)** including:

a second body communication unit **(18, 52, 80)** that receives data from and communicates with the first body communication unit **(16, 78)** utilizing the near field capacitive body coupled protocol, and

an external communication unit **(24, 56, 72)** which communicates the data to a remote medical monitoring station.

2. The system according to claim 1, wherein the relay system **(14, 72)** includes one of a cellular phone **(24, 60)**, a personal digital assistant, a palmtop computer, a pager and a laptop computer.

3. The system according to claim 1, the at least one wearable monitor **(12, 70)** further including:

an alarm sensor **(36, 76)** that interfaces with the physiological condition sensor **(34, 74)** to detect whether the sensed physiological condition is outside of a predetermined threshold and causes the first communication unit **(16, 78)** to send out an alarm signal.

4. The system according to claim 1, the wireless body network further including:

a relaying component **(60)** that receives data from one of the wearable monitor **(12, 70)** external communicating unit **(56)** and transmits the data to the remote monitoring station.

5. The system according to claim 4, wherein the data is transmitted *via* a radio frequency signal.

6. The system according to claim 4, wherein the wireless network further includes:

an identification component **(54)** that provides a unique patient identifier with the data.

7. The system according to claim 1, the relaying component **(14, 60, 72)** broadcasts received data on one of a cell phone network and the internet.

8. The system according to claim 1, the physiological condition sensor is one of heart rate, pulse oximetry, respiratory rate, blood pressure, temperature and electrocardiographic activity.

9. The system according to claim 1 wherein the relay unit includes a cell phone **(24, 60, 72)**, the cell phone including the second body communication unit **(18, 52, 80)** which receives the data transmitted with the body coupled protocol when the cell phone is touching or closely adjacent the patient and the external communication unit **(24, 60, 72)** which communicates the data over a cell phone network to the remote station.

10. The system according to claim 9 wherein the wearable monitor **(12, 70)** includes a low power radio frequency transmitter **(82)** and the cell phone includes a radio frequency receiver **(84)** which receives the physiological data directly from the wearable monitor when the second body communication unit **(18)** is not touching or closely adjacent the patient.

11. The system according to claim 1 wherein the external communication unit **(56)** includes a radio frequency transmitter that transmits a radio frequency signal and further including:

a cell phone or PDA unit which includes a receiver **(58)** which receives the radio frequency signal and a cell phone **(60)** or PDA that retransmits the data on a cell phone network or the internet to the remote station.

12. The system according to claim 11 wherein the wearable monitor also includes a radio frequency transmitter **(82)**, the cell phone or PDA unit radio frequency receiver receiving the both radio frequency signals.

13. A method for communicating medical information within a wireless network, comprising:

monitoring a physiological condition of a patient **(10)** *via* a sensor **(34, 74)** coupled to the patient **(10)**;

communicating data related to the physiological conditions sensed by the sensor **(34, 74)** *via* a first body communication unit **(16, 78)** that communicates over the patient **(10)** utilizing a near field capacitive body coupled protocol;

receiving data from the at least one wearable monitor **(12, 70)** utilizing the near field capacitive body coupled protocol; and

communicating the received to a remote medical monitoring station.

14. The method according to claim 13, further including:

monitoring the sensed physiological condition data and generating an alarm signal in response to the sensed physiological data being outside of a predetermined threshold.

15. The method according to claim 13, wherein communicating the received data includes:

transmitting the received data over a cell phone network or the internet.

16. The method according to claim 13, wherein communicating the received data includes:

transmitting a radio frequency signal to a relay system that retransmits the data over the internet or a cell phone network.

17. The method according to claim 16, further including:

communicating the data relative to the sensed physiological condition utilizing a radio frequency protocol; and,

with a cell phone, receiving one of the radio frequency protocol and the radio frequency signal and retransmitting the data over the cell phone network.

18. The method according to claim 13, wherein the physiological is condition is one of heart rate, pulse oximetry, respiratory rate, blood pressure, temperature and electrocardiographic activity.

19. A method for transmitting medical information within a wireless network, comprising:

associating a wearable monitor **(12, 70)** with a mobile alarm relay system **(14, 72)** including:

initializing communication between a first body communication unit **(16, 78)** associated with the wearable monitor **(12, 70)** and a second body communication unit **(18, 52, 80)** associated with the mobile alarm relay system **(14, 72)** utilizing a near field capacitive body coupled protocol, and

establishing secure communication between the wearable monitor **(12, 70)** and the mobile alarm relay system **(14, 72)** by sending an authentication request from the wearable monitor **(12, 70)** to the mobile alarm relay system **(14, 72)** and returning an authentication key from the mobile alarm relay system **(14, 72)** to the wearable monitor **(12, 70)**;

verifying the communication between the wearable monitor **(12, 70)** and the mobile alarm relay system **(14, 72)** is active including:

monitoring the connection between the wearable monitor **(12, 70)** and the mobile alarm relay system **(14, 72)**, and

generating an alarm if the connection becomes inactive; and

triggering an alarm if the data transmitted by the wearable monitor **(12, 70)** is outside of a predetermined threshold including:

transmitting an alarm message from the wearable monitor **(12, 70)** to the mobile alarm relay system **(14, 72)**, and

relaying the alarm message from the mobile alarm relay system **(14, 72)** to an external network.

20. A method for transmitting patient physiological data across a wireless network, comprising:

associating a wearable monitor **(12, 70)** with an identification and relaying component **(50)** utilizing a near field body coupled communication protocol;

establishing a radio frequency connection between the identification and relaying component **(50)** and a mobile alarm relay system **(14, 72)**;

verifying the communication between the wearable monitor **(12, 70)**, the identification and relaying component **(50)** and the mobile alarm relay system **(14, 72)** is active; and

transmitting an alarm from the wearable monitor **(12, 70)** to the mobile alarm relay system **(14, 72)** *via* the identification and relaying component **(50)** if the data transmitted by the wearable monitor **(12, 70)** is outside of a predetermined threshold.

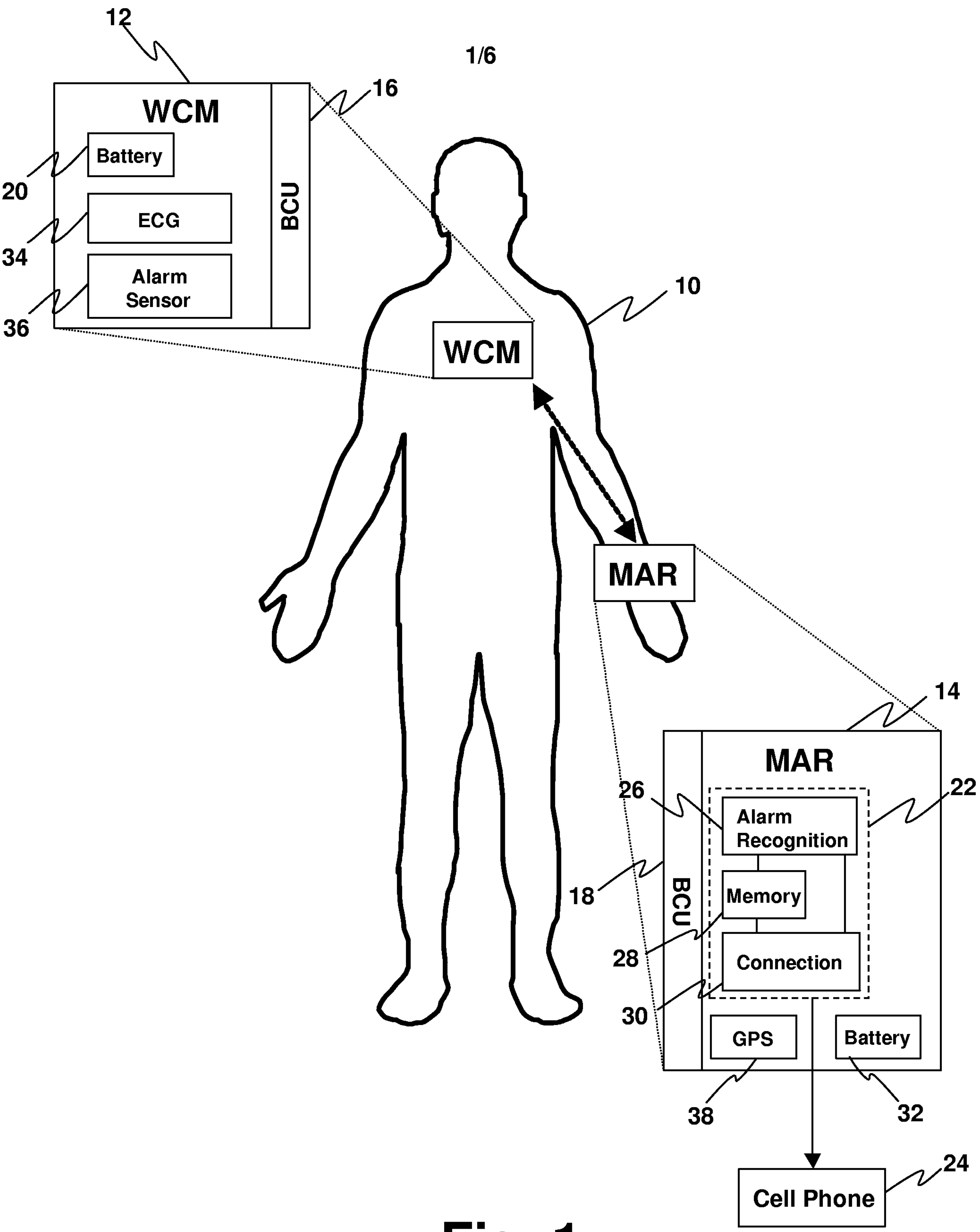
12
WCM
Battery
ECG
Alarm Sensor
BCU
16
20
34
36
10
WCM
MAR
14
MAR
22
26
Alarm Recognition
Memory
Connection
BCU
18
28
30
GPS
Battery
38
32
Cell Phone
24

Fig. 1

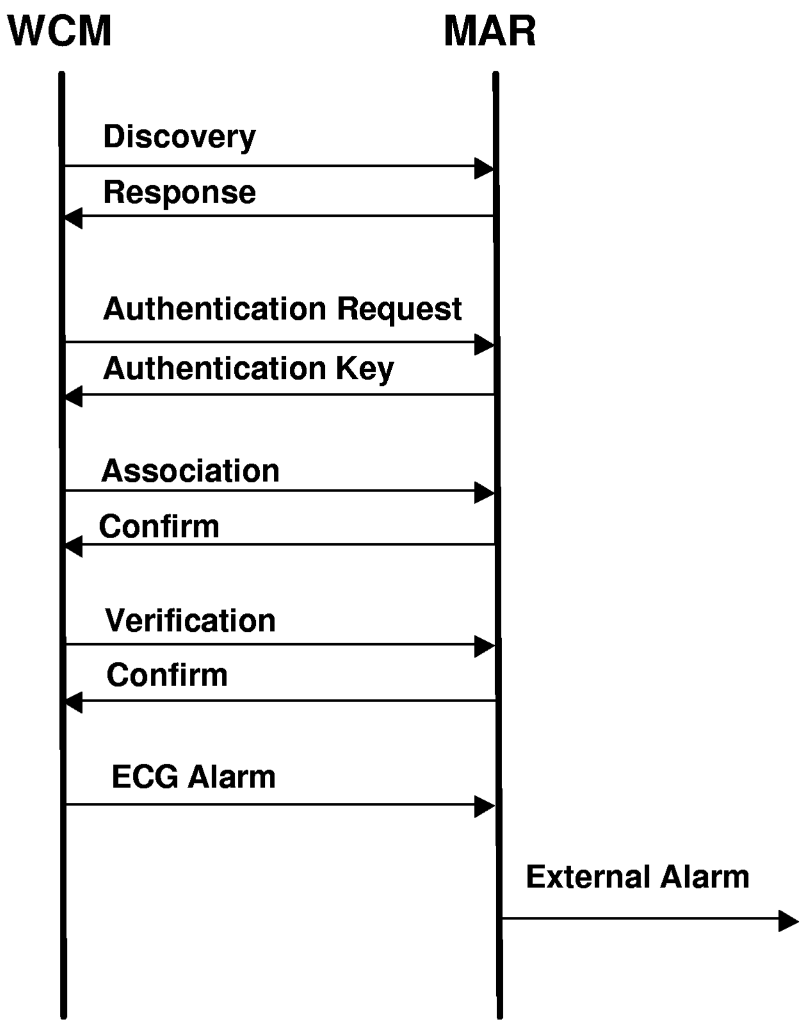
WCM
MAR
Discovery
Response
Authentication Request
Authentication Key
Association
Confirm
Verification
Confirm
ECG Alarm
External Alarm

Fig. 2

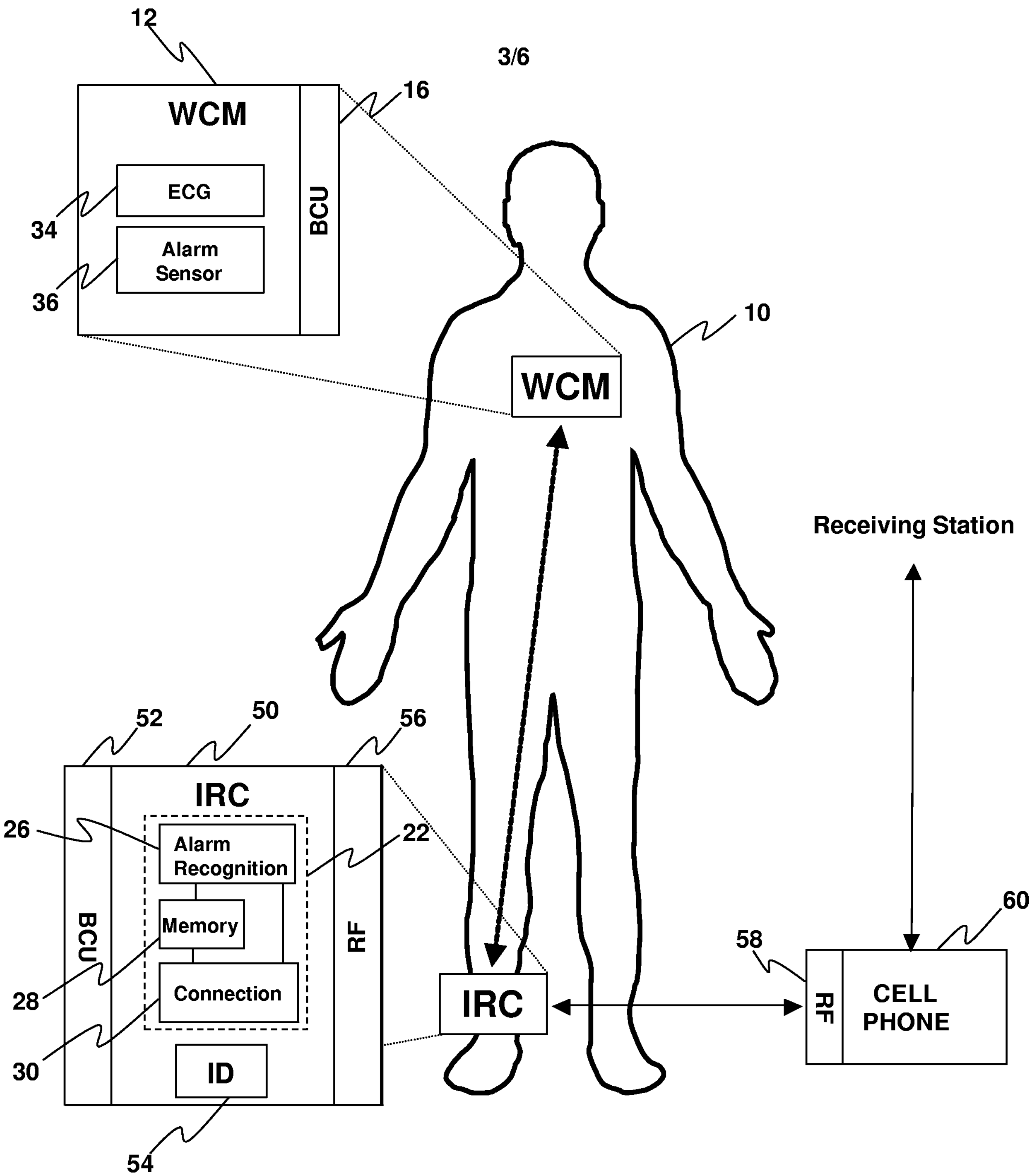
12
WCM
16
ECG
BCU
34
Alarm
Sensor
36
10
WCM
Receiving Station
52
50
56
IRC
26
Alarm
Recognition
22
BCU
Memory
RF
60
58
28
Connection
IRC
RF
CELL
PHONE
30
ID
54

Fig. 3

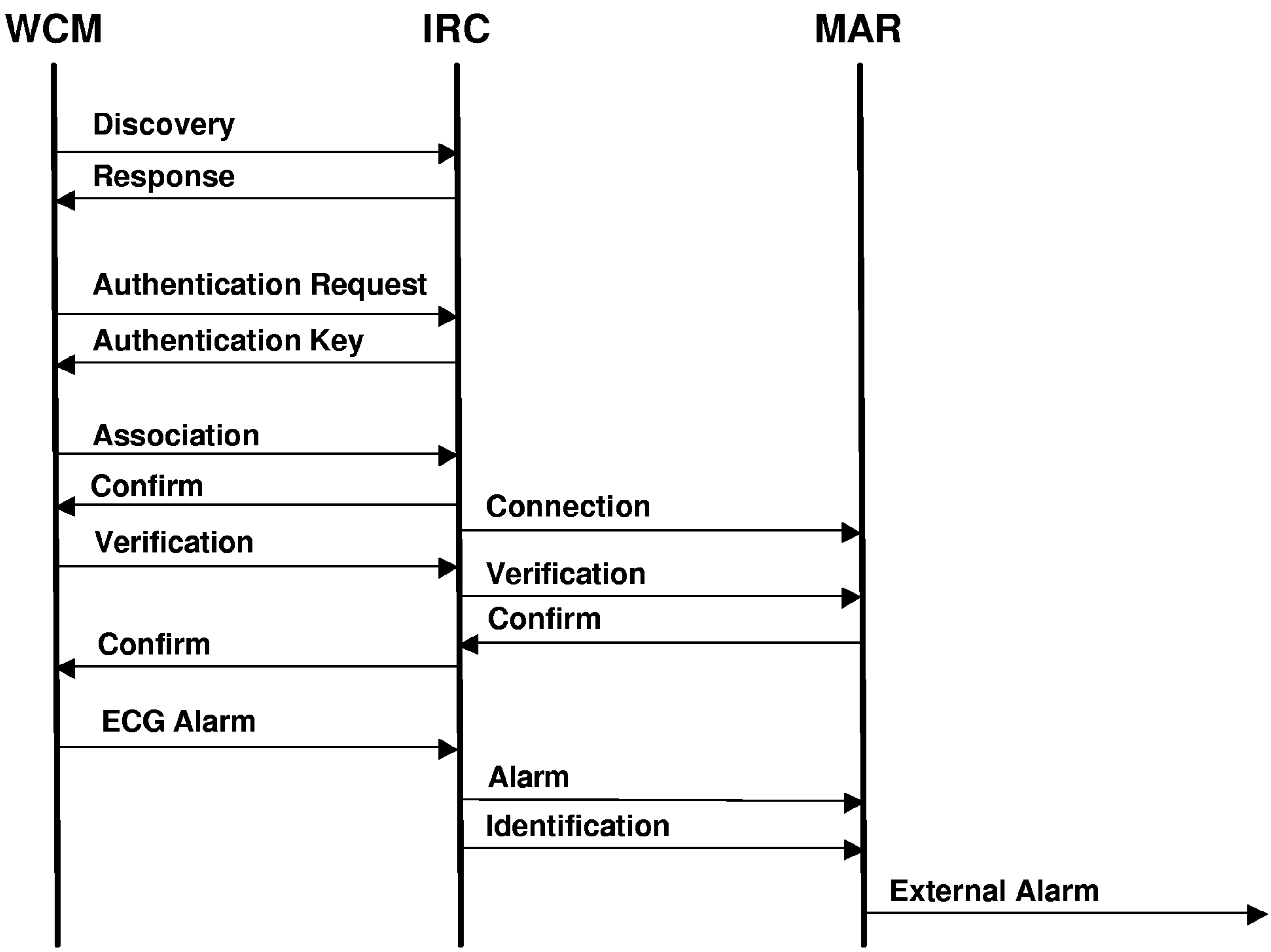
WCM
IRC
MAR
Discovery
Response
Authentication Request
Authentication Key
Association
Confirm
Connection
Verification
Verification
Confirm
Confirm
ECG Alarm
Alarm
Identification
External Alarm

Fig. 4

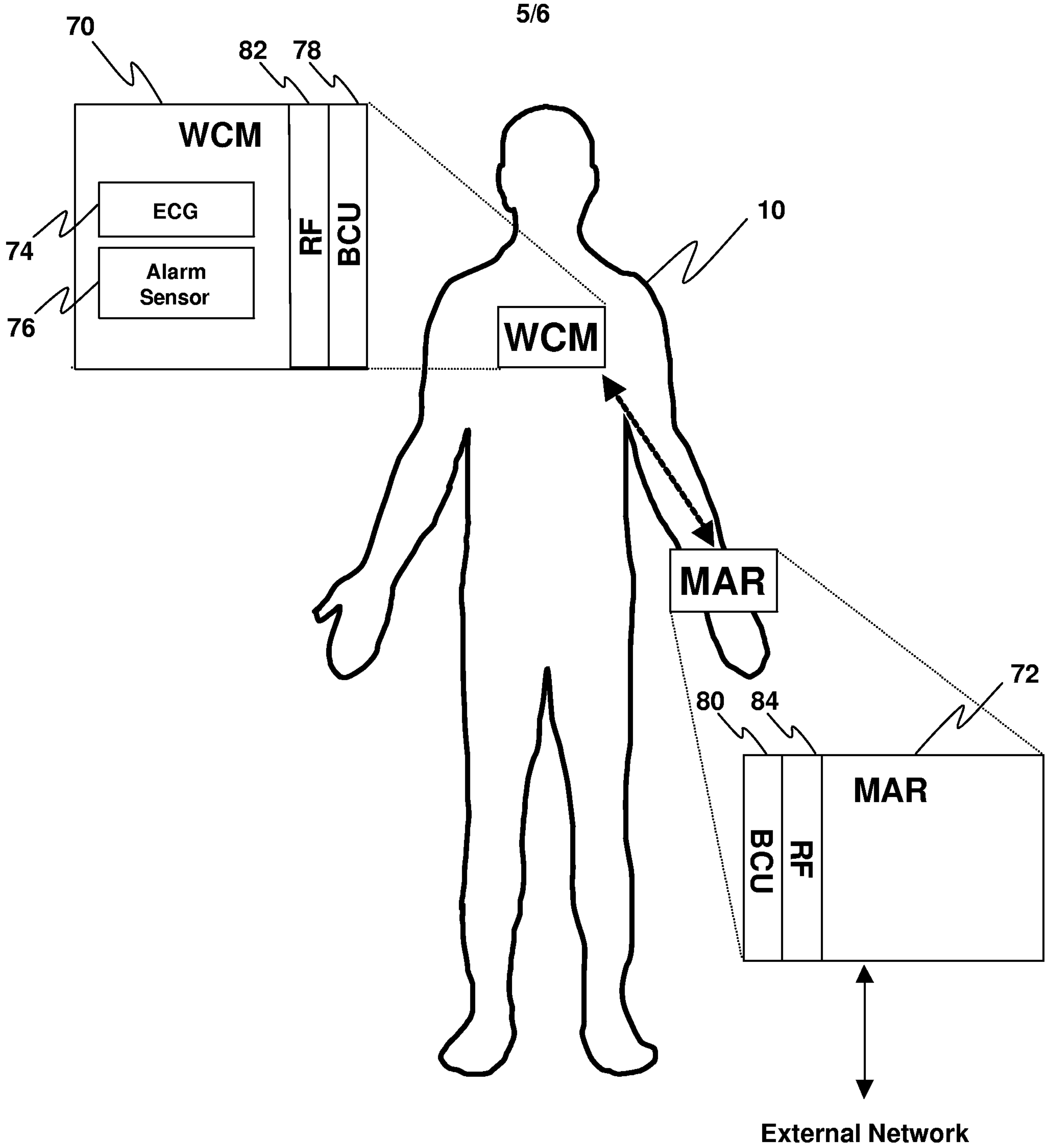
70
82
78
WCM
ECG
74
Alarm
Sensor
76
RF
BCU
10
WCM
MAR
72
80
84
MAR
BCU
RF
External Network

Fig. 5

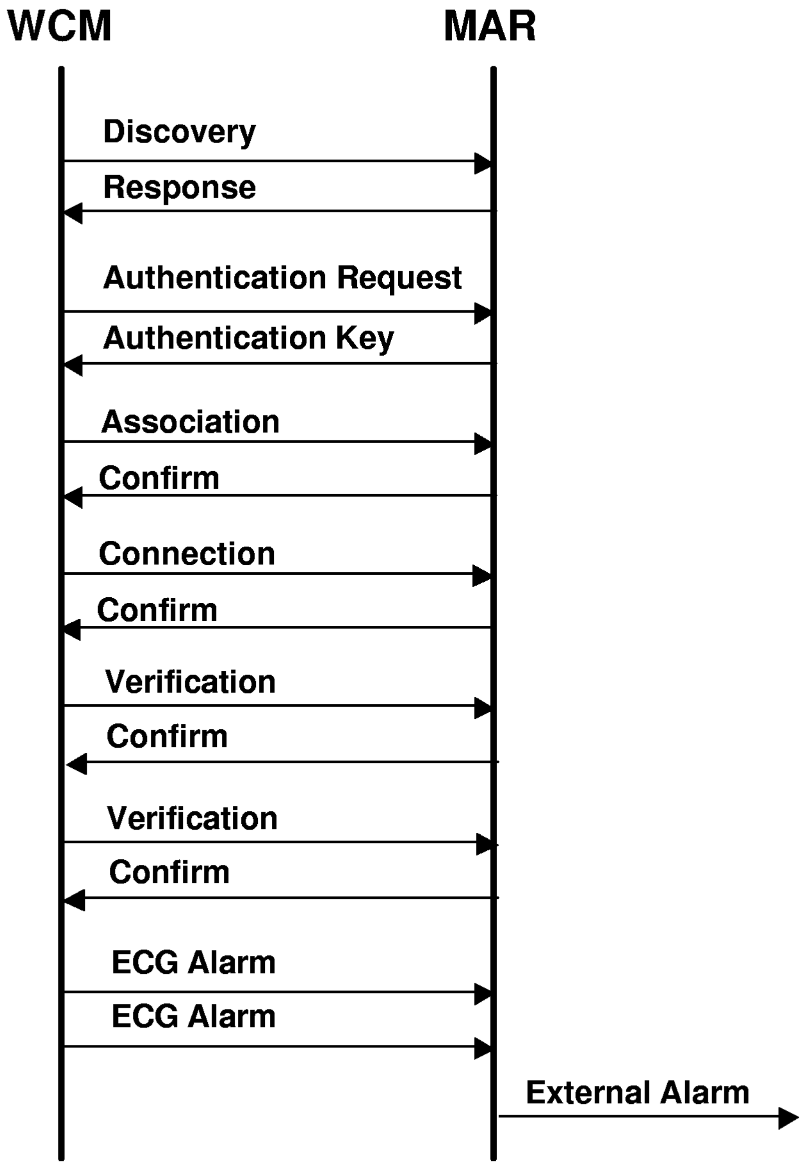
WCM
MAR
Discovery
Response
Authentication Request
Authentication Key
Association
Confirm
Connection
Confirm
Verification
Confirm
Verification
Confirm
ECG Alarm
ECG Alarm
External Alarm

Fig. 6

patsnap

专利名称(译)	移动监控		
公开(公告)号	EP1827214A2	公开(公告)日	2007-09-05
申请号	EP2005826721	申请日	2005-12-05
[标]申请(专利权)人(译)	皇家飞利浦电子股份有限公司		
申请(专利权)人(译)	皇家飞利浦电子N.V.		
当前申请(专利权)人(译)	皇家飞利浦电子N.V.		
[标]发明人	BALDUS HERIBERT ELIXMANN MARTIN J		
发明人	BALDUS, HERIBERT ELIXMANN, MARTIN, J.		
IPC分类号	A61B5/00		
CPC分类号	H04B13/005 A61B5/0006 A61B5/0028 A61B5/6804 A61B5/681		
优先权	60/635645 2004-12-13 US 60/670386 2005-04-12 US		
其他公开文献	EP1827214B1		
外部链接	Espacenet		

摘要(译)

用于监视患者（10）的无线网络包括至少一个可佩戴监视器（12,70），其包括耦合到患者（10）的生理状况传感器（34,74），以感测和传送与该患者的一个生理功能相关的数据。病人（10）。第一身体通信单元（16,88）与至少一个可佩戴监视器（12,70）对接，以利用近场电容体耦合协议在患者（10）上进行通信。中继系统（14,50,72）包括第二主体通信单元（18,52,80），其接收来自至少一个可穿戴监视器（12,70）的数据并与第一主体通信单元（16,88）通信利用近场电容体耦合协议。外部通信单元（22）经由蜂窝电话网络或因特网将数据传送到远程医疗监控站。